

## Comparison of kidney transplant outcomes before and after COVID-19 pandemic: a single-institution experience

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COVID-19 pandemic had a significant impact on the field of kidney transplantation. Recipient was found to have high mortality associated with COVID-19 infection and also had vaccination-related problems. We conducted this study to understand whether there is a difference in new transplant outcome before and after COVID-19 pandemic when the treatment protocol and the composition of the transplant team are the same. From January 2018 to December 2021, patients who underwent kidney transplantation at Haeundae Paik Hospital were included in the study. We confirmed the living-donor or deceased donor transplantation, the presence or absence of rejection, hospitalization, the presence or absence of BK polyomavirus infection, and creatine (Cr) and cystatin C at 1 month, 3 months, and 12 months after transplantation. A total of 56 patients were included in the study. Prior to COVID-19 pandemic, 28 patients (male 20 and living donor transplants 10) underwent kidney transplantation, and 28 patients (15 male, 12 living donor transplant) underwent surgery thereafter. The average age for each group was  $54 \pm 9.56$  years and  $53 \pm 11.40$  years. Rejection was seven T-cell mediated rejection, three antibody-mediated rejection in the group prior to COVID-19 pandemic, and seven T-cell mediated rejection in the group after COVID-19 pandemic, with no statistically significant difference. There were two and four BK polyomavirus infections in each group. There were seven hospitalizations per group within 1 year, and the average length of stay was  $19.52 \pm 32.68$  days and  $10.86 \pm 89.34$  days. Laboratory tests showed no statistically significant difference in Cr and cystatin C levels at 1 month, 3 months, and 12 months. There was no difference in the outcome of the kidney transplantation before and after COVID-19 pandemic when the treatment protocol and the transplant team in charge were the same.

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# The effect of donor against recipient one-way human leukocyte antigen mismatch on liver transplantation outcomes: an analysis of Korean Organ Transplantation Registry (KOTRY) Database

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**Background:** Donor against recipient (D-R) one-way human leukocyte antigen (HLA) mismatch (MM) seemed strongly associated with graft-versus-host disease (GVHD) after liver transplantation (LT). The aim of this study is to investigate the relevance of D-R one-way HLA MM in outcome of LT by analyzing Korean Organ Transplantation Registry (KOTRY) database.

**Methods:** We retrospectively analyzed 2,670 patients with HLA type data who underwent LT between April 2014 and December 2020 in KOTRY database. The patients were categorized into two groups whether D-R one-way HLA MM or not.

**Results:** Among 2,670 LT recipients, 18 patients were found to be D-R one-way HLA MM. All 18 D-R one-way HLA MM patients underwent LT from living donors who were mostly offspring (83.3%). D-R one-way HLA MM patients showed significantly higher mortality rate ( $P=0.003$ ) and higher rate of GVHD prevalence ( $P<0.001$ ). According to Cox regression analysis, deceased donor LT (hazard ratio [HR], 1.64;  $P=0.012$ ), D-R one-way HLA MM at three loci (HR, 12.75;  $P<0.001$ ), and retransplantation (HR, 2.01;  $P=0.036$ ) were found to be the independent risk factors for patient death. Patients with D-R one-way HLA MM at three loci showed significantly lower overall survival comparing to patients without D-R one-way HLA MM. There were no significant differences in rejection-free survival and death-censored graft survival. In addition, D-R one-way HLA MM at three loci seemed to be strongly associated with the incidence of GVHD (odds ratio, 163.3;  $P<0.001$ , multivariate).

**Conclusions:** D-R one-way HLA MM occurs mainly in LT from living donors and D-R one-way HLA MM at three loci not only affects the overall survival of LT patients but also the incidence of GVHD. Therefore, careful consideration would be required in the LDLT of patients with D-R one-way HLA MM especially at three loci.

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## Pediatric liver transplantation: experience in single center

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**Background:** Liver transplantation is currently the only treatment for terminal liver disease.

**Methods:** In our center, from 2014 to 2022, 15 liver transplants from a living donor to pediatric patients were performed. The ages of the children ranged from 6 to 14 months. The causes of terminal liver damage were congenital liver disease (atresia of the biliary tract) and intrauterine infections (cytomegalovirus). All transplants were performed according to the group compatibility of the donor and recipient. The donors were relatives of the patients. The body weight of children ranged from 6.5 to 17 kg. In all cases, transplantation of the left lateral sector of the liver was performed. Immunosuppressive therapy included: induction - basiliximab, basic - tacrolimus, MMF, glucocorticoids.

**Results:** Of the 15 transplants performed, surgical complications were observed in three (20%) cases. All complications were corrected by repeated surgery. Mortality 2 (13.3%) patients. Mortality arose in the early posttransplant period. Cause of death - multiple organ failure. One donor developed a beloma in the area of the resected liver in the early postoperative period. Drainage of liquid formation was carried out. The rest of the donors had no complications. The duration of surgical intervention in donors was 41.5 hours, in recipients, 7.52 hours. The average length of hospital stay for donors was 13.4 bed-days, and recipients were hospitalized for an average of 47.7 bed-days.

**Conclusions:** We consider liver transplantation from a living donor to young children to be a more optimal method of treatment. Removing the left lateral liver for transplantation is safer for a living donor.

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## Transition of metabolic dysfunction after kidney transplantation and its association with transplant outcomes: a nationwide prospective cohort study

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**Background:** Kidney transplantation is expected to modify the metabolic status. However, it remains unclear whether the transition of metabolic status before and after transplantation affects the transplant outcomes.

**Methods:** We analyzed 4,187 kidney transplant recipients registered in a nationwide prospective cohort from 2014 to 2020. Metabolic dysfunction (MD) was considered, if three conditions are met (body mass index, blood pressure, fasting blood glucose, triglyceride, and high-density lipoprotein cholesterol level). Patients were categorized into four groups based on the presence of MD at pretransplant and 1-year posttransplant. The primary outcome was the occurrence of death-censored graft failure and patient death.

**Results:** Prevalence of pre- and posttransplant MD was 49.0% and 40.1%, respectively. Among recipients without pretransplant MD, 19.6% developed MD at 1-year posttransplantation. By contrast, MD disappeared in 38.7% of the recipients with pretransplant MD. The cumulative event rate of composite of graft failure and patient death was significantly higher in both recipients with newly developed posttransplant MD and recipients with persistent MD ( $P < 0.001$ ). Compared to recipients without pre- and posttransplant MD, those with newly developed posttransplant MD showed an increased risk of graft failure (adjusted hazard ratio [HR], 2.50; 95% confidence interval [CI], 1.74–3.58) and those with persistent MD had higher risk of patient death (adjusted HR, 3.21; 95% CI, 1.40–7.39). The risk of composite event was increased as more metabolic components was converted to be dysfunctional after transplantation. An analysis of each component of MD showed that a normalization of blood pressure after transplantation led to a decrease in the risk of composite event.

**Conclusions:** Kidney transplantation significantly affects the metabolic status in patients with end-stage kidney disease. Newly developed posttransplant MD increases the risk of graft loss and persistent posttransplant MD adversely affects patient survival, suggesting that transition of metabolic status was significantly associated with kidney transplant outcomes.

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## Psychological effects of kidney transplantation in South Korea: a national-wide population study

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**Background:** Kidney transplantation (KT) improves not only physically but also psychologically in patients with kidney failure. However, there are few studies comparing the psychiatric effects of renal replacement therapy (dialysis versus KT).

**Methods:** By using National Health Insurance Service database, we extracted 21,809 kidney failure patients who had no history of depression and insomnia before receiving renal replacement therapy between January 2002 and December 2018.

**Results:** 17,649 patients received dialysis (15,537 patients hemodialysis, 2,112 patients peritoneal dialysis), and 4,160 patients received KT. Dialysis patients more suffer from insomnia than KT recipients (7,949; 45.04% vs. 1,070; 25.72%,  $P < 0.001$ ). Compared to KT recipients, dialysis patients were more prescribed antidepressant medication (4,019; 22.77% vs. 358, 8.61%,  $P < 0.001$ ). Compared to KT recipients, dialysis patients were more completely suicided (33; 0.19% vs. 5; 0.12%,  $P = 0.047$ ). In multivariate-adjusted analysis, the hazard ratio (HR) of depression was 1.82 (95% confidence intervals [CI], 1.62–2.04). In subgroup analysis, insomnia patients (HR, 2.15; 95% CI, 1.86–2.47), living in rural areas (HR, 2.04; 95% CI, 1.70–2.36), male patients (HR, 1.85; 95% CI, 1.61–2.13), aged under 65 years old patients (HR, 1.90; 95% CI, 1.68–2.14) were more prescribed anti-depressant medication.

**Conclusions:** Compared to dialysis, KT reduced complete suicide rate. In addition, KT is effective in reducing the prevalence of depression in patients with kidney failure in Korea, especially for insomnia patients, patients living in rural areas, male patients, and those aged under 65 years old.

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# Pretransplant mycophenolate mofetil reduces intrahepatic cholangiopathy related to laparoscopic donor hepatectomy in ABO-incompatible liver transplantation

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**Background:** Intrahepatic cholangiopathy is a rare but life-threatening sequela of ABO-incompatible liver transplantation. This study analyzed the clinical impact of using pretransplant mycophenolate mofetil for reducing intrahepatic cholangiopathy in ABO-incompatible liver transplantation.

**Methods:** Patients who underwent living donor liver transplantation at Samsung Medical Center between 2010 and April, 2022 were included. Pretransplant mycophenolate mofetil was started since November, 2020. Comparison between ABO-compatible and ABO-incompatible transplantation was performed. Among ABO-incompatible transplantation, groups were divided into open donor surgery, laparoscopic donor surgery without pretransplant mycophenolate mofetil and laparoscopic donor surgery with pretransplant mycophenolate mofetil. Cox regression analyses on risk factors for intrahepatic cholangiopathy was performed.

**Results:** A total of 1,037 transplantations, 802 ABO-compatible and 234 ABO-incompatible transplantations were included. The intrahepatic cholangiopathy rate in ABO-incompatible transplantation with laparoscopic donor surgery (13/143, 9.1%) was significantly higher than that of ABO-compatible transplantation. (1/419, 0.2%;  $P < 0.001$ ) Multivariable analysis showed that laparoscopic donor surgery without pretransplant mycophenolate mofetil of recipients were at higher risk of intrahepatic cholangiopathy (hazard ratio [HR], 13.449; confidence interval [CI], 1.710–05.800;  $P = 0.014$ ) compared to open donor surgery group, while laparoscopic donor surgery with pretransplant mycophenolate mofetil showed no increased risk. (HR, 5.307; CI, 0.315–89.366;  $P = 0.247$ ).

**Conclusions:** Laparoscopic donor surgery was a risk factor for intrahepatic cholangiopathy in ABO-incompatible liver transplantation and pretransplant mycophenolate mofetil can reduce the risk if intrahepatic cholangiopathy.

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## Improved graft survival in liver transplantation recipients with three-dimensional printing of intra-abdominal cavity to prevent large-for-size syndrome: propensity-score matched analysis

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**Background:** In liver transplantation (LT), large-for-size syndrome is not common but can result in fatal outcome. Therefore, we invented cost-effective and time-saving three-dimensional (3-D) printing protocol of LT recipients abdominal cavity to prevent large-for-size syndrome.

**Methods:** We manufactured 3-D printed abdominal cavity model of patients who were expected to have small abdominal cavity between July 2020 to February 2022. Clinical outcomes were compared between patients using our 3-D model during LT and patients who underwent LT without 3-D model by using 1:5 ratio propensity score-matched analysis.

**Results:** After matching, total 20 patients using 3-D printed abdominal cavity model and 100 patients of control group were included in this study. There were no significant differences in 30-day postoperative complication (50.0% vs. 64.0%,  $P=0.356$ ) and the incidence of large-for-size syndrome (0% vs. 7%,  $P=0.599$ ). Overall survival of 3-D printed group was similar to the control group ( $P=0.851$ ) but graft survival was significantly superior in 3-D printed group than the control group ( $P=0.041$ ).

**Conclusions:** Since it showed better graft survival as well as low cost and short production time, our 3-D printing protocol can be a feasible option for patients with small abdominal cavity to prevent large-for-size syndrome after LT.

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## Graft-recipient-weight ratio and lowered immunosuppression is important for the success of adult liver retransplantation: 25-year single center experience

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**Background:** This study analyzed the risk of liver retransplantation and factors related to better outcome.

**Methods:** Adult liver transplantations performed during 1996 to 2021 were included. Comparison between first transplantation and retransplantation were performed. Among retransplantation cases, comparison between whole liver and partial liver graft was performed. Multivariable Cox analyses for analyzing risk factors for graft and overall survival were performed for the entire cohort as well as the subgroup of patients with retransplantation.

**Results:** A total 2,237 transplantations from 2,135 adults were included and 103 cases were retransplantation. A total of 44 (42.7%) cases were related to acute graft dysfunction while 59 (57.3%) cases were related to subacute or chronic graft dysfunction. Retransplantation was related poor graft (hazard ratio [HR], 3.439; confidence interval [CI], 2.230–5.304;  $P<0.001$ ) and overall survival (HR, 2.905; CI, 2.089–4.040;  $P<0.001$ ). Among retransplantations, mean serum FK506 trough level 9ng/mL was related to poor graft (HR, 3.692; CI, 1.288–10.587;  $P=0.015$ ) and overall survival (HR, 2.935; CI, 1.195–7.211;  $P=0.019$ ). Graft-recipient-weight ratio under 1.0% was related to poor overall survival in retransplantations (HR, 3.668; CI, 1.150–11.698;  $P=0.028$ ).

**Conclusions:** Retransplantation can be complicated with poor graft and patient survival compared to first transplantation, especially when the graft size is relatively small. Lowering the FK506 trough level during the first month can be beneficial for outcome.

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## Treatment of chronic active antibody-mediated rejection in kidney transplant patients: a systematic review

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**Background:** Chronic antibody-mediated rejection (cAMR) is a major cause of graft dysfunction, graft loss and mortality in kidney transplantation. Variable treatment combinations have been used to treat cAMR but benefit is not clear. This study aims to examine effect of treatment on graft survival, kidney function and donor-specific antibody (DSA) level.

**Methods:** A systematic search of articles was performed on two English databases (PubMed, Cochrane Central Register of Controlled Trials [CENTRAL], LILACS, HERDIN, Google Scholar and Research Gate) published between January 2000 to November 2021.

**Results:** Rituximab given in combination with IVIg and/or bortezomib improved graft survival by 20%–51%. RATG and belatacept also seemed to improve outcome in patients when given early. While graft survival was not examined following treatment with newer therapies, results on their effect on eGFR and creatinine are promising. Evidence on treating patients with increased proteinuria and severe transplant glomerulopathy is less clear. While Billing showed that some of these patients still improved following therapy, these characteristics were associated with nonresponse to treatment in many other studies.

**Conclusions:** Given the prevalence of cAMR and evidence showing benefit of treating even subclinical cAMR, protocol biopsies should be considered. In patients already diagnosed with cAMR, treatment should be initiated early before development of severe transplant glomerulopathy and graft dysfunction. Evidence on treating patients already with increased proteinuria and severe transplant glomerulopathy is less clear. Potential benefit should be weighed against cost of therapy and complications, especially infections.

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## Humoral immunogenicity of two doses of BNT162b2 in pediatric solid organ transplant recipients

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**Background:** Pediatric solid organ transplant recipients (SOTRs) are at high risk of severe COVID-19, but studies on their COVID-19 vaccine immunogenicity are lacking. We investigated the humoral immunogenicity of pediatric SOTRs after two doses of BNT162b2 (BNT).

**Methods:** This prospective study was conducted at Severance Hospital in Seoul from October 2021 to March 2022. Pediatric SOTRs who received BNT/BNT were included as participants. Serum samples were collected between 14 days and 150 days after vaccination. We evaluated SARS-CoV-2 anti-S IgG titers, surrogate neutralization inhibition and plaque reduction neutralization test (PRNT) against wild-type (WT), Delta and Omicron. For comparison, serum samples from adult SOTRs (n=15) and healthcare workers (HCWs, n=12) vaccinated with BNT/BNT were used.

**Results:** Twelve pediatric SOTRs were included. The median age at SOT was 10 years (7–12 years), and the male to female ratio was 1:1. The median time from SOT to vaccination was 49 months (33–98 months), and 50% of them were taking two or more immunosuppressants. Pediatric SOTRs (92%) showed significantly higher anti-S IgG positivity than adult SOTRs (67%, P=0.002) and similar positivity to HCWs (100%, P>0.59). In the neutralization assay, the median inhibition of WT in pediatric SOTR was 98%, Delta was 97%, and Omicron was 12%, which was significantly lower for Omicron than the others (P<0.001). The PRNT results were similar to those of the surrogate neutralization assay, except that the ND50 titer of Delta (147.5) was significantly lower than that of WT (409.0, P=0.03).

**Conclusions:** After BNT/BNT, the humoral responses in the pediatric SOTRs were not lower than those in the adult SOTRs. However, the immunogenicity against Omicron variant was very poor. Since humoral immunogenicity results may be different between strains and test methods, caution is required when interpreting the humoral responses in these SOTRs.

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## Outcomes of immunosuppression regimen modification strategies among kidney transplant recipients admitted for COVID-19 infection at the National Kidney and Transplant Institute

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Kidney transplant recipients (KTRs) are a vulnerable population in COVID-19 infections due to their necessary immunosuppression. These are adjusted when a KTR contracts COVID-19 infection, but there remains no conclusive data as to how this is best done. The objective of this study was to assess the outcomes of KTRs who contracted COVID-19, with regards to whether or not their immunosuppression regimens were altered/adjusted. The outcomes of interest were: mortality, length of hospital stay, progression of COVID-19, acute kidney injury (AKI), renal replacement therapy (RRT), graft loss, biopsy proven rejection, and cardiac/cerebrovascular events. This was a retrospective analytical study which included 206 KTRs diagnosed with COVID-19 infection and admitted from January 2020 until December 2021 at the National Kidney and Transplant Institute. Cross-tabulation was done to describe the Immunosuppression modification strategies utilized. Chi-square test and risk ratio (with 95% confidence interval) were used to determine the association of strategies and the outcomes. Results showed that mortality rate (25.7%), length of stay (median 12 days), AKI incidence (37.9%) and RRT utilization (19.4%) were comparable to previous studies and institutions. Shifting oral steroids to dexamethasone decreased risk of covid progression ( $P=0.00$ ) and discontinuing antimetabolite drugs in COVID-19 severe patients decreased risk of RRT ( $P=0.043$ ). Discontinuing calcineurin inhibitors led to a longer hospital stay for COVID-19 severe patients ( $P=0.02$ ). Data did not support the other strategies. This study concluded that for COVID-19 severe patients, shifting oral steroids to dexamethasone and discontinuing antimetabolite drugs should be done; calcineurin inhibitors should be maintained. For all other strategies in all other use cases (COVID-19 mild, moderate and critical patients), there is insufficient evidence for or against adjusting medications.

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## Awake-extracorporeal membrane oxygenation bridged adult heart transplantation: the importance of maintaining isolated cardiac failure

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**Background:** Veno-arterial extracorporeal membrane oxygenation (VA-ECMO) has been used as a bridge to heart transplantation (HTx). Progression of multi-organ failure during ECMO is a well-known poor prognostic factor for mortality after HTx. Thus, maintaining isolated cardiac failure before HTx is important, and keeping a ventilator-free state (awake ECMO) could be one of these efforts. The purpose of this study is to compare the clinical outcome of ECMO-applied recipients who underwent HTx with or without ventilator.

**Methods:** From June 2014 to June 2022, a total of 89 patients who underwent HTx in a single tertiary hospital were included. Baseline characteristics, short-term, and long-term clinical data were collected prospectively and analyzed retrospectively. The recipients were divided into three groups as follows: group A, non-ECMO; group B, awake-ECMO; group C, ventilator-ECMO.

**Results:** The baseline characteristics of each group are presented in Table. Group C showed significantly higher total bilirubin and renal replacement rate than other groups (Table). There was statistically significant difference in the 30-day survival rate between the three groups: (A, 100%; B, 100%; C, 81.8%;  $P=0.048$ ). However, the long-term survival rate showed no significant difference between the B and C groups (Figure).

**Conclusions:** The early survival rate was significantly higher in the awake-ECMO group compared with the ventilator-ECMO group, implying that the isolated heart failure state affects the short-term survival rate after HTx. Further large volume investigation is warranted.

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## Factors affecting psychosocial adjustment of liver donors after living liver donation

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This study was conducted to identify factors affecting psychosocial adjustment in liver donors after living liver donation. The study was comprised of 121 liver donors who underwent liver donation surgery. The survey data was collected from August 10 to November 10, 2021. The questionnaire consisted of general characteristics, donation-related characteristics, knowledge, uncertainty, and psychosocial adjustment tools. It was analyzed by descriptive statistics, independent t-test, one-way ANOVA, Pearson correlation coefficient, and multiple regression analysis using SPSS ver. 25.0 program. The result of the study showed the lower the uncertainty of the liver donor ( $\beta=-0.698$ ,  $P<0.001$ ), the higher the economic level ( $\beta=0.180$ ,  $P<0.01$ ), and the higher recommendation of the liver donation ( $\beta=0.120$ ,  $P<0.05$ ), the higher level of psychosocial adjustment ( $F=65.479$ ,  $P<0.001$ ). Therefore, in order to increase the level of psychosocial adjustment of liver donors, it is necessary to develop nursing intervention and education programs, reduce the uncertainty of liver donors, and provide medical cost support system and cost-related counselling. This would have a positive impact on donation recommendations and help the increase in number of living liver donors.

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## Rare infectious complication after living donor liver transplantation

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Despite the remarkable advances of liver transplantation, infections are still the most common and often life-threatening postoperative complications. Methicillin-resistant *Staphylococcus aureus* (MRSA) infection frequently complicates the postoperative course of liver transplant recipients. It has been well described that MRSA associated bacteremia, pneumonia and surgical site infection are common. But, MRSA infection manifesting as pyogenic spondylodiscitis is very rare. To our knowledge, pyogenic spondylodiscitis due to MRSA in lumbar spine after living donor liver transplantation (LDLT) has not been previously reported. Here, we report a 50-year-old man who developed pyogenic spondylodiscitis caused by MRSA after LDLT. Our patient underwent LDLT for hepatitis B virus related cirrhosis. Immunosuppressive treatment was administered with basiliximab, tacrolimus, corticosteroids and mycophenolate mofetil. He discharged on postoperative the 28th day with uncomplicated course. At 1 week after discharge the patient was readmitted for abdominal pain and high fever. Bile leakage at the bilo-biliary anastomosis site was found by endoscopic retrograde cholangiopancreatography and managed successfully with endoscopic nasobiliary drainage. The culture of drained fluid showed MRSA and he was treated with vancomycin for 4 weeks. These treatments resulted in resolution of the infection. However, 1 month later the patient presented with severe back pain. At this time, MRI showed spondylodiscitis of lumbar 2–3 spine and paraspinal abscess formation. Our patient underwent surgical debridement and primary bone graft. MRSA was cultured from the abscess. Postoperatively, the patient received intravenous vancomycin for 2 weeks and revealed complete outcome with no neurological sequelae. Although molecular analysis might be needed to identify the clonality of these strains, we compared the antibiogram of these isolates. Presently he is followed up and doing well without rejection and other complications.

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## Posttransplant plasma exchange prevents hepatocellular carcinoma recurrence in ABO-incompatible liver transplantation: propensity-matched analysis

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**Background:** Total plasma exchange (TPE) may play a role in cancer treatment by eliminating immune checkpoint inhibitors. This study investigated whether TPE improved oncological outcomes in hepatocellular carcinoma (HCC) patients who underwent ABO-incompatible living donor liver transplantation.

**Methods:** The study included 158 patients who underwent ABO-incompatible living donor liver transplantation for HCC between 2010 and 2021 at Samsung Medical Center. Recurrence-free survivals were analyzed using the Kaplan-Meier method after propensity score matching. In addition, the Cox regression model was used to identify factors associated with tumor recurrence.

**Results:** A propensity score matching resulted in 52 matched pairs, whether postoperative TPE [post-op TPE (+)] or not [post-op TPE (-)]. The 5-year recurrence-free survival was superior in the post-op TPE (+) group (88.3% [95% confidence interval {CI}, 83.3%–93.3%]) compared to post-op TPE(-) group (61.1% [95% CI, 53.6%–68.6%]; P=0.003). Subgroup analysis performed for beyond Milan group showed superior 5-year recurrence-free survival in Post op TPE (+) group (86.2% [95% CI, 78.8%–93.6%]) compared to post-op TPE (-) group (36.9% [95% CI, 25.0%–48.8%]; P=0.001). In patients with microvascular invasion, post-op TPE (+) group also showed superior 5-year recurrence-free survival (82.9% [95% CI, 75.0%–90.8%]) compared to post-op TPE (-) group (31.0% [95% CI, 20.7%–41.3%]; P=0.001). In multivariable analysis, postoperative TPE significantly decreased the risk of tumor recurrence (hazard ratio, 0.24; 95% CI, 0.09–0.68; P=0.007).

**Conclusions:** Postoperative TPE improved recurrence-free survival after ABO-incompatible living donor liver transplantation for hepatocellular carcinoma, especially in advanced cases such as microvascular invasion and beyond Milan criteria.

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## Comparison of humoral immunogenicity in solid organ transplant recipients after third-dose mRNA vaccine with homologous or heterologous schedules: an observational study

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**Background:** Solid organ transplant recipients (SOTRs) are susceptible to severe coronavirus disease 2019 (COVID-19) and immunogenicity studies of Omicron variants according to vaccination schedules are lacking. We examined the humoral immunogenicity following third-dose mRNA vaccine administration in Korean SOTRs who received primary COVID-19 vaccine series on a homologous or heterologous schedule.

**Methods:** We recruited SOTRs at the Severance Hospital from October 27, 2021, to March 31, 2022. Blood samples were collected between 14 days and 5 months after the second and third mRNA vaccine (BNT162b2 or mRNA-1273) doses. The SARS-CoV-2 anti-spike IgG titer was analyzed using an enzyme-linked immunosorbent assay (cut-off <7.1 BAU/mL), and the neutralization inhibition rate was analyzed using the surrogate neutralization assay (cut-off <30% of inhibition) for the wild-type, Delta, and Omicron variants.

**Results:** Overall, 148 participants were included. About 30% participants (n=45) received ChAdOx1/BNT162b2/BNT162b2, 24% (n=36) ChAdOx1 nCoV-19/ChAdOx1 nCoV-19/BNT162b2, 22% (n=33) BNT162b2/BNT162b2/BNT162b2, 20% (n=29) ChAdOx1/ChAdOx1/mRNA-1273, and 3% (n=5) received other regimens. No significant differences existed in the SARS-CoV-2 anti-spike IgG positivity rate obtained between the homologous BNT162b2/BNT162b2/BNT162b2 (85%) and the other heterologous groups (83% of ChAdOx1/ChAdOx1/BNT162b2, 90% of ChAdOx1/ChAdOx1/mRNA-1273, and 78% of ChAdOx1/BNT162b2/BNT162b2). There was no significant difference in the neutralization inhibition rate between the four groups for wild-type, Delta, and Omicron variants. The median neutralization inhibition rates against Omicron were 25%, significantly lower than those against wild-type (87%–97%) and Delta (55%–89%) ( $P<0.001$ ).

**Conclusions:** Heterologous COVID-19 vaccinations, comprising a third-dose mRNA vaccine, showed similar humoral immunogenicity compared to homologous BNT162b2/BNT162b2/BNT162b2. Regardless of the schedule, the neutralization inhibition rate against Omicron was very low; therefore, additional preventive measures are required in such high-risk populations.

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## Combined impact of tacrolimus interpatient variability and inpatient variability on allograft outcomes in kidney transplantation

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**Background:** Concentration to dose ratio (CDR) of tacrolimus (TAC) is an index of inter-patient variability that reflects TAC metabolism, and whether it influences allograft outcomes is controversial in kidney transplantation (KT). This study analyzed the effect of TAC interpatient variability combined with TAC inpatient variability (IPV) on allograft outcomes.

**Methods:** In total, 1,080 patients with low immunologic risk were enrolled. Interpatient variability was calculated as the mean value of CDRs up to 3 months after KT, and was defined as rapid metabolizer (RM) if it was lower than 1.05. IPV was calculated as the time-weighted coefficient variability (TWCV) of the TAC-trough level (C<sub>0</sub>) up to 1 year after KT, and was defined as high IPV group if it was higher than 30%. According to CDR and TWCV, patients were divided into four groups: non-rapid metabolizer (NRM)/low IPV, RM/low IPV, NRM/high IPV, and RM/high IPV, and allograft outcomes were analyzed.

**Results:** Death-censored graft loss (DCGL) rates were 5.5% in the NRM/low IPV group, 5.7% in the RM/low IPV group, 10.5% in the NRM/high IPV group, and 19.1% in the RM/high IPV group, which was the significantly highest in the RM/high IPV group. In Cox regression analysis, the hazard ratio (HR) of RM/high IPV was 3.06, which was observed as a significant risk factor. In the analysis in which the TAC time weighted average value was adjusted, RM/high IPV was remained as a significant risk factor with HR 2.49. In the subgroup analysis of the panel reactive antibody (PRA) (-) and (+) groups, the risk for DCGL of RM/high IPV was higher in the PRA (+) group (HR 3.75 in PRA [+]) group vs. 2.79 in PRA [-] group).

**Conclusions:** High TAC-IPV in patients with low CDRs in the early posttransplantation period is thought to have a significant adverse effect on the allograft outcomes.

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## Ethical issues for uterine transplant donation

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Absolute uterine factor infertility accounts for approximately 3% of the global burden of infertility in cis-gendered women (Koplin and Kendal 2020). Uterine transplantation is currently the only intervention that would allow these women to gestate a pregnancy themselves, rather than engaging a surrogate or starting a family through adoption. Although still in its experimental phase, there have been increasing numbers of successful live and cadaveric uterus donations around the world, with the first live birth using a transplanted womb achieved in Sweden in 2014. However, there are significant ethical concerns regarding the procurement and allocation of scarce organs for transplant, as the usual methods for determining which potential recipient has the greatest need or best prognosis do not apply (Arora and Blake 2014). Uterine transplantation is unique among organ transplants, as it is neither life-sustaining nor lifesaving, but rather "life-propagating" (Olausson et al. 2014). As such, justifications for organ harvesting that rely on saving lives are not relevant in the case of uterine transplantation. There are also significant societal pressures regarding reproduction that might diminish informed consent for donors and recipients that require urgent attention before this intervention passes into routine clinical care. This talk will consider these issues with a particular focus on protecting the rights and dignity of potential donors and their families. Sources: Arora KS, Blake V. Uterus transplantation: ethical and regulatory challenges. *J Med Ethics* 2014;40:396-400; Koplin JJ, Kendal E. Ethical issues in uterine transplantation. *Korean J Transplant* 2020;34:78-83; Olausson M et al. Ethics of uterus transplantation with live donors. *Fertility and Sterility* 2014;102:403.

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# Visualization of ischemia reperfusion injury of kidney and prediction of early allograft dysfunction after kidney transplantation using cysteine probe

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**Background:** In kidney transplantation (KT), ischemia-reperfusion injury (IRI) of the transplanted kidney inevitably occurs through a series of processes, especially from deceased donors. About 20%–30% of early graft failure is caused by this IRI. In order to prevent and minimize IRI, it is important to develop a model evaluating the presence and severity of IRI. However, adequate markers for kidney injury are not clear. In this study, we suggest the new diagnostic model for kidney injury and verified its effectiveness.

**Methods:** A new diagnostic method was introduced using the molecular probe NPO-B, which selectively responds to cysteine and exhibits fluorescence. To confirm the efficacy of the NPO-B probe, human kidney-2 cells IRI model in vitro and mouse IRI model in vivo was established. In addition, we compared the predictive capacity for posttransplant early allograft dysfunction between convention factors without urine cysteine and with urine cysteine using the area under the curve (AUC) in 91 KT recipients.

**Results:** *In vitro* model, an increased expression of cystathionine-gamma-lyase was observed in the IRI-treated cell group using Western blot. In the mouse IRI model, dose-dependent increases in NPO-B fluorescence according to ischemia time in both methods including NPO-B injection and NPO-B soaking method was confirmed by using FITS and two-photon microscopy (TPM) (Fig. 1). Cysteine was measured well with NPO-B in mouse urine, and it was confirmed that the predictive power to predict immediate posttransplant graft dysfunction with patient urine was improved by adding urine cysteine to the conventional factors (AUC, 0.82 vs. 0.79).

**Conclusions:** A method to identify and visualize the severity of IRI with cysteine detection using NPO-B was introduced. If this is applied to clinical practice in the future, it is expected to be used to determine the severity of IRI at the time of organ procurement or reperfusion from the deceased donors.

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## Cadaveric kidney transplantation from 2010–2020 at Viet Duc University Hospital: our experience from Vietnam, a developing country

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**Background:** The first case of renal transplantation successfully performed in Vietnam was in 1992. So far, there are more than 20 organ transplant centers around the country, having performed approximately 5,255 renal transplantation cases consisting of 5,045 cases from living donors, 205 cases from brain-dead donors, and five cases from donors after circulatory death. Viet Duc Hospital is the top-ranked surgical center in Vietnam and also the highest level hospital in national system of surgical treatment, having performed around 66,355 intensive operations, including 150–200 renal transplantations and 20–30 liver transplantations each year. Therefore, the aim of this study is to describe the outcome of Vietnamese patients receiving renal transplantation derived from brain-dead donors in Viet Duc Hospital over the course of 10 years.

**Methods:** Cross-sectional descriptive study on 116 patients who have had successful kidney transplantation and are currently being treated at Viet Duc Hospital from May 2010 to May 2020. Various donor and recipient characteristics were analyzed along with graft and patient survival, using Kaplan-Meier method.

**Results:** The mean age of the recipients was 40.01±12.20 years while that of cadaver was 29.1±10.93 years. Proportion of females among recipients was 40.01%. The most common underlying pathology was chronic glomerulonephritis (81.9%). Tacrolimus-based triple-drug regimen was most commonly. The most common cause of death was sepsis intestinal. More than 80% deaths (4/5) occurred within first 5 years, while acute graft: 4.31%. Cumulative proportion of graft patient survival was 97.4% at 3 years and 96.5% at 5 years. Pretransplant hemodialysis, WIT, HLA mismatch has no significant effect on graft.

**Conclusions:** Graft and patient survival rate of cadaveric transplant at our center was very well. There is need to sensitize and augment the rate of cadaveric transplantation to increase the donor pool.

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## The role of passive hepatitis b virus immunization in hepatitis d virus reactivation in liver transplant patients

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**Background:** The advent of high-efficacy nucleos(t)ide analogues (NA) have cast doubt on the utility of the hepatitis B virus (HBV) passive immunization (HBIg) in a post-liver transplant setting. However, the literature on the role of the HBIg in protection from hepatitis D virus (HDV)-reactivation remains contradictory. In this study, we randomly compare for current HDV-replication in those who have received HBIg and in those who have not in our HBV+HDV related post-liver transplant population.

**Methods:** We invited 89 adults who prior to transplantation were HBV or HBV+HDV, and who were at least 1-year posttransplantation on January 1, 2021 (1–9 years follow-up). Fifty-seven patients (34/23 males/females; average age, 50.3 years) accepted: 23 in HBIg and 34 in non-HBIg group. The HBsAg, Anti-HDV, HBV-DNA and HDV-RNA were analyzed between March and December 2021. Non-HBV/HDV causes were excluded. Individual interviews were conducted with each patient on NA-regimen compliance and pre-op HBV/HDV status. The GPT and GOT were tested in replication-positive patients.

**Results:** The HDV-RNA, HBV-DNA, HBsAg and Anti-HDV positivity in the HBIg-group (n=23) was one (4.3%), four (17.4%), two (8.7%) and 22 (95.6%) patients respectively, in the non-HBIg-group (n=34) the same was two (5.9%), three (8.8%), four (11.8%) and 33 (97.05%) patients respectively. Upon interview, all reactivations were in patients who were non-compliant with their NA-regimen. Of the 13 patients who were said to be HBV or HBV/HCV co-infected prior to the transplantation, all but two exhibited Anti-HDV positivity.

**Conclusions:** We could not detect any HDV replication in the two study groups that was attributable to a spontaneous reactivation while being compliant to their NA-regimen. The NAs seem to be effective in maintaining suppression of HDV replication. Adherence to the NA-regimen is more important than the HBIg in the liver transplantation setting. The vast majority of HDV recrudescence cases were mild and were self-limiting after 1–2 years.

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## Preoperative skeletal muscle index is associated with early remnant liver regeneration in living donors after right hemihepatectomy for liver transplantation

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**Background:** We aimed to investigate the correlation between preoperative skeletal muscle index (SMI) and remnant liver regeneration after right hemihepatectomy for living donor liver transplantation, and to determine the preoperative factors predictive of greater remnant liver regeneration in living donors.

**Methods:** This retrospective study included 525 right hemiliver donors (mean age, 28.9±8.3 years; 345 males) between 2017 and 2018, who underwent computed tomography (CT) before surgery and on postoperative day (POD) 7. Preoperative anthropometry, laboratory parameters, skeletal muscle area at the third lumbar vertebral level, and liver volume before and after surgery were evaluated. Correlations were analyzed using Pearson's correlation coefficient, and stepwise multiple regression analysis was used to identify independent predictors of greater remnant liver regeneration.

**Results:** Remnant liver regeneration volume on POD 7 was positively correlated with body mass index (BMI) ( $r=0.280$ ,  $P<0.001$ ) and SMI ( $r=0.322$ ,  $P<0.001$ ), and negatively correlated with age ( $r=-0.154$ ,  $P<0.001$ ) and future remnant liver volume (FRLV)/total liver volume (TLV) ratio ( $r=-0.261$ ,  $P<0.001$ ). Stepwise multiple regression analysis showed that high BMI ( $r=0.146$ ,  $P=0.001$ ) and SMI ( $r=0.228$ ,  $P<0.001$ ) and low age ( $r=-0.091$ ,  $P=0.025$ ) and FRLV/TLV ratio ( $r=-0.225$ ,  $P<0.001$ ) were predictors of greater remnant liver regeneration.

**Conclusions:** High SMI as well as high BMI, low age, and low FRLV/TLV ratio may be predictors of greater early remnant liver regeneration after LDLT in living donors.

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## Optimal dose of anti-thymocyte globulin to improve allograft and patient survival after kidney transplantation: analysis from Korean Organ Transplantation Registry data

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**Background:** The optimal dose of anti-thymocyte globulin (ATG) as an induction regimen in Asian kidney recipients is unclear.

**Methods:** We performed a retrospective cohort study of 4,579 adult patients who received renal transplantation in South Korea between January, 2015 and December, 2019. Patients who received ATG induction were divided into two groups according to the dose of ATG. For creating high-quality propensity score weights, The Toolkit for Weighting and Analysis of Nonequivalent Groups (TWANG) package was applied.

**Results:** Of the 924 recipients with ATG induction, 467 were classified as low dose ATG group and 457 as high dose ATG group based on median value of ATG dose, 4.5 mg/kg. During the 4-year follow-up, the rate of biopsy-proven acute rejection was significantly higher in the high dose group compared with other groups (high dose ATG 25.6%, low dose ATG 22.4%, and basiliximab 20.8%;  $P<0.0001$ ). However, overall graft failure was significantly lower in the high dose ATG group (high dose ATG 2.6%, low dose ATG 5.0%, and basiliximab 4.0%;  $P<0.0001$ ) whereas it is likely that death-censored graft failure was lower in the high dose ATG group with marginal significance (high dose ATG 1.7%, low dose ATG 2.2%, and basiliximab 2.4%;  $P=0.08$ ). Furthermore, mortality was significantly lower in the high-dose ATG group (high dose ATG 1.0%, low dose ATG 2.8%, and basiliximab 1.7%;  $P<0.0001$ ).

**Conclusions:** Compared to basiliximab and low dose ATG induction, high dose ATG induction (more than 4.5 mg/kg) showed superior outcomes in terms of graft and patient survival.

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## Current status of brain death organ donor's management through introduction of electronic notification system of potential brain death donor

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**Background:** In the pandemic situation caused by COVID-19, the restrictions on access are increasing due to the infection problem and the intensive care unit access control has been strengthened. So, the visit of the Korea Organ Donation Agency (KODA) coordinator to discover potential brain death donor is limited. Pusan National University Hospital has a potential brain death donor inquiry system, but there is a problem in that it does not have an automatic notification function. So there is a problem in that the notification of the potential brain death donor is omitted by the medical staff due to busy, or the notification of the potential brain death donor is omitted when it is outside of regular hours. Recognizing the need for an untact way for discovering and notifying potential brain death donor while minimizing the risk of infection, a new electronic notification system for potential brain death donor was introduced, and I would like to introduce the current situation.

**Methods:** A computer was developed to generate a pop-up window when the condition that potential brain death donor criterion lasts for more than 6 hours is satisfied through the information entered in the clinical record of the ICU. Text message are sent to the KODA call center and the Pusan National University Hospital organ transplant center's cell phone on duty. The new electronic notification systems for potential brain death donor operate from February 22, 2021. (Potential brain death donor criterion: Loss of consciousness, LOC: coma, light reflex: fixed, pupil size: 4 mm or more, ventilator mode: CMV, SIMV mode).

**Results:** The number of notification of potential brain death donors from February 22, 2021 to June 30 was 86 cases, of which 19 (22.09%) cases were organ donations. As a result of conducting a survey on 14 users, 64.2% of the respondents said that the electronic notification system of potential brain death donor was working well and 57.1% said that it increased work efficiency. And 57.2% of the respondents answered that the electronic notification system of potential brain death donor had an effect on organ donation, 78.5% were satisfied with the system, and 64.2% said it was convenient to use. 85.7% said that the electronic notification system of potential brain death donor was working for the right patient, and 71.5% said it would not interfere with their work.

**Conclusions:** We have confirmed the efficiency and convenience of the new electronic notification system of potential brain death donor, and it is still in operation for only neurosurgery, trauma surgery, and emergency medicine in its early stages, but it will have to be applied to all clinical departments and patients in the future. And I think that a study to analyze the effect of the applied electronic notification system of potential brain death donor is needed, and a satisfaction survey targeting more users.

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## Efficacy of remote ischemic preconditioning in living donor renal transplantation: a randomized controlled trial

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**Background:** In kidney transplantation ischemia reperfusion injury (IRI) is an inevitable complication. However, paradoxically, an additional injury occurs upon reperfusion which limits the amount of tissue that can be salvaged. Limiting this injury can increase patient and graft survival and can decrease complications associated with transplantation.

**Methods:** Eligible participants were adults (>18 years) undergoing transplantation. The intervention group received RIPC half an hour before undergoing transplantation. The RIPC procedure consisted of four cycles of 5 minutes inflations of the standard blood pressure cuff on the upper arm to 40 mm of Hg above systolic blood pressure followed by 5 minutes of deflated cuff period (reperfusion period). The control group did not receive any intervention before the operation. The efficacy was evaluated as the proportion of patients achieving a 50% decline in serum creatinine level at 72 hours after transplantation and oliguria (<400 mL/day) on days 1, 2 and 3. Secondary objectives were creatinine at 3 months of transplantation, acute rejections and delayed graft function.

**Results:** At the end of 3 months, 58 patients in the RIPC group, and 52 patients in the control group were analyzed. All patients showed a >50% decline in creatinine level at 72 hours of transplant. There was no oliguria in the first 3 days. Delayed graft function was present in 3.8% of cases in the control group and 1.7% in the RIPC group (P=0.7). The mean serum creatinine level in both groups was the same at 3 months (1.2 mg/dL vs. 1.08 mg/dL, P=0.5). Slow graft function was present in 17.3% in the control group while 10.3% in the RIPC group (P=0.1). Acute rejections were similar in both groups (5.2% vs. 7.1%, P=0.8).

**Conclusions:** RIPC has no beneficial effect on urine output and graft outcome in renal transplant patients.

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## ABO-incompatible renal transplant: a single center experience from India

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**Background:** In view of ever-increasing end-stage renal disease (ESRD) population but inadequate availability of suitable donors, ABO-incompatible (ABOi) transplantation can be an important void filler. The initial enthusiasm has been slightly lessened in view of higher rate of infections and poor graft survival as compared ABO-compatible transplant. This study was conducted to study the outcomes of ABOi that were performed over the last decade.

**Methods:** Data from 2012 to 2021 was retrospectively analyzed of all the ABOi transplant performed in a tertiary care hospital. The anti-ABO antibody (IgG) titers (1:4) were considered safe before transplantation. Desensitization included Rituximab, Plasma exchange or selective immunoabsorption column. Tacrolimus and mycophenolate mofetil were initiated at day 7. Induction agent included ATG, ATLG, Basiliximab or no induction. Postoperatively, Anti ABO titers were done daily for 2 weeks.

**Results:** A total of 202 patient underwent transplantation, 195 patients whose data for available for 12 months, were included in the study. UTI was the most common source of infection, occurring in almost half (46.1%) of the patients. ABMR (15%) was common in the first year. Death censored patient survival was 86.6% (169/195) at 1 year. Sepsis was the most common of death in more than two-thirds of the population including COVID-19 associated mortality in nine (4.6%) patients. Graft survival was 89.3% (174/195). AMR was the leading cause of graft loss in almost half of the patients.

**Conclusions:** ABOi should be considered in ESRD patients where suitable ABO compatible donor is not available. Higher rate of rejection and, infection are still a major concern.

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## Profile of serum total bile acid levels and their value in the evaluation of graft dysfunction in live donor liver transplant

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**Background:** Early allograft dysfunction (EAD) in the immediate post liver transplant period is based on clinical criteria and laboratory values. Acute cellular rejection (ACR) is the prototype of graft dysfunction. The aims of this study were to study the profile of serum total bile acids (STBA) in the early posttransplant period in the living donor liver transplant (LDLT) setting and to explore their value in the diagnostic resolution of EAD especially in relation to ACR in liver recipients.

**Methods:** Consecutive patients who underwent LDLT from August, 2018 to December, 2019 were studied. STBA level was measured preoperatively and from postoperative day 1 to 14. EAD was defined as per Olthoffs criteria. ACR was defined as doubling of liver enzymes AST/ALT (transaminitis) from previous in the absence of other causes that responded to steroid pulse or increasing immunosuppression.

**Results:** Of the 63 patients who underwent LDLT, EGD occurred in 25.4% and ACR in 26.9%. The median baseline STBA in cirrhotic patients awaiting liver transplant was 95.1 mol/L (range, 15.5–578.6 mol/L). The STBA levels decrease to near normal values on postoperative day (POD) 1 and continue to plateau till POD 14. The mean value of POD 1 STBA was 30.5 (SD, 56.8) mol/L and on POD 14 was 35.7 (SD, 53.8) mol/L. The STBA levels were higher and with increasing trend in those with EAD from POD 3–14. STBAs increase before ACR 24–48 hours before the increase in liver enzymes. The sensitivity and specificity of STBA increase to predict ACR was 94.1% and 61.9% and the area under the receiver operating characteristic curve is 0.78 (95% CI, 0.653–0.877).

**Conclusions:** STBAs levels were higher and in increasing trend in the first postoperative week in those with EAD. STBAs increase from previous value may help to differentiate between ACR and sepsis.

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# Effect of hypothermic oxygenated machine perfusion compared to conventional static cold preservation in liver transplantation: a systematic review and meta-analysis

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**Background:** Hypothermic oxygenated machine perfusion (HOPE) is a novel technique for liver grafts preservation. Many studies have been performed to demonstrate the effect of HOPE compared to conventional static cold storage (SCS) in extended criteria donors.

**Methods:** We systemically reviewed MEDLINE, Embase, and Cochrane Library for randomized control trials (RCTs) and propensity score matched (PSM) cohort studies that compared HOPE and SCS for preservation of liver grafts published up to August 1, 2022. Data extraction and synthesis were conducted following the PRISMA guidelines. Data were pooled by using random effect model. Primary outcomes were early allograft dysfunction (EAD) and 1-year graft survival. Secondary outcomes were postoperative biochemical outcomes (serum peak alanine aminotransferase) and postoperative complications by ischemia-reperfusion injury (non-anastomotic biliary complications).

**Results:** Overall, two RCTs and nine PSM studies (HOPE, n=418; SCS, n=1,143) were included. Applying HOPE was associated with a significant reduction of EAD in RCTs and PSM studies analysis (RCTs analysis: odds ratio [OR], 0.49; 95% confidence interval [CI], 0.27–0.91; P=0.02; PSM studies analysis: OR, 0.37; 95% CI, 0.24–0.59; P<0.0001). In HOPE group, a significant 1-year graft survival was observed in PSM studies analysis (hazard ratio [HR], 0.57; 95% CI, 0.40–0.81; P=0.002). And serum peak alanine aminotransferase (ALT) remained significantly lower in applying HOPE group in both analyses. Although there was no difference in the incidence of anastomotic biliary structure, non-anastomotic biliary stricture was significantly less occurred in HOPE group in both analyses (RCTs analysis: OR, 0.40; 95% CI, 0.17–0.93; P=0.03; PSM studies analysis: OR, 0.47; 95% CI, 0.25–0.87; P<0.02).

**Conclusions:** This meta-analysis demonstrated that applying HOPE showed less EAD with low serum peak ALT level and improved 1-year graft survival. And using HOPE resulted in lowering risk of non-anastomotic biliary stricture by reducing ischemia-reperfusion injury.

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## What is the ideal surgical procedure for donor and recipient respectively?

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Surgical procedure or technique differ institution to institution or surgeon to surgeon. Benefit or advantage from the patient point of view is paramount important when we choose the procedure. Up to today, we have changed our surgical procedure for patients to enhance their fast recovery, minimize the complications and ensuring the better quality of life postoperatively. For donor procedure, on the earliest days, we have adapted hand assisted retroperitoneal approach then moved to laparoscopic abdominal approach. Currently laparoscopic retroperitoneal approach with pfannenstiel incision for taking out the graft kidney is the procedure we are conducting that allows the scar less prominent. All the manipulations are completed in retroperitoneal space and no manipulation into the abdominal cavity decrease complications such as postoperative ileus. For recipient, our concept is minimize the size of the incision to prevent postoperative hernia or pain, minimize the area of the dissection to prevent lymphocele etc. However, smaller the incision and narrower the space for working, it will be more difficult to handle the situations in case any unexpected events such as bleeding occurs. Taking the balance of these considerations, we make about 7 cm incision, minimal exposure of the vessels, making the future bed for the graft on iliac fossa, decide the position of the graft on the bed and conducting vessel anastomosis with the graft positioned on the bed. Starting the anastomosis with graft positioned on the bed already enable the assistant no need to hold the graft not necessitate us make much space to work. Venous anastomosis is done with intraluminal running suture for posterior wall and over and over suture for anterior wall. For arterial anastomosis, we use parachute technique. This way of anastomosis could be done in smaller space. We will introduce our technique and investigate the benefit for patients compared to other procedure.

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## Deceased donor liver transplantation under Korean MELD score-based liver allocation system at a high-volume transplantation center

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**Background:** The Korean model for end-stage liver disease (MELD) score-based liver allocation system started in June 2016 in Korea.

**Methods:** This study analyzed the detailed status of deceased donor liver transplantation (DDLT) after implementation of the MELD score-based liver allocation system at a high-volume liver transplantation (LT) center in Korea.

**Results:** The study patients were 432 patients with age greater than 14 years. Their ABO blood groups were A (n=158, 36.7%), B (n=104, 24.0%), O (n=90, 20.8%), and AB (n=80, 18.5%). Types of LT were primary LT in 344 (79.6%) and retransplantation in 88 (20.4%). Their KONOS statuses at LT were status 1 (n=21, 4.9%), status 2 (n=260, 60.2%), status 3 (n=133, 30.8%), and status 4 (n=18, 4.1%). Mean MELD score at LT and waiting period were 37.0 and 80.4 days in blood group A; 37.0 and 44.4 days in blood group B; 39.0 and 73.2 days in blood group O; and 34.0 and 87.3 days in blood group AB. Blood group O and AB patients had the highest and lowest mean MELD score at LT allocation, respectively.

**Conclusions:** Serious deceased organ donor shortage led to make a deleterious cycle in raising the MELD score cutoff of LT allocation. Blood group O and AB patients had disadvantage and advantage in LT allocation due to ABO blood group compatibility. High-volume multicenter or nationwide follow-up studies are necessary to precisely delineate the allocation status of DDLT.

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## The effect of retrograde venous renal reperfusion on ischemia-reperfusion injury in rabbits

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**Background:** Ischemia-reperfusion injury (IRI) of a kidney graft is still a current problem in transplantation. The aim of this research was study of the effect of kidney retrograde venous reperfusion (RVR) on IRI.

**Methods:** The seven New Zealand white male rabbits used. Conditionally, two groups were formed: main group including seven left kidneys of rabbits, which underwent RVR before typical antegrade arterial reperfusion; control group including seven right kidneys, which underwent antegrade arterial reperfusion without RVR. After laparotomy, isolation of the left and right kidneys performed and with isolation vessels and adrenal veins. After 15 minutes of ischemia, the kidneys washed with perfusion solution with evacuation of perfusate through the adrenal veins. Then, a prior retrograde venous reperfusion of the left kidney performed, followed by a typical antegrade arterial reperfusion of both kidneys. After 7 days, euthanasia performed and both kidneys of rabbits were taken for histological examination. Histological changes were evaluated by seven parameters with gradations from 0 to 3, where: 0 no changes; 1 minimal; 2 moderate; 3 severe. Bakent University Ethical Committee for Experimental Research on Animals approved this study.

**Results:** According histological characteristics of the kidneys, there were no significant differences between the two groups when comparing histological changes in four parameters (Table 1). However, the degree of vacuolization, glomerular shrinkage and nuclear apoptosis in the tissue samples of the group with RVR are less pronounced compared to the control group ( $P < 0.05$ ).

**Conclusions:** The results of the experimental study showed that the use of RVR could reduce the degree of kidney IRI.

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## Absence of influence of the ABO blood group system on hepatocellular carcinoma recurrence after living donor liver transplantation

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**Background:** The ABO blood group system may influence tumorigenesis, and blood group A has been reported to be associated with adverse oncological outcomes of patients undergoing liver transplantation (LT) for hepatocellular carcinoma (HCC). We intended to validate the prognostic impact of the recipient ABO blood group on HCC recurrence and patient survival after living donor liver transplantation (LDLT).

**Methods:** This study included 843 HCC patients who underwent LDLT between January 2006 and December 2015 at Asan Medical Center. These cases were divided into ABO blood group as group A (n=308 [36.5%]), B (n=216 [25.6%]), AB (n=116 [13.8%]) and O (n=203 [24.1%]).

**Results:** In all patients, the 5-year tumor recurrence rates were 19.8% in blood group A, 20.3% in B, 24.4% in AB, and 23.7% in O (P=0.680). Their overall 5-year patient survival rates were 84.8% in blood group A, 86.0% in B, 86.9% in AB, and 88.0% in O (P=0.603). Comparing with blood group A patients, other blood group patients did not show any statistically significant difference in tumor recurrence (P=0.381) and patient survival (P=0.450). When confined to 685 patients satisfying the Milan criteria, other blood group patients did not show any statistically significant difference in tumor recurrence (P=0.772) and patient survival (P=0.464). When confined to 185 patients exceeding the Milan criteria, other blood group patients also did not show any statistically significant difference in tumor recurrence (P=0.947) and patient survival (P=0.228).

**Conclusions:** The results of the present study revealed that ABO blood system may not influence the oncological outcome of recipients undergoing LT for HCC. Further studies are necessary to validate the prognostic impact of ABO blood system on the posttransplant prognosis of HCC.

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## Analysis of posttransplant hepatocellular carcinoma prognosis using ADV score: a validation multicenter study

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**Background:** ADV score ( $\alpha$ -fetoprotein [AFP]–des- $\gamma$ -carboxyprothrombin [DCP]–tumor volume [TV] score) has been reported as a prognostic surrogate biomarker of hepatocellular carcinoma (HCC) following liver transplantation (LT) and hepatectomy. This study aimed to validate the prognostic impact of ADV score for analyzing prognosis of HCC following LT.

**Methods:** The study patients were 1,599 LT recipients selected from Korean Organ Transplantation Registry database.

**Results:** Deceased-donor and living-donor LTs were performed in 143 and 1,456 cases, respectively. Weak correlation was present among AFP, DCP and TV. The viable HCC group showed ADV score-dependent disease-free survival (DFS) and overall patient survival (OS) rates from 1log to 10log ( $P < 0.001$ ). Prognosis of complete pathological response group was comparable to that of ADV score  $< 1\log$  ( $P \geq 0.099$ ). ADV score cutoff of 5log (ADV-5log) for DFS and OS was obtained through receiver operating characteristic curve analysis with area under the curve  $\geq 0.705$ . Both ADV-5log and Milan criteria were independent risk factors for DFS and OS, and their prognostic impacts were comparable each other. Combination of these two factors resulted in further prognostic stratification, showing hazard ratios for DFS and OS as 2.98 and 2.26 respectively for one risk factor and 7.92 and 8.19 respectively for two risk factors ( $P < 0.001$ ). ABO-incompatible recipients with ADV score  $\geq 8\log$  or two risk factors showed higher recurrence rates.

**Conclusions:** This multicenter validation study revealed that ADV score is a reliable surrogate biomarker for posttransplant HCC prognosis, which can be used for selecting LT candidates and guiding risk-based posttransplant follow-up surveillance.

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## A 10-year retrospective study from a single center of the long-term patency of all-in-one sleeve patch graft venoplasty in 16 patients who underwent living donor liver transplantation with a right liver graft

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**Background:** This retrospective study from single center aimed to evaluate the long-term patency of all-in-one sleeve venoplasty (ASV) in 16 patients who underwent living donor liver transplantation (LDLT) with a right liver graft (RLG) between 2009 and 2019. ASV unifies the right hepatic vein (RHV), short hepatic vein (SHV), and middle hepatic vein (MHV) of an RLG. ASV enables wide side-to-side anastomosis to the recipient inferior vena cava (IVC).

**Methods:** Of 2,875 patients who underwent LDLT with an RLG from August 2009 to July 2019, 16 (0.5%) patients underwent ASV. The ASV techniques applied to these patients, as well as patient long-term outcomes, were analyzed.

**Results:** Type 1 ASV unified one RHV, one IRHV, and one MHV conduit (n=12 [75.0%]). Type 2 ASV unified one RHV, multiple IRHVs, and one MHV conduit (n=4 [25.0%]). All patients are currently alive with a mean follow-up period of 70.1±41.9 months. No patient underwent retransplantation. Follow-up computed tomography showed SHV occlusion in one (6.3%) patient at 4 months, resulting in 1-, 3-, and 5-year SHV patency rates of 93.8% each. MHV occlusion was identified in six (37.5%) patients, with the 1-, 3-, and 5-year MHV patency rates being 81.3%, 68.8%, and 68.8%, respectively (P=0.037). No patient underwent endovascular stenting of the SHV or MHV. Patency rates were significantly higher for SHV than MHV (P=0.037).

**Conclusions:** ASV using various vascular patches is a useful technique enabling secure reconstruction of an RLG in grafts with complex hepatic vein anatomy or recipients with poor IVC condition.

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## Incidence of superficial left hepatic vein and its usability for graft hepatic vein venoplasty in pediatric liver transplantation

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**Background:** The anatomy of the left hepatic vein (LHV) is variable, thus it should be considered for graft hepatic vein (GHV) venoplasty for left lateral section (LLS) and left liver grafts. This study assessed the incidence of superficial LHV (sLHV) branches according to LHV anatomy and its usability for GHV venoplasty in pediatric liver transplantation (LT).

**Methods:** This study consisted of three parts: (1) anatomical classification of LHV variations and the incidence of sLHV branches; (2) morphometric simulative analysis of GHV reconstruction; and (3) clinical application based on LHV anatomy.

**Results:** The LHV anatomy of 248 potential LLS graft donors was classified into four types according to the number and location of GHV openings: one single opening (type 1, n=186 [75.0%]), two large openings (type 2, n=35 [14.1%]), one large and one small adjacent opening (type 3, n=14 [5.6%]), and two large widely-separated openings (type 4, n=13 [5.2%]). An sLHV branch was identified in 87 of 248 (35.1%) donor livers. Morphometric analysis of simulative GHV venoplasty with an sLHV branch increased GHV diameters by 30% in type 1 LLS grafts and 20% in type 2/3 LLS grafts. An analysis of 50 consecutive patients who underwent pediatric LT showed that the 2-year rates of GHV obstruction were 2.0% with LLS grafts and 0% with left liver grafts.

**Conclusions:** The GHV orifice can be enlarged through LHV anatomy-based unification venoplasty. Unification venoplasty with an sLHV branch provided sufficient enlargement of the GHV orifice.

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## Diagnostic role of tumor markers for hepatocellular carcinoma in liver transplantation candidates: an analysis using Korean Organ Transplantation Registry database

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**Background:** This study intended to analyze pretransplant alpha-fetoprotein (AFP) and proteins induced by vitamin K absence or antagonist-II (PIVKA-II) in liver transplantation (LT) candidates.

**Methods:** A total of 3,273 LT recipients enrolled at the Korean Organ Transplantation Registry were divided according to hepatocellular carcinoma (HCC) status and background liver disease, and AFP and PIVKA-II were compared.

**Results:** In all patients, the median AFP and PIVKA-II were 6.3 ng/mL and 29 mAU/mL in viable HCC group and 3.3 ng/mL and 35 mAU/mL respectively in no HCC group ( $P<0.001$  for AFP and  $P=0.037$  for PIVKA-II). In hepatitis B virus-associated patients, they were 6.0 ng/mL and 26 mAU/mL in HCC group and 3.2 ng/mL and 21 mAU/mL in no HCC group, respectively ( $P<0.001$  and  $P<0.001$ ). In hepatitis C virus-associated patients, they were 10.7 ng/mL and 37 mAU/mL in HCC group and 2.6 ng/mL and 21 mAU/mL in no HCC group, respectively ( $P<0.001$  and  $P=0.117$ ). In ALD patients, they were 5.2 ng/mL and 61 mAU/mL in HCC group and 6.4 ng/mL and 75 mAU/mL in no HCC group, respectively ( $P<0.001$  and  $P=0.419$ ). In patients with other diseases, they were 7.1 ng/mL and 32 mAU/mL in HCC group and 3.3 ng/mL and 28 mAU/mL in no HCC group, respectively ( $P<0.001$  and  $P=0.822$ ).

**Conclusions:** The results of the present study indicate that pretransplant serum AFP and PIVKA-II were highly variably expressed in LT candidates with end-stage liver diseases, thus their values should be cautiously interpreted because their role for HCC diagnosis is limited.

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## Expression of tumor markers in liver transplant recipients showing complete pathological response of hepatocellular carcinoma

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**Background:** Complete pathological response (CPR) is achieved with various pretransplant locoregional treatments (LRTs) for hepatocellular carcinoma (HCC). This study aimed to investigate pretransplant expression of HCC tumor markers in liver transplantation (LT) recipients showing CPR.

**Methods:** For CPR group, 166 patients were selected from single-institution LT database. A control group of 332 patients without HCC was also selected.

**Results:** Model for end-stage liver disease score in CPR group was  $11.5 \pm 7.7$ . The number of transcatheter arterial chemoembolization sessions before LT was once in 68 (14.0%), twice in 38 (22.9%), and  $\geq 3$  times in 60 (36.1%). In the explant livers, non-viable solitary tumor was identified in 120 (86.4%) and the largest tumor size was  $2.4 \pm 1.3$  cm. Living-donor and deceased-donor LTs were performed in 152 (91.6%) and 14 (8.4%), respectively. The mean and median levels of  $\alpha$ -fetoprotein (AFP) and protein-induced by vitamin K absence or antagonist-II (PIVKA-II) measured within 2 weeks before LT were  $19.6 \pm 50.4$  ng/mL and 4.2 ng/mL, and  $46.7 \pm 126.2$  mAU/mL and 20.5 mAU/mL, respectively. Receiver operating characteristic curve analysis of AFP and PIVKA-II showed no definite cutoff values for CPR, and area under the curve was 0.552 ( $P=0.052$ ) for AFP and 0.541 ( $P=0.126$ ) for PIVKA-II. The 1-, 3- and 5-year disease recurrence-free and overall survival rates of CPR group were 94.9% and 93.3%, 92.4% and 89.6%, and 92.4% and 89.6%, respectively.

**Conclusions:** The present study results suggest that serum AFP and PIVKA-II are expressed variably in patients with CPR of HCC. Therefore, pretransplant values of HCC tumor markers should be interpreted with caution.

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## Safety and outcome of treatment of latent tuberculosis infection liver transplant recipients

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**Background:** There are limited data on the outcome and tolerability of latent tuberculosis infection (LTBI) treatment in liver transplant. We performed a retrospective cohort study of screening and treatment of LTBI in liver transplant (LT) patients.

**Methods:** All adult LT candidates at Asan Medical Center, a tertiary care teaching hospital in Seoul, Republic of Korea, from March 2020 to February 2022 were screened for LTBI. Patients with positive interferon-gamma releasing assay (IGRA) results or clinical risk factors for LTBI were treated, and the patients were planned to be followed for at least one year after transplantation.

**Results:** Of 899 LT patients, 199 (23%) were diagnosed with LTBI and deemed eligible for treatment (188 positive results for IGRA, nine abnormal chest radiography and no prior prophylaxis, one donor with active TB, three recent close contact with active TB). Of 199 patients, 171 (86%) initiated LTBI treatment and 28 (14%) did not receive treatment. Adequate LTBI treatment occurred in 142/171 (83%) patients; 109/142 (77%) completed, and 33/142 (23%) currently on LTBI treatment. LTBI treatment was discontinued prematurely in 29/171 (17%) patients. The most frequent reason reported was liver enzyme elevation (11/29, 38%). Nine months of isoniazid was the preferred regimen (133/142, 93.7%). Alternative regimens included isoniazid/rifampin (8/142, 5.6%), and quinolone (1/142, 0.7%). During the follow-up period, none of the LTBI-treated patient developed TB. Among 28 LTBI patients who did not receive treatment, 3.6% (1/28) developed TB. Among 658 patients without LTBI, 0.5% (3/658) developed TB.

**Conclusions:** Our study demonstrates that LTBI treatment in LT patients is effective for preventing active TB disease. Some proportion of LT recipients do not tolerate LTBI therapy, therefore treatment should be carried out with caution, especially for potential hepatotoxicity.

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## Donor safety and risk factors of pure laparoscopic living donor right hepatectomy: a Korean multicenter study

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**Background:** The aim was to analyze safety and risk factors of living donor after pure laparoscopic donor right hepatectomy (PLRDH) in a Korean multicenter cohort study.

**Methods:** This retrospective study included 543 patients undergoing PLRDH between 2010 and 2018 in five Korean transplantation centers. Rate of complication based on Clavien-Dindo classification was assessed and multivariate logistic regression analyses were performed to identify risk factors of overall complications, major complications, biliary complications, and open conversion.

**Results:** Overall complication, major complication (Clavien-Dindo classification III and IV), and biliary complication rate were 7.9%, 5.3%, and 3.3% respectively. For overall complication, risk factors were graft weight >680 g ( $P=0.017$ ; odds ratio [OR], 2.35; 95% confidence interval [CI], 1.17–4.71), estimated blood loss ( $P<0.001$ ; OR, 4.88; 95% CI, 2.52–9.45), and operation time >400 minutes ( $P=0.01$ ; OR, 2.45; 95% CI, 1.24–4.85). For major complication, risk factor was graft weight >680 g ( $P=0.026$ ; OR, 3.37; 95% CI, 1.16–9.83). For biliary complications, risk factor was graft weight >680 g ( $P=0.019$ ; OR, 4.84; 95% CI, 1.30–17.97). For open conversion, risk factors were BMI >30 kg/m<sup>2</sup> ( $P=0.006$ ; OR, 11.08; 95% CI, 2.01–60.97) and operation time >400 minutes ( $P=0.036$ ; OR, 4.24; 95% CI, 1.10–16.40).

**Conclusions:** Careful donor selection for PLRDH considering graft weight, high BMI, operation time, and estimated blood loss combined with skilled procedure can minimize the risk of complications.

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## Go-together care programs for living organ donors

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Organ donation itself does not increase the risk of any specific disease or negatively affect life expectancy. However, people can experience severe social pressure to donate when family members are suffered from organ failure. For preparing of organ transplantation, donors must undergo several blood tests, imaging study, in-depth interviews with a social worker, and counseling with a psychiatrist. These result in large mental burden and time investment. Furthermore, after donation, effort is needed by the donor to maintain their health and return to daily life. In response, the Organ Transplant Coordinate Team (OTCT) of Eunpyeong St. Mary's Hospital operates a special donor-care program to help to maintain donor health through counseling, one-stop care service, and regular follow-up. The donor-care program consists of one-stop study service for pre- and postoperative evaluations, periodic out-patient examination, and coordination of charge and spiritual care. For example, the one-stop donor study service in liver transplant patients assessed donation qualification through rapid examination that provides results within 2 days. The care program also provides periodic face-to-face and phone counseling for donors. Spiritual care is supported by visits from priests or nuns during hospitalization before and after surgery. According to statistics from the Ministry of Health and Welfare published in June 2022, donors for living-transplantation numbered 2,581 in 2020, accounting for 84.4% of the total donors. To achieve successful transplant and management of recipients and donors, personalized care is required throughout the process, and education and support programs are required to ensure good self-management after transplantation. Accordingly, Eunpyeong St. Mary's Organ Transplant Hospital supports donors and beneficiaries through the reported program to maintain health throughout the transplant process.

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## Morbidity of laparoscopic living liver donors and its risk factor during the 10-year period

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**Background:** Although laparoscopic living donor program has been safely established in leading centers, donor morbidity is still remaining. This study reviewed the detailed morbidity of laparoscopic living donors and analyzed the risk factors.

**Methods:** Laparoscopic living donors operated during May 2013 to June 2022 were reviewed. The detailed information of donors complication was reviewed. Risk factors related to bile leakage and biliary stricture were analyzed using multivariable logistic regression method.

**Results:** During the study period, a total of 636 donors underwent laparoscopic living donor hepatectomy. Open conversion rate was 1.6%. Right liver graft comprised 92.1% (n=586) of cases. Grade IIIa and IIIb complication occurred in 4.4% (n=28) and 1.9% (n=12), respectively. The most common postoperative complication was bleeding (n=38, 6.0%). Fourteen donors (2.2%) required reoperation. Portal vein stricture, bile leakage and biliary stricture occurred in 0.6% (n=4), 3.3% (n=21), and 1.6% (n=10) of cases and every donor returned to their normal life after proper intervention. There was one case of inferior vena cava stricture and thrombosis which was resolved after balloon angioplasty with thrombectomy. Risk factors related to bile leakage were hepatic artery variation (odds ratio [OR], 3.067; confidence interval [CI], 1.203–7.818; P=0.019), Free margin <5 mm from main duct (OR, 2.731; CI, 1.099–6.787; P=0.031) and estimated blood loss during operation (OR, 1.002; CI, 1.001–1.003; P=0.004) while Pringle maneuver (OR, 0.311; CI, 0.118–0.920; P=0.018) was protective for leakage. Regarding biliary stricture, only bile leakage was significant (OR, 11.902; CI, 2.773–51.083; P=0.001) in the multivariable analysis.

**Conclusions:** Laparoscopic living donor program during the decade showed excellent safety for majority of the donors and critical complications were resolved with proper management.

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## Risk and outcomes after living donor nephrectomy in Korea: 15-year single center outcome

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**Background:** Living-donor kidney transplantation tend to be more common in Asian countries. Previous studies have shown that donor nephrectomy does not increase operation-related mortality or end-stage renal disease (ESRD) risks in usual healthy donors. However, these results were based on studies performed in western countries, and only few results have been reported in the Asian population including Korea. We aimed to analyze the short and long-term risks of living kidney donors in Korea.

**Methods:** We retrospectively analyzed medical records of 1,352 patients who had undergone donor nephrectomy from August 2005 to December 2020 at Seoul St. Marys Hospital. We collected baseline characteristics such as obesity, hypertension, dyslipidemia, diabetes, and GFR. Immediate postoperative complications were graded according to the Clavien-Dindo classification. Hemoglobin, BUN, Cr, GFR, proteinuria, glucose, cholesterol, and triglyceride levels were assessed at regular follow-up intervals. Long-term mortality and incidence of comorbidities were also assessed.

**Results:** Of the 1,352 patients, 740 patients had 5-year follow-up results, and 137 patients had 10-year follow-up results. Five (0.4%) patients had severe postoperative complications; one patient requiring ICU care due to postoperative bleeding. Before donation, 3.0% were hypertensive, 4.7% had dyslipidemia, and 0.1% were diabetic. After donation, 5.8% were hypertensive, 4.9% had dyslipidemia, and 0.1% had diabetes. All donors had eGFR above 60 mL/min/1.732 before nephrectomy, but 19.7% donors showed eGFR below 60 after long-term follow-up, and 4.9% reached eGFR below 40. No mortality or ESRD requiring hemodialysis were reported during follow-up.

**Conclusions:** Donor nephrectomy is a safe procedure with low risk of operation related complications. There was no significant difference in renal function, or cardiovascular comorbidities in donors compared to the healthy population. Limitations of our study was that the donors were from a single center, and many were lost during follow-up. Further studies including data from donors before 2005 may show additional outcomes, on mortality and renal failure.

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## Machine learning based prediction model for renal adaptation in living kidney donors

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**Background:** Development of chronic kidney disease or end-stage kidney disease after donation is a critical issue in living kidney donation. It is imperative to predict postdonation kidney function for deciding eligibility because of long life expectancy in young donors and comorbidities affecting kidney function in elderly donors. We aimed to develop a machine learning based prediction model for renal adaptation after donation in living kidney donors.

**Methods:** This retrospective cohort study included a total of 823 living kidney donors from 2009 to 2020. We developed a prediction model using AutoScore, a machine learning-based clinical score generator. Two main outcomes were analyzed: fair renal adaptation and good renal adaptation, defined as estimated glomerular filtration rate (eGFR) 60 mL/min/1.73 m<sup>2</sup> or above and 65% or above of predonation eGFR between postdonation 6 and 12 months, respectively. A web-application tool was developed using 'shiny' R package.

**Results:** Mean age was 45.2 years and 51.6% was female. Among predonation variables, predonation eGFR, age, sex, body mass index, remaining kidney CT volume percentage, and remaining kidney CT volume/weight, GFR of remaining kidney measured with DTPA were selected as significant factors for prediction models. Additionally, cystatin C based eGFR was selected for fair renal adaptation, while creatinine clearance and serum creatinine were selected for good renal adaptation. Areas under the receiver operating characteristic were 0.847 (95% confidence interval, 0.769–0.924) and 0.632 (0.546–0.718), and areas under the precision-recall curve were 0.967 (0.946–0.979) and 0.708 (0.656–0.781) for fair and good renal adaptation, respectively. An interactive web-application for clinical decision support system was entitled as "Renal Adaptation Prediction Tool prior to Operation (RAPTO)".

**Conclusions:** We developed a novel prediction model for renal adaptation after donation. The RAPTO may help clinical decision for eligibility of living kidney donation and selection of high-risk donors requiring more intense follow-up after donation.

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## Fat and protein modification affects the repair process in ischemic acute kidney injury

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**Background:** The effects of dietary fat and protein on the repair process after ischemic acute kidney injury (AKI) are not well established. In this study, we investigated the effects of dietary fat and protein modification on intrarenal immunologic microenvironment and the repair of postischemic kidneys using murine ischemic AKI and human kidney-2 (HK-2) cell hypoxia model.

**Methods:** Control diet, high-fat with high-protein (HF+HP) diet, and low-fat with low protein (LF+LP) diet were provided to 9-week-old male C57BL/6 mice from day 3 after bilateral or unilateral ischemia-reperfusion injury (BIRI or UIRI) operation. Hypoxic HK-2 cells were treated with additional lipid or amino acid.

**Results:** Body weight and total cholesterol concentration were higher in the HF+HP group than in the control group. Body weight, blood pressure, and BUN were lower in the LF+LP group compared to the control group, while there were no differences in plasma creatinine between groups. In the expression of intrarenal cytokines/chemokines after BIRI, RANTES was increased in the HF+HP group, and IFN- $\gamma$ , IL-4, IL-10, IL-6, and TNF- $\alpha$  were increased and VEGF was decreased in the LF+LP group. IFN- $\gamma$ , IL4, and IL-6 were decreased in the HF+HP group and IL-6 was increased in the LF+LP group compared to the control group after UIRI. Postischemic kidneys of the LF+LP group showed more extensive fibrosis compared to the control group after UIRI. Proliferation of HK-2 cells after hypoxic insult was suppressed by additional amino acid, but facilitated by additional lipid.

**Conclusions:** This study demonstrated that extreme restriction of protein and fat during the recovery phase of ischemic AKI can be detrimental. Further studies are required to elucidate the optimal dietary compositions and the individual effects of protein and lipid during the recovery of ischemic AKI.

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## Delayed treatment with poly (ADP-Ribose) polymerase inhibitor during healing phase of ischemic acute kidney injury

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**Background:** Uncontrolled activation of poly (ADP-Ribose) polymerase (PARP) after DNA damage through NAD<sup>+</sup> depletion aggravates tissue injury including postischemic kidney. Although the beneficial effects of PARP inhibition on the early injury phase of renal ischemia-reperfusion injury (IRI) were previously reported, the effects of PARP inhibitors on the healing phase after renal IRI has not been demonstrated. Delayed treatment of JPI-289, a novel PARP inhibitor, was investigated during the healing phase of murine renal IRI and hypoxic HK-2 cell models.

**Methods:** In murine renal IRI models of unilateral IRI (UIRI) and bilateral IRI (BIRI), male 9-week-old C57BL/6 mice were allocated to the control and the JPI-289 groups and received intraperitoneal injection of saline and JPI-289 50 or 100 mg/kg at 24 or 48 hours after IRI surgery, respectively. Hypoxic HK-2 cells were treated with the JPI-289 and the degree of proliferation was compared.

**Results:** In BIRI model, renal function initially worsened and then recovered in the JPI-289 treated group compared to the control group. At 12 weeks after UIRI, the JPI-289 100 mg/kg twice treated group showed more prominent renal tubular necrosis and damage, inflammatory cell infiltration, and intrarenal expression of proinflammatory cytokines/chemokines compared to the control group, while those were comparable between the groups at 6 weeks after BIRI or UIRI. The degree of fibrosis was comparable between the groups. In HK-2 cell hypoxia model, JPI-289 treatment of 0.5 and 0.75 mg/mL at 3 or 6 hours after hypoxia facilitated the proliferation of hypoxic HK-2 cells, however delayed treatment after 24 hours inhibited proliferation.

**Conclusions:** Our study suggests possible detrimental effects of delayed treatment with PARP inhibitors on the recovery process of ischemic AKI. Further studies regarding the most optimal timing and dosage of PARP inhibitors to facilitate repair of post-ischemic kidney are required.

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## The first case of brain death organ donation in a positive COVID-19 donors in Korea

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**Background:** Solid organ transplants from COVID-19 positive donors were avoided due to concerns about the risk of COVID-19 infection in transplant recipients in the early stages of the COVID-19 pandemic. However, contrary to initial concerns, the possibility of transmitting the COVID-19 through blood or solid organs is very low, so organ transplants for positive COVID-19 donors are currently actively underway in Korea. Therefore, we would like to report the first case of COVID-19 positive brain death donor in Korea.

**Methods:** The first COVID-19 positive brain death donor organ transplant recipient in Korea that occurred on March 6, 2022 was analyzed to determine whether they were infected and the transplant results until August 2022.

**Results:** The donor was a 46-year-old woman with no history and was diagnosed with meningioma and was diagnosed brain dead during treatment. The donor was first diagnosed for the COVID-19 on February 21, 2022 (D0), and then on March 2, 2022 (Ct:21.59, D9) and March 4 (Ct:31.5, D11) PCR tests confirmed positive. After the brain death judgment on March 6, 2022 (D13), liver, kidney 1, and kidney 2 were donated to non-COVID-19 recipients, respectively.

Recipients of liver, kidney1, and kidney2 all had no COVID-19 infection from organ transplantation, and organ function tests at follow-up in the past 5 months after transplantation were all good.

**Conclusions:** The organ donation of the first COVID-19 donor in Korea completed liver, kidney 1, and kidney 2 transplants to non-COVID-19 recipients, and the transplant results were good without infection. Since the first case, organ donation of COVID-19 infected donor has been actively carried out in Korea, and so far, no cases of COVID-19 infection have occurred through organ transplantation. It is believed that a minimum isolation period is necessary for the safety of medical staff and recipients, but COVID-19 infection is not an important factor in determining whether or not it can be organ donated, as studies show that the possibility of COVID-19 infection through solid organs excluding the lung is extremely low regardless of donors symptoms. In addition, through continuous data accumulation and research on COVID-19 donors and recipients, it is considered necessary to maintain a pool of donors and activate donations despite the burden of the medical field that is prolonged due to the COVID-19 resurgence.

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## Impact of low-level donor-specific anti-HLA antibody on posttransplant clinical outcomes of kidney transplant recipients: analysis from Korean Organ Transplantation Registry data

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**Background:** The clinical relevance of donor-specific anti-human leukocyte antigen antibody (HLA-DSA), detected only by solid phase assay (SPA) remains controversial. This study aimed to investigate the impact of low-level donor-specific anti-HLA antibody (low-DSA) on posttransplant clinical outcomes of living donor kidney transplantation (LDKT) recipients using the Korean Organ Transplantation Registry (KOTRY) database, the nationwide cohort.

**Methods:** We analyzed KOTRY data, which included 5,047 cases of LDKT performed between 2014 and 2020. Patients whose HLA-DSA was positive in SPA but negative in crossmatch test were defined as the low-DSA group. Patients without HLA-DSA using both SPA and crossmatch test were defined as the no-DSA group. 2,612 were excluded because of the positive or unknown crossmatch test result or the unknown SPA result. Thus, 2,435 patients were eligible for analysis. Because we observed obvious differences in baseline characteristics between low-DSA and no-DSA groups, propensity score matching was conducted. Two groups were matched in a 1:1 ratio. We compared the incidence of clinical rejection and biopsy proven acute rejection (BPAR), allograft and patient survival rates, changes in allograft function, and infection free survival rate.

**Results:** The incidence of total rejection including clinical rejection, overall BPAR, or biopsy-proven acute T-cell mediated rejection did not differ between two groups. However, biopsy-proven acute antibody-mediated rejection (ABMR) developed more frequently in low-DSA group than in no-DSA group (5.8%, 17/295 vs. 1.7%, 5/295; P=0.009) (Fig. 1). In multivariable analysis, low-DSA was an independent risk factor for the development of ABMR (odds ratio, 3.060; 95% confidence interval, 1.090–8.592; P=0.034). There was no significant difference in allograft survival rate, patient survival rate, changes in allograft function, or infection free survival rate.

**Conclusions:** In conclusion, pretransplant low-DSA was a significant risk factor for the development of acute ABMR. However, this impact did not lead to differences in long-term allograft outcomes.

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## The results after induction of rabbit anti-thymocyte globulin in the deceased donor kidney transplantation using the grafts of above kidney donor profile index score >65%

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**Background:** There are limited data concerning the benefits and adverse effects associated with different induction regimens in kidney transplant recipients using the high kidney donor profile index (KDPI) grafts. The aim of this study is to evaluate the outcome after rabbit anti-thymocyte globulin (rATG) induction with deceased donor kidney transplantation using the graft above KDPI score of 65%.

**Methods:** Between June 2011 and July 2022, 85 patients underwent deceased donor kidney transplantation at Department of Surgery at Konyang University Hospital, Daejeon, Korea. Recipients were divided into two groups; the high KDPI+rATG group A: n=34 and the low KDPI+basiliximab group B: n=28. The following characteristics were evaluated retrospectively through the medical records.

**Results:** The 5-year patient survival in the group A was 87.0% compared to 88.4% in the group B (P=0.986). Graft survival at 5-year was 93.5% and 96.4% in the group A and the group B (P=0.873) respectively. Creatinine level by period of recipients was more increased in group A. But, creatinine level of recipients at 60th months and 72nd months was not significantly different in both groups. Complications during the follow periods and delayed graft function (DGF) was tended to increase in the rATG group groups (79.4% vs. 53.6%, P=0.055 and 23.5% vs. 7.1%, P=0.097).

**Conclusions:** The results show that patient survival and graft survival after induction of ATG of the deceased donor kidney transplantation using the high KDPI grafts is not different. Creatinine levels of recipients at long term periods were not significantly different in both groups. But complications and DGF was tended to increase in the deceased donor kidney transplantation using the high KDPI grafts after induction of rATG.

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## Optimal blood transfusion strategy in ABO-incompatible solid organ transplantation patients: perspective of passenger lymphocyte syndrome

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There has been a lack of well-constructed practical guideline on blood component transfusion in ABO-incompatible solid organ transplantation patients. According to the survey conducted in Korea, they performed a survey by e-mailing a questionnaire to blood bank specialists at 77 major hospitals in Korea. For ABO-incompatible solid organ transplant cases, the recipients ABO group was the most common choice of ABO group for RBC transfusion (70.6%), followed by group O (29.4%). The reason for transfusion of the recipients ABO group rather than the routine use of group O is lack of blood supply as well as to prevent unnecessary infusion of anti-A or anti-B antibodies. In choosing to transfuse RBCs according to this experts opinion, passenger lymphocyte syndrome (PLS) should be considered. PLS is unique type of graft-versus-host disease (GVHD) caused by the transfer of B-lymphocytes present in the donor graft into the recipient circulation. This circulating graft B-lymphocytes induce antibody-induced hemolysis by producing antibodies. Therefore, the patients typically show low hemoglobin and haptoglobin level and elevated lactate dehydrogenase (LDH) and bilirubin level without evidence of bleeding and thrombocytopenia. Unlike thrombotic microangiopathy (TMA), blood smear analysis does not show schistocyte. The direct antiglobulin test (DAT) can detect donor-derived antibodies on the surface of recipient RBCs. Fortunately, in most cases of PLS, symptoms generally mild and self-limited in 4–6 weeks after transplantation. Treatment of PLS is supportive care and transfusion of O RBCs. Especially after COVID-19 pandemic, problem of lack of blood storage in blood bank is getting worse. In order to prevent wastage of the transfused blood by unnecessary hemolysis, appropriate screening protocol for PLS is important. If a decrease in hemoglobin is observed without definite bleeding within 4 weeks after transplantation, preemptive DAT should be performed to confirm PLS before transfusion.

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## Intragraft Kaposi's sarcoma after kidney transplantation: a case report

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Although Kaposi's sarcoma is rare disease, it has a high prevalence in solid organ transplant recipients. Especially in South Korea, the expected prevalence of Kaposi's sarcoma after kidney transplantation was reported to be higher than in other post-transplantation *de novo* cancers. Skin is the most common site for Kaposi's sarcoma. However, we have confirmed intragraft Kaposi's sarcoma after kidney transplantation and would like to review it. A 53-year-old female who had been on dialysis due to diabetic nephropathy underwent a deceased donor kidney transplantation on December 7, 2021. About 10 weeks after kidney transplantation, the level of serum creatinine increased from 1.77 mg/dL to 2.99 mg/dL. Computerized tomography showed hydronephrosis with kinking in allograft ureter. So percutaneous nephrostomy followed by antegrade double J stent insertion was performed. During the procedure, bleeding due to a renal artery branch injury occurred. Therefore, percutaneous embolization of one branch of renal artery was performed. After embolization, she developed uncontrolled fever due to kidney allograft necrosis. Eventually graftectomy was performed to overcome septic shock. On surgical findings, the kidney parenchyme was necrotic as a whole and lymphoproliferative lesion were infiltrated diffusely in the allograft. In addition, multiple lymphadenopathy was observed around iliac artery. The pathologic report confirmed Kaposi's sarcoma in kidney allograft as well as in adjacent lymph nodes. we report a rare case in which a recipient developed Kaposi's sarcoma in kidney allograft as well as in adjacent lymph nodes.

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## Successful management of splenic artery steal syndrome after living donor liver transplantation by splenic artery embolization

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Splenic artery steal syndrome (SASS) is rarely diagnosed syndrome in patients who received liver transplantation with 0.6%–10.1% incidence. The mechanism of SASS is not clarified but there is a hypothesis that portal hypertension cause hepatic artery buffer response and then HA hypoperfusion. SASS can be diagnosed with Doppler ultrasonography (DUS), computed tomography (CT) and angiography but reliable diagnostic criteria is not defined yet. And splenectomy, splenic artery ligation or embolization are used for treatment of SASS. The patient was a 60-year-old female and has liver cirrhosis due to hepatitis B virus. Preoperative CT showed splenomegaly, large splenorenal shunt, small portal vein with enlarged splenic artery and paraesophageal varix. She received living donor liver transplantation (LDLT) from her son. Right lobe graft was donated and graft-recipient weight ratio (GRWR) was 0.92. Small V5 was ligated and there was no V8. Duct-to-duct anastomosis with internal stent insertion was done and recipients left renal vein was ligated. After LDLT, acute rejection was suspicious with abnormal lab findings. However, liver biopsy showed no evidence of rejection. Under suspicion of portal theft syndrome, splenic coronary embolization was performed, but an emergency exploratory laparotomy was performed due to bleeding. After operation, there were still abnormal and not-recovered lab findings. However, postoperative CT showed preserved blood flow in HA, PV, HV, but interval increased size of spleen. Immediately, splenic artery embolization was performed. After embolization, lab finding was rapidly recovered and finally, the patient could discharge. SASS is hard to diagnose and can lead to graft failure. Suspicion for SASS is very important, but DUS is hard to detect SASS in some cases. Angiography can be gold standard for diagnostic tool. Percutaneous splenic artery embolization is a safe and effective method for the treatment of SASS.

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# Living donor liver transplantation alone is not inferior to combined kidney liver transplant for the cirrhotic patients with chronic kidney disease

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**Background:** Chronic kidney disease (CKD) is common in patients with chronic liver disease (CLD) and so is acute kidney injury (AKI). The differentiation of CKD versus AKI is often difficult and sometimes both may coexist. A combined kidney liver transplant (CKLT) may result in kidney transplant in patients whose renal function is likely to recover or at least have stable renal function posttransplant. This audit was carried out on liver transplant recipients with CKD 3–5 who underwent either liver transplant alone (LTA) or CKLT. We aim to look at outcomes and long-term evolution of renal function in those who underwent LTA so that recommendations can be made for patients with CKD.

**Methods:** We retrospectively enrolled 2,742 patients who underwent LDLT at our center from 2006–2019. Among them, 47 patients met the medical eligibility criteria for CKLT. Twenty-five of 47 underwent LTA and the rest 22 underwent CKLT in our cohort. The diagnosis of CKD was made according to the KDIGO classification.

**Results:** Subgroup analysis was done in both groups based on the history of dialysis. Preoperative creatinine was similar between two groups ( $P=0.63$ ) whereas the glomerular filtration rate (GFR) was significantly lower in the CKLT group ( $P=0.007$ ). Among survival of LTA patients, eight (57%) patients had a stable renal function at 1 month and 1 year posttransplant, two (14%) renal function recovered completely, two (14%) were under regular hemodialysis and two (14%) died of COVID-19 infection. Patient survival was significantly better in CKD stage 5 patients who underwent CLKT (log-rank,  $P=0.0009$ ) whereas survival was better in the LTA group in CKD stage 3 ( $P=0.03$ ).

**Conclusions:** This study shows that LTA or sequential kidney is not inferior to CLKT in living donor situations except for CKD stage 5. Renal dysfunction is stabilized while long-term dialysis may be carried out in others.

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## Eculizumab therapy for recurrent atypical hemolytic uremic syndrome after kidney transplantation in atypical hemolytic uremic syndrome: a case report

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Atypical hemolytic uremic syndrome (aHUS), non-Shiga-toxin-HUS, is a rare cause of end stage renal disease. Recently, four regulatory proteins of the complement alternative pathway, complement factor H (CFH), membrane cofactor protein (MCP or CD46), factor I (CFI) and thrombomodulin (THBD) and two proteins of the C3 convertase, C3 and factor B (CFB), had a role in the pathogenesis of aHUS. All patients with a clinical diagnosis of primary aHUS are eligible for treatment with a complement inhibitor like eculizumab. The outcome of kidney transplantation in aHUS is poor and is largely predicted by the underlying genetic alteration. But the lowest incidence of recurrence was observed in patients with MCP mutations. We report a case in which eculizumab was used as a treatment for relapse of aHUS in a patient who underwent a kidney transplant after being diagnosed with renal failure due to aHUS (MCP mutation). A 34-year-old male patient was diagnosed as aHUS with MCP mutation, and received treatment with eculizumab, dialysis and plasma exchange. Despite therapy, his renal function did not recover. So, he underwent a living donor kidney transplantation from his mother. She had also MCP mutation that was not revealed. Five months after the kidney transplant, he developed recurrent aHUS and suspicious antibody-mediated rejection (AMR). So, He was treated with rituximab and plasmapheresis for AMR and resumed treatment with eculizumab for recurrent aHUS. Now he is well-followed up with controlled disease status.

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## Lessons learned from 261 consecutive living donor hepatectomy operations at a single center

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**Background:** Due to the lack of available organs from deceased donors for transplant, living-donor liver transplantation (LDLT) has become available the most feasible treatment option for end-stage liver disease. One essential prerequisite for LDLT is the highest level of donor safety.

**Methods:** From May 2010 to May 2020, a total of 261 completed donor hepatectomies were performed in our center. We analyzed donor morbidity associated with LDLT.

**Results:** The 261 donors included 182 males (69.7%) and 79 females (30.3%), ranging in age from 16 to 64 years, with a mean body mass index of 23.4 kg/m<sup>2</sup>. Five types of liver grafts were obtained, 117 (45%) of a modified right lobe, 113 (43%) consisting of the caudal middle hepatic vein trunk with a preserved right lobe, 16 (6%) of an extended right lobe, 14 (5%) of a left lobe, and one (1%) of a right posterior segment. The average graft weight was 686.2 g, and the average graft volume was 37.5%. No complications were observed in 217 (83.1%) donors, and 44 (16.9%) donors experienced complications. Pleural effusion complications were most common, occurring in 12 (4.6%) patients. According to a modified Clavien classification, grade I, grade II, grade IIIa, and grade IIIb complications were experienced in 28 (10.7%), 1 (0.4%), 12 (4.6%), and 3 (1.1%) donors, respectively. Surgical or interventional management was successful in all grade IIIa and grade IIIb donors.

**Conclusions:** In conclusion, the majority of significant problems associated with significant living donors appear to be preventable by careful selection of living donors and graft types, rigorous postoperative monitoring, and prompt feedback on surgical approaches.

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## The unusual grafts for living donor liver transplantation

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**Background:** To find an adequate graft for living donor liver transplantation (LDLT), the left lobe and the right lobe grafts of the liver were introduced. However, the left lobe graft has a possibility of a small-for-size syndrome, and the right lobe graft has donor safety issues. Then, an extended left liver plus caudate lobe graft (Ext LLC), right anterior section graft (RASG), and right posterior section graft (RPSG) are introduced as alternative options to consider. This study looks at the results of these unusual grafts in LDLT.

**Methods:** In total, 497 recipients underwent an LDLT at Severance Hospital between January 2016 and December 2021. Patients who have received grafts from two separate donors, re-LT patients, and pediatric LT recipients were excluded. Ten patients were found to be the recipients of the unusual grafts. Two patients were RASG recipients, five patients were RPSG recipients, and three patients were Ext LLC recipients. All recipients and donors underwent a detailed investigation of the liver anatomy. We gathered information on recipients' and donors' laboratory findings, graft survival, and complications. The unusual and conventional graft groups were matched in 1:2, using propensity-score matching.

**Results:** The mean model for end-stage liver disease score of the unusual graft recipients was 18 and the mean graft-to-recipient weight ratio was 0.8. ABO blood groups were characterized as incompatible in four cases. All laboratory findings of both the recipients and the donors indicated a downward trend. The survival rates of the unusual graft and the conventional grafts were not statistically different. The major complication rate of unusual graft recipients was similar to the rate of conventional graft recipients. Just like the recipients, the complication of the donor from the unusual graft did not differ from the conventional graft donors.

**Conclusions:** Even though the unusual grafts have a complicated indication, they will ensure improved donor safety and may provide feasible surgical outcomes to recipients.

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## Successful treatment of renal malakoplakia with reduction of immunosuppression and antimicrobial therapy after kidney transplantation: case report

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Malakoplakia is a rare granulomatous disease that usually affects immunocompromised individuals. Genitourinary tract is the most frequent site of infection, manifesting as recurrent urinary tract infection with impaired renal function. Cases of renal allograft malakoplakia are generally associated with a poor graft and patient survival. We present the case of renal malakoplakia after kidney transplantation. A 33-year-old female with CKD grade 5 underwent living-donor kidney transplantation from her mother at Severance Hospital. She was administered 375mg/BSA of rituximab for desensitization due to high PRA (Class 1: 55%). Induction immunosuppression was initiated with 1.5mg/kg of anti-thymoglobulin with intravenous methylprednisolone. Maintenance immunosuppression was done with tacrolimus and oral methylprednisolone with mycophenolate mofetil. She was hospitalized for urinary tract infection with elevated serum creatinine, 3.14 mg/dL seven months after kidney transplantation. Ultrasonography revealed two mass-like lesions on the upper-pole and mid-pole of the transplanted kidney. Renal biopsy was undertaken for further pathological examination and malakoplakia involving renal parenchyma was diagnosed. Upon the diagnosis, immunosuppression was reduced and mycophenolate mofetil was stopped. The dose of tacrolimus was reduced to achieve the trough levels of 3–5 ng/mL. Fluoroquinolone was used for 16 days and TMP/SMX dose was doubled for 7 days. Follow-up renal biopsy was performed 10 days after the initial renal biopsy. Acute T-cell mediated rejection (Banff IA) was diagnosed in addition to malakoplakia. Methylprednisolone pulse therapy was promptly performed to treat the acute TCMR. Her hospitalization lasted for 3 weeks and she was closely observed during her outpatient clinic visit. The mass-like lesions disappeared on ultrasonography after five months and the renal function has been improved. The serum creatinine level decreased to 1.29 mg/dL eight months after the diagnosis of malakoplakia. Our results suggest that a successful treatment of renal malakoplakia can be achieved with reduction of immunosuppression and sustained antimicrobial therapy.

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## Acute kidney injury in kidney transplant recipients with active SARS-CoV-2 infection due to drug interaction of tacrolimus and nirmatrelvir/ritonavir: three serial case reports

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The mortality of SARS-CoV-2 infection of kidney transplant recipients (KTR) is higher than that of general population since immunocompromised condition. A novel oral protease inhibitor against SARS-CoV-2, nirmatrelvir (NR) is considered as a good option for outpatient-based antiviral treatment by reducing the risk of hospitalization and death. However, NR is metabolized mainly by cytochrome P450 3A4 (CYP3A4), which also metabolize calcineurin inhibitor (CNI). Hence, co-administration of these two drug results in drug interaction and increases serum tacrolimus (TAC) level almost 50 times, inducing acute CNI toxicity. Here we report serial three cases, two cases of NR without CNI dose reduction and one case of NR with cessation of CNI after telemedicine consultation with transplant physician. In case 1, since the patient did not aware of the risk of co-administration of NR and TAC, he took these two drugs together, which lead to acute kidney injury due to CNI toxicity. After discontinuation of TAC, renal function was recovered soon with normalized serum TAC concentration. Contrastively, in case 2, 3 days of simultaneous administration of NR and TAC led to sustained acute kidney injury even after discontinuation of TAC. Active intravenous hydration with cessation of TAC for several days improved renal function. However, in case 3, patient was informed to stop TAC with NR initiation in telemedicine consult, which resulted in harmless to renal function with stables serum TAC concentration nor any rejection event after 5 days of cessation of TAC. Therefore, special situation like SARS-CoV-2 pandemic, educating transplant recipient to discuss their new medication through telemedicine with transplant specialist is very important to avoid acute graft injury.

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## Potential tacrolimus sparing role of bisphosphonate in kidney transplantation patients

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**Background:** For the reason of chronic toxicity, tacrolimus-sparing is an important issue to be addressed in patients with kidney transplantation (KT). Several recent studies have shown that bisphosphonate use was associated with a favorable graft outcome in patients with KT. Therefore, we investigated whether the association between tacrolimus trough levels (TTLs) and graft outcome was different according to the use of bisphosphonate in patients with KT.

**Methods:** This retrospective study included 1,657 KT patients who received tacrolimus-based immunosuppressive therapy. Primary exposure was time-dependent cross-product term of TTL (low TTL vs. normal-high TTL with reference of 6ng/mL) and bisphosphonate use. Co-primary outcomes were graft survival defined as patients death or conversion to kidney replacement therapy and eGFR <30 mL/min/1.73 m<sup>2</sup>.

**Results:** During the 11211.8 person-year, graft outcomes occurred in 183 (11.0%) patients. In multivariable Cox regression analysis, normal-high TTL without bisphosphonate was associated with a lower risk of graft outcome (hazard ratio [HR], 0.61; 95% confidence interval [CI], 0.43–0.87) compared to low TTL without bisphosphonate. Normal-high TTL with bisphosphonate was associated with a further lower risk of graft outcome (HR, 0.36; 95% CI, 0.16–0.83) compared to low TTL without bisphosphonate. Low TTL with bisphosphonate was also associated with a lower risk of graft outcome (HR, 0.26; 95% CI, 0.14–0.49) compared to low TTL without bisphosphonate. Similar results were observed with outcome of eGFR <30 mL/min/1.73 m<sup>2</sup>.

**Conclusions:** The use of bisphosphonate was associated with favorable graft outcomes even in lower TTL. The addition of bisphosphonate to the conventional immunosuppressant regimen may reduce tacrolimus requirement.

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## Cardiovascular complications after kidney transplantation

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**Background:** Cardiovascular disease is at a higher risk in patients undergoing dialysis and is known to be the leading cause of death. Kidney transplantation (KT) has the advantage of reducing the cardiovascular risk by discontinuing dialysis, although there is a risk of general anesthesia and aggravation during postoperative care. KT is known to have an intermediate risk with cardiovascular complication of less than 5% after surgery. The purpose of this study is to evaluate the cardiovascular events after KT at a single center.

**Methods:** This study was conducted from January 2017 to June 2022 on 923 patients who underwent KT at Seoul St. Mary's Hospital. Patients who had cardiac enzyme elevation (CK-MB, Troponin T, Troponin I, Pro-BNP) and specific events within 1 month after surgery were analyzed and the incidence of cardiovascular and other complications were investigated.

**Results:** Among patients with cardiac enzyme elevation or abnormal event after surgery, 37 (4.0%) of 923 patients were included. Cardiac enzyme elevation was identified in 36 patients. Among them, cardiovascular origin was confirmed in six (0.6%) and stroke in one (0.1%). Three (paroxysmal AF) out of them improved with medication, and three (STEMI, Variant angina) underwent CAG. The most common cause of cardiac enzyme elevation was postoperative bleeding. Two out of eight expired due to deterioration after reoperation, and the course improved after reoperation in six. In four of cardiac enzyme elevation, dysfunction (one) and graft nephrectomy (three) were performed due to graft kidney failure, and 11 died within 1 month after surgery.

**Conclusions:** The cardiovascular event within 1 month after KT was 0.6% of all patients, the overall fatal complication rate (expired, graft failure, stroke) was 1.6%. Since the incidence of complications within 1 month after KT is not high, the benefits of transplantation are expected to be greater if the risk of general anesthesia is not high.

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# Discovery of cellular and molecular pathways involved in the development of anti-human leukocyte antigen antibody through single cell RNA sequencing in highly sensitized mouse model

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**Background:** Presence of allo-antibody to human leukocyte antigen (HLA), so called sensitization is an important obstacle for successful kidney transplantation. It is well known that B-cell lineage including antibody producing plasma cells have a major role for the induction of sensitization. However, the specific molecular pathway involved in sensitization has not been fully investigated yet. In this regard, we proposed to observe the specific pathway involved in the sensitization to HLA using allosensitized mouse model using HLA.A2 transgenic mice.

**Methods:** Wild-type C57BL/6 mice were sensitized with two times of skin allografts from C57BL/6-Tg (HLA-A2.1)1Enge/J mice. We performed single-cell RNA sequencing analysis using splenocytes isolated from allogenic mice (C57BL/6-Tg [HLA-A2.1]1Enge/J to C57BL/6) and syngenic control (C57BL/6 to C57BL/6) and compared the gene expression in single cell level to characterize the HLA sensitization.

**Results:** We generated 10,705 and 17,411 single-cell transcriptomes from allogenic and syngenic control mouse, respectively. Five major cell types (B-cells, T-cells, NK cells, macrophages, and neutrophils) and their transcriptome data were annotated according to the representative differentially expressed genes (DEGs) of each cell cluster. The percentage of B-cells and T-cells were significantly increased in allogenic mouse, while that of NK cells, macrophages, and neutrophils were decreased. Hsp90aa1 and genes encoding histocompatibility antigen such as H2-Eb1, H2-Ab1, H2-Aa, H2-Oa, H2-DMa, H2-Ob, H2-Q4 were upregulated in B-cells. In addition, GO and KEGG enrichment analyses indicated that the upregulated genes in B-cells were mainly enriched in antigen processing and presentation pathways.

**Conclusions:** This study identified the comprehensive profiles of complex immune response after transplantation using single-cell RNA sequencing analysis. The results indicated that overexpressed genes in B-cells after allosensitization were mainly involved in antigen processing and presentation pathways. It may offer detailed understanding of pathogenesis of HLA sensitization after transplantation and may have implications for the identification of potential therapeutic targets for desensitization.

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## Remission of posttransplant diabetes mellitus in kidney transplant recipients with type 2 diabetes: a multicenter 1-year prospective study

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**Background:** In this study, we analyzed the results of OGTT follow-up for 1 year for kidney transplant patients who had already been diagnosed with diabetes before transplantation or pretransplant screening. In addition, we investigated the pattern of changes in diabetes after transplantation, and a detailed analysis was performed on patients whose diabetes improved.

**Methods:** The multicenter prospective cohort study was conducted between April 1, 2016 and September 31, 2018. Adult patients (aged 20 to 65 years) who received kidney allografts from living or deceased donors were included. After posttransplant 1-year, 74 recipients were divided into diabetic group (n=58) and remission group (n=16) by combining the results of the OGTT test performed 1 year after transplantation and the presence or absence of diabetes medication

**Results:** In the remission group, as in the diabetic group, the HOMA value increased, but the IGI value after transplantation increased unlike the diabetic group. In univariate analysis, younger age, newly-diagnosed diabetes, low HbA1c, high baseline IGI30 were significantly associated with remission of diabetes. After multivariate analysis, only newly-diagnosed diabetes and IGI30 at baseline were associated with remission of diabetes (34.00 [1.192–969.84], P=0.039 and 17.625 [1.412–220.001], P=0.026, respectively).

**Conclusions:** In conclusion, our prospective study revealed that preserved insulin secretory function and undiscovered diabetes at pretransplant were found to be important factors inducing remission of diabetes after kidney transplantation. Based on this study, it is hoped that more advanced research will be conducted on the aspects of diabetes in kidney transplant recipients with diabetes.

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## Kidney transplantation during the COVID-19 era in Myanmar

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**Background:** Kidney transplantation, although widely available nowadays, still need adequate resources, trained personnel and expertise to be successful. In the era of COVID-19 pandemic with its risks and limitations, performing a successful transplantation can be challenging, especially for a developing country like Myanmar.

**Methods:** The kidney transplant cases (mostly live-related) done at four government hospitals during the COVID-19 pandemic (2020 January to 2022 August) were studied. All these cases were managed by a core group (led by the three principal authors and consist of urologists, nephrologists, anesthetists, vascular surgeons, OT and ICU nurses) together with personnel from the respective hospitals. The COVID-19 protocols (mandatory PCR testing of both recipient & donor with strict isolation measures) and the transplant protocols of each hospital were followed.

**Results:** A total of 63 cases from the four hospitals were reviewed, and there was only one (1.6%) death. This patient developed sepsis, acute tubular necrosis and cell-mediated rejection, and expired after 45 days in spite of the extensive treatment given. Eight (12.7%) patients developed complications as shown in the table.

**Conclusions:** Although these transplants were performed during the COVID-19 era in four different hospitals, the outcomes were comparable with the results from our previous cases. Still, there are lessons to be learnt and room for improvement to reduce the morbidity and mortality.

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# The predictive role of absolute lymphocyte counts for fatal infection in heart transplantation recipients who received induction therapy

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**Background:** The induction therapy for heart transplantation (HT) recipients could reduce the rejection risk. However, induction therapy also increases fatal infection risk by decreasing the absolute lymphocyte count (ALC). We investigated the relationship between ALC before and after induction therapy and fatal infection, and determined the cutoff value of ALC for selective induction therapy.

**Methods:** We retrospectively collected 181 HT recipients who received basiliximab or thymoglobulin induction therapy from January 2011 to June 2021. Patients who maintained percutaneous cardiopulmonary support before and after HT were excluded. We collected ALC values at pre-induction (pre-ALC) and nadir after induction therapy (nadir-ALC). Infection within 1-month after HT and fatal infection were determined as clinical outcomes. Fatal infection was defined as mortality in a patient who developed an infection.

**Results:** Among a total of 107 patients (mean age, 49±13 years; female, 31.8%), 1-month infection after HT was confirmed in 24.3% (n=26) of patients and 9.3% (n=10) were fatal infection. ALC significantly decreased after induction (1440.0±629.4 to 275.4±165.7 cells/l, P<0.001). Pre-ALC (1492.9±626.5 vs. 927.0±395.7 cells/l, P=0.006) and nadir-ALC (287.1±164.0 vs. 162.0±144.0 cells/l, P=0.022) were significantly lower in patients with fatal infection than those without fatal infection, but there was no difference in the ratio of pre-ALC and nadir-ALC. The cutoff value of pre-ALC for fatal infection was 1,255 cells/l (AUC 0.782; 95% confidence interval, 0.64–0.92). When grouped into two groups by cutoff value of pre-ALC, the incidence of fatal infection was lower in a high pre-ALC group (1.8% vs. 18.0%, P=0.011).

**Conclusions:** Low ALC before induction therapy was associated with 1-month infection, especially fatal infection in HT recipients. A cut-off value of 1,255 cells/l in pre-ALC could identify the patients at high risk for infection-related death in HT recipients who had induction therapy.

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## Immunogenicity of SARS-CoV-2 vaccine in kidney transplant recipients: a cross-sectional study in Korea

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Data of antibody responses in Asian kidney transplant recipients are scarce. We identified 97 Korean kidney transplant recipients who received two or three doses of SARS-CoV-2 vaccine. Patient samples were cross-sectionally tested with Elecsys anti-receptor binding domain (RBD) antibody (Roche Diagnostics) and R-FIND SARS-CoV-2 neutralizing antibody ELISA (SG Medical). High anti-RBD antibody responses were defined as anti-RBD antibody 100 U/mL. High anti-RBD antibody responses and neutralizing antibody responses were detected in 51/97 (52.6%) patients. Multivariate analysis revealed that increased antibody responses when the time from transplant to vaccination was 2.5 years or longer (odd ratio [OR], 1.31; confidence interval [CI], 1.09–1.57). Anti-RBD antibody titers (441.3 vs. 2531.43 U/mL,  $P=0.006$ ) and neutralizing antibody levels (25.6% vs. 56.4%,  $P<0.001$ ) were significantly lower in patients who were vaccinated less than 2.5 years after the transplantation. Korean kidney transplant recipients had sub-optimal antibody responses after the second or third dose of SARS-CoV-2 vaccine. Shorter time from transplantation to vaccination was an independent risk factor of a low or negative anti-RBD antibody response. Further studies are needed to evaluate the immunogenicity of SARS-CoV-2 vaccines in Asian kidney transplant recipients.

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## Uremic cardiomyopathy may improve with kidney transplantation: a case report

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**Background:** In patients with chronic kidney disease (CKD), left ventricular (LV) hypertrophy with impaired LV systolic function, which is called uremic cardiomyopathy is often observed. In recent studies, CKD may cause and aggravate uremic cardiomyopathy in patients without coronary artery disease. We report a case of improvement of severe uremic cardiomyopathy without coronary artery disease after kidney transplantation (KT).

**Methods:** A 43-year-old male, who received deceased donor kidney transplantation on January 25, 2019. Time on dialysis before KT was 73 months. The cause of CKD was IgA nephropathy. At the time of admission, an echocardiogram revealed a LV ejection fraction (LVEF) of 8%, severe global hypokinesia, and an enlarged bilateral chamber. A coronary angiogram demonstrated normal coronary arteries. He underwent a deceased donor kidney transplantation from marginal donor and produced urine soon after the transplantation. He was treated with the immunosuppression regimen, which included prednisone, mycophenolate mofetil and tacrolimus. Patients were also receiving other medicines than immunosuppressants such as antihypertensive drugs, taken both before and after KT.

**Results:** Successful KT improved his cardiac symptoms and increased his LVEF to 16% at POD 17. His LV function improved as his LVEF increased to 32%, which has been maintained along with a favorable renal allograft function for 4 months. Two years after KT, his LVEF was 60% and the blood creatinine level was maintained at 1.36 mg/dL.

**Conclusions:** This case demonstrates the patients with severely impaired cardiac function could be able to receive significant benefits after successful KT. KT should be considered for CKD patients with LV systolic dysfunction.

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## Undersized lung allograft and long-term pulmonary function after lung transplantation: analysis of Korean Organ Transplantation Registry (KOTRY) data

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**Background:** A mismatch between a smaller donor lung allograft and a larger recipient thorax has been associated with inferior posttransplant survival. However, some controversy exists regarding the association of undersized lung allograft with poor clinical outcomes of lung transplantation (LTx), and the available data are still limited. This study evaluated long-term outcomes, including pulmonary function of undersized allograft compared to well-matched allograft.

**Methods:** Between March 2015 and June 2020, a total of 188 patients received LTx were registered in the prospective, multi-center KOTRY registry. The donor-to-recipient size matching was classified using the donor-to-recipient predicted total lung capacity (pTLC) ratio. After excluding patients received oversized allografts (pTLC ratio of >1.1, n=82), patients were divided into an undersized group (allografts with pTLC ratio of <0.9, n=23) and a well-matched group (allografts with pTLC ratio of between 0.9 and 1.1, n=83).

**Results:** During the immediate posttransplant period, there was no difference in primary graft dysfunction, operation-related complications, hospital mortality, and functional status at discharge. Also, there was no difference in mortality, acute cellular rejection, and chronic lung allograft dysfunction during the long-term follow-up period. However, in the serial follow-up of pulmonary function, FEV1 was significantly decreased in the undersized group than the well-matched group at 3 months (49.0% vs. 66.0%, P=0.038), 6 months (60.5% vs. 75.5%, P=0.023), 1 year (57.0% vs. 81.0%, P=0.046) and 2 years (63.0% vs. 77.0%, P=0.055). FVC was also significantly decreased in undersized group than well-matched group at 3 months (44.0% vs. 61.0%, P=0.033), 6 months (53.0% vs. 64.5%, P=0.037), 1 year (59.5% vs. 75.5%, P=0.039), and 2 years (57.0% vs. 75.0%, P=0.029).

**Conclusions:** Undersized allografts based on pTLC ratio is associated with poor long-term pulmonary function than well-matched allografts, although there are no differences in clinical outcomes.

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## Prevalence of persistent hyperparathyroidism after renal transplantation in Myanmar

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**Background:** Organ transplantation is an effective therapy for end-stage organ failure and is widely practiced around the world. Successful renal transplantation corrects the abnormalities of mineral metabolism that lead to mineral bone disease. However, the degree of renal function recovery is usually incomplete, and persistence of hyperparathyroidism is common. Persistent hyperparathyroidism after renal transplantation in Myanmar population are incompletely known. This is the first clinical trial in Myanmar to evaluate the persistent hyperparathyroidism in kidney transplant recipients.

**Methods:** This is hospital based, single center, descriptive study. Consecutive sampling was used to recruit patients at visit to the DSGH renal transplant clinic over a period of 18 months. Persistent hyperparathyroidism is defined as iPTH greater than 65 pg/mL after 3 months of transplantation.

**Results:** This study found that 77 out of 107 (72%) KTR patients demonstrated persistent hyperparathyroidism. In this study, mean iPTH level was  $96.75 \pm 63.9$  pg/mL with minimum of 25.1 pg/mL and maximum of 443.2 pg/mL. Normal level of iPTH is 15–65 pg/mL. Most of patients 50 (46.7%) were in CKD stage 2T and second most 33 patients were in CKD stage 3A T (30.8%). Only six (5.6%) patients were in advanced CKD stage 4T and 5T. Patients with posttransplant eGFR were negative correlation with posttransplant persistent hyperthyroidism ( $P=0.032$ ). Patients with longer duration of CKD prior to transplantation had increased risk of developing posttransplant hyperparathyroidism. Low vitamin D status ( $<30$  ng/mL) was noted in 56 patients (72.7%).

**Conclusions:** High prevalence of persistent hyperparathyroidism (about 72%) was observed in Myanmar renal transplant recipients despite the recipients healthy allograft function. It is hoped that this study will contribute some information in the clinical practice of posttransplant renal bone disease in our country.

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## Liver transplantation: a 10-year low-volume transplant center experience in Kazakhstan

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**Background:** Liver transplantation is the best available treatment option for patients with end-stage liver disease. The organ transplantation program in Kazakhstan started in 2010. Here we present 10-year experience of liver transplantation in a low-volume transplant center in Kazakhstan.

**Methods:** Clinical data of the 72 consecutive liver transplantations from deceased and living donors between 2010 and 2022 were collected from electronic records. All data were retrospectively analyzed.

**Results:** Among 72 liver transplantations, 12 from deceased and 58 from living donors have been performed in our center from 2010 to 2022. The mean age of the recipient was  $43.7 \pm 10.9$ ; 54.2% female; 45.8% male. Hepatitis B+hepatitis D infection was the most common cause of end-stage liver disease (21 cases, 32.8%). The overall patient survival rates for 1, 3, 5 years were 75%, 71.3%, 65.9% respectively for liver transplant recipient from a living donor and 58.3%, 32.4%, and 32% for the liver recipient from a deceased donor.

**Conclusions:** Our clinical outcomes showed a high rate of biliary and vascular complications that led to the low survival rate of the recipients. Starting the transplant program in Kazakhstan faced various challenges. In the early period, most transplantations were performed in collaboration with or under the guidance of transplant teams of Russia, Turkey, and South Korea. We believe that improving surgical techniques and protocols of pre- and posttransplantation management can diminish the complications after transplantation.

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## HLA-C\*04:01 affects HLA class I heterozygosity and predicted affinity to SARS-CoV-2 peptides and in combination with age and sex of Armenian patients contributes to COVID-19 severity

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The SARS-CoV-2 coronavirus infection has become a global health concern, causing the COVID-19 pandemic. The disease symptoms and outcomes depend on the host immunity, in which the HLA molecules play a distinct role. The present study aimed at detecting associations between HLA alleles and COVID-19 susceptibility and severity in Armenians. The study included 299 SARS-CoV-2 infected patients (75 asymptomatic, 102 mild, 122 severe). To compare the allelic frequency profiles of patient groups with those specific to the general population, we used HLA data of 2,781 registered donors at the Armenian BMDR. This group was used as a control cohort for age-genotype and allele frequency analyses. Based on the conjoint approach of HLA classical loci genotype and allelic distribution analyses between Armenian population controls and COVID-19 cases we discovered an age-related protective effect of the HLA-B\*51:01 carriage against COVID-19 severity. In contrast HLA-C\*04:01 allelic-load contributes to the risk for severe COVID-19 independently of age and classical HLA variables. The HLA-C\*04:01 association with COVID-19 manifestation is rather in concert with the female gender and older age. Along with the expected significant decrease in cumulative heterozygosity of HLA class I loci, we report a previously undescribed decrease in heterozygosity of the HLA-B locus blueprinted by the HLA-C\*04:01 homozygous genotype. In patients with mild to severe COVID-19, due to the high prevalence of HLA-C\*04:01, these effects provide a decrease of the HLA class I loci heterozygosity and a down-modulation of the predicted HLA class I ability to recognize SARS-CoV-2 peptides. The genomic number of HLA-C\*04:01 allele and demographic variables compose the model, in which >15% potential share in the detection of cases with adverse clinical phenotypes belongs to HLA-C\*04:01. The results of the study suggest a putative role of HLA-C genetic variation in the development of a specific immune response to COVID-19.

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## A deep-learning based model for identification of prognostic factors and prediction of graft survival in kidney transplant patients

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**Background:** Kidney transplantation has been known as the ideal treatment for patients with end-stage renal disease. Graft function and survival are key aspects in posttransplant outcomes but it is rather difficult to predict such outcomes due to multifactorial components contributing to patients postoperative course. We attempted to incorporate a deep-learning based model to identify most important prognostic factors that correlate closely with graft function and survival in kidney transplant patients.

**Methods:** We collected clinical information of 4,036 patients who underwent kidney transplantation between 2000 and 2017 at Asan Medical Center. Out of 39 retrospectively collected parameters, 29 parameters were selected as data sets. Using machine-learning algorithms, we made a computerized model to identify potential important features associated with the graft failure. We performed comparative analysis of logistic regression (LR) and machine-learning algorithms (XG boost [eXtreme Gradient Boosting], neural network, support vector machines [SVM]). AUROC (area under receiver operating curve), accuracy, F1 score, precision and recall were used to evaluate the predictive performance of each model.

**Results:** Delayed graft function, positivity of T-flow and B-flow cytometry, presence of donor-specific antibody, HLA mismatch were identified as the most important prognostic factors with regard to graft survival (Fig. 1). Recipients factors including comorbidities such as diabetes, hypertension, high BMI and ABO-incompatibility were also identified as contributing features for graft failure. In addition, serum creatinine measured at 2 years postoperatively was found to be an important predictor of the graft survival. Our results show that all logistic regression, XG boost, neural network, support vector machines have high predictive power (AUROC of 0.835, 0.851, 0.828, 0.815, respectively). The best performing model was XG Boost with accuracy (0.86), F1-score (0.91), precision (0.89), and recall (0.94).

**Conclusions:** With the help of machine-learning algorithms, it was possible to identify predictive factors associated with graft survival after kidney transplantation.

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## Effect of postoperative rapid amylase elevation on graft function after renal transplantation

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**Background:** In patients with renal failure, the excretion fraction of amylase is low, so serum amylase is usually increased, and it is often high even after kidney transplantation. Among them, it is not uncommon for amylase levels to increase to more than 1,000 without typical symptoms of pancreatitis, such as abdominal pain, nausea, or vomiting. There have been few studies investigating the direct relationship between rapid increased amylase level and delayed graft function (DGF).

**Methods:** This study was performed with 114 patients whose amylase level increased to more than 1,000 U/L at least once after renal transplantation between January 2010 and December 31, 2020 in our hospital. Group A was defined as patients whose amylase level increased to 1,000 or higher in 7 postoperative days, and group B was defined as patients whose amylase level increased after 7 postoperative days. The sex of each group, the number of transplants, the dialysis method before transplantation, the donor type, the rate of DGF, and mortality within 30 days after surgery were investigated.

**Results:** There were 95 patients in group A and 19 patients in group B, and the DGF rate of group A was significantly higher than that of group B ( $P < 0.05$ ). Other variants between the two groups including sex, number of transplants, dialysis method before transplantation, transplant type, and mortality within 30 days after surgery showed no significant difference.

**Conclusions:** The DGF rate of patients whose amylase level increased early after surgery was significantly high, so closer monitoring would be necessary for these patients after kidney transplantation.

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## Use of a right lateral sector graft in living donor liver transplantation

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**Background:** Living donor liver transplantation (LDLT) is performed more frequently than deceased donor liver transplantation (DDLT) in Asian countries. Our group firstly reported the usage of right lateral sector graft (RLSG) for LDLT in 2001. In this study, we report donor and recipient outcomes using RLSG.

**Methods:** LDLTs performed from January 2000 to December 2021 in our center were retrospectively analyzed. RLSG was chosen if the left or right liver graft were unappropriated. In this period, we performed 661 LDLTs and used RLSGs in 42 (6.4%) patients.

**Results:** The median age of donor and recipient were 41.5 (interquartile range [IQR], 30–49) and 47 (IQR, 32–56), the median model for end-stage liver disease score was 15.6 (IQR, 12.6–20.9), median operation time of donor and recipient were 525 minutes (IQR, 449–567) and 857 minutes (IQR, 745–968), median graft volume was 458g (IQR, 402–516) and median graft to recipient standard liver volume ratio was 40.9% (IQR, 36.6–46.1). The major complication ratio (Clavien-Dindo classification grade: C-D was three or more) was 7.1% (three patients). No donor mortality occurred. The major complication ratio of the recipient was 50% (21 patients), and the mortality ratio was 9.5% (four patients). Hepatic artery thrombosis and venous stenosis (C-D was three or more) occurred in 9.5% (four patients), portal vein stenosis (C-D was three or more) occurred in 7.1% (three patients), bile leakage (C-D was three or more) occurred in 11.9% (five patients), and biliary stenosis occurred in 38.1% (16 patients). Five-year survival rate was 80%, and the 10-year survival rate was 73%.

**Conclusions:** RLSGs are a feasible graft option in LDLT, but indications should be carefully considered because RLSGs may cause more major complications than right and left liver grafts.

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## Verifying the benefits of radical treatment in posttransplant hepatocellular carcinoma oligo-recurrence: a propensity score analysis

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**Background:** It is unclear whether radical treatment for hepatocellular carcinoma (HCC) oligo-recurrence after liver transplantation conveys survival benefits.

**Methods:** A retrospective study of 144 patients with posttransplant HCC recurrence was performed. Propensity score matching was performed to adjust for baseline covariates between patients receiving radical and palliative treatment. The primary endpoint was post-recurrence survival.

**Results:** Fifty (35%) patients received radical treatment for recurrence, while 76 (53%) and 18 (13%) patients received palliative and supportive treatment, respectively. Comparing to the radical group, patients who received palliative treatment had more early recurrences (time from transplant 17 vs. 11 months,  $P=0.01$ ) and more extensive disease in terms of tumor numbers (1 vs. 4,  $P<0.001$ ), size of largest tumor (1.8 vs. 2.5 cm,  $P=0.046$ ), numbers of involved organs (interquartile range [IQR], 1–1 vs. 1–2;  $P=0.02$ ) and AFP level (7 vs. 40 ng/mL,  $P=0.01$ ). Multivariate Cox-regression analysis revealed that early recurrence (time from transplant hazard ratio [HR], 1.02; 95% confidence interval [CI], 1.01–1.03;  $P=0.001$ ), larger recurrent tumor (HR, 1.12; 95% CI, 1.03–1.23;  $P=0.01$ ), liver recurrence (HR, 1.84; 95% CI, 1.17–2.90;  $P=0.01$ ) and log<sub>10</sub>AFP level upon recurrence (HR, 1.27; 95% CI, 1.07–1.52;  $P=0.01$ ) predicted poor survival. mTOR inhibitor (HR, 0.331; 95% CI, 0.213–0.548;  $P<0.0001$ ) and radical treatment (HR, 0.342; 95% CI, 0.213–0.548;  $P<0.0001$ ) were associated with improved survival. After 2-to-1 propensity score matching for covariates, the 50 patients receiving curative treatment survived significantly longer than the 25 matched patients receiving palliative treatment (median survival 30.9±2.4 vs. 19.5±3.0 months,  $P=0.01$ ).

**Conclusions:** Radical treatment conveys survival benefits to HCC oligo-recurrence after liver transplantation.

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## Impact of tumor biology on outcomes of radical therapy for hepatocellular carcinoma oligo-recurrence after liver transplantation

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**Background:** It is uncertain whether tumour biology affects radical treatment for posttransplant hepatocellular carcinoma (HCC) oligo-recurrence, i.e., recurrence limited in numbers and locations amenable to radical therapy.

**Methods:** We conducted a retrospective study on 144 patients with posttransplant HCC recurrence.

**Results:** Early recurrence within 1 year after transplant (hazard ratio [HR], 2.53; 95% confidence interval [CI], 1.65–3.88;  $P < 0.001$ ), liver recurrence (HR, 1.74; 95% CI, 1.12–2.68;  $P = 0.01$ ) and AFP  $> 200$  ng/mL upon recurrence (HR, 1.62; 95% CI, 1.04–2.52;  $P = 0.03$ ) predicted mortality following recurrence. In patients with early recurrence and liver recurrence, radical treatment was associated with improved post-recurrence survival (early recurrence: median  $18.2 \pm 1.5$  vs.  $9.2 \pm 1.5$  months,  $P < 0.001$ ; liver recurrence: median  $28.0 \pm 4.5$  vs.  $11.6 \pm 2.0$ ,  $P < 0.001$ ). In patients with AFP  $> 200$  ng/mL, improvement in survival did not reach statistical significance (median,  $18.2 \pm 6.5$  vs.  $8.8 \pm 2.2$  months;  $P = 0.13$ ). Survival benefits associated with radical therapy were reduced in early recurrence (13.6 vs. 9.0 months) and recurrence with high AFP (15.4 vs. 9.3 months) but were similar among patients with and without liver recurrence (16.9 vs. 16.4 months). They were also diminished in patients with multiple biological risk factors (0 risk factor: 29.0 months; 1 risk factor: 19.7 months; 23 risk factors: 3.4 months).

**Conclusions:** The survival benefit following radical therapy was superior in patients with favorable biological recurrence but was also observed in patients with poor tumor biology. Treatment decisions should be individualized considering the oncological benefits, quality of life gain and procedural morbidity.

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## Analysis of HLA types with cytomegalovirus-specific cell mediated immunity in seropositive kidney transplant candidates

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**Background:** Cytomegalovirus (CMV)-specific cell-mediated immunity (CMV-CMI) is variable in CMV-seropositive (R+) individuals and has been defined as a predictive biomarker of CMV infection after kidney transplantation (KT). We analyzed whether HLA A, B, C, DR types are associated with CMV-CMI response in R+ KT candidates.

**Methods:** A total of 229 CMV transplant candidates were included. The CMV-CMI was measured by enzyme-linked immunospot (ELISPOT) assays against pp65 and IE-1 antigens.

**Results:** In KT candidates, pp65- and IE-1-ELISPOT results were (277.5 [233.6–325.8]) and (41.0 [27.2–59.8]) (median [95% confidence interval]) spots per 200,000 lymphocytes. Candidates with HLA-A2 (+) or HLA-A30 (-) had increased CMV-CMI than those with HLA-A2 (-) or HLA-A30 (+), respectively (P=0.025 and 0.042, respectively). HLA-B7 or HLA-B58 was associated with an increase in IE-1 CMV-CMI (P=0.027 and 0.032, respectively). We divided the patients into four groups according to pp65- and IE-1-ELISPOT results (pp65-ELISPOT: <115, 115–276, 277–470, >471; IE-1-ELISPOT: <9, 9–40, 41–184, >185 spots per 200,000 lymphocytes). Candidates with HLA-A2, -B7, -B54, or -Cw1 tended to be included in the group with higher ELISPOT results. When we analyze the association between Korean HLA haplotypes and CMV-CMI results, candidates with HLA-A2/B27/Cw1/DR1 had the highest pp65-ELISPOT results (456 [244.9–59.3]), and those with HLA-A30/B13/Cw6/DR7 had lowest results (105.5 [18.2–264.6], P=0.017). For IE-1-ELISPOT, A2/B54/Cw1/DR15 haplotype and A30/B13/Cw6/DR7 haplotype had highest and lowest results, respectively (372.3 [56.1–808.1] vs. 10.8 [4.7–94.5], P=0.028).

**Conclusions:** We observed the differences in CMV-CMI according to the HLA types and HLA haplotypes. HLA types may help stratify the risk of CMV infection associated with CMV-CMIs in CMV-seropositive KT candidates.

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## Current trends and clinical impact of cytomegalovirus prophylaxis in kidney transplant recipients in Korea: the Korean Organ Transplantation Registry study

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**Background:** Cytomegalovirus (CMV) infection is a frequent and devastating complication after kidney transplantation (KT). To minimize adverse effects of CMV, anti-viral prophylaxis is considered an essential treatment in KT recipients, except for low-risk group of CMV. In this study, we investigated current status and clinical impact of CMV prophylaxis in KT recipients in Korea.

**Methods:** A total of 3,241 kidney recipients from 20 transplant centers registered with the Korean Organ Transplantation Registry were included in this study. The recipients were divided into two groups according to receiving prophylaxis, and the impact of prophylaxis on CMV infection and disease, rejection, graft loss, cardiac events, and all-cause mortality were investigated.

**Results:** Among the total study population, 2,853 (88.0%) were intermediate risk and 56 (1.7%) were high risk for CMV infection. 962 (29.7%) recipients received prophylaxis, and the most common reason was routine protocol, followed by thymoglobulin usage. The duration of prophylaxis and types of drugs used were as follows; ganciclovir only for 1.8 weeks (n=429, 44.6%), valganciclovir±ganciclovir for 12.5 weeks (n=412, 42.8%), and valganciclovir±ganciclovir for 10.0 weeks (n=96, 9.9%). 194 (20.1%) experienced side effects, and hematologic complications were the most common (n=154, 79.3%). To evaluate the clinical impact of CMV prophylaxis, 2,756 recipients (ganciclovir±valganciclovir, n=393; ganciclovir±valganciclovir, n=84; and non-prophylaxis, n=2279), excluding those who received prophylaxis less than 4 weeks were analyzed. Non-prophylaxis group experienced more frequent CMV infection and rejection compared with prophylaxis group (28.7% vs. 18.2% and 21.7% vs. 12.21%, respectively). Prophylaxis group showed significant lower risk of CMV infection (hazard ratio [HR], 0.555; 95% confidence interval [CI], 0.139–0.702) and rejection (HR, 0.512; 95% CI, 0.385–0.681) compare with non-prophylaxis group.

**Conclusions:** Our results illustrate current trends and clinical impact of CMV prophylaxis after KT in Korea. Considering the clinical impact of prophylaxis on clinical outcomes, the range of KT recipients receiving CMV prophylaxis should be expanded.

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## Cancer prevalence and risk factors among Korean solid organ transplant recipients

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**Background:** With the number of solid organ transplantations (SOT) in Korea increasing, interest in long-term complications in solid organ transplant recipients (SOTRs) is also increasing. Malignancy is one of the leading causes of death in recipients and the use of immunosuppressants or cancer-causing virus infection is considered as risk factors. Also, it is known that the distribution and risk factors of cancers are different from those of the general population. So here we reported prevalence and risk factors of cancers in Korean SOTRs.

**Methods:** Using data from Korean National Health Insurance Service, we compared incidence of malignancies after SOT to general population by standardized incidence ratios (SIR) and hazard ratio (HR).

**Results:** Total 25,330 (male:female, 15157:10173; median age, 48) patients were transplanted from 2003 to 2019, of which 1,392 (5.5%) developed cancers. SOTRs had 2-fold higher risk (SIR, 2.31; 95% confidence intervals [CI], 2.19–2.44). The highest risk cancer is Kaposi sarcoma (SIR, 159.14; 95% CI, 90.96–258.43) followed by non-hodgkin lymphoma (SIR, 11.21; 95% CI, 9.39–13.29), and non-melanoma skin cancer (SIR, 9.94; 95% CI, 7.91–12.34). Of 1,304 patients, under 19 years old, 49 (3.8%; SIR, 36.31; 95% CI, 26.86–48.01) developed cancer, of which 35 were non-hodgkin lymphoma (SIR, 212.14; 95% CI, 147.76–295.03). Cancer incidence was the highest after 1–3 years of transplantation (315 of 1151; SIR, 1.84; 95% CI, 1.65–2.06). Cancer incidence was not significantly different regardless of induction agent use. SOTRs using tacrolimus or mycophenolate mofetil had less cancer than those who did not use ([HR, 0.79; P<0.05] and [HR, 0.71; P<0.05], respectively).

**Conclusions:** Cancer risk after SOT is higher than general population especially under 19 years old. As types of cancer are different from general population, close monitoring and screening is necessary in SOTRs. Also, other risk factors unanalyzed such as EBV infection should be considered.

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## Transplantation status, challenges and outlook: Bangladesh perspective

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In Bangladesh, the first living donor kidney transplantation was performed in 1982. Since then above 2,300 kidney transplantations were performed. Liver transplantation was started in 2010, but only six were performed. Cornea transplantation was started in 1984 and over 5,500 were done. Bone marrow transplantation was started in 2014 and 25 were transplanted. About 10 centers are performing kidney and three centers performing liver transplantation. In 2018, ABO-incompatible kidney transplantation was started and seven cases performed. Each year, nearly 40,000 patients reach end-stage renal disease (ESRD) but only 250–300 get transplanted. The graft survival at 1-, 5-, and 10- year is 96%, 85%, 50% respectively. Challenges in living donor transplantation include (a) scarcity of donors due to lack of awareness and fear of donation; (b) high cost of investigations, surgery and immunosuppressive drugs with meagre Government subsidy makes transplantation unaffordable for many patients; (c) lack of trained transplant physicians, surgeons, nurses, (d) lack of necessary laboratory facilities. Hurdles for deceased donor transplantation are (a) lack of ICU infrastructure for identification, declaration and management of brain death donors; (b) lack of awareness among general people and health care professionals; (c) certain socio-cultural and religious beliefs; (d) lack of trained transplant physicians, surgeons, nurses, transplant coordinators and grief counselors. In Bangladesh, only living donor transplants were performed so far. Efforts are now being made to start deceased donor transplantation. To increase awareness, different programs and conferences involving healthcare professionals, public, Islamic scholars and international advisers were organized. Leaflets, posters, donor cards were made. Brain Death Committee and Organ Procurement Committee are established and training programs for transplant coordinators and grief counsellors have been organized. It is expected that in future deceased donor transplantation will take place and facility for living donor transplantation will expand.

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## Mac-2 binding protein glycan isomer is new serum biomarker for assessing liver fibrosis: non-invasive method

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**Background:** Hepatitis B virus (HBV) and hepatitis C virus (HCV) hepatitis are common in Mongolia; therefore, above mentioned diseases related hepatocellular carcinoma (HCC) and end stage cirrhosis are serious concern of our country. Most patients with HCC, who undergo liver resection, have chronic liver disease. As a result of it, complications of liver resection are usual. For these reasons, we assess liver fibrosis via Mac-2 binding protein glycan isomer (M2BPGi) in order for diminishing the complications and planning of operation.

**Methods:** Two-hundred-twenty-six patient with HCC, who are subjected to liver resection, are participated to measure fibrosis in this study from 2015 to 2017. In order to assess fibrosis, M2BPGi are taken from patients before operation. The result of M2BPGi are compared with postoperation specimen by ISHAK.

**Results:** Although the number of specimens was small, M2BPGi tended to be very high at F4 stage in both HBsAg and Anti-HCV positive specimens. Compared to HBsAg positive, M2BPGi tended to be high in Anti-HCV positive specimens.

**Conclusions:** M2BPGi correlated with fibrosis stage in specimens gathered at the Mongolian Cancer Center and showed high discrimination ability in F3 / 4 in ROC analysis. M2BPGi is thought to be a useful biomarker in liver fibrosis. However, HBV tends to have a lower value than HCV, so careful attention to background disease is necessary for interpretation of result.

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## Pediatric transplants in India (2013–2020), its growth and the effect of the COVID-19 pandemic

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**Background:** Solid organ transplants (SOT) being the ideal replacement therapy for end organ failures, aim was to identify trends in pediatric transplants across India, its growth from 2013–2019, effect of COVID-19 pandemic, compare with global and WHO SEARO region.

**Methods:** 2013–2020 yearly data of transplant centers, donation and transplantation submitted by identified WHO focal points in member states to GODT was collected, analyzed for pediatric patients.

**Results:** In India 1,522 pediatric transplants (324 DDOT & 1,198 LDOT) were conducted from 2013 to 2020, majority being kidney and liver. Renal transplants exhibited seesaw graph until 2019 when a surge was witnessed followed by a drop in 2020 due to COVID-19 (Fig 1). Contrarily, liver transplants increased till 2020, COVID-19 having negligible effect. Pediatric cardiac transplants were performed in 2013, the first country in the SEARO region (11 countries). Pancreatic transplant started in 2016 and lung in 2017. Living donor transplants were more common due to limited number of pediatric DDs with resultant shortage. There were 324 DD pediatric transplants in 8 years, organs sourced from 174 DDs. India has the maximum number of kidney (560), liver (186), heart (151) and lung (78) transplant centers in the world. Only India performs all the above pediatric SOTs in SEARO, while Thailand does renal and liver transplants. India jumped from 10th to 5th place globally in the total number of pediatric transplants.

**Conclusions:** India exhibits a rising trend in the number of pediatric renal and liver transplants. Efforts are required to increase DDs. Despite being LMIC adequately trained professionals make India the third largest transplanting country and fifth in pediatric transplants. Uniform distribution of transplant facilities is needed. Demand supply gap depicted by data can be bridged by training and dedicated transplant departments as per NOTP guidelines.

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## Severity of post-COVID-19 organizing pneumonia in kidney transplant recipients according to SARS-CoV-2 vaccination

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Kidney transplant recipients (KTR) are on maintenance immunosuppression, therefore showed a higher risk for infection including coronavirus disease 2019 (COVID-19). In addition, the risk of progression to severe state of COVID-19 infection such as acute respiratory distress syndrome (ARDS) can increase in comparison within the general population. Therefore, to prevent COVID-19 infection, the importance of vaccination has been emphasized. However, the beneficial effect of vaccination in KTRs has not been fully investigated yet. In our hospital, we experienced 21 KTRs who had the COVID-19 infection and also showed post-COVID-19 organizing pneumonia (OP). We analyzed the clinical outcomes of those patients according to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) vaccination history. Fifteen patients received vaccination and the other six did not. All patients showed prolonged symptoms for more than a week after diagnosis of COVID-19 and typical chest tomographic findings including bilateral ground glass opacities or lobar consolidation. The patients were treated with the same protocol including glucocorticoid and empirical antibiotics. Post-COVID-19 OP was worse in unvaccinated KTRs. Two out of six unvaccinated patients needed renal replacement therapy (RRT) and mechanical ventilation (MV), and expired. One out of 15 vaccinated KTRs required RRT and MV, and expired. We also found the adverse outcome in older KTRs. Two out of six KTRs over the age of 65 required RRT and MV, and did not survive. One out of 15 KTRs under the age of 65 demanded RRT and MV, and expired. Among six older patients, two of the four unvaccinated patients required RRT and MV, and died of post-COVID-19 OP. Vaccinated KTRs, especially in older patients, showed better recovery after post-COVID-19 OP. Our results suggest that SARS-CoV-2 vaccination may help to prevent the development of severe form of post-COVID-19 pneumonitis, in KTRs who are infected with COVID-19.

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## Educational needs of liver transplant patients before discharge

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**Background:** Liver transplantation (LT) is being implemented as a last resort in patients with end stage of liver diseases. Recent improvement of surgical technic and the development of immunosuppressants, survival rate and success rate. also increasing. In order to maintain liver function, liver transplant patients aim to learn various things such as taking immunosuppressants, diet, and infection control through pre-discharge education and return to home or society, so discharge education after surgery is very important.

**Methods:** The subjects of the study are patients who got pre-discharge education from one hospital after LT within 2 years in Gangnam-gu, Seoul. The discharge program currently in progress provides paper documents and verbal explanation. The contents of education are divided into infection control, medication, emergency response methods, diet, postoperative complication symptoms, and treatment of causative diseases. Overall satisfaction and educational needs for detailed contents were investigated through a 14-question questionnaire.

**Results:** The subject of this study was 81.8% male, 18.2% female, and the age was 54.82 years old. There were 18.2% of NASH, 27.3% of alcoholic liver disease, 27.3% of hepatitis B, and 27.3% hepatocellular carcinoma. The dissatisfaction rate with the educational media was 27.3%, and the dissatisfaction with the number of education session was 36.4%. The dissatisfaction with the content was 36.4% infection control, 18.2% medication, 36.4% emergency response methods, 18.2% diet, and 18.2% education for treatment of causative diseases after LT. Through this, it can be seen that there is a need to improve the content of education, the method, frequency, and timing of education.

**Conclusions:** Through this, it can be seen that it is necessary to improve the content of education. Therefore, this study can be used as basic data for the improvement of the discharge education program for liver transplant patients currently being implemented by investigating the educational needs of discharged time transplant patients.

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## Outcomes and biliary complications of staged biliary reconstruction in living donor liver transplantation: a propensity score matched analysis

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**Background:** Uncontrolled massive bleeding and bowel edema are critical issues during performing liver transplantation. In encountering these circumstances, temporal intra-abdominal packing with staged biliary reconstruction (SBR) had been mentioned as comparable results in deceased donor liver transplantation. However, data in living donor liver transplantation (LDLT) are scarce. Therefore, we aim to analyze the survival and biliary complications of SBR in LDLT.

**Methods:** From January 1, 2009, to January 31, 2020, 1,269 patients underwent LDLT at Kaohsiung Chang Gung Memorial Hospital. Among them, 55 Patients receiving LDLT with SBR were included in SBR group. One-to-two propensity score matching was performed by age, gender, blood loss, model for end-stage liver disease score, Child-Pugh score, and operation period. One-hundred-ten patients receiving one-stage biliary reconstruction (OSBR) LDLT are as OSBR group. Primary outcomes were graft and patient survival. Secondary outcomes were postoperative biliary complications.

**Results:** The mean follow-up was 63 months. Mean blood loss was 8,987 mL in SBR group and 8,582 mL in OSBR group. Patients in SBR Group had more abdominal operation history (49.1% vs. 25.5%,  $P=0.002$ ), longer an hepatic time (86 vs. 67 minutes,  $P=0.007$ ), and more intraoperative blood transfusion (32 vs. 19 units of leukocyte-poor red blood cells,  $P=0.010$ ) comparing to OSBR group. Roux-en-Y hepaticojejunostomy was performed in 74.55% (SBR group) and 3.64% (OSBR group) ( $P<0.001$ ). Patients receiving SBR-LDLT had higher incidence of sepsis (69.01% vs. 43.64%,  $P=0.002$ ), intra-abdominal infection (60.0% vs. 30.9%,  $P<0.001$ ) and antibiotic duration (35 vs. 18 days,  $P<0.001$ ) compared to OSBR-LDLT. Biliary complication rates (30.9% vs. 21.8%,  $P=0.203$ ) and 1- and 5-year survival rates for graft (87.27%, 74.60% vs. 83.64%, 72.71%;  $P=0.978$ ) and for patient (89.09%, 78.44% vs. 84.55%, 73.70%;  $P=0.752$ ) were comparable between two groups.

**Conclusions:** Despite a higher postoperation complication rate, the long-term survival and biliary outcome of SBR group are comparable. SBR is a life-saving procedure for patients in complex critical LDLT.

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## Analysis of status and waiting period of simultaneous transplant (heart-lung, heart-liver) recipients

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**Background:** Simultaneous heart and lung transplantation was performed for the first time on July 24, 2010 at Asan Medical Center. Simultaneous heart and liver transplantation was performed on November 17, 2012, and simultaneous heart, lung and liver transplantation was performed on December 7, 2013, the first in Korea. The criteria for selecting deceased donor organs differ according to the characteristics of each organ, in the case of liver, heart and lung, emergency status is the first consideration. Because there is a shortage of deceased donors, selection of multi-organ transplant recipients requires a complex and careful decision process from the donor's management.

**Methods:** In this study, the degree of emergency status and waiting period of heart-lung and heart-liver transplant recipients performed at our hospital were retrospectively investigated through KONOS computer network data and medical records.

**Results:** In our hospital, a total of 16 heart-lung transplants were performed until November 21, 2021. The gender of transplant recipients was 10 males and six females. Blood types were five type A, four type AB, five type B, and two type O patients. The average age at the time of transplantation was 35 years old (1–64 years) for males and 30 years old (5–49 years) for females. At the time of transplantation, the final emergency status (Status, S) was S0 (11 patients), S1 (three patients), S3 (two patients) for heart and S0 (10 patients), S1 (three patients), S2 (three patients) for lung. The average of the total waiting period was 161 days, and the average of the waiting days after the emergency level was raised was 32 days. At the time of transplantation, the average waiting period for each emergency status (Status, S) was 31.9 (2–114) days for heart S0, 719 (57–1,926) days for S1, and 33 (4–87) days for S2. After the emergency level was raised, the waiting period was 15 (1–95) days for S0, 194 (17–3641) days for S1, and 165 days for S3. Lung were S0 31.9 (2–114) days, S1 719 (57–1,926) days, and S2 33 (4–87) days. After the emergency level was raised, the waiting period was S0 21.9 (2–98) days for S0, 67 (17–165) days for S1, and 30 (1–87) days for S2. A total of six cases of heart and liver transplantation were performed until November 26, 2020. The gender of transplant recipients was four males and two females. Blood types were four type A, one type AB and one type B patients. The average age at the time of transplantation was 43 years old (35–46 years) for males and 58 years old (57–59 years) for females. The final emergency status (Status, S) at the time of transplantation was S0 (five patients) and S1 (one patient) for heart, and for liver in 2012 (2A) and after 2016, the average model for end-stage liver disease (MELD) was 39 (37–40). Average waiting period was S0 (13 days), S1 (4 days) for heart, 2012 (2 days) for liver, and after MELD system in 2016 (7 days). Recipients with a long waiting period (14 days, 29 days) died (42 and 76 days after transplantation), and four patients with a short waiting period (2–10 days) are still alive.

**Conclusions:** Due to the shortage of deceased donors, the use of extended category donors is expanding. It is considered that it is necessary to continue discussing the efficient multi-organ distribution standard that can increase the survival rate of patients with high-severity emergency organ transplantation.

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## Right kidney living donor transplantation with lesser asymmetric split renal function: two case reports

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The number of end-stage renal disease (ESRD) patients continues to grow in South Korea. Because of the discrepancy between increase in ESRD patients and kidney donations, transplantation with expanded criteria donors is gradually being implemented. We present two cases of renal transplantation with lesser asymmetric split renal function that did not fall under the expanded criteria, but were performed as an opportunity to expand the indications for kidney donation. For case 1, a 67-year-old female underwent ABO-identical living related kidney transplantation from her 42-year-old son on May 2022. For case 2, a 42-year-old male underwent ABO-compatible living unrelated kidney transplantation from his 40-year-old wife on February 2022. In preoperative <sup>99m</sup>Tc-DTPA renal scan for donor evaluation, the results showed asymmetric split renal function. Scaled glomerular filtration rate of donors were 96.91 mL/min/1.73 m<sup>2</sup> in case 1 and 165.81 mL/min/1.73 m<sup>2</sup> in case 2. The left to right ratios of donor kidney split renal function were 62:38 in case 1 and 60:40 in case 2. Laparoscopic right donor nephrectomy was performed for the safety of donor. For renal vein elongation, we obtained right gonadal vein for case 1 and right ovarian vein for case 2. The vein grafts were reconstructed as circular wide tubes for right renal vein lengthening. Elongated right renal veins were anastomosed to each of the recipients right external iliac vein with end-to-side fashion. Then we performed end-to-side anastomosis of the allograft right renal artery to each of the recipients right external iliac artery. For case 1, recipient underwent hemodialysis for 45 days due to delayed graft function. Three months after transplantation, allograft function of both recipients was acceptable. Short term outcome of our cases shows lesser asymmetric split renal function may be additional option of the expanded criteria of living donor kidney transplantation.

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## Simultaneous pancreas kidney transplant: a tertiary care center experience in India

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**Background:** Simultaneous pancreas kidney transplant (SPK) gives a physiological replacement of pancreas and kidney function in patients with end-stage renal disease (ESRD) due to type 1 diabetes mellitus (DM) after which the patients can be free from dialysis and insulin therapy. The aim of our study was to report the experience with SPK transplant at a tertiary care center in India.

**Methods:** Outcomes were reported by retrospective review of data of patients who underwent SPK transplant at our center from January 2019 through December 2021.

**Results:** Eleven patients underwent SPK transplant during the study period. Median age of recipients was 36. Ten patients had type 1 DM and one patient had type 2 DM. Median age of donors was 32 years. Median serum creatinine in the donors was 3.54 and amylase was 87. Kidneys were placed in left iliac fossa and pancreas in right iliac fossa. Median cold ischemia time was 561 minutes for pancreas and 417 minutes for kidneys. Median graft weight of kidneys was 142 g. Pancreatic drainage was enteric in all cases. Five patients needed re-laparotomy. Two patients needed graft pancreatectomy in view of duodenal necrosis. One patient had SMV thrombosis but graft was salvaged after re-exploration. One year graft survival was 100% for kidneys and 81% for pancreas. Median creatinine at end of 1 year was 1.01 mg/dL. All patients were independent of dialysis and insulin at end of 1 year.

**Conclusions:** SPK transplant is an effective treatment for type 1 DM with ESRD with favorable outcomes. Though SPK transplant patients had early period complications, timely diagnosis and intervention can prevent graft loss and provide better outcomes.

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## Simultaneous heart-kidney transplantation during mechanical circulatory support in a patient with bilateral iliac artery stenosis

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A 54-year-old male patient was admitted to the emergency room due to cardiac arrest. He had history of coronary artery bypass surgery 3 years ago. Despite the surgery and optimal medical treatment for heart failure, the left ventricular ejection fraction (LVEF) remained less than 35%, and implantable cardioverter-defibrillator was inserted 2 years before admission. Also, he was on hemodialysis for chronic kidney failure and had severe stenosis with heavy calcification of bilateral lower extremity arteries. Six months ago, elective heart and kidney transplantation was discouraged by multi-disciplinary team discussion due to the concern of vascular risk related to the heavy calcification on lower extremity arteries. At the time of admission, he was on pulseless state, and an electrocardiogram (EKG) showed pulseless electrical activity. Thus, cardiopulmonary resuscitation (CPR) was performed, but there was no return of spontaneous circulation. Therefore, extracorporeal membrane oxygenation (ECMO) was inserted at the same time as CPR was performed. Coronary angiography showed significant stenosis at proximal right coronary artery (RCA) and a stent was deployed successfully. Despite revascularization of RCA, his LVEF was not recovered. Since the ECMO weaning process was not successful, we decided to perform simultaneous heart-kidney transplantation. After 2 weeks, appropriate donor was matched, and successful heart and kidney transplantation was performed with the meticulous management of calcified arteries. After the surgery, both heart and kidney remained normal function. He was transferred to the general ward on the third day, and discharged on the 45th day after the operation. To date, he is on stable follow-up at an outpatient clinic. This case showed successful simultaneous heart-kidney transplantation during ECMO in a patient with very high vascular risk and both heart-kidney dysfunction. Patients with multiple comorbidities require systematic management and multi-dimensional cooperation with flexible decision making according to the encountering situation.

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## Impact of acute kidney injury and renal recovery in deceased donor to kidney transplant outcome: report from Thai Transplant Registry

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**Background:** Influence of acute kidney injury (AKI) in deceased donor (DD) on long term kidney transplant (KT) outcome is still conflicted. Effect of renal recovery after AKI to transplant outcome in developing country is not previously elucidated.

**Methods:** Our retrospective cohort study included all DDKT performed in Thailand between 2001 and 2018. AKI was diagnosed according to KDIGO criteria. Renal recovery was defined if DD had improvement of AKI to normal or lower stage. All outcome was determined until end of 2020. The Kaplan-Meier analysis was used to evaluate impact of AKI and transplant survival.

**Results:** This study enrolled 4,234 KT recipients from 2,203 DD, of whom 2,969 (70.1%) recipients received kidneys from 1,545 (70.1%) DD with AKI. Recovery from AKI before procurement was observed in 36.2% (559/1,545) of DD with AKI. Incidence of DGF in no AKI and AKI with recovery group is comparable (34.5% vs. 33.2%,  $P=0.52$ ). Multivariate analysis revealed association between delayed graft function (DGF) and donor AKI (adjusted odd ratio [OR], 1.39; 95% confidence interval [CI], 1.21–1.61) and more significant with persistent AKI (without recovery) (OR, 1.77; 95% CI, 1.55–2.02). Compared to no AKI and AKI with recovery group, recipients of donor with persistent AKI had significantly inferior 1- and 5-year graft survival ( $P=0.041$  and  $0.034$ , respectively), and inferior 1-, 5- and 10-year patient survival ( $P=0.048$ ,  $0.035$  and  $0.047$ , respectively). However, after adjustment for donor, recipient and transplant factors, there was no association between donor AKI and its recovery to graft and patient survival.

**Conclusions:** Outcome of KT from donor AKI with renal recovery is comparable to donor without AKI, including of DGF. However, AKI in DD did not affect long term transplant outcome. Utilization of kidneys from DD with AKI should be reasonable way to expand donor pool.

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## A systematic review and meta-analysis comparing everolimus+CNI with MMF+CNI in kidney transplant

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**Background:** The ideal immunosuppression for kidney transplant patients has the least incidence of acute rejection with the least occurrence of adverse events. This study aims to compare the everolimus against mycophenolate mofetil/sodium in combination with calcineurin inhibitors (CNI) with or without steroids as maintenance immunosuppression in kidney transplant patients.

**Methods:** Studies, databases and literature were searched in Pubmed, the Cochrane Central Register of Controlled Trials and grey literature to identify relevant studies until August 21, 2022. Assessment of risk of bias was done independently by two authors using the revised Cochrane risk of bias assessment tool (RoB 2). Rev-man 5.4 program was used to calculate the risk ratio with corresponding 95% confidence interval for biopsy-proven acute rejection, death and infection. Mean difference was used to compare estimated glomerular filtration rate between two groups.

**Results:** Sixteen RCTs with a total of 5,403 patients comparing everolimus (n=2,763) with MMF (n=2,542) in maintenance immunosuppression post kidney transplant were retrieved and synthesized in the meta-analysis. Results of the study showed no significant difference in the risk for biopsy-proven acute rejection (risk ratio [RR], 1.12; 95% confidence interval [CI], 0.92–1.35; P= 0.13; I<sup>2</sup>=29%) and death (RR, 0.85; 95% CI, 0.63–1.16; P= 0.57; I<sup>2</sup>=0%). There is no significant mean difference of the eGFR between two groups (mean deviation [MD], 0.93; 95% CI, –2.25–4.1; P<0.00001; I<sup>2</sup>= 84%). There was significant increased risks for any infection in the MMF group compared with the everolimus group (RR, 0.83; 95% CI, 0.73–0.93; P=0.0003; I<sup>2</sup>=66%).

**Conclusions:** This meta-analysis showed that everolimus and MMF combined with CNI (cyclosporine or tacrolimus) have no difference in the risks for biopsy-proven acute rejection, death and increased in estimated GFR However, the MMF group exhibited a significant increased risks for any infection. They are equally safe and effective for kidney transplantation recipients.

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## Subnormothermic *ex vivo* lung perfusion protects against ischemia-reperfusion injury via the mTORC–HIF-1 $\alpha$ pathway

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**Background:** *Ex vivo* lung perfusion (EVLP) is a useful technique for evaluating and repairing donor lungs for transplantation. However, studies examining the effects of perfusate temperature on graft function are limited. This study aimed to examine the effects of subnormothermic perfusate temperature during *ex vivo* lung perfusion on ischemic reperfusion injury of the donor lung.

**Methods:** Twenty-four male Sprague-Dawley rats were randomly divided into three groups, namely no treatment (sham group, n=8), normothermic EVLP (37 C, normo EVLP, n=8), and subnormothermic EVLP (30 C, subnormo EVLP, n=8). Lung function analyses, in terms of oxygen capacity, compliance, and pulmonary vascular resistance, were performed. The expression levels of inflammatory cytokines were evaluated. Metabolome analysis was performed on lung tissues from each group using capillary electrophoresis time-of-flight mass spectrometry.

**Results:** Functional parameters such as oxygen capacity, compliance during EVLP and subsequent histologic results were significantly superior in the subnormo EVLP than in the normo EVLP. Expression levels of inflammatory cytokines were significantly lower in the subnormo EVLP than in the normo EVLP. Metabolome analysis showed glycolysis to be significantly decreased in the subnormo EVLP than in the normo EVLP. Expression levels of mTORC, HIF-1, NLRP3, and its effector caspase-1 were significantly lower in the subnormo EVLP than in the normo EVLP.

**Conclusions:** Compared to normothermic EVLP, subnormothermic EVLP improves lung graft function by decreasing the expression of pro-inflammatory cytokines and suppressing glycolytic activity. This can be explained by inhibition of the mTORC-HIF-1 $\alpha$  pathway in subnormothermic EVLP.

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## Diagnosis of severe life-threatening decompensated liver cirrhotic complication via cytokines

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**Background:** Mongolia is known to be the leading country in the world for liver cancer. The primary cause of liver cancer evidently reported were hepatic virus such as HCV, HBV and HDV. The high mortality of patient with liver cirrhosis is mostly due liver decompensation related complication such as GI bleeding, hepatic failure, infection mostly due to spontaneous bacterial peritonitis (SBP). In this study we aimed to determine the SBP in early stages through examination of cytokines from peritoneal fluid.

**Methods:** Study was conducted among 58 hospitalized patients at the Gastroenterology Center of The FCHM between February to September 2020, who were diagnosed with liver cirrhosis and ascites. Ascites fluid was aspirated following the hospital protocol via abdominal tap with a 16-inch needle guided by ultrasonography on the day 1 of hospitalize and examined for IL-4, IL-6 and INF-gamma.

**Results:** The average age for patients was 52.5 and 31 (53.4%) were males. The hepatic viral cirrhosis was 52 (89.6%). Of the total cases, 28 (48.2%) were CTP-B, and 30 (51.8%) were CTP-C and the mean model for end-stage liver disease score was 20.6. The SBP and non-SBP groups characteristics presented in table 1. Best cut-off value to determine SBP for IL-6 was 629.78 pg/mL with sensitivity and specificity both 100% in Mongolian patients.

**Conclusions:** In patient with liver cirrhosis, elevated IL-6 level (more than 630 pg/mL) in ascites can predict the SBP status as early as possible in limited secondary hospital and to start antibiotic treatment also as early as possible.

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## AI model for the segmentation of skeletal muscle, visceral and subcutaneous fat at L3 level using donor CT

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**Background:** Although the L3 skeletal muscle index is accepted as a surrogate marker of sarcopenia and associated vulnerability, the effects of sarcopenia in kidney donors is not well defined. The purpose of this study was to develop and validate an automated method to quantify the skeletal muscle, visceral and subcutaneous fat from an L3 slice on contrast-enhanced abdominal CT images of kidney donors.

**Methods:** The predonation arterial phase CT DICOM images of living kidney donors were downloaded and uploaded to 'OncoStudio' (OncoSoft Inc., Seoul, South Korea), which was used as the AI-based auto-segmentation tool. The AI model within the OncoStudio has a U-Net structure based on a 3D Dense block and automatically proceeds to CT site detection and segmentation without clicking by humans. For this study, a total of 41 datasets were used, 33 for training, one for validation, and seven for independent testing.

**Results:** The consistency between manually segmented volumes and automatically segmented volumes based on AI was evaluated. The average of dice similarity coefficient (DSC) representing the degree of agreement between 3D volumes was 0.92; skeletal muscle: 0.92, subcutaneous fat: 0.97, visceral fat: 0.86. The average The Hausdorff distances 95% (HD95) representing the lower 95% distance between 3D surface points were 8.42, 3.81, and 1.72 mm, respectively.

**Conclusions:** An automated method for measuring volume of muscle and fats at L3 level was successfully developed. This auto-segmentation program can be easily used for prognostic evaluation including donor's sarcopenia and adult diseases.

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## Changes of brain death donors for recent 10 years in Korea: based on Organ Transplantation Law

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**Background:** Although the Korea National Organ Transplantation Law was enacted on February 9, 2000, the disparity between supply and demand was problematic with lack of organ donors. On June 1, 2011, the establishment of independent organ procurement agency, Korea Organ Donation Agency (KODA) and obligatory reporting potential brain death (PBD) patients to KODA were amended. We analyze and report on brain death organ donation (BDOD) in Korea retrospectively for 10 years.

**Methods:** A retrospective analysis was conducted on 20,171 PBD and 5,047 BDOD notified to the KODA from 2011 to 2021.

**Results:** Notifications of PBD increased from 609 in 2011, recording the highest notifications to 2,484 in 2019, and notifications of PBD was 2,141 in 2021. The number of BDOD increased from 368 (pmp 7.2) in 2011 to highest 573 (pmp 11.39) in 2016. Recently, it shows a decreasing trend (442 in 2021 [pmp 8.53]). The BDOD average age of them increased by 5.8 years old from 43.3 years old in 2011. The causes of brain death of BDOD were indicating that the proportion of hypoxic brain injury increased.

**Conclusions:** Even in the unique Asian cultural and ethical environment such as Confucianism, BDOD has made great progress in Korea. The number of notifications of PBD and BDOD increased because of the enforcement of the amended law. However, it is currently stagnant because of various factors such as the enforcement of the 「Act On Hospice And Palliative Care And Decisions On Life-sustaining Treatment For Patients At The End Of Life」 in February 2018 and the recent COVID-19 outbreak. In order to promote organ donations by BDOD in the future, it is required to prepare for a new leap forward for life sharing by strengthening the role of organ procurement organizations and by preparation of the groundwork for DCD implementation with the amendment of the law.

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## Hepatic arterial thrombosis complication after living donor liver transplantation for hepatocellular carcinoma in Mongolia: report on first case

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**Background:** The liver transplantation (LT) has evolved last two years in National Cancer Center of Mongolia and LT has become one of the few curative treatment for patients with hepatocellular carcinoma (HCC) and liver cirrhosis.

**Methods:** Since 2017, We have successfully performed 60 cases in our hospital. One patient of them, had complication for hepatic arterial thrombosis at POD 5. It is happened only one case in 60 patients.

**Results:** The patient 52-year-old male, diagnosed HCC in liver with HBV+HDV related liver cirrhosis, gall bladder stone and esophageal varicose. Pre-procedure TACE (two times) and RFA (three times) due to HCC. Before operation patients laboratory and radiological experiments normal except liver failure. Surgery was successfully done and no complication during surgery. After surgery, condition of patient was stable. We check Doppler sonography every morning. Suddenly, hepatic arterial flow in Doppler sonography at POD 5, and we checked abdominal CT with contrast and angiography. We confirmed hepatic arterial thrombosis, then emergency reoperation for hepatic arterial re-anastomosis. But our second operation is failed, after operation hepatic arterial blood flow is not blowing. We use the local thrombolysis treatment by angiography.

**Conclusions:** In POD 11, arterial flowing normal, RI -0.6 in Doppler ultrasonography. Laboratory experiments are WBC  $6.76 \times 10^4$  U/L, RBC  $3.03 \times 10^6$  mmol/L, PLT 59, HGB 9.5 g/dL, Ast 30 Alt 27, Crea 213 mmol/L, bun 24.4 mmol/L, total bilirubin 29 g/dL, INR 1.54, APTT 32.4 seconds, PT 18.9 seconds. we are infused among six unit blood divided three times. Now additionally patients have problem for pneumonia, we treating by antibiotics combination and mechanical ventilation by tracheostomy. Patients renal impairment was treated by CRRT, now diuresis are increased, enough for hour, creatinine and bun levels are decreased. Considering that case is our first case, based on only one case and we have no experience. This case result is not complete yet.

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## Experiences of living organ donors about advocator in Korea

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**Background:** The percentage of living organ donors in Korea is higher than other countries, which is 49.74 per one-million. The rate of living organ donation has recently increased as the proportion of brain-dead donors declined due to COVID-19, etc. The donor-supporting advocate system is implemented in only few hospitals in Korea. It is necessary to recognize cultural differences and importance of advocator in Korea by referencing experience of living organ donors who conducted interviews with advocator.

**Methods:** Ten people who donated liver or kidney as living organ donors in same hospital were interviewed. It is a qualitative study that analyzed donor statements through open questions about experience of the advocated system before transplantation. Through phenomenological approach, this study classified consequences living donors experienced by interviewing with advocator before donation.

**Results:** Even in case of living donation for family, donor may fear about his or her health. Support for living donors through advocator has been opportunity for donors to reflect on their anxiety about donation. Additionally, it relieved donors by notifying existence of donor supporting systems. On the other hand, donors who already received enough information responded that it was unnecessary.

**Conclusions:** This study identified psychological shifts experienced by living donors when they met advocator in process of donations. It is believed that based on the advocate support system, donors were provided psychological support and convinced about donation before donation. This study is expected to be helpful for donor education, which can be psychological support to living donors in Korea.

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# The effect of a recipient's body mass index to kidney transplantation outcomes: a retrospective cohort study at National Kidney and Transplant Institute

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**Background:** Studies have shown various outcomes on the effect of body mass index to transplant recipients. Currently, no local study has done to document the results of pre-obese and obese individuals post-kidney transplantation. The study aims to determine the effects of recipients' body mass index on short-and long-term outcomes after living donor kidney transplantation.

**Methods:** This is a retrospective cohort study. Body mass index and posttransplant outcomes were measured through chi-square test and ANOVA. The link between body mass index, graft and patient survival was studied using univariate analysis.

**Results:** Significant difference among recipients' body mass index and renal graft function was noted in the first week, 1 and 6-months, 1 and 3-years post-kidney transplantation. The eGFR levels at the first week, 1 and 6-months were higher in underweight compared to normal, pre-obese and obese transplant patients. With a P-value of 0.037, link between recipient's body mass index and graft survival after 3 years was noted. Obese patients were three times to experience graft loss compared to patients with normal body mass index (95% OR, 1.03–7.6) at 3 years. Association between body mass index and graft survival one-year posttransplant was not clearly identified due to small sample size. The same issue with patient survival at 1 and 3-years after kidney transplantation.

**Conclusions:** Study concludes that pre-obese and obese patients are still viable candidates for kidney transplant. The patient and family should be properly informed about the risks and advantages.

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## Association of COVID-19 vaccination and COVID-19 infection risk in heart transplantation recipients

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**Background:** Orthotopic heart transplant (OHT) recipients are vulnerable to SARS-CoV-2 (COVID-19) infection. However, there are few studies studying the clinical impact of COVID-19 vaccination in OHT patients. We aimed to evaluate the COVID-19 infection and related clinical outcomes following vaccination in OHT recipients.

**Methods:** We retrospectively investigated 180 patients alive who underwent OHT from November 1994 to June 2022 at a single tertiary center. We compared the COVID-19 infection rate and related clinical outcomes between vaccinated and non-vaccinated OHT patients.

**Results:** Of the 180 patients (mean age 49 years, male 62.7%), 111 (61.7%) were vaccinated and 69 (38.3%) were not vaccinated. Among them, a total of 60 (33%) patients were infected by COVID-19. The infection rate of COVID-19 in vaccinated patients was tended to be low compared to non-vaccinated patients (28.8% vs. 40.9%,  $P=0.143$ ). Then, among patients who received OHT within 1 year, the rate of COVID-19 infection was significantly lower in patients with vaccination than those without vaccination (3.1% vs. 25.0%,  $P=0.035$ ). A total 21 patients were hospitalized due to pneumonia with COVID-19 infection and one patient died from COVID-19 infection. In hospitalized patients, vaccination was tended to be related to lower risk for pneumonia (38.1% vs. 61.9%,  $P=0.143$ ).

**Conclusions:** The COVID-19 vaccination seemed to reduce the COVID-19 infection and related pneumonia risk in OHT patients. Especially, in patients who had OHT within 1 year, vaccination could significantly reduce the COVID-19 infection risk.

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# Evaluating the effect of Anti-HLA-DR51/52/53 donor-specific antibodies on antibody-mediated rejection in kidney transplantation recipients

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**Background:** The donor-specific antibody (DSA) is a well-known biomarker for predicting antibody-mediated rejection in allograft transplantation. The antigenicity of anti-HLA-DR51/52/53 antigens is relatively weaker than those of HLA-A, -B, and -DR, and its clinical significance is yet understudied. We conducted this study to seek the clinical relevance of anti-HLA-DR51/52/53 DSAs in kidney transplant recipients by evaluating allograft rejections.

**Methods:** All patients who received kidney transplantation between January 2011 and August 2022 were investigated retrospectively using electro-medical records. The single-antigen-bead panel reactive antibody (PRA) results and the history of graft rejection were analyzed. Since our institution did not perform HLA-DRB3/DRB4/DRB5 typing, whether the patients anti-HLA-DR51/52/53 antibody can be considered a DSA, defined as possible anti-HLA-DR51/52/53 DSA, was assumed using the linkage disequilibrium based on the donors HLA-DRB1 type.

**Results:** Among 305 patients who underwent kidney transplantation, 56 (18.36%) presented anti-HLA-DR51/52/53 antibodies in single PRA tests during a median follow-up of 758.50 days (range, 1–3879 days). Thirty-four patients harbored possible anti-HLA-DR51/52/53 DSAs, and 22 showed non-DSA anti-HLA-DR51/52/53 antibodies. Table 1 represents the characteristics of two groups, including anti-HLA-DR51/52/53 type, preformed/*de novo*, and presence of other PRAs and DSA. The antibody-mediated rejection occurred more frequently in the possible anti-HLA-DR51/52/53 DSA group. However, they were not statistically significant in both univariate and multivariate analysis (Cox proportional hazard model: hazard ratio, 2.110; 95% confidence interval, 0.556–8.006; P=0.273).

**Conclusions:** Although the antibody-mediated rejection was higher in the possible anti-HLA-DR51/52/53 DSA group compared to the non-DSA anti-HLA-DR51/52/53 group, no statistically significant difference was observed. Further studies should include more detailed information such as the type of other DSAs and PRAs, grade of ABMR, mean fluorescence intensities, and donors HLA-DRB3/4/5 type to elucidate the clinical relevance of anti-HLA-DR51/52/53 antibodies.

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## A case report on South Korea's first organ donation in a patient with cerebral edema caused by COVID-19

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**Background:** From January to July 2022, a total of 24 patients diagnosed with COVID-19 were assessed for brain death donor in South Korea. Among them, 13 patients tested negative for COVID-19, two patients did not re-test, one patient tested false positive, and a total of eight patients tested positive for COVID-19 during their first brain death examination. This study aims to report the first case of organ donation in South Korea completed by the patient whose underlying cause of brain death was cerebral edema caused by COVID-19.

**Methods:** A retrospective study was conducted by review the medical records from March 23 to 24, 2022.

**Results:** A healthy 6-year-old male patient visited the hospital on March 03, 2022, and presented with high fever (>40C) that lasted more than 12 hours, loss of consciousness, and convulsions. He was diagnosed with R/O COVID-19 MIS-C, myocarditis. Although remdesivir treatment was considered, it was not administered as it is authorized for ages 12 and above. On the fifth day, he was presumed brain death, and his parents gave consent for organ donation. Medical advice was provided by the Division of Infectious Diseases: it is recommended to end quarantine after 20 days and to confirm that cycle threshold value is above 25 when using operating rooms. Following their advice, the CT value was tested at 28.85 for the 20th day and the patient conducted the first brain death test. The next day, donated organs were heart, liver, and kidneys. Each recipient recovered well after 6 months, and none of the recipients were infected with COVID-19.

**Conclusions:** The study confirmed that critical COVID-19 patients can proceed with safe organ donations after sufficient quarantine periods and confirmation of CT values. Therefore, inclusion of COVID-19 positive patients as potential brain death donors may help reduce the shortage of organ donors.

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## Development of critical pathway for ABO-incompatible liver transplant patients

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A critical pathway, a part of case management, has emerged in the health care delivery system for quality management that can satisfy the needs of patients with limited manpower and time and increase the satisfaction of medical personnel. In the case of ABO-incompatible transplantation, the complex process that requires preoperative treatment such as plasmapheresis and immunosuppressant treatment and additional postoperative treatment and monitoring, and communication of a multidisciplinary team in the process, is required. If suitable CP is developed, it is expected that the quality of the treatment process and efficient operation will be achieved. This study was conducted to develop CP for ABO-incompatible liver transplant patients at one hospital. The research method forms a conceptual frame of reference based on the literature review and the protocol currently used in this hospital, and is preliminarily prepared through meetings between multidisciplinary teams such as transplant surgery, gastroenterology, laboratory medicine, radiology, blood bank, and nursing. In order to prepare the critical pathway and confirm its practical applicability, the final critical pathway is confirmed after verifying the clinical validity for liver transplantation patients from 2020 to 2021. In the critical pathway, seven items including examination, diet, medication, assessment, treatment, lab, and education on the vertical axis and the horizontal axis were determined from the time of admission to the day of discharge. By applying the CP developed as a result of this study to practice, it is expected that the ABO-incompatible liver transplantation process will be standardized to improve the quality of medical care and improve the efficiency of medical institution operation.

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## Usefulness of ureteroureterostomy for kidney transplantation

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External ureteroneocystostomy (UNC) is a standard method for kidney transplantation. Some of the recipients, particularly with long dialysis vintage, may have small and contracted bladder having a hard and friable wall, where UNC is difficult to be performed, and complications such as stenosis or urine leak frequently occur. Ureteroureterostomy (UUS) has an advantage of maintaining the natural anti-reflux anatomy of vesicoureteral junction, but the prevention of stenosis at the site of anastomosis is challenging. We have four cases of successful UUS; three patients with contracted bladder and one case with very short donor ureter. The first case had hemodialysis vintage of 15 years. the bladder volume on the preoperative cystography was 50 cc, which increased to 450 cc after 3.5 years. The second case had hemodialysis vintage of 14 years, had a preoperative bladder volume 80 cc, which increased to 400 cc after 4 years. The vintage of peritoneal dialysis of the third case was 9 years. Preoperative bladder volume was 50 cc, that increased to 350 cc at 9 months. The ureter of cadaveric donor kidney of the 4th case was accidentally cut at the pelvis level during harvest. A double J catheter was inserted during the surgery, which was removed after one month. No cases of urine leak or stenosis was observed. UUS would be a useful alternative for patients with a contracted bladder or a short donor ureter.

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## Recent perioperative blood transfusion in elective kidney transplantation

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**Background:** Forecasting an appropriate demand for blood transfusion is essential for a blood bank. Balancing supply and demand is a key factor for effective and efficient blood product inventory management. Due to the risk of an emergency such as massive bleeding during transplantation surgery, it is necessary for the blood bank to maintain an adequate level of blood product inventory. In this study, we analyzed the perioperative transfusions in elective kidney transplantation patients.

**Methods:** Data of all complement-dependent cytotoxicity-crossmatched assays between the year 2013 and the year 2022 were collected. We excluded duplicates in case of a repeated assay in one patient and we excepted the patients who did not undergo kidney transplantation. Transfusion records such as a number of blood products and transfusion adverse reactions were reviewed retrospectively.

**Results:** A total of 30 patients were undergone elective kidney transplantation from the year 2015 to the year 2022. The mean age of the patients was 48.07 years. The male to female ratio was 1.5:1. Four patients were transfused intraoperatively, whereas eight patients were transfused postoperatively. The postoperative hemoglobin level of the transfusion group was significantly lower than that of the non-transfusion group. Postoperative platelet count, PT INR, and aPTT concentration were not significantly different between the two groups. Leuko-reduced filtered red blood cells were most transfused intraoperatively followed by fresh frozen plasma. As a result of dividing the study period into the first half and the second half according to the time of operation, there were more cases of significant transfusion in the first half.

**Conclusions:** In most cases of elective kidney transplantation, surgery was performed without blood transfusion, and the transfusion time was changed from intraoperative to postoperative. The introduction of patient blood management along with the development of surgical techniques seems to have influenced the perioperative transfusion pattern.

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## Comparison analysis of ABI between internal iliac artery anastomosis and external iliac artery anastomosis in renal transplantation: our 1-year experience

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**Background:** The aim of this study was to identify the difference in ABI before and after surgery between internal iliac artery anastomosis and external iliac anastomosis in patients with DM.

**Methods:** This retrospective study consisted of a review of the medical records of 162 consecutive patients who underwent living donor kidney transplantation for end-stage renal disease from April 8, 2021 to July 11, 2022.

**Results:** There were 162 patients 124 with EIA anastomosis and 38 with IIA anastomosis included. There was no statistically significant difference of ABI before and after surgery between the two groups ( $P < 0.12$ ).

**Conclusions:** There was no difference in the ABI before and after surgery in the EIA anastomosis and the IIA anastomosis group. The short ABI f/u period may act as a limitation, and additional research is needed. However, the result of this study was that the EIA anastomosis did not cause PAD even in patients with DM.

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## Antibody titer after COVID-19 vaccination in liver transplant recipients

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**Background:** COVID-19 has raised a pandemic. A mRNA-based vaccine is released for prophylaxis, and its high efficacy has been reported. However, there is a paucity of data in immunosuppressed individuals. We estimated the serum antibody (Ab) titer after vaccination in liver transplant (LT) recipients.

**Methods:** The LT recipients who took vaccination were included in this study. Twice vaccination was performed and SARS-CoV-2 S-IgG Ab titer was measured 1, 3, 6 months after the second dose of vaccination.

**Results:** We measured Ab titer in 107 LT recipients which entered for this study by July 11, 2022. A median age at LT was 34 (interquartile range, 2–53) years old, an observation period was 15.0±7.9 years, and a period between LT and the first dose was 15.2±11.2 years. Posttransplant immunosuppression regimen included calcineurin inhibitor (n=104, 89.7%), mycophenolate mofetil (MMF) (n=33, 30.8%), steroid (n=21, 19.6%) and mTOR inhibitor (n=6, 5.6%) at the time of the first dose. Recipients took single reagent (n=65), 2 reagents (n=28), 3 reagents (n=13) and 4 reagents (n=1). An Ab titer 3 and 6 months after was significantly reduced than that 1 month after (26.0 [5.4, 59.5], 14.7 [6.5, 31.4] vs. 59.7 [18.3, 164.0] AU/mL, respectively; P<0.0001). The Ab titers 6 months after in LT recipients were comparable to those in healthy volunteer (n=20, 12.2 [7.7, 20.0]; P=0.5120). Multi-variate regression analysis identified age at LT <37 years old and a period between LT and the 1st dose >12.3 years as independent predictors for positive SARS-CoV-2 S-IgG Ab titer after 2nd dose.

**Conclusions:** Acquired acquisition rate after two doses of SARS-CoV-2 Vac was relatively good (89%) in LT recipients. However, An Ab titer rapidly decreased after vaccination. LT recipients could also obtain acquired acquisition by vaccination as well as healthy people.

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## Outcomes of liver transplant recipients in 5 years postoperative period

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**Background:** Liver transplantation (LT) is a highly successful treatment for patients with end-stage liver disease and acute liver failure. The aim of this study was to review the outcomes such as morbidity and mortality of adult living donor liver transplant recipients within 5 years of postoperative period.

**Methods:** Medical records of 30 liver transplant recipients during 2016 October to 2019 December period at the Department of Hepatobiliary and Pancreatic Surgery, Yangon Specialty Hospital have been evaluated retrospectively. In this study, primary outcome that was patient survival and secondary outcome like late complications (including surgical complications, postoperative biliary complications and medical complications infection, chronic rejection, recurrence of primary disease and post-transplant metabolic syndrome and major cardiovascular events) were reviewed.

**Results:** Regarding the primary outcome, 1-year survival was 73 %, 3-year survival was 50% and 5-year survival was 43%. Biliary complications were the most frequent postoperative complications of liver transplant patients. Eight out of 30 patients face with biliary complications range from early anastomotic leak to late stricture and obstruction in the extra-hepatic or intra-hepatic biliary system. In this 5 years study, the rate of tumor recurrence after transplant is patients with hepatocellular carcinoma is 35%. Approximately 60% of tumor recurrence occurred after third year of LT and only three cases were detected during the first 2 years after LT. Regarding the medical complication, severe infectious complication occurred in two post-LT recipients, minor infection occurred in three patients, and only two patients faced with chronic rejection and four patients over 5-year survival had hypertension.

**Conclusions:** Improvement in immunosuppression, perioperative management, and surgical techniques made a decrease in perioperative mortality and short-term survival has improved. However long-term complications have not been fully elucidated. Analysis of chronic complications individually give a chance to find the possible risk factors and to improve long-term outcomes after LT.

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## Effect of preexisting human leukocyte antigen donor-specific antibodies especially human leukocyte antigen-DQ on kidney transplant outcome

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**Background:** Luminex based anti-human leukocyte antigen (HLA) antibody assay to detect donor-specific antibodies (DSA) single antigen bead (SAB) assay a useful tool for pretransplant immunologic risk evaluation.

**Methods:** One-hundred-nineteen prospective kidney recipients in our study group, were evaluated for pretransplant HLA sensitization by SAB for HLA class I and class II antibodies, CDC cross match was negative in all, three had T cells and one had borderline B cells flow cross match positive. Total 100 Kidney transplants were performed with follow-up of 2 years, where 19 kidney transplants were ABO-incompatible.

**Results:** Thirty-four recipients had class I (mean fluorescence intensity [MFI], 9057-757), anti HLA-A antibodies were detected in 15 recipients (MFI, 2084-975), HLA-B antibodies in 16 recipients (MFI, 9057-877), HLA-C antibodies in three recipients (MFI, 1715-944), 85 were negative for HLA antibodies. Of 34 only five were had DSA (MFI, 2084-822), there was no episode of rejection. Nine recipients were both class I and class II antibodies which were not donor-specific. Thirty-eight of recipients had class II SAB positive, HLA-DRB1 antibodies in seven recipients (MFI, 3634-795), HLA-DQ in 20 recipients (MFI, 7725-766), HLA-DP in eight recipients (MFI, 1715-944), HLA-DRB3 antibodies (MFI, 896), HLA-DRB4 antibodies (MFI, 1369) and HLA-DRB5 (MFI, 792) antibodies each in three recipients. Out of 20 who had HLA-DQ antibodies (MFI, 7725-776) only eight were donor-specific. HLA-DQ DSA recipients one was ABO-incompatible transplant who had ABMR posttransplant (MFI, 7725-2555), all of eight HLA-DQ DSA recipients posttransplant SAB MFI came down with in a month. Seven recipients had no episode of rejection.

**Conclusions:** In class II SAB positivity with HLA-DQ antibodies in combination with ABO-incompatibility with (more than 5,000 MFI) can result in acute antibody mediated rejection. DQ antibodies with MFI less than 5,000 would need close posttransplant monitoring for rebound increase of antibodies.

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## Safety of pure laparoscopic donor hepatectomy for adult living donor liver transplant: comparison with laparoscopic non-donor hepatectomy

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**Background:** Pure laparoscopic donor hepatectomy (L-DH) has seen a rise in uptake in recent years following the popularization of minimally invasive modality for major hepatobiliary surgery, but has not yet become standard of care due to the relatively small sample sizes in existing studies and small number of centers performing the procedure. Our study aimed to assess the safety of L-DH compared to laparoscopic non-donor hepatectomy (L-NDH) in our center.

**Methods:** We used propensity score matching to compare perioperative outcomes of L-DH against a cohort of L-NDH in a 2:1 ratio. Eighty laparoscopic hemi-hepatectomies performed between 2015 and 2022 were included, of which 11 were L-DH. Patients were matched for body mass index, gender, ASA status, and laterality.

**Results:** The L-NDH cohort were significantly older ( $P<0.05$ ) with higher ASA scores ( $P<0.05$ ) compared to the L-DH cohort. While the L-NDH patients had a shorter median operative time compared to the L-DH ( $P<0.05$ ), they had a longer median length of stay ( $P<0.05$ ). No patient who underwent L-DH experienced postoperative complication (Clavien-Dindo 3). None of the patients who underwent L-DH required reoperation nor readmission within 30-days, and none of them experienced postoperative liver decompensation or bile leak. There were no open conversions. There was no significant difference in complication rate between the L-DH and L-NDH cohort after 2:1 matching.

**Conclusions:** L-DH is a safe procedure with similar outcomes compared to L-NDH, and may be attempted by surgeons who are experienced in performing L-NDH and open donor hepatectomies.

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## Long-term catch-up growth and risk factors for short adult height after pediatric liver transplantation

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**Background:** Children who require liver transplantation (LTx) for end-stage liver disease generally have severe growth retardation. After LTx, recipients experience catch-up growth (CUG), though there are not a few cases resulting in short adult height. The aim of the study was to determine decades-long CUG trends and risk factors for short adult height after pediatric LTx.

**Methods:** We examined long-term trends of height Z-score (normalized with the mean of the values is 0 and the standard deviation is 1 using age- and sex-specific references for the general population) in a single-center retrospective cohort of 117 pediatric LTx recipients survived >5 years. The risk factor analysis for short adult height were performed on 75 patients who reached adult height.

**Results:** The median age at LTx was 1.3 years and most primary diagnoses were biliary atresia (77%). Mean height Z-score of pre-LTx and 1, 2, 5 and 8 years after LTx were -2.26, -1.59, -0.91 and -0.59, respectively. After that point, the data plateaued until 20 years. Mean final adult height Z-score was -0.87. In the multivariate analysis, older age at LTx (odds ratio [OR], 1.22 by 1 year; 95% confidence interval [CI], 1.06-1.40; P=0.002), lower height Z-score at LTx (OR, 0.46 by 1 point; 95% CI, 0.29-0.71; P<0.001) and post-LTx hospital stay 60 days (OR, 4.95; 95% CI, 1.26-19.42; P=0.015) were identified as independent risk factors for short adult height.

**Conclusions:** Marvelous CUG was observed after LTx, nevertheless the final adult height was inadequate. For healthy physical growth, LTx should be performed as young as possible and without severe growth retardation, and if growth is inadequate after LTx, use of recombinant human growth hormone might need to achieve proper adult height.

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## The results of a living donor liver transplant for hepatocellular cancer following loco-regional treatment: a single-center retrospective study

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**Background:** Over the past 10 years, there has been a significant increase in loco-regional treatments (LRTs) for hepatocellular carcinoma (HCC), bridging or downstaging patients on the liver transplant waiting list. This research aimed to investigate the results of LRTs performed on HCC patients after living donor liver transplantation.

**Methods:** From May 2010 to December 2019, 143 HCC patients underwent living donor liver transplants at Pusan National University Yangsan Hospital. Preoperative LRTs were performed on 29 patients. Before liver transplantation (LT), the number of patients who were successfully downstaged, the methods used, the length of follow-up, and the results of those patients' LT were all reported.

**Results:** Nine out of 29 were within Milan. The mean size of the HCCs was  $3.23 \pm 1.65$  (range, 0.9–7.7) cm, and the mean number of the HCCs was  $5.28 \pm 6.73$  (range, 1–30). 1-, 3-, and 5-year overall cumulative survival rates were 93.1%, 86.2%, and 82.1%, respectively, and the corresponding cumulative disease-free survival rates were 89.4%, 82.2%, and 73.6%, respectively. Seven out of 29 patients recurred, and the location is as follows: lung (four), bone (one), chest wall (one), and Intrahepatic (one).

**Conclusions:** These results demonstrated tumor bridging/downstaging as a possible therapeutic option for HCC patients who did not meet conventional LT criteria. Additional research involving many more patients is required.

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## Motivations and obstacles in the process of donor identification based on hospital characteristics

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**Background:** In our organ procurement unit, we use three different strategies to identify all potential brain death donors. So we aimed to evaluate the incentives and deterrents in the process of donor identification based on hospital characteristics.

**Methods:** In the electronic, cross-sectional study, a 16-item questionnaire that includes information regarding hospital characteristics (having a transplant and neurosurgery ward), being related to an organization versus general or private hospital, and also medical staff experience about the donation process and their attitude about donor identification. Items related to the donor identification were nine questions about the potential facilitators as well as seven items corresponding to the potential barriers.

**Results:** Two-hundred-thirty nurses and medical staff with a mean age of  $38.5 \pm 28$  years participated in the study, of which 62.3% (n=143) were female. In the type I hospitals, 12.4% of respondents believed that hospital policies were weak in identifying potential identifiers, and in type II hospitals, 21.7% agreed that these policies were weak. While 35.9% and 42.2% of them in type I and II hospitals, respectively, believed that the hospital's policies are strong and acceptable,  $P=0.04$ . The main facilitator was active detection via regular phone calls which were mentioned by 65.2%. Donor detection by in-hospital coordinators was in second place (42.7%). Also, the availability of the donor coordinators and visiting by the inspectors were other important motivations for donor detection. Regarding barriers, staff viewpoints toward donor selection affect the donor referral to the OPU (54.7%) and staff opinions that this process would be distressing to the donor family avoids donor identification (47.1%). Moreover, concerns about patient care were another notable obstacle (43.1%).

**Conclusions:** It is important to use phone calls for better coverage of donation and also train medical staff to improve their ability in donor selection.

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## Patient selection and outcomes of liver transplantation for adult patients with Wilson disease: a single center experience

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**Background:** Liver transplantation (LT) is a definitive cure for Wilson's disease (WD). LT cures the basic defect and is treatment option for liver failure or neurological symptoms of WD. Limited outcomes are reported regarding LT for adult WD patients in Korea.

**Methods:** Thirty-nine adult patients of our institutional LT cohort from January 2001 to December 2020 were retrospectively analyzed.

**Results:** The study cohort comprised of 16 males and 23 females, aged  $33.9 \pm 11.4$  years. Four patients had acute liver failure. The model for end-stage liver disease score of other patients were  $24.7 \pm 10.6$ . Types of LT were deceased donor LT in 13 and living donor LT in 26. Mean graft-to-recipient ratio in living donor LT recipients were  $1.08 \pm 0.28$ . WD was pathologically confirmed at explant pathology. Concurrent hepatocellular carcinoma was identified in 3 patients. Posttransplant hospital stay was  $43.4 \pm 35.4$  days. In-hospital mortality was four (10.3%) patients due to septic shock, multi-organ failure and hepatorenal syndrome. Three of these in-hospital mortality cases were deceased LT recipients. During follow-up, only one (2.7%) patient died from hepatocellular carcinoma recurrence at posttransplant 2 years. The overall survival rates were all 89.7% at 1 year, and 87.2% at 5 years, 10 years and 20 years.

**Conclusions:** The long-term posttransplant outcomes of WD in adult patients were excellent, thus LT is eligibly indicated for WD patients manifesting liver failure.

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## Advanced liver surgery for hepatic alveolar echinococcosis

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**Background:** Hepatic alveolar echinococcosis (HAE) is rare tumor-like mass caused by tapeworm *Echinococcus multilocularis*. The condition is characterized by asymptomatic development and invasive growth.

**Methods:** Between February 2019 and August 2022, 11 patients underwent advanced liver surgery (extended resection or liver transplantation [LT]) for alveolar echinococcosis. Liver resection was performed in seven cases including four extended right hepatectomies with portal vein resection, two extended right hepatectomies with IVC replacement and one *ex situ* liver resection with IVC, portal vein replacement and venoplasty (all the procedures has been performed via cold perfusion); LT (deceased donor LT and living donor LT) was carried out in four cases, one of which the LT was supplemented by Whipple procedure due to duodenum and pancreas invasion.

**Results:** All the patients successfully underwent procedures with no intra- nor early mortality. No palliative resections were performed. One patient died due to sepsis caused by vascular graft infection. There was not any biliary or vascular complication in LT group.

**Conclusions:** Advanced liver resection seems a more complicated procedure than LT with higher complication rate. Both procedures demonstrate satisfying outcomes in patients with severe HAE.

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## An unusual cause of acute kidney injury after kidney transplant

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Leak of urine from allograft kidney is a rare surgical complication post kidney transplant, generally occurring in the immediate post-op period and usually from the lower ureter. We present an unusual case where it occurred from upper ureter and 6 weeks posttransplant in the background of acute rejection. A 25-year-old male suffering from stage 5 CKD on maintenance hemodialysis thrice a week for an year, underwent living donor ABO-compatible kidney transplant with mother as donor. He had low immunological risk, hence started on triple immunosuppression without any induction. Laparoscopic donor nephrectomy was performed uneventfully. The immediate postoperative recovery was uneventful with progressive decline in creatinine. He suffered an acute cellular rejection a week after transplant which resolved with methylprednisolone IV pulse and anti-thymocyte globulin therapy. His creatinine settled to 1.4 mg/dL. Double-J (DJ) stent removal was done at 4 weeks posttransplant. Three days later his creatinine started rising again with preserved urine output. Repeat allograft biopsy showed acute cellular and antibody mediated rejection. He underwent five sessions of plasmapheresis along with low dose IVIg. He became oliguric with progressive abdominal distension and scrotal swelling. Examination was suggestive of free fluid in abdomen. Creatinine increased to 9 mg/dL. Ultrasonography showed massive ascites and normal graft kidney. Ascitic fluid was clear and transudative with a creatinine of 7 mg/dL. A dynamic nuclear medicine scan was done for evaluation of possible urine leak. The scan revealed ongoing urine leak from the upper ureter and renal pelvis. A DJ stent was re inserted followed by brisk diuresis and decline in creatinine to 1.0 mg/dL. The ascites resolved spontaneously and DJ stent was removed after 6 weeks. The case highlights the important role of a nuclear medicine scan in suspected urine leak and delineating the location.

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## Four-year experience of liver transplantation in National Cancer Center of Mongolia

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**Background:** Liver transplantation (LT) is the gold standard treatment for patients with end-stage liver disease. In Mongolia, the main reason for LT is liver cancer and hepatitis B virus, hepatitis c virus- related liver cirrhosis. Liver cancer is by far the leading cancer in Mongolia, contributing almost two-fifths of the total cancer burden. Samsung Medical Center of Korea (SMC) have a big role to set up LT program at National Cancer Center of Mongolia (NCCM) since 2011. During this project doctors and nurses of NCCM were trained for LT several times at SMC.

**Methods:** We just started our liver transplant program in 2018 with our honor partner SMC organ transplant center. We performed 46 liver transplants (living donor LT [LDLT], n=37; deceased donor LT [DDLT], n=9) from January 2018 to February 2022. The aim of this study was to report outcome of this 4-year experience of liver transplantation.

**Results:** Among 46 patients (20 males and 26 females) of overall mean age of 48 who underwent LDLT (all of them right lobe exclude MHV). The postoperative outcomes observed in each LDLT and DDLT recipients were death (21.6% and 11.1%), renal failure (4.3% and 11.1%), postoperative GI tract bleeding (4.3% and 11.1%), liver graft subcapsular hematoma (both 6.6%), and hepatocellular carcinoma recurrence (both 6.7%). In LDLT recipients, the most common posttransplant complications were biliary leakage (both 21.7%) and surgical complication (22.5% and 23.9%) and postoperative bleeding (11.7% and 44.4 %).

**Conclusions:** This report is only based on 46 cases. In order to have long term results, we need to have more operations and experiences for a long time. We have concentrated on our selection criteria choosing LDLT patients. Our long-term purpose is to update economical and effective protocol.

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## Expert recommendations for new heart allocation system in Korea

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**Background:** Despite the introduction of the new Korean heart allocation system in 2018, donor heart utilization has been still suboptimal. Waitlist mortality has worsened due to an increase in transplantation under extracorporeal membrane oxygenation (ECMO) support. Posttransplantation survival has not improved significantly. Accordingly, requirements for revision of the allocation system have been emerging. This study aimed to propose expert recommendations for a new heart allocation system in Korea.

**Methods:** The recommendation for revision of the allocation system was established based on analyses of heart transplantation data from the Korean Network for Organ Sharing (KONOS) and Korean Organ Transplantation Registry (KOTRY) data and the questionnaires from heart transplantation experts in Korea.

**Results:** The questionnaires were obtained from 69/129 (53.5) experts. 82.6% answered revision of the allocation system is needed. The main revisions for the new heart allocation system include (1) requirements for detailed patient clinical assessment data at the time of recipient registration. (2) Requirement of exceptional approval for age >75 for status 0. (3) Reassessments of reasons for maintaining ECMO or ventilator support every 2 weeks. (4) Detail of serious complications after left ventricular assist (LVAD) was redefined.

**Conclusions:** It is still concerned about high waitlist mortality and stagnation of posttransplantation survival in the current heart allocation system. The recommendations may provide guidance to overcome problems of the current heart allocation system.

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## Reduced ceramides are associated with acute rejection in liver transplant patients and skin and hepatocyte transplant mice

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We set up this study to discover novel metabolic biomarkers for acute rejection and understand the roles of ceramides on immune cells in acute rejection. Serum concentrations of ceramides and sphingomyelins were measured by LC-MS/MS. Serum concentrations of C24 ceramide, C24:1 ceramide, C16:0 sphingomyelin, and C18:1 sphingomyelin were lower in liver transplant (LT) recipients with than without acute rejection (AR). Comparisons with the results of LT patients with infection and cardiac transplant patients with cardiac allograft vasculopathy in humans and in mouse skin graft and hepatocyte transplant models suggested that the reduced C24 and C24:1 ceramides were specifically involved in AR. To understand the underlying mechanisms, a ceramide synthase inhibitor, fumonisin B1, was administered to reduce ceramide levels during mixed lymphocyte reactions (MLR) and in mice given skin grafts. Fumonisin B1 exacerbated allogeneic immune responses *in vitro* and *in vivo*, partly changing the subsets of plasmacytoid dendritic cells in the draining lymph nodes. The results of MLR with ceranib-2, an inhibitor of ceramidase, and C24 ceramide also support that increasing ceramide concentrations could benefit transplant recipients with AR.

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## Continues renal replacement therapy in acute kidney injury after liver transplantation in National Cancer Center of Mongolia

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**Background:** Liver transplantation has become a widely accepted treatment for a variety of liver diseases, such as viral and alcoholic cirrhosis, liver malignancy, acute liver failure, and many metabolic abnormalities.

**Methods:** We have performed 60 liver transplantation (LT) in National Cancer Center of Mongolia (NCCM) in our hospital. Fifty cases on living donor LT (LDLT), 10 cases are deceased donor LT (DDLT). After LT, seven patients have acute kidney injury (AKI), we used CRRT six trouble condition patient. Since January 2018, 7/60 (11.6%) patients entered in the CRRT. The primary reasons for the initiation of (CRRT) were treatment of fluid overload, electrolyte imbalance, acidosis, anuria, sepsis and renal failure.

**Results:** Seven patients are (100%) survived now. For example, the patient, 44-year-old male diagnosed with hepatocellular carcinoma in liver with cirrhosis, portal hypertension, ascites, and hepatorenal syndrome. Pre-surgical lab; blood test, WBC-4.5, RBC-3.8 HGB-13.1, HCT-38.3, PLT-53. Biochemistry; Albumin-30.0, BUN-13.8, T protein-55.3, ALAT-62.8, ASAT-89.5, T Bilirubin-46, Creatinine-217.2, Na-141, K-4.2. LDLT was successfully done. The operation time was 9 hours. Blood loss was 400 mL, intraoperative fluid: transfused blood was 490, plasma solution 18,000, urine output is 600 mL. vasopressin and noradrenalin received. When admitted to the ICU intubated, postoperation laboratory results are increased, BUN 24 mmol/L, creatinine 333 mmol/L, hyperkalemia 6.9 mmol/L, pulmonary, all body edema, urine output is decreased to 20 mL/hr. We connected CRRT 48 hours, ultrafiltrated 100 mL/hr. After CRRT patient condition and laboratory results are increased, urine output increased to 70 mL/hr, creatinine and bun are measured normal range, no edema.

**Conclusions:** We performed CRRT in NCC, first time. Critically ill patients with AKI are often treated with CRRT. Although it is presumed that it offers patients the benefits of greater hemodynamic stability, metabolic clearance, and volume control, randomized clinical trials comparing CRRT to intermittent modalities have failed to demonstrate its superiority in terms of survival.

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## Current status of COVID-19 vaccination and factors influencing vaccination in liver transplant patients

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The COVID-19 pandemic continues worldwide and has created a public health crisis. The whole world made an effort to form herd immunity through vaccination. However, there were few studies on the factors affecting the actual inoculation rate and completion of inoculation for liver transplant recipients who are taking immunosuppressants after organ transplantation and are in the high-risk group. The purpose of this study was to confirm the status of COVID-19 vaccination in liver transplant recipients and to analyze the influence factors. The subjects of this study were adult males and females aged 19 years or older who were under follow-up at the hepatobiliary and pancreatic surgery department for more than 6 months after liver transplantation. An online questionnaire was sent to a total of 1,850 people, and 411 liver transplant recipients understood the purpose of the study and agreed to participate. The contents of the questionnaire are the general characteristics of the study subjects, the status of COVID-19 vaccination, factors related to vaccination and reasons for not being vaccinated, and awareness of vaccination. The data collection period was from March 2 to March 13, 2022, and the collected data was analyzed using the SPSS 26.0 program. Of the total 411 study subjects, 382 (92.9%) received at least the first dose of the COVID-19 vaccine, 324 (78.8%) completed the third dose, which corresponds to the primary dose of liver transplant recipients, and 58 (78.8%) incomplete recipients (14.1%) and 29 (7.1%) patients were not vaccinated. The rate of completion of vaccination was significantly higher in the elderly aged 60 years or older, male, married, college graduate or higher, income level of 2 million won or less, and 10 years or more after surgery ( $P<0.05$ ). Awareness of vaccination was significantly higher in subjects who completed vaccination ( $P<0.001$ ). When asked about their intention to receive additional vaccines in the future, 278 (67.6%) answered 'I would like to be vaccinated', 52 (12.7%) 'I will not be vaccinated', and 81 (19.7%) 'I don't know'. The most common reason for the subject's COVID-19 vaccination was 'because COVID-19 is a serious disease'. The most common reason for refusal or hesitation to receive a booster vaccination after vaccination was because of fear of side effects of vaccination. When asked how they would be vaccinated against COVID-19 in the future, the answer was 'if they were confident about the usefulness of the COVID-19 vaccine'. Age, sex, marital status, education level, income level, postoperative period, and awareness of vaccination were identified as factors affecting the completion of COVID-19 vaccination. To improve the vaccination rate, a strategy tailored to the characteristics of liver transplant recipients is required.

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## Feasible living donor liver transplantation for patients on chronic hemodialysis: a multicenter study in Eastern countries

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**Background:** End-stage liver and kidney disease is an indication for simultaneous liver and kidney transplantation. However, in countries where deceased donor transplantation has not developed, patients on hemodialysis (HD) are forced to choose living donor liver transplantation (LDLT). We investigated the outcome of LDLT for patients on HD in a multinational survey.

**Methods:** A retrospective multinational survey was performed for patients on HD who underwent LDLT. The characteristics of donors and recipients, and short and long-term outcomes were analyzed excluding patients with kidney transplantation.

**Results:** From 2001 to 2021, 46 patients on HD underwent LDLT. Of these, eight patients underwent kidney transplantation after LDLT reaching 100% survival rate. In 37 patients with only LDLT, 14 (38%) patients developed posttransplant bleeding and the overall survival rate at 5 years was 56%. In multivariate analysis, low graft recipient weight ratio (<1%) (hazard ratio [HR], 2.98; 95% confidence interval [CI], 1.00–8.80; P=0.049) and HD duration (less than 4 months or more than 10 years) (HR, 3.83; 95% CI, 1.25–11.8; P=0.02) were independently poor predictors of the overall survival.

**Conclusions:** It is important to select patients considering graft size and HD duration for LDLT of patients on HD.

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# Posttransplant lymphoproliferative disorders after solid organ and hematopoietic stem cell transplantation: a nationwide cohort study in Korea

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**Background:** Posttransplant lymphoproliferative disorders (PTLD) are the majority of cancer diagnoses after solid organ transplantation (SOT) and allogeneic hematopoietic stem cell transplantation (HSCT) with a high incidence of PTLD developed in the first posttransplant year. However, there is minimal nationwide literature examining the incidence and risk analysis of PTLD. We investigated the incidence and risk determinants of PTLD in Korean SOT and HSCT recipients using a large national database.

**Methods:** This study recruited 47,518 patients (SOT, 36,945; HSCT, 10,573) from the Korean National Health Insurance Service database between 1 January 2009 and 31 December 2020. Patients previously diagnosed with hematologic or lymphoproliferative malignancies or multi-organ transplant recipients were excluded.

**Results:** PTLD developed in 529 patients (SOT, 294; HSCT, 235). According to the type of transplant, PTLD after HSCT was the most common (2.22%), followed by heart (1.40%), lung (0.97%), liver (0.82%), and kidney (0.64%). The subdistributional hazard ratio (SHR) of PTLD in pediatric patients aged 10 to 19 years was higher than that in those aged 20 to 39 years (SHR, 1.671;  $P=0.0018$ ; 95% confidence interval [CI], 1.211–2.306). Compared with kidney transplantation, HSCT was associated with a greater risk of PTLD (SHR, 3.016;  $P<0.001$ ; 95% CI, 2.399–3.791). The hazard ratio (HR) of death after diagnosing PTLD in patients aged over 60 years was higher than that in those aged 20 to 39 years (HR, 2.170;  $P<0.001$ ; 95% CI, 1.999–2.355). Compared with kidney transplantation, HSCT was associated with a greater risk of death after PTLD (HR, 9.954;  $P<0.001$ ; 95% CI, 9.259–10.701).

**Conclusions:** This nationwide population-based cohort study revealed that PTLD was associated with a higher risk in the pediatric age group. According to the type of transplantation, HSCT was at greater risk of developing PTLD and death after diagnosing PTLD than SOT.

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## Protection of urteteroneocystoanastomosis with platelet-rich plasma in kidney transplanted recipients

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**Background:** One of the most common problems after kidney transplantation is urological complications. Urine leakage is the most common early urological complication after kidney transplantation. The aim of the study was to study the effect of platelet-rich plasma (PRP) on urteteroneocystoanastomosis (UNCA) in a recipient after kidney transplantation.

**Methods:** This method was applied to 14 recipients with standard UNCA by Lich-Gregoir. Before the manipulation, 50 mL of venous blood was taken from each recipient. The blood is placed in test tubes with a sodium citrate content of 3.8%. The tubes were centrifuged twice; 10 minutes at 2,400 rpm and 15 minutes at 3,600 rpm. After the first centrifugation, the middle layer with leukocytes and platelets was collected and transferred to other test tubes using a long needle. After the second centrifugation, the platelet count was  $125000010(9)/L \pm 35000010(9)/L$  platelets and increased 6.4 times compared to the initial amount. Before use, PRP was activated with a 10% solution of calcium chloride and a gel-like mass was obtained. Then the PRP gel was applied to the UNCA line in the recipients.

**Results:** In all cases, there were no early urological complications. The graft function was satisfactory. There were no reanastomosis during and after surgery in the recipients.

**Conclusions:** UNCA using PRP-gel is a highly effective, cost-effective method of preventing urological complications. However, this method of surgical treatment does not provide a 100% guarantee of the success of the operation, which requires additional study for the application of this method of treatment.

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## Quality of life in recipients after renal transplantation: a single-center experience

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**Background:** It is well known that renal transplantation can restore renal function and reduce complications associated with renal failure in patients with end-stage renal failure. On the other hand, whether renal transplantation can restore patients' quality of life (QOL) has not been fully evaluated.

**Methods:** One hundred and eleven renal transplant recipients who underwent preoperative and longitudinal QOL surveys in our institution were included in this study. Patients' QOL was assessed using the Short Form-36 Health Survey Version 2 (SF-36 ver. 2), and the eight scales of the SF-36 ver.2 were compared for change over time before and after surgery, respectively.

**Results:** The median age at transplantation was 51 years, and 21 patients were older than 65 years. Before kidney transplantation, physical functioning, role physical, general health, social functioning, and role emotional were below the Japanese national standard. Compared to the preoperative level, role physical, body pain, social functioning, and role emotional were significantly lower at 1 month postoperatively, but all scales improved significantly at 1 year postoperatively. In elderly patients, only body pain and general health improved in the first postoperative year, but role physical, vitality, social functioning, and role emotional also significantly improved in the second postoperative year.

**Conclusions:** While QOL was significantly lower in patients with end-stage renal failure before renal transplantation compared to the Japanese national norm, QOL was significantly improved by renal transplantation. QOL was also significantly improved postoperatively in elderly patients, although at a later time than in non-elderly patients.

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## Quantitative ultrasound for non-invasive evaluation of rejection in renal transplantation

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**Background:** This study aimed to investigate the predictive efficacy of shear-wave elastography, superb microvascular imaging (SMI), and contrast-enhanced ultrasound (CEUS) for allograft rejection in kidney transplant without graft dysfunction.

**Methods:** From January 2021 to November 2021, 72 consecutive patients who underwent both allograft biopsy and ultrasound were evaluated. Blood test results were obtained within a week of the ultrasound examination. Ultrasound examinations were performed before protocol biopsy. Resistive index (RI), tissue viscoelasticity, vascular index, and quantitative CEUS parameters were measured. The patients were divided based on biopsy results into the rejection and no rejection groups.

**Results:** Among the 72 patients, 21 patients had pathological characteristics of acute rejection. RI of allograft was significantly higher in the rejection group ( $P=0.007$ ). There were no significant between-group differences in vascular indices of SMI, mean elasticity, and mean viscosity. Meanwhile, among the parameters obtained by time-intensity curve on CEUS, the cortical and medullary ratios of average contrast signal intensity, peak enhancement, wash-in area AUC, wash-in perfusion index, wash-out AUC, and wash-in and wash-out AUC were significantly different between the two groups ( $P<0.05$ ). In the receiver operating characteristic curve analysis for predicting allograft rejection, the AUC was 0.853 for the combination of six CEUS parameters, RI, and blood urea nitrogen.

**Conclusions:** Among non-invasive quantitative ultrasound measurements, CEUS parameters are the most useful for diagnosing subclinical allograft rejection. Furthermore, the combination of CEUS parameters, RI, and blood urea nitrogen may be helpful for the early detection of renal allograft rejection.

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## Benefits of switching mycophenolic acid to sirolimus on serological response after a SARS-CoV-2 booster dose among kidney transplant recipients: a randomized controlled trial

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Kidney transplant recipients (KTRs) have a suboptimal immune response to COVID-19 vaccination due to the effect of immunosuppression, mostly mycophenolic acid (MPA). This study was conducted to investigate the benefits of immunosuppressive regimen switching from the standard regimen; tacrolimus (TAC), MPA, and prednisolone to a regimen of mammalian target of rapamycin inhibitor (mTORi), TAC and prednisolone during a period of BNT162b2 vaccine booster dose. A single-center, opened-label randomized controlled trial was conducted in KTRs who received two doses of ChAdOx-1 and a single dose of BNT162b2. The participants were randomly assigned to continue standard regimen (control group, n=14) or switched the regimen to sirolimus (an mTORi), TAC, and prednisolone (switching group, n=14) starting two weeks before and continuing 2 weeks after a booster dose of BNT162b2. The anti-SARS-CoV-2 S antibody level after vaccination in the switching group was significantly greater than the control group (4,051.0 [3,142.0–6,466.0] vs. 2,081.0 [1,077.0–3,960.0] BAU/mL, respectively; P=0.01) (Figure). One patient who was initially seronegative and was in the control group remained seronegative after a booster dose. These findings suggest humoral immune response benefits of switching the standard immunosuppressive regimen to the regimen of mTORi, TAC, and prednisolone in KTRs during vaccination.

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## Pattern of porcine cytomegalovirus detection and its association with recipient survival following renal xenotransplantation in non-human primate preclinical study

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**Background:** With growing interest in xenotransplantation to resolve the worldwide organ shortage, a considerable progress in the prevention of immunological rejection has been made using genetic modifications of pig that is considered the best donor animal. However, a paucity of knowledge exists in the potential zoonotic transmission and its impact on clinical outcome. Notably, porcine cytomegalovirus (pCMV), also known as roseolovirus, remains a major barrier to clinical application of xenotransplantation. pCMV is highly resistant to the traditional antiviral therapy and has been reported to negatively impact on the graft survival. This study was conducted to analyze the pattern of pCMV detection, and the association between presence of pCMV and survival of cynomolgus primate recipients following kidney xenotransplantation.

**Methods:** A retrospective review was performed in 21 pig-to-cynomolgus renal xenotransplants. Archived sections of various anatomical tissues and blood samples were analyzed for the presence of pCMV, using real-time PCR, which is currently the gold standard modality for its detection. Genetically modified pigs with at least -1, 3-galactosyltransferase knockout (GalT-KO) were used as a donor, and they were preoperatively determined pCMV negative on routine husbandry practice.

**Results:** Despite negative preoperative surveillance, five donor pigs were later found to be pCMV positive on PCR testing. Interestingly, the detection was not uniformly positive across the samples tested, indicating the significance of latency in pCMV and the need for multi-site testing. A marked difference was demonstrated in mean survival ( $P < 0.001$ ), with the pCMV negative kidney recipients ( $n=17$ ) averaging 40.8 days and the pCMV positive recipients ( $n=4$ ) only 8.0 days with rapid viral replication.

**Conclusions:** This study confirms that the presence of pCMV is associated with reduced survival following kidney xenotransplantation. Therefore, with no effective treatment available, thorough donor evaluation is warranted preoperatively, remembering that pCMV is a latent infection.

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## Impact of high IgG titer in ABO-incompatible kidney transplant

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**Background:** In antibody mediated rejection in ABO-incompatible kidney transplantation (KT), it was demonstrated that anti-ABO IgG response was more important than the IgM response. This study aims to prove the safety of transplantation of recipient with high IgG titer by comparing graft survival and biopsy proven acute rejection in low IgG titer ( $\leq 512$ ) and high IgG titer ( $> 512$ ) group.

**Methods:** This retrospective observational study included O+ recipient who received ABO incompatible kidney transplantation between Jun 2018 and Dec 2020 in Asan medical center. A total of 89 patients were divided into a low IgG titer ( $\leq 512$ ) and a high IgG titer ( $> 512$ ) group.

**Results:** Level of preoperative IgG was higher in high IgG group (17.95 vs. 25.83,  $P < 0.001$ ). Number of preoperative plasmapheresis was more in high IgG group than in low IgG group (6.56 vs. 3.76,  $P < 0.001$ ). Number of ABDR mismatch and DR mismatch is more in high IgG group than in low IgG group (3 vs. 4.04, 1 vs. 1.42;  $P = 0.004$ ). Kaplan-Meier curve shows 1-year rejection free survival (low IgG group 95.2% vs. high IgG group 93.6%), 2-year rejection free survival (low IgG group 96.2% vs. high IgG group 89.3%). The incidence of graft failure and biopsy proven acute rejection, antibody mediated rejection showed no difference between two groups ( $P = 0.924$ ,  $P = 0.195$ ,  $P = 0.495$ ). Posttransplant infectious disease (APN, pneumonia, etc.) occurs 10 (23.8%) in low IgG group, four (8.5%) in high IgG group.

**Conclusions:** There was no difference in postoperative outcome between high IgG group and low IgG group. This indicates that if successful desensitization is taken before transplantation, high baseline IgG titer does not increase risk of postoperative rejection and graft failure.

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## Organ procurement management in COVID-19

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COVID-19 pandemic and the confusion of the world at the beginning of the epidemic affected many aspects of the life and health care. In this regard, organ donation as a vital approach for life saving in patients on the waiting list was influenced too. This essential treatment requires the provision of vital organs from the brain death cases, which is a sensitive, accurate and lengthy process. This process begins with the identification of Glasgow Coma Scale (GCS) cases less than five and is followed by organ harvesting and assignment to waiting list patients. Organ donation and factors related to its process have been fluctuated during three specific time periods, including the first and second year of the epidemic with the year before the epidemic. This decrease in the number of donations has been felt worldwide and it has been reported that this number has decreased significantly even in the amount of blood donation. Numerous barriers to the treatment system during the epidemic, limitations of surgeries except in emergencies, asymptomatic patients, and many unknown aspects of the disease have shown that the policies and approaches of procurement centers need to be changed to continue efforts in this situation. New protocols (according to the needs of these days) should be developed and implemented according to the conditions ahead.

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## Immunosuppression for failed allograft: how prolonged and much is adequate?

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**Background:** The development of human leukocyte antigen (HLA) antibodies towards a failed allograft is a critical factor for the feasibility and outcomes of future transplantation. Therefore, we investigated the factors contributing to sensitization in patients with failed allografts.

**Methods:** A single-center retrospective study of patients with failed allografts between 2010 and 2020 was performed. Samples for HLA antibodies were tested at the time of graft failure and after immunosuppression withdrawal. Sensitization was defined as more than 80% of calculated Korean panel reactive antibody (PRA) I or PRA II. In addition, variables for affecting sensitization were collected.

**Results:** Twenty-three patients were included in the study. The mean follow-up duration after failed allograft was  $43 \pm 33.3$  months. The sensitized patients tended to have a longer follow-up period and were exposed to less total calcineurin inhibitor (CNI) than non-sensitized patients. (non-sensitized vs. sensitized patients:  $27.1 \pm 12.9$  vs.  $51.7 \pm 37.8$  months,  $P=0.196$ ;  $4.2 \pm 4.9$  vs.  $5.1 \pm 2.9$  months,  $P=0.231$  respectively). In multivariate logistic analysis, there was no significant difference regarding the total exposure to CNI and follow-up duration (sensitization group: [multivariate odds ratio {OR}, 1.188; 95% confidence interval {CI}, 0.55–2.52;  $P=0.655$ ], [OR, 1.03; 95% CI, 0.97–1.10;  $P=0.282$ ] respectively). In some patients, even prolonged immunosuppression after returning dialysis therapy did not prevent sensitization toward failed allograft.

**Conclusions:** In this study, there was no significant difference regarding the contributing factors for sensitization in the multivariate logistic analysis. However, in sensitized patients, trends were showing longer follow-up duration and less CNI exposure. Sensitization towards a failed graft might be affected by the dose and duration of immunosuppressant. Finally, the small sample size is one of the limitations of this study, and additional prospective research analysis for patients with failed allografts is needed in the future.

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## Histopathologic evaluations on porcine vessel lacking GGTA1/CMAH/ $\beta$ 4galNT2/iGb3 genes in non-human primate xenotransplantation

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**Background:** Although alpha-galactosyltransferase knock out (GTKO) pigs overcome the hyper-acute-rejection in pig to non-human primate (NHP) xenotransplantation, it still remains severe acute humoral xenograft rejection. HD and Sda as non-Gal antigens should be eliminated for pig to human-primate xenotransplantation. A residual alpha-Gal epitope by isoglobotrihexosylceramide synthase (iGb3s) on GTKO pig might be barrier. In current study, we evaluated the histopathology on pig-to-NHP immune cross-reactivity by comparing wild type (WT)-, GTKO-, GGTA1/CMAH/4GalNT2(TKO)- and GGTA1/CMAH/4GalNT2/iGb3s (QKO)-porcine vessel (PV) xenograft from monkey (PVG).

**Methods:** WT-, GTKO-, TKO- and QKO-PVs were transplanted to cynomolgus monkey under immunosuppressive protocols. Preformed monkey IgM- and IgG-antibody binding to porcine pPBMCs (pPBMCs) were determined by flow cytometry. Histopathology of PVG was evaluated through H&E staining and immunofluorescence images for CD3 T-cells, CD20 B-cells, IgM-, IgG-antibody binding, tissue factor (TF), C3 and CD42b by confocal microscopy.

**Results:** Preformed monkey plasma IgM-antibody bindings to WT pPBMCs were higher than those to the other three types of pPBMCs. However, preformed monkey plasma IgG-antibody bindings to all four types of pPBMCs have no differences. Endothelial cells (ECs) were completely destroyed, and thrombus was formed severely in WT-PVG on postoperative day (POD) 11. Although ECs were destroyed, thrombus was generated mildly in GTKO- and TKO-PVG on POD 15. In QKO-PVG on POD 16, ECs were barely destroyed and thrombus was generated minimally. CD3 T- and CD20 B-cells were abundant on the outer wall of GTKO- and TKO-PVG on POD 90. IgM- and IgG-antibody binding to WT-, GTKO- and TKO-PVG were observed on POD 11–POD 15, but rarely to QKO-PVG on POD 16. TF on WT- and TKO-PVG were observed on POD 11–POD 15, but rarely on GTKO- and QKO-PVG POD 15–POD 16. C3 and CD42b on WT- and TKO-PVG were enriched on POD 11–POD 15, but rarely on GTKO- and QKO-PVG.

**Conclusions:** Our data suggest that coagulopathy could be modulated through inhibiting C3, CD42b and TF binding to QKO-PV in pig-to-NHP xenotransplantation model.

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## Comparison between internal iliac artery and external iliac artery for renal artery anastomosis in renal transplantation

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**Background:** In renal transplantation, the most common way to anastomose single donor renal artery to recipient is using internal iliac artery or external iliac artery. We compared the outcomes between the two groups.

**Methods:** From 2005 to 2021, the medical records of 381 patients who underwent renal transplantation at Seoul National University Bundang Hospital were retrospectively examined. Hospital stay, serum creatinine level, GFR (MDRD), graft survival (death censored), patient survival were compared.

**Results:** The hospital stay after surgery was longer in external group than in internal group ( $P=0.08$ ). Short-term GFR up to 40 days after surgery was significantly higher in the internal group than external group ( $P<0.01$ ). There was no difference between the two groups in 5-year graft survival ( $P=0.755$ ). There was also no difference between the two groups in the case of 5-year patient survival ( $P=0.218$ ). We divided the patient into four groups, living donor renal transplantation with internal anastomosis, living donor renal transplantation with external anastomosis, deceased donor renal transplantation with internal anastomosis, and deceased donor renal transplantation with external anastomosis. There was no difference among the subgroups ( $P=0.652$ ).

**Conclusions:** Although the internal group showed better results in postoperative hospital stay and short-term GFR, there was no significant difference in 5-year long-term graft survival and patient survival between two groups. Therefore, it is desirable to select appropriate anastomosis among the two methods according to the condition of donor kidney and the anatomy of recipient.

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## Effect of vascular reconstruction types on dual arteries in living donor kidney transplantation

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**Background:** The situation with donor's two renal arteries in kidney transplantation is challenging. Unlike the single artery, additional anastomosis is required, and various reconstructions can be attempted depending on the arrangement of the two arteries. We tried to investigate the outcome according to the reconstruction methods of two arteries.

**Methods:** Among the 387 patients who underwent living donor kidney transplantation at Seoul National University Bundang Hospital from 2005 to 2021, 86 cases had double donor renal arteries. As for the reconstruction methods, internal and external iliac arteries was nine cases, inferior epigastric artery was 15 cases, anterior and posterior division of internal iliac artery was 23 cases, end to side was 20 cases, and side to side was nine cases. Then we compared these groups with the control group, single artery (n=292).

**Results:** As a short-term result, there was no difference in postoperative 40-days GFR (MDRD) according to reconstruction method (P=0.176). In 1-year survival analysis, graft survival in side to side group was significantly decreased (P=0.018), and patient survival was also decreased in side to side group (P=0.001). In case of 3-year graft survival, there was no significant difference between the groups (P=0.074), but a trend of decreasing survival rate was observed in side to side and inferior epigastric group on the survival curve. The 3-year patient survival was significantly decreased in side to side group (P=0.001). In 5-year long-term survival analysis, there was no significant difference in graft survival between groups (P=0.525), however survival rate of side to side and inferior epigastric groups tended to decrease in the survival curve. The 5-year patient survival was significantly decreased in side to side group (P=0.001).

**Conclusions:** Our study shows that side to side reconstruction method for two donor renal artery is disadvantageous in patient survival of 1, 3, 5 years and inferior in 1-year graft survival.

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## Effects of policy on promotion of organ donation and Donation Improvement Program on donation

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**Background:** In Korea, after the establishment of the organ procurement organization (Korea Organ Donation Agency, KODA) in 2009, institutional framework for designation of organ procurement organization and implementation of the reporting system for potential brain death donors has been prepared through amendment of the Organs Transplant Act in 2011. In addition, although a donation activation program is being implemented at medical institutions that have entered into an agreement with the organ procurement organization, the organ donation is in gridlock due to various factors including new infectious disease such as the recent COVID-19, and lack of a national consensus, etc. Therefore, improvements should be made to approaches to institutions and social system that allow excavation of potential brain death donors, face-to-face talk with the donors, and their donations. As such, this paper aims to present the direction of its development in the future.

**Methods:** We have analyzed 79 hospitals across the country that entered into an agreement with KODA for using the Donation Improvement Program (DIP) between 2012–2021 and compared the number of brain death donors per million population (PMP) in countries (EU nations) that applied the Organ Donation European Quality System (ODEQUS) of Europe with the number of donors prior to its application.

**Results:** The number of brain death donors per million population (PMP) in Korea was found to be 8.35 in 2012 and 8.56 in 2021, which did not show any significant change in donation rate during the past 10 years. However, it was confirmed that there were changes in recognition rate and donation rate at hospitals that entered into an agreement for using the Donation Improvement Program. According to change in recognition rate based on the agreement period, it was 26.5% 6 months prior to agreement. However, it was increased up to 66.9% 2–3 years after the agreement. As for the donation rate, while it was 6.5% 6 months prior to agreement, it was increased up to 16.0% 2–3 years after the agreement. Among the top 10 countries showing the high donation rate (PMP) in the world in 2021, seven of them were EU nations which enforced 'ODEQUS'. When comparing PMP between 2009 and 2021 in major cooperative countries for the initial project for ODEQUS, it was increased from 34.4 to 40.2 in Spain, 17.4 to 29.5 in Croatia, 21.3 to 24.4 in Italy, and 13.8 to 18.39 in Sweden.

**Conclusions:** In order to achieve donation activation, overall social systems should be able to be managed together in an organic way. At the level of medical institution, each hospital should introduce the DIP, and need to have a systematic training system for donation-related medical staffs and coordinators for promoting active excavation activities through connections with medical staffs and increasing their capacity. Moreover, a systematic media campaign should be made for the public for improving their positive social recognition, and a proper compensation system for medical institutions' donation activities should be introduced.

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## Identification and comparison of functional microbiomes affecting immune homeostasis in long-term stable and tolerant patients after liver transplantation

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**Background:** In this study, we aimed to identify the gut microbial balance and functional microbiomes affecting immune homeostasis in the long-term post-liver transplant (LT) and tolerant patients.

**Methods:** A total of 27 long-term LT patients and 20 healthy volunteers were consecutively enrolled in our study. Of 27 included LT patients, 22 patients ingested immunosuppressants (long-term post-LT group) and the other five were tolerant patients without immunosuppressants (tolerance group). Included LT patients had normal liver function without history of rejection and underwent LT more than 5 years ago. Healthy controls have no medical diseases including metabolic and alcoholic disease. The frequency of regulatory T (Treg) and T helper 17 (Th17) cells and cytokines in the blood were analyzed by flow cytometry and multiplex cytokine assay. Moreover, the diversity and composition of fecal microbiomes were analyzed by 16S rRNA sequencing.

**Results:** The mean age of LT patients was 63.0 years and the mean time from LT was 13.2 years. The gut microbiome of the long-term post-LT group showed lower alpha-diversity ( $P < 0.05$ ) with distinct overall microbial composition ( $P = 0.001$ ) compared to healthy controls. Among the 11 distinct bacterial genera in abundance, *Faecalibacterium* was the most decreased in the long-term post-LT group (Fig. 1A). The long-term post-LT group also demonstrated a decrease in Treg with an increase in Th17 cells, recovered by administration of *Faecalibacterium prausnitzii* and butyric acid in *in vitro* analysis. Moreover, in tolerant patients, *Faecalibacterium* was marginally increased, coupled with an increase in Treg cells, compared to the long-term post-LT group (Fig. 1B).

**Conclusions:** The long-term post-LT patients showed a decrease in functional microbiomes represented as *Faecalibacterium* affecting immune homeostasis, which were recovered in tolerant patients.

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## The changes in immune markers including regulatory T, regulatory B and T helper 17 cells during tapering immunosuppressants in liver transplant patients

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**Background:** In this study, we examined the changes in the proportion of B cells including regulatory B cells and their roles in immune homeostasis during the tapering the immunosuppressants (ISs) in long-term post-liver transplant (LT) patients.

**Methods:** A total of 16 long-term LT patients were prospectively enrolled in our study. Included LT patients had normal liver function without history of rejection and underwent LT more than 5 years ago. Patients were followed up every 3 months and the dose of ISs were tapered by 25%–30% every 6 months. In every visit, blood samples had been collected and the proportion of T cells and B cells including regulatory T (Treg), T helper 17 (Th17), T helper 1 (Th1), and regulatory B cells (CD19+CD24hiCD38hi cells; Breg) were analyzed by flow cytometry. The changes of immune cells and their correlations were analyzed during tapering ISs in LT patients.

**Results:** Among 16 patients, eight patients (50%) totally tapered ISs without rejection and tolerant after stopping ISs. Other six patients minimized their dose of IS to 25% without rejection. The other two patients experienced rejection at the time of 25%, 50% reduction, respectively. During tapering ISs, the proportion of Treg and Breg cells were increased in tapering patients. At the time of 50% reduction, the frequency of Breg and Th17 cells were inversely correlated ( $P < 0.005$ ).

**Conclusions:** During tapering the ISs, the proportion of Breg and Treg cells were increased and inversely correlated with Th17 cells, suggesting the potential role of Breg cells in controlling immune homeostasis in LT patients.

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## Preexisting nonhuman leukocyte antigen antibodies are associated with allograft rejection after thoracic transplantation

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There is growing evidence of an important role of non-human leukocyte antigen (HLA) antibodies in lung and heart transplant rejection. However, data on the prevalence and clinical significance of non-HLA antibodies in the Asian population are scarce. We used a Luminex machine to measure non-HLA antibodies in patients who underwent heart (n=28) or lung transplantation (n=36) between 2016 and 2019. We evaluated the association between pre-existing non-HLA antibodies and acute rejection-free days in heart and lung transplant recipients. Of the 64 patients, acute allograft rejection occurred in 27 (42.2%). Acute cellular rejection occurred in 26 (40.6%) patients, and acute antibody-mediated rejection occurred in one (1.6%) patient. Among 33 non-HLA antibodies, only the anti-glutathione S-transferase theta-1 (GSTT1) antibody positive rate was significantly higher in the acute rejection group compared to the no rejection group (40.7% vs. 13.5%, P=0.013). The angiotensin II type I receptor (AT1R) positive rate was not significantly different between the two groups (40% vs. 18.5%, P=0.129). In the multivariate Cox regression analysis, anti-GSTT1 antibody-positive patients had a higher risk of acute allograft rejection (hazard ratio, 2.33; 95% confidence interval [CI], 1.08–5.04; P=0.032). The Kaplan-Meier curve showed that anti-GSTT1 antibody-positive patients had fewer acute rejection-free days ( $\chi^2=5.50$ ; P=0.019). In addition, patients who underwent packed red cell transfusion (odds ratio [OR], 1.30; 95% CI, 1.07–1.57; P=0.007) or mechanical ventilation (OR, 20.83; 95% CI, 2.49–173.97; P=0.005) before transplantation were more likely to be positive for anti-GSTT1 antibody. Patients with antibodies against GSTT1 before heart or lung transplantation had an increased risk of acute rejection.

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## Survival of patients undergoing liver resection for advanced hepatocellular carcinoma

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**Background:** Liver resection has been reported as a safe and effective approach for the management of hepatocellular carcinoma (HCC). However, liver resection has not been recommended for patients with huge advanced HCC because of high operative morbidity, mortality, recurrence rate and lack of survival benefit.

**Methods:** The aim of this study is to evaluate the outcomes of liver resection with advanced HCC. We retrospectively analyzed 50 patients with advanced HCC who underwent major hepatic resection. We evaluated tumor size, TNM stage, number of tumor, AFP level, tumor thrombus and liver cirrhosis.

**Results:** Fifty patients with HCC enrolled in this study. Patients with higher stage cirrhosis and huge HCC had the worst prognosis. Multivariable analysis showed that tumor size affected long-term survival. Prognostic factors for huge HCC were surgical margin, poor differentiation, multiple tumors, vascular invasion and cirrhosis.

**Conclusions:** In this study, we have demonstrated that safe and radical liver resection is still suitable for the HCC patients with huge, multinodular lesions and macrovascular invasion. Patient should be selected carefully and needed sufficient perioperative care. Advanced HCC patients without liver cirrhosis and with a tumor-free resection margin demonstrate longer survival and lower recurrence.

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## Development of Korean lung allocation system using machine learning

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**Background:** The shortage of donor lungs in Korea has raised ethical demands to optimize organ allocation. We developed a Korean lung allocation system (LAS) that maximizes the transplant benefit using the Korean Network for Organ Sharing data.

**Methods:** Transplant benefit was defined as a high probability of dying within 1 year of the waiting list and a high probability of surviving at 1 year after transplantation. From 2010 to 2020, 1,587 registered patients for lung transplantation aged 12 years and older and 760 lung transplant patients in Korea were included in the analysis. Through elastic net Cox regression, each model was created to predict death within 1 year on waitlist, and 1 year death after transplantation, and the two models were combined. The final model was validated through the validation cohort and compared with LAS score in US.

**Results:** The waitlist mortality model included hospitalization at registration, ventilator, extracorporeal membrane oxygenation, gender, age, body mass index, first status at registration, diagnosis, and blood type, and the C-index of training cohorts was 0.801 ( $P<0.001$ ) and C-index of test cohorts was 0.858 ( $P<0.001$ ). The transplant mortality model included hospitalization at registration, ventilator, age, body mass index, first status at registration, status at transplantation, diagnosis, and blood type, and the C-index of training cohorts was 0.645 ( $P<0.001$ ) and C-index of test cohorts was 0.814 ( $P<0.001$ ). In the weighted sum model, AUC was 0.655 in training cohorts ( $P<0.001$ ) and AUC was 0.630 in test cohorts ( $P<0.001$ ).

**Conclusions:** Compared to the existing LAS score in US, the newly developed Korean LAS showed better performance for predicting transplant benefit. Prospective validation of this model and further refinement of the model are needed.

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## Comparison of long-term outcomes in simultaneous pancreas-kidney transplant versus simultaneous deceased donor pancreas and living donor kidney transplant

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**Background:** Because of the limited nature of organ transplants in most countries, many diabetic patients with end-stage renal disease might not have the chance to undergo simultaneous pancreas and kidney transplantation. To overcome this paucity of organs, simultaneous deceased donor pancreas and living donor kidney transplant (SPLK) can be implemented with certain advantages over conventional simultaneous pancreas-kidney transplant (SPK).

**Methods:** A total of 195 patients who underwent SPK (n=149) or SPLK (n=46) were retrospectively analyzed. Their pre- and posttransplantation variables, development of *de novo* DSA, occurrence of biopsy-proven acute rejection (BPAR), and graft survival rates were compared.

**Results:** There were no significant differences in the baseline characteristics between the SPK and SPLK groups except for the shorter cold ischemic time of kidney graft (331 vs. 93 minutes,  $P<0.001$ ), shorter duration of diabetes (21.1 vs. 17.8 years,  $P=0.004$ ), older age of pancreas graft-donors, and younger age of kidney graft-donors in the SPLK group. Ten years of follow-up data showed that the death-censored pancreas graft survival rate was significantly lower in the SPLK group. In addition, the incidence of BPAR of the pancreas graft was significantly higher in the SPLK group (Fig. 1). There was no significant difference in the presence of *de novo* DSA and the incidence rates of kidney graft failure, kidney BPAR, and mortality between the two groups.

**Conclusions:** SPLK resulted in similar rates of early graft function and survival to those of SPK, albeit showing more incidences of acute rejection with regard to the pancreas graft.

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## Ventilator support in pretransplant predisposes early graft failure after deceased donor liver transplantation

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**Background:** Graft failure is one of the most serious complications that can lead the patient to death after liver transplantation. The aim of this study is to find factors affecting early graft failure in patients who received deceased donor liver transplantation (DDLT).

**Methods:** This single center retrospective study included a consecutive series of 64 patients undergoing DDLT from August 2017 to February 2021. Graft failure that occurred within 30 days postoperatively was analyzed using binary logistic regression analysis.

**Results:** Sixty-four patients identified in study period. The incidence of early graft failure was 17.7% (n=11). Among them, three patients underwent retransplantation. The proportion of hepatic encephalopathy grade 3 or 4, the presence of continuous renal replacement therapy due to hepatorenal syndrome, ventilator care support in intensive care unit before transplantation were higher in the early graft failure group than in the no early graft failure group. However, difference in those factors did not reach significant level. Only preoperative ventilator care (odds ratio, 7.750; 95% confidence interval, 1.148–52.297; P=0.036) in intensive care unit is a strong predictive factor for early graft failure after DDLT in multivariate analysis.

**Conclusions:** A pretransplant factor predicting 30-day graft failure in DDLT is patients who received ventilator care before transplantation. Present study suggests that patients on the DDLT waiting list receiving ventilator support should be carefully determined DDLT. DDLT should be determined after withdrawal of ventilatory support through sufficient lung care.

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# Clinical relevance of the Living Kidney Donor Profile Index in Asian kidney transplant recipients

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**Background:** The Living Kidney Donor Profile Index (LKDPI) was developed in the United States to predict the graft outcomes. There are significant differences in donor demographics, access to transplantation, proportion of ABO-incompatibility, and posttransplant mortality in Asian countries as compared with the United States. We evaluate the clinical relevance of LKDPI score in Asian kidney transplant recipients.

**Methods:** We analyzed 1,877 patients who underwent kidney transplantation between 2000 and 2019. Patients were divided into three groups according to the LKDPI score: <0, 1–19.9, and 20.

**Results:** The median LKDPI score was 3.11 (interquartile range, –8.9 to 16.7); 42.9% of donors had LKDPI <0, and 2.3% of donors had LKDPI >50. In total, mean age of the 1,877 donors was 41.0 years and 12.0% recipients received ABO-incompatible graft. During a median follow-up of 119 months, 87 (4.6%) patients died and 238 (12.7%) patients experienced death-censored graft loss. The 10-year death-censored graft survival rates were 92.2%, 88.6%, and 86.0% for LKDPI score of <0, 1–19.9 and 20 groups ( $P<0.001$ ). LKDPI group was significantly associated with an increased risk of death-censored graft loss, independent of recipient characteristics (LKDPI, 1–19.9; hazard ratio, 1.389; 95% CI, 1.036–1.863 and LKDPI, 20; hazard ratio, 2.121; 95% CI, 1.50–2.998). By contrast, overall patient survival rates were comparable among LKDPI groups. LKDPI was also significantly associated with posttransplant graft renal function.

**Conclusions:** Among the Asian kidney transplant recipients, high LKDPI score is associated with an increased risk of death-censored graft loss and poor graft renal function.

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## Robotic kidney transplantation: a single institutional experience

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**Background:** Minimally invasive surgery reduces perioperative pain and morbidity, facilitating rapid recovery. However, the field of kidney transplantation has lagged in this regard, its customary open surgical techniques going nearly unchanged until recently. Robotic kidney transplantation (RKT) is a novel and welcomed innovation yielding good surgical outcomes. As the first institution to perform a RKT in Korea, our aim is to evaluate and share our surgical and functional results of RKTs performed in our center.

**Methods:** This is a retrospective study of all RKTs performed between November 2019 and July 2022 at the Severance Hospital. We analyzed the surgical, functional outcomes and complication rates.

**Results:** During the aforementioned period, 36 patients successfully underwent RKT from living donor. The mean age was 44.3±11.2 years old and male to female ratio was 26:10. Mean body mass index was 21.9±2.9 kg/m<sup>2</sup> and KT was performed preemptively in 55.6% of cases. Surgical console time was 212.9±41.6 minutes (154–327) with vascular anastomoses time 39.9±5.9 minutes (28–58), rewarming time 67.3±12.1 minutes (43–112), and mean estimated blood loss 122.8±82.4 cc (50–400). No patient was converted to open transplantation. Subcapsular hematoma and penetrating injury of proximal ureter during ureteral stent insertion occurred in one patient, but this improved after conservative management. No anastomosis revision and wound infections occurred. Delayed graft function was not shown in all RKT cases. The mean serum creatinine level at discharge day was 1.3±0.3 mg/dL (0.7–2.1).

**Conclusions:** RKT with regional hypothermia may be a safe and effective, minimally invasive alternative to open KT, yielding comparable clinical outcomes.

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## Risk analysis of waiting list mortality for heart transplantation: multicenter study in Korea

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**Background:** There were little national studies about the waiting list mortality of heart transplantation (HT) in Korea. We performed a multicenter study investigated the waiting list mortality for HT and its risk factors.

**Methods:** A retrospective analysis of 1,101 consecutive patients who were list for HT between 2012 and 2017 in the four high-volume Korean centers was performed. Time on the waiting list was defined as time from initial listing for HT to the time of delisting from the waiting list due to heart transplant, death, or recovery. Subjects were censored at the time of transplantation or recovery.

**Results:** In whole cohort, 327 (29.7%) patients needed mechanical circulatory support (MCS) during waiting list; 314 were treated with extracorporeal membrane oxygenation (ECMO) bridge, 13 were treated with ventricular assist device (VAD) bridge. Overall survival rate in patients who underwent ECMO bridge was significantly lower than patients who underwent VAD bridge or did not undergo MCS bridge. Overall survival rate in patients with initial status 0 and 1 was significantly lower than patients with initial status 2 or 3. In the last follow-up urgent grade, survival rate in patients with status 0 showed significantly lower than status 1, 2, or 3. In multivariate analysis, independent risk factors for waiting list mortality were congenital heart disease and restrictive cardiomyopathy compared with dilated cardiomyopathy; status 0 compared with status 2 and 3; low hemoglobin; history of ventricular arrhythmia; high model for end-stage liver disease score; and ECMO bridge during waiting period.

**Conclusions:** This study showed ECMO as bridge to transplantation and status 0 showed significantly high waiting list mortality. And advanced end-organ damage at the time of listing and ventricular arrhythmia were found to be independent risk factors for waiting list mortality.

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## Comparison between continuous versus intermittent infusion of human antithrombin III concentrate in the immediate postoperative period after liver transplantation

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**Background:** Antithrombin-III (AT-III) concentrates have been used in the immediate postoperative period after liver transplantation to prevent critical thrombosis. In the preceding study that retrospectively analyzed the pharmacokinetics of AT-III in liver recipients, plasma AT-III activity level was expected to be more stably maintained in the target range (80%–120%) with a continuous infusion regimen than with a conventional intermittent infusion regimen.

**Methods:** In this randomized controlled trial, 130 adult patients undergoing living-donor liver transplantation were randomly allocated into an intermittent infusion group (group I) or a continuous infusion group (group C). For group I, 500 international units (IU) of AT-III concentrate were administered after liver transplantation and repeated every 6 hours until postoperative 72 hours. For group C, 3,000 IU of AT-III was continuously infused for 71 hours after a loading dose of 2,000 IU over an hour. The plasma AT-III activity level was measured at 12, 24, 48, 72, and 84 hours from the first AT-III administration. The primary outcome was the target attainment rate at 72 hours. The plasma AT-III activity levels at other time points and associated complications were collected as secondary outcomes.

**Results:** A total of 107 patients were included in the analysis (54 patients for group I and 53 patients for group C). The target attainment rates at 72 hours post-dose were 30% and 62% in group I and group C, respectively ( $P=0.003$ ). Compared to group I, patients in group C reached the target plasma AT-III activity level more rapidly (median time, 12 hours vs. 24 hours;  $P<0.001$ ) and was more likely to remain in the target range until 84 hours.

**Conclusions:** The continuous infusion regimen was more adequate in maintaining the serum AT-III activity level within the normal range compared to the conventional intermittent infusion regimen.

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## COVID-19 infection outcomes of the kidney transplant recipients in Mongolia

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**Background:** The number of deaths due to the COVID-19 pandemic is 649.9 per 1 million people globally, and 542 cases per 1 million people are recorded in Mongolia. This study was conducted because the prognosis of kidney transplant recipients after treatment for COVID-19 infection has not been studied in Mongolia.

**Methods:** This study was held between period from March 15, 2021 to Nov 1, 2021 in the Transplantation Center of First Central Hospital. Of 278 recipients, 105 (37.7%) kidney transplant patients were confirmed to have COVID-19 infection.

**Results:** Out of 278 kidney transplantation recipients, 239 (85.9%) were from living donors and 39 (14%) were from diseased donors. From total infected recipients 35.5% are living donors and 51% diseased donors was a statistically significant difference ( $P < 0.001$ ). The average age was  $43.5 \pm 9.2$ , 33.4% were over 50 years old and 70.5% were male. 48.3% diabetes recipients were infected with COVID-19, which was the leading risk of underlying disease ( $P < 0.001$ ). Recipients were immunized with the M-RNA-based Pfizer vaccine, and four out of five unvaccinated recipients was infected COVID-19, 12 out of 19 got the first dose, 79 out of 95 got the second dose, and 10 out of 159 got the third dose, had confirmed COVID-19 infection. Recipients who received three doses of immunization had a lower risk of COVID-19 infection, whereas four out of five (80%) of unimmunized recipients died, showing a vaccine effectiveness ( $P < 0.001$ ). There were 33 (31.4%) cases of lung pneumonia and eight (7.6%) kidney injury reported due to the infection.

**Conclusions:** The recipients of the kidney transplantation with confirmed COVID-19 infection are over 50 years old, unimmunized, underlying diseases, and immunosuppression are risk factors for complication of disease and affecting the future prognosis.

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## Early experiences of liver transplantation in new opened hospital

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**Background:** Since the first human liver transplantation (LT) performed in 1963, LT has been most effective option for end-stage liver diseases and for selected patients with hepatic neoplasm. The number of LT is increasing until now and, also, the number of institutions performed LT is increasing. Herein, we will report early experiences of LT in new opened hospital.

**Methods:** Our hospital was newly opened in Seoul, Korea in April 2019. We performed 33 LT from June 2019 to September 2021.

**Results:** We performed 26 living donor liver transplantations (LDLT) and seven deceased donor liver transplantations (DDLT). On clinical features of recipients, major original diseases were 14 (42.4%) alcoholics and 12 (36.4%) hepatitis B, mean age was 54.1±9.7 years, 21 (63.6%) male patients, 11 (33.3%) combined hepatocellular carcinoma (HCC), three (9.1%) ABO-incompatible patients, mean model for end-stage liver disease score was 19.1±10.2, mean operative time was 628 minutes, and mean post-LT hospital stay was 34.9±16.3 days. The complications of recipients were one (3.0%) post-LT bleeding, 10 (30.3%) infections, 10 (30.3%) hepatic vein outflow obstruction, nine (27.3%) acute rejection, and eight (24.2%) biliary strictures. Two (6.1%) patients were dead after LT, one patient was dead because of cardiac arrest in post 22 days after DDLT, and the other patient was dead because of alcoholic acute pancreatitis in post 1 year after LDLT. There were 4/27 (14.8%) bile leak complications of living donors, and no mortality of donors.

**Conclusions:** The multidisciplinary approach with surgical, medical, radiologic, and anesthetic teams, and a wide range of administrative services, which can be provided with institutional and foundational support, is essential. We thought that the multidisciplinary teamwork including thorough preparation for LT is most important for which first started the liver transplant hospital.

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## Outcomes of paired kidney exchange: an early experience from Nepal

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**Background:** Paired kidney exchange (PKE) is a therapeutic strategy where two or more pairs of donor and recipient exchange kidneys between themselves in order to avail an immunologically better compatible organ. It is a cheaper option as compared to the complicated and expensive procedures of pretransplant immune desensitization or ABO-incompatible kidney transplantation. PKE demands high level of commitment from the patients, donors and the transplantation medical team. This is a report of two-way PKE done in the pioneer transplant institute of Nepal.

**Methods:** Medical records of patients who had undergone PKE in the institute were retrieved. Necessary data was captured and retrospective analysis of the characteristic data was done.

**Results:** First two-way PKE was done in February 14, 2018. Six pair of two-way PKE were performed in the last 4 years. Four (66.67%) pairs were due to unavailability of blood group compatible donor in the legitimate living donor pool and two (33.33%) pairs were due to positive tissue crossmatch despite having a blood group compatible donor. Three (25%) recipients and nine (75%) donors were female. Mean age at transplantation was 40.16 (range, 24–63 years). Basiliximab was used as induction agent in one patient who was treated for hepatitis C, while all others were induced with rabbit thymoglobulin. Three had rejection. One had mixed cellular and humoral rejection on day 4 of transplantation. One had a cellular rejection in the ninth month while the other had a humoral insult, after a year of kidney transplant. Eleven (91.6%) of them survived for at least 6 months. Nine (90%) of the 10 patients transplanted at least 12 months before analysis survived at least one year. Of the total 12 patients, two died. Both deaths were both due to sepsis.

**Conclusions:** PKE is a rationale strategy to reduce the costs of kidney transplantation.

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## Comparison of immunogenicity among each human leukocyte antigen DQ mismatches for the development of de novo donor specific antibodies in Thai kidney transplant recipients

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**Background:** Human leukocyte antigen (HLA) mismatches are associated with the development of de novo donor-specific antibodies (dnDSA) which can lead to premature allograft failure. HLA-DQ antibodies are the most common (dnDSA) after kidney transplantation (KT). However, each HLA-DQ mismatch might have the unequal immunologic risk and different impact on graft outcomes.

**Methods:** We performed retrospective analysis in KT recipients with HLA-DQB1 mismatches at Siriraj hospital between January 2006 and December 2020. Our center performed routine post-KT dnDSA surveillance annually. The prevalence and associated risk factors for the development of dnDSA against each HLA-DQB1 was determined. Effect of dnDSA to late rejection and graft survival was also observed.

**Results:** During the median follow-up time of 6.4 years, 59 of 491 (12.02%) recipients developed dnDSA to HLA-DQB1 with median time 4.2 years after KT. The patients who had dnDSA were younger ( $P=0.009$ ), pre-KT PRA  $>20\%$  ( $P=0.044$ ), non-tacrolimus immunosuppression ( $P<0.001$ ) and non-adherence ( $P=0.031$ ). Risk for dnDSA occurrence is significantly higher in recipients who had HLA-DQ7 (hazard ratio [HR], 2.8; 95% confidence interval [CI], 1.21–6.52;  $P=0.017$ ) and HLA-DQ9 (HR, 2.63; 95% CI, 1.11–6.27,  $P=0.028$ ), respectively. Recipients who developed dnDSA to HLA-DQ had significantly higher incidence of late allograft rejection (HR, 7.76; 95% CI, 5–12.03;  $P<0.0001$ ) and had lower 10-year allograft survival compared with whom without dnDSA (70.2% and 87.8%;  $P=0.001$ ).

**Conclusions:** Antibodies against HLA-DQB1 significantly increase risk of allograft rejection and unfavorable graft survival. All HLA-DQ mismatches do not express the same immunogenicity for triggering antibodies formation. Patients with HLA-DQ7 and subsequently HLA-DQ9 mismatch have the greatest risk for dnDSA occurrence. Kidney allocation and individualized immunosuppressive adjustment based on each HLA-DQ mismatches will improve the long-term graft survival.

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## Second hand allotransplantation experience after the revised transplantation law: 5-month follow-up

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**Background:** Hand transplantation for upper extremity amputation provides a unique treatment that restores form and function. In January 2021, the first hand allotransplantation since legalization was successfully performed. Based on that experience, the authors performed a second Hand allotransplantation in March 2022.

**Methods:** A 47-year-old man patient underwent mechanical amputation injury in February 2019. After going through the registration process of waiting for transplant registration, hand transplantation was performed in March 2022. The transplantation was performed in distal 1/3 in right forearm. The immunosuppressive induction therapy included basiliximab with successive maintenance therapy of tacrolimus, methylprednisolone and mycophenolate mofetil. And proper anti-coagulant therapy was performed before and after surgery.

**Results:** The operation took about 18 hours, and there was no abnormality in the blood flow of the transplanted hand after the operation. One month after the operation, a debridement and skin graft was performed on partial skin necrosis of forearm. A mild acute rejection episode was found (postoperative day 2 months), in which hand skin rash occurred. Rejection episode is resolved through steroid pulse therapy. The graft is tolerable with current maintain dose of lowered tacrolimus level and oral steroid. Dorsal, volar and finger area senses are currently being restored, and cognitive senses for each digit are also being restored. Motor function is also being trained through rehabilitation exercise.

**Conclusions:** The 47-year-old male patient's hand allotransplantation has been good so far, and it is necessary to thoroughly observe whether there is a rejection reaction in the future and focus on rehabilitation treatment at the same time.

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## Retrospective analysis of monocyte distribution width in kidney transplantation

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**Background:** A few reports have been published about monocyte/macrophages play a role in transplantation. Monocyte distribution width (MDW) is known as new screening indicator in sepsis. MDW is not reported yet in kidney transplantation (KT). We aimed to analyze MDW level with donor type (DT) and HLA antibody status and to evaluate correlations between MDW and other laboratory parameters in KT recipients.

**Methods:** From April 2019 to July 2022, a total of 64 KT recipients with underwent deceased-donor (DD, n=37) and living-donor (LD, n=27) KTs in Eunpyeong St. Mary's Hospital. Panel reactive antibody (PRA), flow cytometric cross-match (FXCM), and initial MDW level according to DT (DD/LD) and DSA (DSA+[n=57]/DSA-[n=5]) were analyzed. A total of 645 consecutive MDW levels from 64 KT recipients were analyzed to evaluate correlations between MDW levels and other laboratory parameters; white blood cell (WBC), neutrophil (N), lymphocyte (L), N/L ratio (NLR), monocyte (M), eosinophil (E), basophil (B), C-reactive protein (CRP), creatinine (Cr), modification of diet in renal disease-estimated glomerular filtration rate (MDRD-eGFR), and chronic kidney disease epidemiology collaboration-eGFR (CKD-EPI-eGFR).

**Results:** Initial median MDW level (interquartile range) was higher in DD than in LD; DD vs. LD (17.1 vs. 16.6) and was higher in DSA+ than in DSA- (17.5 vs. 16.8). In 645 consecutive MDW levels, MDW showed significant negative correlations with WBC, L, N, M, MDRD-eGFR, and CKD-EPI-eGFR (all P<0.05) except for NLR, E, B, CRP, and Cr.

**Conclusions:** This is the first study to analyze MDW level in KT. MDW level was a trend to be higher in DD-KT and DSA+ KT groups. In addition, MDW level is significantly correlated with both MDRD-eGFR, and CKD-EPI-eGFR. Although the further study is needed, MDW will be an effect on the kidney function in KT recipients.

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# The role of computed tomography volumetry of the liver with subsequent three-dimensional modeling in the planning of the operation

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**Background:** To evaluate the capabilities and reliability of the computed tomography (CT) method with the subsequent construction of three-dimensional (3D) reconstructions and segmentation as a tool for planning surgical intervention in liver malignancies.

**Methods:** Measurements of the future residual volume of the liver (FRLV) using CT were performed in 39 patients before various operations, as well as on day 8 after surgery. CT volumetry was performed on a scanner with an 80-row detector with intravenous contrast. Semi-automatic post-processing of the volume of the data obtained consists in algorithmic layer-by-layer calculation of the number of voxels included in the designated contours of the liver, according to averaged density indicators depending on the phase by contrast, with their further summation reflecting the total volume of the organ. Further, the resulting volume of the liver is divided into fractions and segmented according to anatomical landmarks. With a satisfactory condition of liver tissue for the prevention of the development of postoperative acute renal failure, the critical minimum value of FRLV was established at a level of more than 32%–35% of the total initial volume.

**Results:** In the period from January 2019 to December 2022, in 39 patients with indications for liver resection, the preoperative values of FRLV were up to 34%–39%. Repeated CT to calculate the increase in parenchyma volume was performed on the 8th day after liver resection. According to the calculation results, all patients had a significant increase in FRLV (195.1%).

**Conclusions:** The presented method is an important tool of an individual approach when planning liver resections in patients with primary and metastatic malignant tumors, which allows us to reliably estimate not only the total and future residual volumes of the liver, but also the volumes of each segment individually.

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## Kidney transplantation from deceased donor treated with continuous renal replacement therapy due to acute kidney injury and anuria: a case report

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**Background:** Heart-beating organ donors are in a variety of conditions. The number of brain-dead donors with serum creatinine 3 mg/dL or higher with anuria is small. It is difficult to predict the outcome of kidney transplantation from such a donor. Herein, we report a case of a successful kidney transplantation from a deceased donor who underwent continuous renal replacement therapy (CRRT) for 5 days with acute kidney injury (AKI) and anuria.

**Methods:** A 34-year-old male developed sudden cardiac arrest, presumably due to respiratory by asthma aggravation. He was return of spontaneous circulation with cardiopulmonary resuscitation during total 44 minutes. At the time of admission, serum creatinine 1.08 mg/dL, but on hospital day 3, serum creatinine 5.62 mg/dL, 24-hour urine output of 300 mL. He received CRRT owing to norepinephrine use. Thereafter he showed anuria for 5 days. The patient did not recover from the hypoxic brain injury on the hospital day 8 and remained brain death.

**Results:** The recipient was a 37-year-old female. She was undergoing hemodialysis (HD) for 4 years and 7 months. Her primary renal disease was hypertension. Immunologic studies included negative results of crossmatch test and panel reactive antibody. The induction and maintenance immunosuppressive agents were basiliximab, with tacrolimus, mycophenolate, and glucocorticoid. After transplantation, she underwent hemodialysis due to delayed graft function from postoperative day (POD) 4. However, she underwent an allograft biopsy at POD 12. Allograft findings revealed severe acute tubular necrosis and subcapsular cortical necrosis. Finally, her serum creatinine decreased from POD 16. The patient discharged with serum creatinine 2.2 mg/dL at POD 22. Her renal function was 0.91 mg/dL of serum creatinine 18 months after transplantation.

**Conclusions:** Allograft kidney of deceased donor candidates with severe acute kidney injury can ensure successful transplant outcomes with appropriate management for peritransplant period.

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## Antiplatelet drugs on the recurrence of hepatocellular carcinoma after liver transplantation

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**Background:** Previous studies reported suppressive effects of antiplatelet agents on hepatocellular carcinoma (HCC); however, this has never been assessed in patients who underwent liver transplantation (LT).

**Methods:** This retrospective observational study used data from LT recipients with pretransplant HCC in a single tertiary hospital. The study population was divided into two groups according to the use of antiplatelet agents for >90 days within the study period (377 antiplatelet group vs. 91 non-antiplatelet group). Matched groups containing 79 patients in each group were also compared regarding HCC-recurrence and HCC-related mortality, which were analyzed by treating non-HCC death as a competing risk.

**Results:** In Kaplan-Meier analysis of the matched cohort, the 5-year cumulative incidences of HCC recurrence and HCC-specific death were similar between the antiplatelet ( $P=0.876$ ) and non-antiplatelet groups ( $P=0.701$ ). All-cause and non-HCC deaths were also similar between the two groups ( $P=0.867$  and  $P=0.413$ , respectively). In multivariable analysis of the entire cohort, antiplatelet use was not associated with HCC recurrence (hazard ratio [HR], 1.37;  $P=0.300$ ) or HCC-specific death (HR, 1.54;  $P=0.310$ ).

**Conclusions:** Unlike usual setting with liver disease, antiplatelet therapy did not affect HCC recurrence or HCC-specific mortality when used after LT.

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## Thrombotic microangiopathy, rare cause of deceased donor acute kidney injury: is a donor biopsy necessary before donation?

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Although deceased donor acute kidney injury (AKI) frequently leads to kidney discards. There is no significant difference in graft survival. However, since some causes are related to graft loss, evaluation based on objective criteria before transplantation should determine whether the kidney should be discarded. We reported a case who had thrombotic microangiopathy (TMA) in the graft kidney after deceased donor kidney transplantation (KT). A 25-year-old male with IgA nephropathy-induced end-stage renal disease (ESRD) received KT from a deceased donor. Before the KT, the donor's initial serum creatinine (sCr) was 0.39, and the last sCr was 3.86 mg/dL, suggesting AKI. A zero-time protocol biopsy was performed on graft kidney immediately after vascular anastomosis, and the graft kidney's arterial resistance index (RI) showed 0.8. On light microscopy, TMA was observed in the tissue of the graft (Fig. 1). After transplantation, he was treated with hemodialysis due to delayed graft function for one month, and on postoperative day (POD) 36, he was discharged without hemodialysis. However, there was no significant improvement in sCr (3.7–4.1) and eGFR (18–20 mL/min/1.73 m<sup>2</sup>). Even though deceased donor AKI is not related to graft survival, AKI caused by causes like the TMA almost results in graft loss. Therefore, for more effective and safe transplantation, donors accompanying AKI will need to undergo a preliminary examination to rule out the causes of AKI resulting in graft loss.

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## Preclinical xeno-kidney transplantation of pig to cynomolgus non-human primate: 2 years of experience

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**Background:** Xenotransplantation is gaining much attention as an alternative means to resolve the worldwide organ shortage. Pigs are currently considered the best donor animal, and recent clinical application of kidney xenotransplantation in a decent model was encouraging. However, there are a lot more to learn and preclinical study using non-human primates is valuable in moving to a successful clinical trial. We present our 2-year experience with renal xenotransplantation using cynomolgus primate recipients in South Korea. Our primary aim was to investigate the immunological changes following xenotransplantation.

**Methods:** A total of sixteen cynomolgus monkeys received kidneys from pigs of various genetic modifications, including DKO (GGTA1, B4galNT2), DKO (GGTA1, CMAH), TKO, QKO (TKO+iGb3S), and DKO (GGTA1, B4galNT2) with CD46, TBM. A standardized immunosuppressive regimen was used, with anti-thymocyte globulin and rituximab as induction, followed by aCD154, sirolimus and steroids as maintenance. Serial biopsies were performed after transplantation, and histology was reported by a renal transplant specialist pathologist.

**Results:** The mean overall survival was 43.1 days. A significant proportion of recipients (n=10, 62.5%) died of systemic complications including systemic oedema, septic shock, and asphyxia. AMR and TCMR were present in two cases each, and one borderline rejection was identified. There was no mortality secondary to post-operative bleeding. A subgroup analysis was performed to compare outcomes between donor groups, but a meaningful conclusion could not be drawn due to small numbers.

**Conclusions:** Our experience demonstrates that rejection-free kidney xenograft survival is possible with adequate genetic modifications and immunosuppression. However, the rate of systemic complications was unacceptably high, although they might be related to immunological reasons. To achieve longer survival, a better understanding of histopathological changes in xenotransplantation and improved management of such complications would be necessary, in addition to further development of organ-specific optimal target gene modifications and refinement of immunosuppressive regimen.

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## Knack and pitfalls in making a mouse model of small intestinal transplantation

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In organs transplantation, mouse models are useful tools to analyze transplant biology and immunology because of their well-recognized genetic background and existence of abundant antibodies. At our department, we have been conducting basic research on intestinal transplantation using mouse model. The important steps for successful surgery are (1) to harvest procure a high-quality graft while maintaining blood pressure with minimal blood loss during donors surgery, and (2) to complete vascular anastomoses in approximately 20–25 minutes. Accordingly, we have performed the procedure as the following. Briefly, in donor surgery, appropriate length of small intestine is disconnected after the colon is removed to the outside of the body. The portal vein is dissected all the way up to the hepatic hilum. After right renal artery and infrarenal aorta are ligated, cross-clamping the aorta just below the celiac artery is performed. Immediately after cross-clamping, graft should be perfused with cold heparinized saline by puncturing the aorta. The portal vein and the aorta are transected and the graft is procured. At back table, we prepare the superior mesentery artery (SMA) with the carrel's patch for the anastomosis. In recipients surgery, after the infrarenal aorta and inferior vena cava (IVC) are clamped, vascular anastomoses between donor PV and recipient IVC with 10-0 Nylon and between donor SMA and recipient aorta with 11-0 Nylon are performed using continuous suture technique with the aid of microscope. According to our protocol, we can achieve a perioperative survival rate close to 100% after a several month training period. We will introduce our protocol and present detailed procedure.

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## Effect of cumulative exposure to tacrolimus on the recurrence of hepatocellular carcinoma after liver transplantation

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**Background:** Previous studies reported that maintaining at lower trough level of tacrolimus could reduce the recurrence of hepatocellular carcinoma (HCC) after liver transplantation (LT); however, this has never been assessed regarding everyday exposure of tacrolimus.

**Methods:** Using whole data of tacrolimus trough levels, which were measured at in-hospital and outpatient setting, we calculated cumulative exposure to tacrolimus (CET) by the formula recently introduced. Eligible patients who underwent LT for HCC (n=504) were divided into four groups by CET within 3 months after LT; high (3-month CET>840, n=101), conventional (3-month CET 580–839, n=215), minimization (3-month CET 321–579, n=158), and aggressive minimization (3-month CET<320, n=30).

**Results:** In Kaplan-Meier analyses, the 5-year recurrence free survival was not significantly different between the four groups (P=0.770) while that of patient survival was significantly lower in the aggressive minimization group and the high exposure group (P=0.005). In multivariable analyses, neither groups by CET nor CET as continuous variable did not affect the recurrence of HCC. However, the aggressive minimization (hazard ratio [HR], 2.97; P=0.011) and the high exposure group (HR, 1.89; P=0.023) showed significantly higher risk of death when compared with conventional exposure group. Subgroups stratified by Milan criteria, up-to-7, french high risk model, preoperative systemic therapy and treatment with mTOR inhibitor did not show significantly different recurrent free survival between CET groups.

**Conclusions:** In this study, CET did not affect the recurrence of HCC after LT while aggressive minimization and high exposure of tacrolimus resulted in higher death. Usage of tacrolimus should not target to reduce HCC recurrence but to prevent rejection.

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## Oral health status is associated with the incidence of infection after kidney transplantation

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**Background:** Periodontitis is known as a risk for many systemic diseases. We investigated the association between oral health status and outcomes after living donor kidney transplantation.

**Methods:** We retrospectively analyzed 57 patients who had undergone living donor kidney transplantation and preoperative oral care at our institution. We divided patients into two groups by preoperative percentage of tooth sites with bleeding on probing (BOP), followed by comparing the cumulative incidence of infection (cytomegalovirus infection, biopsy-proven BK nephropathy, urinary tract infection, and any other infection requiring hospitalization) and biopsy-proven rejection including borderline changes after transplantation between the two groups.

**Results:** The cumulative incidence of patients with BOP of 2% or more was significantly higher (180 days and 1 year; 49.2% and 55.5%, respectively) than patients with BOP<2% (180 days and 1 year; 22.8% and 29.8%, respectively;  $P=0.018$ ). Cox hazard regression analysis showed that preoperative BOP was a statistically significant risk factor for the incidence of infection after transplantation in univariate (hazard ratio [HR], 1.03; 95% confidence interval [CI], 1.00–1.06;  $P=0.019$ ) and multivariate analysis (HR, 1.03; 95% CI, 1.00–1.06;  $P=0.013$ ). Rejection-free survival of patients with BOP of 2% or more was higher than patients with BOP<2%, although it was not statistically significant ( $P=0.286$ ).

**Conclusions:** Our data suggest that preoperative BOP is a risk factor for infection after transplantation, especially within 180 days.

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## The predictors for severe Omicron-infected kidney transplant recipients: a nationwide study

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**Background:** The number of infected kidney transplant recipients (KTRs) has sharply increased since the Omicron emerged. The risk factor of developing severe coronavirus disease 2019 (COVID-19) among KTRs in the Omicron period has been not evaluated.

**Methods:** A nationwide prospective cohort study of SARS-CoV-2-infected KTRs was conducted between March 2020 and August 2022 in Thailand. Predictive factors for developing pneumonia defined as moderate to critical illness as per the National Institutes of Health and disease progression were evaluated. The KTRs who were fully vaccinated were adjusted. Variables with  $P < 0.10$  in the univariate were selected for multivariate analysis.

**Results:** There were 369 KTRs developed COVID-19; 108 (29.3%) KTRs and 261 (70.7%) KTRs were infected with SARS-CoV-2 during the pre-Omicron and Omicron periods, respectively. The mortality rate was 15.7% in pre-Omicron and 1.5% in Omicron period;  $P < 0.001$ . Sixty-three (58.3%) pre-Omicron-infected KTRs and 15 (5.8%) Omicron-infected KTRs developed pneumonia;  $P < 0.001$ . From multivariate logistic regression, the predicting factors for developing pneumonia were infection with pre-Omicron variants (adjusted odds ratio [OR], 11.63; 95% confidence interval [CI], 3.60–37.57;  $P < 0.001$ ), increasing age (adjusted OR, 1.08; 95% CI, 1.03–1.12 per 1 year;  $P < 0.01$ ), presenting with cough (adjusted OR, 4.05; 95% CI, 1.61–10.22;  $P = 0.003$ ), and presenting with diarrhea (adjusted OR, 3.87; 95% CI, 1.42–10.52;  $P = 0.008$ ). We found no admission investigation (cycle threshold of real time polymerase chain reaction, serum creatinine, interleukin-6, C-reactive protein, and D-dimer) that could predict the disease progression.

**Conclusions:** The Omicron variant of SARS-CoV-2, though highly transmissible, caused less severe symptoms compared to previous variants in infected KTRs. During the Omicron period and the vaccination era, the elderly and KTRs presented with cough or diarrhea remain at high risk of developing pneumonia; thus they should be hospitalized and receive high-efficacy medications in a setting where there were medication shortages.

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## Detecting high risk patients for new-onset diabetes after transplantation after kidney transplantation using continuous glucose monitoring device

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**Background:** Perioperative hyperglycemia is common in kidney transplantation and is associated with not only renal allograft outcomes, but also increased risks for development of new-onset diabetes after transplantation (NODAT). The purpose of this study was to identify risk factors associated with NODAT using perioperative continuous glucose monitoring.

**Methods:** A prospective observational study starting May 1, 2021, was conducted for patients who underwent living donor kidney transplantation. Upon enrollment, a continuous glucose monitoring (CGM) system was applied and CGM was undertaken 2 weeks preoperatively and 2 weeks postoperatively. No additional interventions were undertaken. Clinical characteristics and transplant related outcomes were collected along with glucose profile using the CGM system.

**Results:** A total of 100 patients were enrolled in the study and completion of both preoperative and postoperative CGM was accomplished in 69 patients. Excluding 13 patients with underlying diabetes, 14 (20.3%) patients developed NODAT and 42 (60.8%) patients did not (nonNODAT). The underlying characteristics of patients that developed NODAT compared to nonNODAT were older ( $56.1 \pm 9.7$  vs.  $45.4 \pm 13.0$ ;  $P=0.006$ ), more likely male ( $56.1\%$  vs.  $78.6\%$ ;  $P=0.044$ ) and had younger kidney donors ( $42.7 \pm 13.1$  vs.  $50.8 \pm 12.1$ ;  $P=0.038$ ). The preoperative metabolic lab values of NODAT patients showed higher baseline HbA1c ( $5.5 \pm 0.5$  vs.  $5.5 \pm 0.4$ ;  $P=0.044$ ) and lower baseline HDL levels ( $37.6 \pm 10.6$  vs.  $51.5 \pm 16.5$ ;  $P=0.005$ ). The preoperative and postoperative CGM showed higher mean daily peak glucose levels in NODAT patients (preoperative  $119.8 \pm 14.6$  vs.  $107.0 \pm 15.9$ ;  $P=0.012$  and postoperative  $166.4 \pm 26.9$  vs.  $137.5 \pm 25.5$ ;  $P=0.001$ ).

**Conclusions:** Despite the normal ranges of serum glucose levels or HbA1c, kidney transplant patients who develop NODAT have significantly higher preoperative and postoperative mean daily peak glucose values detected through CGM.

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## Development of an AI model for kidney cortex volumetry for donor evaluation

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**Background:** Computer tomography (CT) images can accurately map vasculatures, identify abnormalities and potentially measure split renal function through length or volume of each kidney. The purpose of this study was to develop and validate an automated method to segment and measure kidney cortex volume on contrast-enhanced abdominal CT images of kidney donors.

**Methods:** The predonation arterial phase CT DICOM images of living kidney donors were downloaded and uploaded to 'OncoStudio' (OncoSoft Inc., Seoul, South Korea), which was used as the AI-based auto-segmentation tool. The AI model within the OncoStudio has a U-Net structure based on a 3D dense block and automatically proceeds to CT site detection and segmentation without clicking by humans. For this study, a total of 82 datasets were used, 70 for training, two for validation, and 10 for independent testing.

**Results:** The consistency between manually segmented volumes and automatically segmented volumes based on AI was evaluated. The statistics for a total of 20 organs were calculated by combining the left and right cortex of 10 testing datasets. The Dice similarity coefficient (DSC) representing the degree of agreement between 3D volumes was 0.91, and the Hausdorff distance 95% (HD95) representing the lower 95% distance between 3D surface points was 1.52 mm.

**Conclusions:** An automated method for measuring kidney cortex volume was successfully developed. The auto-segmentation program can be a time saving and promising evaluation tool for donor suitability and split renal function.

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# Liver transplantation from brain-dead donors with hepatitis B or C in South Korea: a 2014–2021 Korean Organ Transplantation Registry data analysis

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**Background:** In Korea, due to the Korean Network for Organ Sharing (KONOS) guidelines, brain-dead donor liver/kidney transplantation from hepatitis B or C positive donors can be implemented only to identical hepatitis-positive recipients. However, in the US, it has been more than 15 years since organ transplantation from hepatitis-positive donors to negative recipients had been implemented. Korea also needs to discuss transplantation safety from hepatitis B or C positive donors to hepatitis negative recipients. But we cannot get the results due to the KONOS guidelines. Instead, we studied transplantation results from hepatitis B or C positive donors to each hepatitis negative recipient as a starting point to support expanding indication criteria.

**Methods:** This is a retrospective, observational study using data from Korean Organ Transplantation Registry (KOTRY) data analysis. A total of 1,035 liver transplantations from brain-dead donors, from April 2014 to March 2021 were included in this study. It consists of 24 HBV (+) grafts, one HCV (+) graft and 1,010 hepatitis (–) grafts.

**Results:** In donor characteristics, the rate of the standard donor was higher in hepatitis (–) donors than HBV (+) donors (735/274, 11/13;  $P < 0.01$ ). In recipient characteristics, median model for end-stage liver disease (MELD) score (baseline) of HBV (+), HCV (–), hepatitis (–) were  $22.4 \pm 9.3$ , 16 and  $33.0 \pm 15.4$ , respectively (HBV [+]-hepatitis [–],  $P < 0.01$ ). Median MELD score (KONOS final) were  $27.8 \pm 7.8$ , 11 and  $35.5 \pm 7.1$ , respectively (HBV [+]-hepatitis [–] and HCV [–]-hepatitis [–],  $P < 0.01$ , respectively). From a Kaplan-Meier analysis, overall patient survival rate after LT at 5 years were 85.6%, N/A (2-year patient survival rate 100%) and 76.7%, respectively and showed no statistically significant differences (HBV [+]-HCV [+],  $P = 0.695$ ; HCV [+]-hepatitis [–],  $P = 0.638$ ; HBV [+]-hepatitis [–],  $P = 0.383$ ). Overall graft survival rates after LT at 5 years was 87.5%, N/A (2-year patient survival rate 100%) and 76.6%, respectively and showed no statistically significant differences.

**Conclusions:** There were no significant differences in the 5-year transplantation patient/graft survival rate between HBV (+), HCV (+) and hepatitis (–) grafts. One more step, it's time to consider implementing transplantation from hepatitis (+) donors to hepatitis (–) recipients.

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# Kidney transplantation from brain-dead donors with hepatitis B or C in South Korea: a 2015-2020 Korean Organ Transplantation Registry data analysis

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**Background:** Because of the Korean Network for Organ Sharing (KONOS) guidelines, brain-dead donor transplantation (liver/kidney) from Hepatitis B or C (+) donors only can be done to the same hepatitis (+) recipients. In the US, organ transplantation from hepatitis (+) donors to (-) recipients has been implemented for more than 15 years. We need to consider the safety of transplantation from hepatitis B or C (+) donors to hepatitis (-) recipients. The aim of the study is to show the transplantation results from hepatitis B or C (+) donors to each hepatitis (-) recipient and make it as a starting point for the consideration.

**Methods:** This is a retrospective, observational study using data from Korean Organ Transplantation Registry (KOTRY) data analysis. A total of 2,105 kidney transplantations from brain-dead donors, from January 2015 to June 2020 were included in this study. It consists of 80 HBV (+) grafts, 12 HCV (+) grafts and 2013 hepatitis (-) grafts.

**Results:** In donor characteristics, median ages of the three groups [HBV (+), HCV (+), hepatitis (-)] were 57.4±10.1, 50.1±11.8 and 48.7±14.9, respectively (P=0.02; HCV (+)-hepatitis (-), P=0.04). Baseline serum creatinine (median, mg/dL) were 1.25±0.87, 1.45±0.46 and 1.57±1.34, respectively (P=0.02; HBV (+)-hepatitis (-), P=0.01). In recipient characteristics, male/female ratio were 60/20, 7/5 and 1228/785, respectively (P=0.04; HBV (+)-hepatitis (-), P=0.04). Wait time (median, days) were 1550.8±1145.5, 1434.3±957.2 and 2188±1207.9, respectively (P<0.001; HBV (+)-hepatitis (-), P<0.001). In posttransplant results, there were no significant differences in follow-up serum creatinine, survival, postop hospital day and complication between the three groups. From a Kaplan-Meier analysis, overall patient survival rates after KT at 5 years were 95%, 100% and 76.2%, respectively (HBV [+]-hepatitis [-], P<0.001). Overall graft survival rates after KT at 5 years were 95%, 83.3% and 84.5%, respectively (HBV [+]-hepatitis [-], P=0.02).

**Conclusions:** There were no differences in baseline, postop and follow-up serum creatinine between the three groups. Moreover, 5-year patient and graft survival were significantly higher in HBV (+) grafts than in hepatitis (-) grafts. Do not hesitate to consider implementing brain-dead donor transplantation from hepatitis (+) donors to hepatitis (-) recipients.

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## Stereotactic body radiation as pretransplant locoregional therapy for hepatocellular carcinoma presenting beyond University of California San Francisco criteria: a report of three cases

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Liver transplantation (LT) remains an effective treatment modality for patients with hepatocellular carcinoma (HCC). For those beyond University of California San Francisco criteria, locoregional therapy to reduce tumor burden and downstage to fall within the criteria is widely accepted. For advanced tumors with larger size or portal vein (PV) involvement ineligible for radiofrequency ablation (RFA) or transarterial chemoembolization (TACE), radiotherapy (RT) has shown to be effective for tumor control. Proton beam therapy (PBT) is an emerging form of RT for HCC, carrying less risk of radiation-induced liver disease with its excellent dose distribution. Due to its rarity and novelty, limited literature has discussed the potential role of PBT for pretransplant locoregional therapy. In this article, we present two cases who received PBT prior to LT, and one case who endured stereotactic body radiation (SBRT).

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## Survival outcomes and prognostic factors following liver transplantation in Malaysia: overcoming challenges in a single center with 19 years of experience

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**Background:** Since the first solid organ transplantation in Malaysia in 1970, we have come a long way in the development of the liver transplant program spanning close to two decades of experience. Selayang Hospital is the designated national center for both hepatopancreatobiliary surgery and liver transplantation. This is the first review undertaken to evaluate our experience since the program has been established

**Methods:** A retrospective review of all transplants performed in our institution between (2002–2021) Data were retrieved from the existing computer database as well as patient health care notes. A total of 116 patients were included. The main outcome measures analyzed were survival and factors that contributing the survival.

**Results:** A Total of 116 patients were transplanted in the period of 19 years. Overall (living donor liver transplantation [LDLT] and deceased donor liver transplantation [DDLT]) first and fifth year survival rate for both the LDLT and DDLT of (73.9% and 69.9%,  $P=0.695$ ) for first and fifth year respectively. Data analysis using Kaplan-Meier for individual LDLT vs. DDLT was (76.2% and 73.4%) for the first year and (66.3% and 70.9%) for the fifth year respectively. In the first 10 years of transplant (early phase) survivor probability for first year and fifth year is (77.8% and 71.1%) vs. later phase (71.4% and 69.3%,  $P=0.496$ ) The factors that contributed to the survival posttransplantation is young age at transplantation ( $P=0.339$ ) and low model for end-stage liver disease score ( $P=0.34$ ).

**Conclusions:** The rate of LT is still relatively low in comparison with our neighboring countries. Nevertheless, our study has demonstrated an acceptable overall first and fifth year survival rate for both the LDLT and DDLT respectively. With the increased public-doctor awareness, the availability of required resources and improved surgical techniques as well as a coordinated LT program, we can achieve and sustain a better LT care with good overall survival outcome in the near future.

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## Robot-assisted ureteral reconstruction for the management of kidney transplant patients with ureteric complications

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**Background:** To evaluate the feasibility of robotic assisted ureteral reconstruction for managing ureteric complications in transplanted kidney as the minimally invasive alternative to open surgery.

**Methods:** From January 2020 to November 2021, robot-assisted ureteral reconstruction was performed for a total of nine patients with transplanted kidney who had vesico-ureteral reflux (VUR) or ureteral stricture and had failed to treat with previous endoscopic treatments.

**Results:** Patients were eight females and one male, mean age was  $53.7 \pm 6.6$ . Five (55.6%) Patients underwent surgery due to VUR (grade III) on transplanted kidney while four (44.4%) patients had transplanted ureteral stricture. Seven (77.8%) received kidney transplants from living donors while two (22.2%) received from deceased donors. For VUR patients, average number of endoscopic injections were  $2.2 \pm 0.8$ . Four transplanted ureteral stricture patients had a balloon dilatation with keeping ureteral catheter. Preoperative creatinine level was  $1.1 \pm 0.2$ . Post-op voiding-cystourethrography (VCUG) was performed on  $3.8 \pm 1.6$  months. Four (80%) patients had no VUR and one (20%) had VUR regression from grade III to I. Four patients who underwent reconstruction due to anastomosis site stricture, became stenosis free without indwelling ureteral catheter. For one male patient with a long stenosis length of 5 cm, a boari flap was performed during reimplantation. In total, mean operators console time was  $138.1 \pm 32.6$  minutes and patients stayed in hospital for average  $6.7 \pm 4.2$  days. Urethral catheter was removed on  $17.5 \pm 5.3$  days and the ureteral catheter was removed after  $4.9 \pm 1.5$  weeks. The mean serum creatinine level was  $1.2 \pm 0.1$  mg/dL on 1 month after the surgery. The mean followed up period was  $13.7 \pm 6.1$  without having additional intervention after robot ureteral reconstruction. There were no recorded complications above Clavien-Dindo grade II.

**Conclusions:** Robot ureteral reconstruction is a technically feasible and may provide effective treatment for ureteric complications in transplanted kidney as minimally invasive alternative to open surgery.

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## Urine-derived stem cell attenuated renal fibrosis via Klotho activation

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**Background:** After renal ischemia reperfusion injury (IR), regeneration and recovery of the renal tubular cell occurs. However, if the renal repair process is maladaptive, it progresses to renal fibrosis. The role of stem cells in kidney regeneration or fibrosis has not been fully elucidated. we evaluated the urine derived stem cells (UDSC) for renal inflammation and fibrosis after renal IR.

**Methods:** 10-week-old balb/c nude male mice were used. Sham, sham with UDSC, IR, IR with UDSC. UDSC were infused three times via tail vein at 6,7,8th day after renal IR. Urine NGAL/creatinine (Cr) were checked. The kidneys tissue were harvested at day 14. *In vitro*, TGF- treated HK2 cell were co-cultured with UDSC. Klotho-siRNA silencing was performed in UDSC.

**Results:** Urinary NGAL/Cr were significantly increased in IR mice after 14 day IR, compared to sham mice. Urinary NGAL/Cr significantly decreased in UDSC treated IR mice, compared to IR mice. In H&E stain, renal tubulo-interstitial injury were significantly decreased in UDSC treated IR mice, compared to IR mice. In Masson trichrome stain, renal fibrosis area were significantly decreased in UDSC treated IR mice, compared to IR mice. The renal expression of MCP-1, osteopontin, TGF-beta, alpha-SMA, collagen IV, and F4/80 positive cells were significantly decreased in UDSC treated IR mice, compared to IR mice. The renal expression of Klotho were increased in UDSC treated IR mice, compared to IR mice. *In vitro*, UDSCs were stem cells that expressed Klotho protein more strongly than other mesenchymal stem cells (MSCs). UDSCs also suppressed fibrosis by inhibiting TGF-beta in HK-2 human renal proximal tubule cells in an *in vitro* model. Klotho-siRNA silencing reduced the TGF-beta-inhibiting ability of UDSCs.

**Conclusions:** UDSC attenuate renal fibrosis after renal IR. Klotho-secretion of UDSC play a role in these anti-fibrotic effects.

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## Beating heart and breathing lungs in the box: future of transplant and beyond

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**Background:** Continuous *ex situ* machine perfusion of the donor heart and lung has been proposed as an alternative and superior method of donor heart preservation compared to cold static storage especially during the transport time. The *ex situ* heart and lungs perfusion opens new horizons in the transplant field, and beyond for isolated organs treatment including gen and cell therapies, surgical corrections, diagnostics, pharmacokinetics, resuscitation and transportation.

**Methods:** Twenty-five domestic adult pigs, weighing 93.1±13.1 kg were selected for this study. Until cardiectomy, all pigs received Principles of Laboratory Animal Care. The pig heart and lung were cannulated, and then connected to the portable system for normothermic *ex situ* heart/lung preservation. In the heart preservation system (HPS), oxygenated blood is perfused by a centrifugal pump into the aorta, perfusing the coronary arteries. In the lung preservation system (LPS) oxygenated blood is perfused by centrifugal pump into the pulmonary artery and ventilation occurs. After the end of experiment (6 hours), pig heart is arrested with normothermic blood cardioplegia and is disconnected. The pig isolated heart was conditioned with levosimendan while in the system and hemofiltration was applied in the HPS in order to protect and improve donor heart function. *Ex situ* heart and lungs perfusion process was accompanied with echocardiographic, computerized tomography, and contrast-enhanced magnetic resonance assessment.

**Results:** Mean±SD ischemic time was 19.2±3.3 minutes. Mean *ex vivo* perfusion time was 360±0.7 minutes. Time of sinus rhythm restoration was 2.3±5.7 minutes. All isolated lungs had normal ventilation parameters. All isolated hearts and lung had stable perfusion, biochemical and histological characteristics in the perfusion system. Mean venous lactate trend are with normal levels at the end of perfusion. Figure 1 simplified schema of the experimental design and protocol.

**Conclusions:** Normothermic *ex situ* heart and lungs perfusion provides more physiologic and reproducible approach to sustain the isolated organs.

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## Should we discontinue angiotensin converting enzyme inhibitor and angiotensin receptor blocker before kidney transplantation?

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**Background:** Angiotensin converting enzyme inhibitors (ACEi) and angiotensin receptor blockers (ARB) are usually recommended to stop before surgery to prevent postoperative acute kidney injury. However, it is uncertain that ACEi and ARB should be discontinued before kidney transplantation (KT). Therefore, we investigated the effect of pre-KT administration of ACEi and ARB on the outcomes of KT.

**Methods:** We reviewed patients who received living-donor KT in our tertiary center between 2018 and 2020. Among 923 patients, 291 patients continued ACEi/ARB within 3 days before KT (ACEi/ARB group), and 632 patients did not take ACEi/ARB within 3 days before KT (no ACEi/ARB group). Delayed graft function, hyperkalemia events, slope of creatinine after KT, rejection and graft survival were compared between two groups.

**Results:** Baseline characteristics were not significantly different between two groups except medical history of hypertension (96.2% in ACEi/ARB group vs. 90.2% in no ACEi/ARB group,  $P=0.001$ ). The numbers of ABO incompatible KT or HLA-sensitized KT, the degree of HLA mismatches and immunosuppressant were not different significantly between two groups. Delayed graft function occurred in two (0.7%) patients in ACEi/ARB group and 13 (2.1%) patients in no ACEi/ARB group ( $P=0.165$ ). The event of hyperkalemia ( $K>5.5$  mEq/L) did not happen more frequently in ACEi/ARB group (21.3% vs. 22.9%,  $P=0.611$ , the day before KT; 11.3% vs. 10.1%,  $P=0.566$ , the day of surgery; 0.3% vs. 0.3%,  $P=1.000$ , the day after surgery). The slopes of creatinine from post-operative day 0 to day 7 were similar in two groups ( $-0.732\pm 0.349$  vs.  $-0.751\pm 0.325$ ,  $P=0.435$ ). Rejection-free survival and graft survival were not significantly different between two groups ( $P=0.890$  and  $0.619$  by log-rank test, respectively).

**Conclusions:** Use of ACEi/ARB before KT did not increase the incidence of delayed graft function, hyperkalemia and rejection. Also, renal function improvement after KT was not affected by the use of ACEi/ARB before KT. Therefore, ACEi/ARB might not give significant impact on the outcomes of KT.

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## Nutritional management and branched-chain amino acids diet among patients undergoing living donor liver transplantation

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**Background:** End-stage liver disease (ESLD) patients commonly suffer from malnutrition that may increase risk of infections, poor quality of life, and decreased survival after liver transplant (LT). Etiology of malnutrition in ESLD are caused by decreased food intake, malabsorption and hypermetabolism. Branched-chain amino acids (BCAA) and protein intake help to restore muscle mass and improve appetite. Maintain BCAA and aromatic amino acids helps to synthesize skeletal muscle which is important to improve nutritional status pre-LT. The aim of this review was to summarize of various intervention of BCAA treatments among ESLD patients before undergoing liver transplant.

**Methods:** This systematic review was obtained from the analysis and synthesis of recent journals on PubMed, Web of Science and Google Scholar. Relevant study was collected up to August 2022 using the following search terms: BCAA, nutrition pre liver transplant, nutritional management ESLD, malnutrition before liver/hepatic surgery.

**Results:** Nutritional therapy among ESLD patients concern on providing adequate calories for the efficient use of protein source. Maintaining high nutrient requirement among pre-LT patients can be helps by BCAA enriched supplements. Patients with BCAA groups (received oral BCAA supplementation before transplantation) is significantly higher in Child-Pugh scores ( $P=0.0003$ ) rather than the non-BCAA group. The incidence of bacteremia was significantly lower in the BCAA groups among pre-LT patients with Child-Pugh class C. Others study showed the same result which the incidence of posttransplant bacteremia was significantly lower in BCAA groups ( $P=0.011$ ). Based on nutritional status, BCAA groups showed significantly higher level of pre-albumin ( $P=0.023$ ) and branched-chain-amino-acids-tyrosine ratio ( $P=0.046$ ), but preoperative skeletal muscle mass did not significantly different both two groups ( $P=0.143$ ).

**Conclusions:** BCAA supplementation may contribute on decreasing of bacteremia incidence post-LT. Others beneficial of BCAA should be observe more to show efficiency of BCAA supplementation before pre-LT to the nutritional status after liver transplantation.

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## High inpatient variability and low nadir of tacrolimus level with high class II eplets mismatch are associated with inferior graft survival

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**Background:** The development of donor-specific antibodies (DSAs) is associated with chronic rejection, inferior graft survival, and poor quality of life. Recent HLA DR/DQ-eplets matching between donor and recipient are better predictors for the development of de novo DSAs and graft outcome. Limited data on the association between proper tacrolimus (Tac) level and HLA class II eplets-mismatch loads on kidney graft outcomes are available.

**Methods:** We examined 194 kidney transplant recipients with molecular HLA typing by Luminex by July 2022. High total eplets MM ( $\geq 17$ ), high all Abv eplets MM ( $\geq 7$ ), high coefficient variability (CV,  $\geq 17\%$ ), and high inpatient variability (IPV,  $\geq 13\%$ ) were defined, respectively. The purpose of our study was to evaluate whether different types of Tac levels (a nadir level, mean trough level, CV, and IPV) are associated with the development of de novo DSA and poor graft outcomes

**Results:** The low nadir of Tac trough level ( $< 6$  ng/mL) is a risk factor for the development of de novo DR-DSA and DQ-DSA, respectively. Four different Tac tests; the low nadir of Tac level ( $< 6$  ng/mL), low mean Tac level ( $< 7$  ng/mL), high CV ( $\geq 17\%$ ), and high IPV ( $\geq 13\%$ ), were significantly associated with inferior graft survival. High low IPV and low total eplets MM showed the lowest death censored graft survival rate compared with the low/low group, as a reference. Independent predictors of graft failure on multivariate analysis were chronic ABMR, and the low nadir of Tac trough level ( $< 6$  ng/mL).

**Conclusions:** Our study demonstrated that combined high DQ/DR-eplets mismatch with high IPV and/or low Tac trough levels were significantly associated with poor graft outcomes, respectively. We also tested four different Tac levels, which were related to inferior graft survival, but high eplets MM was not associated. Our study needs to verify whether intensifying immunosuppression improves graft outcomes among patients who have high DR, DQ-eplets mismatch.

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## Impact of pancreas donor risk index on pancreas graft survival after simultaneous pancreas and kidney transplantation

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**Background:** Simultaneous pancreas and kidney transplantation (SPK) has become an established treatment for diabetic patients with end-stage renal disease. However, organ shortage and restrictive selection criteria for pancreas allograft are major obstacles pancreas transplantation. Pancreas donor risk index (PDRI) was introduced to predict suitability of pancreas donors but true reliability of the index was not determined. Therefore, we investigated the reliability of PDRI and factors that affect transplantation outcomes.

**Methods:** This is a retrospective cohort study including 163 patients who underwent SPK from 2006 to 2021 at Asan Medical Center. Donor and recipient characteristics were collected and the PDRI score for each donor was calculated. Clinical outcomes were compared between high PDRI ( $\geq 1.5$ ) group ( $n=61$ ) and low PDRI ( $< 1.5$ ) group ( $n=102$ ). Also, the impact of high body mass index (BMI) ( $\geq 25$  kg/m<sup>2</sup>), old age ( $\geq 40$  years) and other factors of each donor were analyzed.

**Results:** There was no significant difference in recipient characteristics between high PDRI and low PDRI groups. There was no significant difference in pancreas graft survival between the two groups ( $P=0.396$ ). A pancreas allograft from an old donor ( $> 40$  years) had comparable to an allograft from a younger donor ( $< 40$  years) in terms of graft survival ( $P=0.243$ ). Also, higher BMI ( $\geq 25$  kg/m<sup>2</sup>) did not show a significant impact on long term graft survival ( $P=0.776$ ). Multivariate logistic regression analysis revealed that cold ischemic time and presence of donor-specific antibody were significantly associated with pancreas graft failure.

**Conclusions:** This study suggests that PDRI did not reflect long-term pancreas allograft survival after SPK. Pancreas from donors with old age ( $\geq 40$  years) and higher BMI ( $\geq 25$  kg/m<sup>2</sup>) did not have inferior outcomes in terms of pancreas graft survival.

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## Deep venous thrombosis in deceased donor kidney transplant recipient infected with COVID-19

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Kidney transplant recipients remain a vulnerable population for COVID-19 due to their immunosuppressive state and usual concomitant co-morbidities. Like the general population, they commonly present with fever, cough, dyspnea and diarrhea. However, COVID-19 can also cause profound coagulopathy which if unidentified and untreated can lead to morbidity. There has been limited reports on the incidence and management of thromboembolic events in kidney transplant recipient infected with COVID-19. We present a case of a 36-year-old male who underwent deceased donor kidney transplantation with delayed graft function. At day 6 post-op he developed fever, loose stool and cough and tested positive for COVID-19 infection. Chest computed tomography scan revealed reticular densities in both lower lungs and blood test showed leukocytosis and elevated CRP and procalcitonin. On day 18 post-op, he developed swelling of the right lower extremity. D-dimer was elevated and doppler ultrasound showed venous thrombosis of the right external iliac vein, right common and superficial femoral vein. Medical management included, heparin bolus and enoxaparin, immunosuppression adjustment using low dose CNi and mycophenolic acid, Remdesivir and IV antibiotics. The patient was COVID-19 recovered after 13 days of treatment. Medical management was continued and there was recovery from delayed graft function and gradual resolution of leg swelling. On day 41 post-op, the patient was discharged, off-dialysis, recovered from delayed graft function with decreasing swelling of the right lower extremity. Home medications included Apixaban 5 mg tablet twice a day for the next 3 months. Follow-up ultrasound at 3 months post-op showed resolution of venous thrombosis and serum creatinine at its nadir at 1.19 mg/dL. Risk for thromboembolism is higher among kidney transplant recipients than general population and COVID-19 infection is another recently identified significant contributory risk factor. There should be higher index of suspicion and intensified thrombosis prophylaxis among this population.

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# A nationwide study of regional preference and graft survival of kidney transplantation in South Korea: patterns of centralization in capital area

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**Background:** While the extent of the kidney transplant (KT) field is increasing in South Korea, a problem of centralization of medical care into the capital city is rising. This study is focused on a pattern of regional preference and differences in graft survival rates of KTs by region in South Korea, based on the national database.

**Methods:** We identified KT patients between 2002 and 2017 from Korean National Healthcare Insurance Service (NHIS) database. Patients actual residency, the city that KT was performed, and post-KT dialysis to identify graft failure were collected. The final collected data was verified by comparison to the KT from the Ulsan University Hospital, and KOTRY (Korean Organ Transplantation Registry) 2017 report.

**Results:** Of 20,978 KTs, 60.48% (12,688 cases) was counted in Seoul, and 39.52% (8,290 cases) was counted in non-Seoul areas. Overall graft survival was 81.52% (median, 57 months), and overall patient survival was 83.80% (median, 61 months). The overall graft and patient survival of Seoul versus non-Seoul major cities were 84.14%, 85.31% for Seoul and 80.65%, 83.33% for non-Seoul respectively (P=0.0371 and 0.2259). Of 4,167 KTs from 2002 to 2007, the 10-year graft survival rate and patient survival rate were 89.3% and 90.26% respectively.

**Conclusions:** We recognized the regional preference from the number of KTs in South Korea. KTs were highly concentrated in the capital city and it is due to a significant proportion of non-residents. There was no statistically significant difference in KT graft and patient survival rates by region.

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## Metabolic acidosis in a kidney transplantation who underwent bladder augmentation and both nephrectomy due to myelomeningocele

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Bladder augmentation using the gastrointestinal tract is an enlargement surgery designed to lower bladder pressure in patients with low bladder compliance. But, metabolic acidosis develops in some patients who have had bladder augmentation using the gastrointestinal tract due to the part of the intestine that absorbs urinary components including hydrogen ions and chlorides, and exchanges sodium for bicarbonate. We experienced a rare case of metabolic acidosis in a kidney transplantation who underwent bladder augmentation and both nephrectomy due to myelomeningocele. A 33-year-old male born with myelomeningocele and neurogenic bladder. He started hemodialysis due to severe hydronephrosis and recurrent cystitis. But inpatient treatment was repeated for recurrent cystitis undergoing clean intermittent self-catheterization. In the end, both nephrectomies were performed and bladder augmentation when he was 28 years old. A 20 cm distal ileal segment was isolated proximal to the ileo-cecal valve. The bladder dome was incised and ileo-bladder anastomosis was performed. He received a cadaveric donor kidney transplantation when he was 33 years old. His postoperative course was stable, but severe metabolic acidosis developed on postoperative day 15. At that time, the serum creatine 1.71 mg/dL and urine output was maintained at 3,000 cc/day. Arterial blood gas demonstrated hyperchloremic metabolic acidosis with pH 7.28, bicarbonate 14 mmol/L. Normal serum AG of 9 mEq/L and CRP (<0.5 mg/dL) may rule out the initial diagnosis of urosepsis, high urine AG of 22 mEq/L has a narrow differential diagnosis that include renal tubular acidosis (RTA). However, urine pH 7.0 and serum K of 4.6 mmol/L may rule out the RTA. We started intravenous sodium bicarbonate supplementation and the metabolic acidosis improved. On his most recent outpatient visit, he had no further metabolic acidosis without complications. In this report, we introduce a rare case with transient severe hyperchloremic metabolic acidosis in a kidney transplantation who underwent bladder augmentation using distal ileum.

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## Reconstructive plastic surgery on the middle a third of the ureter of the transplanted kidney

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**Background:** In obstructive uropathy, if the method of drainage of the kidney followed by antegrade/retrograde augmentation and stenting of the ureter of the transplant is ineffective, reconstructive plastic surgery on the urinary tract of the transplanted kidney is used by the open method.

**Methods:** Patient A, 46 years old, with a diagnosis of "stage 5 chronic kidney disease" in the outcome of autosomal dominant polycystic kidney disease after bilateral nephrectomy, kidney transplantation with ureteral graft stenting was performed. In the postoperative period, delayed graft function, oliguria was noted, the level of nitrogenous plasma slugs decreased extremely slowly, nephrosclerosis (50%), acute tubular necrosis was diagnosed. Ten hemodialysis sessions were performed. The ureteral stent of the kidney transplant was removed on day 21. On day 39, the restoration of the graft function was noted. Two months after kidney transplantation, urolithiasis of the transplanted kidney, a stone of the upper third of the ureter of the transplant, necrosis of the ureter of the transplant, urinary congestion were diagnosed.

**Results:** Reconstructive plastic surgery was performed on the ureter of the transplanted kidney, removal of the concretion of the upper third of the ureter of the graft, resection of the ureter of the graft, formation of ureteroureteroanastomosis with stenting of the ureter of the graft, percutaneous puncture nephrostomy of the renal graft in order to drain the cup-pelvic system and urine drainage. The postoperative period proceeded without complications.

**Conclusions:** The formation of ureteroureteroanastomosis in the upper third of the ureter of the graft with stenting and unloading of the cup-pelvic system by nephrostomic drainage are possible with perforative damage to the ureter due to prolonged concretion due to the lack of the possibility of using the ureter of their own kidneys.

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## Hypertension after kidney transplantation

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**Background:** Arterial hypertension (AH) after kidney transplantation has a direct relationship with the kidney graft survival. The aim of our study was to identify the prevalence of hypertension in recipients after kidney transplantation at the outpatient level.

**Methods:** The 15 patients after kidney transplantation who are being monitored on an outpatient level with AH were analyzed. The age, sex, the cause of renal failure, the number of transplants, the presence of hypertension before kidney transplantation, serum creatinine levels studied.

**Results:** There were nine males and six females. Only one patient had two kidney transplantation. The average age at the time of transplantation was  $36 \pm 12.4$  years. The main cause of chronic renal disease was chronic glomerulonephritis 80%. The average stay on hemodialysis before kidney transplantation was  $12 \pm 7.0$  months. Thirteen (86.7%) patients had pretransplantation AH before the transplant. Out of 15 patients, nine (60%) took two or more medications for AH. After transplantation, 11 (73.3%) patients had hypertension in the range of 140–160/85–98 mm Hg. Patients with AH had serum creatinine levels within  $96 \pm 28.5$  mol/L. In the posttransplantation period, there was a decrease in the number of recipients with hypertension from 86.7% to 73.3%.

**Conclusions:** AH in most cases accompanies chronic kidney disease, and is a risk factor that is associated with long-term survival of a kidney transplant. However, kidney transplantation can reduce the number of recipients with hypertension.

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## Impact of baseline anti-ABO antibody titer on biliary complications following ABO-incompatible living donor liver transplantation

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**Background:** ABO-incompatible living donor liver transplantation (LDLT) has been increasingly performed in the shortage of ABO-compatible live and deceased donors. Although vigorous efforts to overcome immunologic hurdles, a higher biliary complication rate remains a critical issue to be solved. This study evaluated the impact of baseline anti-ABO antibody titer on biliary complications following ABO-incompatible LDLT.

**Methods:** Consecutive patients who underwent adult-to-adult LDLT were enrolled in this study. The study cohort comprised 126 patients in the ABO-compatible group, 16 in the low anti-ABO antibody titer (<1:64) group, and 23 in the high anti-ABO antibody titer (1:64 or higher) group. Rituximab (300 mg/m<sup>2</sup>) was administered 2 weeks before surgery, and total plasma exchange was performed according to the anti-ABO antibody titer from 1 week before surgery. The target anti-ABO antibody titer was 1:8 or less.

**Results:** Postoperative biliary complications frequently developed in the ABOi-high titer group (9 [39.1%]) compared to the ABOi-low titer group and ABOc group (3 [18.8%] and 19 [15.1%], P=0.026). The number of bile duct openings and hepaticojejunostomy were not different between the three groups. High anti-ABO antibody titer (1:64 or higher) and male sex were independent risk factors for biliary complication (odds ratio, 4.14 [1.16–14.8], P=0.029 and 6.28 [1.35–29.3], P=0.019, respectively). In the long-term outcome, the patient and graft survival rates were not different between the groups.

**Conclusions:** Although anti-ABO antibody titer just before the LDLT is lowered, the higher baseline titer is an important factor for developing postoperative biliary complications. We should pay particular attention to bile duct anastomosis and postoperative care for patients with higher baseline titer.

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## Result of biomarker and three-dimension Vincent research of liver volume changes after prosthetic valve endocarditis treatment

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**Background:** Liver cancer is the most commonly diagnosed cancer in Mongolia, and in 2018, a total of 2,312 new cases were diagnosed nationwide, accounting for 38.1% of all cancers, the highest prevalence, an increase of 4% compared to 2017. In developed countries, 2–5 new cases per 100,000 people are diagnosed, of which 93 are in females and 130 in males, and this number is expected to increase. About 80% of newly diagnosed liver cancers are diagnosed in stages III and IV. Large cirrhosis in patients with cirrhosis and liver cancer increases the risk of postoperative liver failure and is a major cause of postoperative mortality. Prosthetic valve endocarditis (PVE) treatment is a very simple procedure that is very different from surgery to open the abdomen and separate the hepatic portal vein from the hepatic vein, and requires precise skills to puncture the hepatic venous vein under ultrasound guidance. With the introduction of this procedure, new surgical possibilities, patient complications, and complications associated with any surgery have been drastically reduced.

**Methods:** The study will sample a total of 120 clients who underwent major liver resection at the NCCD in 2020–2022 and underwent major liver resection one month after PVE treatment. This study will be conducted using a one-moment survey model based on a destructive research hospital.

**Results:** The results of our study are important in the selection of patients for interventional radiology and liver surgery practice.

**Conclusions:** The results of our study are important in the selection of patients for interventional radiology and liver surgery practice. It will help you choose a treatment that is less harmful. Plasma levels of Mac-2 binding protein glycan isomer help to predict factor the outcome of PVE treatment. It will be used in the future to develop recommendations for the treatment of large liver resections.

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## Accidental intra-operative hyperkalemia in living donor liver transplantation

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Given the potential lethal effects on the myocardium including dysrhythmias, hyperkalemia (serum potassium 5.5 mmol/L) is considered a medical emergency that warrants prompt evaluation and treatment. A 46-year-old male who underwent liver transplantation suffered of alcoholic liver cirrhosis and hepatitis B. Preoperatively the patient's body weight was 77 kg, height 170 cm, had mild dyspnea and edema, moderate ascites, model for end-stage liver disease 11 and vital signs were stable. In preoperative laboratory results; the potassium 4.92 mmol/L, creatinine 3.21 mg/dL, bilirubin 2.5 mg/dL, and urea 93.4 mg/dL. In the preoperative settings, infusion of potassium chloride 7.5% (100 mL) in 5% (500 mL) glucose for three times within 2 days, presumably, was one of the reasons for intra-operative hyperkalemia. Anesthesia was induced at 05:30 AM on May 6, 2022, with propofol (120 mg), fentanyl (50 µg), with rocuronium (40 mg), further maintained by sevoflurane (titrated to maintain the bispectral index at 50–60), fentanyl (0.1–0.5 µg/kg/hr) and rocuronium infusion by pump syringe. Around in 3 hours from the beginning of general anesthesia the potassium level increased dramatically. The table 1 shows the level of potassium and AGB intra-operatively. The therapy for hyperkalemia urgently started when the laboratory results confirmed of the serum level of potassium measured as 7.2 mmol/L at 08:30 and the highest level reached at 9:23 AM. As potassium lowering therapy, we administered 10 mL of 10% calcium gluconate was given IV at 100 mL saline repeatedly for five times, and 20 IU of short-acting insulin at 20% (200 mL) glucose two times and sodium bicarbonate 4% as 100 mL two times. We continued potassium-lowering therapy until the serum potassium reached the level of 4.8 mmol/L at 16:17 PM. Upon completion of LDLT surgery his serum potassium was normal (4.2 mmol/L) and the next day it lowered down to 3.54 mmol/L.

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## Medical accessibility and outcomes in liver transplantation

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**Background:** Medical accessibility is important in liver transplantation (LT) because of the risk of infections due to the use of immunosuppressant and complications that require continuous treatment such as biliary stenosis. However, there are no evidence on the effect of medical accessibility and LT. The aim of this study is to investigate whether medical accessibility affects the outcome of LT.

**Methods:** For this retrospective observational study, we enrolled patients who had undergone LT at the Samsung Medical Center between January 2017 and December 2021. Medical accessibility was divided into two groups (hard and easy) and the criterion was the time (120 minutes) taken by public transportation. Basal characteristics were calibrated with propensity score matching (PSM). The outcomes (overall survival [OS] and graft survival) and the severity of emergency center visits according to medical accessibility were investigated.

**Results:** A total of 486 patients were included in this study. The median time taken by public transportation was 135 minutes. The variables included sex, Child-Pugh classification, model for end-stage liver disease, presence of hepatocellular carcinoma, and donor type were calibrated with PSM and each group consisted of 217 patients. The OS (87% vs. 86.7%,  $P=0.649$ ) and graft survival (97.7% vs. 96.1%,  $P=0.35$ ) showed no significant differences between the hard and the easy groups. In the severity of emergency center visits, the hard group (27.2%) demonstrated more severe than easy group (17.1%), but it was not statistically significant.

**Conclusions:** Medical accessibility in LT did tend to increase emergency center severity, but did not affect long-term outcomes.

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## Cytomegalovirus reactivation after chemotherapy in a kidney transplant recipient with breast cancer: a case report

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**Background:** Late-onset cytomegalovirus (CMV) reactivation after kidney transplantation (KT) is associated with donor and recipient (D/R) CMV serostatus, shorter courses of immunosuppressive (IS), higher levels of IS medications, and allograft rejection. However, chemotherapy (CMT) that impairs the recipients immune surveillance is another under-reported risk factor.

**Methods:** We report a case of KTR who had received breast cancer CMT and CMV reactivation was detected during the evaluation of allograft dysfunction. We investigated the cause of allograft dysfunction and CMV reactivation as presented in this case report.

**Results:** A 74-year-old female underwent living-related KT 20 years ago. The human leukocyte antigen (HLA A-B-DR) mismatch was 1-1-0. The recipient received basiliximab as induction therapy. Cyclosporin and mycophenolate mofetil (MMF) were used for the maintenance regimen. CMV IgG serostatus of the D/R were both positive. The posttransplant clinical course was normal. Last year, the recipient was diagnosed with stage1c breast cancer. Modified radical mastectomy of the left breast was done, followed by an adjuvant CMT consisting of Adriamycin and cyclophosphamide. Three months after CMT, serum creatinine (sCr) was increased from baseline of 1.5 to 2.0 mg/dL. Serum BK viral load and donor-specific anti-HLA antibody were not detected. CMV viral load was found to be 327,000 copies/mL (log 5.51). There was neither leukopenia nor liver function test abnormalities. A kidney allograft biopsy was performed which showed 50% IFTA without evidence of rejection or active inflammation. The immunohistostaining for CMV and SV40 were negative. Because of CMV viremia, MMF was decreased from 3 to 1.5 g/day and hydration was advised. Two months later, plasma CMV viral load became undetectable without any anti-viral initiation, and sCr was returned to the baseline.

**Conclusions:** A very late-onset CMV reactivation can occur after immunosuppressed KT recipients receive additional CMT. CMT should be recognized as another uncommon risk factor of CMV reactivation and prompt decreasing of immunosuppression may help in the treatment of CMV infection.

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## The retransplantation case which required a massive transfusion and fluid resuscitation

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Since 2011, we have performed 168 living donor liver transplantation (LDLT) at the First Central Hospital, of which two of them were retransplanted. A 35-year-old female, hepatitis virus B related LC and underwent LDLT in May 2019. The first LT surgery went well without any major complications. However, the patients clinical condition worsened due to sinusoidal obstructive syndrome. Therefore, orthotropic retransplantation was performed again in January 2020. At that time the patients body weight was 40 kg, Hb level 7.8 g/dL, severe coagulopathy and model for end-stage liver disease score calculated as 40. The retransplantation surgery lasted for 17 hours. Based on vital signs and laboratory results of Hb, Hct, ROTEM parameters of coagulation and other tests, we used a rapid infusion system to determine rate and amount of transfusion and infusions in intraoperative settings. Throughout this surgery, a large amount of transfusion was used, including 82 liters of plasmalyte; 8.2 liters (33 units) filtrated and irradiated pRBC; 13 L (65 units) of FFP; 4.3 L of 20% albumin, and 450 mL of cryoprecipitate. The amount of fluids and blood products reached 108 L in total. In addition, we used 0.6 g/kg/min of norepinephrine, 0.8 g/kg/min of epinephrine, and 1 unit/hr of vasopressin to sustain the patients vital signs. The kidney function during and after retransplantation was preserved. Following the completion of surgery, the patient stayed at an ICU on mechanical ventilation for 144 hours and was able to extubated. The patients clinical condition improved gradually and discharged on postoperative day 44. Retransplantation cases with high model for end-stage liver disease scores require a large amount of blood product and fluids, however, the rate and types of infusion therapy depend on patients clinical condition and vital signs. The appropriate dosage of vasopressors and effective replacement of blood products and fluid resuscitation are the key approach to maintain vital sings and protect organ functioning during the retransplantation.

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## Study of risk factors for anastomosis and non-anastomosis biliary strictures after liver transplantation

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**Background:** In Mongolia 2020, there are 1,414 respiratory diseases, 1,833 gastrointestinal diseases, 1,268 cardiovascular diseases, 1,084 urogenital diseases, 598 injuries, poisonings and other external diseases per 10,000 population in our country, and compared to 2019, the leading causes of diseases are decreased by 12,685. As of 2020, there were 353 cases of acute hepatitis virus infection nationwide, which is 1.1 per 10,000 population, which is 1.1% of the total infectious diseases. Compared to last year, the number of reported cases decreased by 174 cases or 0.6 per 10,000 population.

**Methods:** The survey will be conducted among 155 clients who underwent liver transplant surgery between March 2011 and April 2022, based on the Organ Transplant Center of the Ulaanbaatar City Hospital, with the approval of the Ethics Committee.

**Results:** Regardless of the type of grafts or biliary reconstruction, the overall incidence of BC's in recipients ranges from 7.4% to 25%; leaks occur in 5%–18%, Pan strictures occur in 6%–20%.

**Conclusions:** Anastomosis and non-anastomosis stenosis after liver transplant surgery are affected by the duration of warm and cold ischemic time, stenosis and occlusion of the hepatic artery.

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## A noninferiority, randomized controlled trial of late conversion to once-daily regimen of sirolimus and extended-release tacrolimus versus mycophenolic acid and extended-release tacrolimus for kidney transplant recipients

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**Background:** Once daily regimen could improve medical adherence and quality of life. Sirolimus based regimen can reduce calcineurin inhibitor (CNI) exposure. Therefore, we conducted randomized controlled trial, comparing once daily regimen of sirolimus and extended-release tacrolimus (ER-Tac) versus standard regimen of mycophenolic acid (MPA) and ER-Tac for late conversion in low immunologic risk kidney transplant recipients.

**Methods:** This randomized controlled, open label, noninferiority trial was conducted from April 2018 to March 2022 at King Chulalongkorn Memorial Hospital and Bhumirajanagarindra Kidney Institute Hospital, Thailand. The kidney transplant recipients greater than 4-month posttransplant were randomized 2:1 to once daily arm and standard arm. Patients were followed up for 12 months. The primary outcome was estimated glomerular filtration rate (eGFR), CKD-EPI at 12 months. The noninferiority margin was 5 mL/min/1.73 m<sup>2</sup>. Donor specific antibody and protocol kidney biopsy were followed up at 12 months.

**Results:** Seventy-two kidney transplant recipients were randomized to once daily arm (n=48) or standard arm (n=24). The baseline characteristics of patients were comparable both groups. The primary endpoint, mean eGFR at 12 months was 74.75 mL/min/1.73 m<sup>2</sup> in once daily group and 70.5 mL/min/1.73 m<sup>2</sup> in standard group (difference, 4.24; 95% confidence interval, -4.35 to 12.83). Once daily arm was noninferior as the difference does not exceed noninferiority margin. Mean change eGFR (standard error) at 12-month from baseline of once daily arm and standard arm were 1.97 (1.27) mL/min/1.73 m<sup>2</sup> (P=0.127) and -0.08 (1.69) mL/min/1.73 m<sup>2</sup> (P=0.962), respectively. De novo donor specific antibody incidence rate was 2.1% and 8.3% for once daily and standard groups, respectively.

**Conclusions:** Once daily regimen of sirolimus and ER-Tac was noninferior to standard regimen for mean eGFR at 12-month after conversion in low immunologic risk kidney transplant recipients. Once daily regimen of sirolimus and ER-Tac could be an alternative regimen for low immunologic risk kidney transplant recipients.

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## Assessing anxiety pre- and post-living donor liver transplantation in the First Central Hospital

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**Background:** Anxiety refers to a state of feeling uneasy, restless, anxious, fearful, or hyperactive. Anxious psychological instability can cause a person to hesitate or even avoid surgery. We decided to conduct this study because there is a lack of research on anxiety before and after surgery in our country.

**Methods:** Fifty-one patients who were scheduled to undergo surgery at the center for organ transplantation of the were included in the study according to the inclusion criteria. Demographic questionnaires, surgical status questionnaires, anxiety level questionnaires, and preoperative anxiety factor questionnaires were collected from the participants.

**Results:** A total of 51 people, 30 females and 21 males, participated in our study. Twenty-six (51.0%) participants had significant preoperative anxiety, while eight (15.7%) participants had significant postoperative anxiety. A significantly higher level of anxiety was identified in the preoperative period compared with the preoperative and postoperative period.

**Conclusions:** Preoperative anxiety is high in surgeons who perform surgery in the transplantation center. providing accurate and adequate information about the identified factors can help reduce preoperative anxiety.

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## Application of engineered cell sheets composed of human islets and supporting stem cells enhances the outcome of islet cell transplantation *in vitro* and *in vivo*

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We have so far conducted various islet transplantation research using cell sheet engineering technique. By using engineered cell sheets composed of human islets and supporting cells, cytoprotective effect on islets and overcoming the issue of poor vascularization are expected. As a results, the improvement of the outcome of islet transplantation would be expected. In this study, we review our islet transplantation research to date and state future prospective. Engineered cell sheets composed of islets and mesenchymal stem cells (MSCs) derived from rats overcome the issue of poor vascularization in subcutaneous sites and succeeded in reversing DM in a rodent model. Co-culture of human islets with human fibroblast sheets showed higher viability rate with cytoprotective factors (VEGF and fibroblast growth factor) than islets-alone group. When fibroblasts, bone marrow-derived stem cells, and adipose-derived stem cells (ADSCs) respectively were co-cultured with islet cells, ADSCs were found to be beneficial in terms of viability and VEGF production. An engineered cell sheets composed of pig islets and ADSC sheets were transplanted subcutaneously into type I diabetic pig models. Subcutaneous transplantation of engineered islet/ADSC sheets could regulate the blood glucose levels even in large animal models. Application of engineered cell sheets composed of human islets and supporting cells, we have showed the cytoprotective effect on islets *in vitro* and achieved better glycemic control *in vivo*. ADSCs are considered as an attractive cell source for creating engineered cell sheets.

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## A case of COVID-19 1 month after ABO-incompatible living donor liver transplantation

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COVID-19 due to SARS-CoV-2 spread from China in December 2019 and is still a worldwide problem in August 2022. The seventh wave of the epidemic has arrived in Japan, and the number of infected patients is increasing. We report here our experience with a case of COVID-19 1 month after living donor liver transplantation. A 69-year-old female with decompensated cirrhosis due to nonalcoholic steatohepatitis underwent living donor liver transplantation. The donor was her 43-year-old daughter, and the graft was from the right lobe of the liver. The patient had postoperative bile leak and underwent reoperation on postoperative day 4, but otherwise, the postoperative course was generally good. The recipient's blood type was B Rh+ and the donor's blood type was A Rh+. The patient was immunosuppressed with FK, MMF, and steroids after surgery. On postoperative day 32, the patient developed a sore throat, hoarseness, and low-grade fever. PCR test was positive for SARS-CoV-2, and the patient was diagnosed with COVID-19. Respiratory failure was not observed, and the patient was considered mild illness. Remdesivir 200 mg/day was administered for 3 days, and the dose of MMF was reduced to half. FK and steroids were continued at the same dose, however, FK was measured daily at trough level. Symptoms disappeared 3 days after the onset of the disease, and the trough level of FK passed without significant change. With the spread of COVID-19 infection, the number of cases of COVID-19 after transplantation is likely to increase, and accumulation and analysis of medical data is desirable.

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## The impact of early tacrolimus exposure to long-term renal function and growth in pediatric liver transplant recipients

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**Background:** Life-long immunosuppression is required for liver transplant (LT) recipients to prevent graft rejection. This study aimed to analyze the effect of early calcineurin inhibitor exposure to the long-term outcomes of pediatric recipients.

**Methods:** This was a retrospective study from a university center. Pediatric patients (age <11-year-old at time of LT) and had regular follow-up, from 2001 to 2018 were included. All tacrolimus (TAC) trough level within the first year after LT were plotted against time and the area under curve was defined as total TAC exposure. Patients were divided into high and low TAC exposure according to the median TAC exposure.

**Results:** Eighty-five patients were included (high TAC, n=42; low TAC, n=43). The TAC exposure of the two groups became similar from third to fifth year after LT. The estimated glomerular filtration rate at 5-, 10- and 15-year after LT were 107.6 vs. 116.0, 111.9 vs. 117.8 and 98.7 vs. 118.3 in the high and low TAC group respectively although there was no difference in serum creatinine level. Long-term complication rates for ACR, OI and PTLD were similar in both groups (11.9% vs. 7.0% and 2.4% vs. 2.3% and 26.2% vs. 18.6%). Growth of LT recipients was comparable to the general population and there was no difference between the two groups for body weight, height and body mass index. There was no difference in the incidence of other metabolic complications including hypertension, dyslipidemia and diabetes and the risk remains very low in the long run (0%–2.4%).

**Conclusions:** Early TAC exposure is detrimental to the long-term renal function of pediatric recipients while the risk of ACR, opportunistic infection and graft survival were similar. TAC exposure should be reduced early after LT as long as graft function allows, in order to preserve long-term renal function.

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## Comparison of hypothermic static and normothermic *ex situ* donor heart preservation in heterotopic heart transplantation with the murine model

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**Background:** Hypothermic static and normothermic *ex situ* preservation methods are the most widely used preservation technique worldwide. While cold static storage is associated with subsequent ischemic injury, normothermic perfusion preservation has the potential to elongate preservation time with less ischemia. The current study compares the hypothermic and normothermic preservation methods in terms of graft performance, morphologic changes, and acute immune response in an experimental model.

**Methods:** Twenty-five rats underwent heterotopic abdominal heart transplantation after 2 hours of donor heart hypothermic storage (HT group; n=10) or normothermic *ex situ* preservation (NT group; n=15). Blood samples were obtained just before and after 4 hours of implantation to analyze surface markers of immune cells (CD4, CD8, CD161, CD45R). ECG and Echocardiography were performed before harvesting and after implantation. Hearts were extracted after 4 hours of implantation for hematoxylin-eosin (HE) and TUNEL-staining, and recipient rats were euthanized.

**Results:** Nineteen (76%) rats successfully survived after implantation (HT group, 100%; NT group, 60%). The mean ischemic time of the donor heart was 162.7±8.34 minutes in the HT group and 453.7 minutes in the NT group. The NT group showed no significant change in the heart rate before and after implantation but significantly decreased in the first hour of implantation in the HT group (259.5±24.3 beats per minute) and normalized at 3 hours (338.3±34.1 beats per minute). Ejection fraction and fractional shortening significantly decreased after implantation in both groups but were less significant in the NT group (P=0.001). Granulocyte was less significantly increased in the NT group compared to the HT group after the experiment (P=0.037). Although the gross structure was well preserved in both groups in HE-staining, the number of TUNEL-positive cells was significantly higher in the HT group.

**Conclusions:** Our findings suggest that normothermic *ex situ* preservation is associated with well-preserved donor hearts but similar recipient immune response in comparison with hypothermic static preservation.

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## Outcomes of heart transplantation according to allocation region

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**Background:** The Korean donor heart allocation system divides the region into three, and recipients of heart transplantation (HT) in the same status have priority of the donor in the same region. Generally, it is thought that HT of intra-region can reduce ischemic time, however, its clinical impact is unclear. The purpose of this study is to compare the characteristics and outcomes of intra-region HT and inter-region HT.

**Methods:** From June 2014 to July 2022, a total 111 patients underwent HT at a single institution. Of these, 91 cases were adult (>18 year) isolated HT and enrolled present study (pediatric HT, 13 cases; multiple transplantation, 7 cases). Of subjects, 45 cases were intra-regional HT, and 46 cases were inter-regional HT.

**Results:** Preoperative recipient's characteristics were no difference between two groups. Ratio of male donor was higher in intra-regional group (80.0% vs. 58.7%,  $P=0.048$ ). The cold and total ischemic times were longer (approximately 2 hours) in inter-regional group ( $P<0.001$ ). Other donor's profiles were similar in two groups. There was no difference of early clinical outcomes between both groups. And postoperative cardiac index and vasoactive inotropic score were also no difference in two groups. In addition, the long-term survival rate was no difference in two group ( $P=0.23$ ).

**Conclusions:** In our experience, about half of whole HTs were performed with donors from other regions in the present Korean allocation system. Despite interregional HT takes an average of 2 hours longer ischemic time than intraregional HT, there was no difference in postoperative results between the two groups. According to the present study, the clinical impact of donor location on the outcome of recipient in the domestic HT is not considered to be significant.

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## Pediatric kidney transplantation in Mongolia

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**Background:** Renal transplantation is the best treatment for children with end-stage renal disease (ESRD) offering advantages of improved survival, growth potential, cognitive development, and quality of life. Current data in Mongolia show that every year around 20 children diagnose ESRD. On dialysis have 19 children, average age is 10.26. The aim of our study was to compare the outcomes child recipients at a single adult center in First Central Hospital of Mongolia.

**Methods:** Retrospective chart review of pediatric patients who underwent kidney transplantation from 2006 to 2021.

**Results:** Renal transplants were accomplished and five cases were living donor kidney transplantation, one case were deceased donor kidney transplantation, only one of the cases, the graft was obtained through laparoscopy. Average age was 12.6. Two receptors weighted <25 kg. Five receptors were male and one was female. Four receptors live donor was the fathers and one was mother. Immunosuppressant induction treatment one case Compath, four cases had basiliximab and maintenance regimen one case had steroid and cyclosporine, five cases had triple tacrolimus, mycophenolate mofetil and steroid. Complication rate was 9.67% (urine tract infection, acute allograft nephropathy). Patient survival rate was 100%, and graft survival rate was 96.7% at a year. Two cases have survival of 5 years and two case 3 years, one case 1-year survival. Our program of pediatric kidney transplantation has achieved optimal patient and graft survival rates with low rate of complications. Pediatric kidney transplants have higher patient and better graft survival rates then dialysis.

**Conclusions:** In this study we wanted show success of introduction pediatric kidney transplantation, but not all children with ESRD cannot have this treatment due to lack of donors, kids age, and weight. Also we need to train pediatric surgeon and nephrology doctors for kidney transplantation. We need have deceased donor kidney transplantation for child in Mongolia.

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## Single center experience of COVID-19 management among kidney transplant recipient in Omicron pandemic

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**Background:** Omicron variants of coronavirus disease 2019 (COVID-19) have been prevalent since 2021. Kidney transplant recipients have a lower response rate to the vaccine and are considered a high-risk group for mortality and complications from COVID-19 infection. This study aimed to investigate the outcome of COVID-19 in kidney transplant patients in which omicron variants were prevalent.

**Methods:** This retrospective study included kidney transplant recipients with COVID-19 from a single center. Patients diagnosed with COVID-19 were subjected to self-quarantine with supportive care unless there was no evidence of serious diseases such as pneumonia. We conducted the surveillance to evaluate whether pneumonia develops at end of quarantine. Patients who progressed to pneumonia or severe disease at diagnosis were hospitalized and administered antiviral agents and steroids regardless of the time after diagnosis. We investigated all-cause mortality in kidney transplant recipients with COVID-19.

**Results:** A total of 106 recipients were enrolled. The mean age of the patients was  $54.6 \pm 11.2$  years, and 51.9% were female. The median time from transplant to diagnosis of COVID-19 was 112 (57–161) months. The prevalence of hypertension, diabetes, and cardiovascular disease were 63.2%, 42.5%, and 19.8%, respectively. The most common symptoms were upper respiratory tract symptoms including sore throat (34%). Ninety-four patients had mild disease, pneumonia and severe disease occurred in 10 patients. Of 94 patients with mild disease, 19 (20.2%) patients developed pneumonia at end of quarantine and were hospitalized. The median time from diagnosis of COVID-19 to the antiviral agent (34%) and steroid (25%) was a median of 10 (1–14) days. The all-cause mortality rate was 2.8%.

**Conclusions:** Unlike previous studies, COVID-19-related mortality was very low. This could reflect the characteristics of the omicron variants and the effect of vaccination. However, there is a possibility that active surveillance and treatment of pneumonia regardless of the severity reduced mortality.

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## Impact of the longitudinal changes of myocardial remodeling on kidney transplantation outcomes

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**Background:** Kidney transplantation (KT) improves the hemodynamic burden associated with volume overload, and anemia in patients with chronic kidney disease, but cardiovascular disease remains the leading cause of death after KT. This study evaluated the longitudinal change of eccentric and concentric myocardial remodeling and its impact on cardiovascular outcomes after KT.

**Methods:** A total of 600 patients who underwent echocardiography before and 3 years after KT were included from a multi-center observational cohort (KNOW-KT). Conventional echocardiograph evaluated left ventricular ejection fraction (LVEF), LV mass index (LVMI) LV end-diastolic dimension (LVEDD), and relative wall thickness (RWT) at baseline and after KT, and the changes of these parameters and their effect on the cardiovascular events were investigated.

**Results:** After KT, LV EF, LVMI, and the myocardial eccentricity represented by LVEDD were significantly improved during 3 years (LVEF, 61.4±7.9%–64.8±6.0%; LVMI, 113.4±31.8–94.4±23.4 g/m<sup>2</sup>; LVEDD, 51.2±5.6–47.1±4.8 mm), however, the myocardial concentricity represented by RWT were increased from 0.39±0.07 to 0.41±0.07. In the correlation analysis between the change of echocardiographic and clinical parameters, the change of LVEDD was associated with change of hemodynamic stress such as hemoglobin or systolic blood pressure, whereas the change of RWT showed significant association with change of metabolic stress such as HbA1c and triglycerides. There were 30 major adverse cardiovascular events (MACE, myocardial infarction, angina or strokes) after KT, and the incidence of MACE significantly increased in patients with the increased RWT group, but not in the increased LVEDD group after KT. In particular, in multivariate analysis corrected for baseline echo value, age, sex, diabetes, etc., an increase in RWT, independently predicted the occurrence of MACE (hazard ratio, 2.20; confidence interval, 1.21–3.99; P<0.01), but other echocardiographic parameters including LVEF, LVMI, and LVEDD did not.

**Conclusions:** Longitudinal changes in myocardial concentricity is associated with the metabolic stress and have a significant impact on the new onset cardiovascular disease in KT patients. Improving metabolic burden after KT should be considered as an important strategy for amelioration of cardiac remodeling and adverse event.

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## Intraoperative management of coagulation disturbances, replacement of blood, blood products and fluid management during living donor liver transplantation

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**Background:** Intraoperative blood loss and coagulopathy is a common consequence of pre-existing abnormalities of the hemostatic system in living donor liver transplantation (LDLT). Estimated amount for fluid management and blood transfusion are challenging and unpredictable for recipient.

**Methods:** The patients involved in this study were divided into two groups. In the first group 76 cases underwent LDLT from 2011 to 2019 and in the second group included 85 recipients which operated after 2019. The data such as coagulation factors, blood, blood products and fluid used during LT and compared whether there are any correlations or relationships between two groups.

**Results:** In the first group there is an operation time of 16.4±4.12 hours, Intraoperative fluid replacement measured as 28.56±18.44 liters. In the second group, the average operation time continued 14±3.06 hours and the amount of intraoperative fluid replacement consisted of 19.9±6.4345 L. There is observable reduction in operation time and intraoperative fluid replacement in the second group. There is no significant difference between the groups on transfused blood products and in the second group used slightly more PRBC of 2.56±1.60 L whereas in the first groups was 1.54±1.86 L.

**Conclusions:** This retrospective study shows that the operation time reduced significantly in the second group. Due to frequent surgery performances enhanced and strengthened the surgeons experience and skill which led to reduction of operation time significantly and eased the potential technical difficulties. Monitoring and determining of coagulation factors by using coagulation, point-of-care testing and ROTEM enabled the transfusion of the blood, blood products and fluid at the right time during LDLT that definitely lead to increased success rate of surgery. The reason for the increased usage of PRBC in the second group was due to clinical conditions of patients which major policy change in National Health Insurance gave an opportunity to perform LDLT in more severe cases in Mongolia.

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## Impact factors leading to renal impairment after liver transplant surgery: a single center study

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**Background:** Mongolia is known as one of the countries with a high prevalence of viral hepatitis infection and its related liver cirrhosis and hepatocellular carcinoma. Therefore, liver transplantation (LT) surgery increases from year to year in Mongolia. Liver transplant recipients frequently develop renal impairment, but the predisposing factors and long-term consequences of renal impairment are not well understood. Our goal was to evaluate posttransplant renal dysfunction (PTRD) and to investigate the predicting factors for renal dysfunction after LT.

**Methods:** This is a hospital-based case control study of 167 consecutive cases undergoing LT between September 2011 and September 2022. Early renal impairment was identified by measuring serum creatinine at pretransplantation, intraoperatively, 24 hours, 72 hours, 7 days, 14 days, 28 days post-LT. Patients with and without renal impairment were compared to identify risk factors associated with this complication. The impact graft ischemic time, peri- and postoperative blood product transfusion, perioperative hemodynamics, on time to extubation, intensive care length of stay, incidence of chronic renal failure, mortality and morbidity were examined alone and then as a combined outcome. Collected each recipient data by survey card and fill out the card in accordance with the questionnaire.

**Results:** Early renal dysfunction was identified by measuring serum creatinine and glomerular filtration rate. In our investigation which was a study group of patients following LT, the following renal dysfunctions were found: 46.7% of recipients in the study had renal dysfunction, while the rest its 4.8% had renal dysfunction preoperatively. The average creatinine level of the recipients who had a renal dysfunction after LT, was  $0.825 \pm 0.24$  mg/dL and the glomerular filtration rate was  $111 \pm 36.3$  mL/min, and statistically significant.

**Conclusions:** According to a study of the recipient side effects of renal failure after liver transplantation, preoperative kidney function plays a crucial role for postoperative renal dysfunction.

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# The difference of outcomes according to the duration of delayed graft function for kidney transplantation: 15-year experience of single institution

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**Background:** It is well known that delayed graft function (DGF) has an adverse effect on graft kidney. However, there are not many studies on the effect of DGF on the long-term prognosis of kidney transplantation and even fewer studies with subdivided DGF by period. So, we aimed to evaluate the outcome of DGF with its duration.

**Methods:** We retrospectively analyzed 1,904 patients who received kidney transplantation from 2005 to 2020 at Seoul St. Marys hospital. After performing propensity score matching by the presence of DGF, graft survival rates were analyzed according to the duration of DGF. DGF duration was subdivided into four groups. (A, no DGF; B, DGF days 0–1; C, DGF days 2–7; D, DGF days 8–13; E, DGF days 14–).

**Results:** DGFs were occurred in 84 (5%) patients. Among them, 10 (1.1%) patients were after living donor kidney transplantation and 74 (14.7%) patients were after deceased donor kidney transplantation. The 10-year graft survival of all DGF patients was 59.4%. When DGF duration was subdivided and compared, 10-year graft survival was A, 73.5%; B, 66.2%; C, 76.4%; D, 64.6%; E, 27.2% respectively, and there were significant differences between groups (log-rank P-value=0.01).

**Conclusions:** It was found that not only the presence of DGF but also its duration affects graft survival, and the worse prognosis can be predicted with longer duration of DGF.

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## The future of tacrolimus dosing: harnessing the potential of CURATE.AI for tacrolimus dose optimization: retrospective data analysis

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**Background:** Living donor liver transplantation (LDLT) has become a gold standard treatment in pediatric end-stage liver disease. Tacrolimus forms the cornerstone of immunosuppression after pediatric LDLT. Standard-of-care for tacrolimus dose titration is conventionally based on physician-guided drug dosing. This, however, leads to frequent deviations from target trough levels due to inter- and intra-patient variability, particularly during the critical early postoperative phase. Tacrolimus has a narrow therapeutic index and under or overexposure leads to clinically significant adverse effects. We explored the applicability of CURATE.AI, a small data, clinically validated artificial intelligence-derived platform, for guiding tacrolimus dosing towards achieving desired therapeutic levels.

**Methods:** This is a retrospective study of 16 pediatric LDLT recipients (13 males; median age, 2 years) at the National University Hospital Singapore from 2011–2018. Each patients' clinical data including tacrolimus dose and corresponding tacrolimus trough was used to generate a personalized CURATE.AI response profile that identifies and recommends an optimal dose to achieve the target treatment outcomes. CURATE.AI is both disease mechanism-independent and indication-agnostic and has dynamic ability to evolve with time. CURATE.AI's predictive performance was then evaluated with metrics that assessed both technical performance and clinical relevance.

**Results:** CURATE.AI-guided dosing fared better than standard-of-care physician-guided dosing in terms of percentage days within clinically acceptable tacrolimus levels of 6.5–12 ng/mL (54.55% vs. 49.08%). With CURATE.AI-guided dosing, patients could potentially achieve therapeutic range earlier (Fig. 1A) and better maintain therapeutic range with dynamic dose adjustments (Fig. 1B).

**Conclusions:** CURATE.AI was able to enhance the accuracy of tacrolimus dosing compared to unaided physician-guided decisions. Prospective studies may reveal its full potential as a clinical decision support system to balance tacrolimus dose optimization with drug-related toxicities.

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## Effects of cytochrome P450 3A5 (CYP3A5) on pharmacokinetic profiles of tacrolimus in Thai patients with liver transplantation

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**Background:** Tacrolimus, an immunosuppressant used in liver transplant patients, has narrow therapeutic index and large inter-individual pharmacokinetic variability, partly due to the pharmacogenetic variation in the main drug-metabolizing enzyme cytochrome P450 3A5 (CYP3A5). However, the contribution of the donor (D)'s genetic variation in CYP3A5 to the pharmacokinetics of tacrolimus measured in recipients (R) is still inconclusive. Therefore, we investigated the full pharmacokinetic profiles of tacrolimus in Thai deceased donor liver transplantation according to recipients/donors (R/D) pharmacogenetics.

**Methods:** At 1-week posttransplantation, plasma tacrolimus concentrations were measured at 0, 2, 4, 6, 9, 12 and 24 hours post-dose in 19 recipients using a semiautomated enzyme immunoassay technique. Pharmacokinetics profiles were calculated (WinNonlin, including time to maximum plasma concentration [T<sub>max</sub>; hour], maximum plasma concentration [C<sub>max</sub>; ng/mL], trough plasma concentration [C<sub>trough</sub>; ng/mL], area under the concentration-time curve at 0–24 hours [AUC 0–24; hr.ng/mL], half-life [T<sub>1/2</sub>; hour], volume of distribution [V<sub>z</sub>/F; L], and clearance [CL/F; L/hr]). Genotypes of CYP3A5\*3 was analyzed in both R and D. CYP3A5\*1/\*1 and \*1/\*3 were regarded as CYP3A5 expressors (E). CYP3A5\*3/\*3 were reported as non-expressors (NE).

**Results:** Patients were classified into four groups according to R/D CYP3A5 phenotypes: RE/DE, R-NE/DE, RE/D-NE, and R-NE/D-NE. R-NE/D-NE had a significant increase in C<sub>max</sub> (21.9 [19.6–23.7] vs. 10.6 [5.5–14.0] ng/mL, P=0.034) and tacrolimus dose (0.06 [0.06–0.08] vs. 0.04 [0.06–0.06], P=0.032) compared to RE/D-NE. There were trends of increased AUC 0–24 and decreased CL/F in D-NE regardless of recipient phenotypes (Table 1). No difference was observed in other parameters.

**Conclusions:** Genetic variation of CYP3A5 in donors affects overall drug accumulation and the clearance of tacrolimus in early posttransplant period. This suggested that the donors genetic variation should be considered in dose adjustment and therapeutic drug monitoring of tacrolimus. A prospective study with D/R genetic-guided treatment in a larger cohort is warranted.

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# The comparison of coefficient of variation among once-daily and twice-daily tacrolimus in kidney transplant patients: a meta-analysis

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**Background:** Kidney transplantation is the treatment of choice end stage renal disease. Tacrolimus often used as prophylaxis of organ rejection in patients receiving organ transplants. Maintaining tacrolimus trough levels is important in preventing acute rejection, but twice-daily dosing often leads to nonadherence. One concern with once-daily tacrolimus is that the desired tacrolimus trough levels may not be achieved. The primary objective of this study was to evaluate tacrolimus trough levels of once-daily and twice-daily tacrolimus for maintenance immunosuppression.

**Methods:** We systematically searched PubMed, Directory of Open Access Journal, Google Scholar and ScienceDirect screening with the following search terms: ("kidney transplant" or "renal transplant") and ("extended-release tacrolimus" or "once-daily tacrolimus") and ("immediate-release tacrolimus" or "twice-daily tacrolimus") and ("trough level").

**Results:** Total 10 studies were included. We found there are no significant differences in tacrolimus trough levels between once-daily and twice-daily tacrolimus (mean difference [MD], 0.51 [-1.05, 0.03]; P=0.07). Coefficient of variation was calculated for each type of tacrolimus. We found there are no significant differences in CV of tacrolimus trough levels between once-daily and twice-daily tacrolimus (29.87 vs. 26.76) (MD, 3.10 [-3.35, 9.55]; P=0.35).

**Conclusions:** There are no differences in tacrolimus trough levels between once-daily and twice-daily tacrolimus.

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## Acute rejection associated with short-term and long-term survival in kidney transplantation: a single center study in Indonesia

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**Background:** Acute transplant rejection is proven to have significant impact on the graft and patients' survival. This study aims to evaluate the short- and long-term outcomes of acute rejection in the largest kidney transplant (KT) center in Indonesia.

**Methods:** Retrospective cohort study was conducted at Dr. Cipto Mangunkusumo National General Hospital, Jakarta. We recruited all recipients of living-donation kidney transplantation from 2011 to 2016. All-cause graft survival and patient survival rate were analyzed and its association with acute rejection rate. Kaplan-Meier, log-rank, Cox regression and logistic regression were used for statistical analysis.

**Results:** A total of 344 subjects were included in this study. Most of the recipients were male (69.5%), with a mean age of 47.65±13.05 years. Acute rejection rate was identified in 5.6% of patients. The 5-year all-cause graft survival rate was 68.9% and 5-year patient survival after KT was 72.4%. While the 1-year, 3-year, and 5-year all-cause graft-survival rate in subjects developing acute rejection was 10.5%, 5.3%, and 0%, respectively. Furthermore, the 1-year, 3-year, and 5-year patient survival rate in acute rejection was 21.1%, 15.86%, and 10.5%, respectively. We found a significant correlation of acute rejection episodes with the 1-year, 3-year, and 5-year graft survival and patient survival ( $P<0.001$ ). Mean survival time in acute rejection subjects was 13.22 (3.03–23.42) months. Acute rejection was independently associated with 5-year all-cause graft survival (hazard ratio [HR], 6.96; 95% confidence interval [CI], 3.79–12.79;  $P<0.001$ ) and 5-year patient survival (HR, 4.15; 95% CI, 2.26–7.6;  $P<0.001$ ) after KT. Further analysis on the risk factors of acute rejection demonstrated that duration of dialysis >3 years before KT was associated with acute rejection (adjusted HR, 7.11; 95% CI, 2.72–18.6).

**Conclusions:** Acute rejection is associated with short-term and long-term graft survival and patients survival in KT. Early diagnosis of acute transplant rejection and heightened monitoring may make graft preservation feasible.

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## Liver transplantation in high acuity recipients: a single center analysis of outcomes and factor predicting futile transplantation

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**Background:** Although life-saving benefit of liver transplantation (LT) is evident in end-stage liver disease patients, the futility rate is concerned among high acuity recipients, acute liver failure (ALF) and acute on chronic liver failure (ACLF), due to the possibility of too sick to transplant condition. To predict patients who are unlikely to be futile LT would be advantage to select suitable candidates. The study aimed to evaluate LT outcomes for recipients with ALF or ACLF who needed an urgent-in-hospital evaluation and to identify factor predicting futility.

**Methods:** An analysis included patients who underwent urgent LT for ALF/ACLF in Siriraj Hospital, 2002–2021. The Kaplan-Meier survival analysis and the binary logistic regression analysis were performed to identify factors associated with futility which was defined as same admission death (SAD) or totally dependent status (TDS) after LT.

**Results:** Sixty-nine recipients (ALF, 23.2% ; ACLF, 76.8%) were enrolled. The 5-year survival rate was 73.1% for ALF and 79.3% for ACLF. There were 15 (21.7%) futile LT (eight SAD and seven TDS). The univariate analysis revealed four possible pretransplant predictors of futility including vasopressor support ( $P=0.010$ ), abnormal chest film (CXR;  $P=0.011$ ) suggesting lung infection, renal replacement therapy (RRT;  $P=0.106$ ), and positive hemoculture ( $P=0.185$ ). The multivariate analysis identified two independent predictors of futility, vasopressor support and abnormal CXR ( $P=0.036$  and  $P=0.037$ ). Moreover, recipient with four aforementioned predictors experienced 100% futility while recipient with three predictors experienced 83% futility. Additionally, recipients who needed vasopressor support with abnormal CXR were associated with 75% futility.

**Conclusions:** Long-term survival of patients with ALF/ACLF following LT is acceptable. To avoid too sick to transplant recipients is the key to prevent futile LT. Our study recommended to deny LT for patients with combination of the conditions including vasopressor support, abnormal CXR, positive hemoculture, and RRT.

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## Effect of tacrolimus XL on variance coefficients in comparison with twice daily tacrolimus, and relationship with serum creatinine concentrations in kidney transplant recipients

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**Background:** Immunosuppressive therapy aims to prevent allograft rejection and minimize nephrotoxicity and infection. This study aims to determine the variance coefficient of plasma tacrolimus concentrations among kidney transplant recipients.

**Methods:** A comparative observational analytic with single group cross-over and a cross-sectional design was done at Transplant Outpatient Clinic General Hospital, RSUP Prof. Dr. I.G.N.G Ngoerah, Denpasar, Bali, Indonesia March 2019–August 2021. Nineteen kidney transplant recipients were assessed for tacrolimus therapy, blood tacrolimus, and serum creatinine. Tacrolimus treatment has two phases. First period immunosuppressive treatment was divided-dose tacrolimus. Second, tacrolimus XR was used as an immunosuppressant.

**Results:** There was significant difference between blood tacrolimus coefficient of variance (Co-V) of patients with XR tacrolimus and DD tacrolimus therapy ( $22.22\% \pm 7.39\%$  vs.  $44.32\% \pm 15.54\%$ ,  $P < 0.001$ ). There was significant linear correlation between blood tacrolimus Co-V and serum creatinine Co-V in all patients ( $r = 0.74$ ;  $RSQ = 0.54$ ;  $b = 1.15$ ;  $P < 0.001$ ). There was only significant linear correlation between blood tacrolimus Co-V in subgroup with DD tacrolimus therapy ( $r = 0.58$ ;  $RSQ = 0.33$ ;  $P = 0.02$ ) and none in patients with XR therapy ( $r = 0.06$ ;  $RSQ = 0.004$ ;  $P = 0.84$ ). In multivariate analysis with ANCOVA, it was shown that serum creatinine Co-V was associated with Co-V of blood tacrolimus ( $B = 0.72$ ;  $RSQ = 0.255$ ;  $P = 0.01$ ). Lower Co-V of tacrolimus and use of XR tacrolimus therapy is associated with lower Co-V of serum creatinine. On the other hand, XR treatment was associated with lower serum creatinine Co-V ( $B = -20.7$ ;  $RSQ = 0.20$ ;  $P = 0.02$ ).

**Conclusions:** XR tacrolimus treatment reduces blood tacrolimus variation in renal transplant recipients. Blood tacrolimus concentrations vary with serum creatinine, especially with divided-dose therapy. XR tacrolimus treatment reduces serum creatinine variation.

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## Health technology assessment of kidney transplantation and hemodialysis for the treatment of end-stage kidney disease

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**Background:** Kidney transplantation is an expensive procedure, and it is an alternative treatment of end-stage renal disease other than dialysis. Cost-effectiveness and the cost-utility study was undertaken at Prof. Dr. I.G.N.G Ngoerah Hospital, Bali, Indonesia aiming to assess whether living-related kidney transplantation is more cost-effective and cost-utility than hemodialysis in the treatment of end-stage renal disease. A health technology assessment was done in living-related kidney transplant and hemodialysis during 2018.

**Methods:** Data search from internet resources using the electronic library and critically appraised the best evidence of the data of best data of 5-year mortality and survival of kidney transplant and hemodialysis. A preliminary study about quality of life (QOL) was also done among kidney transplant and hemodialysis patients.

**Results:** Fourteen living-related kidney transplant patients consisted of 14 recipients, 12 males and two females aged 27–55 years and 14 donors, three males and 11 females aged 24–63 years were included. Thirty hemodialysis patients at the same hospital were also recruited consisted of 20 males and 10 females, with average age 50.9 years. Average 5-year cost of kidney transplant was 49895.51 USD, while cost of hemodialysis was 39152.34 USD, leading to cost difference was 10743.17 USD. Five-year mortality of kidney transplant was 55%, (survival 45%), 5 years survival rate was 18.9%. Five years of survival difference between kidney transplant and hemodialysis was 26.1 %. Meanwhile, QOL for kidney transplant was 0.7063 and hemodialysis was 0.5596, leading to QOL difference 0.15. Kidney transplantation will spend 411.38 USD for every 1% increase of survival during 5 years with 15% better QOL. In 5 years, kidney transplantation produces 67% ICER, and from cost-utility perspective kidney transplantation yields 2089.87 USD per QALY or 2,217 USD per QALY.

**Conclusions:** Living-related kidney transplantation is more cost-effective and cost-utility than hemodialysis in the treatment of end-stage renal disease.

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## Evolution of simultaneous pancreas and kidney transplant program in PGIMER Chandigarh

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**Background:** Simultaneous pancreas kidney (SPK) transplant is an effective treatment in patients with end-stage renal disease (ESRD) due to type 1 diabetes mellitus. SPK transplant is associated with significant mortality and morbidity. In India, pancreas transplant program is in its infancy. Less than 200 SPK transplants have been performed so far. We started SPK at our institute in 2014 and we review the experience comparing the initial years with the recent years.

**Methods:** Retrospective analysis of data of all patients who underwent SPK transplant at our center was done dividing them into two groups; initial years (2014–2018, group 1; n=17) and recent years (2019–2022, group 2; n=17) and outcomes were compared.

**Results:** The rate of re-exploration was 53% in group 1 and 43% in group 2. Biopsy proven rejections were equal in both groups (23%). There was one case of duodenal leak in each group and one anastomotic leak in group 1. There were four cases of vascular thrombosis in group 1 and two in group 2. Three cases in group 1 had delayed graft function whereas one patient had DGF in group 2. No renal graft loss was seen in either group. Five (29%) patients in group 1 lost their pancreas and two (12%) patients in group 2 had pancreatic graft loss. The 30-day mortality was 6% in group 1 and zero in group 2. The 1-year patient survival and death-censored pancreatic graft survival were 76% and 64% in group 1 and 94% and 94% in group 2 respectively. The hospital stays, infection rate, creatinine and HbA1C at various time intervals were similar. The learning curve over the years reflected in the results.

**Conclusions:** Improved surgical techniques and peri-operative protocols have improved outcomes. Keys to success include teamwork, decision making, surgical skills, experience and close follow-up.

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## Merkel cell carcinoma in young post-renal transplant male with atypical presentation

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**Background:** Merkel cell carcinoma (MCC) is a rare, aggressive neuroendocrine tumor of the skin which typically affects white men between 70 and 80 years, in sun-exposed areas.

**Methods:** A 39-year-old male from the north-eastern region of India with a history of renal transplant 8 years ago, on continuous immunosuppressive drugs developed a single painless, hard, hyperpigmented nodule over left the gluteal region on the posterolateral aspect of 3 months duration, 2×2 cm to start with. It further progressed to a nonhealing fungating mass with a necrotic surface and had grown in size since then. Dermis showed infiltration by lymphoid cells with large areas of coagulative necrosis of tumor cells described on excision biopsy by some pathologists as cutaneous lymphoma (NHL), and MCC by others. The lesion has increased to three times its original size over a span of 3 weeks. Surgical excision of mass done with sentinel lymph node biopsy of inguinal lymph nodes. Histopathology shows a tumor in the upper dermis extending up to muscle. IHC is positive for CD99, and CK20 and weak for synaptophysin, CK7 negative.

**Results:** In the span of 1-month post-excision, recurrence is seen even with continuous cycles of chemotherapy and distant metastasis to the meninges and brain. The patient had stable renal graft function in spite of ongoing tumor growth and continuous chemotherapy.

**Conclusions:** MCC is a rare and aggressive tumor. It can spread to local lymph nodes early, and surgeons should consider MCC as a differential diagnosis in case of rapidly growing painless lesion. Due to the rarity of MCC, further studies are needed to develop treatment protocols for dealing with immunosuppression in transplant patients. A multidisciplinary approach is required with the involvement of nuclear medicine and radiotherapists for early diagnosis, and treatment. and follow-up management.

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## Clinical outcomes of controlled rewarming technique in heart transplantation: a single-center experience

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**Background:** Orthotopic heart transplantation remains the final method of treatment in end-stage heart failure. In studies to minimize ischemia-reperfusion injury, sudden changes in temperature of the graft has been proposed as a crucial factor, which then led to the concept of controlled rewarming in organ transplantation. In this regard, we have adapted a reperfusion technique protocol in which the harvested graft is perfused with blood cardioplegia that starts at 10 and slowly raised to 26 in 8 minutes, immediately after anastomosing the left atrium (LA) and aorta.

**Methods:** A retrospective study was conducted using registry database, we identified 23 consecutive patients who received heart transplantation using the controlled rewarming technique between October 2021 and July 2022. The primary outcomes were 30-day mortality or in-hospital mortality and primary graft dysfunction (PGD) as defined by the ISHLT. The secondary outcomes were other surgical complications including bleeding, prolonged ventilation, intensive care unit (ICU) days, acute renal failure requiring CRRT, and cardiac enzyme levels.

**Results:** We identified 23 consecutive cases of orthotopic only-heart transplantation. There were 12 males and 11 females, with median age of 61 (range, 38–71). Twelve patients were under mechanical circulatory support. The median follow-up was 104 days (range, 38–256). As for operative profiles, median total ischemic time 137 minutes (range, 98–282), warm ischemic time 38 minutes (range, 31–53), anastomosis time 55 minutes (range, 41–73), cardiopulmonary bypass time (CPB) 151 minutes (range, 110–250). There were three 30-day mortalities due to sepsis. There were two cases of severe LV-PGD that required ECMO (V-A) insertion. There was one case of need for veno-venous ECMO due to severe pulmonary dysfunction.

**Conclusions:** A rather novel method at our center showed outcomes that are comparable to high-quality centers. Although a larger cohort is needed to show its statistical effectiveness, we believe this is an efficient, reproducible method.

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## Pancreas transplantation: a 12-year single-center experience at Siriraj Hospital, Thailand

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**Background:** Simultaneous pancreas kidney transplantation (SPK) and pancreas after kidney transplantation (PAK) are the best treatment for type I diabetes mellitus (T1DM) with end-stage renal disease (ESRD). Pancreas transplantation alone (PTA) is also an option in selected case of T1DM. However, there were still limited numbers of reports from South-East Asia. Herein, we reported our experience of pancreas transplantation from the largest pancreas transplant center in Thailand.

**Methods:** We retrospectively reviewed 18 cases of pancreas transplantation at Siriraj Hospital between October 2010 and August 2022. There were 11 males and seven females. Mean age was 38.6±6.9 years (range, 25–52 years). Sixteen (88.9%) patients underwent SPK, and one each underwent PAK and PTA. All of pancreas transplantation was performed with portal-venous and enteric drainage.

**Results:** Almost all pancreatic grafts were maintained in good renal function and normoglycemia without insulin therapy. There was only one pancreas graft loss due to ruptured arterial graft aneurysm from candida infection in the early postoperative period resulting graft pancreatectomy. There was no rejection of pancreas graft during the follow-up. Three patients died from sudden hypovolemic shock, congestive heart failure and stroke during the follow-up period. The overall survival at 1, 3, 5 and 10 years was 94.4%, 94.4%, 76.3% and 76.3%, respectively.

**Conclusions:** Since the first successful pancreas transplantation in Thailand since 2010 at Siriraj Hospital, we have continued to provide the pancreas transplant service with good long-term outcome for 12 years. Pancreas transplant is safe and can provide better quality of life in T1DM patients.

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## Early enteral nutrition in post-liver transplantation patient

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**Background:** Malnutrition is commonly found in patients with liver transplantation and associated with morbidity, mortality, and high costs of posttransplantation setting. The transplant procedure increased catabolism system and energy demand. Therefore, it is essential for patients to receive the sufficient of nutrition to promote recovery, wound healing and prevent infection. The aim of this review was to discuss the nutritional management among patients with liver transplantation.

**Methods:** This review was conducted by searching several studies using the keyword nutrition and liver transplantation and 15,870 studies were identified. Based on the article titles and removal of those not relevant, 40 studies were selected for further appraisal. After reading the full article, this review was performed by six studies.

**Results:** Early enteral nutrition feeding showed an effective result in patients after liver transplantation. A study indicates that changes in daily calory intake (DCI) showed nutritional advantages in enteral nutrition (EN) subjects over the total parenteral nutrition (TPN) patient. EN patients received more than 20 kcal/kg/d within the postoperative day (POD) 7 and TPN patient received less than 20 kcal/kg/d when patient started oral intake on the POD 9. Other than that, the incidences of bacterial infections in patients who did not receive enteral feeding was significantly higher than LDLT recipients who receive early enteral nutrition. Bacterial infections occurred in 63.2% in patients with intravenous fluid compared with 29.4% of the early enteral nutrition group ( $P=0.043$ ). Several studies also revealed that fiber, probiotics, and early enteral nutrition formula enriched with hydrolyzed whey peptide could lower the incidence of bacterial infections.

**Conclusions:** Early enteral nutrition was associated with significantly reduced risk of developing bacterial infections. It also reduced the possibility of mortality as the results of decreased infectious complications.

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## Heightened mortality associated with acute on chronic liver failure among waitlist patients with model for end-stage liver disease 3.0 of 40 or higher

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**Background:** Recently, the Organ Procurement and Transplant Network (OPTN) approved an updated version of the model for end-stage liver disease score, namely MELD 3.0, to replace the current score in determining waitlist priority in liver transplant (LT) in the US. Traditionally, MELD has been capped at 40, which may disadvantage patients with acute on chronic liver failure (ACLF), as their MELD is often >40 and face the highest risk of death. Here, we examine waitlist mortality and LT outcomes in patients with acute on chronic liver failure (ACLF) and MELD 3.0 >40.

**Methods:** Adult waitlist registrations for LT from January 2016 to December 2021 were identified in the OPTN registry. ACLF was defined according to NACSELD, namely >2 organ failures, including hepatic encephalopathy grade 3–4, vasopressors, mechanical ventilation, and renal failure. Waitlist mortality for up to 30 days was calculated as well as post-LT survival.

**Results:** There were 54,060 new waitlist registrants, of whom 2,820 (5.2%) had MELD 3.0 >40 at listing. 1706 (3.2%) met the criteria for ACLF of whom 754 (1.4%) had MELD 3.0 >40. Figure A shows that waitlist mortality continued to increase for MELD 3.0 40 with 30-day mortality of 58.3% for MELD 3.0 40–44 and 82.4% for 50. In Figure B, mortality was significantly higher in patients with ACLF. In the multivariable Cox model, ACLF was associated with a hazard ratio of 1.79 (95% confidence interval [CI], 1.51–2.12) and each point of MELD 1.12 (95% CI, 1.10–1.15), after adjustment for age and diagnosis. In contrast, MELD 3.0 >40 had no significant impact on posttransplant survival.

**Conclusions:** ACLF is associated with nearly 80% increase in waitlist mortality even among patients with MELD 3.0 >40. Post-transplant outcome was not adversely affected in liver recipients with MELD 3.0 >40. These data call for a policy change including uncapping the MELD score and/or granting priority points to patients with ACLF.

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## Japanese national survey on declined liver allografts from brain-dead donors: high decline rate but promising outcomes in allografts with moderate steatosis

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**Background:** Liver allografts from brain-dead donors which were declined and eventually not transplanted due to accompanying marginal factors have never been surveyed in Japan. We surveyed and characterized the declined allografts and discussed the graft potential focusing on various marginal factor.

**Methods:** We collected data on brain-dead donors between 1999 and 2019 from the Japan Organ Transplant Network. We divided their liver allografts into declined (non-transplanted) and transplanted ones, and then characterized declined one focusing on their time points of decline and accompanying marginal factors. For each marginal factor, we calculated the decline rate from the number of declined and transplanted allografts and assessed the 1-year graft survival rate from transplanted allografts.

**Results:** A total of 571 potential liver allografts were divided into 84 (14.7%) declined and 487 (85.3%) transplanted ones. In the declined allografts, a majority was declined after laparotomy (n=55, 65.5%), most of which had steatosis and/or fibrosis (n=52). Out of the moderately steatotic (without >F2 fibrosis) allografts (n=33), 21 were declined and 12 were transplanted, leading to 63.6% of decline rate. The latter 12 achieved a 92.3% of 1-year graft survival rate after transplanted. Comparison of representative features showed no significant difference between these declined and transplanted allografts. Moderately fibrotic allografts (without >30% steatosis) (n=12) also showed a high decline rate (58.3%) and a comparable 1-year graft survival rate (83.3%), but the transplanted grafts did not include elderly (>60 years) donors.

**Conclusions:** Pathological abnormalities of steatosis/fibrosis seem the most common donor factor leading to graft decline in Japan. Especially, allografts with moderate steatosis were highly declined but transplanted one achieved promising outcome. This national survey may highlight the possible potential of liver allografts with moderate steatosis.

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## Smartening of organ donation process

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**Background:** Organ donation from a brain-dead person is done through a three-step process that begins with the identification of a suspected brain-dead case, continues with the mission of coordinator, and ends with the allocation of an organ. Postponed identification processes and poor management led to organ and donor loss. In which, during the last 14 months in a single center procurement unit, out of 428 potential donors, 174 cases were missed. In case of developing a smart process, all cofounding factors, would be considered beyond the human faults. We introduce a platform to overcome all concerns of donation process.

**Methods:** We created an application which nurses can use for input GCS of patients instead of writing on sheets. It alerts if their GCS is three and recommends further considerations. Coordinator will be notified if a clinical examination indicated brain death. Application guides coordinator step by step. Allocation system works as a block chain system which each receiver considered as a new block and more stakes get the organ. Also, it includes a social media to share experiences. We employed this method in Imam Hossein Hospital for 3 months in 2022 and compared donation rates with the same period in 2021.

**Results:** There was an increase of 5.41 folds in potential donors, 1.5 folds in actual donors, and 1.5 folds in procured organs (four kidneys, three livers and one heart).

**Conclusions:** Donors detection will improve by using this application and saves time and human sources. Also, reduces hospital staffs' mismanagement which lead to improvement in the process. Guidance of this application helps coordinators with better choices in the face of challenges and it can be used as a learning courses platform. Blockchain system ensures transparency and security in allocating resources, and social media improves colleagues' communication.

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## Split kidney transplant from pediatric donor less than 18kg: 5-year single-center outcome analysis

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**Background:** As demand has outpaced the supply of organs. Pediatric split kidney donors are now looked as a potential source of good quality organs at par with adult diseased donors and living kidney donors and *en bloc* pediatric kidney donors.

**Methods:** A single-center retrospective cohort study was done from August 2017 to August 2022, Total number of transplants done were 922 and out of which deceased donor were 233, during the study period. Fourteen split kidneys from seven pediatric donors weighing less than 18 kg were transplanted into recipients which were free from any comorbidities. Patients' data were retrieved from an electronic database, telegram, case file, and outpatient department follow-up in the department of renal transplant surgery PGIMER.

**Results:** The male and female recipients were (11:3). The mean (standard deviation [SD]) age of donors was 3.4 (1.1) years and recipients 27.7 (9.9) years. The mean (SD) estimated glomerular filtration rate (eGFR), increased steadily from 58 (31.8) mL/min/1.73 m<sup>2</sup> at the time of discharge to 116 (24.8) mL/min/1.73 m<sup>2</sup> at end of 12 months. The mean (SD) eGFR remained stable at 24- and 36 months posttransplant with the decrease in mean (SD) eGFR to 104 (17) mL/min/1.73 m<sup>2</sup> at mean follows up of 31 (23.5) months. Rejection was noticed in 1/14 transplant recipients and 1/14 had DGF. No vascular and urinary complications were seen in any of the patients. 6/14 patients (42.8%) had covid infection posttransplant, 3/14 patients (21.4) had urinary tract infection and 2/14 patients (14.2) had surgical site infection.

**Conclusions:** Split pediatric kidneys can contribute to the organ donor pool with good outcomes and robust graft function in long term but are associated with manageable adverse outcomes in short term and the technical difficulties can be dealt with good surgical skills of the operating transplant surgeon.

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## Uncontrolled donation after circulatory determination of death: 11-years single center experience in India

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**Background:** Donation after circulatory determination of death (DCDD) donors is now looked upon as potential source of organs with increasing contribution to donor pool world over. Current study aims to analyze the outcomes of uncontrolled DCDD kidneys performed within the confines of restrictive legislative, ethical, and infrastructural challenges in India.

**Methods:** A single center retrospective study done from February 2011 to January 2022 to analyze outcomes after DCDD. The patient data was retrieved from file records, electronic database and outpatient department follow-up of the department of renal transplant surgery Post Graduate Institute of Medical Education and Research, Chandigarh, India.

**Results:** From 19 eligible DCDD donors 38 kidneys were retrieved. Thirty-one (81.5%) kidneys were utilized and seven (18.5%) kidneys were discarded (six unfit and one without recipient). The utilized 31 kidneys were allocated to 28 recipients (25 single kidney and three dual kidney recipients) with mean (standard deviation [SD]) age 41 (11.7) years. Donors mean (SD) age was 31 (15) years with majority donors had severe head injury (15/19). Mean (SD) warm ischemia time was 35.04 (11) minutes. Delayed graft function (DGF) and primary non function (PNF) rate was 71.4% and 10.7% respectively. Rejection rate was 14.2%. Entire study period witnessed eight (three PNF and five after initial function) graft losses (28.5%). Serial interval analysis of estimated glomerular filtration rate (eGFR) revealed significant rise ( $P=0.016$ ) up to 1 year after transplant with fall in eGFR beyond 1 year. DCDD contribution to total donor pool stood at 6.8 % (28/411).

**Conclusions:** DCDD kidneys in current study worked at par with DCDD kidney retrieved elsewhere in the world despite the existing roadblocks and challenges in India. Provided these challenges are overcome in coming days, DCDD can surely fill the void of current and future demand of kidneys in India for end-stage renal disease patients.

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## Three-dimensional laparoscopic donor nephrectomy: single-center experience

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**Background:** In the last years have been experience with three-dimensional-laparoscopy for the donor nephrectomy (3D-LDN). This is the report of first experience on hand-assisted 3D-LDN performed in the Kazakhstan within a single center.

**Methods:** From 2017 to 2020, 20 3D-LDN performed in our center. The technique of performing all 3D-LDN was typical. The donor kidney extracted from abdomen through a hand-port. When necessary, drainage left.

**Results:** The baseline characteristics of donors were statistically comparable ( $P>0.05$ ). The donors were relatives of the recipients; all of them underwent left nephrectomy. During the 3D-LDN average warm ischemic time was  $115\pm 9.6$  seconds; operative time was  $181.2\pm 35.0$  minutes; volume of blood loss was  $41\pm 25.0$  mL. There were no conversions to open surgery and major complications by Clavien-Dindo. The average drainage duration and postoperative hospitalization were 2.5–0.5 days.

**Conclusions:** The results of the first 3D-LDN experiment show encouraging results. With the subsequent increase in the number of operations and experience, a more thorough analysis of the results will be required.

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## Prevention therapy in patients with the severy hepatorenal syndrome

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**Background:** Hepatorenal syndrome (HRS) plays an important role in patients with liver cirrhosis before liver transplantation. To determine the dynamics of the severity of the condition and prediction of the estimated risk of mortality (ERM) patients with HRS using cellular mediators.

**Methods:** The study included a group of nine patients with HRS in ages from 22 to 64 years. Six patients of the main group received cell mediators. Inside the main group investigated patients were divided into three groups (moderate, severe and very severe) depending on the number of points. Assessment of the dynamics of flow multiple organ failure (MOF) performed before treatment, 3–5 days and 7–10 days of treatment.

**Results:** According to the results of intragroup analysis revealed statistically significant dynamic changes in the main group for the subgroup of moderate severity. Decrease in the average scores in the subgroup indicates positive patient outcomes. Comparison between subgroups and control group showed no statistical differences in the dynamics of APACHE III. The exception were two subgroups moderate groups where there was a statistically significant difference in the initial state—prior to treatment. This is due to the small sample of patients, where the average score was higher APACHE III in the study group than in the control. At subsequent stages of observation for 3–5 and 7–10 day these differences offset due to the patients. The dynamics of the estimated risk of death in one and two subgroup of the main group shows a statistically significant decrease of this indicator.

**Conclusions:** The use of cellular mediators can be combine in the complex therapy of patients with HRS before liver transplantation. The expediency of using cellular mediators in patients with HRS remains controversial and requires additional evidence in studies.

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## Ultrasound diagnostic after liver transplantation in late postoperative period

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**Background:** The determination of ultrasound criteria for assessing the condition of a liver transplant at various times of the postoperative period is paramount for the early diagnosis of complications.

**Methods:** A comprehensive ultrasound examination of 12 patients after liver transplantation from a living donor (right lobe) after discharge from the hospital was analyzed. The duration of follow-up varied from 1 month to 2 years. The average age of the recipients was 49±12 years. There were seven females and four males among them. Ultrasound was performed after discharge from the hospital once a month for the first 3 months, then once every 3 months.

**Results:** As a result of dynamic ultrasound monitoring, the following types of pathologies of the transplanted liver were identified. Signs of partial portal vein stenosis were found in one (8.3%) recipient. The patient was referred for a CT scan. Local accumulation of bile on the medial surface of the graft was found in one (8.3%) patient 1.5 months after liver transplantation. The presence of biloma confirmed after undergoing a CT scan. Signs of biliary hypertension in the form of expansion of intrahepatic bile ducts were found in three (25%) recipients. At the same time, in two patients, further examination revealed laboratory signs of cholestasis and confirmed the presence of biliary anastomosis stenosis during MRI. And one patient had no other clinical signs of cholestasis, the patient was under dynamic observation.

**Conclusions:** Ultrasound examination of patients after liver transplantation is a simple and basic research method that allows timely and reliable assessment of the condition of the transplant in the posttransplant period and allows effective monitoring of recipients. Assessment of the condition of blood vessels and bile ducts allows you to reliably diagnose the development of complications.

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## Extracorporeal photopheresis for refractory rejection in intestinal transplantation

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**Background:** Extracorporeal photopheresis (ECP) is an immunomodulatory therapy. Leukopheresed cells are administered 8-methoxypsoralen and exposed to ultraviolet A radiation. ECP has been used in GvHD and treatment of acute and chronic rejection in other solid organs (lung, heart, liver, kidney). We report the use of ECP as salvage therapy for refractory rejection after intestinal transplantation.

**Methods:** Intestinal transplant recipients who received ECP as rescue therapy for acute or chronic cellular rejection between 2016 and 2022 were included in this single-center retrospective analysis. Baseline demographics, pre- and post-ECP histopathological, endoscopic, and biochemical characteristics and long-term transplant outcomes, were analyzed.

**Results:** Four patients (three pediatric and one adult) with acute and chronic steroid- and biologic-refractory rejection were treated with ECP. Patients received twice weekly ECP for 4 weeks and once weekly thereafter. Three patients had acute cellular rejection, one had chronic rejection. Immunosuppression at the time of ECP initiation included high-dose tacrolimus and sirolimus. All patients failed treatment with high dose steroids and infliximab despite therapeutic infliximab troughs. Histologic resolution of rejection was achieved in all patients over 12 to 16 weeks. Steroids were weaned to low-dose or withdrawn in every patient within 4 weeks of ECP initiation. Pre- and post-ECP biochemical data reflected improvement in immune activation; C-reactive protein decreased from an average of 14.75 to 1.6 mg/dL and fecal calprotectin decreased from average 800 mg/kg to 31 mg/kg. Pleximmune assay, a measure of the inflammatory response of CD 154+ T-cytotoxic memory lymphocytes to donor cells, showed substantial decrease in peripheral blood. There were no complications associated with treatment. All patients are alive with graft function intact.

**Conclusions:** ECP is a safe and effective therapy for steroid- and biologic-refractory cellular rejection in pediatric and adult intestinal transplant recipients. Early use may reduce toxicities associated with conventional anti-rejection regimens.

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## Role of native liver derived ECM-gel to develop a novel approach for orthotopic hepatocyte transplantation

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**Background:** In conventional, hepatocytes have been injected via portal vein or directly into liver parenchyma for cell transplantation, however this methodology could not provide efficient cell survival or function *in vivo* due to their fragile engraftment and dispersion. Recently, novel methodology using hydrogels for hepatocyte transplantation have been introduced to enhance the engraftment and distribution of the cells. However, most commonly used material type I or IV collagen didn't show improvement of cell survival and function *in vivo*, since it failed to reproduce the native environment of liver. Therefore, alternative gels are required to develop for improvement of hepatocyte transplantation. This research is aimed to investigate the roles of liver-derived extracellular matrixes gel (L-ECM-gel) in cultivation *in vitro* and transplantation of human hepatocytes *in vivo*.

**Methods:** Solution of L-ECM-gel was prepared by the optimized protocol of decellularization and solubilization of porcine livers. For *in vitro* assay, human hepatocytes (HepG2 and PXB cells) were dispersed into the hydrogel solution, and immediately gelled in 37 incubator. For *in vivo* assay, hepatocyte was encapsulated in L-ECM-gel as the graft. The grafts were transplanted between the liver lobes of normal rat. Tacrolimus and Prednisolone were administered as immunosuppressants.

**Results:** *In vitro*, the hepatocytes formed cell aggregates by cell-cell interactions during cultivation in hepatocyte medium for 3 days. In quantitative analysis showed production of human albumin (hAlb) in culture supernatant. *In vivo*, grafts localized at the transplant sites and retained the human hepatocytes. Moreover, hAlb was detected in rat blood, which indicated that hepatocytes demonstrated sufficient functions in the rat body. Furthermore, same results were confirmed in another rat model where Thioacetamide was administered to induce liver fibrosis.

**Conclusions:** In this study, L-ECM-gel showed the favorable environment for cell engraftment and functionality. Further investigation is required whether L-ECM-gel could help to improve recipients liver fibrosis or damages on hepatocyte transplantation.

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## Prospective study to evaluate the effectiveness of donor-derived cell-free DNA for early diagnosis of biopsy-proven rejection in renal transplant recipients

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**Background:** In this study, we investigated to verify whether the titer of donor-derived cell-free DNA (dd-cfDNA) has diagnostic value in predicting biopsy-proven rejection in kidney transplant recipients (KTR).

**Methods:** This study was prospectively designed to verify the effectiveness of dd-cfDNA for the diagnosis of biopsy-proven rejection in KTR. Analysis was performed on 42 KTR in Seoul St. Mary's Hospital. All these patients underwent an indication biopsy for reasons such as elevated serum creatinine, proteinuria, and DSA detection. Blood samples were collected immediately before the biopsy and dd-cfDNA test was performed using the AlloSeq cfDNA kit. The biopsy specimen was diagnosed by a renal pathologist according to Banff classification.

**Results:** Of the total 42 patients, 12 patients were diagnosed with rejection, and the other 30 patients were diagnosed with glomerulonephritis, diabetic nephropathy, acute tubular necrosis, and BK virus nephropathy. The mean titer of dd-cfDNA in patients diagnosed with rejection was 1.38%, which was higher than 0.61% of patients without rejection ( $P=0.013$ ). The median dd-cfDNA in all patients was 0.425%. Patients with dd-cfDNA values higher than the median value were assigned to the high dd-cfDNA group, and other patients were assigned to the low dd-cfDNA group. As a result of comparing the pathologic findings between two groups, the glomerulitis and peritubular capillaritis scores were higher in the high dd-cfDNA group. Chronic glomerulitis score was also higher in the high dd-cfDNA group but was not statistically significant ( $P=0.079$ ). To evaluate the predictive value of cfDNA for rejection, receiver operating characteristic area under the curve revealed 0.74; 95% confidence interval, 0.58 to 0.91. Sensitivity and specificity for biopsy proven rejection at a cut-off of 0.39% dd-cfDNA were 91.7% and 63.3%, respectively.

**Conclusions:** In KTR, the dd-cfDNA is useful marker for allograft rejection. In particular, the predictive power of renal injury related to glomerulitis and peritubular capillaritis was high.

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## Antibody production after SARS-CoV2 vaccination and COVID-19 incidence in liver transplant recipients

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**Background:** Organ transplant recipients are immunocompromised and at high risk for COVID-19. In the present study, we investigated the antibody production after SARS-CoV2 vaccination and COVID-19 incidence in liver transplant recipients.

**Methods:** Thirty patients who were vaccinated at least 6 months after liver transplantation were included. IgG antibodies against nucleocapsid protein and spike protein (N-IgG, S-IgG) were quantified. We also investigated immunosuppressive therapy, number of vaccinations, severity of COVID-19, and outcome of PCR test-positive liver transplant recipients after January 2020.

**Results:** One patient had a subclinical infection with positive N-IgG and S-IgG titers before vaccination. Three patients were infected after their vaccination started; S-IgG antibody titers were positive in 45% before the second vaccination, and in 80%, 90%, and 90% after 1, 3, and 6 months the second vaccination, respectively. Median antibody titers were 227, 381, and 208 U/mL at 1, 3, and 6 months after the second vaccination, respectively, and decreased after 6 months. 78,800, 12,000, and 14,800 U/mL S-IgG in COVID-19 patients after twice vaccinations were significantly higher than vaccination, and the severity of COVID-19 was mild. Three patients were negative for S-IgG antibodies after vaccination and were treated with three immunosuppressive drugs. Of the 1,370 post-liver transplant patients under follow-up at our department, 12 had COVID-19 by the end of December 2021, all seven patients over the age of 60 had moderate or severe disease, and two of seven died.

**Conclusions:** Although the acquisition rate of antibody titers tended to decrease when three immunosuppressive drugs were used in combination, antibody titers could be maintained by twice vaccinations even in post-liver transplant recipients. Appropriate dose reduction of immunosuppressive agents and patient management are important in the treatment of COVID-19.

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## Rare manifestations of disseminated histoplasmosis after renal transplant: bone histoplasmosis and thrombotic microangiopathy: a case report

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Histoplasmosis is an opportunistic infection affecting those with weakened cellular immunity. Suppression of cell mediated immunity after transplant can allow unchecked progression of this disease. A 41-year-old male patient from North India was diagnosed with localized histoplasma infection (Cheek region) based on biopsy at 1.2 years after renal transplant. This localized infection was treated with reduction of immunosuppressive medication (mycophenolate) and itraconazole. Upon resolution of symptoms itraconazole was stopped by local physician and immunosuppressive medications reinstated after 3 weeks. Three years after transplant patient again presented with multiple painful skin lesions with bony involvement (right ulna and left tibia). Biopsy from skin and involved bone revealed histoplasma. Whole body PET scan revealed metabolically active disease. Diagnosis of disseminated histoplasma was kept and started on liposomal amphotericin B (induction) and itraconazole (maintenance for 1 year) with itraconazole drug level monitoring. Also immunosuppression was reduced (mycophenolate stopped). Follow-up MRI at 3 months showed size reduction of involved lesions but bone biopsy revealed persistence of histoplasmosis. During same time serum creatinine also rose from baseline of 1.2–1.4 mg/dL to 2.4 mg/dL. Renal graft biopsy revealed glomerular and vascular thrombotic microangiopathy (TMA). Based on clinical response, treatment was continued with plan for interval surveillance renal graft biopsy. Surveillance graft biopsy after 3 months showed resolution of TMA. The whole-body PET scan after 6 months of initial PET showed decrease in FDG avidity and extent of the lesions. At 9 months of treatment completion patient has a stable graft function with creatinine at 2.2 mg/dL to 2.4 mg/dL on tacrolimus and prednisolone. Itraconazole is being continued with therapeutic drug monitoring. Histoplasmosis, particularly if involving bone, is slow to respond to antifungal therapy. Prolonged therapy with therapeutic drug monitoring, ideally supported by culture and sensitivity reporting, is the sine qua non of histoplasma treatment. Disseminated histoplasmosis can cause TMA which regresses on treating histoplasmosis.

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## The clinical significance of vitamin D changes before and after lung transplantation

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**Background:** Low vitamin D levels have been associated with the prognosis of lung transplant recipients, perhaps reflecting the patient's poor health condition. However, the clinical significance of vitamin D changes before and after transplantation was unknown.

**Methods:** We retrospectively reviewed the medical records of patients who underwent lung transplantation at Severance Hospital in Seoul, Korea from January 2013 to March 2020. Among a total of 267 transplant recipients, the clinical outcomes of 171 patients with both pre- and posttransplant vitamin D measurements (serum 25(OH)D level) were investigated.

**Results:** Before and after transplantation, the 25(OH)D levels increased in 101 patients (59.1%) and decreased in 70 patients (40.9%). Their mean changes were +8.2 and -7.5 ng/mL, respectively. Compared with the 25(OH)D-increase group, the 25(OH)D-decrease group had a longer transplant waiting time and showed a higher rate of retransplantation. In addition, there were no significant differences in the baseline characteristics between the two groups. In the comparison of postoperative complications, the incidence of BPF (bronchopleural fistula) was higher in the 25(OH)D decrease group than in the 25(OH)D-increase group, and the total hospital stay was longer in the 25(OH)D-decrease group. There were no significant differences between the two groups in terms of overall mortality and variables related to prognosis. In the correlation analysis of 25(OH)D changes, there was a positive correlation between survival time and posttransplant FEV1, and a negative correlation with total hospital stay. Survival analysis according to the changes in 25(OH)D levels did not show significant differences between the survival curves.

**Conclusions:** Patients with decreased vitamin D levels before and after transplantation had increased transplant waiting time, increased retransplantation, increased BPF, and increased length of hospital stay compared to patients with increased vitamin D levels, but there was no statistical difference between the two groups in overall mortality and survival curves.

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## Factors influencing low organ donor registration rates in Bangkok, Thailand are not religious in nature

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**Background:** Southeast Asia has the lowest rates of organ transplantation and donor registration globally. In Thailand, 95% of the population is Buddhist and its core teachings dissuade followers from any action following clinical death that may cause trauma in their journey to rebirth. We sought to determine the effects of Thai culture and Buddhist religion on attitudes toward transplantation and donor registration rates.

**Methods:** This study utilized a convenience sample of 138 participants who were randomly selected to complete a survey assessing beliefs and opinions on organ transplantation.

**Results:** Overall support of organ donation among participants was 91.67%, but only 20.83% of respondents were registered organ donors. 87.5% of registered donors disagreed with the importance of a body having all parts when buried, compared to only 58.33% of unregistered participants who disagreed ( $P=0.0357$ ). However, 73.68% of unregistered organ donation supporters stated the desire to have their organs donated after death. The most important factor for organ donation among registered donors was health status of the recipient (38.10%), followed by assurance of respectful treatment of the organ (28.57%). Unregistered individuals indicated relationship to recipient as the most important factor in organ donation (43.66%), differing significantly from the registered group ( $P=0.02$ ). Willingness to donate and receive an organ was 87.29% and 81.90%, respectively. Of organ donation supporters unwilling to register as an organ donor, 52.17% said they were change their mind if someone was in need.

**Conclusions:** Survey responses indicated a high rate of acceptance for organ donation, despite low rates of donor registration among respondents. Low rates of transplantation in Thailand seem to be unrelated to Buddhist and cultural beliefs though registered donors demonstrate a greater degree of acceptance for postmortem removal of organs. Further investigation is necessary to identify future pathways for increasing organ donor registration in Thailand and other Southeast Asian countries.

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## The three-step method to break death news to family of the brain-dead case: a successful experience

Seyed Khashayar Mirbahaeddin, Aryan Aarabi, Mahdi Haghshenas, Faezeh Eslami, Saba Mardeh Katani, Leila Kia, Niloufar Bahrapour, Fariba Ghorbani, Mojtaba Mokhber Dezfoli

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Organ transplantation is one of the most important and challenging fields of medicine. In Iran, brain death cases are the most frequent source of transplanted organs. Donated organs are only available after successful consent seeking from the family of the brain dead case. The consent seeking is assigned to donor coordinator according to the Iranian protocols. A serious pitfall during the consent process is any discussion about organ donation with family members before they reach the internal acceptance of death. This mistake can dramatically reduce the chance of success in consent seeking and can stem from an insufficient time between the announcement of a death and the discussion about organ donation. The three-step method for breaking the death news is based on systematic desensitization. It breaks the death news to three sub-news. This advances the beginning of exposure of the family to the bad news facilitating the acceptance process. Three sub-news are as follows: sub-news 1 "severe brain injury", a severe brain damage is explained to be the reason of the decreased level of consciousness. The pathogenesis of this process is described for the family; sub-news 2 "vegetative state or worse", the family realizes how serious their loved one's condition is (it is further revealed that their loved one "will never get up from the bed."); sub-news 3 "death"; the family is informed of the death. Breaking the death news in three steps brings forward the exposure of family members to the bad news and provides ample time for them to accept the death of their loved one before any discussion about organ donation. A further benefit of this method is that the extended time affords the coordinator to build a robust trust with the family members, and to identify the anatomy of the family and its influential members.

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## Significant association between warm ischemic time and posttransplant biliary stricture

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**Background:** Biliary stricture after liver transplantation is unsolved issue. The aim of the present study is to detect the predictive factor of biliary stricture after liver transplantation.

**Methods:** From January 2010 to March 2022, we retrospectively reviewed the 83 patients underwent liver transplantation in Ehime University Hospital. Of the 83 patients, 12 patients of within 90-day mortality were excluded and 71 patients were enrolled. Definition of biliary stricture was the patients required biliary stenting for elevated liver enzymes/bilirubin or cholangitis.

**Results:** Posttransplant biliary stricture occurred in the 25 (35.2%) patients and the median day from transplantation to biliary stenting was 121 days (range, 42–1,162 days). Of 25 patients, 21 were anastomotic stricture and four were non-anastomotic stricture. No significant differences were observed in incompatible blood type, cold ischemic time, and number of bile ducts between the group with biliary stricture and that of not. In the log-rank test comparing the occurrence of biliary stricture generated by Kaplan-Meier method, postoperative complication (Clavien-Dindo classification 3), biliary leakage, intraoperative estimated blood loss >68 mL/kg, intraoperative red cell transfusion 0.2 U/kg, intraoperative final portal vein pressure >16 mmHg, and warm ischemic time >60 minutes showed significantly higher rate of biliary stricture ( $P=0.013$ ,  $P<0.0001$ ,  $P=0.001$ ,  $P<0.001$ ,  $P=0.006$ , and  $P=0.013$ ). In multivariate analyses using Cox-hazard model, intraoperative red cell transfusion 0.2 U/kg (hazard ratio [HR], 6.776; 95% confidence interval [CI], 2.469–18.591), intraoperative final portal vein pressure >16 mmHg (HR, 4.587; 95% CI, 1.664–12.645), and warm ischemic time >47/60 minutes and >60 minutes (HR, 14.420, 27.044; 95% CI, 1.793–115.995, 3.128–233.775) were selected as independent predictor of biliary stricture.

**Conclusions:** Long warm ischemic time was associated with posttransplant biliary stricture.

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## Cost-effective donor lung preservation with high-volume continuous perfusate purification in *ex vivo* lung perfusion

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**Background:** *Ex vivo* lung perfusion is an ideal platform for donor lung evaluation and preservation. Its application in Asia was limited due to the high running costs and potential lung reperfusion injury. Previous research showed that perfusate purification could maintain perfusate homeostasis during *ex vivo* lung perfusion and improve the perfuse outcome. However, the optimal purification rate remains unclear.

**Methods:** A home-designed EVLP system (LuPS-1) which provides the capability of continuous perfusate purification (CPP), was used in this study. Seventeen human donor lungs experienced extended cold ischemia preservation and were perfused by the LuPS-1 system for 12 hours. Five of them were set as the control group. The rest 12 lungs were separated into the low-volume CPP group (LV-CPP, n=6) and the high-volume CPP group (HV-CPP, n=6), the hyperfiltration and replacement volume targets were set at 500 mL/hr for the LV group, and 1500 mL/hr for the HV group. Perfusate electrolyte and lactate profiles were analyzed. Lung function parameters, radiographic, histologic assessment, and weight gain were used for donor graft evaluation. Cell apoptosis and tight junction protein levels in the donor graft were investigated.

**Results:** All the donor lungs from the two CPP groups and two lungs from the control group accomplished 12 hours of EVLP. HV-CPP group showed stable perfusate electrolyte, lactate profile, and significantly decreased lung weight gain compared with the other two groups. High-volume CPP reduced lung reperfusion injury characterized by significantly reduced cell apoptosis and lower microvascular permeability.

**Conclusions:** High volume CPP improved donor lung function and reduced lung injury during EVLP. Meanwhile, it significantly reduced running costs.

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## Risk of graft loss on once-daily versus twice-daily tacrolimus in kidney transplant patients: a meta-analysis

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**Background:** Tacrolimus has been used as immunosuppressant for various organ transplantation, including kidney. Recently, clinician is more interested in using once-daily tacrolimus compared to twice-daily due to higher adherence. One of main concern of kidney transplant is graft loss. Tacrolimus should be able to prevent graft loss in transplant patients. The primary objective of this study was to evaluate risk of graft loss of once-daily and twice-daily tacrolimus.

**Methods:** We systematically searched PubMed, Directory of Open Access Journal (DOAJ), and ScienceDirect screening with the following search terms: (kidney transplant OR renal transplant) AND (extended-release tacrolimus OR once-daily tacrolimus) AND (immediate-release tacrolimus OR twice-daily tacrolimus) AND (randomized controlled trial). We only included research articles fulfilling the following inclusion criteria: (1) studies enrolled adult patients (>18 years old) on tacrolimus after kidney transplantation, (2) studies studied graft failure as primary outcome.

**Results:** Total seven studies were analyzed. We found that once-daily and twice-daily tacrolimus did not differ in risk of graft loss in kidney transplant patients (OR, 0.96 [0.65, 1.42];  $P=0.84$ ;  $I^2: 0\%$ ,  $P=0.76$ ).

**Conclusions:** Once-daily and twice-daily tacrolimus did not differ in risk of graft loss in kidney transplant patients.

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## Risk factors of incisional hernia after liver transplantation in the era of mammalian target of rapamycin inhibitors combined usage

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**Background:** Incisional hernia (IH) is a common complication after liver transplantation (LT) with an incidence of 5% to 46%. The purpose of this retrospective study was to evaluate the risk factors for IH development after LT in the era of mammalian target of rapamycin inhibitors usage (mTORi).

**Methods:** Data on patients who underwent LT at Seoul National University Hospital between 2015 and 2021 were retrospectively reviewed. They were divided into two groups according to occurrence of IH during their postoperative course; an IH group and a non-IH group.

**Results:** There were 646 patients during the study period. Among those, 24 (3.7%) patients experienced IH. The mean body mass index was significantly higher in the IH group compared to non-IH group (25.3 vs. 23.9;  $P=0.024$ ). There were no significant differences in age, gender, model for end-stage liver disease score, operation time, usage of mTORi between the two groups.

**Conclusions:** Attention should be paid to IH in obese patients.

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## BK viremia after kidney transplantation: efficacy of stepwise treatment

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**Background:** BK polyomavirus (BKV) increases the risk of graft loss in kidney transplant recipients. However, there is no consensus on treatment methods and outcomes are different. The purpose of this study was to compare the outcomes according to the different treatment methods in kidney transplant recipients who developed BKV viremia.

**Methods:** From January 1, 2016 to June 30, 2020, patients with BKV viremia after kidney transplantation at two participating institutions was retrospectively enrolled. The demographics, clinical information, and laboratory data were collected and analyzed.

**Results:** A total of 199 patients were enrolled and classified into three groups according to the stepwise treatments; group A (reduction of tacrolimus and mycophenolate) (n=123), group B (reduction of tacrolimus and mycophenolate and addition of leflunomide) (n=23), and group C (reduction of tacrolimus and mycophenolate and addition of mTOR inhibitor) (n=53). The average age was 50.7 years, and 125 (62.78%) patients were male. The number of patients suffering BKV-associated nephropathy (BKVAN) was 23 (11.6%), and four (3.3%), two (8.7%), 17 (32.1%) respectively in group A, B, and C (P<0.001). Acute rejection occurred in 69 (34.7%) patients, 31 (44.9%), 11 (47.8%), and 27 (50.9%) patients, respectively (P=0.001). The de novo donor-specific antibody (DSA) was found in 21 (10.6%) patients. DSA was found in 13 (10.6%), 0 (0.0%), and eight (15.1%) patients, respectively (P=0.529). The mean follow-up period was 45.7 months. The 3-year graft survival was 98.0%. The 3-year patient survival was 97.0% in total. The initial viral load at the time of diagnosis was 2000.0 (IQR, 1000.0–5000.0), 4198.0 (IQR, 811.0–10715.0), and 7500.0 (IQR, 2250.0–25750.0) copies/mL, respectively (P<0.001). The rate of decreasing serum viral load was 1000.0 (IQR, 359.3–2646.3), 1397.7 (IQR, 1077.0–3571.7), and 6333.3 (IQR, 2666.7–14525.0) copies/mL/month, respectively (P<0.001).

**Conclusions:** We compared three different treatments to manage BKV infection in kidney transplant recipients. Considering costs and effects, treatment modalities for BKV infection should be carefully chosen in kidney transplant recipients.

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## De novo posttransplant lymphoproliferative disorders in heart transplant recipients: predictors and clinical outcomes

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**Background:** Posttransplant lymphoproliferative disorder (PTLD) is a major cause of morbidity and mortality in heart transplant (HTx) recipients. However, the real-world clinical profiles and predictors of PTLD have not been well studied.

**Methods:** We retrospectively analyzed clinical characteristics, predictors, and outcomes of PTLD in 28,136 heart alone transplants recipients between January 2000 and June 2015 from the International Society for Heart and Lung Transplantation Thoracic Organ Transplant Registry, with minimal exclusion.

**Results:** Ten-year incidence of PTLD after successful discharge from HTx during 2000–2007 was 3.8%. The adjusted overall risk of mortality was significantly higher in patients with PTLD within 3 years after HTx, compared to those without PTLD (HR, 2.42; 95% CI, 2.01–2.91;  $P < 0.001$ ). Bimodal peak of recipient age was noted regarding both PTLD incidence and mortality within the 3 years of HTx. Both adjusted risk of PTLD development and mortality were lower in recent era of HTx in 2008–2015, compared with earlier era of 2000–2007 (incidence: HR, 0.75; 95% CI, 0.57–0.98;  $P = 0.038$ ) (mortality: HR, 0.86; 95% CI, 0.81–0.91;  $P < 0.001$ ). Recipients age at transplant, male recipient, high risk Epstein-Barr virus (EBV) mismatch (donor positive and recipient negative for EBV) were independent risk factors for PTLD within 3 years, while primary maintenance therapy with cyclosporine (vs. tacrolimus) at initial discharge was found to be a protective factor.

**Conclusions:** The incidence as well as mortality of PTLD has decreased in recent years of HTx, possibly with tailored peri-transplant management and advances in immunosuppressive strategies. Clinical characteristics such as recipient age, male recipients, and EBV status mismatch are key factors for assessing the risk of PTLD, associated with detrimental course in post-HTx care. These findings will guide clinicians to identify high risk PTLD patients, and assist tailored peri- and long-term post HTx management with vigilant surveillances for PTLD.

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## Experience from Vietnam and lessons learned in setting up a living donor liver transplant program

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**Background:** Living donor liver transplantation (LDLT) is the only treatment option for patients with end-stage liver disease (ESLD) where cadaveric donors are not available. In developing countries, the inception of LDLT programs remains a challenge. The first successful liver transplantation in Vietnam underwent in 2004. The objective of this study was to report outcomes of 140 LDLT recipients in a developing country and to highlight the challenges encountered by a new LDLT program in a resource-limited setting in highest-volume center in Vietnam.

**Methods:** We retrospectively reviewed recipients who underwent LDLT between October 2017 and August 2022 in 108 Military Central Hospital. Demographics, etiology, graft characteristics, and operative variables were assessed. Outcome was assessed on the basis of morbidity and mortality. All complications of three on the Clavien-Dindo grading system were included as morbidity. Estimated 1-year, 3-year, 5-year survival was calculated using Kaplan-Meier curves, and a log-rank test was used to determine the significance. Outcomes between the first 80 LDLTs (group 1) and latter 60 LDLTs (group 2) were also compared.

**Results:** Median age was 48.5 (11–80) years, whereas the median MELD score was 24 (7–37). The male to female ratio was 4:1. ACLF to hepatitis B virus was the most common indication (40% patients). There were 43 patients significant (grade 3) complications. The most common morbidities were bile leaks in eight and biliary strictures in 21 patients. Overall mortality in patients who underwent LDLT for ACLF was 15.7%. Estimated 1-year survival was 91%, 3 years 85%. Patients who underwent transplantation in the latter period had a significantly lower overall complication rate (36% vs. 68%;  $P=0.01$ ).

**Conclusions:** Comparable outcomes can be achieved in a new LDLT program in a developing country. Outcomes improve as experience increases.

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## Post-heart transplant outcomes according to age and ECMO support: implications for New Heart Allocation System in Korea

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**Background:** Although recipient age and extracorporeal membrane oxygenation (ECMO) support are known to affect clinical outcomes after heart transplantation (HTx), data are limited for recent Korean recipients. We sought to evaluate the impact of recipient age and ECMO support on the post-HTx outcomes using nationwide prospective cohort.

**Methods:** From the Korean Organ Transplant Registry (KOTRY), we analyzed clinical characteristics of 628 patients who received HTx from January 2015 to December 2020. Enrolled recipients are divided into three groups according age; below 50 years (group 1), between 50 and 64 years (group 2) and over 65 years (group 3). Post-HTx survival and rates of infection, moderate-to-severe rejection and cardiac allograft vasculopathy (CAV) were analyzed.

**Results:** Recipients with old age tended to have more comorbidities, heart failure of ischemic etiology, more ventricular assist device for bridge to transplantation and older age of donor. Post-HTx survival was significantly different among three groups for 5 years ( $P=0.025$ ). Recipient age over 65 years is an independent predictor for increased mortality (group 1 vs. 3; hazard ratio, 2.14; 95% CI, 1.14–4.01;  $P=0.018$ ), after adjusting clinical variables. Post-HTx survival rate showed significant difference according to pre-HTx ECMO support in group 2 ( $P<0.001$ ) and group 3 ( $P<0.001$ ) but not in group 1 ( $P=0.054$ ). Incidence of moderate-to-severe rejection, CAV was similar between three groups, but infection was more prevalent in group 3 ( $P<0.001$ ). Furthermore, pre-HTx ECMO support was associated with significant higher rates of post-HTx mortality ( $P<0.001$ ), infection ( $P<0.001$ ), but no significant differences in rates of moderate-to-severe rejection ( $P=0.555$ ) and CAV ( $P=0.244$ ).

**Conclusions:** Recipient age over 65 years is significantly associated with increased mortality and higher infection after HTx, especially with ECMO support. These data might have clinical implications for new heart allocation system in Korea.

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## Postoperative outcomes and risk factors for cardiac surgery in solid organ transplant recipients

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**Background:** This study aimed to investigate postoperative outcomes and risk factors associated with mortality and readmission after cardiac surgery in solid organ transplant recipients.

**Methods:** We retrospectively analyzed 78 adult solid organ transplant recipients (58.7±10.5 years; 51 males) who consecutively underwent cardiac surgery between January 2000 and February 2022 at Asan Medical Center. Cardiac surgery included isolated coronary artery bypass grafting (CABG), isolated valve, or both CABG and valve surgical procedures. Primary outcomes included all-cause mortality and readmission.

**Results:** A total of 48 (61.5%) patients underwent isolated valve surgery, 21 (26.9%) patients underwent isolated CABG, and 9 (11.5%) underwent both CABG and valve surgery. Among these patients, 11 patients had valve surgery for infective endocarditis. Type of organ transplant included 43 (55.1%) patients with kidney, 33 (42.3%) patients with liver, and 2 (2.6%) patients with lung transplants. Three (3.9%) patients had an operative (30-day) mortality. During median follow-up of 2.3 (min-max, 0.1–18.6) years, primary outcomes included death in 24 patients and readmission in 31 patients, demonstrating overall survival at 5 years of 69.4% and freedom from readmission at 5 years of 49.0%, respectively. Of note, patients with body mass index (BMI) <20 kg/m<sup>2</sup> demonstrated a higher mortality of 44.4% at 1 year compared to 15.1% for those with BMI ≥20 kg/m<sup>2</sup>. On multivariable Cox regression analysis, age and BMI were associated with all-cause mortality (hazard ratio [HR], 1.08; 95% confidence interval [CI], 1.02–1.14; P=0.008 and HR, 0.80; 95% CI, 0.67–0.96; P=0.02, respectively).

**Conclusions:** Cardiac surgery is feasible for solid organ transplant recipients with acceptable morbidity and mortality. Old age and low BMI were found as risk factors for worse postoperative outcomes.

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## Early biliary leakage after liver transplantation: a single center study

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**Background:** Liver transplantation (LT) is the gold standard treatment for patients with end-stage liver disease. In Mongolia, the main reason for LT is Liver cancer and HBV, HCV related LC. Liver cancer is by far the leading cancer in Mongolia, contributing almost two-fifths of the total cancer burden. National Cancer Center (NCC) is the second LT center in Mongolia. NCC of Mongolia was performed first LDLT for HCC patient in January 2018 collaborating with Samsung Medical Center of Korea.

**Methods:** Retrospective review of prospectively collected data study sample; 50 living donor and 10 deceased donor LT recipients, transplanted in the National Cancer Center, Ulaanbaatar, Mongolia, between January 2018 and July 2022. Collected data before and after transplant are age, BMI, indication, MELD score, type of allograft, type of anastomosis, biliary complications, management of these complications and survival BC's included: early biliary leaks.

**Results:** Fifty patients underwent LDLT, 10 patients underwent DDLT. There was not a split liver graft in DDLT patient. Median follow-up time was 49. Average recipient age was 48. All patients were transplanted for end stage liver disease or hepatocellular carcinoma MELD-Na score was used to prioritize patients for graft allocation. One-month, 6-month, 1-year and 3-year survival rates were 100%, 91.3%, 87% and 81%. Fourteen (23.3%) biliary leakage occurred during follow-up. With biliary fistula (BF) were surgically treated in four patients who underwent hepatico-jejunostomy. Two patients were with favorable outcome. With BF were surgically treated in two patients who underwent re-anastomosis with internal tube, one patient was favorable outcome eight patients with BF were treated. By ERCP stent placement in six patients. Two patients; early after transplant, by PCD in bilioma, after 3 months stent placement by ERCP.

**Conclusions:** Biliary complications were recognized early and managed using diverse therapeutic modalities, ranging from minimally invasive to surgical interventions. Future efforts should be directed toward reducing the incidence of posttransplant complication.

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## Pretransplant C-reactive protein-to-albumin ratio predicts mortality in kidney transplant recipients: a retrospective cohort study

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**Background:** C-reactive protein (CRP)-to-albumin ratio (CAR) has been reported as a more effective prognostic indicator than CRP or albumin alone in various diseases. However, the association between CAR and transplant outcomes was not studied in kidney transplantation (KT). This study aimed to evaluate the predictive value of CAR in kidney transplant recipients (KTRs).

**Methods:** A total of 924 patients who underwent the first KT in the Kyungpook National University Hospital from January 2006 to August 2020 were retrospectively analyzed. KTRs were classified into quartile groups according to the pretransplant CAR value. A multivariate Cox proportional hazard regression analysis was applied to compare the hazard ratio (HR) of mortality by CAR groups.

**Results:** Fifty-nine patients died during the mean posttransplant period of 85.2±44.2 months. The incidence of all-cause death increased linearly according to the increase of CAR quartile (quartile 1, 3.0%; quartile 2, 4.8%; quartile 3, 7.8%; quartile 4, 10.0%; P=0.001) (Figure 1). The incidence of infection-related death also increased according to the increase of CAR quartile (quartile 1, 0.9%; quartile 4, 5.2%; P= 0.004). After adjusting for confounding factors, quartile 3 and quartile 4 groups showed increased risk of all-cause mortality compared to the quartile 1 (quartile 3, HR, 2.49; 95% confidence interval [CI], 1.04–5.99; P=0.041; quartile 4, HR, 3.09; 95% CI, 1.31–7.27; P=0.010). Quartile 4 was also independently associated with infection-related mortality (HR, 5.83; 95% CI, 1.27–26.8; P=0.023). The area under the curve of the CAR was higher than CRP or albumin alone in receiver operating characteristic curve for all-cause death and infection-related death both. CAR was not related with allograft failure or acute rejection.

**Conclusions:** A higher pretransplant CAR is associated with increased risk of posttransplant mortality, especially with infection-related mortality. CAR can be a useful predictor of mortality in KTRs.

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## Outcome of total necrosis of hepatocellular carcinoma after liver transplantation: is it really totally gone?

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**Background:** Total necrosis of hepatocellular carcinoma (HCC) by locoregional treatment (LRT) is considered to have no tumor viability. Nonetheless, there is no sufficient evidence of recurrence prevalence after liver transplantation. This study aims to investigate the prognosis of patients who are diagnosed with a totally necrotic nodule on explant hepatectomy after liver transplantation (LT).

**Methods:** We conducted a retrospective study of patients diagnosed with a totally necrotic nodule after liver transplantation due to HCC. A total of 165 HCC patients were included who underwent living donor or deceased donor liver transplantation from 2000 to 2020 in Seoul National University Hospital.

**Results:** A total of five (3.03%) patients had HCC recurrence during follow-up after transplantation. Five-year overall survival and recurrence-free survival of totally necrotic nodule patients were 92.7% and 98.1% respectively. Four (80%) patients of the recurred group showed mortality even after further treatment including TACE, surgery, or systemic treatment. Univariate analysis of clinicopathological factors identified maximal diameter >5cm of a totally necrotic nodule as the only factor associated with a high probability of recurrence following LT ( $P=0.005$ ).

**Conclusions:** Total necrosis of HCC via locoregional treatment demonstrate excellent outcome for patients undergoing transplantation. Nevertheless, preoperative large tumor size should be considered as high-risk group of recurrence after transplantation, suggesting active surveillance after LT.

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## Equine antithymocyte globulin for treatment of acute T-cell mediated rejection

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Acute cell mediated rejection is a major worry in the post transplant scenario as it can lead to irreversible nephron loss. Although steroid pulses and ATG (antithymocyte globulin) has been effective, the cost of transplant therapy escalates and the risk of posttransplant infection also increases. We have treated 27 of our post-kidney transplant recipients with biopsy proven pure acute cell mediated rejection over a period of 7 years with equine ATG (eATG) successful. A total of five to 10 doses of eATG were used depending on the severity, each dose given was 10 mg/kg body weight. Of the 27 patients, 26 could complete the treatment and for one patient treatment was stopped because of infection and sepsis. The recipients either had a live related transplant where only pulse steroid was given as induction, or spousal and cadaver transplant where eATG was given as induction therapy. Out of 26 patients who received treatment 21 attained a normal renal function after the therapy and five recipients had partial response. The patients showed excellent response to treatment with no additional risk of infection or malignancy during the follow period. There were no drug related side effects or reactions in the treated patients. The cost of five doses of eATG is USD 1,125 compared to USD 2,500 of rabbit ATG which is significantly less and helps lessen the cost of the therapy. We found that five doses of eATG was sufficient in most of the cases for sustained and effective response. Thus, eATG should be considered as a first line choice of therapy for anti-rejection and perhaps induction therapy in posttransplant treatment regimens as it is an effective and cheap therapy without any adverse events.

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# Inhalation alone versus inhalation plus intravenous colistin for multidrug-resistant gram-negative bacterial infection after lung transplantation

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**Background:** After lung transplantation, patients are exposed to the risk of various infections accounting for significant morbidity and mortality. Multidrug-resistant gram-negative (MDR-GN) bacteria are emerging pathogen that is difficult to treat. Intravenous (IV) colistin retains good activity against these pathogens, despite its known nephrotoxicity, especially with concurrent calcineurin inhibitor use. Several studies revealed that nebulized colistin provides good therapeutic responses with less nephrotoxicity. Since there are little data about the efficacy of nebulized or intravenous administration of colistin in MDR-GN infection after lung transplantation, this study compared the nephrotoxicity and clinical outcomes of these two delivery routes in lung transplantation.

**Methods:** From January 2015 to December 2020, 307 lung transplantations were performed. Ninety-eight (31.9%) patients received colistin due to MDR-GN infection. Forty-seven patients received only nebulized colistin and 51 patients were treated with intravenous with or without nebulized colistin. Variables related to clinical features were retrospectively.

**Results:** *Acinetobacter baumannii* was the predominant primary microorganism (n=54, 55.1%), followed by *Klebsiella pneumoniae* (n=28, 28.6%). No significant difference of basic characteristics was observed between the inhalation and the intravenous groups (Table 1). The intravenous group showed longer duration of colistin use (P=0.001) and MDR-GN was more frequently isolated from blood and wound than the inhalation group (P=0.007, P=0.027, respectively). There was no difference in the median creatinine clearance before colistin between the groups. The incidence of nephrotoxicity was significantly higher in the intravenous group (P<0.001). The achievement of microbiological eradication and clinical cure were significantly higher in the inhalation group than the intravenous group (P=0.001, P=0.007, respectively).

**Conclusions:** Our findings suggested that colistin Inhalation alone could provide an effective and safe treatment option for MDR-GN infection after lung transplantation. However, indication for nebulized colistin should be decided deliberately, especially when MDR-GN is isolated from blood or infected wound.

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## Immunogenicity of an mRNA-based COVID-19 vaccine among adolescents with obesity or liver transplants

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**Background:** The mRNA-based SARS-CoV-2 vaccine (BNT162b2) is initially used in Thailand as a voluntary policy for children 12–18 years of age. There is limited data regarding the immunogenicity of this vaccine among immunosuppressed or obese individuals. This study aimed to evaluate the humoral immune response in adolescents with obesity or liver transplants (LT) after receiving two doses of BNT162b2.

**Methods:** Sixty-eight participants, comprising 12 LT, 24 obese and 32 healthy adolescents, were enrolled. The immunogenicity was evaluated by anti-SARS-CoV-2 spike total antibodies (Elecsys), surrogated viral neutralization test (sVNT) against two variants of concern, including Delta and Omicron. The specimens were collected at baseline and 4 weeks after the second dose of vaccination. All participants were monitored for adverse events by phone call after each dose of vaccination.

**Results:** The median age of enrolled subjects (44 males) was 15 (range, 13–16) years. At the median time of 27 (range, 24–29) days after the second dose, the median antibody levels were 1,173 (range, 440–2,300), 2,653 (range, 1,914–4,027) and 4,166 (range, 2,634–7,687) among LT, obese and control, respectively ( $P < 0.001$ ). LT recipients who received mycophenolate mofetil tended to develop a lower antibody response, compared with other regimens (843.7 [440.5–2769.8] vs. 1357.5 [493.7–2300.7],  $P = 0.83$ ). Among obese, the presence of liver stiffness measurement greater than 5.5 kPa by Fibroscan was significantly associated with higher median antibody levels. The injection site pain was the most common local adverse event and occurred 96% after each dose. All nine participants (three obese, six control) developed a COVID-19 infection with a median time of 49 (range, 23–108) days from the second vaccination. All were mild and recovered without any consequence.

**Conclusions:** Our study supports that the booster regimen in specific groups, including LT recipients and obese individuals is needed. BNT162b2 is capable of reducing COVID-19 severity and is safe in adolescents.

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## Auxiliary liver xenotransplantation technique in a transgenic pig to non-human primate model: a surgical approach to prolong survival and better understand graft rejection

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**Background:** Xenotransplantation using pigs' liver has long been proposed as an alternative method to overcome worldwide donor shortage, or more importantly as a bridge to allotransplantation. However, xenotransplantation in a pig-to-primate model has been challenged by profound thrombocytopenia and coagulation disorders, leading to uncontrollable hemorrhage and early mortality. Here we suggest that a left auxiliary technique using left lateral lobe graft can potentially be a useful model to help broaden knowledge on liver xenotransplantation (XLT).

**Methods:** Fifteen consecutive XLTs were carried out using male cynomolgus monkeys of specific pathogen-free health status as recipients. All experiments were approved by the Institutional Animal Care and Use Committee in Seoul National University Hospital (SNUH-20-0108-S1A3). Right auxiliary XLTs were performed in two cases, orthotopic XLTs in eight cases, and left auxiliary XLTs in five cases.

**Results:** None of the right auxiliary XLT cases survived after surgery due to massive bleeding during the recipient right hepatectomy. Right lobe of the primate's liver encircles the inferior vena cava (IVC) and dissection between the right liver and IVC was the main cause of bleeding. Orthotopic XLT cases survived less than 7 days, and the early mortality was related to profound thrombocytopenia and coagulopathy. Two recipients out of the five left auxiliary XLTs survived more than 3 weeks without thrombocytopenia or anemia. One of them survived 34 days, which is the longest survival reported after a pig-to-primate XLT.

**Conclusions:** Left auxiliary XLT is a feasible operative technique for XLT experiment using non-human primates. With this approach, the feared risk of thrombocytopenia and coagulopathy associated with XLT can be minimized, thus achieving extended survival and allowing for longer evaluation of xenograft. This may help better understand histopathological and immunological changes that occur in the xenograft following XLT.

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## Intra-arterial thrombolysis for early hepatic artery thrombosis following liver transplantation: a case report

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**Background:** Hepatic artery thrombosis is a rare complication but should be detected at an early time. Early hepatic artery thrombosis is the major cause of graft failure and mortality following liver transplantation. At this time, the following methods can be used including retransplantation, revascularization, intra-arterial thrombolysis (TPA) treatment, and also observation.

**Methods:** On the first day after the operation, hepatic artery thrombosis was detected using US Doppler, and revascularization surgery was performed urgently using an RGEA vessel. However, due to the patient's arterial damage, revascularization surgery failed. Therefore, in collaboration with the angiography department, we performed TPA (alteplase) treatment on the second day after the liver transplantation.

**Results:** At present, one case of hepatic artery thrombosis occurred out of a total of 60 liver transplants, and intra-arterial thrombolytic infusion treatment was performed. One year after surgery, biliary stricture occurred and ERCP-stenting was performed. He is currently being monitored for the third year after the operation.

**Conclusions:** Early hepatic arterial thrombosis is one of the most serious complications after liver transplantation, and it is important to detect and treat it at an early stage. Although the intra-arterial infusion of TPA was successful in this case, it is not the best option. It is believed that there is a risk of complications of the biliary tract after surgery.

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## Successful eculizumab rescue therapy of atypical hemolytic uremic syndrome in kidney transplant recipient: a case report

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Atypical hemolytic uremic syndrome (aHUS) is a form of thrombotic microangiopathy (TMA) that results in end-stage renal disease (ESRD) in up to half of patients without prompt treatment. Patients with aHUS often have predisposing dysfunction related to complement pathway where continuous activation of complement proteins is triggered by various events, including organ transplantation. Use of eculizumab, a terminal complement protein blockage, has been reported in several studies to be effective in posttransplant TMA. This is a report of aHUS in kidney transplant recipient which was successfully rescued with early use of eculizumab. The patient was 32-year-old male with ESRD from IgA nephropathy and the donor was his 60-year-old mother. Cross matching tests were all negative and the graft showed immediate good function. On postoperative day (POD) 3, thrombocytopenia, anemia without bleeding, and elevated lactate dehydrogenase made clinical diagnosis of TMA. Plasma exchange (PE) was immediately initiated along with tacrolimus withdrawal, and differential diagnosis of TMA and biopsy were performed. Despite 10 PE sessions, hematological response was only partial and renal dysfunction was persistent, prompting initiation of eculizumab (900 mg weekly) treatment from POD 18 under suspicion of aHUS (Fig. 1). Biopsy confirmed TMA without evidence of rejection. NGS reported gene mutations classified to variant of unknown significance in coagulation-associated genes. Laboratory data gradually improved during three doses of eculizumab, and the patient was discharged on POD 33 with serum creatinine level of 1.82 mg/dL (Fig. 1). Total 16 doses of eculizumab were administered for 27 weeks. At last follow-up on posttransplant 27 months, transplanted kidney was maintaining its functioning with serum creatinine level of 1.83 mg/dL without proteinuria. *De novo* TMA after kidney transplantation can be caused by sustained activation of complement pathway and that early eculizumab treatment might be important in successful treatment of aHUS that is refractory to conventional PE.

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## Basic characteristics of living kidney donors in Bangladesh: a single-center experience

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**Background:** Kidney transplantation is the best treatment modality for end-stage renal disease (ESRD) patients. In Bangladesh, kidney transplantation was started in 1982. Till date living kidney donation is the only source of kidney transplantation. In this study we evaluated the demographic and clinical characteristics of kidney donors.

**Methods:** This retrospective study was conducted at Kidney Foundation Hospital and Research Institute, Bangladesh. Data of kidney donors from 2006 to 2020 was collected and analyzed with SPSS software.

**Results:** A total of 503 donors were studied. The mean age of donors was 41.9 years (range, 21–67). Nearly two thirds of donors were female (63%) while only one third of donors were male (37%). Mothers comprised 37.2% of total donor pool followed by sisters (16.7%), brothers (16.3%), fathers (9.5%), and wives (5.4%). Majority donors were Muslims (94%). The commonest blood group was O (41%). The average weight was 55.4 kg; mean systolic and diastolic blood pressure was 114 mmHg and 76 mmHg respectively. About 10.2% donors were hypertensive according to JNC8 classification. Investigations showed mean hemoglobin 12.8 mg/dL, serum creatinine 75.5 mol/L, eGFR 86.4, PCR 0.17, calcium 2.2 mmol/L, phosphate 1.2 mmol/L, uric acid 260 mol/L; fasting and 2hABF blood sugar 5.9 mmol/L and 7.7 mmol/L respectively. About 12.6% donors had impaired glucose tolerance according to ADA criteria. Ultrasonography showed that average size of right kidney 9.4 cm, left kidney 9.6 cm. CT angiogram demonstrated that 4.6% donor kidneys had cyst, 1.4% had stone and 25.2% had accessory renal arteries. Split renal function assessed using Tc-99m DTPA found that mean GFR of right kidney 48.7 mL/min, left kidney 49.6 mL/min and mean total GFR 98.8 mL/min. In 0.5% donors eGFR was less than 60%.

**Conclusions:** This is the baseline profile of kidney donors of Bangladesh. This knowledge will be useful during selection of both living and deceased organ donors.

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## Varicella zoster virus and cytomegalovirus co-infection in a live related kidney transplant recipient: a case report

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Infections are common complications in kidney transplant recipients owing to the lifelong immunosuppression. Cytomegalovirus (CMV) and varicella zoster virus (VZV) infections are quite common in the posttransplant period. Coinfection with both however has been reported only once. The immunomodulatory effect of CMV makes their interaction with other organisms like VZV potentially sinister. This is a case of a female who developed coinfection with HZV and CMV in the first month following a live related kidney transplantation. A 32-year-old female, with a presumptive diagnosis of glomerulonephritis, hypertension and chronic kidney (CKD) underwent live-related kidney transplantation from her mother following a period of hemodialysis for 8 months. There was one haplotype match and both B and T cell cross matches were negative. CMV DNA was undetected in both donor and recipient prior to transplantation. Immunosuppression consisted of prednisolone, mycophenolate sodium and tacrolimus. The surgery went well, yielding a urine output of 4–6 L/day. However, the serum creatinine did not reach baseline, with a nadir of 2 mg/dL. On the postoperative day (POD) 25, she developed low grade fever, which was followed 2 days later by pain and vesicular eruptions involving the dermatomal distribution of the ophthalmic division of the trigeminal nerve (V1) on the left, resembling herpes zoster ophthalmicus. CMV polymerase chain reaction (PCR) yielded 300 copies/mL. Treatment was immediately started with oral Acyclovir, which was later switched to oral Ganciclovir, along with acyclovir ointment and ganciclovir eye gel. The patient's fever subsided and the skin lesions resolved over a period of 2 weeks. Serum creatinine came down to baseline. Infections after kidney transplant is often difficult to diagnose, manage and cure, especially in the immediate post-transplant period. In our case, early diagnosis and treatment resulted in a good outcome.

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## Bridging to lung transplantation in idiopathic pulmonary fibrosis

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**Background:** Among interstitial lung diseases (ILD), idiopathic pulmonary fibrosis (IPF) and connective tissue diseases (CTD) have different characteristics and prognosis; IPF is associated with older age and poor prognosis. Donor scarcity limits timely lung transplantation for progressive end-stage interstitial lung disease (ILD) and bridging to transplantation (BTT) with extracorporeal life support (ECLS) helps maintain the best possible physical conditions. To date, few studies have investigated lung transplantation in IPF, especially with BTT. This study examines the outcome of lung transplantation especially with BTT in patients with IPF compared those with non-IPF ILD.

**Methods:** Lung transplantation cases of ILD patients at Asan Medical Center, Seoul, Korea from 2008 and 2021 were collected and retrospectively analyzed (n=112). Cases were divided into IPF and CTD groups based on the diagnosis. Student's t-test and Fischer's exact test were performed for intergroup differences.

**Results:** From 2008 to 2021, 112 ILD cases were subject to lung transplantation, among whom 53 (47.3%) were IPF and 59 (52.7%) were CTD. The median age was 61 (interquartile range [IQR]; 56–65) in IPF group, which was older than 57 (IQR; 4–63) in CTD group (P<0.01). Preoperatively, 31 (58.5%) IPF and 40 (67.8%) CTD cases were bridged on ECLS. Statistical significance between IPF and CTD was absent for mortality at 28 days, 90 days, and 6 months, regardless of BTT status. No significant differences were found in BTT duration, ICU stay, hospital stay, or duration of postoperative mechanical ventilation.

**Conclusions:** The patients with IPF are older than those with CTD, but lung transplantation and BTT outcomes do not significantly differ between the disease groups. This single-center observational study shows lung transplantation with BTT may be a treatment option for IPF.

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## **De novo hepatitis B virus infection after liver transplantation from anti-hepatitis B core antibody positive donor: a 20-year experience at a single center**

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**Background:** As an endemic area of hepatitis B virus (HBV), Thailand has a significant proportion of liver donors who were previously infected with HBV. Liver transplantation (LT) from anti-hepatitis B core antibody (anti-HBc) positive donor to hepatitis B surface antigen (HBsAg) negative recipient has some risk for *de novo* HBV infection. The aim of this study is to evaluate the incidence and factors associated with *de novo* HBV infection after LT from anti-HBc positive donors in non-hepatitis B recipients.

**Methods:** We retrospectively reviewed 396 patients who underwent LT between 2002 to 2021 at Siriraj Hospital, Bangkok, Thailand. Among these, there were 75 HBsAg negative recipients receiving anti-HBc positive liver grafts. *De novo* HBV infection was defined as HBsAg positive detected after LT. Incidence of *de novo* HBV infection was calculated and associated factors, such as pre- and posttransplant hepatitis B immunoglobulin (HBIG) and antiviral, were evaluated.

**Results:** *De novo* HBV infection occurred in 12 recipients (16%). The median time to *de novo* HBV infection was 1,133 days. Posttransplant antiviral drug (lamivudine) was the significant protective factor against *de novo* HBV infection ( $P < 0.001$ ). There was no *de novo* HBV infection occurred in recipients who continuously received posttransplant lamivudine. While 36.8% of recipients who did not receive and 27.8% of recipients who discontinued lamivudine during the posttransplant period had *de novo* HBV infection. Recipients who received pretransplant and posttransplant HBIG had a trend to have a lower rate of *de novo* HBV infection (9.8% vs. 29.2%,  $P = 0.05$  and 8.7% vs. 27.6%,  $P = 0.05$ , respectively). Pretransplant anti-HBs and anti-HBc antibody status, pretransplant antiviral, and posttransplant HBV vaccine were not significant factors related to *de novo* HBV infection.

**Conclusions:** Anti-HBc positive liver grafts are safe to be transplanted to HBsAg negative recipients if they receive suitable prophylaxis especially posttransplant antiviral medication continuously.

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## Extensive liver resection in alveococcosis

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**Background:** Alveococcosis is a parasitic disease of the liver, characterized by slow infiltrative growth with damage to the vessels and bile ducts. The incidence of alveococcosis (according to WHO) is 0.03–1.2 per 1,000,000 population in endemic areas. Mortality >90% at 10–15 years from onset without treatment. Low efficiency of drug therapy (albendazole). Mostly rural residents are affected, which leads to late diagnosis of the disease.

**Methods:** For the period from April 2017 to August 2022, 358 patients with liver alveococcosis were on treatment. Of the 358 patients, 317 were operated on, of which 167 underwent extensive liver resections (52.7%). The average duration of inpatient stay is 16.5±0.9 bed-days.

**Results:** 167 patients had 214 complications: obstructive jaundice, 31; cavernous forms of alveococcosis, 25; invasion into neighboring organs (lung, kidney, diaphragm, stomach, pancreas, GDS, colon, adrenal gland), 54; bilobar lesion, 95; MTS in lungs, 4; MTS to the brain, 2; MTS to soft tissues, 3. 167 (100%) extensive liver resections were performed. Of them, with resection of the bile ducts, 9 (5.4%); with resection of the portal vein, 22 (13.2%); resection and prosthetics of the IVC, 7 (4.2%); right-sided hemihepatectomy, 79 (47.3%) (of which with resection of the bile ducts, 3; with resection of the portal vein, 11; resection and prosthetics of the IVC, 5); left-sided hemihepatectomy, 26 (15.6%) (including bile duct resection, 2; portal vein resection, 4); extended left-sided hemihepatectomy, 19 (11.4%) (of which with resection of the bile ducts, 1; with resection of the portal vein, 4); extended right-sided hemihepatectomy, 43 (25.7%) (of which with resection of the bile ducts, 3; with resection of the portal vein, 3; resection and prosthetics of the IVC, 2). Postoperative complications were in 24 patients (14.3%): liver failure, 16; bile leakage, 6; reactive pleurisy, 7; bilateral pneumonia, 1; gastrointestinal bleeding, 1. Mortality is 2.4%, 2 patients.

**Conclusions:** The final decision on resectability can be made after intraoperative revision, IOUS, ultrasound and liver mobilization, liver resection is quite feasible even with invasion into the main vessels and bile ducts (VV, IVC, hepaticocholedochus), liver resection remains a radical method of treatment R0.

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## Identification of multiple hub genes in acute kidney injury after kidney transplantation by bioinformatics analysis

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**Background:** The molecular mechanisms of the development of acute kidney injury (AKI) after kidney transplantation are not yet clear. Bioinformatics analysis has recently been widely applied to investigate the mechanisms of various diseases. Therefore, in this study, we executed an integrative bioinformatics analysis to identify hub genes associated with AKI after transplantation, using three data sets with mRNA and miRNA expression information.

**Methods:** To investigate potential genetic targets for AKI, an analysis of the gene expression omnibus database was used to identify key genes and pathways. After identification of differentially expressed genes, Kyoto Encyclopedia of Genes and Genome pathway enrichment analyses were performed. We identified the hub genes and established the protein-protein interaction network.

**Results:** In this study, three GEO datasets with mRNA and miRNA expression information were analyzed to identify DEGs in AKI after transplantation. Finally, we identified 137 differentially expressed genes (59 upregulated genes and 16 downregulated genes). AKAP12, AMOT, C3AR1, LY96, PIK3AP1, PLCD4, PLCG2, TENM2, TLR2, and TSPAN5 were filtrated by the hub genes related to the development of posttransplant AKI from the protein-protein interaction network.

**Conclusions:** These findings may provide biomarkers for diagnostic and therapeutic targets of AKI and suggest their mechanisms.

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## Successful simultaneous heart-liver-kidney transplantation with excellent long-term outcomes: first in Asia

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Simultaneous heart-liver-kidney (HLK) transplantation is a super-complex surgery that is an effective treatment for end-stage disease of multiple organs. There have been only 25 HLK transplants reported worldwide, and none were from Asian countries. Herein, we reported our experience in successful simultaneous HLK transplantation in Thailand. A 27-year-old male, who was diagnosed with IgM nephropathy and on dialysis, later developed uremic dilated cardiomyopathy and cardiac cirrhosis. His condition gradually worsened with NYHA class III, refractory ascites, and intradialytic hypotension. Simultaneous three-organ transplantation was decided by the multidisciplinary transplant team according to the end-stage disease of the three organs. He underwent combined simultaneous HLK from a 15-year-old traffic-related brain death donor in December 2017. Induction therapy was initiated with total plasma exchange. After the recipient's heart was prepared for removal, liver was dissected before cardiopulmonary bypass (CPB) was initiated to prevent bleeding after heparinization. Intravenous immunoglobulin, thymoglobulin, and methylprednisolone were given later intraoperatively after CPB was initiated. After completion of cardiac grafting and heart beating, orthotopic liver transplantation was performed while on CPB. CPB was weaned off before kidney transplantation was finally performed. The total operative time was 12 hours and 5 minutes. Cardiac and liver function was stabilized, while kidney had delayed graft function and hemodialysis was needed for 2 more months. He was discharged on postoperative day 83 without any organ support. At 56-month posttransplant, all allografts have normal function without graft rejection. The patient can return to work with good quality of life. Regarding immunosuppression, he is currently on tacrolimus, everolimus, and prednisolone. We reported our experience in successful simultaneous HLK transplantation for the treatment of dilated cardiomyopathy, liver cirrhosis, and end-stage renal disease with excellent long-term outcomes. To our knowledge, this is the first case report of simultaneous HLK transplantation in Asia.

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## QuantiFERON cytomegalovirus assay for evaluation of CMV reactivity among renal transplant recipient and donor in Bangladesh

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**Background:** CMV is the one of the most common viral infections after kidney transplantation with significant morbidity and mortality. Currently sero-positivity for CMV IgG before solid organ transplantation is the laboratory test of choice for stratifying the risk of CMV reactivation after transplantation. Test for CMV specific T cell responses have been proposed to change the current risk stratification strategy using CMV assays. We therefore tested QuantiFERON cytomegalovirus assay for evaluation of CMV reactivity among renal transplant recipient and donor in Bangladesh.

**Methods:** A retrospective study was done with 326 subjects from 2017 to 2021 in Kidney Foundation Hospital and Research Institute, Bangladesh. Data analyzed by statistical analysis software.

**Results:** In this study for assaying CMV reactivity by QuantiFERON cytomegalovirus assay, 326 subjects were included. The mean age was 38.5 (SD, 11.9) years, 140 (42.9%) were female, 186 (57.1%) were male. Among these 191 (58.6%) were recipients with mean age 34.3 (SD, 10.7) years and 135 (41.4%) were donors with mean age 44.4 (SD, 11.0) years. Among recipient 68 (20.86%) was reactive and 123 (37.7%) was non-reactive to QuantiFERON cytomegalovirus assay. Among donor 65 (19.94%) was reactive and 70 (21.47 %) was non-reactive to the assay. Recipients were significantly less reactive to donors ( $P < 0.02$ ). In our study younger people were less reactive to this assay ( $P < 0.001$ ) which can be explained by recipients being of younger age. In our study it has also been shown that most of the recipients being male 145 (76%) and donor being female 94 (70%).

**Conclusions:** This is the baseline study for evaluation of CMV reactivity in kidney recipients and donors of Bangladesh. This knowledge will be used for stratifying the risk of CMV reactivation after transplantation.

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# The impact of oversized donor matching on clinical outcomes after heart transplantation

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**Background:** Adequate cardiac allograft sizing is one of the main considerations in heart transplantation. Although several studies report the use of undersized hearts and its impact on post-heart transplant outcomes, compelling evidence regarding the use of oversized hearts is lacking.

**Methods:** We identified patients who underwent orthotopic heart transplantation at our institution from November 1992 to September 2020. Patients were categorized based on donor-recipient predicted heart mass (PHM) matched or oversized matched (>30%). The effect of the use of an oversized heart on clinical outcomes was investigated.

**Results:** Of a total of 485 patients, 108 (22.3%) patients received an oversized heart. During follow-up (median, 78.8; postoperative months interquartile range, 39.7–119.4 months), death occurred in 116 patients (3.57/patient-year). In multivariable analysis, diabetes mellitus (hazard ratio [HR], 2.25; 95% confidence interval [CI], 1.47–3.44;  $P < 0.001$ ), dialysis (HR, 2.04; 95% CI, 1.05–3.99;  $P = 0.04$ ), preoperative mechanical cardiac support (HR, 2.14; 95% CI, 1.35–3.38;  $P = 0.001$ ) were independent predictors of death. After adjustment for such predictors, spline curves showed that PHM oversized donor was not associated with death (Fig. 1). As size-matched recipients, recipients of oversized hearts showed similar mortality (5 years; 82.8% vs. 82.3%,  $P = 0.6$ ).

**Conclusions:** Utilizing predictive heart mass oversized donors may not be associated with a detriment in survival.

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## Excellent outcomes in living-related kidney transplantation in children 15 kg or less: experience from a tertiary pediatric referral center in Singapore

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**Background:** Despite significantly improved outcomes in pediatric renal transplantation (RT), there remain challenges for children weighing 15 kg or less; with consequently higher risks of complications and graft loss. Especially for smaller pediatric recipients of adult-donor kidneys, we aim for optimal renal perfusion by emphasizing meticulous technique for vascular anastomoses; together with aggressive volume support in the living-donor and recipient.

**Methods:** The medical records of 10 pediatric kidney recipients <15 kg at transplant (eight living-related donors) between 1989 and 2020 were retrospectively reviewed.

**Results:** Overall, the median age and weight at transplant were 56.5 months (IQR, 44.8–68) and 12.9 kg (IQR, 12.2–14.2) respectively. There were nine children who received pretransplant dialysis over a median duration of 26 months (IQR, 13–40). The surgical approach was either transperitoneal (n=6) or retroperitoneal (n=4) with the vascular anastomoses being to the aorta/inferior vena cava (n=7), common iliac vessels (n=2) or splenic vessels (n=1). One child developed early vascular thrombosis requiring graft nephrectomy (day 4). None of the remaining children developed delayed graft function. Delayed complications were BK virus nephropathy (n=1, progressive graft failure 6 months posttransplant requiring resumption of dialysis and eventual re-transplantation at age/weight of 79 months and 19.5 kg respectively) and ureteric stricture (n=1, requiring revision ureteroureterostomy at five years posttransplant). Graft survival at 1-year and 2-years was 90% and 80% overall; and was 100% and 87.5% for living-related grafts respectively. Nine children have functioning grafts to date; over a median follow-up period of 14 years (IQR, 6–19.5). The mean creatinine levels were 83.5±35.3  $\mu\text{mol/L}$  at last follow-up.

**Conclusions:** Living-related kidney transplantation in children 15 kg or less may be safely performed in experienced pediatric centers with excellent short-term and long-term outcomes.

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## COVID-19 in pediatric liver transplant recipients from a single center in Thailand

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**Background:** Children with immunosuppression may be at risk of severe coronavirus disease 2019 (COVID-19). The outcomes of COVID-19 on pediatric liver transplant recipients (PLTR) are variable and there are limited data available in Thailand. This study aims to report the impact of COVID-19 on pLTR at the current transplant center.

**Methods:** PLTR under 18 years old, who had COVID-19 infection from April 2020 to July 2022, were included. Data were retrospectively reviewed, including demographics, clinical presentation, laboratory, and treatment outcomes.

**Results:** A total of 38 PLTR (50% male) with COVID-19 infection were identified. Ten (28%) received two doses of BNT162b2 and 14 (38%) did not vaccination. The median age was 7.1 (range, 4.2–10.1) years. The median time from transplantation to infection was 55.5 (range, 28.5–86) months. Twenty-nine patients (76.3%) were symptomatic. The most common symptoms were fever (65%), followed by sore throat (26%) and rhinorrhea (21%), respectively. There were neither gastrointestinal nor lower respiratory symptoms. The median AST and ALT were not different between pre- and post-infection. PLTR who received mycophenolate mofetil (MMF) developed lower total white blood cell count, compared with other regimens (2,320 [1780–3112] vs. 4,450 [3750–5316]/cu mm.,  $P < 0.001$ ). Prednisolone, MMF and tacrolimus were used in 10%, 23%, and 80%, respectively. Immunosuppression was modified in 5.2% of patients after infection, all of which was MMF dose reduction. Three (7.8%) patients were hospitalized, two of whom were treated with favipiravir. The rest (35 patients, 82.8%) were treated with favipiravir outpatient. The median duration of symptoms was 2.3 (range, 0.7–3) days. All patients recovered without disease progression or liver graft dysfunction. No mortality was observed.

**Conclusions:** PLTR receiving immunosuppression might not be at risk of severe COVID-19. COVID-19 in PLTR poses no significant impact on liver graft survival and morbidity. Immunosuppression dose adjustment may not be necessary.

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## Urine exosomal bkv-miR-B1-5p and BK virus nephropathy in kidney transplant recipients

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**Background:** Urine exosomal bkv-miR-B1-5p was associated with BK virus (BKV) nephropathy (BKVN), but its serial post-transplantation changes and predictability for BKVN have not been determined in kidney transplant recipients (KTRs).

**Methods:** Urine exosomal bkv-miR-B1-5p and urine BKV DNA were measured at 2 weeks and 3, 6, and 12 months posttransplant in 83 KTRs who stratified into biopsy-proven BKVN, presumptive BKVN, BKV viremia, and no evidence of BKV reactivation. Joint models, Cox proportional hazard models, and receiver operating characteristic curve (ROC) were used to investigate each urine assays predictability for a composite of biopsy-proven or presumptive BKVN, and biopsy-proven BKVN.

**Results:** The urine exosomal bkv-miR-B1-5p and urine BKV DNA loads showed similar posttransplant time-course changes. Joint models showed independent predictability of both urine assays for subsequent BKVN. In multivariable Cox analyses incorporating single timepoint value of 2-week posttransplant, urine exosomal bkv-miR-B1-5p, but not urine BKV DNA, was significantly associated with BKVN development. In ROC analyses, the area under the curve of urine exosomal bkv-miR-B1-5p was larger than that of urine BKV DNA.

**Conclusions:** Urine exosomal bkv-miR-B1-5p has predictability for BKVN development and may identify KTRs at risk for BKVN whose urine BKV DNA loads otherwise would have missed.

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## The first human application of a newly developed “smart all-in-one” extracorporeal life support device for bridging to lung transplantation: a case study

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The extracorporeal membrane oxygenation (ECMO) bridge-to-lung transplantation (TPL) is essential nowadays, however, there was no domestic ECMO device in Korea. Herein, we presented a patient with respiratory failure due to interstitial lung disease (ILD) aggravation who had a bridge to lung TPL with a newly developed “smart all-in-one” ECMO. A 59-year-old female developed dyspnea and general weakness 2 months ago with subpleural reticular opacities and traction bronchiectasis in both lungs at chest computed tomography, probable connective tissue disease-associated ILD. Anti-nuclear and Anti-Sjogren's-syndrome (SS-A/RO) antibodies were positive. She took steroids and conservative care for a month but had suspected ILD aggravation due to pneumonia, transferred to our hospital under intubated state. Multiple infiltrates of both lungs and diffuse subcutaneous emphysema with progressive hypoxemia resulted in ECMO insertion. Elective veno-venous ECMO, a newly developed “smart all-in-one” ECMO, as the first human clinical trial was applied for 6 hours and then changed to commercial ECMO. The sonography-guided femoral cannulation was done for 37 minutes without any procedural events. There were no device-related clinical and mechanical events. After 22 days of applying ECMO, she underwent bilateral cadaveric lung TPL. She needed veno-venous ECMO for 2–3 days postoperatively and weaned thereafter. She is still in an alive, ambulatory state for more than 2 years. This is the first case of a newly developed ECMO system, which was expected comparable to foreign devices and contributable to reducing medical expenses and treating critically ill patients who need thoracic transplantation.

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## Early complication of liver transplantation in the intensive care unit

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**Background:** Early complications usually happen during the 1st month and complication during the stay at the intensive care unit has important impact on the further survival of the patient. Early complications include postoperative bleeding, coagulopathy, graft dysfunction, vascular thrombosis, rejection, infection (complication of respiratory), renal dysfunction, gastrointestinal, and neurological complication. In the long term, the complications are typically a consequence of the prolonged immunosuppressive therapy, and include diabetes mellitus, systemic arterial hypertension, *de novo* neoplasia, and organ toxicities, particularly nephrotoxicity.

**Methods:** Clinical data of 60 adult patients who received liver transplantation in National Cancer Center of Mongolia from 2018 to 2022.

**Results:** The study included 60 patients who were performed liver transplantation. Of whom 28 (46.7%) were male and 32 (53.3%) were female. Fifty cases (83.3%) on living donor liver transplant, 10 cases (16.7%) are deceased liver transplant. Of 60 liver transplantations, one patient (1.7%) developed early hepatic artery thrombosis, seven patients (11.7%) had acute kidney injury, one patient (1.7%) had cardiomyopathy, three patients (5.0%) had delirium, one patient (1.7%) had postoperative bleeding, one patient (1.7%) had hypoxia, one patient (1.7%) had multiple infections, and one patient (1.7%) had hypertension.

**Conclusions:** Intensive care management of liver transplanted patients requires sophisticated monitoring and multidisciplinary approach. Rapid hemodynamic stabilization, correction of severe coagulopathy, respiratory stabilization and early weaning from mechanical ventilation, appropriate fluid-electrolyte therapy, preservation of renal functions, prevention of graft rejection, and prophylaxis/treatment of infection are particularly important in intensive care management of liver transplanted patients. Since early postoperative period is critical, close monitoring, stabilization and maintenance of cardiorespiratory functions, frequent examination of graft function, early identification of complications, and prompt treatment of extrahepatic organ failure are mandatory in order to reduce mortality/morbidity.

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## Deceased organ transplantation: knowledge, awareness, and attitude among health care professionals in Bangladesh

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**Background:** Asia has greatest growth rate for number of chronic diseases and end-stage organ failure, but has the lowest rate of organ transplant, particularly deceased donor. This survey was conducted to assess knowledge, awareness, and attitude regarding deceased organ-tissue donation among health care professionals (HCP) in Bangladesh.

**Methods:** This was a cross-sectional observational study, done in six tertiary hospitals of Dhaka from January to June 2022. A questionnaire constructed by the Asian Society of Transplantation was used for data collection. Statistical analysis was performed by SAS software.

**Results:** A total of 446 HCP participated. There were nurses (42.0%), medical students (29.0%), doctors (21.0%), and others (8.0%). The mean age of participants was 28 years; 44.0% were male participants and 56.0% were female. About 92.6% participants heard about organ-tissue donation, but majority (75.2%) never participated in educational programs and only 8.3% knew it well. About 72.3% HCP showed positive attitude towards organ-tissue donation. Nonetheless, 24.0% strongly wished to donate and only 0.9% registered as donor. The main reason for not willing to donate were never thought about it (29.0%) and lack of information (27.0%). The principle cause of not registering was not knowing the procedure (34.4%). Majority advised outdoor campaigns, educational activities, and TV commercials as necessary sources for activating brain death donation. However, most reliable source for information chosen was TV (53.7%), Internet, and newspaper. Majority felt that when promoting life-sharing, the essential message that should be delivered is giving new lives to patients. About 85.0% participants knew the difference between brainstem death and vegetative state, 75.0% considered brain death as death and 46.4% assumed one brain death donor can save five persons lives.

**Conclusions:** There was lack of knowledge, awareness, and attitude about deceased organ-tissue donation among HCP in Bangladesh. More educational program is needed to improve deceased organ transplantation.

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## Mixed reality imaging in the preoperative planning of high-risk pediatric renal transplants: proof of concept case report

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**Background:** Pediatric renal transplants can be technically challenging because of disparity in the recipient vessels and body cavity, and the adult donor vessels and organ mass respectively. Innovative technologies utilizing spatial reconstruction may be beneficial in preoperative planning for these patients. We present a case where three-dimensional (3D) reconstruction, and a mixed reality system were employed in preoperative planning as proof of concept.

**Methods:** The recipient is an 18-year-old male patient with end-stage renal failure from Alport syndrome and steroid-resistant nephrotic syndrome. His small and slender stature (36.7 kg, 161.3 cm) and severe thoracoabdominal scoliosis (Cobb angle of >60°) raised concerns of potential limitations in space for retroperitoneal implantation and challenges in alignment with potentially tortuous and size-matched iliac vessels for vascular anastomoses. A computed tomography scan was hence performed for preoperative planning. The donor's (the mother) computed tomography scan of the kidneys was superimposed with that of the recipient utilizing Synapse 3D (Fujifilm Holdings America Corp.). Real-time holographic visualization was also accomplished utilizing HoloLens 2 (Microsoft Corp.).

**Results:** Preoperative visualization of the 3D images and video confirmed that there was sufficient domain for a retroperitoneal implantation and planning of vascular anastomoses to the right common iliac artery and vein which were respectively 6 to 7 mm and 10 mm in caliber and relatively straight at the proposed site of anastomoses. The renal transplants proceeded as planned with a warm ischemic time of 44 minutes. There was brisk urine output on-table and preserved vascular patency and satisfactory waveforms on postoperative doppler ultrasound. Serum creatinine normalized by postoperative day 4.

**Conclusions:** A combination of modern technologies (3D reconstruction and HoloLens2) are useful adjuncts in preoperative planning and performance of high-risk pediatric renal transplants. This technology may be also considered in the training, education, and intraoperative assistance of young pediatric renal transplant surgeons.

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## Initial high anti-ABO isoagglutinin titer is a major red flag of bacterial infection in ABO-incompatible living donor liver transplantation

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**Background:** Many previous studies showed comparable clinical outcomes of ABO-incompatible (ABOi) living donor liver transplantation (LDLT) compared to ABO-compatible (ABOc) LDLT, but there were few studies related to initial high anti-ABO isoagglutinin titer.

**Methods:** From January 2012 to March 2022, a total of 1,108 liver transplantations were performed at Severance Hospital. In ABOi LDLT, we compared initial high-anti-ABO and low-anti-ABO isoagglutinin (IA) titer groups based on a cutoff value of 1:256. The simplified desensitization protocol for ABOi LDLT consisted of plasma exchange and rituximab (375 mg/m<sup>2</sup> body surface area) aiming at maintaining levels of anti-ABO IA titers below 1:32.

**Results:** The initial low-IA titer ABOi LDLT group (immunoglobulin M [IgM] and IgG, <1:256) consisted of 142 patients and the initial high-IA titer ABOi LDLT group (IgM or IgG, 1:256) consisted of 59 patients. Additionally, the ABOc LDLT group consisted of 577 patients. Bacterial infection rates were 19.1% in ABOc LDLT group, 25.4% in the initial low-IA titer ABOi LDLT group, and 37.3% in the initial high-IA titer ABOi LDLT group, and the initial high-IA titer ABOi LDLT group had a significantly higher rate of bacterial infection than the other two groups (P=0.003). The initial high-IA titer ABOi LDLT group had a significant higher rate of bacterial sepsis and bacterial pneumonia than the other two groups (P=0.031 and P=0.021, respectively). In terms of infection-related mortality, the initial high-IA titer ABOi LDLT group had a higher rate of 18.6% than 8.5% in the initial low-IA titer ABOi LDLT group and 4.7% in ABOc LDLT group (P=0.001).

**Conclusions:** ABOi LDLT is more prone to infectious complications than ABOc LDLT. Among ABOi LDLTs, recipients with an initial high-IA titer are more susceptible to bacterial infection, sepsis, and bacterial pneumonia, along with reducing overall survival rate.

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## Virtual crossmatch versus complement-dependent cytotoxicity crossmatch in deceased kidney paired donations: a single-center experience from India

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**Background:** High-resolution single antigen bead helps in identifying recipients' alloantibody profile in comparison with donors' histocompatibility antigens. Retrospective analysis of paired kidney donations using only virtual crossmatch (VXM; human leukocyte antigen [HLA] only) versus actual crossmatch (using complement-dependent cytotoxicity crossmatch and HLA no flow cytometry) was done.

**Methods:** A total of 30 deceased donor kidney donations were carried out from August 2021 to mid-August 2022 at the Postgraduate Institute of Medical and Education Research; the initial 15 donations were carried out using actual crossmatch. Of the later 15 donor-recipients who underwent VXM, recipients with donor-specific antibody of mean fluorescence intensity >3,000 were excluded. All deceased donors were typed for high-resolution HLA-A, HLA-B, and HLA-DR.

**Results:** In the VXM group, 13 paired kidney donations (including five simultaneous pancreas and kidney transplants) and two dual kidney transplants were performed (a total of 28 transplants). Twelve graft biopsies (42.0%) were performed in the early postoperative period of which rejections were seen in six patients (21.0%), and five patients (17.8%) were given antirejection therapy. In the actual crossmatch group 15 deceased donors (four simultaneous pancreas and kidney transplants, one dual kidney transplants, one single kidney transplant, one pediatric paired kidney transplant), 10 graft biopsies (38.0%) were performed and seven (26.0%) were treated. The difference between the follow-up creatinine in two groups was not significant (VXM,  $1.44 \pm 0.80$ ; actual crossmatch,  $1.60 \pm 1.72$ ;  $P=0.66$ ).

**Conclusions:** These results show excellent outcomes when only VXM is used in comparison to actual crossmatch, as it saves time, is cost-efficient, and avoids unnecessary recipients' mobilization.

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## DNA test to distinguish *de novo* transitional cell carcinoma from donor-derived malignancy: a case report

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**Background:** Transitional cell carcinoma (TCC) of urinary tract appears more common in kidney transplantation recipients than in general population. *De novo* TCC after renal transplantation was treated with transurethral resection of the bladder tumor or partial cystectomy. But, if TCC was derived from donor, the most frequent treatment was removal of graft. Herein, we report on a case in which DNA testing between TCC and the deceased donor blood was performed.

**Case report:** A 45-year-old male patient underwent renal transplant from a deceased donor (subarachnoid hemorrhage, 52-year-old female). Dysuria and creatinine elevation occurred 34 days after transplant. He was admitted for graft biopsy and double J (DJ) catheter removal. Renal biopsy was revealed as acute T cell-mediated rejection, grade IA. Steroid pulse therapy (500 mg/day) was used for 3 days immediately. Cystoscopy for DJ catheter removal revealed the dysfunction of DJ catheter within neo-ureterocele at ureteroneocystostomy site. transurethral resection of the bladder tumor and DJ catheter change was done after steroid pulse therapy. Pathology of neo-ureterocele was revealed as noninvasive urothelial carcinoma, low grade, inverted pattern. As the possibility of derivation from the deceased donor could not be ruled out, DNA testing was planned between the tissue of TCC and the blood sample of deceased donor. Blood sample of deceased donor was offered from the Korea Organ Donation Agency Laboratory. Male DNA was detected from tissue, but female DNA was detected from the blood sample. Discrepancies were found at 18 gene loci among 20 gene loci. Finally, the TCC was decided as *de novo* TCC after transplantation. Then, the patient has been followed up every 3 months for cystoscopy test without any abnormality.

**Conclusions:** Treatment of TCC after transplantation is decided differently whether the cancer was developed *de novo* or derived from donor. DNA testing could be one of methods for distinguishment of cancer origin.

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## Phascolarctobacterium-producing propionate and acute rejection of kidney transplant recipients

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**Background:** Acute rejection (AR) is associated with worse long-term allograft survival. Therefore, identifying and regulating the potential risk factors of AR is very important. Growing evidence has shown that gut microbiota regulates host immune response. Here, we aimed to evaluate the gut microbiota and its metabolites that could predict AR after kidney transplantation (KT).

**Methods:** We prospectively collected 98 KT recipients stool samples at pretransplant (n=97), posttransplant 3 months (n=66), and posttransplant 12 months (n=33). Metagenomic DNA was isolated from feces and was sequenced using by Illumina MiSeq system. Stool metabolites were measured by a <sup>1</sup>H nuclear magnetic resonance spectroscopy. We obtained various clinical factors including biopsy-proven AR within 1 year after KT.

**Results:** Within the 1st year of the transplantation, 33 patients (34%) developed AR. Bacterial richness (observed amplicon sequence variants) and diversity of the microbial communities (Shannon index) were lower in the AR group than in the nonrejection group (Wilcoxon rank-sum test with false discovery rate [FDR];  $P_{FDR}=0.07$  and  $P_{FDR}=0.02$ , respectively). The genus *Escherichia-Shigella* was significantly increased ( $P_{FDR}<0.25$ ), while the *Phascolarctobacterium* was decreased ( $P_{FDR}<0.25$ ) in the AR group compared to the nonrejection group. In linear discriminant analysis (LDA) effect size (LEFSe) analysis, we found 83 differentially abundant MetaCyc pathways in the AR group than in the nonrejection group (LDA score,  $>2.0$ ;  $P<0.05$ ). Pathways of homolactic fermentation and mixed acid fermentation were enriched in the AR group. Fecal propionate, a key metabolite of short-chain fatty acid and lactate was lower in the AR group than in the nonrejection group ( $P=0.05$  and  $P=0.02$ , respectively). In the comparison of two receiver operating characteristic (ROC) curves, two bacteria and two metabolites adding clinical values provide a better prediction of AR (area under the ROC curve [AUC], 0.958) than only clinical values (AUC, 0.849;  $P=0.006$ ).

**Conclusions:** In this study, we found that pretransplant decreased relative abundance of *Phascolarctobacterium* was associated with AR after KT. In addition, fecal propionic acid which was known to be produced by *Phascolarctobacterium* was decreased in the AR group.

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## Transplantation of chemically induced liver progenitors as a treatment to ameliorate liver fibrosis

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**Background:** Hepatocyte-based regenerative therapy has been reported as an alternative treatment to liver transplantation for end-stage liver disease. We have been investigating the reprogramming of mature hepatocytes to liver progenitors by chemical stimulation (chemically induced liver progenitor, CLiP) as a possible liver regenerative therapy considering its proliferative capacity and abundant exosomes.

**Methods:** Experiment 1 was conducted under the following: for making CLiP, hepatocyte isolated from healthy rats were cultured in YAC medium containing Y-27632 (Rho-associated protein kinase inhibitor), A-83-01 (transforming growth factor type I receptor inhibitor), and CHIR99021 (glycogen synthase kinase-3 inhibitor). CLiP was administered to a diet-induced nonalcoholic steatohepatitis (NASH) mouse model (severe combined immunodeficient mice). We evaluated serum laboratory data and the behavior of rat CLiP. In addition, liver tissue was subjected to Azan staining and smooth muscle actin (SMA) immunostaining after 8 weeks to compare the degree of fibrosis with that of the control group. Experiment 2 was conducted under the following: using surgical specimens, mature hepatocytes were isolated from human cirrhotic liver and cultured in YAC medium. For each degree of fibrosis (F0–F4), immunostaining was performed for liver progenitor cell markers (epithelial cell adhesion molecule, SRY-like HMG box 9, cytokeratin 19). Additionally, the CLiP creation efficiency was measured by flow cytometry using CD133.

**Results:** The results for experiment 1 are the following: Azan and SMA area-positive rates and serum alanine aminotransferase levels were significantly reduced in the CLiP-treated group ( $P < 0.05$ ). Rat albumin-positive cells were confirmed cell at 8 weeks. The results for experiment 2 are the following: regardless of the degree of fibrosis, cells cultured with YAC medium expressed hepatic progenitor cell markers. Characteristic of CLiP of the cultured cell was determined using CD133, and approximately 60% of the cells were positive.

**Conclusions:** Transplantation of rat CLiP suppressed the elevation of liver damage markers and dissolved collagen fibers in the liver in a mouse model representing NASH. We succeeded in producing human CLiP from various background livers. CLiP might become an effective cell source for the treatment of liver diseases.

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## Medullary histology may help to predict Banff scores in allograft kidneys

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**Background:** Most of the current Banff classification parameters for renal allograft are obtained from the cortex. For example, the peritubular capillaritis score is obtained only in cortical capillaries, but their medullary counterpart (vasa recta) is not the object of scoring. In this regard, renal allograft biopsies dominantly composed of the medulla are unsuitable for diagnosing rejection. We compared the cortical components' scores and their medullary counterparts to evaluate whether the medullary scores may contribute to the diagnosis of rejection in medulla-dominant allograft biopsies.

**Methods:** We collected 50 cases of allograft kidney biopsies that contain both cortex and medulla. Interstitial inflammation, total inflammation, tubulitis, peritubular capillaritis, interstitial fibrosis, tubular atrophy, interstitial inflammation in the area of interstitial fibrosis and tubular atrophy (IFTA), and tubulitis in the area of IFTA were scored according to the current Banff classification. Medullary lesions were scored similarly. The correlation of each medullary score with cortical Banff scores was evaluated by the Spearman test.

**Results:** The medullary scores of tubulitis, interstitial inflammation, total inflammation, tubular atrophy, interstitial fibrosis, inflammation and tubulitis in the area of IFTA, and peritubular capillaritis were significantly correlated with their cortical counterparts. In addition, the medullary peritubular capillaritis score correlated with the glomerular basement membrane double contour score and intimal arteritis score of the cortex.

**Conclusions:** Some medullary histologic findings are significantly correlated with Banff classification scores. These results may help pathologists to suggest the diagnosis of rejection in medulla-dominant allograft biopsies.

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# Standardization of lymphoapheresis in living donor liver transplant patients for the engineered antigen specific regulatory T cell product for tolerance induction

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**Background:** We are developing antigen specific regulatory T cell product that aims to suppress posttransplant rejections in a donor antigen-specific manner and induce immune tolerance and conducting multicenter clinical trial in Japan. Though peripheral blood mononuclear cell (PBMC) collected from patients and donors via apheresis are used as the raw material for this cell product, for the liver pretransplant patients, the coagulopathy and severe pancytopenia greatly affect the safety and ensure the collection of enough PBMC by lymphapheresis. We investigated the risk of PBMC collection by apheresis in the liver cirrhosis patients to ensure the patient safety and evaluate the collected PBMC for manufacturing.

**Methods:** In addition to the patient's disease background and condition, we analyze leukocyte fraction and lymphocyte subpopulation by flow cytometer and estimated the processed inlet volume, time required for lymphapheresis, and the implementation conditions. Apheresis data from living donor liver transplant patients participated in the tolerance clinical trial were analyzed from the viewpoint of patient safety. Furthermore, we investigated the quality of collected PBMC as the raw materials for manufacturing process.

**Results:** In order to ensure patient safety, it was considered necessary to secure puncture of the vascular route and prepare for citric acid poisoning and exacerbating the risk of bleeding due to decreased platelets during apheresis. As for the suitability of the raw materials used for manufacturing, although the cell fractionation profile varies greatly among liver transplant patients, the target number of cells was secured in all patients. The validity of the simulation was confirmed.

**Conclusions:** Our simulation for lymphapheresis contribute to the safety for liver transplant patients and standardize the apheresis setting to correct enough number and quality of PBMC as the raw material for manufacturing.

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## Artificial intelligence-guided bile duct division during pure laparoscopic donor hepatectomy

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**Background:** Pure laparoscopic donor hepatectomy (PLDH) has become a standard procurement practice for living donor liver transplantation in expert centers. During the procedures of PLDH, a good anatomical approach for donor bile duct division is crucial to avoid multiple bile duct openings, which increases the risk of biliary complications for the recipient. This study was designed to develop a deep learning-based artificial intelligence model to identify biliary structures intraoperatively, helping to determine the optimal transaction site.

**Methods:** Semantic segmentation of the bile duct was performed using a convolutional neural network-based approach. Deep-LabV3+ was utilized as the model with the ResNet as a backbone. Ground truth annotations were generated with the help of images of the bile duct under infrared fluoroscopy with indocyanine green by a single surgeon. The dice coefficient was utilized as an evaluation metric for the proposed model.

**Results:** Three hundred images of the biliary structure were extracted from 30 PLDH videos, 80% of images were used as train dataset, and 20% were used for validation dataset. As a result, the model predicted the area of the bile duct with a precision of 0.66.

**Conclusions:** Intraoperative artificial intelligence-guided bile duct division can be used for PLDH. This technology may provide real-time guidance and improve surgical outcomes.

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## Safety and efficacy of letermovir for cytomegalovirus prophylaxis in allogeneic hematopoietic stem cell transplantation

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**Background:** The existing studies investigated the effect of different antiviral agents for cytomegalovirus (CMV) prophylaxis in hematopoietic stem cell transplantation (HSCT). However, there is scarce of evidence on letermovir used for CMV prophylaxis. The objective of this study was to conduct a systematic literature review and meta-analysis to examine the impact of letermovir used for CMV prophylaxis in HSCT.

**Methods:** A systematic literature search in PubMed/Medline, Cochrane Central Register of Controlled Trials, Web of Science, and Google Scholar with pairing relevant keywords to identify English language articles. The eligible studies examine the impact of letermovir used for CMV prophylaxis in HSCT. The meta-analysis was carried out using Review Manager ver. 5.3. Random effects model was used to compute the pooled estimates of risk ratios (RRs) and 95% confidence intervals (CIs).

**Results:** A total of 260 participants with a median age of 54.13 years (range, 17–78 years) were included. Results from meta-analysis showed that prophylaxis letermovir significantly reducing the incidence of CMV infection versus placebo/control (RR, 0.49; 95% CI, 0.41–0.59;  $P < 0.001$ ) and control group (RR, 0.49; 95% CI, 0.41–0.58;  $P < 0.001$ ), respectively. However, prophylaxis letermovir did not significantly reduce the incidence of CMV infection versus placebo (RR, 0.60; 95% CI, 0.35–1.04;  $P = 0.07$ ). The prophylaxis letermovir almost reduces the all-cause mortality versus control group in reducing (RR, 0.77; 95% CI, 0.60–1.00;  $P = 0.05$ ). No significant difference found between letermovir group and control group in serious adverse events (RR, 0.91; 95% CI, 0.78–1.05;  $P = 0.20$ ). Moreover, significant difference found between letermovir group and placebo in incidence of all-cause prophylaxis failure ( $P = 0.002$ ).

**Conclusions:** Evidence from current synthesis, showed that prophylaxis letermovir significantly reduce the incidence of CMV infection. All-cause prophylaxis failure was dose dependent. However, further randomized controlled trials with long-term follow-up are required to confirm the current findings.

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## A potential role of gut microbiome in predicting of early acute rejection after kidney transplantation

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**Background:** Gut microbiota may affect host immunity and therefore it may be associated with the immunologic response of kidney transplantation (KT) recipients, given their risk for allograft rejection. The aim of this study is to explore the association between gut dysbiosis and early acute rejection (EAR) in KTs.

**Methods:** Stool samples from a tertiary hospital were collected from KT recipients before transplantation and metagenomic shotgun sequencing was performed for taxonomic profiling and detection of microbiota-derived genes. Their clinical data were gathered, including demographic factors, immunologic risks, immunosuppressive treatment, and the outcome defined as biopsy-proven EAR within 2 weeks of KT. Using a trainset, EAR prediction models were built in combination of clinical data, microbiota taxonomy, and microbiota-derived gene families, and tested the change of statistical power for EAR prediction and possibility for validation in the independent cohort.

**Results:** A total of 78 and 71 stool samples were collected for a train-test set and a validation set, respectively. EAR was found in 26 (33.3%) and 20 (28.2%) in each set, respectively. There was no specific difference in clinical characteristics except a higher proportion of hypertension in validation set. Recipients experiencing EAR showed a higher body mass index, number of HLA mismatch, and a higher rate of delayed graft function compared to nonrejection recipients. In taxonomic profiling, the abundance of *Bacteroides eggertii*, *Phascolarctobacterium faecium*, and *Desulfovibrio piger* decreased in rejection group. In gene families analysis, a total of 532 genes including 85 metabolism pathway related genes were differentially expressed. Predictability of EAR was enhanced (C-statistics, 0.77; 95% confidence interval, 0.59–0.86) when we add on the differently expressed microbiota-derived genes and taxonomic profiles to the clinical model (C-statistics, 0.57; 95% confidence interval, 0.35–0.67). In addition, the optimized model showed a modest performance with 64.8% of accuracy in the validation cohort.

**Conclusions:** The gut microbiome-driven metagenomic signatures may have an additive role in predicting EAR after KT when combined with clinical and immunologic features.

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## Human dermis as a new substitute for middle hepatic vein during living donor liver transplantation: early results from ongoing clinical trial

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Iliac vein allografts are suitable for middle hepatic vein (MHV) reconstruction during living donor liver transplantation, but their supply is often limited. Polytetrafluoroethylene (PTFE) grafts are easily available but have drawbacks of accidental gastric penetration and nondegradable foreign body. We used the acellular dermal matrix (ADM) to replace PTFE grafts. This study presents the technical details and patency outcomes of using ADM in MHV reconstruction. We reviewed the surgical techniques of ADM interposition and analyzed the patency rates in five patients who underwent living donor liver transplantation during the clinical trial period. The control groups received either Headshield grafts (n=52) or PTFE grafts (n=25). The surgical techniques for MHV reconstruction used to implant the ADM and iliac vein allografts are very similar because the techniques developed for the allografts were also applied to ADM. We made one opening with the right hepatic vein and reconstructed the middle hepatic vein. No patient underwent MHV stenting during the follow-up period in all groups. The 6-month patency rate was 63.7% in the Headshield group versus 57.2 % in the PTFE group versus 80.0% in the ADM group. The overall graft and patient survival rates did not differ depending on the MHV interposition vessel materials. The ADM grafts demonstrated high patency rates that surpass other vessel grafts, and thus, we suggest that ADM can be reliably used for MHV reconstruction instead of artificial grafts.

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## Proposal of a network system to solve the problem of small volume in liver transplantation: Catholic Medical Center network

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**Background:** Liver transplantation (LT) is a challenging procedure that is associated with high perioperative morbidity and mortality, due to patient comorbidities and technical demands of the procedure. There are concerns about the outcomes of LT at a low-volume center. In the medical network of the Catholic Medical Center, we tried to make up these concerns through an integrated training and surgical team network. In this study, we reviewed 9 years of LT experience in the medical network of the Catholic Medical Center .

**Methods:** We performed a retrospective study of LT procedures performed from January 2013 through August 2021 in six hospitals of Catholic Medical Center. One medical center was categorized as high volume by mean annual volume over 60 cases per year. This study compared the results of one high-volume hospital and the results of five small-volume hospitals. The primary endpoint were 1-year survival and 5-year survival. A subgroup analysis was conducted after June 2016 when the Model of End-stage Liver Disease score was applied.

**Results:** A total of 793 LT were performed during the study period. In the high-volume center, 411 living donor LT (LDLT) cases were performed and 127 deceased donor LT (DDLT) were performed. Also, 146 LDLT cases and 109 DDLT cases were performed in five small-volume center. One-year and 5-year patient survival for LDLT patients was 88.3% and 78.8%, respectively, in high-volume center, and 85.6% and 80.6%, respectively, in low-volume center. Five-year survival was not significantly different in small-volume centers ( $P=0.903$ ). For DDLT, 1-year and 5-year patient survival was 80.3% and 70.6%, respectively, in high-volume center, and 76.1% and 67.6%, respectively, in low-volume center. In DDLT cases, 5-year survival was not significantly different in small-volume centers ( $P=0.445$ ), either.

**Conclusions:** In conclusion, comparable outcome for LT can be obtained in a small volume center with a high level of integrated training systems and networks.

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# Outcomes of ABO-incompatible living donor kidney transplantation compared to waiting or deceased donor kidney transplantation

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**Background:** ABO-incompatible (ABOi) living donor kidney transplantation (LDKT) is one of efforts to overcome organ shortage for end-stage kidney disease patients. However, it is unclear whether ABOi LDKT has better outcomes compared to remaining on dialysis while waiting for ABO-compatible (ABOc) deceased donor kidney transplantation (DDKT).

**Methods:** We performed a retrospective study with propensity matching. Four hundred twenty-six patients underwent ABOi LDKT between 2010 and 2020 in Seoul National University Hospital and Severance Hospital in Korea. We compared outcomes between ABOi LDKT group and the matched control groups (426 ABOc LDKT group, 1,278 waiting-list-only group, 1,278 waiting-list-or-ABOc-DDKT group). The matched controls were derived from 3,053 adult waiting lists for first-time kidney transplantation, 426 ABOc DDKT, and 1,366 ABOc LDKT patients.

**Results:** Patient survival rates of the ABOi LDKT group were significantly lower than those of the ABOc LDKT group at 1 year (97.9% vs. 99.8%, respectively) and 8 years (95.2% vs. 97.2%), respectively ( $P=0.032$ ). Furthermore, ABOi LDKT group showed significantly lower death-censored graft survival rate compared to ABOc LDKT group ( $P=0.032$ ). Interestingly, ABOi LDKT with a low baseline anti-ABO titer (1:32) also showed lower patient and death-censored graft survival rate compared to ABOc LDKT group ( $P=0.011$  and  $P=0.005$ , respectively). Next, we compared outcomes of ABOi LDKT compared to those of waiting-list-only group and waiting-list-or-ABOc-DDKT group. Patient survival rates at 1-year and 8-year in the waiting-list-only group were 97.8%, and 89.1%, respectively, and those in the waiting-list-or-ABOc-DDKT group were 97.7% and 89.3%, respectively. ABOi LDKT group showed significantly better patient survival rate compared to waiting-list-only group ( $P=0.015$ ) and waiting-list-or-ABOc-DDKT group ( $P=0.018$ ).

**Conclusions:** ABOi LDKT is a better choice for end-stage kidney disease patients without potential ABOc living donors, especially in Asian countries with a long waiting time for DDKT.

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## Clinical effect of early statin uses in kidney transplant recipients: results from the KNOW-KT study

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**Background:** Cardiovascular disease remains a leading cause of morbidity and death with a functioning graft after kidney transplantation. Although statins reduce cardiovascular risk and have renal benefits in the general population, their beneficial effects in kidney transplant recipients have not been well established.

**Methods:** We studied whether early statin use affects long-term transplant outcomes in 714 kidney transplant recipients from the Korean cohort study for outcome in patients with kidney transplantation (KNOW-KT). Patients were divided into a group that received statins within 1 year after transplantation (statin group) and a group that did not (no statin group).

**Results:** In total, the mean age of the 714 recipients was 45.6 years, 83.1% received a kidney from a living donor, and 25.5% had diabetes mellitus at the time of transplantation. Compared with no statin group, statin group recipients were significantly older, had a higher body mass index, and were more likely to have diabetes mellitus. During a median follow-up of 85 months, 74 graft losses occurred (54 graft failures and 15 patient deaths). A multivariable analysis confirmed that early statin use was independently associated with lower all-cause graft loss (hazard ratio, 2.441; 95% confidence interval, 1.395–4.271). Low-density lipoprotein (LDL) cholesterol levels were higher in the statin group at the time of transplant, but from 1-year posttransplant, LDL cholesterol levels of the statin group were consistently lower than those of the no statin group. A total of 37 major cardiovascular adverse events occurred. Although statin group had a higher crude incidence of major cardiovascular adverse event, multivariate analysis showed no significant difference between two groups. There were no significant differences between two groups in biopsy-proven acute rejection and graft renal function.

**Conclusions:** Among the kidney transplant recipients, early statin use effectively lowers LDL cholesterol levels and is associated with a lower risk of all-cause graft loss.

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## The long-term perioperative lymphopenia associates with low absolute counts of T lymphocytes in liver transplantation recipients with hepatocellular carcinoma

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**Background:** Liver transplantation (LT) is the best treatment option for patients with hepatocellular carcinoma (HCC), however it still has unmet needs in cause of mortality after LT. Although several studies have revealed that higher absolute lymphocyte counts (ALC) leads to better outcome in HCC recipients after LT, the impact of ALC on survival at 1 year post-LT for HCC patients and the alterations of lymphocyte subsets in those lymphopenia patients are not illustrated.

**Methods:** A total of 145 LT recipients with HCC were retrospectively enrolled at Kaohsiung Chang Gung Memorial Hospital between 2005 and 2014. Clinical records from 7 days before LT (pre-LT) to 1 year after LT (post-LT). In prospective study, 20 lymphopenia and 25 nonlymphopenia HCC recipients were enrolled, and a phenotypic analysis of peripheral blood lymphocytes was performed using multiparameter flow cytometry.

**Results:** The higher ALC at pre-LT, post-LT 1 year can indeed predict the better overall survival. Clinical records of 145 patients with HCC from seven days pre-LT to 1 year post-LT illustrated that the longitudinal values of lymphocytes, red blood cell, and hemoglobin were persistently low in patients with peritransplant high neutrophil lymphocyte ratio, which represented a significantly worse survival rate in association with increased red blood cell distribution width and pancytopenia when compared to other patients. We further found that only a significantly decreased in cell counts and percentage of overall T cells in peritransplant lymphopenia group. In detail, the T cell subsets T helper cells, CD8+ cytotoxic/activated T cells were significantly decreased in peritransplant lymphopenia group with all of their nave, effector and memory forms.

**Conclusions:** Our results demonstrated the association between hematopoietic deficiencies and with decreased overall T cells but not other immune cells of peritransplant lymphopenia in LDLT recipients with HCC might imply immune checkpoint deficiencies in association with those patients.

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## A 3-year experience with kidney transplantation at a newly opened university hospital

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**Background:** This study aims to present the clinical short-term outcome of kidney transplantation at a newly opened university hospital.

**Methods:** Between April 2019 and July 2022, a consecutive series of 64 kidney transplants were performed. We analyzed clinical characteristics and outcomes of kidney transplant recipients retrospectively.

**Results:** Of the 64 kidney transplantations, 57.8% were male recipients and 64.1% received a kidney from a male donor. The average recipient age was 54.1±9.9 years, and the mean follow-up duration was 14.3±10.5 months. Thirty-seven patients (57.8%) received a kidney from 33 deceased donors. After the exclusion of one graft nephrectomy due to antibody-mediated rejection with bleeding, seven grafts (11.1%) showed delayed graft function, while 56 grafts (88.9%) were early graft function. The mean modification of diet in renal disease glomerular filtration rate level at 7 days, 1 month, 6 months, and 12 months after transplantation were 55.5±32.7, 58.2±22.8, 64.6±25.2, and 57.6±30.9 mL/min/1.73 m<sup>2</sup>, respectively. The incidence of a biopsy proven acute rejection episode and cytomegalovirus infection were 26.6% (n=17) and 6.3% (n=4), respectively. Graft survival rates at 6 months, 1 year, and 3 years posttransplantation were 98.4%, 98.4%, and 98.4%, respectively. Patient survival rates at 6 months, 1 year, and 3 years posttransplantation were 98.4%, 96.8%, and 96.8%, respectively.

**Conclusions:** This review of 3-year experience in a newly opened KT program showed that the short-term graft survival was comparable to the large-volume center.

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## The effect of loupe magnification on occurrence of duct complication after liver transplantation: a single-center experience

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**Background:** Despite advances of surgical techniques, biliary complications are still considered to be a technical "Achilles' heel" of liver transplantation (LT) due to the high incidence, requiring long-term interventional treatment, and potential risk for graft failure. The purpose of this study was to evaluate the effect of loupe magnification in reducing biliary complications after LT.

**Methods:** From April 2017 to February 2022, LT was performed in 307 patients in Seoul St. Mary's Hospital. Among them, except for three patients who underwent hepaticojejunostomy, 304 adult LT patients were enrolled. They were divided into three groups according to the loupe magnification: 2.5 times ( $\times 2.5$  group,  $n=105$ ), 3.5 times ( $\times 3.5$  group,  $n=95$ ), and 5.0 times ( $\times 5.0$  group,  $n=105$ ). By dividing biliary complication into bile leakage and stricture, the effect of loupe magnification on biliary complications after LT was analyzed.

**Results:** In all patients with LT, the mean age was 54.3 years, and 218 (71.7%) were male. Biliary complications occurred in 63 patients (20.7%). Anastomosis site leakage occurred in 37 patients (12.2%) and stricture occurred in 52 patients (17.1%). There was no difference between the three groups in the number and size of duct openings. Anastomosis site leakage occurred in 15 patients (14.3%) in the  $\times 2.5$  group, 15 patients (16.0%) in the  $\times 3.5$  group, and seven patients (6.7%) in the  $\times 5.0$  group ( $P=0.097$ ). Biliary stricture occurred in 26 patients (24.8%) in the  $\times 2.5$  group, 15 patients (16.0%) in the  $\times 3.5$  group, and 11 patients (10.5%) in the  $\times 5.0$  group ( $P=0.021$ ). Total duct complications occurred in 31 patients (29.5%) in the  $\times 2.5$  group, 19 patients (20.2%) in the  $\times 3.5$  group, and 13 patients (12.4%) in the  $\times 5.0$  group ( $P=0.009$ ).

**Conclusions:** The use of a high-magnification loupe can reduce biliary complications in liver transplantation. Further large-scale analyses of clinical data or randomized controlled trial are required to support this study.

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## Testicular pain after laparoscopic left-sided living donor nephrectomy: postoperative scrotal ultrasonography findings

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**Background:** Ipsilateral orchialgia after laparoscopic donor nephrectomy (LDN) has been rarely described. Our objective is to investigate the incidence and characteristics of testicular pain following LDN, and the relationship among orchialgia, the level of ligation of gonadal vein (GV) and results of postoperative scrotal ultrasonography.

**Methods:** Perioperative data and patient demographics were collected prospectively. During the study period, all patients who underwent left-sided LDN were evaluated with scrotal duplex ultrasonography at 1 to 2 months after LDN. The ligation of the GV at the level of renal vein confluence was defined as level 1 and the ligation of the GV at or below the level of the crossing of iliac vessels was defined as level 2.

**Results:** Between March 2017 and December 2018, 61 male patients (level 1 group, 33 patients vs. level 2 group, 28 patients) underwent left-sided LDN. Ipsilateral orchialgia developed in 26 patients (42.6%) and 12 of 33 patients (36.4%) and 14 of 28 patients (50.0%) in level 1 and 2 groups, respectively ( $P=0.283$ ). There was no statistical difference in patient demographics and perioperative data according to the level of ligation of GV and/or the presence of orchialgia. In the statistical analysis of scrotal duplex ultrasonography, 12 of 33 (36.4%) and 7 of 28 patients (25.0%) had an ipsilateral varicocele in level 1 and 2 groups ( $P=0.340$ ). Among the patients with ipsilateral testicular pain, 4 of 12 (33.3%) and 2 of 14 patients (14.3%) had an ipsilateral varicocele ( $P=0.365$ ). All patients with orchialgia in level 1 and 2 groups had no statistical differences in orchialgia incidence, onset, duration, and intensity.

**Conclusions:** Ipsilateral testicular pain following LDN may be more common than known. We found that the incidence of testicular pain following LDN was not related to the level of ligation of GV. The results of postoperative scrotal ultrasonography were not consistent with the development of ipsilateral testicular pain.

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## Biliary nonanastomosis stricture related with hepatic congestion in the right liver graft

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**Background:** Biliary nonanastomosis stricture (NAS) and passive hepatic congestion are common complications after living donor liver transplantation (LDLT). The former is known to be caused by ischemic cholangiopathy and the latter by impaired venous drainage, but the relationship between these two complications has not yet been reported.

**Methods:** We reviewed the medical records of patients who underwent LDLT using a right liver graft in a single institution from January 2011 to December 2018. A total of 198 patients who needed biliary interventions due to stricture were selected, and images taken on postoperative day 7 confirmed whether the graft was congestive. Hepatic congestion and NAS were divided into three parts: right anterior section, right posterior section, and whole right lobe.

**Results:** Hepatic congestion occurred in 70 patients (35.4%), 42 patients (60.0%) in AS, and 28 patients (40.0%) in NAS. After excluding AS, 16 patients (57.1%) of congestion were observed in the right anterior section and five (17.9%) in the posterior section in the remaining NAS. NAS was observed 18 (64.3%) in the right anterior section, seven (25.0%) in whole right lobe, and three (10.7%) in right posterior section. Both congestion and NAS were observed frequently in right anterior section and there was a statistical relationship between the location of congestion and NAS ( $P=0.02$ ).

**Conclusions:** Both hepatic congestion and NAS of a right liver graft were frequently observed in the right anterior section and congestion occurring in LDLT is associated with subsequent NAS. However, an additional analysis is needed on the correlation between a right graft liver with no congestion and NAS.

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## Allele and haplotype frequencies of 11 human leukocyte antigen loci in Koreans by next-generation sequencing

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**Background:** Data on human leukocyte antigen (HLA) genotype distribution, including DQA1 and DPA1, in the Korean population are limited. We aimed to investigate the allele and haplotype frequencies of 11 HLA loci in 339 Korean subjects using HLA typing based on next-generation sequencing (NGS).

**Methods:** A total of 339 samples from unrelated healthy subjects were genotyped for HLA-A, HLA-B, HLA-C, HLA-DRB1, HLA-DRB3, HLA-DRB4, HLA-DRB5, HLA-DQB1, HLA-DQA1, HLA-DPB1, and HLA-DPA1 using two different NGS-based HLA typing kits (166 tested using the NGSgo-MX11-3 kit [GenDx] and 173 by the AllType NGS 11 Loci Amplification kit [One Lambda]). PyPop software was used to estimate allele and haplotype frequencies and linkage disequilibrium between the loci. Additionally, a principal component analysis was performed to compare the allele distribution of Koreans with that of other populations.

**Results:** A total of 214 HLA alleles (97 class I and 117 class II alleles) were assigned. The most frequent alleles for each locus were A\*24:02:01 (24.78%), B\*15:01:01 (10.18%), C\*01:02:01 (18.44%), DRB1\*04:05:01 (9.59%), DRB3\*02:02:01 (13.72%), DRB4\*01:03:01 (25.81%), DRB5\*01:01:01 (9.0%), DQA1\*01:02:01 (16.96%), DQB1\*03:01:01 (14.31%), DPA1\*01:03:01 (44.4%), and DPB1\*05:01:01 (35.10%), respectively. The most frequent haplotypes were A\*33:03:01-B\*58:01:01-C\*03:02:02 for HLA class I (5.01%) and DRB1\*04:05:01-DQA1\*03:03:01-DQB1\*04:01:01-DPA1\*02:02:02-DPB1\*05:01:01 for HLA class II (6.23%). The total allelic ambiguities by NGS were estimated to be minimal and considerably decreased compared to those by Sanger sequencing.

**Conclusions:** Frequency data of 11 HLA loci in Koreans can provide essential data for exact HLA typing for organ transplantation and disease association studies.

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## Factors associated with quality of life after kidney transplantation: a cross-sectional study

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**Background:** Kidney transplantation is currently the best choice for renal replacement therapy, it reduces the risk of death and increases the survival rates compared with conservative therapy and is also known to improve health-related quality of life (QoL) from various aspects, especially physical health and aspects of psychosocial functioning. This study aims to determine and identify factors associated with QoL after kidney transplantation.

**Methods:** This is a cross-sectional study conducted in Dr. Cipto Mangunkusumo National Central Public Hospital. We enrolled 107 consecutive subjects who received kidney transplantation from January 2018 to December 2020. All participants had the same evaluations which QoL was performed by the 36-Item Short Form Health Survey (SF-36) questionnaire. Univariate, bivariate, and multivariate analyzes were performed on the independent variables and dependent variable (SF-36).

**Results:** Duration of dialysis, hemoglobin levels, Eastern Cooperative Oncology Group (ECOG) status, and depression were contributed to the physical component summary component of QoL ( $R^2=21.4\%$ ) while hemoglobin levels and depression contributed to the mental component summary component ( $R^2=33.6\%$ ). And factors related to total score of SF-36 were hemoglobin levels, ECOG status, and depression ( $R^2=40.7\%$ ). Factors that contributed and were statistically significant to QoL status were hemoglobin levels, ECOG status, and depression.

**Conclusions:** The results of the study can support the need for an assessment of the quality of life as a regular basis in patients before and after kidney transplantation.

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# Nonsurgical removal of migrated polytetrafluoroethylene graft used for middle hepatic vein reconstruction in stomach 10 years after living donor liver transplantation

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Most centers use polytetrafluoroethylene (PTFE) grafts for middle hepatic vein reconstruction in living donor liver transplantation (LDLT). PTFE graft may cause some complications such as thrombosis, infection, migration, etc. There are some reports that the complications result in life-threatening septic shock. The migrations of PTFE graft into hollow viscous organs usually are managed by surgery. We present nonsurgical removal of migrated PTFE graft in stomach 10 years after LDLT. Recipient was 61-year-old female who had underwent LDLT in other hospital. The etiology was hepatitis B virus-related liver cirrhosis and hypersplenism. There was still huge portal vein shunt after liver transplantation, and she suffered intermittent biliary stricture and thrombocytopenia. She took multiple interventions such as endoscopic retrograde choangiopancreatography, percutaneous transhepatic biliary drainage, partial splenic embolization, splenorenal shunt embolization, etc. Recently, she complained intermittent upper abdominal discomfort, therefore, we performed an esophagogastroduodenoscopy (EGD). There was an invaginated foreign material at lesser curvature of stomach. Patient was evaluated whole abdomen by magnetic resonance image (MRI). We assumed there are severe adhesions in the abdomen because the patient suffered various complications after LT and underwent multiple interventional treatment. The PTFE graft was set apart from inferior vena cava from the review of MRI. Endoscopist performed EGD again and removed PTFE graft by gentle traction with snare. The patient took serial X-ray exams after endoscopy, there was no free air in the abdomen. There was no related complications 4 months after PTFE removal endoscopic nonsurgical removal of migrated PTFE graft in the stomach after LDLT is safe procedure in highly selected patients.

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## Angioplasty or sacrifice is better in multiple renal artery grafts: a computed tomography image analysis study

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Recently, more detailed organ evaluation using computed tomography (CT) volume analysis has been developed. In living donor renal transplantation, preoperative three-dimensional (3D) CT volume analysis based on contrast-enhanced thin-slice CT images is used to estimate total renal weight and quantify renal cortical volume, which contributes to securing space in the transplant bed and provides useful information for the evaluation of divided renal function and post-transplant renal function. In addition, in patients with multiple renal arteries, the reflux area of each artery can now be quantified. In the present study, 3D CT volumetric analysis was performed on 188 patients who underwent living donor renal transplantation at the Japanese Red Cross Aichi Medical Center, Nagoya Daini Hospital from January 2020 to November 2021. Of these, 160 patients were analyzed with actual thin slice data; 36 (22.5%) had grafts with multiple renal arteries, and 18 (11.3%) were sacrificed. The 3D CT volumetric analysis predicted by renal cortical volume on initial renal function of recipients after living donor kidney transplantation. The impact of multiple renal artery grafts sacrificed was examined.

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## Erythrocytosis after liver transplantation: a case report

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Erythrocytosis is not uncommon after renal transplantation and many studies have been reported. The prevalence and causes of erythrocytosis after liver transplantation have not been studied wide yet. Erythrocytosis after liver transplantation can be defined as an increase in the red cell mass >125% in patients without pre-liver transplant history of this condition. We would like to report a case of erythrocytosis after liver transplantation without definite cause. The patient is 50 years old male with both hepatitis B virus (HBV) and hepatitis C virus (HCV)-associated decompensated cirrhosis of liver with portal hypertension. He underwent liver donor liver transplantation in February 2017. Donor was his 25-year-old nephew and right lobe modified graft was used. Hepatic artery thrombosis was observed in postoperative day 1 and revision of hepatic artery was done on this day. HCV was already treated before liver transplant and hepatitis B immune globulin (HBIG) was injected after transplantation. Posttransplant period was uneventful but after 3 years, gradual rise in hematocrit level was noticed. After consultation with hematologist, venesection was started when hematocrit was 57%. He had to do venesection monthly, and now it is up to 18 times. No thromboembolic attack has occurred during regular follow-up except dizziness and tingling of extremities. Antiplatelet therapy was continued since transplantation. JAK2 mutation was negative, and no identifiable cause was detected up to now. We reviewed the literatures and possible risk factors are present in this patient including male sex, HBV infection, and HBIG therapy, but no definitive cause and mechanism has not been studied. Further high-volume studies are needed to figure out the cause and treatment of erythrocytosis after liver transplantation.

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## Long-term survival outcome beyond the 1st year of pediatric acute liver failure after liver transplantation compared with biliary atresia: a large-volume living donor liver transplantation single-center study

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**Background:** Pediatric acute liver failure (PALF) is the second most common cause for liver transplantation (LT) in children, but its outcomes are the worst. The purpose of this study is to compare the long-term outcomes of PALF to biliary atresia (BA) in living donor LT-dominant country.

**Methods:** From 2000 to 2015, patients who received primary LT for BA or PALF were analyzed, retrospectively. Survival outcomes and surgical complications between the two groups are compared. Univariate and multivariate analyses of patient factors were performed to identify risk factors associated with patient survival.

**Results:** One hundred and fifty-six patients received primary LT. Patients in the PALF group were older (6.2 years old vs. 2.9 years old) with higher body weight (25.7 kg vs. 13.8 kg,  $P < 0.01$ ). PALF group also showed a higher rate of hepatic artery complication (13.9% vs. 0.8%,  $P < 0.01$ ). In the comparison of 1-year survival rates, the PALF group showed lower survival than the BA group (77.8% vs. 96.7%,  $P < 0.01$ ). Analyzing patients who survived beyond the 1st year of transplantation, there was no significant difference in the 5-year patient survival rates between the two groups (96.4% in PALF group vs. 99.1% in BA group,  $P = 0.548$ ). The most common causes of death were graft failure and infection. Hepatic artery complication and need for postoperative renal replacement therapy were factors associated with worse 5-year survival ( $P < 0.01$  and  $P = 0.029$ , respectively).

**Conclusions:** In conclusion, the overall survival of the PALF is lower than the survival of BA patients. However, there was no difference in the survival between two groups who survived the 1st year LT. We have identified hepatic artery complication and need for posttransplant renal replacement therapy as poor prognostic factors. Children with associated factors should receive more attentive care and follow up after LT as liver failure can recur.

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## Early posttransplant vitamin D improvement is associated with better long-term kidney graft survival

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**Background:** Vitamin D (25-hydroxyvitamin D [25(OH)D]) deficiency in chronic kidney disease is usually ameliorated after kidney transplantation (KT). However, it is not conclusive if the posttransplant vitamin D deficiency is associated with poor graft outcome. This study aimed to investigate the effect of early posttransplant vitamin D status on clinical outcomes.

**Methods:** The Korean cohort study for outcome in patients with kidney transplantation (KNOW-KT) is a multicenter, observational cohort study. A total of 1,034 hundred subjects were included in this study. Annual serum 25(OH)D, 1,25(OH)<sub>2</sub>D<sub>3</sub>, and clinical outcomes, all-cause mortality, cardiovascular event, graft survival, and fracture, were assessed according to vitamin D improvement.

**Results:** Median follow-up duration was 7.4 years. Serum 25(OH)D levels were increased after KT (before KT, 12.6±7.4 ng/mL; 1 year after KT, 22.6±6.4 ng/mL; 3 years after KT, 24.3±5.8 ng/mL). Vitamin D deficiency was present in 79.1% just before KT. Prevalence of vitamin D deficiency was decreased after transplantation; however, it was still 38.2% at 7 years after KT. The patients with 25(OH)D improvement 1 year after transplantation showed higher 25(OH)D level than the patients without improvement at any point during follow-up. At 7-year follow-up, higher vitamin D level was associated with vitamin D improvement after KT and vitamin D analog supplementation during 1 year after KT. The 25(OH)D nonimprovement at 1 year after KT was a risk factor for poor graft survival (hazard ratio, 2.408; 95% confidence interval, 1.187–4.886; P=0.013).

**Conclusions:** The early vitamin D improvement after kidney transplantation was associated with better long-term graft outcome.

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## Inpatient variability of tacrolimus in a recurrently ill kidney transplant recipient

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Tacrolimus is a key immunosuppressant used in kidney transplant patients. A 73-year-old female patient presented with a fever and sputum who had received deceased kidney transplantation for end-stage renal disease due to diabetic nephropathy 15 years ago. She had a baseline serum creatinine ranging from 0.7 to 0.9 mg/dL, and maintenance of immunosuppression has been stable with triple therapy. She was released from quarantine due to a COVID-19 infection the day before ER visit. A chest computed tomography scan showed multifocal ground glass opacities on both lungs compatible with COVID-19 pneumonia. Nevertheless, the blood test showed that the level of the inflammatory marker was not high (high-sensitivity C-reactive protein [hsCRP], 5.72 mg/L). Therefore, she was discharged with oral antibiotics and discontinuation of mycophenolate mofetil (MMF). A week later, the patient's condition deteriorated, and she was admitted to the hospital again. According to blood test results on admission, the patient's white blood cell count was 10,410 cells/L; creatinine, 0.94 mg/dL; hsCRP, 152 mg/L. A chest X-ray revealed pneumonia aggravation. Furthermore, the urine culture was reported 2 days later, *Pseudomonas aeruginosa* grew, and the stool toxin assay confirmed the presence of *Clostridioides difficile*. The last tacrolimus level measured before hospitalization was 8.54 ng/mL, but on the 5th day of admission, it rose sharply to 20.14 ng/mL despite no interacting drug. Thus, we reduced the tacrolimus dose, stopped MMF, and administered antibiotics for pneumonia and *C. difficile* infection (CDI). Finally, she was discharged with full recovery 10 days after. However, the patient presented with fever and bloody loose stool three months after the last hospitalization. A stool exam revealed the recurrence of CDI, serum hsCRP (68 mg/L), and tacrolimus levels (16 ng/mL) repeatedly increased with stable kidney function. We experienced the tacrolimus level increase whenever the infection requiring hospitalization occurred, and the increase was more significant in the presence of overlapping infection in the kidney transplant recipient.

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## Donor's quality of life after living donor liver transplantation and influencing factors in Mongolia

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**Background:** Improving the quality of living liver donor's postdonation is an important aspect of care quality. In addition, there are many factors that affect the quality of life. In Mongolia, evidence-based information on the quality of life of living donors is few. This study aims to propose the quality of life of living donors who donated organs for liver transplantation and influencing factors.

**Methods:** The study was conducted from February 10, 2018 to May 15, 2020 at the National Cancer Center using a descriptive study design. The quality of life of a liver transplant donor from a living donor was collected using the 36-Item Short Form Health Survey questionnaire.

**Results:** The study involved 63 donors aged 19 to 52 years. The mean age of the total donors was 31.0±7.1 years and 35 donors (55.6%) were male. The mean quality of life score of donors who underwent liver transplantation was 50.9±5.9. Of the participants who underwent surgery, 39.7% were donors to parents and 9.5% were donors to unrelated recipients. In participants, 30.2% did not receive information, and 52.4% received information after decision making. In all donors, 85.0% did not make their own decisions. In donors, 50.8% made the decision to undergo surgery within 1 week. In liver transplant donors, 65.1% had symptoms after surgery.

**Conclusions:** The quality of life of a donor after live liver transplantation is relatively lower than that of the general population. The quality of life after surgery is influenced by the relationship between the donor and the recipient, the age of the donor, the pain after surgery, and the availability of information.

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# Biliary reconstruction for multiple graft bile ducts does not impact posttransplant outcome compared with one graft bile duct during living donor liver transplantation

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**Background:** Multiple graft bile ducts (BDs) are related to higher incidence of biliary complications (BCs), and biliary reconstruction for multiple BDs still remain a technical challenge during living donor liver transplantation (LDLT). Especially, biliary reconstruction using high biliary radicals of recipients for multiple BDs has very high probability of BCs secondary to devascularization and ischemia.

**Methods:** Herein, we analyzed clinical outcomes through retrospective reviews 281 patients receiving duct to duct anastomosis (DDA) for right lobe grafts LDLT from January 2013 to September 2019. A total of 104 LDLT using grafts with multiple BDs have been performed under our strategy. In cases with two close ducts or the two orifices were located in the same hilar plate, we have recently performed dunking with mucosal eversion technique instead of ductoplasty. In the cases of two orifices far located, we tried to perform two separate DDAs using high biliary radicals of the recipient with minimal hilar dissection, external biliary stents and mucosal eversion technique to reduce BCs.

**Results:** Among multiple BDs group, 20 underwent unification ductoplasty, 45 were treated using dunking with mucosal eversion technique, and 39 patients underwent two DDAs separately using high biliary radicals (HBR group). The incidence of biliary leakage and stricture were 11.5% and 10.6%, respectively, in multiple BDs group and these outcomes were not different to those in one BD group. Neither overall patient survival nor graft survival differed significantly between the two groups. In subgroup analysis, we compared clinical outcomes between HBR group and one BD group and the incidence of biliary complications in HBR group was 10.3%, which was comparable to that in one BD group.

**Conclusions:** LDLT using multiple graft BDs could be a safely without negative impacts on posttransplant outcomes. Furthermore, biliary reconstruction using high biliary radicals could be a safe option for multiple graft BDs during LDLT.

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## Pulse pressure variation-guided intraoperative fluid management in kidney transplant recipients

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**Background:** Despite advances in perioperative fluid management in kidney transplantation, the best strategy to provide individualized need and response to volume therapy remains unclear. A pulse pressure variation (PPV) is a well-established hemodynamic monitoring parameter for evaluating fluid responsiveness during perioperative fluid administration in major high-risk surgeries.

**Methods:** A total of 70 American Society of Anesthesiologists (ASA) physical status grade III patients, aged 20 to 65 years, who underwent living donor kidney transplant surgery between September 2018 and April 2021 were enrolled in this hospital-based, comparative study. Every 35 patients were allotted into two groups: group P was managed with PPV and received 100 mL of crystalloid bolus whenever the value was greater than 13%, while group C patients received the same amount and type of fluid if the central venous pressure (CVP) was less than 10 mmHg. All patients received 4 mL/kg/hr of maintenance fluid.

**Results:** Fluid requirement was significantly different between group P and group C (1,764.86±274.88 mL vs. 2,059.71±240.02 mL, P<0.001), as well as mean CVP (9.03±0.85 mmHg vs. 11.14±0.22 mmHg, P<0.001), without difference in inotrope requirement. Hemoglobin, hematocrit, and bicarbonate significantly decreased, while lactate and chloride substantially increased in all patients. Blood pH decreased in CVP patients but was stable in PPV patients. The percent changes in hemoglobin, hematocrit, blood pH, and chloride differed significantly between groups. Urinary output was significantly increased, while serum creatinine and blood urea nitrogen decreased considerably from baseline. Between the groups, the percent change in creatinine was more in PPV and differed significantly though no statistically significant difference in blood urea nitrogen and urine output.

**Conclusions:** This study revealed that pulse pressure variation was an effective and safe perioperative hemodynamic guiding predictor providing better biochemical parameters while maintaining graft function in fluid management of kidney transplant recipients.

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## Incidence of cardiovascular events and mortality in kidney transplant recipients compared to the general population in Korea

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Although kidney transplant (KT) reduces the incidence of cardiovascular disease (CVD) compared to the patients staying with dialysis, still, CVD is a major risk factor for mortality and CVD death in KT population. However, few studies about the relative incidence of CVD in Asian KT population. This study aimed to assess the incidence of CVD events with or without cerebrovascular accident, and death in a prospective KT cohort compared to general population. We analyzed incidence rates for 1,080 patients from the Korean cohort study for outcome in patients with kidney transplantation (KNOW-KT). Standard incidence rate (SIR) in KT population was calculated by normalization to that in the general population using data from the National Health Insurance Service. Additionally, SIR was also calculated according to renal function. During a median follow-up of 7.1 years, the incidence of CVD, CVD with cerebrovascular accident, and all-cause mortality was 7.8, 9.5, and 4.8 per 1,000 person-years, respectively. Compared to the general population, the cohort KT population showed significantly higher risk of CVD (SIR, 2.60; 95% confidence interval [CI], 1.99–3.40;  $P < 0.001$ ) and higher all-cause mortality (SIR, 1.67; 95% CI, 1.46–1.91;  $P < 0.001$ ). Especially, all-cause mortality increased with increasing chronic kidney disease (CKD) stage (stage G3: hazard ratio, 2.45;  $P < 0.001$ ; stage G4: hazard ratio, 2.03;  $P < 0.001$ ) after adjustment. CVD risk was increased as the CKD stage was higher from G1 to G4. This study showed that KT population still has a higher risk for CVD and all-cause mortality in a Korean population.

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## Analysis of specificity of expressed transcripts according to clinical results after kidney transplantation

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**Background:** After kidney transplantation, approximately 30% of patients develop BK viremia and 7% develop BK nephropathy. We performed transcriptome-based clustering at the single-cell level to identify these patients to be effective in monitoring and treating allograft dysfunction after transplantation.

**Methods:** Single-cell libraries were generated using the 10× Genomics Chromium Platform from peripheral blood mononuclear cells from each of one posttransplant stable patient, two patients with BK viremia, and three patients with BK virus-associated nephropathy (BKVAN). We analyzed multiplexing data in Cell-Ranger pipeline and used R and "Seurat" packages for downstream analysis.

**Results:** A total of 5,811 differentially expressed genes (DEGs) in 17 cell clusters were identified using 5,473 stable cells, 9,068 BK viremia cells, and 17,238 BKVAN cells for analysis. In the BK virus infection group, CENPF, MKI67, TOP2A, UBE2C, and HIST1H1B were overexpressed in gamma-delta T cells (logarithm two of fold change [ $\log_2FC$ ] difference, 8.2–63.8), and TSC22D1, C2orf88, RGS18, and ACRBP in platelets than in the stable group ( $\log_2FC$  difference, 3.5–153). Among them, CENPF, MKI67, and TOP2A were more expressed in gamma-delta T cells of BKVAN group than in BK viremia group ( $\log_2FC$  difference, 53.5–56.5), whereas PF4, PPBP, and GNG11 in platelets were more overexpressed in BK viremia group than in the BKVAN group ( $\log_2FC$  difference, 27.6–70.9). In the stable group, LGALS3, CTSD, CD68, CST3, and GRN were overexpressed in FCGR3A monocytes ( $\log_2FC$  difference, 12.0–244.7) and TVP23A in CD16 monocytes ( $\log_2FC$  difference, 14.1 or more) than in the BK infection group.

**Conclusions:** In patients with reactivated BK virus, the relationship to specific genomes can determine progression to nephropathy. In the case of gamma-delta T cells, the expression level was very low, so the difference in expression of each sample could be confirmed through single-cell RNA analysis. The developed marker is expected to enable more careful management of patients after kidney transplantation.

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## A new formula for estimation of standard liver volume using liver height and thoracic width

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**Background:** Precise estimation of the standard liver volume (SLV) is crucial in decision making regarding major hepatectomy and living donor liver transplantation. This study aimed to propose an accurate and efficient formula for estimating the SLV in the Korean population.

**Methods:** We created a regression model for SLV estimation using a data set of 230 Korean patients with healthy livers. The proposed model was cross validated using a different data set of 37 patients with healthy livers. The total liver volume, except for the volume of liver blood vessels, was measured through computed tomography volumetry as the dependent variable. Various anthropometric variables, liver height, thoracic width, age, and sex (female, 0; male, 1) were considered as candidates for independent variables. We conducted stepwise regression analysis to identify variables to be included in the proposed model.

**Results:** A new formula was established:  $SLV = 1,275 + 9.85 \text{ body weight (kg)} + 19.95 \text{ thoracic width (cm)} + 7.401 \text{ liver height (mm)}$ . The proposed formula showed the best performance among existing formulas over the cross-validation data set.

**Conclusions:** The proposed formula derived using body weight, thoracic width, and liver height, estimated the total liver volume in the cross-validation data set more accurately than existing formulas.

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## Swine partial liver transplantation model for practicing living donor liver transplantation based on a new liver segmentation method

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**Background:** Living donor liver transplantation (LDLT) is one of the most technically demanding and complicated procedures. However, unlike deceased donor liver transplantation, there is no suitable animal model for practicing LDLT. Herein, we propose a new liver segmentation method and a feasible pig LDLT model for practicing for LDLT in humans.

**Methods:** Four landrace pigs weighing 25, 25, 27, and 28 kg were used as donors and recipients to establish a partial liver transplantation model. Partial liver transplantation was performed using a right liver and a left liver, respectively, based on a new segmentation system compatible with that of humans.

**Results:** We established a new segmentation system for porcine liver transplantation and a partial liver transplantation model. For right liver transplantation, 91 and 142 minutes was required to operate on the donor and recipient, respectively; for left liver transplantation, 57 and 104 minutes was required to operate on the donor and recipient, respectively. All pigs that underwent partial liver transplantation remained alive until the operation was complete.

**Conclusions:** It is expected that this new pig model based on the new segmentation system will be suitable as an educational tool for LDLT training and will replace the existing animal models for partial liver transplantation.

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## Back on track: outcomes of deceased donor kidney recipients at national kidney and transplant institute during the COVID-19 pandemic

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**Background:** Despite the decreased referrals and strict protocols, the primary transplant center in the Philippines, the National Kidney and Transplant Institute (NKTi), has been accepting deceased donor referrals to keep up with the ever-growing shortage of the country's donor pool. NKTi has received various challenges during retrievals such as shortage of Kidney Perfusion Solution (KPS-1) for the LifePort Kidney Transporter (LifePort) and delayed referrals due to strict COVID-19 restrictions. The study aims to describe the outcomes of the country's deceased organ retrieval since the pandemic.

**Methods:** This is a retrospective descriptive study. Data are gathered from NKTi and the Human Organ Preservation Effort.

**Results:** Since 2020, NKTi was able to do 16 cadaveric kidney retrievals. Eight donors were stable enough to have the retrieval done at NKTi while the other eight were retrieved at the referring institutions. Five of those donors were hypotensive, eventually leading to cardiac arrest, necessitating the need for immediate harvest. Donor ages range from 17 to 47 years old. Only one patient underwent preemptive kidney transplantation. From the retrieved kidneys, 10 were placed on LifePort. Of these kidneys, seven had immediate graft function, while three had delayed graft function. One of the recipients expired due to septic shock secondary to non-COVID-19 pneumonia. Nineteen kidneys were placed on cold storage with two having allograft nephrectomies within the same month of transplant due to graft intolerance syndrome. The institute also had its first dual kidney transplant, having one recipient receive two kidneys from a single donor due to having 50% glomerulosclerosis on biopsies done on the donor kidney. The recipient had immediate graft function. Two kidneys were retrieved simultaneously with the recipients, having similar cold ischemia times, due to absence of the institutes' LifePort. None of the recipients contracted COVID-19 during their admission.

**Conclusions:** Deceased organ donation still remains a viable option for recipients without living donors, even during the pandemic.

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## Successful ABO incompatible living donor liver transplantation in giant polycystic liver disease: a case report

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A 49-year-old female patient was diagnosed of having a giant polycystic liver with severe abdominal distention and sarcopenia for over 10 years. Her polycystic liver disease (PLD) became severe and resulted in dyspnea, abdominal pain, abnormal liver functions, and repeated intraabdominal infection. No prior transcatheter arterial embolization, percutaneous cyst drainage, fenestration, or hepatectomy was performed prior to the liver transplantation. Owing to no available ABO compatible donor, an ABO incompatible (ABOi) living donor liver transplantation (LDLT) was arranged. The patient underwent our desensitization protocol with rituximab administration, plasma exchange and mycophenolate mofetil introduction. The pretransplant hemagglutinin titer was 1:16. The ABOi LDLT was smoothly performed with the technique of total mobilization and reduction of the abdominal cavity. A rebound of the hemagglutinin up to 1:64 was noted on postoperative day 2 and a 5-day course of intravenous immunoglobulin was given based on our protocol. The patient recovered uneventfully without any surgical complications. The native liver was measured 13 kg in weight. This is by far the largest polycystic liver in LDLT in our institute to date. We demonstrated a feasible approach to such advanced PLD cases without complications, even in the ABOi setting.

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## End-to-side jump graft from superior mesenteric vein for portal vein reconstruction in pediatric liver transplantation: a case report

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Attenuated portal vein (PV) flow is challenging in pediatric liver transplantation (LT) because the PV size of a large-for-size graft is unsuitable even for an end-to-end jump vein graft from a small sized superior mesenteric vein (SMV). We introduce a novel technique of an end-to-side jump graft from the SMV for the patients with a large-for-size graft and attenuated portal flow during pediatric LT. In the first case, a 2-year-old male patient with hepatoblastoma had a Yerdel grade 3 PV thrombosis. He underwent a deceased split LT. The other patient is an 8-month-old female with biliary atresia and PV hypoplasia with stenosis on the confluence level of the SMV. Because her first liver graft was failed 9 days after deceased donor LT, emergency living donor LT from her father was planned. After hepatectomy, the PV was resected at the SMV confluence level. Then, an end-to-side reconstruction from the SMV to the interposition fresh iliac vein of a deceased donor was made for bridging to the graft left PV. The interposition graft through posterior to the pancreas was obliquely anastomosed to the graft PV. There were no PV related complications during the follow-up period. In cases that a pediatric LT recipient has inadequate portal flow due to thrombosis or hypoplasia of the PV, it is a feasible option to adopt a jump graft as an end-to-side fashion to connect between the small native SMV and the large graft PV.

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## Epidemiology and outcomes of extrapulmonary fungal infections among kidney transplant recipients: a tertiary care experience

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**Background:** With the advances in post-transplant care leading to improved kidney graft and patient survival, the incidence of fungal infections has also increased. The published data regarding extrapulmonary fungal infection is few and lacking. The aim is to study the clinical profile, etiology, risk factors, treatment, and outcome of extrapulmonary fungal infections in kidney transplant recipients.

**Methods:** This is a 15-year retrospective observational study from January 2007 to December 2021 conducted at Sanjay Gandhi Postgraduate Institute of Medical Sciences, wherein kidney transplant recipients with extrapulmonary fungal infection were included and followed.

**Results:** Extrapulmonary fungal infections were diagnosed in 103 of 1,649 recipients (6.3%) with mean age of 44.56 years. Mean duration of acquiring infection posttransplant was 35.68 months, and mean serum creatinine at presentation was 2.00 mg/dL. Majority of donors were living related (n=100). Ninety-seven transplants were ABO-compatible, whereas six were ABO-incompatible. Forty-six patients received basiliximab induction, 18 received antithymocyte globulin, one received daclizumab, whereas 35 did not receive any induction. Most common extrapulmonary fungal infection was phaeohyphomycosis (37.9%; 37 subcutaneous, one nasal, one central nervous system [CNS]), followed by candidiasis (27.2%; 23 GI, one subcutaneous, one graft, three others) and cryptococcosis (18.5%; 18 CNS, one disseminated). Five patients (4.9%) had evidence of dual fungal infections. Diabetes mellitus (53.9%), cytomegalovirus infection (9.7%), antirejection therapy (43.7%), hepatitis C (6.8%), and hepatitis B (7.8%) were risk factors identified. The immediate patient outcomes were nine death (8.7%), three discharge against medical advice (2.9%), and 78 normal discharge (75.7%). Thirty-nine patients (37.9%) had evidence of graft dysfunction, but only four (3.9%) had graft loss. During long-term follow-up, 12 patients (11.7%) had graft loss and 29 patients (28.2%) died. Further, 23 patients (22.3%) were lost to follow-up.

**Conclusions:** Extrapulmonary fungal infection may range from benign lesions like phaeohyphomycosis to fatal cryptococcal meningitis. Prevention, early diagnosis, and appropriate management are necessary to improve their prognosis and quality of life.

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## The impact of COVID-19 on pediatric liver transplantation recipients in National Center for Child Health and Development

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**Background:** Patients with immunosuppression are reported to be at a high risk of severe and prolonged COVID-19. However, there is insufficient evidence of the clinical significance of COVID-19 and the therapeutic management after pediatric liver transplantation (LT).

**Methods:** We retrospectively studied the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, treatment, and management of immunosuppression drugs in 658 pediatric patients who underwent LT at the National Center for Child Health and Development between November 2005 and July 2022.

**Results:** SARS-CoV-2 polymerase chain reaction became positive in 88 recipients (13.4%) after LT and SARS-CoV-2 infection was identified during the operation in one patient. Median age of the recipients when they became COVID-19 positive was 8 years and 8 months (range, 9–296 months). Eighty-two patients (93.2%) became positive after January 2022 during the Omicron surge. Only seven patients (8.0%) were vaccinated before infection because most of children were not old enough to be vaccinated. Regarding the severity of COVID-19, 87 patients (98.9%) were categorized in asymptomatic or mild infection, and there was no patient who required mechanical ventilation. Antibody preparations were administered to nine patients and antiviral drugs were done to six patients as the treatment for COVID-19. As adjusting immunosuppressive drugs, the calcineurin inhibitor was hold in 51 patients only for the duration of the fever. We reduced the dosage of mycophenolate mofetil by half in 11 patients and hold it off in one patient. As a result of adjusting immunosuppressant, one patient had the episode of acute cellular rejection (ACR) 14 days after COVID-19 positive result was confirmed, and he was treated by steroid bolus therapy. Median time from positive SARS-CoV-2 test to negative was 46 days (range, 21–176 days).

**Conclusions:** COVID-19 infection did not lead to severe outcomes in the pediatric recipients after LT in this study. We should pay much attention not to provoke ACR after adjusting immunosuppressive drugs.

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## Clinical outcomes and implications of pretransplant history of malignancy in heart transplant recipient

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**Background:** The number of patients with prior malignancy needing heart transplant (HTx) is increasing; however, detailed clinical characteristics and long-term clinical outcomes of these patients are largely unknown. We sought to evaluate long-term clinical outcomes of HTx patients with pretransplant history of malignancy (PTM).

**Methods:** This study is a single-center retrospective analysis to assess the characteristics and outcomes of HTx recipients with PTM. Among 1,062 HTx recipients (between 1997 and 2013), 73 patients had a history of PTM. We compared long-term HTx outcomes between patients with PTM (n=73) and those without PTM (n=989). We analyzed post-HTx outcome, recurrence of PTM and development of *de novo* malignancies. Post-HTx outcome included overall survival, 10-year survival, 10-year freedom from cardiac allograft vasculopathy (CAV), nonfatal major adverse cardiac events (NF-MACE), any treated rejection (ATR), acute cellular rejection (ACR), and antibody mediated rejection (AMR).

**Results:** Four most common PTMs were lymphoproliferative disorders (18.2%), prostate cancers (18.2%), nonmelanoma skin cancers (18.2%), and breast cancers (13.0%). Median time from PTM and HTx was 9.0 years. During a median follow up of 8.6 years after HTx, patients with PTM, compared to those without, showed significantly higher incidence of posttransplant malignancies (43.8% vs. 20.8%,  $P<0.001$ ) including 9.6% of PTM recurrences (n=7). However, patients with PTM, compared to those without, showed comparable overall survival, 10-year survival, 10-year freedom from CAV, NF-MACE, ATR, ACR, and AMR. HTx recipients with PTM showed comparable long-term clinical outcome to those without PTM.

**Conclusions:** Even with pretransplant history of malignancy, carefully selected HTx recipients showed comparable clinical outcome with patients without PTM, despite higher incidence of posttransplant malignancy. A history of PTM should not disqualify patients from HTx listing, while further research is necessary for prevention and early detection of posttransplant malignancies in these patients.

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## Association of number of donated organs per brain death donor and the etiology of brain death

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**Background:** Organ donation from brain death (BD) cases is the main mode of organ donation in Iran. An important index in organ donation is the organ per donor (OPD) number. OPD can be assessed versus several parameters, such as etiology of BD. This original research aimed to investigate the association of OPD and the most prevalent BD causes in Iran, including trauma, convulsion, cranial bleeding, cerebrovascular accidents, drug toxicity, falling, hanging, post-cardiopulmonary resuscitation (post-CPR), and brain tumor.

**Methods:** This registry-based study retrospectively recruited the data of successful organ donation cases in our organ procurement unit (OPU) through years 2005–2022. OPD and age of donors were investigated among different BD etiologies and in two genders using descriptive and analytical data processes.

**Results:** A total number of 2,299 BD cases with a mean age of 37.96 years (16.56) were included in this study. The average OPD was 2.60 (1.23) in our donors. The greatest OPD of 2.94 in trauma group was remarkably higher than the lowest OPD of 2.36 in post-CPR group ( $P=0.01$ ). Moreover, the mean OPD in female donors was 2.67 (1.18), that was larger compared to OPD in male donors with a mean value of 2.561.26 ( $P=0.04$ ). No significant difference in the age of female and male donors was found (38.52 years [16.71] vs. 37.65 years [16.48], respectively;  $P=0.23$ ). The youngest BD causative group was convulsion with a mean age of 21.80 years (14.65). The age difference with the oldest BD causative group of cerebrovascular with a mean age of 50.16 years (10.49) was statistically significant ( $P=0.01$ ).

**Conclusions:** This study described the findings of OPD and BD etiologies during 18 years of medical record in our OPU. The OPD significantly depended on the BD etiology and the gender. Our findings can help coordinators to provide better organ-preservation care. Further research is recommended to refine the protocols of such care in specific BD causes.

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# Clinical significance of late onset antibody-mediated rejection without donor-specific anti-human leukocyte antigen antibodies in kidney transplantation

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**Background:** Late onset antibody-mediated rejection (AMR) is a leading cause of allograft failure after kidney transplantation. Although the presence of donor-specific antibodies (DSA) is no longer required for AMR diagnosis according to Banff 2017 classification, the clinical significance of late onset AMR without DSA remains unclear.

**Methods:** We analyzed 137 cases of late onset AMR (>6 months after transplant) that meet the Banff 2017 histologic criteria for AMR. All cases were diagnosed by for cause biopsy and grouped into DSA-positive (n=116) and DSA-negative (n=31) AMR groups.

**Results:** The diagnosis of AMR was made on median 87 months after transplantation. Two groups had similar histological pictures and graft renal function at the time of biopsy. Of the DSA-negative AMR group, 19 patients were tested for antibodies against angiotensin II type 1 receptor and 6 of them had antibodies (31.6%). In total, 85.7% of patients received AMR-specific treatment, including rituximab, plasmapheresis, and/or intravenous immunoglobulin. During a median follow-up of 41 months after AMR diagnosis, 48 patients lost their grafts. The 5-year death censored graft survival rates were 61.6% for DSA-positive AMR and 70.6% for DSA-negative AMR (P=0.752). Multivariable analysis revealed that young age, interstitial fibrosis/tubular atrophy (ci+ct score), transplant glomerulopathy (cg score), and impaired renal function at the time of biopsy were independent risk factors for death-censored graft loss. During the follow-up, graft renal function after AMR diagnosis was comparable between DSA-positive and DSA-negative AMR.

**Conclusions:** DSA-negative late onset AMR have similar clinical outcomes compared to DSA-positive AMR.

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## Clinical impact of early blood transfusion after kidney transplantation

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**Background:** Pretransplant blood transfusion is well-known cause of allosensitization. However, the effects of blood transfusion after kidney transplantation on graft outcomes remain controversial.

**Methods:** We analyzed 785 patients who underwent human leukocyte antigen- and ABO-compatible kidney transplantation between 2014 and 2020. Patients were grouped based on receiving red blood cell transfusion within the first 30 days after transplantation.

**Results:** Overall, 18.9% of patients received red blood cell transfusion within 1 month after transplantation. The median number of packed red cells among transfused recipients was 2 (interquartile range, 1.0–3.0) and the median time to first transfusion was 5.0 days (interquartile range, 2.0–12.0). Transfusion group patients were more often women, more often received a deceased donor transplant, and had a longer dialysis vintage compared to no transfusion group patients. During a median follow-up of 53 months, 30 patients (3.8%) died and 39 patients (5.0%) experienced death-censored graft loss. Multivariable analysis confirmed that blood transfusion was independently associated with higher all-cause mortality (hazard ratio, 3.030; 95% confidence interval [CI], 1.438–6.384;  $P=0.004$ ). Transfusion was also significantly associated with an increased risk of death-censored graft loss (hazard ratio, 2.178; 95% CI, 1.059–4.477;  $P=0.034$ ). Cumulative probabilities for antibody-mediated rejection was significantly higher in the transfusion group than in the no transfusion group ( $P=0.012$ ), whereas cumulative probabilities for T cell-mediated rejection between two groups were not significantly different ( $P=0.694$ ).

**Conclusions:** Transfusion within 1 month after kidney transplantation is associated with increased risk of all-cause mortality, death-censored graft loss, and antibody-mediated rejection.

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## Clinical impact of myosteatoris in liver transplant recipients

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**Background:** Myosteatoris, excessive intramuscular fat disposition, is common in patients with chronic liver disease and is associated with increased morbidity and mortality. We investigated the effects of pretransplant myosteatoris on transplant outcomes following liver transplantation.

**Methods:** We analyzed 873 patients who underwent first liver transplantation between 2006 and 2019. Muscle quantity and quality were evaluated using the pretransplant computed tomography-based skeletal muscle index and intramuscular adiposity tissue contents (IMAC). Patients were grouped into myosteatoris and no myosteatoris group based on the sex-specific highest quartile of the IMAC.

**Results:** In total, mean laboratory model for end-stage liver disease (MELD) score was 23.2, 584 (66.9%) received a liver from a living donor, and 466 (53.4%) had hepatocellular carcinoma at the time of liver transplantation. During a median follow up of 65 months, 234 patients died and 14 underwent re-transplantation. The 1-year, 3-year, and 5-year patient survival rates were 80.1%, 71.3%, and 65.4% for the myosteatoris group and 89.7%, 82.5%, and 79.0% for the no myosteatoris group. Myosteatoris was associated with mortality (hazard ratio, 1.685; 95% confidence interval [CI], 1.282–2.215;  $P < 0.001$ ) and all-cause graft failure (hazard ratio, 1.469; 95% CI, 1.112–1.940;  $P = 0.007$ ), independent of skeletal muscle index, visceral adiposity, MELD score, and donor characteristics. Myosteatoris was also associated with an increased risk of early allograft dysfunction (hazard ratio, 1.653; 95% CI, 1.081–2.527;  $P = 0.020$ ).

**Conclusions:** Pretransplant myosteatoris was associated with an increased risk of mortality and early allograft dysfunction after liver transplantation.

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## Intraoperative cholangiography for precise localization of accurate biliary division and hilar plate transection in living donor liver transplantation

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**Background:** Biliary complications have been the Achilles heel of living donor liver transplantation (LDLT). Regardless of technique used, a patient with multiple ductal openings has a higher incidence of biliary complications than those with single duct. Precise investigation of the donors biliary anatomy and accurate division of the bile duct (BD) are of paramount importance. We aimed to evaluate our strategy of the donors BD division using IOC localization with a radiopaque tagging method.

**Methods:** Sixty-six LDLTs from October 2020 to August 2022 were retrospectively investigated. To determine the BD division site, the radiopaque material was tagged transversely on the proposed division site of the BD by holding sutures. From October 2020 to September 2021 (period I, n=30), we used two radiopaque rubber band (1 mm in diameter) as the radiopaque material and then (period II, n=36) a home-made metal hook (20 mm in length, 1.5 mm in diameter) was used. IOC via the cystic duct was checked to identify the relation between the radiopaque tag and the proposed division site of the BD. Careful sharp division of the duct and the residual hilar plate was made. During Period II, we modified the division strategy: the residual hilar plate was transected cranially with the direction of 10°–15° left deviation.

**Results:** During period I, six patients were type I with short common trunk (SCT) of the right BD in 22 LDLTs using right-lobe grafts. Four grafts (67%) had two BD openings, and two with one BD opening. During period II, seven patients were type I with SCT in 25 right-lobe LDLTs. One graft (14%) had two BD openings, and six with one BD opening.

**Conclusions:** Using IOC with the appropriate radiopaque tags to localizing the division site, we could obtain coalesce BD in right-lobe LDLT with SCT of the right BD.

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## Clinical presentation and outcomes of the COVID-19 infection in kidney transplant patients

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**Background:** While COVID-19 poses a significant threat to immunocompromised patients, there is limited data on the clinical course and the risk factors for severe disease in the Korean transplant population. We have performed a single-center, cross-sectional, survey-based study to evaluate the clinical presentation, treatments, and outcomes of COVID-19 infection among renal transplant recipients (RTRs).

**Methods:** Eligible patients were adult RTRs who had reported confirmed COVID-19 infection. We conducted an electronic survey using a structured questionnaire via Google Forms to collect information on symptoms and treatments sought during the infection. The data were combined with data documented in the electronic health report.

**Results:** Among 2,250 adult RTRs, 239 patients (10.6%) had experienced COVID-19 infection. Patients had a mean age of 49 years, 56.9% (n=136) were male, and 77.1% (n=182) had received transplantation from a living donor. Patients had experienced COVID-19 infection after one (n=217, 90.7%), two (n=315, 89.9%), and three doses (n=185, 77.4%) of vaccination, respectively. The mean period between the prior vaccination and infection was 84 days. The most common route of infection was family (n=100, 42%) followed by unknown and multi-use facilities. Main symptoms were cough (n=158, 66.1%), sore throat (n=145, 60.7), and fever (n=129, 54.0%). The majority of the patients were infected during the Omicron surge (n=221, 92.4%) and initially received home treatment with upper respiratory infection medications (n=181, 75.7%) only. 13 patients experienced severe disease (World Health Organization severity scale), and there were (n=2, 0.8%) mortalities. Factors independently associated with COVID-19 disease were old age (odds ratio [OR], 1.08), diabetes (OR, 5.39), low hemoglobin (OR, 0.71), and high neutrophil-lymphocyte ratio (OR, 1.28) in the multivariate logistic model.

**Conclusions:** The mortality rate associated with COVID-19 disease was higher in kidney transplantation patients than in the general population. Age, diabetes, hemoglobin levels, and Neutrophil-to-lymphocyte ratio were factors associated with the severe COVID-19 disease. Larger studies are warranted to confirm these findings.

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# Impact of everolimus versus mycophenolate mofetil in combination with reduced tacrolimus in liver transplantation patients with hepatocellular carcinoma within Milan criteria

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**Background:** The benefit of using everolimus with reduced tacrolimus (rTAC) in respect of hepatocellular carcinoma (HCC) recurrence is still controversial and whether preventive effect of HCC recurrence resulted from everolimus or from minimization of tacrolimus is not clear. There has been no head-to-head study that compared rTAC+everolimus with rTAC+mycophenolate mofetil (MMF). We describe retrospective intention-to-treat (ITT) analysis comparing outcome of those to regimens, with HCC recurrence as primary endpoint in liver transplant (LT) recipients within Milan criteria.

**Methods:** Three hundred thirteen patients who received LT for HCC at Severance Hospital, between January 2014 and December 2020 were retrospectively reviewed. Pediatrics, retransplants, combined transplants, patients with use of cyclosporine or Rapamune, and above Milan were excluded. Goal of tacrolimus blood level was 4–10 ng/mL in the first month after LT and 3–6 ng/mL thereafter. With the use of Everolimus, target level thereof was 3–5 ng/mL.

**Results:** ITT population composed of patients receiving at least 1 month of MMF and then continued MMF (rTAC+MMF, n=52) or switched to everolimus (rTAC+Everolimus, n=81). Among them, 105 patients who continued MMF or everolimus without changing regimen thereafter comprised per-protocol (PP) population. In ITT population, there was no difference in sex, age, model for end-stage liver disease (MELD), Child-Turcotte-Pugh score and original liver disease between the two groups. There were no significant differences in acute rejection rate, recurrence-free survival (RFS) and overall survival (OS). In PP population, four patients had recurrence of HCC in rTAC+MMF group and five patients in rTAC+Everolimus group (10.8% vs. 7.4%, P=0.717). There was no significant difference in 5-year RFS nor OS between rTAC+MMF and rTAC+Everolimus group (87.7% vs. 91.3%, P=0.653; 83.2% vs. 94.1%; P=0.351).

**Conclusions:** There was no significant difference in HCC recurrence rate between patients receiving rTAC+MMF or rTAC+Everolimus for HCC within Milan. Prospective studies are needed to find best strategy of immunosuppression for prevention of HCC recurrence.

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## Determination of tacrolimus dosage using machine learning in kidney transplantation

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**Background:** Maintaining tacrolimus trough levels in kidney transplantation is very important. The purpose of this study is to analyze the determination of tacrolimus dosage to maintain tacrolimus trough levels using machine learning.

**Methods:** This retrospective study included 801 consecutive patients from a prospectively registered database who underwent kidney transplantation at Seoul St. Mary's Hospital, South Korea, between January 1, 2015, and December 30, 2019. After kidney transplantation, supervised learning was performed based on individual tacrolimus trough levels and tacrolimus dosage during hospitalization.

**Results:** A total of 771 patients were enrolled in the study with a mean age  $48.7 \pm 11.5$  years (range, 16–75 years). Four hundred forty-five patients (57.7%) were male. Three hundred twenty-six patients (42.3%) were female. One hundred fifty-seven patients (20.4%) were ABO incompatible kidney transplantation and 196 (25.4%) were deceased donor kidney transplantation. Significant results of tacrolimus trough levels and tacrolimus dosage during hospitalization were confirmed through machine learning. It was analyzed that weight had a significant effect.

**Conclusions:** Determination of tacrolimus dosage to maintain appropriate tacrolimus trough levels through machine learning during hospitalization after kidney transplantation should be considered as a useful tool.

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## Is it acceptable to perform duct to duct anastomosis during living donor liver transplantation in patients with hepatocellular carcinoma treated with external beam radiotherapy before?

Byeong-Gon Na, Dong-Hwan Jung, Gil-chun Park, Shin Hwang, Ki-Hun Kim, Chul-Soo Ahn, Deok-Bog Moon, Tae-Yong Ha, Young-In Yoon, Sung-Gyu Lee

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**Background:** External beam radiotherapy (EBRT) has been proven to provide acceptable oncologic outcomes in the selected patients with hepatocellular carcinoma (HCC), followed by adult living donor liver transplantation (LDLT). The study aims to evaluate the biliary stricture after duct-to-duct anastomosis during LDLT in patients with HCC previously treated with EBRT.

**Methods:** We retrospectively enrolled 51 patients with HCC treated with EBRT who underwent duct-to-duct anastomosis during LDLT using a single right graft between January 2019 and December 2020. Perihilar EBRT case was defined as when right and left hepatic ducts, common hepatic duct, and common bile duct were close to or included in the planning tumor volume (PTV) for EBRT. We identified the risk factors for biliary stricture by analyzing the LDLT and EBRT factors.

**Results:** During a median follow-up period of 24.6 months (range, 138 months), 17 patients (33.3%) presented biliary stricture after LDLT. In a comparative analysis between biliary stricture and no stricture groups, the patients with perihilar EBRT in the biliary stricture group were significantly more than those in the no stricture group (50.0% vs. 15.2%,  $P=0.016$ ). In univariate and multivariate analyses, intraoperative portal vein stent insertion (hazard ratio [HR], 7.81; 95% confidence interval [CI], 1.5339.99;  $P=0.014$ ) and perihilar EBRT (HR, 5.34; 95% CI, 1.2223.12;  $P=0.026$ ) were identified as significant risk factors for biliary stricture.

**Conclusions:** Duct-to-duct anastomosis in LDLT can be acceptable if PTV does not contain the perihilar area. Otherwise, hepaticojejunostomy can be recommended to prevent biliary stricture instead of duct-to-duct anastomosis.

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## Pure laparoscopic donor right hepatectomy in donor with severe portal vein anomaly

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**Background:** Donor operation in adult-to-adult living donor liver transplantation is still associated with postoperative morbidity. But, laparoscopic donor hepatectomy is sporadically reported in a few center with substantial experience and pure laparoscopic donor right hepatectomy (PLDRH) has been gradually increased because of cosmetic satisfaction and rapid recovery, despite the controversial issues. We present the case of PLDRH in donor with severe portal vein anomaly to discuss the feasibility of PLDRH.

**Methods:** A 57-year-old man volunteered to living liver donation for his wife who suffered from hepatic encephalopathy related with cirrhosis. Donors portal vein was unusual type on preoperative computed tomography; Nakamura type - single non-bifurcating portal vein variation. Right hepatic artery and hepatic duct were single. P6 and P7 portal veins were meticulously dissected and encircled with vessel loops before liver parenchymal transection, and right anterior portal vein was identified after right hepatic duct transection. Three portal veins were reconstructed to one orifice during bench work procedure.

**Results:** Donors and recipients portal vein were patent, postoperatively. In postoperative computed tomography on postoperative day 7, there were no abnormal finding both donor and recipient. In postoperative laboratory test including aspartate transaminase, alanine transaminase, total bilirubin and international normalized ratio, donor and recipients results were gradually decreased. Donor discharged at postoperative day 8, recipient discharged at postoperative day 23.

**Conclusions:** PLDRH seems to be a feasible procedure when performed by a highly experienced surgeon, but careful preoperative evaluation and preparations are essential. Laparoscopic donor hepatectomy is being tried consistently and PLDRH can be cautiously expanded to donors with anatomical variation.

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## Urinary beta-2-microglobulin is associated with allograft function and rapid renal function decline in kidney transplant recipients

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**Background:** Urinary beta-2-microglobulin (B2MG) has been known as a biomarker for chronic kidney disease. The aim of this study was to investigate the association of urinary B2MG with allograft function and renal function decline in kidney transplant recipients (KTRs).

**Methods:** Thirty KTRs whose estimated glomerular filtration rate (eGFR) were less than 60 mL/min/1.73 m<sup>2</sup> (chronic allograft injury group) and 20 KTRs with normal allograft function group were included in this study. Though urinary proteomic analysis with liquid chromatography-tandem mass spectrometry, several urinary proteins including B2MG were identified and then validated by enzyme-linked immunosorbent assay (ELISA). Rapid renal function decline was defined as eGFR decline of >3 mL/min/1.73 m<sup>2</sup>/yr or initiation of dialysis, and 19 (38%) were included in rapid renal function decline group.

**Results:** Among protein profiles identified by proteomics, urinary B2MG levels were different between chronic allograft injury group and normal allograft function group (9,882.0 vs. 1,165.7, P<0.001). Urinary B2MG levels measured by ELISA were also higher in chronic allograft injury group (1,686.4±2,997.8 vs. 28.1±27.5 ng/mL, P=0.005). Urinary B2MG/creatinine levels had high association with chronic allograft injury group (the area under the receiver operating characteristic, 0.770 [0.641–0.899], P<0.001). Urinary B2MG levels were higher in rapid renal function decline group than stable renal function group (2,253.5±3,615.4 vs. 269.0±631.6 ng/mL, P=0.029). Higher urinary B2MG levels (>2,347 ng/mL) were associated with significantly lower graft survival compared to lower urinary B2MG levels (<2,347 ng/mL) (log-rank test, P=0.006).

**Conclusions:** Urinary B2MG levels might be a potential biomarker for detection of chronic allograft injury and could be used as predictor for rapid renal function decline in KTRs.

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## The usefulness of contrast enhanced magnetic resonance angiography in the early period after renal transplantation

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**Background:** Our objective was to evaluate the usefulness of three-dimensional contrast enhanced magnetic resonance angiography (3D CE-MRA) for assessment of renal parenchyma itself, arterial inflow stenosis, and peritransplant fluid collection in the early period after renal transplantation.

**Methods:** Between April 2019 and July 2022, a consecutive series of 62 renal transplants was examined with 3D CE-MRA 14 days after transplantation. MRA studies were analyzed for the volume of renal parenchyma, presence of arterial stenosis, renal infarction, and peritransplant fluid collection. The degree of renal transplant artery inflow stenosis was graded qualitatively as <50%, mild; 50%–70%, moderate; >70%, severe.

**Results:** Kidney volume, measured with MRA, varied from 148 to 421 (226.146.8 mL). It is higher than that of preoperation CT volume (171.132.8) ( $P<0.005$ ). Twenty (31.3%) of the 64 patients had normal CE-MRA which were no parenchymal infarction, no fluid collection and no arterial inflow stenosis. MRA showed parenchyma infarction ( $n=8$ , 12.5%), arterial inflow stenosis ( $n=17$ , 26.6%), lymphocele ( $n=22$ , 34.4%) and hematoma ( $n=3$ , 4.7%). Among the patients with arterial inflow stenosis, 16 (25.0%) showed mild, 1 patient (1.6%) moderate, and no severe stenosis. The patient with moderate arterial stenosis on CE-MRA underwent selective digital subtraction angiography; PTA with stent was performed successfully. The mean creatinine level at 1 month, 6 months, and 1 year after transplantation were not significantly different in patients with arterial stenosis from those of others ( $P=0.379$ ,  $P=0.359$ , and  $P=0.136$ ).

**Conclusions:** The incidence of renal parenchyma infarction, peritransplant fluid collection and arterial flow stenosis is unexpectedly high in the early period after kidney transplantation. MRA and MR imaging allows rapid global assessment of renal parenchyma, renal transplant arterial system, and peritransplant fluid collection. It can also help detect or exclude many of the various causes of renal transplant dysfunction.

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## **Listeria monocytogenes endophthalmitis in immunocompromised patient**

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**Background:** *Listeria monocytogenes* is known for pathogen of enteritis. In severe case, *Listeria* infection can cause meningo-encephalitis, corneal ulcer, pneumonia, endocarditis and intrauterine or cervical infections may result spontaneous abortion in immunocompromised patients and pregnant women. *L. monocytogenes* causing endophthalmitis was reported, the patient with rheumatoid arthritis, the other had previous listeria gastroenteritis history, and the last one had no underlying disease and previous history.

**Methods:** We experienced *L. monocytogenes* causing endophthalmitis in liver transplant patient who presented with ocular discharge and discomfort. A 58-year-old male received deceased donor liver transplantation (DDLT) in 2016. He underwent the steroid pulse therapy (SPT) due to hyperbilirubinemia by acute cellular rejection, at 2 year after OLT. At 1 month after SPT, he complained about ocular discomfort with discharge.

**Results:** In ophthalmology, anterior chamber paracentesis was performed, microbiological result was *L. monocytogenes* infection. Intravenous antibiotics with intravitreal antibiotics injection was administered for 1 week and immunosuppression was gradually decreased. Oral ampicillin was continued for 2 month after intravenous injection, and he recovered without complications.

**Conclusions:** *L. monocytogenes* infection may be invasive in the immunocompromised patients as above. Early diagnosis is key factor in treatment and outcomes of endophthalmitis caused by *L. monocytogenes*. An appropriate chamber paracentesis is important to diagnose, systemic antibiotics treatment should be considered.

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## Incident fractures in kidney transplant recipients: a nationwide cohort study from South Korea

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**Background:** An increased fracture incidence is a challenging issue in kidney transplant recipients (KTRs). This study investigated the incidence, location, and predictors of fractures after kidney transplantation (KT).

**Methods:** Data were obtained from the Korea Organ Transplantation Registry, which is a nationwide cohort study of KTRs. A total of 4,134 KTRs who underwent KT between January 2014 and June 2019 were included in the study. The cumulative incidence and risk factors for fractures were evaluated using the Kaplan-Meier method and Cox proportional hazard model.

**Results:** During a follow-up of 12,441.04 person-years (median, 2.94 years), 63 patients developed incident fractures. The cumulative 5-year incidence of fractures was 2.10%. The most frequent fracture locations were the leg (25.40%) and foot (22.22%). Older recipient age (hazard ratio [HR], 1.043; 95% confidence interval [CI], 1.016–1.070; P=0.002), diabetes mellitus (HR, 2.627; 95% CI, 1.559–4.426; P<0.001) and previous KT (HR, 10.085; 95% CI, 1.679–60.554; P=0.029) at baseline were associated with a higher risk of fractures after KT, whereas the use of anti-thymocyte globulin as induction therapy (HR, 0.170; 95% CI, 0.053–0.542; P=0.003) and a higher serum phosphorus at 6 months posttransplantation (HR, 0.537; 95% CI, 0.366–0.788; P=0.001) were associated with a lower risk of fractures.

**Conclusions:** The first 5 years after KT were associated with the risk of peripheral skeletal fractures. Recipient age, comorbid diabetes mellitus, induction strategy, previous KT history and serum phosphorus level may be responsible for the incidence of fractures.

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## Clinical relevance and characteristics of pretransplant donor-specific anti-human leukocyte antigen-DQ antibodies in kidney transplantation

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**Background:** Pretransplant detection of donor-specific anti-human leukocyte antigen antibody (HLA-DSA) is associated with adverse allograft outcomes such as posttransplant development of antibody mediated rejection (ABMR). However, the impact of HLA-DSA type, especially HLA-DSA-DQ has not been fully investigated yet. The aim of this study is to investigate the clinical relevance of HLA-DSA-DQ at baseline compared to other types of HLA-DSA.

**Methods:** In this retrospective study, 1,228 kidney transplant recipients (KTRs) who underwent ABO compatible KT between January 2010 and December 2019 were screened for the presence of isolated HLA-DSA-DQ or non-DQ before KT. Cases were divided into three groups according to the presence and the type of pretransplant HLA-DSAs (no pretransplant DSA [n=1,008], non-DQ [n=72], DQ [n=18]). We compared the change of mean fluorescence intensity (MFI) value of HLA-DSA and the incidence of acute ABMR across three groups.

**Results:** Five out of 18 KTRs with pretransplant HLA-DSA-DQ underwent desensitization, and the median MFI value of HLA-DSA after plasmapheresis was 9,893.5 (7,511.0–10,162.5). The incidence of acute ABMR and cumulative overall acute ABMR rate were significantly high in the non-DQ and DQ groups than no pretransplant DSA group (no pretransplant DSA vs. non-DQ, log-rank  $P < 0.001$ ; no pretransplant DSA vs. DQ,  $P = 0.001$ ; non-DQ vs. DQ,  $P = 0.764$ ). KTRs in non-DQ-ABMR(+) subgroups had significant higher MFI of pretransplant HLA-DSA ( $P < 0.001$ ). However, no significant difference was found between DQ-ABMR(–) and DQ-ABMR(+) subgroups in pretransplant HLA-DSA titer ( $P = 0.721$ ). Among 18 KTRs with isolated pretransplant HLA-DSA-DQ, acute ABMR occurred in four. Two had persistent HLA-DSA-DQ after KT, and one was C1q fixing.

**Conclusions:** In patients with pretransplant HLA-DSA DQ, the MFI value of HLA-DSA was higher compared to HLA-DSA-non-DQ at baseline. However, the incidence of acute ABMR was similar, and MFI showed no significant impact. Therefore, MFI titer of HLA-DSA-DQ should not be the only factor to represent pretransplant immunologic risk.

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## The outcome and risk factor of refractory T-cell-mediated rejection on renal allograft transplantation based on the Korean Organ Transplantation Registry

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**Background:** Refractory T-cell-mediated rejection (rTCMR) is a rare but critical complication affecting allograft survival in kidney transplantation (KT). We analyzed the outcome and risk factors of rTCMR in nationwide prospective KT cohort study.

**Methods:** Patients enrolled in the Korean Organ Transplantation Registry (KOTRY) who underwent KT from 2014 to 2021 were used for analysis. Logistic regression and cox regression were used. Primary outcome was death censored graft failure. Analysis of rejection was limited on events within 1 year of transplantation. The rTCMR was defined as a case in which creatinine was greater than 2.8 mg/dL even after treatment of TCMR or histologically persistent TCMR in the consecutive biopsy.

**Results:** A total of 9,150 donor-recipient pairs were analyzed. A 16% (n=1,472) incidence of a rejection detected including clinical or biopsy proven rejection. Among them, rTCMR occurred in 7.1% (n=105). Baseline characteristics were compared in three groups, no rejection after transplantation, rejection group except rTCMR, and rTCMR group. Recipients mean age (50.0 vs. 49.1 vs. 48.8, P<0.023), male (59% vs. 65% vs. 73%, P<0.001), deceased donors (32% vs. 36% vs. 42%, P<0.002) and mean donor age (47.6 vs. 50.3 vs. 50.6, P<0.001) in three groups were identified. Age (odds ratio [OR], 0.976; 95% confidence interval [CI], 0.956–0.996), cancer (OR, 2.398; 95% CI, 1.245–4.619) of recipient, deceased donor (OR, 2.704; 95% CI, 1.446–5.053), human leukocyte antigen (HLA) mismatch number (OR, 1.284; 95% CI, 1.119–1.472) were associated with refractory TCMR in multivariable logistic regression analysis. In no-rejection, resolved rejection, and rTCMR groups, death-censored graft survival rates at 1, 2, and 5 years were 99.1%, 98.5%, 97.1%, and 94.7%, 93.1%, 90.2%, and 61.2%, 58.7%, 48.9%, respectively.

**Conclusions:** The rTCMR is fatal risk factor to allograft survival. Age, malignancy history, HLA mismatch numbers, deceased donor kidney transplantation were independent risk factors.

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## Long-term clinical outcomes of ABO incompatible kidney transplantation in patients with high baseline anti-A/B antibody titer

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**Background:** ABO incompatible (ABOi) kidney transplantation (KT) has been considered to overcome donor shortage. We investigated the long-term clinical outcomes in ABOi KT in patients with high baseline anti-A/B antibody titer.

**Methods:** We retrospectively included 271 patients who had undergone ABOi KT from May, 2009 to February, 2021. One hundred and ninety-one patients with a baseline immunoglobulin G (IgG) titer of higher than 1:128 were assigned to the high-titer group and 80 patients with a baseline titer of lower than 1:64 were assigned to the low-titer group. We used a protocol composed of rituximab, plasmapheresis, and intravenous immunoglobulin (RTX/PP/IVIG). We compared the clinical outcomes of the two groups.

**Results:** The median follow-up periods were 59.12 months (high-titer group) and 41.53 months (low-titer group) ( $P=0.003$ ). The high-titer group required more sessions of PP/IVIG than the low titer group ( $7.50\pm 2.47$  vs.  $3.39\pm 1.30$ ;  $P<0.001$ , respectively). Patient survival rate at 5 years was 93.80% in high-titer and 96.30% in low-titer group. Graft survival rate at 5 years was 90.00% in high-titer and 92.60% in low-titer group. During the follow-up period, serum creatinine and urine protein-to-creatinine ratio showed no difference between two groups up to nine years ( $P$  for interaction= $0.171$ ). No significant differences were detected in the graft survival rate, patient survival rate and rejection-free survival rate between two groups. However, the infection-free survival rate was significantly lower in the high-titer group ( $P=0.049$ ). The incidence of bacterial infection was higher in high-titer group (45.00% vs. 28.27%,  $P=0.008$ ).

**Conclusions:** Patients with high baseline anti-A/B IgG isoagglutinin titers had equally successful long-term outcomes as those with low titers. However, the high baseline antibody titer may require greater caution because of the higher tendency of infection.

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## Risk factors for 1-year low graft function after deceased donor kidney transplantation

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**Background:** As the use of kidney grafts from extended criteria donors increases due to the shortage of donor organs, concerns about graft outcomes after kidney transplantation (KT) has been amplified. Estimated glomerular filtration rate (eGFR) is an intuitive indicator of kidney function and lower eGFR 1 year after KT is associated with early graft loss. This study aimed to investigate the risk factors for low eGFR at 1 year after deceased donor KT.

**Methods:** A retrospective study was performed in patients who underwent deceased donor KT at our hospital from 2009 to 2018. Graft loss within 1 year after KT were excluded. According to the Modification Of Diet In Renal Disease equation, less than 45 eGFR at 1 year after KT was defined as low eGFR. Logistic regression analysis was used to identified the risk factors for low eGFR.

**Results:** This study included 148 patients consisting of 112 with normal eGFR and 36 with low eGFR at 1 year after KT. The age of donors and the proportion of female were higher in the low eGFR group. Donor age older than 50 years and body mass index (BMI) above 25 kg/m<sup>2</sup> of the donors were significant risk factors for low eGFR (odds ratio [OR], 3.546; P=0.018 and OR, 2.747; P=0.047, respectively). Acute rejection after KT was significantly higher in the low eGFR group (20.5% vs. 63.9%), which was a strong risk factor for low eGFR (OR, 7.293; P<0.001). Cytomegalovirus infection within 1 year after KT was significantly higher in the low eGFR group (18.8% vs. 47.2%), which was a significant risk factor for low eGFR (OR, 3.237; P=0.018).

**Conclusions:** Aged donors or higher BMI were donor factors predicting the low eGFR at 1 year after KT. Cytomegalovirus infection and, not surprisingly, acute rejection were risk factors affecting low eGFR at the same period of time.

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## Graft survival according to donor type, and risk assessment in liver transplantation of extremely high model for end-stage liver disease score $\geq 35$

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**Background:** Although organ shortage was still the greatest problem in liver transplantation, living liver donation with high model for end-stage liver disease (MELD) score was discouraged until recently. The purpose of this study was to compare graft survival between living donor liver transplantation (LDLT) and deceased donor liver transplantation (DDLT) groups in extremely high MELD recipient defined as score 35 and to evaluate risk factors affecting graft survival.

**Methods:** Between 2008 and 2018, a total of 359 patients who underwent liver transplantation with MELD score 35 at the Samsung Medical Center, were enrolled. The primary endpoint was the graft survival and the secondary endpoint was short term postoperative complication (within 90 days after liver transplantation). Also, we compared the graft survival and overall survival between living and deceased donor and assessed risk factors for graft survival according to the donor type.

**Results:** There was no statistical difference in graft survival between LDLT and DDLT group ( $P=0.753$ ). Old age, preoperative management in intensive care unit and RBC transfusion during the operation were the risk factors in graft failure ( $P=0.032$ ,  $P=0.036$ ,  $P=0.001$ , respectively). Biliary complication was more common in LDLT group ( $P=0.021$ ), and viral infection and postoperative uncontrolled ascites were more common in DDLT group ( $P=0.002$  and  $P=0.018$ ). In LDLT group, acute on chronic liver failure, left side graft, retransplantation, postoperative short-term complications, intraoperative transfusion and long cold ischemic time were risk factors in graft failure ( $P=0.004$ ,  $P=0.025$ ,  $P=0.015$ ,  $P=0.016$ ,  $P<0.001$ , and  $P=0.006$ , respectively).

**Conclusions:** In the meantime, LDLT in high MELD score was often avoided, but our study showed LDLT is not inferior to DDLT in graft survival if appropriate risk evaluation was performed even in extremely high MELD score. This result will help overcoming the organ shortage in high MELD liver transplantation.

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## Short-term safety of carbapenem-resistant enterobacteriaceae colonized donor on deceased donor kidney transplantation

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Donor-derived infection has been an important issue in kidney transplantation (KT). Here we report cases of deceased donor kidney transplantation (DDKT) from a single donor with carbapenem-resistant enterobacteriaceae (CRE) to two different recipients. A 44-year-old woman was hospitalized due to mental change. Owing to dyspnea and severe metabolic acidosis, she was applied ventilator and continuous renal replacement therapy. On hospital day 5, she was diagnosed as brain death. Before organ donation, incidentally, CRE was confirmed in her sputum and rectal culture, but it was not observed in blood or urine culture. First recipient, a 63-year-old woman on hemodialysis, underwent DDKT. The patient complained of urinary symptom on postoperative day 5. Urine culture was performed and *Pseudomonas aeruginosa* was identified. Ceftazidime was applied for 7 days, and the follow-up urine culture showed no growth. She had no infectious complication until 5 months after transplantation. At that time, graft failure occurred and she restarted hemodialysis. Second recipient, a 67-year-old man on hemodialysis, underwent DDKT. He had repeatedly suffered from pneumonia and hemoptysis because of nontuberculous mycobacteria infection after transplantation. Five months after transplantation, unexpectedly, he was newly diagnosed as bile duct cancer. He had been performed pylorus preserving pancreatoduodenectomy and concomitant chemoradiotherapy, but expired 19 months after transplantation. Both of two recipients had never experienced CRE infection during the follow-up period. Therefore, for a short period after transplantation, CRE identified from sources other than blood or urine may not transmit to recipient and may not cause infectious complications.

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## Histopathological findings of indication kidney allograft biopsy: 16-year experience from a tertiary care center in Korea

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**Background:** Kidney allograft dysfunction (KAD) has various causes and presentations. Although many studies on biomarkers for detection of KAD were performed, kidney biopsy remains the gold standard for the diagnosis of KAD. We evaluated the spectrum of histopathological changes seen in KAD.

**Methods:** We retrospectively reviewed histopathological findings of 490 patients who received kidney allograft biopsy between 2005 and 2021. Among 490 patients, 61 patients who underwent protocol biopsy were excluded.

**Results:** The mean age at allograft biopsy was 47.9±12.3 years and 289 patients (66.7%) were male. Two hundred thirty-two patients (54.1%) underwent living donor kidney transplantation and mean duration of kidney biopsy was 62.3±70.1 months. The most common cause for allograft biopsy was allograft dysfunction (83.0%), followed by delayed graft function (9.8%) and proteinuria (7.2%). Of the 429 patients, the most common pathological finding was chronic antibody-mediated rejection in 17.0%, followed by 66 acute T cell mediated rejection (15.3%), 59 acute antibody-mediated rejection (13.7%), and 31 calcineurin inhibitor toxicity (7.2%). Incidence of glomerulonephritis was 17.5%. The most prevalent glomerular diseases were immunoglobulin A nephropathy (48.0%), focal segmental glomerulosclerosis (32.0%), and diabetic nephropathy (9.3%).

**Conclusions:** Clinical presentations do not reliably distinguish the various causes of KAD. Kidney allograft biopsy is a useful tool in the evaluation of allograft dysfunction.

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# Anti-spike antibody titer in kidney transplant recipients after the third dose of SARS-CoV-2 vaccination correlates with the incidence and severity of breakthrough infection during the Omicron surge

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**Background:** While a small number of studies have shown that the booster vaccination was able to provide additional serologic protection in transplant population, evidence on whether immunogenicity elicited provides actual protection from symptomatic Omicron infection is unclear.

**Methods:** CoVaKT was a prospective non-interventional study assessing the serologic efficacy and safety of a booster dose of SARS-CoV-2 vaccinations in COVID-19 infection nave renal transplant recipients (RTRs). To further evaluate the clinical effectiveness of the vaccine, we collected data on the incidence and severity of subsequent breakthrough infections which all occurred during the Omicron surge and evaluated the association between post-booster anti-spike antibody level and clinical outcomes. Vaccine-induced SARS-CoV-specific antibody was quantified through Abbott SARS-CoV-2 immunoglobulin G (IgG) II Quant assay.

**Results:** A total of 287 RTRs who had standard doses of the COVID-19 vaccine were enrolled. After the booster mRNA vaccine dose, the seropositivity rate increased from 57.1% (164/287) to 82.2% (236/287). Median antibody titer also was significantly increased (62.3 to 1,382.8 AU/mL,  $P < 0.01$ ). Factors associated with negative antibody response were shorter duration since transplantation, lower hemoglobin, lower estimated glomerular filtration rate, high tacrolimus trough concentration, mycophenolate mofetil or mycophenolic acid use and having two doses of ChAdOX1-S during the primary vaccination. Sixty-five patients (22.6%) had breakthrough COVID-19 infection within 4 months after the booster vaccination, of which 12 patients needed admission. The median time to infection was 83 days. Factors associated with infection in the multivariable logistic regression model were post-booster anti-spike IgG  $< 400$  AU/mL (odds ratio [OR], 3.55; 95% confidence interval [CI], 1.99–6.32;  $P < 0.01$ ), and having received living donor transplantation (OR, 1.97; 95% CI, 1.03–3.75;  $P = 0.04$ ). Low post-booster antibody level (IgG  $< 200$  AU/mL) was also a risk factor for severe disease (OR, 22.9; 95% CI, 2.27–231.6;  $P = 0.01$ ).

**Conclusions:** The COVID-19 mRNA booster vaccination was immunogenically effective in RTRs, and a higher anti-spike IgG level post-boost provided protection against both breakthrough infection and severe COVID-19 disease.

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## Post-COVID emphysematous graft pyelonephritis

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Emphysematous pyelonephritis in the allograft kidney can be a devastating illness with risk of graft loss. COVID-19 illness has been associated with both worsening of glycemic control and new onset of diabetes in susceptible population. We present a 39 years old lady who underwent kidney transplant in 2007 with mother as donor and developed new onset diabetes after transplantation (NODAT) since 2011. She was maintaining normal renal parameters on triple immunosuppressive medication and glycemic control with insulin. She suffered from severe COVID-19 illness in June 2021. She presented again in August 2021 with C/O fever, pain abdomen for 3 days and oliguria for 1 day. On evaluation she was in sepsis with impending shock and respiratory distress. Investigations showed leucocytosis, metabolic acidosis, hyperglycemia and worsening azotemia. Serum ketones were positive. Ultrasound abdomen showed normal graft kidney. She was managed on IV antibiotics, insulin infusion and oxygen. She showed no significant improvement hence a non-contrast computed tomography abdomen and chest was done which showed emphysematous graft pyelonephritis and fibrotic sequelae of COVID in both lungs. It was decided to continue with antibiotics treatment rather than go for nephrectomy in order to save the renal allograft. She started improving with increasing urine output and oxygenation after 48 hours of treatment. She developed herpes zoster during the stay in hospital and immunosuppression had to be reduced. After 3 weeks of antibiotics she finally had complete recovery of renal function. The case shows that early empirical antibiotic treatment initiation, blood sugar control and early computed tomography scan is of paramount importance in timely diagnosis and management. COVID infection can precipitate uncontrolled diabetes and life threatening infections in immunosuppressed.

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## Renal cell carcinoma in pretransplant native nephrectomy of hemodialysis patient with acquired cystic kidney disease for deceased donor renal transplantation

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The incidence of renal cell carcinoma is known to be higher in patients with end-stage renal disease, including those with acquired cystic kidney disease. Pretransplant native nephrectomy is performed to create space in the pelvis, to decrease compression by the enlarged polycystic kidney, and to prevent development of various symptoms. A 52-year-old man with end-stage kidney disease due to chronic glomerulonephritis planned to deceased donor kidney transplantation. Because of gallstone and enlarged polycystic kidneys, he underwent a cholecystectomy and bilateral nephrectomy. The tumor diameter of the left kidney was 2.6×1.5 cm. Pathology indicated multifocal renal cell carcinoma in both kidney with Fuhrman nuclear grade 1/4 and no lymphovascular invasion. This case reinforces the importance of considering the possibility of an occult malignancy in the native kidneys of patients with acquired cystic kidney disease. we present a case of incidental renal cell carcinoma in a patient with acquired cystic kidney disease who underwent bilateral native nephrectomy for deceased donor renal transplantation.

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## Role of gender mismatch on outcomes of living donor kidney transplant recipient: a 5-year retrospective study

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**Background:** Gender mismatch may affect graft survival. Female recipients of male kidneys have an inferior graft survival. This study aims to evaluate the role of gender mismatch in living donor kidney transplant (LDKT) recipient outcomes in Indonesia.

**Methods:** Retrospective cohort study was conducted to all donors and recipients of LDKT at Cipto Mangunkusumo Hospital from 2011 to 2016. Patient survival rate, all-cause and death censored graft survival were analyzed and associated with gender mismatch.

**Results:** A total 343 subjects were included. Most of the recipients were male (69.4%) and hypertensive (33.5%), with median age 48 years. Most of the donors were male (62.7%), with median age 30 years. We classified the donors and the recipients into 4 gender mismatches. The all-cause graft survivals was lower in male-to-female than male-to-male, female-to-male, and female-to-female (15 vs. 20, 36, and 36 months respectively), but not statistically significant ( $P=0.784$ ). The acute rejection in female-to-male and male-to-female were higher than male-to-male and female-to-female (8.4% and 7.8% vs. 4.6% and 2%), but not statistically significant ( $P=0.439$ ). The highest 5 year-graft survival was male-to-male (70.6%), with the lowest was female-to-female (66.7%), but not statistically significant ( $P=0.939$ ). The death censored graft survival at 5 years was higher in male donor (80% in male-to-male and male-to-female) than in female donor group (74% in female-to-male and 76.5% in female-to-female), but not statistically significant ( $P=0.674$ ). The patient survival at 5 years was higher in female donor (75.3% in female-to-male and 70.6% in female-to-female) than in male donor group (65% in male-to-male and 69% in male-to-female), but not statistically significant ( $P=0.861$ ).

**Conclusions:** Gender mismatch is not associated with acute rejection and 5 year-patient survival, all-cause and death censored graft survival. Male-to-female was the lowest in all-cause graft survival, but not statistically significant.

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## Intraoperative aborted living donor liver transplantation surgeries, lessons from 13,937 cases of Vanguard multi-center study of international living donor liver transplantation group

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**Background:** We rarely experience these situations where intraoperative abortions are inevitable in living donor liver transplantation (LDLT) by unexpected or catastrophic events in the real world. To date, there has been only a few reports of aborted LDLT in both donors and recipients, and no multi-centric study has been reported. The aim of this study is to summarize the cases of aborted LDLT, and to propose the strategy to prevent the abortion or minimize the donor damage, from the aspect of both recipient and donor sides.

**Methods:** We collected data of totally 43 cases of aborted LDLT from 13,937 cases, with the seven high-volume hospitals from the Vanguard multi-center Study of the international LDLT group, between 2002 and 2021 and reviewed it retrospectively.

**Results:** Of the 43 cases, there were 24 cases of recipient-related aborted LDLT and 19 cases of donor-related. Recipient-related abortions included pulmonary hypertension (n=8), hemodynamic instability (n=6), advanced hepatocellular carcinoma (n=5), bowel necrosis (n=4), and severe adhesion (n=1). In contrast, donor-related abortions were from graft steatosis (n=7), low quality of graft (n=8), anaphylactic shock (n=2), and hemodynamic instability (n=2). In particular, donor-related abortions have been on the rise since 2018. Total incidence of aborted LDLT was 0.31%, and there was no remarkable difference among the centers.

**Conclusions:** For some reasons of aborted LDLT, such as pulmonary hypertension, advanced cancer, severe adhesion, the strategy to minimize the additional donor damage by delaying donors laparotomy or trying to open the recipients abdomen with a small incision must be effective.

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## Serial changes of donor-derived cell-free DNA in recipients of pancreas transplants

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**Background:** The transplant rejection reaction is validated with an organ biopsy if transplant rejection occurs after transplantation in the early stages following transplantation. According to the notion that DNA fragments from transplanted organs persist in the recipient's plasma as cell free DNA, it has been observed that if acute rejection occurs, donor-derived cell free DNA (ddcfDNA) increases. The aim of this study was to investigate the pattern of ddcfDNA changes in pancreas transplant recipients following transplantation.

**Methods:** This was a prospective, observational study in patients who underwent pancreatic transplant from December 2016 to August 2017. In total 14 patients were underwent transplantation, of which five patients were included in this study. From five patients, samples were obtained according to the study protocol at postoperative day (POD) 4, 7, 14, 30, 60, 90, and 120–180. Serum samples were tested: amylase, lipase, tacrolimus. Plasma samples were tested for donor derived cell free DNA. The study protocol was reviewed and approved by the Institutional Review Board of Pusan National University Yangsan Hospital (IRB No. 05-2019-006) and written informed consent was obtained from all participants.

**Results:** The median age of the patients was 35 years. Of the five pancreatic transplant patients, one (20.0%) had T-cell mediated rejection (TCMR) episode. The median percentage (range) of the ddcfDNA for POD 4, 7, 14, 30, 60, 90, and 180 were 2.7 (0.4–5.5), 0.6 (0.2–4.4), 3.7 (0.4–12.7), 7.1 (0.4–7.9), 2.1 (0.1–5.4), 2.0 (0.3–8.5), and 0.3 (0.2–7.6). The median amylase (range) for POD 4, 7, 14, 30, 60, 90, and 180 were 68.0 (30.0–80.0), 82.0 (57.0–151.0), 74.0 (66.0–157.0), 81.0 (50.0–137.0), 74.0 (39.0–111.0), 80.0 (27.0–98.0), and 80.0 (43.0–105.0). The ddcfDNA value of POD14 in patients who developed TCMR on POD 530 was higher than 10%.

**Conclusions:** The ddcfDNA levels remained elevated for 2 weeks following transplantation in patients with TCMR.

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## Kidney transplant in a pediatric patient with double inferior vena cava: a case report

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Renal transplant is the gold standard for treatment of end-stage renal disease. One of the obstacles that can be encountered during surgery is an anatomic anomaly which could complicate the surgery. One of these rare anomalies is a double inferior vena cava which is reported in 0.2% to 0.3% of the population. We present a case of an 8-year-old female with an end-stage renal disease secondary to congenital anomalies of kidney and urinary tract who underwent kidney transplant living related donor (mother). During the transplant procedure, the donated kidney was transplanted to the right iliac fossa and the allograft vein was anastomosed to inferior vena cava and the allograft artery was anastomosed to the common iliac artery. The surgery was successful and was unremarkable postoperatively. The patient was discharged with normal renal function.

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## Internal biliary stent in adult liver transplantation: a systematic review and meta-analysis

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**Background:** Biliary complications in liver transplantation (LT) are a significant source of postoperative morbidity and mortality, and there is controversy as to whether the use of an internal stent (IS) can reduce these complications. The aim of our study was to perform a systematic review and meta-analysis comparing the use of ISs in LT on the incidence of biliary complications.

**Methods:** All published English language studies were screened to identify all the clinical comparative studies of ISs in LT. The main outcome assessed was biliary complications (overall biliary complications, biliary leaks, and biliary strictures) in the IS group and the no-IS group after LT. The quality of the studies was assessed using the Newcastle-Ottawa scale.

**Results:** Five studies (two randomized controlled trials and three observational studies) with a total of 804 LT patients were included in this meta-analysis. There were no differences between the IS group and no-IS group in overall biliary complications and biliary leaks (odds ratio [OR], 1.030; 95% confidence interval [CI], 0.714–1.486; P=0.876 and OR, 0.991; 95% CI, 0.472–2.083; P=0.982, respectively). Also in terms of biliary stricture, no significant difference was observed between the IS group and no-IS group (OR, 0.687; 95% CI, 0.441–1.072; P=0.098).

**Conclusions:** Our results failed to show significant difference in the incidence of biliary complications according to the use of ISs in LT.

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## Successful downstaging treatment of hepatocellular carcinoma with trans arterial chemoembolization followed by liver transplantation

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**Background:** The hepatocellular carcinoma (HCC) is the leading and the most common cancer of Mongolia. The Interventional radiology department of National cancer center of Mongolia performed 1200 trans arterial chemoembolization (TACE) and 400 ablations for HCC this year. The department is the largest IR department of Mongolia. Since, the TACE is a treatment, not a cure, we are still seeking TACE as a bridge treatment for Liver transplantation. Seventy percent of HCC patients in Mongolia is diagnosed in the advanced stage, which are beyond Milan criteria. Therefore, we are presenting successful downstaging treatment of HCC with TACE followed by living donor liver transplantation (LDLT).

**Methods:** The patient underwent conventional TACE with Lipiodol Doxorubicin 3:1 emulsion and 150–350 micron Gelfoam as an embolic agent.

**Results:** A 53-year-old man, was diagnosed multiple HCC with advanced liver cirrhosis Child-Pugh C. The HCC were located in S5 and S6 of the liver. S5 was measured 5.0 cm and second one in S6 was measured 3.0 cm in diameter, which was beyond Milan criteria. Then, our multidisciplinary team discussed on this patient and decided TACE treatment. After three times of TACE treatment, tumor was controlled and shrunken by size and undergo for Milan criteria. The patient underwent successful LDLT and followed by IR department, without any recurrence.

**Conclusions:** The advanced stage of HCC is a complicated and often continuous with poor prognosis and there is only limited treatment available for it. But for some patients, if we treat them successfully and downstage the HCC, there's still little hope for further radical treatment option such as liver transplantation. This case shows TACE is a successful treatment for advanced HCC in well selected case.

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## The experience of donation coordinator

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**Background:** The donation coordinator in an organ procurement process is one of highly stressful job. Little has been written about the experiences of donation coordinators. The purpose of this qualitative study was to understand the experiences in the donation coordinators' practice.

**Methods:** The grounded theory methodology was used for this study. The data was collected through in-depth interview from six participants who were donation coordinators from two hospitals in Seoul. Data was collected between February and March. Theoretical sampling was used until the data reached saturation.

**Results:** As a result of the analysis, "Must solve in an unpredictable situation" was identified as the core category. Eleven sub-categories were identified and they were integrated to the core category. "Having the expertise with full view" was identified as the consequence.

**Conclusions:** Lifesaving organ transplantations cannot be performed without donation coordinating. The donation coordinators played various roles, they had a conflict in role identity due to poor working environments. The results of this study suggested that an increase in understanding for the coordinators' role, and institutional support for better working conditions are needed for donation coordinators to be acknowledged as professionals.

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## Living donor liver transplantation using right lobe graft for hepatocellular carcinoma: a single-center study in Vietnam

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**Background:** Liver transplantation is now one of established therapeutic options for patients with hepatocellular carcinoma (HCC). The aim of study is to describe the current practice of living donor liver transplantation (LDLT) for HCC, including the patient selection criteria, surgical techniques, management of small-for-size syndrome, postoperative complications, and the results of our center.

**Methods:** We prospectively analyzed the data on all right lobe LT adult patients for HCC, consecutively performed from October 2017 to June 2022 in Military Central Hospital 108. Our center practices careful selection for HCC patients using the Milan and University of California San Francisco (UCSF) criteria, supplemented by alpha-fetoprotein level and the model for end-stage liver disease (MELD) score. We pioneered in using the extended right lobe graft and the novel hepatic venoplasty technique, which lessen the risk of hyperperfusion and small-for-size syndrome with improved overall recipient survival. When the remnant and total liver volume ratio less than 35%, we used modified right lobe graft. We conjoined the middle hepatic vein and right hepatic vein as a single orifice hepatic vein. Data were collected prospectively and presented as the mean values and ranges, or the number of patients in proportion of total patient population.

**Results:** A total of 57 cases of adult-to-adult LDLT using right lobe graft for HCC treatment were collected. Of our patients, and 50,8% met the Milan and UCSF criteria. Regarding the Milan and UCSF criteria, the 2-year recurrence rate was significantly lower in patients who met Milan than in patients who exceeded the Milan criteria (1.75% vs. 14%). A 5-year overall and disease-free survival rate of 73.5% and 70.3% were achieved. Seventy-three point six percent of the complications were rated as Clavien I.

**Conclusions:** LDLT is an ideal treatment for HCC in Vietnam with regard to the critical organ shortage and high demand for transplantation.

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## Multicenter, prospective observational study to identify and validate a composite of urinary exosomal biomarkers for kidney allograft tubulointerstitial fibrosis

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**Background:** The severity of kidney allograft fibrosis is one of the most important factors affecting long-term graft survival after deceased-donor kidney transplantation. In this study, we tried to identify and validate urinary exosomal miRNA biomarkers which may reflect the grade of interstitial fibrosis and tubular atrophy (IFTA).

**Methods:** We collected urine samples from 109 deceased donors at the time of solid organs recovery from May 2019 to June 2021, and a zero-day biopsy was performed before transplantation at five medical centers in Korea. Among 109 specimens, 34 showed no IFTA on zero-day biopsy (No IFTA group) and the other 75 allografts showed IFTA score 1 or more than 1 on zero-day biopsy (IFTA group). Urinary exosomes were isolated by ultracentrifugation and the levels of miRNAs were quantified by qRT-PCR.

**Results:** After reviewing previous reports and electronic databases, a total of six miRNAs (miR-19, miR-21, miR-29c, miR-150, miR-200b, and miR-205) were chosen as potential biomarker candidates for IFTA. miR-16-5p was used as an endogenous control. Among the six candidates, relative expression levels of miR-21, miR-29c, miR-150, and miR-205 were significantly higher in the IFTA group whereas miR-19 expression level was significantly lower in the IFTA group compared with the No IFTA group. Receiver operating characteristic analysis of miR-21 (area under the curve, 0.762; 95% confidence interval [CI], 0.658–0.846;  $P < 0.001$ ) and miR-29c (AUC, 0.825; 95% CI, 0.727–0.898;  $P < 0.001$ ) showed good diagnostic accuracy for predicting IFTA. Although there were no differences in patient survival, graft survival, and rejection between two groups, the estimated glomerular filtration rate (eGFR) level of No IFTA group at 1week posttransplant was higher than IFTA group (41.34 vs. 28.65,  $P = 0.012$ ) and the improvement patterns of eGFR over time showed significant difference (time group  $P = 0.031$ ).

**Conclusions:** In conclusion, urinary exosomal miRNAs are potent biomarker candidates to determine the IFTA severity of kidney allograft before recovery.

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## Mammalian target of rapamycin inhibitor attenuates warm ischemic biliary injury (rat model)

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**Background:** The purpose of this study was to establish a model of warm ischemic biliary injury and evaluate the effects of immunosuppressants (IS) on biliary stricture using this model.

**Methods:** Fifty Sprague Dawley rats were used. The peribiliary vascular plexus and hepatic artery were ligated. The portal vein was then clamped for 30 minutes following which the rats were divided into three groups; tacrolimus (T), rapamycin (R) administration and no medication (C). Each group consisted of 15 rats, subdivided into three subgroups according to the date of sacrifice for liver tissue sampling (1, 3 and 6 weeks). Serum sampling was performed at postoperative 1 day, 1, 2, 3, 4, 5, 6 weeks in all rats, and enzyme biomarkers of hepatobiliary function were evaluated. Tissues were stained with hematoxylin-eosin and Sirius red for evaluation of biliary stricture. The peribiliary fibrosis was estimated using an image analyzer and the ratio (fibrotic area:normal area) was measured in each slides.

**Results:** The results revealed no significant difference between groups. Liver tissue obtained at postoperative 6 weeks showed different trends in bile duct proliferation and fibrosis according to IS. The average difference in fibrotic ratio between C and T group was 2.4, and between C and R group was 3.1.

**Conclusions:** The mammalian target of rapamycin inhibitors (mTORIs) exhibit better protective effects on peribiliary fibrosis compared with calcineurin inhibitors, highlighting the therapeutic potential of mTORIs, in a model of warm ischemic biliary, to counter biliary complications after liver transplantation injury.

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## Analysis of antibody responses after COVID-19 vaccination in liver transplant recipients: a single center study

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**Background:** Liver transplant (LT) recipients are considered a vulnerable population during the COVID-19 pandemic. The clinical efficacy of the COVID-19 vaccine is unknown in immunocompromised patients. The purpose of this study is to give evidence of antibody responses after COVID-19 vaccination in LT recipients.

**Methods:** A total of 46 patients who underwent LT at Samsung Medical Center (SMC, Seoul, Korea) were enrolled before the implementation of the first-dose vaccine in Korea. Those who completed the second dose COVID-19 vaccine between August 2021 and September 2021 were included and followed up through December 2021. Semiquantitative anti-spike serologic testing was undertaken with the Roche Elecsys anti-SARS-CoV-2 S enzyme immunoassay, positive cutoff of at least 0.8 U/mL. This study was approved by the SMC institutional review board and participants provided informed consent electronically.

**Results:** Among all 46 participants, 40 participants (87%) had antibody response after second dose COVID-19 vaccine; 6 (13%) had no antibody response after second dose. The average transplant period for patients with high antibody titers was  $9.4 \pm 5.0$  years, which was longer than those with low antibody titer ( $2.3 \pm 2.8$  years) and was statistically significant ( $P < 0.001$ ). Among antibody response group, median (interquartile range [IQR]) trough level of tacrolimus after second dose COVID-19 vaccine were 2.5 (1.6–3.3) and 2.3 (1.6–3.2) before vaccination. Among low antibody response group, median (IQR) trough level of tacrolimus after second dose COVID-19 vaccine and before vaccination were 5.7 (4.2–7.2) and 7.0 (3.7–7.8) respectively.

**Conclusions:** Higher trough level of tacrolimus early after transplantation make the vaccine less effective in liver transplant patients. Booster vaccinations are required, especially for patients in the early stage after liver transplantation with compromised immune function.

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## Generation and characterization of regulatory macrophages for xenotransplantation

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The outstanding role of regulatory macrophages (Mregs) in promoting immunomodulation allowed the clinical application of Mregs-based therapies for controlling unwanted immune responses, especially in the field of transplantation. The major obstacle known to prevent pig-to-human xenotransplantation is the interaction between the human natural anti-Gal antibody and the -Gal epitope (Gal1-3Gal1-4GlcNAc-R). A promising strategy to eliminate the interaction between human immune cells and porcine transplanted organs is to generate Mregs, which is tolerant to -Gal epitope. We established a protocol to generate and characterize Mregs from human monocytes THP-1 cells, specifically resistant to porcine antigen -Gal. The cells were stimulated with a series of stimulants including GM-CSF, IFN-, dexamethasone, vitamin D3, and porcine-specific antigen -Gal. The generated Mregs displayed fiber-like morphology and high levels of CD16, CD163, CD206, Mer-TK, DHRS9, increased mitochondrial fusion and induced histone H3 lysine 4 monomethylation (H2K27me1). Importantly, Mregs showed suppressed inflammatory mediators gene expression and decreased tissue factor-coagulation signaling under co-culture with pig endothelial cells. Our results illustrate a feasible approach for generating functional Mregs which would be an effective and safe tool for pig-to-human xenotransplantation.

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## Impact of allocation priority for children awaiting liver transplantation: a pediatric liver allocation simulated model analysis

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**Background:** Deceased donor pool in pediatric liver transplantation (LT) had increased temporarily for several years since allocation and registration policies of split LT were amended by the Korean Network for Organ Sharing (KONOS) in 2013 and 2014. Despite those efforts, there are still overwhelming number of pediatric patients awaiting LT. The purpose of this study was to investigate problem of current allocation policies for pediatric LT and find a possible solution.

**Methods:** We analyzed the information of 5,252 patients who received deceased donor liver transplantation (DDLT) from February 2000 to December 2020 referring to KONOS database.

**Results:** Out of 5,252 cases of DDLT between February 2000 to December 2020, pediatric recipients were 318 (6.1%). Out of those pediatric patients, only 111 cases (33%) were donated from pediatric cadavers. Pediatric and adult patients who received a split LT were 204 and 234 cases, respectively. In pediatric patients who received a DDLT, mortality was significantly lower than in adult group (14.2% vs. 29.9%,  $P=0.000$ ). Regardless of donors age ( $n=18$ ), mortality was lower in pediatric cases ( $P=0.000$ ). In multivariate analysis, there was no significant difference in mortality between pediatric and adult patients.

**Conclusions:** Under the current allocation system regarding DDLT, pediatric patients have a relatively less chance to enlist on the waiting list because of strict regulations. Also, unlike the United States, priority is not given to pediatric candidates in allocating pediatric cadaveric donors for them in South Korea. Considering mortality, equity and potential social reproducibility of pediatric candidates, there should be modification of the allocation system, which will be able to take into consideration urgency and LT outcome as well.

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## The treatment of hepatic vein anastomotic stenosis by uncovered metal stenting after liver transplantation

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**Background:** The liver cirrhosis among with hepatocellular carcinoma is most common in Mongolia. The National Cancer Center of Mongolia started liver transplantation surgery in 2018 and successfully transplanted 59 cases till today. Although, some complications occurred and most of them were vascular complications. We are presenting the treatment of hepatic vein anastomotic stenosis by uncovered metal stenting after liver transplantation case which is our first case. Even tough, we had successfully treated the patient.

**Methods:** We placed in narrowed HV anastomoses by 1.4 cm×4.0 cm sized self-expandable metallic stent and 1.6 cm sized balloon catheter. Used materials including 8-Fr introducer, 0.035 guidewire, Cobra catheter and Omnipaque contrast agent.

**Results:** Fifty-eight-year-old female underwent living donor liver transplantation surgery due to dual viral related LC. Until postoperative day 23, she has ascites approximately 2 L, per day. On her Doppler sonography and computed tomography scan detected hepatic vein anastomoses stenosis. And, our multidisciplinary team discussed and decided to put stent treatment for the anastomoses. We successfully dilated the narrowed anastomoses by stenting.

**Conclusions:** Hepatic venous outflow defects including stenosis is one of the common vascular complication of liver transplantation. IR stenting procedure is more safe and quicker than surgery. Moreover, patient recovered instantly and clinical symptoms disappeared from the next day of the treatment. This case shows IR stenting treatment is the first choice for vascular complications.

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## Hepatitis C elimination in the country of Georgia: progress report

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Georgia is among the countries with high hepatitis C virus (HCV) prevalence; however, the reasons of the high burden of the disease has not been studied sufficiently. Collapse of the health care system in 1990s, sub-optimal quality standards of health services had negative influence on safe injection practices, infection control and blood safety in health care settings over the years. All these conditions along with the widespread practice of needle sharing among people who inject drugs contributed to the spread of HCV in the general population. According to the latest population-based seroprevalence survey, conducted by the National Center for Disease Control and Public Health and U.S. Centers for Disease Control and Prevention between May and August, 2015, estimated national seroprevalence of hepatitis C is 7.7% and the prevalence of active disease is 5.4%. In April 2015, in collaboration with the U.S. Centers for Disease Control and Prevention and Gilead Sciences, the country of Georgia embarked on the world's first hepatitis C elimination program. As of December 31, 2020, a total of 90,578 persons were diagnosed with chronic HCV infection, representing 60.4% of the estimated 150,000 adults living with HCV in Georgia. A total of 72,811 patients (80.4%) initiated treatment 56.8% of the estimated target population to be treated (128,250). Of the 51,208 patients who were evaluated for SVR, 50,644 (98.9%) tested negative for HCV by PCR, representing 41.6% of the estimated target population cured (121,837). High cure rates were achieved for all HCV genotypes: 98.9% in genotype 1, 98.9% in genotype 2 and 98.3% in genotype 3, typically the most challenging to treat. Treatment effectiveness was comparable among persons with advanced fibrosis (F3 and F4) with 98.2% achieving SVR, and among patients with mild or no liver fibrosis ( $\leq$ F2), SVR=99.1%. In summary Georgia has made substantial progress towards eliminating hepatitis C, with over 40% of persons with chronic HCV infection identified and cured. Efforts to identify and link to care persons with HCV infection, ensure SVR testing and implement prevention interventions are needed to achieve the elimination goals. The nationwide serosurvey conducted in 2021 shows that the proportion of the population with chronic HCV infection decreased from 5.4% to 1.8%.

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## Feasibility of using artificial vascular grafts in one-orifice venoplasty for middle hepatic vein reconstruction during living donor liver transplantation

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**Background:** Middle hepatic vein (MHV) reconstruction is essential to optimize the outflow of the graft in adult-to-adult right lobe living donor liver transplantation (LDLT). The present study aimed to evaluate the safety and feasibility of using artificial vascular to replace MHV with single institute experiences.

**Methods:** Polyester prostheses were used in reconstructing the MHV when the remnant liver volume was less than 35% of the donor liver volume. Venous branches with diameter greater than 5 mm were preserved and anastomosed to the prosthesis. Subsequently, MHV graft was sutured to the right hepatic vein to make one-orifice hepatic vein. From April 2019 to June 2022, 58 cases of LDLT were included in this study.

**Results:** The average age of recipients was  $51.8 \pm 10.6$  years; model for end-stage liver disease score was  $26.4 \pm 11.5$ ; and graft-recipient weight ratio was  $1.32 \pm 2.9$ . The average of back-table time was  $38.6 \pm 8.7$  minutes. V5 reconstruction was done in double (n=11, 24.1%), single (n=41, 70.7%), and none (n=3, 5.2%). V8 reconstruction was done in triple (n=1, 1.7%), double (n=3, 5.2%), single (n=40, 68.9%), and none (n=14, 24.2%). One-month and 6-month conduit patency rates of the vascular grafts were 94.8% and 63.1%, respectively.

**Conclusions:** One-orifice venoplasty with polyester prostheses for MHV reconstruction was feasible in adult-to-adult right lobe LDLT.

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## Prognostic value of anti-vimentin antibodies in pre-sensitized heart transplant patients

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**Background:** Presence of antibodies to donor specific human leukocyte antigens (HLA) is a well-known risk factor associated with outcome in solid organ transplantation. Recent studies have suggested that non-HLA antibodies could also be associated with outcomes in heart transplantation (HTx). We sought to assess the combined effect of donor specific HLA antibodies and non-HLA anti-vimentin antibodies on graft outcome in Korean HTx patients.

**Methods:** Pretransplant serum was analyzed in 192 adult patients who underwent HTx from January 2014 to December 2016 in four large transplant centers in Korea. Demographic and outcome data were obtained from the Korean Organ Transplantation Registry, an organization established in 2014 to collect data on transplant patients.

**Results:** Donor-specific HLA antibodies (DSA) were present in 28 patients (14.6%), while anti-vimentin antibodies were present in 98 patients (51.0%). Anti-vimentin antibodies were more prevalent in males ( $P=0.029$ ), but there were no significant differences in other demographic factors. Positive DSA was associated with a significantly higher rate of 3-month graft failure (log-rank  $P=0.001$ ). Anti-vimentin antibody positivity was also an independent predictor for 3-month and 1-year graft failure (hazard ratio [HR]<sub>adjust</sub>, 5.21; 95% confidence interval [CI], 1.66–16.37;  $P=0.005$ ; HR<sub>adjust</sub>, 3.45; 95% CI, 1.47–8.09;  $P=0.004$ , respectively). In DSA(+) patients, anti-vimentin antibody positivity further discriminated 1-year graft survival (long-rank  $P=0.002$ ).

**Conclusions:** In our analysis of Korean HTx patients, DSA and anti-vimentin antibodies were both associated with increased risk of graft failure at 1 year. Additionally, anti-vimentin antibody positivity was able to further discriminate outcome in patients undergoing pre-sensitized HTx. Pretransplant assessment of anti-vimentin antibodies could help predict outcome and tailor immunotherapy in specific patients.

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## Successful treatment of recurrent immunoglobulin A nephropathy after kidney transplantation

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Immunoglobulin A nephropathy (IgAN) is the most common type of primary glomerulonephritis and recurrent IgAN is common after kidney transplantation (KT). Here, we report a case of a 60-year-old man with end-stage kidney disease who underwent deceased donor kidney transplantation (DDKT). He was diagnosed with IgAN by kidney biopsy 20 years ago. Three years later, in 2005, he started hemodialysis. He underwent DDKT at another nephrology center 5 years ago. Immunosuppressive therapy consisted of prednisolone, mycophenolate mofetil, and tacrolimus. He was transferred to our hospital 2 years ago for residential reasons. The function of allograft was maintained well. The trough tacrolimus level was adequately maintained at 5–10 ng/mL. Ten months ago, proteinuria was newly found at 0.5 g/g in urine protein/creatinine ratio (UPCR), and then, gradually increased to 1.0 g/g. The patient was admitted for a graft biopsy in January 2022. On admission, his general condition was good and he had normal vitals and euvolemic state. In laboratory analysis, renal function was normal with serum creatinine of 1.06 mg/dL. Cytomegalovirus and BK viremia were not observed. The trough tacrolimus level was 6.7 ng/mL. On the second day of hospitalization, a kidney allograft biopsy was performed and 500 mg of methylprednisolone was started intravenously for 3 days. We diagnosed a recurrence of IgAN (M1 E0 S0 T0 C0). Afterwards he was discharged with a prescription of 40 mg of oral prednisolone. Out-patient follow-up showed that proteinuria decreased while maintaining steroids, and after adding 80 mg of valsartan on May 11, 2022, proteinuria continued to decrease, resulting in 0.3 g/g of UPCR on August 24, 2022. In this case, we successfully treated recurrent IgAN after DDKT with pulse and oral steroids and valsartan. Kidney biopsy should be considered when new abnormal findings are found. There is no specific treatment for recurrent IgAN after KT. This case is considered of value to the treatment of recurrent IgAN after KT.

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## Air pollution and posttransplant outcomes in kidney transplant recipients

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**Background:** Elevated ozone levels are associated with increased risk of fatal coronary heart disease in kidney transplant recipients (KTRs). However, there were few studies about the relationship between air pollutants and risk of biopsy-proven acute rejection (BPAR), death-censored graft failure (DCGF) and mortality in KTRs.

**Methods:** Patients who had kidney transplantation between January 1, 2009, and December 31, 2018 at a single center were followed on a regular basis until June 30, 2020. Patients who had previous kidney transplantation, had positive crossmatching, and multi-organ transplantation were excluded. Primary end-points are BPAR, DCGF and all-cause mortality for up to 5 years. CO, NO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub>, and PM<sub>10</sub> concentrations after transplantation were measured at each recipients address using data from Korea meteorological administration. Cox proportional hazard regression models were used to verify contributing factors for primary end-points.

**Results:** Of the enrolled 2,005 KTRs, 61% were male, the median age at transplantation was 47 years of age. ABO-incompatible and donor-specific antibodies-positive kidney transplantation were 23.4% and 10.5%, respectively. The median concentrations of CO, NO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub> and PM<sub>10</sub> were 489 ppb, 23.4 ppb, 4.05 ppb, 25.6 ppb, and 45.1 g/m<sup>3</sup>, respectively. During the study period, annual average PM 10 exposure varied ranging from 23.2 to 73.3 g/m<sup>3</sup>. During the study period, there was 238 episodes of BPAR and 72 patients had graft failure. The estimated overall rejection hazard ratio (HR), per 1 g/m<sup>3</sup> increment increase in annual PM 10 exposure was 1.01 (95% confidence interval [CI], 0.99–1.04). For each 1-ppb increase in ozone, the HR of 5-year graft failure is 1.06 (95% CI, 1.00–1.11).

**Conclusions:** There was a weak association between air pollutants and clinical outcomes such as BPAR, DCGF and mortality in KTRs.

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## The impact of applying University of California San Francisco criteria to patients underwent liver transplantation for hepatocellular carcinoma in a low volume center

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**Background:** There are many studies in patients with hepatocellular carcinoma applying the expanded Milan criteria. The University of California San Francisco (UCSF) criteria are considered as the most promising expansion rules so far. Based on UCSF criteria, we selected the patients underwent liver transplantation for hepatocellular carcinoma since 2008. Here we reported the long-term outcomes of patients underwent liver transplantation for hepatocellular carcinoma to assess the validity of the UCSF criteria instead of Milan in a single center.

**Methods:** Between 2008 and 2020, a total of 201 liver transplantation were performed, of which 39 were liver transplantation for hepatocellular carcinoma patients. Among them, living donor transplantations were 29 cases and deceased donor transplantations were 10 cases. Based on radiologic examination prior to operation, patients were prospectively categorized into two groups: within Milan (n=32) and beyond Milan within UCSF (n=7). Clinical outcomes were reviewed retrospectively.

**Results:** Mean age of patients was 51.2 years, and 28 patients were male. Mean model for end-stage liver disease (MELD) score was  $11.2 \pm 8.7$ . Mean follow-up period was  $63.7 \pm 54.6$  months. The 5-year overall survival rates in within Milan and within UCSF groups were 84.4% and 74.7%, respectively ( $P < 0.041$ ). The 5-year disease-free survival rates in within Milan and within UCSF groups were 94.7% and 76.0%, respectively ( $P < 0.001$ ). Generally, 5-year disease-free survival rate in total patients was acceptable (n=39, 76.0%). However, seven expanded patients from Milan were revealed very poor long term both 5-year overall survival rate and disease-free survival rate (n=7, 26.8%, 0%, respectively).

**Conclusions:** The Milan criteria are still optimal in seeking for long term good results in patients with hepatocellular carcinoma. When the UCSF criteria are applied to hepatocellular carcinoma patients, the overall long-term results are acceptable; however, there is a higher risk of recurrence compared to the Milan criteria.

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## Group analysis of outcomes after liver transplant in patients aged 70 years or older

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**Background:** Liver transplantation (LT) in the elderly requires caution because of its low survival and high morbidity. Since the definition of the elderly beneficiary was unclear, the base age was sequentially changed to 65 years and, more recently, to 70 years. In this study, postoperative outcomes of Orthotopic LT (OLT) in patients aged 70 and older are compared to younger patients to assess its safety and efficacy.

**Methods:** Data on 1,457 OLT recipients were abstracted from Seoul National University Hospital over a 10 year period (2010–2020). The median age was 55 years, and three age-based subgroups were created: elderly (70 years and older), middle-aged (55–69 years old), and young adults (18–54 years old). Pediatric recipients (age <18 years) were excluded. Standard statistical analyzes were performed using donor and recipient data to compare indications, mortality, and graft survival.

**Results:** There were 93 elderly OLT patients (6.4%), compared to 674 (46.3%) middle-aged patients and 690 (47.4%) young patients. There were 368 (25.3%) transplanted with liver from deceased donors and 1,089 (74.7%) from living donors. In elderly OLT patients were significantly more transplanted from deceased donors than others (37.6 % vs. 23.1% and 25.7%) ( $P=0.0101$ ). The survival rate after transplantation in the elderly patient group was statistically significantly lower than in other groups (65.6 % vs. 80.3% and 85.6%) ( $P<0.0001$ ). When survival was divided by life expectancy, the younger patient group was significantly lower than the other groups ( $0.13\pm 0.09$  vs.  $0.21\pm 0.19$  and  $0.19\pm 0.14$ ) ( $P<0.01$ ).

**Conclusions:** Survival rates were significantly lower in the elderly group, but patients who had expired compared to life expectancy did not reach full life expectancy. It is important to determine whether there is sufficient benefit when comparing the life expectancy and postoperative survival rate in surgery for elderly patients, and it is necessary to consider the patient's underlying disease, especially the history of cerebrovascular accident and infection status.

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## The usefulness of kidney transplantation using lower small incision from the level of anterior superior iliac spine

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Minimally invasive surgery offers significant benefits to patients compared to open surgery, including improved peri- and postoperative outcomes, such as shorter hospital stay, less postoperative pain, shorter convalescence period, fewer wound infections, and better cosmetic results. This report is the case of kidney transplantation (KT) using lower small incision from the level of anterior superior iliac spine (ASIS). A 13-year-old woman visited our hospital for KT from deceased donor of other hospital (18-year-old man, A+). She had continuous ambulatory peritoneal dialysis 1 year ago and unknown origin chronic kidney disease. The surgical team planned a KT with a small incision in consideration of the cosmetic complaints and the young age of the recipient. Emergency KT was performed with conventional method except lower small incision from the level of ASIS. An incision was made and the retroperitoneum was dissected to the umbilical level while traction using a deep retractor, and then the iliac artery, vein, and part of the bladder were exposed, and anastomosis was performed using the traditional method. Total operation time was 195 minutes. After surgery, the recipient's outcome was good (blood urea nitrogen/creatinine, 45/9.55 to 13/0.59), and she was discharged after 13 days without any special complications. Minimally invasive KT is a useful method and can be a surgical option that can be safely performed without expansive laparoscopic or robotic surgery.

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## Favorable long-term renal outcome following pediatric liver transplantation

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**Background:** Renal dysfunction is one of the critical issues of long-term outcome after liver transplantation (LT). Posttransplant renal function in adult transplant patients is well described, however, little is known about its prevalence in pediatric transplant patients.

**Methods:** From March 1999 to May 2016, 225 recipients underwent pediatric LT in Seoul National University Hospital. Patients with follow-up period less than 3 months or preoperative chronic kidney disease (CKD) were excluded. Cumulative incidence of CKD (defined as a glomerular filtration rate of 60 mL/min/1.73 m<sup>2</sup> of body-surface area or less or the development of end-stage renal disease) was determined using a Kaplan-Meier method.

**Results:** The median age at LT was 2 years (range, 0.2–17). During a median follow-up of 150 months, CKD developed in nine patients (4.41%). Of these patients, three patients underwent renal transplantation. One-, 5-, 10-year renal survival with CKD as the event was 99%, 97.9%, and 96.1%, respectively. In the adult group who received LT during the same period, 1-, 5-, 10-year renal survival was 96.2%, 85.6%, and 79.4%, respectively, which showed significant difference compared to pediatric group. In a multivariate Cox regression model, hepatic artery thrombosis (P<0.0001) and primary liver diseases with potential renal involvement (P=0.033) were associated with CKD.

**Conclusions:** Renal function can be highly preserved following pediatric LT even in the long-term period, which is distinct finding from adult LT patients. However, more attention should be paid to patients with hepatic artery thrombosis and primary liver diseases with potential renal involvement to better improve renal outcome after pediatric LT.

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## Intraoperative hepatic artery thrombosis in living donor liver transplantation despite immediate reconstruction increases risk of graft failure

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**Background:** Posttransplant hepatic artery thrombosis (HAT) can lead serious complications of are derived from long arterial ischemic time. However, there has been few reports regarding fate of intraoperative HAT during adult living donor liver transplantation (ALDLT).

**Methods:** From 2000 to 2019, 1,355 recipients underwent ALDLT in Seoul National University Hospital. All patients with no intraoperative arterial flow were managed by redoing hepatic artery anastomosis. Survival outcomes and the rates of biliary complication of patients with intraoperative HAT were compared with others without HAT and with postoperative HAT. Median follow-up period was 89 months.

**Results:** Intraoperative HAT was developed in 45 cases (3.3%). Hepatic artery reanastomosis was performed once in 33 cases (73.3%), for more than two times in 12 cases (26.6%). Among 45 patients with intraoperative HAT, postoperative HAT was detected in six cases (13.3%) at a median time of 3 days (range, 1–68). All patients underwent redo arterial reconstruction, but technical success rate was 50.0%. Overall graft survival rates were lower in patients with intraoperative HAT (93.3%) than others without HAT (98.0%) ( $P=0.026$ ), but higher than in patients with postoperative HAT (88.9%) ( $P=0.001$ ). However, patient survival rates were similar among three groups ( $P=0.269$ ). There was no difference in biliary complication between patients with intraoperative HAT (33.3%) and the others without HAT (32.1%) ( $P=0.945$ ), which is lower than patients with postoperative HAT (55.5%,  $P=0.011$ ).

**Conclusions:** Intraoperative HAT after ALDLT did not affect biliary complication and patient survival, but is significantly associated with recurrent postoperative HAT and graft failure. Patients with intraoperative HAT in ALDLT should be intensively monitored for HAT and graft dysfunction.

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## COVID-19 infection in lung transplantation patients: single center analysis

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**Background:** The immune-compromised patients have been suffering from COVID-19, especially solid-organ transplantation patients. The respiratory system is vulnerable to the SARS-COV-2 virus, and the clinical characteristics and outcomes of lung transplantation patients in COVID-19 may be different from other solid organ transplantation patients.

**Methods:** We reviewed the electronic medical records of lung transplantation patients who were infected with COVID-19 from February 2020 to May 2022. The data for baseline demographic characteristics, COVID-19-associated symptoms, treatment for COVID-19, hospital admission, intensive care unit (ICU) admission, and mortality were collected and analyzed retrospectively.

**Results:** The first COVID infection was reported in December 2021. A total of 91 cases were diagnosed with COVID-19. Of those, three patients were infected twice, and one was infected three times. The patients who infected within 1 year after transplantation were accounted for 27.3% (n=21) of the overall population. The most common symptom was sore throat (28.5, n=22), followed by myalgia (22.1, n=17), and 42.8% of the patient were asymptomatic (only positive for the COVID-19 diagnostic test). The clinical outcomes were represented as hospital admission (40.3%, n=32), and ICU admission (10.4%, n=8). 90-day mortality was 6.5% (n=5). Time from transplantation, need for oxygen therapy and COVID-19-related medication were not associated with 90-day mortality.

**Conclusions:** Lung transplantation patients with COVID-19 infection were requiring hospital admission more than the general population.

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## Human leukocyte antigen DPB1 T-cell epitope analysis predicting for kidney transplantation outcome

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**Background:** The impact in the graft-versus-host vector of human leukocyte antigen (HLA)-DPB1 T-cell epitope (TCE) were studied in hematopoietic cell transplantation. HLA-DPB1 TCE-nonpermissive mismatching were associated with improved overall survival. The impact of HLA-DPB1 incompatibility on the outcomes of kidney transplantation is not fully understood. We investigated a potential effect of HLA-DPB1 TCE-nonpermissive mismatching on the short term outcome after kidney transplantation.

**Methods:** A cohort of 31 patients who received a kidney transplantation with availability of donor and recipient HLA-DPB1 high-resolution typing were analyzed retrospectively. HLA-DPB1 mismatches based on TCE were determined based on DPB1 TCE Algorithm 2.0 (<https://www.ebi.ac.uk>).

**Results:** Follow-up period varied from 7 to 183 days after transplantation. Normal creatinine level (1.19 mg/dL) was observed in 19 recipients (61.3%), and others creatinine level was under 2.5 mg/dL. HLA-DPB1 TCE-nonpermissive mismatching was determined in six (19.4%). Whether desensitization due to ABO incompatible or not, possibility of abnormal creatinine level after transplantation in patients with HLA-DPB1 TCE-nonpermissive mismatching was higher than in patients with HLA-DPB1 TCE-permissive (odds ratio, 14.0; 95% confidence interval, 1.3–137.6).

**Conclusions:** Although a longer follow-up period and studies using a larger number of patients are needed, HLA-DPB1 TCE-nonpermissive mismatching is one of factors that may affect the prognosis after kidney transplantation.

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# The impact of COVID-19 pandemic on the number of kidney transplantation at the National Kidney and Transplant Institute: a registry study

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COVID-19 spreads rapidly throughout the Philippines. The first verified case of COVID-19 in the Philippines was detected on January 30 after SARS-CoV-2 viral RNA was recovered from the initial swabs using a polymerase chain reaction. This study aimed to determine the impact of COVID-19 on the number of kidney transplantation (KT) performed at the National Kidney and Transplant Institute (NKTi) in the Philippines. Using the Organ Transplant Unit of the NKTi, the study compared the data of living donor kidney transplantation (LDKT) and deceased donor kidney transplantation (DDKT) from March to December 2019 to 2020. In March and April 2020, the NKTi suspended the KT program when the World Health Organization declared the COVID-19 pandemic, including the pretransplantation orientation. There were 300 KT conducted in 2019, compared to 129 KT in 2020, a decline of 43%. A monthly average of 7 LDKT in 2020, compared to 25 in 2019. There were 65 LDKTs were performed during the pandemic compared to 283 in 2019. Following the announcement of the COVID-19 pandemic, there was no DDKT. In 2020, the majority of patients who received tacrolimus as their initial calcineurin inhibitor were between 31 and 40 years old, male, with chronic glomerulonephritis as their primary kidney illness, blood type O+, and 3 human leukocyte antigen mismatches. Open donor nephrectomy was 42 (35%) versus 90 (32%). There was one retransplant (0.8%) in 2019, compared to 16 (5%). In 2020, nine patients (3%) died within a year after KT, but in 2021, only two (1.6% of patients) died. This study showed that the number of KT at the NKTi decreased throughout the first year of the COVID-19 pandemic and could resume safely while observing safety protocols. Due to the higher risk posed by dialysis patients, renal transplantation should be maintained. This could be accomplished through a phased approach based on risk tolerance and hospital capacity.

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## Characteristics of infection during the first year post pediatric liver transplantation: a 12-year single-center experience

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**Background:** Half of the pediatric liver transplantation (LT) patients developed at least one episode of infection within 6 months after LT. However, few studies reported infections and outcomes after pediatric LT in Thailand. We aim to examine the characteristics of infections and determine the factors associated with infections and clinical outcomes after pediatric LT.

**Methods:** A retrospective cohort study was conducted in patients aged <18 years who had LT. Medical records were reviewed in the first-year posttransplantation. The risk factors for developing an infection, factors associated with infections and clinical outcomes were evaluated using logistic regression.

**Results:** From January 2009 to August 2021, 99 cases who had pediatric LT were analyzed. The median (interquartile range) age was 14 months (10–46 months). All patients, except for four patients, completed their follow-up. There were 464 infection episodes within the first-year posttransplantation. The predominant infection sites were in the bloodstream (120, 25.9%) and gastrointestinal tract (68, 14.7%). Overall, bacterial infections accounted for 166 infections (35.7%). The most common bacterial pathogen was *Escherichia coli* (22.9%). The mean (SD) operative duration was 10 ( $\pm 1.8$ ) hours and 61.6% took more than 10 hours which was a factor significantly associated with infection post LT (odds ratio, 5.5; 95% confidence interval, 1.0–29.0). The 1-year survival rate post LT was 96.0%. Out of the 4 deaths, three patients died due to infections.

**Conclusions:** The most common site of infection was in the bloodstream and Gram-negative bacterial infections developed in one-third of the recipients. Prolonged operative duration significantly increased the risk of developing infections post-LT.

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## Massive gastrointestinal bleeding following living donor liver transplantation: a case report

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Despite advances in anesthesia and surgical techniques manifesting in lower overall transfusion requirements, bleeding is still the most frequent serious early complication following liver transplantation, occurring in approximately 20% of patients. Postoperative bleeding can be life-threatening and requires reoperation in 10%–15% of patients for hemorrhage control and/or hematoma evacuation. Gastrointestinal bleeding (GIB) occurring after living donor liver transplantation (LDLT) without graft dysfunction could be treated by conventional, endoscopic, or surgical procedures. Therefore, GIB is unlikely to result in death in patients with well-functioning LDLT grafts. However, GIB carries a high mortality risk in patients with graft dysfunction, and retransplantation might be an option. A 56-year-old female with hepatitis B virus, hepatitis D virus liver cirrhosis received LDLT from her healthy daughter. Her body mass index was 23.4 kg/m<sup>2</sup> and body surface area was 1.6 m<sup>2</sup>. The massive bleeding was diagnosed by Doppler ultrasound, contrast computed tomography and treated by surgical intervention regarding the patient's underlying comorbidity. Laboratory evaluations included: hemoglobin, 9.9 g/dL; platelet count 37 000 mL, aspartate aminotransferase IU litre; alanine aminotransferase 78 IU litre; albumin, 2.9 g/L; prothrombin time international normalized ratio, 1.37; total bilirubin, 1.8 mg; creatinine, 0.75 mg. In total, 8 units of packed red cells, 10 units of fresh-frozen plasma, and 4 units of platelets were required. After transplantation, further transfusions were required, but the hemodynamic status and laboratory data remained stable (hemoglobin, 10.9 and 9.7 mg and international normalized ratio [INR], 1.25 and 1.06 on postoperative days 5, 6, and 7). Two peritoneal lavages were performed on postoperative day (POD)3 and 4. No further transfusion was required and on postoperative days 1, 2, and 3, hemoglobin was 9.2, and 11.2 g/dL, and INR was 1.12, and 1.13. Computed tomography performed on POD2 showing large amount of hematoma in anterior peritoneal cavity.

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## Living donor liver transplantation postoperative donor follow-up

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**Background:** Mongolia has the highest prevalence of hepatitis B virus (HBV), hepatitis C virus (HCV), and hepatitis D virus infection. The prevalence of HCV was 18.9%. Additionally, HBV infection was observed in 23.1% and 1.2% were coinfecting with HCV and HBV in Mongolia. Mongolia has the highest HCC incidence in the world (78.1/100,000, 3.5\* higher than China).

**Methods:** Of the 156 intended living donors, who had applied for liver donation, living donor liver transplantation (LDLT) surgery was performed at First Central Hospital of Mongolia from September, 2011 to September, 2020. All donors were healthy adults and kin to the recipients. The in-hospital and follow-up data was acquired from the patient records and the Organ Transplantation Center of First Central Hospital of Mongolia. The living donor morbidity was graded according to the modified Clavien-Dindo classification system.

**Results:** Therefore, LDLT was performed 156 donors, 91 male donors (57.9%). The median age of the donors was 32.7±9.03 years (range, 18–49 years). Most donors (151, 96.7%) donated the right lobe liver. The remnant volume of the right lobe of the liver donor is 713.7±152.4 g (59.42%), the remnant volume of the remaining liver is 487 g (40.58%). The average duration of LDLT is 6 hours 38 minutes±2 hours 2 minutes, and the intensive care bed is 5.4±2.4 days. Total bilirubin (1.18 mg/dL), alanine aminotransferase (ALT; 204.9 U/L), aspartate aminotransferase (AST; 224.07 U/L) increased from the first postoperative day of LDLT surgery in all donors, on the seventh day after surgery total bilirubin (0.82 mg/dL), ALT (50.84 U/L), AST (72.69 U/L) decreased too normal. All the donors have led a normal life after donation postoperation seventh–tenth day. Only one case had a complication Clavien-Dindo Classification Grade3b, which is portal vein stenosis. Totally five deliveries had during these 10 years. There was no postoperative mortality.

**Conclusions:** As far the liver donor survival rate after liver transplantation in our hospital is 100% since the first transplantation. Living donor liver transplantation is relatively safe for donors and severe postoperation complication is rare.

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## The reasons for consenting to organ donation in the family

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**Background:** Brain death is the most important source of organ procurement for patients with end stage organ failure. The causes of donor loss is divided into two main categories including: the potential donor may not be clinically suitable and family refusal. Although many studies have reported the causes of family refusal, literature is poor regarding the causes of willing to donation. Respecting family refusal, lack of knowledge and believing in miracles are major reasons for family refusal. Identifying the factors that influence a family's decision could improve the quality of family interview.

**Methods:** This qualitative study has been conducted at in organ procurement unit of Shahid Beheshti University of Medical Sciences, Iran. We randomly selected 100 families of brain-dead donors from 2018 to 2021 and assess the reasons of consent to donation via an interview by a semi-structured questionnaire.

**Results:** Sympathy by patients on waiting list was the most frequent reason (74%). This idea that the donor would be alive after organ transplantation was the second trigger factor (15%) and hope to be forgiven was another facilitating factor (6%) and some other reasons such as donation card of the brain dead person, being famous, getting some points in 5%. There was a significant association between mentioned factors and different causes of brain death. In donors who were children under the age of 14 years, the most common reason was willing to meet the recipients and for middle-aged donors, the most motivating factor for relatives' was sympathy. Families of young aged donors agreed to donation with the intention of their loved one to be forgiven.

**Conclusions:** This study demonstrated that the transplant coordinators should pay attention not only to the religious, cultural and social aspects, but also they should consider the causes of brain death and the donor's age to obtain consent for organ donation.

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## Laparoscopic donor hepatectomy in settings of pediatric living donor liver transplantation: single center experience

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**Background:** The mini-invasive (MIS) approach to living donor hepatectomy is a current trend in experienced centers. At the same time, there are only a few reports describing the utility of laparoscopic donor hepatectomy (LDH) in settings of pediatric living donor liver transplantation (LDLT). We aimed to provide our own experience as a path to implementing the approach to routine practice.

**Methods:** LDH was used in 276 cases of pediatric LDLT between May 2016 and August 2022. Laparoscopic left lateral sectionectomy (LapLLS) was performed in 240 cases, including 3 cases of simultaneous LapLLS and nephrectomy in the same donor. Laparoscopic living donor left hepatectomy (LapLDLH) was applied in 25 cases, including 2 cases of simultaneous LapLDLH and nephrectomy in the same donor. Laparoscopic right hepatectomy in a living donor (LapLDRH) was performed in 11 cases for LDLT in adolescent recipients.

**Results:** In the LapLLS group, the blood loss was 50 mL (20–400 mL), the median operation time was 203 minutes (120–475 minutes) and the median length of the hospital stay was 5 days (2–19 days). The LapLDLH and LapLDRH groups were characterized by higher median blood loss 320 mL (100–700 mL) and 240 mL (100–400 mL) respectively; and also a longer operative time of 322 minutes (210–415 minutes), 380 minutes (280–470 minutes). The complication rate was similar to open procedure in both donors and recipients.

**Conclusions:** The left-sided graft procurement (LLS and LL) is a more demanded procedure in settings of pediatric LDLT. The laparoscopic approach for living donors demonstrates all the advantages of MIS, with preserving recipient outcomes.

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## Recipient outcomes of donor-derived glomerular fibrin thrombi in deceased donor kidney transplants

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**Background:** Deceased donor kidneys with glomerular fibrin thrombi (GFT) are routinely discarded due to perceived poor outcomes. Although good outcomes have been reported, the data is limited. This retrospective case control study has the largest number of cases and reports the clinical and pathological outcomes of donor derived GFT.

**Methods:** Recipients with deceased donor kidney transplant from January 2014 to December 2020 at our center were included. Recipients with GFT in the preimplantation or immediate post-reperfusion biopsy were the cases. Controls were recipients with donor kidney biopsies without GFT. Each case was matched to a control based on the kidney donor profile index, recipient age, gender and diabetes. GFT was defined as focal if <50% of glomeruli had GFT and diffuse if 50% or more of the glomeruli were affected. Our center performs surveillance biopsies at 4 months, 1 and 2 years and this data was also included in the analysis.

**Results:** Of the 1,760 kidney transplants performed, we identified 82 recipients with donor derived GFT. Twenty-seven of these had diffuse GFT and 20 had evidence of necrosis. The cases were matched to 82 controls. Cases and controls were similar at baseline. Compared with the control group, the recipients with GFT had a similar creatine at 1 month and at 3 years (1.9 vs. 1.8 mg/dL at 1 month, and 1.7 vs. 1.6 mg/dL at 3 years). There was no difference in death censored graft survival as shown in the figure. Between the controls and cases, the surveillance biopsies at 1 year did not show a difference in the moderate to severe interstitial fibrosis and tubular atrophy (16.7 vs. 23.8%,  $P=0.44$ ) or moderate to severe chronic glomerulopathy (2.1% vs. 2%,  $P=0.24$ ).

**Conclusions:** When carefully selected, presence of GFT does not portend a poor outcome and hence should not be the sole reason for organ discard.

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## Recurrent atypical hemolytic uremic syndrome after kidney transplantation: a case report

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The etiology of end-stage kidney disease (ESKD) is uncertain in some patients. Atypical hemolytic uremic syndrome (aHUS) is a rare disease that could cause kidney damage. We herein present a case of recurrent aHUS after kidney transplantation (KT). A 45-year-old man who received KT from deceased donor was hospitalized 1 month after transplantation due to allograft dysfunction. The cause of ESKD was unclear and he underwent hemodialysis for 9 years. He received anti-thymocyte globulin as an induction immunosuppression and maintained triple immunosuppressants, including tacrolimus. Allograft biopsy was performed under suspicion of acute rejection and steroid pulse therapy was started. Kidney ultrasound showed no hydronephrosis. There were no signs or symptoms of infection. Additional laboratory test revealed bicytopenia which was not present before and after transplantation. In further evaluation, serum laparoscopic donor hepatectomy level was elevated, haptoglobin level and complement levels were decreased. The presence of schistocytes was confirmed by peripheral blood smear test. Moreover, there was no evidence of rejection in the biopsy result. At this point, we suspected thrombotic microangiopathy (TMA). ADAMTS13 activity, microbiological test for shigatoxin producing bacteria, and DNA sequencing for TMA were conducted. Allograft function continued to deteriorate without responding to the steroid. We decided to start plasmapheresis empirically. Unfortunately, he did not respond to the seven sessions of plasmapheresis and eventually he started hemodialysis. After starting dialysis, genetic testing revealed a mutation in complement factor I, c.119A>C, which was reported to be possibly pathogenic for aHUS. In retrospective review, his past native kidney biopsy presented TMA features. Finally, we diagnosed him with recurrent aHUS after KT and started eculizumab. During induction treatment period of 4 weeks, his urine volume was gradually increased. After he started maintenance treatment, he stopped hemodialysis. Laboratory tests reflecting hemolysis and renal function show improvement.

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## Effectiveness of metformin in kidney transplant recipients with posttransplantation diabetes mellitus

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**Background:** Posttransplantation diabetes mellitus (PTDM) is an important risk factor for cardiovascular disease and mortality. We aimed to determine the effects of metformin on cardiovascular and graft outcome in PTDM.

**Methods:** We collected 1,663 kidney transplant (KT) recipients without preexisting diabetes mellitus. PTDM was defined as hypoglycemic treatment was initiated after transplantation and maintained over 90 days. We conducted propensity score matching between metformin and non-metformin group, and estimated the effects of the metformin usage on percutaneous coronary intervention (PCI), major adverse cardiovascular events, acute rejection, and graft failure.

**Results:** PTDM incidence was 38.1% (n=634), and 406 recipients (65.7%) were treated with metformin. The metformin usage was associated with lower risk of PCI in Kaplan-Meier (log-rank test, P=0.026) and Cox regression analyses (hazard ratio [HR], 0.24; 95% confidence interval [CI], 0.08–0.73; P=0.013). Stronger protective effects of long-term use of metformin (1,192 days, median value) were found on PCI (HR, 0.22; 95% CI, 0.05–0.98; P=0.046) and graft failure (HR, 0.45; 95% CI, 0.21–0.94; P=0.033). In the subgroup administered tacrolimus, metformin lowered the risk of PCI (HR, 0.24; 95% CI, 0.07–0.87; P=0.03), graft failure (HR, 0.35; 95% CI, 0.17–0.72; P=0.004), and significant annual decrease difference in estimated glomerular filtration rate between metformin group (–0.053 mL/min/1.73 m<sup>2</sup>) and non-metformin group (–1.31 mL/min/1.73 m<sup>2</sup>) was observed (P<0.001).

**Conclusions:** This study demonstrates that metformin use is associated with a decreased risk of coronary artery disease in KT recipients with PTDM. Renoprotective effect of metformin was observed in those who were administered tacrolimus.

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## The effect of steroid pulse therapy for the reduction of acute rejection episode in subclinical borderline changes: an open-label, randomized clinical trial

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**Background:** Subclinical rejection (SCR) has been correlated with subsequent chronic allograft nephropathy and allograft dysfunction. SCR is known to be effective in steroid pulse therapy (SPT) in other studies. However, there is controversy about borderline change. The purpose of this study is to investigate the effect of early SPT for the reduction of acute rejection episode during the first year after renal transplantation in the patients who will show subclinical borderline changes at 2-week protocol biopsy.

**Methods:** This study was a randomized clinical study in which 17 recipients with stable kidney graft function and borderline changes in the protocol biopsy at 2 weeks were enrolled. The recipients were divided into two groups depending on SPT. We investigated changes in Banff scores through protocol biopsy after 1 year.

**Results:** Recipients who underwent acute cellular rejection and borderline change within 1 year were four patients (50%) in the No SPT group and six patients (66.7%) in the SPT group, and there was no difference between the two groups ( $P=0.637$ ). There was no difference between the two groups in the change of the Banff score between the 2 weeks and 1 year protocol biopsy. And there was no difference in the rates of opportunistic infections including cytomegalovirus ( $P=0.471$ ) and BK polyomavirus ( $P=0.637$ ). Also, there was no difference between the two groups with respect to creatinine and estimated glomerular filtration rate at 2 weeks to 3 years after surgery.

**Conclusions:** There was no difference in Banff score change, infection rate, and graft function between the two groups. In conclusion, we suggest that SPT is not essential in subclinical borderline change.

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## Pediatric kidney transplantation in cases of steroid-resistant nephrotic syndrome

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**Background:** Kidney transplantation in children with end-stage renal failure associated with steroid-resistant nephrotic syndrome (SRNS) is a difficult task due to the lack of effect when using immunosuppressive therapy and the return of the disease after transplantation. SRNS can be return as early as 24 hours after kidney transplantation.

**Methods:** From 2018 to 2022 four kidney transplants were performed (three from a living donor and one from a cadaver) in children with morphologically diagnosed Focal segmental glomerulosclerosis, manifested by SRNS. Proteinuria, arterial hypertension, edema were clinically observed in all patients. They received hemo- or peritoneal dialysis with an average duration of  $3\pm 1.5$  years. The children were  $7\pm 2$  years old. Before transplantation, all patients underwent a genetic study full exome sequencing, as a result of which the presence of specific genetic disorders that were the cause of the development of SRNS was revealed.

**Results:** After transplantation all children had proteinuria. In order to prevent recurrent NS, they underwent plasma exchange therapy two to three times a week on days 24 after surgery. The volume of plasma replacement ranged from 800 to 1,400 mL for one session. One child also developed transplant dysfunction. In two children after three and five plasma exchange sessions, respectively, proteinuria was arrested, the function of the graft remained satisfactory. The third child with proteinuria continues to receive plasma exchange without impairing the function of the graft. Immunosuppressive therapy included basiliximab, cyclosporine, mycophenolate mofetil and glucocorticoid.

**Conclusions:** In patients with SRNS, serological examination of donor-specific antibodies, histopathological examination, genetic research to predict the course of the disease and determine the tactics of treatment after transplantation should be performed. After kidney transplantation it is necessary to conduct plasma exchange sessions to prevent graft dysfunction. The diagnosis of focal segmental glomerulosclerosis graft return can be established on the basis of nephrobiopsy.

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## Decreased immunogenicity after SARS-CoV-2 vaccination in liver and kidney transplant recipients

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**Background:** Recently published studies have found an impaired immune response after SARS-CoV-2 vaccination in solid organ recipients. However, most of these studies have not assessed immune cellular responses in solid organ transplant recipients. In this study, a prospective double-arm cohort study was performed to evaluate the humoral and cellular immune response to SARS-CoV-2 vaccination in solid organ transplant recipients compared to healthy staff members with the normal function of the immune system.

**Methods:** A total of 64 transplant patients and an age-matched control group of 103 healthy staff members were included. Blood samples were obtained and analyzed after the second dose and the boosting (third) dose, respectively. For evaluation of the virus-neutralization capacity of each group, serum was analyzed using a surrogate SARS-CoV-2 neutralization test to quantify the functional inhibitory capacity of neutralizing antibodies (Genscript) against SARS-CoV-2 spike protein. Inhibition scores of under 30% were considered negative.

**Results:** Except for the vaccination subgroup of initial two dosages of AstraZeneca followed by Pfizer was significantly higher in the healthy control group, other prime-booster combination subgroup proportion was similar between the group. After the standard two doses of vaccination, only 28.3% of the transplant recipients demonstrated positive functional inhibition of neutralizing antibodies, significantly lower than 70.9% of the healthy control group ( $P < 0.001$ ). Even after the booster (third) dose of vaccination, 43.2% of the transplant recipients showed positive functional inhibition of neutralizing antibodies, significantly lower than 100% of the healthy control group ( $P < 0.001$ ). No other immune-associated complications such as acute rejection occurred after SARS-CoV-2 vaccination in the transplant recipient group.

**Conclusions:** Our data strongly suggest revised vaccination approaches in immunocompromised patients, including individual immune monitoring for the protection of this vulnerable group at risk of developing severe COVID-19. It urges a review of future vaccine strategies for these patients.

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## Association of pretransplant skeletal muscle mass with outcomes in kidney transplant recipients

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**Background:** Muscle wasting in chronic kidney disease is associated with increased cardiovascular events, morbidity, and mortality. However, whether pretransplantation skeletal muscle mass affects kidney transplantation outcomes has not been established.

**Methods:** We analyzed 623 patients who underwent kidney transplantation between 2004 and 2019. We measured the cross-sectional area of total skeletal muscle at the third lumbar vertebra level on pretransplantation computed tomography scans. Skeletal muscle mass index was calculated by normalizing skeletal muscle area to the square of the patient's height. Low muscle mass was defined as a mass within the sex-specific lowest quartile of the skeletal muscle index.

**Results:** Of the 623 included patients, 468 were in the normal muscle mass group and 155 were in the low muscle mass group. During the follow-up, 45 patients (7.2%) died and 56 patients (9.0%) experienced death-censored graft loss. The 1-year, 3-year, and 5-year patient survival rates were 95.4%, 90.6%, and 88.4% for the low muscle mass group and 98.5%, 96.8%, and 95.6% for the normal muscle mass groups. Multivariable Cox regression analysis confirmed that pretransplantation low skeletal muscle mass was independently associated with all-cause mortality (adjusted hazard ratio, 2.32; 95% confidence interval, 1.23–4.38). Low skeletal muscle mass was also associated with an increased risk of hospital readmission within one year after transplantation. Death-censored graft survival rates were comparable between the low and normal muscle mass groups, whereas patients with low skeletal muscle mass had consistently higher glomerular filtration rate values after transplantation than those with normal skeletal muscle mass.

**Conclusions:** Pretransplantation low skeletal muscle mass is associated with an increased risk of mortality and hospital readmission after kidney transplantation. These results suggest that appropriate therapeutic interventions for pretransplantation low skeletal muscle mass may improve long-term outcomes in kidney transplant recipients.

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# Clinical association between tacrolimus intra-patient variability and liver transplantation outcomes in patients with and without hepatocellular carcinoma

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Tacrolimus is the mainstay of immunosuppression in liver transplantation to prevent rejection. However, the clinical use of tacrolimus is complicated by its narrow therapeutic window and significant intra-patient variability (IPV). High tacrolimus IPV is associated with overexposure and adverse effects, including malignancy. The effects of tacrolimus IPV in liver transplant recipients with and without hepatocellular carcinoma (HCC) are unknown. We investigated the association between tacrolimus IPV and transplant outcomes in 636 liver transplant patients. Tacrolimus IPV was determined by calculating the coefficient of variance (CV) of outpatient tacrolimus trough levels from 3 to 12 months after transplantation. High tacrolimus IPV was defined as CV >30%. Patients were grouped according to tacrolimus IPV and HCC status. Among 636 liver transplant patients, 349 had HCC and 287 had no HCC. Overall survival in HCC patients was significantly reduced with high tacrolimus IPV ( $P < 0.001$ ), whereas survival of non-HCC patients was not associated with tacrolimus IPV. Multivariable analysis confirmed the independent association between high tacrolimus IPV and overall mortality in HCC patients (hazard ratio [HR], 3.010; 95% confidential interval [CI], 1.084–4.918). HCC recurred in 59 patients (16.9%) posttransplantation. After adjusting for donor/recipient factors, immunosuppression, and tumor characteristics, high tacrolimus IPV was independently associated with an increased risk of HCC recurrence (HR, 2.196; 95% CI, 1.272–3.791). High tacrolimus IPV was associated with significantly increased risks of overall mortality and HCC recurrence in liver transplant recipients with HCC.

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## Simultaneous heart and kidney transplantation in middle-aged women with cardiac amyloidosis

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This is the story of a patient with cardiac amyloidosis who underwent heart transplant. A 56-years-old female underlying diabetes mellitus visited our clinic with dyspnea and was admitted for further evaluation. On electrocardiogram, junctional rhythm and paroxysmal atrial fibrillation (AF) were shown, and NT-proBNP was over 2,000 pg/mL. The free light chain ratio was 93, and chronic kidney disease (CKD) stage 3 with microalbuminuria was confirmed. On cardiac echocardiography, both ventricular walls were thickened and a restrictive pattern of diastolic dysfunction was observed. Bone marrow biopsy showed 30% of plasma cells. During the hospital stay, permanent pacemaker was inserted due to symptomatic sinus pause. Neurological examination showed moderate autonomic dysfunction and mild carpal tunnel syndrome. Under the diagnosis of multiple myeloma with cardiac amyloidosis Mayo stage 4, chemotherapy was started. However, diastolic heart failure did not improve and the burden of AF became 100% during 2 years. Kidney function also progressed to CKD stage 4 due to anticancer drug toxicity and cardiorenal syndrome. Although a complete hematologic response was shown after third chemotherapy, the patient's quality of life declined sharply due to repeated hospitalization. The final neurological examination showed no orthostatic hypotension, and there were no findings suggestive of gastrointestinal amyloidosis. Heart and kidney transplantation was considered because there were no major disorders in other organ. After central extracorporeal membrane oxygenation, heart and kidney cotransplantation was performed. After 2 weeks, the patient complained of sudden abdominal pain, and duodenal perforation was diagnosed, and emergency primary repair was performed. But, next day, gastrojejunostomy was performed due to failure of primary repair. After that, the patient went through antibiotic treatment and rehabilitation for 2 months, and discharged in a state of being able to eat. Currently, the patient is maintaining a normal life without rejection at 8 months of transplantation.

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## Liver resection after sorafenib therapy in advanced hepatocellular carcinoma: a case report

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**Background:** Mongolia is the highest incidence of hepatocellular carcinoma country in the world. There are 64 new cases per 100,000 population are diagnosed in Mongolia every year. It means it is eight times higher than worldwide. Almost 3/4 cases diagnosed in late stage. Sorafenib is a molecular targeted therapy used in palliative treatment of advanced hepatocellular carcinoma.

**Methods:** We present in this case report who had surgery after sorafenib treatment in advanced hepatocellular carcinoma.

**Results:** The young 41-year-old patient had a large 9.0×8.5×9.5 sized hepatocellular carcinoma in the left liver with left portal vein and anterior portal vein tumor thrombosis. The volumetry of left liver 24.9% and anterior section 42.5%. We recommended to patient sorafenib to avoid from SPSS. After taking 6 months of sorafenib with dose 800 mg per day the tumor size had decreased, and anterior portal vein tumor thrombus was disappeared. We performed left hepatectomy with thrombectomy. There is no recurrence after 2-year post-hepatectomy.

**Conclusions:** Sorafenib can downstage hepatocellular carcinoma and could represent a bridge to surgery and liver transplantation patients in a low-income country.

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## Remnant liver volume ratio less than 30% is not contraindication to living donor right hepatectomy

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The current practice of arbitrarily requiring remnant/total volume ratio (RTVR) of at least 30% is still performed based on the experience of early studies to keep donor safety during living donor right hepatectomy (LDRH). Recently, some centers reported that extended resection with RTVR less than 30% for LDRH, but there is no consensus has been established for safe RTVR limit. Herein, we describe our center's experience for LDRH with RTVR <30% and evaluate the outcomes of living donors with RTVR <30%. We retrospectively reviewed the outcomes of 473 LDRH which performed at our institution from January 2010 to December 2020. We performed right hepatectomy for living donors with RTVR <30% under the following criteria: age  $\leq$ 40 years, preservation of middle hepatic vein, no or minimal fatty changes (<15%), flat fish shaped left hemiliver, and RLV/TLV >25% and FRLV/BW  $\geq$ 0.45. The outcomes in these extended criteria for living donors were compared with those in living donors under conventional criteria. Posthepatectomy liver failure (PHLF) occurred in 50 donors (10.6%) and most cases were grade A except one case and no clinically significant PHLF was not evident for these extended donor criteria group. PHLF and major complications did not occur more frequently in living donor group with RTVR <30%. In multivariate analysis, the only event for major complications and FRLV/BW <0.45 were associated with PHLF but RTVR <30% was not related to PHLF. Moreover, even after propensity score matching analysis, the evidence for PHLF and major complications in RTVR <30% group was not frequent compared to conventional criteria group. In conclusion, LDRH under our extended criteria could be performed safely in donors with RLV ratio <30% under our strict criteria when no other living donors are available.

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## Nonsurgical treatment of abdominal compartment syndrome in a patient following living donor liver transplantation: a case report

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The abdominal compartment syndrome is a condition characterized by pressure that leads to a decrease of capillary perfusion, resulting in a compromised vascular supply to abdominal organs followed by injury to the pulmonary, cardiac, and renal systems. The most frequent cause of acute compartment syndrome (ACS) is linked to traumatic injuries of both the bone and the soft tissues. However, surgery can lead to ACS due to an erroneous position of the patient, prolonged hypotension or a specific operation, such as liver transplantation. An intra-abdominal pressure of >20 mmHg is clinically significant in nearly all patients, even at the relatively low intra-abdominal pressure of 1,015 mmHg significant alterations in organ function can be seen. Mesenteric blood flow reduces to 70% of normal when intra-abdominal pressure is about 20 mmHg and falls to 30% of normal at 40 mmHg. ACS evident in up to 0.7% of patients overall and in 31% of patients after orthotopic liver transplantation (OLT). OLT is associated with several factors that may lead to elevated intra-abdominal pressure such as bowel edema after portal vein clamping, ascites, and donor-recipient graft size mismatch. The currently accepted treatment for ACS is decompressive laparotomy. However, decompressive laparotomy does not prevent death in ACS with a mortality rate of 49%. A 41-year-old woman with uncompensated cirrhosis due to hepatitis B virus, hepatitis D virus, Child-Turcotte-Pugh score 12, model for end-stage liver disease score 32. Portal Hypertension, esophageal varices grade 2, splenomegaly, mild ascites received a living-donor liver transplantation (LDLT) from her healthy husband. Body mass index was 23.0 kg/m<sup>2</sup> and body surface area was 1.65 m<sup>2</sup> (height, 156 cm; weight, 56 kg). Fresh frozen plasma, platelet, red blood cell, albumin, and Lasix used as drug treatment starting from postoperative day 7 in addition to the post LDLT standard treatment. Fluid resuscitation was reduced. No reoperations were performed. Large-volume resuscitation with crystalloids should be avoided in patients that have ACS or are at risk of having it.

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## Complication of donor right hepatectomy for living donor right hepatectomy: a single Mongolian center experience

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**Background:** This study aims to evaluate living donor outcome after right hepatectomy in a single Mongolian center. Living liver donation is one of the most selfless and humane acts a person can perform. Few single-center reports have been published specifically evaluating complications and quality of life post donation.

**Methods:** Between from January 2018 to February 2022, 37 living donor right hepatectomy underwent at National Cancer Center of Mongolia. A retrospectively analyzed peri and postoperative complications and outcome of 37 donors. We were classified their complications by Clavien grade.

**Results:** In our center all living donors underwent right hepatectomy. There were 24 males and 13 females. Mean age was 34 years. The mean intensive care unit stay were 2.7 and 11.4 days. A total of 51 complications developed in 37 donors. The commonest complications were biliary complications, postoperative bleeding and ascites. There were 30 grade I, 5 grade II, 4 grade IIIa, 10 grade IIIb (5 postoperative intraabdominal bleeding, 5 biliary leakage [2 endoscopic retrograde cholangiopancreatography stenting, 3 endoscopic nasobiliary drainage]), 1 grade IVa (liver failure), and 1 grade IVb (biliary leakage with hepato-jejunostomy) complications. On follow-up, no donor developed long lasting disability.

**Conclusions:** In our single center study biliary complications were higher. Donor right hepatectomy itself is risky, it is important to assess the patient well. Recently, we have been confirming donors by taking biopsies, liver function tests and indocyanine green clearance for a dynamic assessment of liver function.

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# Pretransplant coronary calcium score is an independent risk factor for long-term mortality and cardiovascular event in kidney transplant patients

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**Background:** Cardiovascular disease (CVD) is the first cause of death in kidney transplant (KT) population. Both coronary calcium score (CCS) and abdominal aortic calcification (AAC) are well-known risk factor for CVD. Previous studies showed higher CCS was risk factor for CVD in KT population, however, most of these studies include small sample size. This study aimed to investigate the effect of pretransplant CCS and AAC on all-cause mortality and CVD event during long-term follow-up in a nationwide KT cohort.

**Methods:** The Korean cohort study for outcome in patients with kidney transplantation (KNOW-KT) is a multicenter, observational cohort study. The data from 1,032 KT patients were used for this analysis. CCS was evaluated at baseline and 5-year follow-up; AAC was measured at baseline, 3-year, and 5-year follow-up. Epidemiologic parameters and laboratory data were collected every year. Clinical outcomes; all-cause mortality, cardiovascular event, and graft survival were assessed according to baseline CCS and AAC values.

**Results:** Median follow-up duration was 7.4 years. Both CCS and AAC were increased after KT, respectively; CCS (before KT, 209.1±680.2; 5-year after KT, 296.3±820.1) and AAC (before KT, 1.9±3.7; 3-year after KT, 2.1±3.6; 5-year after KT, 2.3±3.8). When we categorized subjects into tertile according to baseline CCS values (0, 0–100, >100) or baseline AAC values (0, 0–10, >10). In univariate analysis, all-cause mortality was highest in the third tertile of CCS (P=0.001) and the third tertile of AAC (P=0.003). The development of CVD was also highest in the third tertile of CCS (P=0.001) and the third tertile of AAC (P=0.001). Cox hazard proportion regression analysis showed that higher CCS was an independent risk factor for all-cause mortality (hazard ratio [HR], 6.705; 95% confidential interval [CI], 1.829–24.587; P=0.004) and CVD event (HR, 4.882; 95% CI, 1.342–17.755; P=0.016).

**Conclusions:** Coronary arterial calcification before KT was an independent risk factor for long-term mortality and CVD morbidity after KT.

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## Clinical effectiveness of live attenuated herpes zoster vaccine in kidney transplant recipients immunized prior to kidney transplantation: a retrospective single-center cohort study

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**Background:** Kidney transplant recipients have an increased risk of herpes zoster (HZ) and its complications. Although live attenuated or recombinant subunit zoster vaccine has been recommended for candidates for kidney transplantation, there has been no clinical data of effectiveness for preventing HZ. In this study, we evaluated the clinical effectiveness of live attenuated HZ vaccine in kidney transplant recipients immunized prior to kidney transplantation.

**Methods:** A retrospective single-center cohort study was conducted in Samsung Medical Center, a 1,950-bed tertiary teaching hospital. Adult patients aged 18 years who received kidney transplantation from January 2015 through December 2018 were enrolled. Patients were observed until HZ event, death, loss to follow-up, or 5 years after transplantation. The inverse probability of treatment weighted Cox proportional hazard model was used to compare the incidence of HZ after transplantation to mitigate the effect of baseline imbalance.

**Results:** A total of 84 vaccinated and 340 unvaccinated patients were enrolled. Vaccinees were immunized a median of 121 days before transplantation. The median age was older in the vaccinated group than in the unvaccinated group (57 vs. 54 years,  $P < 0.001$ ). Grafts from deceased donors were more frequently transplanted in the unvaccinated group (16.7% vs. 51.8%,  $P < 0.001$ ). Five-year cumulative HZ incidence was 11.9%, and the incidences of the vaccinated and unvaccinated groups were 3.9% and 13.7%, respectively. After adjustment, vaccination showed a significant protective effectiveness against HZ (adjusted hazard ratio, 0.18; 95% confidential interval, 0.05–0.60). In addition, no disseminated zoster was observed in the vaccinated group, whereas four cases were observed in the unvaccinated group.

**Conclusions:** Our study, which was the first study on the clinical effectiveness of zoster vaccination for kidney transplantation recipients, suggested that a live attenuated HZ vaccination before transplantation effectively prevents HZ in kidney transplant recipients.

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## Increasing the consent for brain death donor family members

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**Background:** Mongolia's Donor Law was first adopted in 2000 and amended in 2012 and 2018 respectively. The Regulatory Department of Cell, Tissue and Organ Transplantation of the Center for Health Development has been established in 2018. There are three donor hospitals and two transplantation hospitals in Mongolia. Our department gets information daily from the donor hospital's brain death diagnosis committee, if there is a donor with brain death, we make consultations with family members. It may be rejected because of religion, superstition, or personal opinion. Changing such factors will increase the number of family members' consent and the number of transplantations.

**Methods:** The study included 20 family members of the last three years approved by the brain death diagnosis committee for three donor hospitals.

**Results:** After meeting with those 46 family members, 26 (65%) of them accepted and 20 (35%) of them denied. Organ harvesting of 29 kidneys and 20 livers was successfully done from 23 out of 26 consented donors and thus saved 49 lives. The reasons for the rejection of family members are lamas (5 families), shamans (5 families), family opinion (3 families), and lack of information about this (7 families). As well from the studies of organ transplantation and donor awareness, 10 of these families (22%) were knowledgeable, of which 5 were approved donor families. Twenty-three families (50%) did not have any understanding, of which 7 were members of refused families.

**Conclusions:** From these, we could say that knowing organ donation is increasing the likelihood of approval of becoming a donor. Therefore, it is important to meet with the religious representatives, which is one of the major opposing factors to give a proper understanding of donations to the public.

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## Healthcare staff knowledge and attitude toward organ donation in Mongolia

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**Background:** To increase knowledge and attitude toward organ donation among healthcare staff in Mongolia. We conducted surveys among our state hospitals in November 2018. Donor law was revised and enforced since February 2018. Therefore, we aimed to know current knowledge and attitude of our healthcare staff at the state hospitals.

**Methods:** In this questionnaire survey study there were 629 personnel participated from five state hospitals. The participants were randomly selected among doctors, nurses and other healthcare staff from those five hospitals. The questionnaire survey consists of 12 multiple choice questions. The questions are related to donor consent age, organ transplantation program, cadaver donor status, family approach and media involvement in organ donation and transplantation.

**Results:** By profession 253 (40%) were medical doctors, 252 (40%) were nurses and 124 (20%) participants were other healthcare staff. One out of three participants were answered that they need to read revised law again. Three hundred fifty-one staff answered that we should use cadaver donor transplantation more than alive donors. Majority of participants were read about cadaver donor transplantation recently. However only 206 participants (33%) were able to provide cadaver donor information to family members. Many staff (377, 60%) want to get information from website which designated to donor and transplantation.

**Conclusions:** In order to increase public knowledge and attitude toward organ donation in Mongolia, we need to start the training for the doctors, nurses and other healthcare staff. Currently we planned some short courses for intensive care unit and emergency room doctors of state hospitals in Ulaanbaatar and regional diagnostic centers. In daily practices healthcare staff provide donor information to patients and family members. In order to approach family members and provide correct information, doctors need to improve their current understanding of organ donation.

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## Analysis of donor factors for clinical prediction of recipient after deceased donor renal transplantation in South Korea

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**Background:** There is little data on allograft survival based on deceased donor characteristics outside the United States. Conservative use of deceased donors based on concern for longer term allograft outcomes likely increases the discard rate of deceased donor kidneys despite a severe international deficit of kidney donors. Using South Korea as a model, we analyzed deceased donor characteristics using 1-year creatinine in the recipient as a surrogate marker for longer term outcomes.

**Methods:** We analyzed a total 2,858 cases contained within the Korean Organ Transplant Registry data which had conducted deceased donor renal transplant from 2009 to 2017. Univariate, multivariate linear regression analysis and five-fold cross validation was performed to make a formula for estimating the serum creatinine of the recipient for 1 year after deceased donor kidney transplant.

**Results:** Univariate analysis indicated a number of different factors were significant in determining outcome, however only donor age, donor serum creatinine and current smoking status without hypertension were statistically significant in a multivariate model for predicting serum creatinine of the recipient after 1 year of kidney transplant. We also found that serum creatinine at 1 year predicted 3-year outcomes in a log-rank test.

**Conclusions:** Currently deceased donor kidney transplant outcomes are extremely good in South Korea (despite a much longer period on dialysis prior to transplant) compared to the United States. Given significant differences in cultural, economic, medical and racial characteristics compared to the US the Korean prediction model obtained from this study relies on checking only three donor factors, and thus can be obtained relatively quickly and conveniently and yet provides more information to the recipient candidates before transplant. In particular, we also believe this study indicates that there is underutilization of potential deceased donors in Korea and that a wider pool of deceased donors could be used safely.

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# Analysis of the degree of alcohol dependence and codependence of family members in patients who underwent liver transplantation for alcoholic liver disease

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**Background:** As a treatment for alcoholic end-stage liver disease, liver transplantation is becoming the most effective treatment. Brain dead liver beneficiaries by disease in 2015, before the change in the hepatic distribution standard to model for end-stage liver disease (MELD), there were 132 patients (28.9% of brain death liver transplants) who underwent brain death transplantation for alcoholic liver disease, but since the change, 166 cases (32.6%) in 2016 and 184 cases (46.6%) in 2020 are increasing every year. In order to successfully return to society and increase the survival rate of patients who have undergone liver transplantation for alcoholic liver disease, prevention of recurrence of drinking habits after surgery must be carried out in parallel, so liver transplantation for each subject to explore an approach strategy to prevent re-drinking. The degree of alcohol dependence and family codependence were analyzed before implementation.

**Methods:** In 41 patients who performed liver transplantation for alcoholic liver disease at Severance Hospital from January 2021 to July 2022, patients were diagnosed with alcohol dependence using the DSM-5 set by the American Psychiatric Association in 2013, which is used as a diagnostic criterion for alcohol dependence, and the degree of codependence was confirmed using the Korean version of the co-dependency self-checklist (CODA version) for the main caregiver.

**Results:** The mean age of 41 patients was 51.3 years, with 31 males and 10 females. Three of these patients received brain-dead liver transplants and 38 patients underwent *vivo* liver transplants. The alcohol dependence of 41 subjects was 5 alcohol-dependent, 4 mild, 9 moderate, and 23 severe. As a result of the codependence status survey on the main caregiver, out of a total of 41 primary caregivers, 14 were judged to be codependent and 6 were determined to be codependent. The main caregiver codependency status by alcohol dependence was identified and found that two people had co-dependency status and one codependence certainty in mild alcohol dependence patients, and four people had codependence status and 0 codependence status in alcohol dependence moderate patients. In patients with alcohol dependence in the severe stage, there were eight patients with codependency status and four people with certain codependence.

**Conclusions:** Diagnosis of alcohol dependence and family codependence status in patients who underwent liver transplantation for alcoholic end-stage liver disease. The results showed that there were differences in alcohol dependence among each subject, as well as differences in family codependence with primary caregivers. Relapse of drinking habits after surgery can cause alcohol-induced liver damage and reduce adherence to medication and outpatient visits, leading to graft liver failure, so access strategies for prevention of re-drinking according to the stage of alcohol dependence before liver transplantation and re-drinking, including family members in a state of codependence. It is believed that prevention programs will need to be developed. This study was conducted on 41 patients before liver transplantation and their primary caregivers, and in order to obtain statistically significant results, more subjects should be included in the future.

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## The free radical scavenger NecroX-7 ameliorates tacrolimus-induced pancreatic $\beta$ cell dysfunction

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**Background:** Tacrolimus (FK506) induces pancreatic beta cell dysfunction, causing new-onset diabetes mellitus after transplantation. Cyclopentylamino carboxymethylthiazolyindole (NecroX-7) is a class of indole-derived, cell-permeable, antioxidant molecules that exhibit cytoprotective effects in cells acting as a scavenger of reactive oxygen species (ROS). In this study, we aimed to investigate the therapeutic potential of NecroX-7, a novel clinical-grade necrosis inhibitor that specifically targets mitochondrial ROS, in tacrolimus-induced pancreatic beta cell dysfunction.

**Methods:** INS-1 cells were incubated with FK506 with or without NecroX-7 and harvested at 24-hour intervals. Cells were assessed for viability, adenosine triphosphate (ATP), apoptosis, cell insulin secretion and content. Western blotting and RT-PCR analyses evaluated protein or gene expression of MDA, HO-1, c-Jun N-terminal kinases (c-Jun), Bcl-2, Bax, caspase-3, interleukin (IL)-6, IL-1 $\beta$ , tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), toll-like receptor-4 (TLR-4), and high mobility group box 1 protein (HMGB-1) expression were assessed in INS-1 cells.

**Results:** NecroX-7 increased remarkably cell viability, ATP and insulin secretion. Cotreatment with NecroX-7 significantly increased expression of HO-1 and Bcl-2. Pancreatic beta cell line showed that FK506 treatment increased apoptosis, while co-treatment with NecroX-7 effectively attenuated these alterations. NecroX-7 could significantly reduce the levels of c-Jun, BAX, caspase-3, IL-6, IL-1 $\beta$ , TNF- $\alpha$ , HMGB1, and TLR-4 in INS-1 cells.

**Conclusions:** NecroX-7 could ameliorate FK506-induced—pancreas beta cell injury through the antioxidant and anti-inflammatory pathway. These findings suggest that NecroX-7 has beneficial effects in tacrolimus-induced diabetes mellitus.

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## Comparison of pure laparoscopic donor right posterior sectionectomy versus right hemihepatectomy: a preliminary study based on surgical outcomes of donors and recipients

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**Background:** Right posterior section (RPS) graft for living donor liver transplantation (LDLT) is an alternative graft in a live liver donor with insufficient remnant left lobe (LL) volume and portal vein anomaly. Although there have been some reports regarding pure laparoscopic donor right posterior sectionectomy (PLDRPS), there is no comparative study of PLDRPS versus pure laparoscopic donor right hemihepatectomy (PLDRH). The aim of our study is to compare surgical outcomes of PLDRPS vs. PLDRH at centers achieving complete transition from open to laparoscopic approach in liver donor surgery.

**Methods:** From March 2019 to March 2022, a total of 351 LDLTs, 16 and 335 donors underwent PLDRPS and PLDRH, respectively. We reviewed the selection process for RPS grafts and evaluated postoperative outcomes of donors and recipients.

**Results:** There was no open conversion or perioperative blood transfusion in donors. In the donor cohort, there was no significantly different major complication (grade III) rate and comprehensive complication index (CCI) between PLDRPS versus PLDRH group (6.3% vs. 4.8%,  $P=0.556$  and  $2.1\pm 8.4$  vs.  $1.7\pm 6.4$ ,  $P=0.788$ ). Furthermore, in the recipient cohort, there was significantly different major complication (grade III) rate (62.5% vs. 35.2%,  $P=0.034$ ), but no significantly different CCI ( $18.3\pm 14.9$  vs.  $15.2\pm 24.9$ ,  $P=0.623$ ) between PLDRPS vs. PLDRH group.

**Conclusions:** PLDRPS in liver donors with portal vein anomaly and insufficient LL was technically feasible and safe with experienced surgeons. PLDRPS group might be comparable with PLDRH group based on surgical outcomes of donors and recipients. However, in terms of recipient outcomes, more careful selection of donor of the RPS graft and further researches in a large number of cases are necessary to evaluate the usefulness of PLDRPS.

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## Initial experience of pure laparoscopic living donor right hepatectomy by junior surgeon with external traction of the cystic duct: a safe and feasible method

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**Background:** Minimally invasive surgery has become the mainstream, laparoscopic major hepatectomy is gradually increasing with two consensus meetings. However, purely laparoscopic donor right hepatectomy (PLDRH) is still being performed carefully, because donor safety and quality grafts must be obtained. One of the thresholds is hilar dissection. The external traction of the cystic duct can be helpful for hilar dissection and duct division.

**Methods:** From March 2019 to December 2019, 86 patients underwent donor right hepatectomy except for 17 patients who used left graft. Forty of them underwent PLDRH and 46 of them underwent open hepatectomy. PLDRH was performed using flexible scope and five ports. The gallbladder was not divided from the liver bed for traction after only cutting the cystic duct and artery. After tying the cystic duct stump in a "round loop," external traction was performed to the left side of the epigastric area. From the seventh patient with PLDRH, cystic duct traction method was used.

**Results:** Their mean age was 40.4±14.4 years and eight (50.0%) were female. The average body mass index was 22.8 kg/m<sup>2</sup> (19.1–25.4 kg/m<sup>2</sup>) and the average graft volume was 778.8 mL (608–1,300 mL). The mean graft steatosis was 2.6%. The average operation time was 327.3 minutes (250–380 minutes) and the time from hepatic artery clamping to graft out was 18.9 minutes (11–31 minutes). There was no intraoperative transfusion and no open conversion in all patients. One duct stricture developed as a surgical complication which was treated with ERBD insertion and there was one spontaneous pneumothorax during the operation. There was no reoperation or readmission. Recipients also recovered well and there was a bile leak in one patient of the recipients.

**Conclusions:** PLDRH still remains a challenging procedure requiring important experiences in both laparoscopic liver surgery and open living donor right hepatectomy. External traction of the cystic duct may be helpful for PLDRH.

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## Spontaneous rupture of graft hematoma in the second day after right-lobe living-donor liver transplantation: a case report

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**Background:** Subcapsular hematoma of the graft is an underreported but essential complication after living donor liver transplantation. Ruptured liver after liver transplant is a very rare complication. It can lead to loss graft loss. We report a case of a ruptured liver graft on the second day after living donor liver transplantation.

**Methods:** A 35-year-old male patient underwent right-lobe living-donor liver transplantation due to hepatitis B virus-related liver cirrhosis and hepatocellular carcinoma (under Milan). The right-lobe graft weighed 719 g, which represented a graft-to-recipient weight ratio of 1.17%. The donor operation procedure was uneventful and no injury during the operation. The recipient operation was performed according to the standard right-lobe living donor liver transplantation procedure. Before abdominal closure, a Doppler echogram study showed that the graft was well perfused, and no parenchymal injury was observed before abdominal closure. The duration and blood loss of the recipient operation was 549 minutes and 900 mL.

**Results:** Postoperative day 1 Doppler echogram study showed two subcapsular hematomas but normal arterial venous and portal blood flow. On the second day, there was bleeding by drainage, and by echography, the size of the hematoma in segment VI was increased and ruptured. Re laparotomy was performed immediately and evacuated blood clots from the liver surface. Hemostasis was very difficult subcapsular area was packed with surgical and we used a vertical mattress stitch with a straight long needle. The patient has recovered and was discharged 1 month after the transplantation.

**Conclusions:** Graft rupture post-liver transplantation is rare, few reported cases described ruptured subcapsular hematomas. We believe we would have lost the patient if we elected conservative therapy or interventional procedure Because spontaneous hematomas mostly will need surgery.

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## Preliminary results of pharmacist's periodic counseling program on medication adherence and satisfaction in kidney transplantation recipients

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**Background:** Medication nonadherence is a leading cause of long-term graft failure in kidney transplantation (KT). After KT, three immunosuppressants are being taken as standard therapy, and due to the differences in immunologic risks and the development of new immunosuppressants, the recipients are exposed to more diverse medications. As the number of elderly recipients are increase, medications for various chronic diseases such as hypertension, diabetes, dyslipidemia, gout and cardiovascular disease must be prescribed at once. These circumstances has contributed to diminish medication adherence. The purpose of this study is to evaluate effect of pharmacist's periodic counseling program (PCP) on medication adherence in KT recipients.

**Methods:** Sixteen patients who underwent KT between from November 2020 to April 2021 in Korea University Anam Hospital had been enrolled. Transplant pharmacists review drug-drug interactions, monitor medication adherence, provide quarterly medication counseling in PCP. Adherence to immunosuppressive medications was assessed by immunosuppressant therapy adherence scale (ITAS) and it was conducted four times every 3 months for 1 year after KT. The four-item ITAS composite can range from a low of 0, indicating very poor adherence, to a high of 12, indicating perfect adherence.

**Results:** Fifteen recipients except one patient who dropped out due to cerebral infarction, completed and returned the scale for a 100% response rate. Sixty percent (9/15) was male and mean age was 55.8±10.3 years. The medication adherence as measured by the ITAS has been gradually improved over time after 3 month-based PCP. The medication adherence rate was 40.0% (6/15) at first, but it had risen up to 86.7% (13/15) after conducting four times counseling. Women reported higher rates of adherence (6/6).

**Conclusions:** PCP appears to be effective in enhancing medication adherence, which would ultimately improve long-term graft survival. We plan to continue this study until 50 recipients, a target number of subjects, are enrolled.

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## Clinical characteristics of lung transplant recipients who underwent bronchoscopic balloon dilatation for bronchial stenosis

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**Background:** Bronchial stenosis (BS) after lung transplantation is a major posttransplant airway complication, and bronchoscopic balloon dilatation is widely used for the management of bronchial stenosis because of its safety and ease of procedure. There are few studies on posttransplant bronchial stenosis and balloon dilatation in Asian lung transplant recipients.

**Methods:** Medical records of lung transplant recipients from January 2013 to March 2020 at a university hospital in Seoul were reviewed retrospectively.

**Results:** In this lung transplant cohort, 42 (15.7%) out of 267 transplant recipients were identified as bronchial stenosis patients who underwent balloon dilatation. The mean age and sex distribution of patients with bronchial stenosis did not show a statistically significant difference compared to patients without bronchial stenosis. There was no statistical difference between the two groups in the presence or absence of major comorbidities. The most common underlying lung disease in both groups was interstitial lung disease, and almost all patients in both groups underwent bilateral lung transplantation. When comparing the incidence of postoperative complications after transplantation, there were no statistically significant difference between the two groups. Also, no statistical difference was observed between the two groups in the overall mortality (without BS vs. with BS, 48.9% vs. 40.5%;  $P=0.404$ ). On average, balloon dilatation for bronchial stenosis was performed 6 months after lung transplantation in patients with bronchial stenosis. Bronchoscopic balloon dilatation was performed at multiple sites in more than half of patients with bronchial stenosis. Patients with bronchial stenosis underwent an average of five or more balloon dilations, and 21.4% of them underwent bronchial stent placement via rigid bronchoscopy (Table).

**Conclusions:** In this lung transplant recipient cohort, the clinical characteristics of patients with bronchial stenosis were similar to those without bronchial stenosis. In many of these, balloon dilatation was repeatedly performed at multiple sites.

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## **In vivo imaging of renal microvasculature in murine ischemia-reperfusion injury models using optical coherence tomography angiography**

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**Background:** Optical coherence tomography angiography (OCTA) is a non-invasive imaging technique that provides three-dimensional structural and semi-quantitative imaging of the microvasculature *in vivo*. We developed an OCTA imaging protocol for the mouse kidney ischemia-reperfusion injury (IRI) model to investigate the correlation of the changes in renal microvasculature with ischemic damage.

**Methods:** A prototype SS-OCT system centered at 1300 nm with a 220.4 kHz A-scan rate was used for kidney imaging. Mice were divided into two groups according to the ischemic time; 10 and 35 minutes for the mild and moderate IRI groups. Each animal was imaged at baseline, during the ischemia, and at 1, 15, 30, 45, and 60 minutes after ischemia. An intensity decorrelation OCTA B-scan was computed from five B-scans acquired at the same position. OCTA images were constructed with 1.5-ms, 3.0-ms, and 5.8-ms interscan time, respectively, to calculate semi-quantitative flow index in the superficial (50–70 μm) and deep (220–340 μm) capillaries.

**Results:** The mild IRI group did not show significant flow index changes in superficial and deep layers. The moderate IRI group manifested a significantly decreased flow index from 15 minutes in the superficial layer and from 45 minutes in the deep layer, respectively. When comparing the two groups, superficial blood flow in the moderate group decreased significantly from 15 minutes, whereas no difference was observed in deep blood flow. Seven weeks after the IRI induction, the moderate IRI group showed lower kidney function and higher collagen deposition than the mild IRI group.

**Conclusions:** OCTA imaging of the murine IRI model could find the changes in superficial blood flow after ischemic injury. The decreased superficial blood flow rather than deep blood flow was associated with sustained dysfunction after IRI. Investigation of post-IRI renal microvascular response using OCTA could evaluate ischemic insult and predict kidney function.

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## Learning curve of robotic living donor right hepatectomy in two specialized centers: a cumulative sum analysis

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**Background:** Robotic donor hepatectomy has proved its feasibility and safety with consecutive studies. However, no current study is reported about the learning curve of robotic donor right hepatectomy. In this study, we evaluated the learning curve of robotic living donor right hepatectomy (RLDRH) in two specialized centers.

**Methods:** From 2016 to 2021, 99 patients underwent RLDRH in center A. From 2018 to 2022, 15 donors underwent RLDRH by center B which received proctorship from A center. We divided procedure time into five steps to confirm learning curve. The learning curve was evaluated using the cumulative sum (CUSUM) analysis based on operation time.

**Results:** Center A had seven (7.07%) major complications and two open conversion cases. Center B had one (6.66%) major complication without any open conversion case. The mean operation of A was 460.91 minutes and B was 486.4 minutes without significant disability of graft. The CUSUM of total operation time explained a learning curve of 17th cases of RLDRH in A and 9th case in B. The mean console time were 389.77 minutes in A and 441.47 minutes in B and a learning curve of 19th case in A and 7th case in B were demonstrated. The mean parenchymal dissection time was 184 minutes in A and 149 minutes in B and a learning curve was 14th case in A and 9th case in B. However, hilum dissection time (mean, 57.99 minutes in A; mean, 57.6 minutes in B) and warm ischemic time (mean, 15.49 minutes in A; mean, 11.33 minutes in B) showed no significant discriminative pattern in both results. No significant risk factor was found in learning curve of operation time.

**Conclusions:** Prior experience with standardized technique for RLDRH, though complex and relatively novel, can be safely reproduced with shortening of learning curve in another specialized center through appropriate proctorship.

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## Clinical manifestations of delayed COVID-19 pneumonia in kidney transplant recipients

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From January to April 2022, during the secondary wave of COVID-19 (Omicron) in Korea, the Korean government mandated 7 days of quarantine for COVID-19 patients. Most patients complained of mild symptoms during the quarantine period and returned to their daily lives after that period. In our hospital, we identified 126 COVID-19 infections in kidney transplant recipients through their contact. We observed the delayed pattern of COVID-19 pneumonia in 11 (8.7%) kidney transplant patients after the legal isolation period. There were nine (72.7%) women, median ages were 66 years (range, 60–79) and median time after renal transplantation was 3.4 years (range, 0.4–29.3). There were eight cases of living donor kidney transplantation and two cases of ABO blood type incompatible kidney transplantation. Most of the immunosuppressants were administered steroids, tacrolimus, and mycophenolate. Half of the patients had diabetes. All patients were vaccinated against COVID-19 more than twice. The patient was hospitalized for a median of 14 days (range, 9–26) after confirmed COVID-19 infection, and the total length of hospitalization was a median of 8 days (range, 6–36). Among the patients, 63.6% of dyspnea, 36.3% of fever, and 81.8% of respiratory symptoms were observed. During hospitalization, maintenance dialysis was started in two patients, and acute renal failure was observed in three patients. One confirmed an increase in FK-506 related to Paxlovid administration, but two had an increase in FK-506 for unknown reasons. All patients were given steroids and antibiotics, and nine (81.8%) were given remdesivir. Two patients completely stopped immunosuppressants during hospitalization, and 7 (63.6%) patients stopped mycophenolate. In COVID-19 infection, delayed patterns of pneumonia are more frequent in kidney transplant recipients than in the general population. Even after the general course of infection, according to his symptoms and CT ratio of PCR, the patient should be considered for additional administration of antiviral drugs.

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## Outright antegrade ureteral stent insertion on an allograft kidney with angiomyolipoma with immediate obstructive uropathy posttransplant

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**Background:** Kidney allograft ureteral obstruction may occur on the first few weeks to the first year posttransplant. It may be due to intrinsic obstruction, extrinsic compression, ureteral ischemia or kinking of the ureter. Once identified, prompt intervention should be done to prevent allograft dysfunction and graft loss. Aside from nephrostomy tube insertion, retrograde stent insertion may be done, although this poses a challenge. Upon improvement of renal function, definitive treatment is done such as percutaneous balloon dilation followed by antegrade stent placement. Surgical revision is recommended for recurrence. We described a case of a 22-year-old female with chronic glomerulonephritis having standard immunologic risk, who received a kidney from a living related donor who developed ureteral obstruction on the first week posttransplant. She underwent outright antegrade ureteral double-J stent insertion. The kidney was also found to have a 0.6 cm angiomyolipoma on the superior pole seen on computed tomography angiogram.

**Methods:** Data from this report is obtained from daily chart entries.

**Results:** After an unremarkable kidney transplant, the patient had no urine output 5 days postoperation. On magnetic resonance imaging (MRI), there was a 100 cc fluid collection impinging on the ureter. He underwent allograft exploration and evacuation of 200 cc hematoma. However on the second day post-exploration, there was recurrence of no urine output. Repeat MRI showed dilated collecting system. Under ultrasound guidance, the superior pole of the kidney was punctured and the tract dilated. Antegrade pyelogram showed moderately dilated collecting system. There was an abrupt narrowing on the middle third segment of the ureter. Guidewire was able to pass through and a ureteral double j stent was inserted. There was marked improvement on the urine output and the creatinine of the patient postoperation.

**Conclusions:** Outright antegrade ureteric stent placement is possible resulting to improvement on allograft function. Monitoring will be done the kidneys angiomyolipoma.

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## A review of 50 kidney transplantation cases: the first steps of a small transplant center

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The purpose of this study is to describe patient outcomes at a low-activity kidney transplantation (KT) center. We report a case series of the first 50 patients who underwent transplantation from 2016 to 2021 at a university hospital, low-activity KT center ( $\leq 35$  KT per year). Baseline patient characteristics and transplant outcomes such as rejection, graft failure, infection, and immediate postoperative complications were observed. Patient demographics showed a mean age of  $44.9 \pm 11.1$  years, 28 (58.3%) of patients were male and 23 (46%) of the transplants were from deceased donors. Five (10%) ABO-incompatible KTs were performed and seven (14%) patients were pre-sensitized with a high panel reactive antibody (PRA) of more than 50%. Thirty-two patients (64%) underwent basiliximab induction, and maintenance immunosuppression was done using tacrolimus in 49 (98%) recipients. Median post-KT follow-up duration 23.7 (interquartile range [IQR], 50.7) months. Of the 22 indication biopsies performed for elevated creatinine or proteinuria, four cases of T-cell mediated rejection (TCMR), two mixed rejection, seven calcineurin inhibitor (CNI) toxicities, and nine other (borderline, BK virus [BKV] nephropathy, recurrent glomerulonephritis, etc.) pathologies were observed. For immediate postoperative complications, there were two cases of postoperative hematoma and one case of lymphocele. For infectious complications, 12 cases of cytomegalovirus (CMV) viremia, two BKV nephropathy, one hepatitis B virus (HBV) reactivation, one neutropenic fever with invasive pulmonary aspergillosis, four urinary tract infections, and three COVID-19 pneumonias were observed. For other complications, two cases of avascular necrosis of the hip joint, two osteoporosis, one new-onset diabetes after transplant, two cataracts, and two recurrent glomerulonephritis cases were observed. One graft failure occurred 10 months post-KT due to delayed postoperative bleeding after restarting of antiplatelets. Although there is a selection bias of low-risk cases, the prognosis of KT patients at small, low-activity KT centers is favorable and KT should be offered to all eligible patients as the first and foremost option before dialysis.

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## Impact of iliac artery calcification of deceased-donors on graft outcomes after kidney transplantation

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**Background:** The quality of deceased donors (DDs) kidney is closely related to graft survival after kidney transplantation (KT). Vascular calcification is a highly regulated, cell-mediated process associated with chronic kidney disease. The purpose of this study was to evaluate the predictability of vascular calcification in DD as determined by a computed tomography (CT) scan-based calcification scoring system and correlation with kidney biopsy scoring and graft outcomes.

**Methods:** A retrospective review of 147 DDs at Korea University Anam Hospital between 2010 and 2020 was performed. A total of 62 recipients with available pretransplant donors CT scan and time-zero biopsy (TZB) were included. Calcification length, circumference involvement, and morphology by iliac artery scoring system by Davis et al. (Figure) were scored and divided into moderate-to-severe (MTS) and non-to-mild (NTM). Calcification score, chronicity score of TZB, and baseline characteristics were collected and correlated with graft outcomes.

**Results:** In 62 recipients, MTS was 14 (22.6%) and NTM was 48 (77.4%). Mean age of MTS was higher (59.71±5.32 vs. 49.35±13.47, P=0.007). Diabetes mellitus (DM) were higher in MTS (6 [42.8%] vs. 7 [14.5%], P=0.032). MTS showed higher delay graft function (5 [35.7%] vs. 5 [10.4%], P=0.038). In severe TZB grading and biopsy-proven acute rejection, there were no statistical differences (0 [0%] vs. 4 [8.3%], P=0.349; 4 (28.5%) vs. 16 (33.3%), P=0.505). Glomerular filtration rate of postoperative 1 year of MTS tended to be lower without statistical significance (42.95±14.92 vs. 48.53±18.33, P=0.318). One recipient of MTS experienced graft loss.

**Conclusions:** Vascular calcification in pretransplant CT scan is associated with old age and DM of DDs. No correlation was found between TZB grade and calcification. Vascular calcification is thought to be related to graft function after KT, and well-designed and long-term studies are needed.

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## A 2-year follow-up after banding of high output arteriovenous fistula using polytetrafluoroethylene graft

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High blood flow within the arteriovenous fistula, although desirable, may cause vein dilatation with resultant increase in vessel capacitance leading to compensatory increased cardiac output. While asymptomatic aneurysms do not require intervention, close monitoring and prophylactic management of arteriovenous access with high flow is reasonable to avoid serious complications such as cardiac failure. We described a surgical technique we utilized to address a high outflow arteriovenous fistula. The patient is a 40-year-old female, case of end stage renal disease secondary to hypoplastic kidneys, status post-kidney transplantation with failed kidney allograft. She is back to hemodialysis since 4 years ago using her left brachiocephalic arteriovenous fistula and presented with progressive enlargement of the left upper arm cephalic vein associated with pain and heaviness and prolonged bleeding at cannulation sites after hemodialysis. Echocardiogram revealed ventricular hypertrophy, diastolic dysfunction with elevated ventricular filling pressure. Preoperative ultrasound confirmed presence of high output fistula with flow of 9,103 mL/min. She underwent ultrasound guided banding of high output arteriovenous fistula using polytetrafluoroethylene graft and reduction of flow to 3766ml/min was achieved. Immediately post-op, there was noted decrease in the size, thrill and bruit of the cephalic vein in the left upper arm. Two years after surgery, the patient still has a functioning arteriovenous fistula and improved symptoms of cardiac overload. Banding is a simple, accessible and reasonable flow-reducing surgical technique to address high-flow arteriovenous access.

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## Spinal reflexes as a barrier for family consent

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**Background:** Brain death (BD) refers to the non-returnable loss of brain function, including the cortex, subcortical layers, and brain stem. Whereas the spinal cord is considered as part of the extra cranial nervous system that is less affected by the damage causes, this can lead to some reflexes and spontaneous spinal movements, which is not a reason to rule out BD. Past studies showed that between 30%–70% of BD cases have spinal reflexes. The purpose of this study is to investigate the consequences of observing these movements in the acceptance of death, the level of satisfaction and emotional behaviors of the family in the donation process.

**Methods:** In 2021–2020, 30 cases of BD were evaluated in terms of spinal reflexes and the level of consent to donation by the Organ Procurement Unit of Shahid Beheshti University of Medical Sciences, Iran.

**Results:** According to observations, among the 30 BD cases with mean age of  $\pm 34$  years, 11 (36.7%) had spinal reflexes, of which six were Lazarus, two were Babinski, one was simultaneous movement of one arm and one leg, and one was a 5-year-old female child who had shoulder flexion. Among the mentioned cases, only one case was not donated due to family refusal and non-acceptance of death by the family. There was not significant difference in spinal refusal in both gender and any ages.

**Conclusions:** In addition to being careful in the examinations, the coordinators must explain to the BD families the cause of spinal reflexes in order to prevent misunderstanding toward death. However, the final decision depends on the family attitude and coordinator capability. The performance of the coordinators in the process family approach and management of high-risk situation including the presence of spinal reflexes are key elements to get family consent.

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## Long term outcome of hepatocellular carcinoma managed with an elective living donor liver transplantation strategy in high volume center

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Patients with hepatocellular carcinoma (HCC) in chronic liver disease (CLD) awaiting deceased donor liver transplantation may progress or decompensate. Living donor liver transplantation (LDLT) offers an elective strategy for them and more so after downstaging in a locally advanced HCC. We compared the long-term outcome following LDLT for HCC in chronic liver disease (CLD) in Milan criteria, University of California San Francisco (UCSF) criteria and outside UCSF criteria. It is a retro-prospective study done by analyzing the long-term outcome of patients managed with LDLT for HCC in CLD during the study period from 2006–2022 viz disease-free survival and recurrence rates with a minimum follow-up 6 months. During the study period a total of 3,538 LDLT were performed out of which 554 LDLT were performed for HCC. A total of 56 patients were lost to follow-up. Hence, 498 LDLT patients were included in the study, of which 87 patients underwent LDLT after downstaging. The 5-year and 10-year overall survival was 81.08% and 63.08% respectively. Among the patient who underwent downstaging the 5-year survival was 73.5% and recurrence occurred in 10.3% patients. The number of patients within Milan criteria, UCSF criteria (outside Milan criteria) and outside UCSF criteria were 73.09% (364), 20.28% (101) and 6.6% (33). The overall recurrence rate among all the groups were 8.52% (excluding 52 patients who had 30-day mortality). The recurrence rate among Milan criteria, UCSF criteria (outside Milan criteria) and outside UCSF criteria were 5.2%, 14.8% and 12.12% respectively. LDLT for HCC with CLD has an excellent outcome in those within UCSF criteria and outside UCSF criteria after adequate downstaging.

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## A study on differences in deceased donor liver transplantation before and after the introduction of the model for end-stage liver disease system: three low volume centers, multi-center trial

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**Background:** The shortage of donor organs in transplantation is the biggest obstacle to organ transplantation. From June 1, 2016, the Korean organ transplant standard was converted to the model for end-stage liver disease (MELD) system. This study aims to clarify the differences in deceased donor liver transplantation before and after the introduction of the MELD system in three low volume centers in the Gyeongin area.

**Methods:** From June 2013 to May 2019, the study was conducted retrospectively with adult patients undergoing deceased donor liver transplantation at Incheon St. Mary hospital, Soonchunhyang University Bucheon Hospital, Gil Medical Center. Of the 431 registered patients, a total of 87 patients who underwent deceased donor liver transplantation (DDLT) were studied. Before June 2016 (before the MELD system) was designated as the Child-Turcotte-Pugh (CTP) group, and later as the MELD group. Finally, the CTP group was 39 patients, and the MELD group was 48 patients.

**Results:** The result is same as the photo file uploaded as an image.

**Conclusions:** Before the MELD system was introduced, liver transplantation due to hepatitis B virus (HBV) was the most common, but after the MELD system, alcoholic liver disease was the most common primary disease. After the introduction of the MELD system, the waiting period for transplantation was shortened. As a cause for this; (A) with the introduction of the MELD system, DDLT is being conducted to more critical ill patients. Therefore, long waiting days for these patients lead to expired in many cases. (B) Alcohol-induced liver failure has increased, which is more worse prognosis than HBV or hepatitis C virus, resulting in shorter waiting days for transplantation. (C) There was no statistically significant difference in hospitalization period and survival rate between the two groups. On this study, the introduction of the MELD system can be considered the advantage of being more distributed to critical, severe patients.

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## Factors associated with the willingness for the organ donation among community dwelling individuals

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Successful transplant surgery relies on the consent of the deceased to donate their organs. But the rates of consent remain below optimal levels in Iran. The aim of this study is to evaluate the knowledge, attitudes, and willingness for the organ donation in the population of Kashan. The study population included 2,389 participants from Kashan, Iran. The questionnaire consisted of 20 items designed to measure the participants knowledge, attitudes, and willingness to donate organs. The study assesses the relationship between knowledge and attitudes about organ donation and willingness to donate. A logistic regression model was used to find out which factor (knowledge or attitudes) is associated with whether or not someone is willing to donate organs. We adjusted for age, gender, and education level. The response rate of the questionnaire was 72.2%. The mean public knowledge of the participants was  $4.43 \pm 2.2$ , attitude score mean was  $2.56 \pm 1.3$ . Seventy-eight percent of the participants were not willing to donate. Regression analysis showed that knowledge is an independent factor that alters the willingness to donate with the odds ratio of 2.4 (confidence interval [CI], 1.2–5.7) and attitude is also an independent and significant determinants of the willingness with the odds ratio of 1.6 (CI, 1.01–8.3). We conclude that both attitude and knowledge can be considered important factors independent of age, sex and educational status of the people that can influence the willingness for donation.

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## Prevalence of hepatopulmonary shunt in agitated saline test and lung perfusion scan and predictive value of arterial oxygenation

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**Background:** Hepatopulmonary syndrome is defined as arterial deoxygenation in cirrhotic patient with intrapulmonary vasodilatation evident in contrast-enhanced echocardiography or lung perfusion scan. Prevalence is reported to be around 5%–35%, and various threshold values defining arterial oxygenation have been reported from partial pressure of oxygen in the arterial blood of 70 or 80 mmHg. We aim to determine different HPS prevalence from echocardiography and lung perfusion scan and compared cut offs for arterial deoxygenation.

**Methods:** We analyzed 490 patients who had transthoracic contrast echocardiography tested for detection of pulmonary vasodilatation and blood gas analysis as preoperative work-up for liver transplantation.

**Results:** Two hundred and fifty-four patients showed positive on agitated saline test (51.8%) and of these 208 patients underwent lung perfusion scans showed positive hepatopulmonary shunt in nine (4.3%) patients. From ROC analysis the areas-under-the curve of PaO<sub>2</sub> and A-a gradient for predicting positive agitated saline test were 0.550 and 0.586, respectively. From ROC analysis the areas-under-the curve of PaO<sub>2</sub> and A-a gradient for predicting positive lung perfusion scan were 0.825 and 0.858. PaO<sub>2</sub> and A-a gradient significantly correlated with hepatopulmonary shunt on lung perfusion scan at the cut offs of 76.3 mmHg and 36.25 mmHg, respectively. Positive predictive value was higher using A-a gradient (34.8 % vs. 19.5%).

**Conclusions:** In addition to contrast enhanced echocardiography, lung perfusion scan can increase the diagnostic rate of hepatopulmonary syndrome in cirrhotic patients undergoing liver transplantation.

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