Aims & Scope
The aim of the Korean Journal of Transplantation (Journal Abbreviation, Korean J Transplant; Acronym, KJT) is to publish articles of up-to-date and high-quality in organ and tissue transplantation and the related clinical and basic sciences that can contribute to saving lives and curing diseases in patients needing transplantation. The journal pursues its advancement through original/special articles, reviews, case reports, study protocols, editorials, and correspondences. The journal is concerned not only at clinicians and scientists in transplantation but also at those in other fields who are interested in transplantation.

The scope covers transplantation internationally as a separate discipline. This includes but does not limited to organ and tissue donation and preservation; tissue injury, repair, inflammation, and aging; immune recognition, regulation, effector mechanisms, and opportunities for induction of tolerance; histocompatibility; drugs and pharmacology relevant to transplantation; graft survival and prevention of graft dysfunction and failure; clinical trials and population analyses; transplant complications; xenotransplantation; and ethical and societal issues. Also included are the relevant sciences of medicine, surgery, pediatrics, cell biology, and infectious diseases. The journal includes thoracic transplantation (heart, lung), abdominal transplantation (kidney, liver, pancreas, islets), transplantation of tissues and related topics. The KJT serves as a platform for debate and reassessment, a trigger of innovation, and a major pedestal for promoting understanding, improving outcomes, and advancing knowledge and technique in this dynamic area. Published quarterly, the KJT furnishes an indispensable resource for researchers and clinicians around the world.

About the Journal
The KJT is the official journal of the Korean Society for Transplantation (http://www.mykst.org/). It was first launched in December 1987, and is published quarterly (on the last day of March, June, September, and December). In March 2019, the name of the official publication was changed from Journal of the Korean Society for Transplantation to Korean Journal of Transplantation (Korean J Transplant, KJT) and articles were published exclusively in English. Total or a part of the articles in this journal are abstracted in KCI (Korea Citation Index), KoreaMed, DOAJ, and CrossRef. Full-text is freely available from: http://www.ekjt.org/. There is no page charge or article processing charge on the author’s side.

Open Access
The KJT is an open access journal. All articles are distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Subscription Information
The Korean Society for Transplantation will send KJT for free to some relevant individuals and institutions. Full-text PDF files are also available at the official website (http://www.ekjt.org). To order a subscription to KJT, please contact our editorial office.

© The Korean Society for Transplantation
Govini Balasubramani  
Gleneagles Global Hospital, Chennai, India

Daniel Tak Mao Chan  
Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong

Jeremy Chapman  
The University of Sydney Westmead Clinical School, Sydney, Australia

Hyun Keun Chee  
Konkuk University School of Medicine, Seoul, Korea

John Fung  
The University of Chicago Pritzker School of Medicine, Chicago, USA

Geun Hong  
Ewha Womans University School of Medicine, Seoul, Korea

Shin Hwang  
University of Ulsan College of Medicine, Ulsan, Korea

Hyeonjoo Jeong  
Yonsei University College of Medicine, Seoul, Korea

Jong Cheol Jeong  
Seoul National University Bundang Hospital, Seongnam, Korea

Hee Gyung Kang  
Seoul National University College of Medicine, Seoul, Korea

Jae Young Kim  
Gachon University College of Medicine, Incheon, Korea

Ji Il Kim  
The Catholic University of Korea College of Medicine, Seoul, Korea

Seong Hoon Kim  
National Cancer Center, Goyang, Korea

Tae Jin Kim  
Sungkyunkwan University School of Medicine, Suwon, Korea

Young-Tae Kim  
Seoul National University College of Medicine, Seoul, Korea

Guenter Kirste  
Albert Ludwig University of Freiburg Faculty of Medicine, Freiburg im Breisgau, Germany

Jong Soo Lee  
Ulsan University College of Medicine, Ulsan, Korea

Sik Lee  
Chonbuk National University School of Medicine, Jeonju, Korea

Wei-Chen Lee  
Chang Gung Memorial Hospital, Taoyuan City, Taiwan

Sangil Min  
Seoul National University School of Medicine, Seoul, Korea

Harun Ur Rashid  
Kidney Foundation Hospital and Research Institute, Dhaka, Bangladesh

Eui-Cheol Shin  
Graduate School of Medical Science & Engineering, KAIST, Daejeon, Korea

Stefan G. Tullius  
Harvard Medical School, Boston, USA

Alessandro Vitale  
Padua University Hospital, Padua, Italy

Chul Woo Yang  
The Catholic University of Korea College of Medicine, Seoul, Korea

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
### Day 1 – December 3 (Thu)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
<th>Moderator(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30-10:00</td>
<td><strong>PG Course 1 (Kidney)</strong></td>
<td>ROOM 1</td>
<td>Jin Seok Jeon (Korea), Jung Hwan Park (Korea)</td>
</tr>
<tr>
<td>08:30-09:00</td>
<td>Evaluation and preparation of kidney donors</td>
<td></td>
<td>Han Ro (Korea)</td>
</tr>
<tr>
<td>09:00-09:30</td>
<td>Evaluation and preparation of kidney recipients</td>
<td></td>
<td>Hee Jung Jeon (Korea)</td>
</tr>
<tr>
<td>09:30-10:00</td>
<td>Prevention of re-transplantation</td>
<td></td>
<td>Steve Chadban (Australia)</td>
</tr>
<tr>
<td>10:00-10:10</td>
<td>Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:10-11:40</td>
<td><strong>PG Course 2 (Basic)</strong></td>
<td>ROOM 1</td>
<td>Junho Chung (Korea), Sangho Lee (Korea)</td>
</tr>
<tr>
<td>10:10-10:40</td>
<td>Deep learning-based prediction of CRISPR nuclease and base editor activities</td>
<td></td>
<td>Hyung Bum Kim (Korea)</td>
</tr>
<tr>
<td>10:40-11:10</td>
<td>Nanomaterial-based delivery of oncolytic adenovirus for optimal cancer immunotherapy</td>
<td></td>
<td>Chae-Ok Yun (Korea)</td>
</tr>
<tr>
<td>11:10-11:40</td>
<td>Cell-free DNA in blood</td>
<td></td>
<td>Duhee Bang (Korea)</td>
</tr>
<tr>
<td>11:40-11:45</td>
<td>Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:45-12:45</td>
<td><strong>Industry Symposium 1 (Chong Kun Dang Pharm.) - 1</strong></td>
<td>ROOM 1</td>
<td>Jae Won Joh (Korea)</td>
</tr>
<tr>
<td>11:45-12:15</td>
<td>Efficacy and safety of conversion to TacroBell® SR Cap. (Once-Daily Tacrolimus) in patients undergoing maintenance therapy with twice-daily tacrolimus after liver transplantation. (SOUL study)</td>
<td></td>
<td>Jong Man Kim (Korea)</td>
</tr>
</tbody>
</table>
### Day 1 – December 3 (Thu)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:45-12:45</td>
<td><strong>Industry Symposium 1 (Chong Kun Dang Pharm.) - 2</strong></td>
<td>ROOM 1</td>
</tr>
<tr>
<td></td>
<td>MODERATOR(S) Chul Woo Yang (Korea)</td>
<td></td>
</tr>
<tr>
<td>12:15-12:45</td>
<td>Efficacy and safety of conversion to TacroBell® SR Cap. or TacroBell® Cap. in renal transplant patients undergoing maintenance therapy with reference tacrolimus. (BLOSSOM study) Byung Chul Shin (Korea)</td>
<td></td>
</tr>
<tr>
<td>12:45-12:50</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>12:50-13:50</td>
<td><strong>PG Course 3 (교육위원회)</strong></td>
<td>ROOM 1</td>
</tr>
<tr>
<td></td>
<td>Optimal nutritional intervention before and after organ transplantation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MODERATOR(S) Hyo Chae Paik (Korea), In Sung Moon (Korea)</td>
<td></td>
</tr>
<tr>
<td>12:50-13:10</td>
<td>Liver</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dong Jin Joo (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:10-13:30</td>
<td>Kidney</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hong Pil Hwang (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:30-13:50</td>
<td>Heart and Lung</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Song Yee Kim (Korea)</td>
<td></td>
</tr>
<tr>
<td>12:50-13:50</td>
<td><strong>KST Sponsored Research Project</strong></td>
<td>ROOM 2</td>
</tr>
<tr>
<td></td>
<td>MODERATOR(S) Sangho Lee (Korea)</td>
<td></td>
</tr>
<tr>
<td>12:50-13:10</td>
<td>Identification of the pathways associated with the generation of anti-HLA alloantibodies using HLA-A2.1 sensitized mouse model Byung Ha Chung (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:10-13:30</td>
<td>Characterization of liver associated natural killer cell -resistant and -susceptible hepatocellular carcinoma cells Tae Yong Ha (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:30-13:50</td>
<td>Difference between liver sinusoidal mononuclear cells and peripheral blood mononuclear cells subset analysis in living liver donor Dong Jin Joo (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:50-14:00</td>
<td>Break</td>
<td></td>
</tr>
</tbody>
</table>
### Day 1 – December 3 (Thu)

#### 14:00-15:30 PG Course 4 (Liver)

**How I do it: surgical tricks in liver transplantation**

**ROOM 1**

- **MODERATOR(S):** Jae Won Joh (Korea), Ki-Hun Kim (Korea)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:00-14:22</td>
<td>Hepatic vein reconstruction in LDLT</td>
<td>Deniz Balci</td>
<td>Turkey</td>
</tr>
<tr>
<td>14:22-14:44</td>
<td>Arterial anastomosis in LDLT</td>
<td>Gyu-seong Choi</td>
<td>Korea</td>
</tr>
<tr>
<td>14:44-15:06</td>
<td>Quick hepatectomy using the piggyback technique - How do I do it</td>
<td>Thiago Beduschi</td>
<td>United States</td>
</tr>
<tr>
<td>15:06-15:28</td>
<td>Laparoscopic living donor hepatectomy</td>
<td>Young Seok Han</td>
<td>Korea</td>
</tr>
</tbody>
</table>

#### 14:00-15:30 Reviewer Training Course 1 (Reviewer 인증 교육 1) KOREAN

**ROOM 2**

- **MODERATOR(S):** Eun-Jee Oh (Korea), Sun Huh (Korea)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:00-14:15</td>
<td>Current status of KJT peer review and management of the certification System (KJT Peer Review 현황과 인증제도의 운영)</td>
<td>Ik Jin Yun</td>
<td>Korea</td>
</tr>
<tr>
<td>14:15-14:50</td>
<td>How to write a good peer review (좋은 Review 작성)</td>
<td>Soo Young Kim</td>
<td>Korea</td>
</tr>
<tr>
<td>14:50-15:30</td>
<td>Improving communication skills for reviewing English journal articles</td>
<td>Yunhee Whang</td>
<td>Korea</td>
</tr>
</tbody>
</table>

#### 15:30-15:40 Break

#### 15:40-17:10 PG Course 5 (Kidney)

**Pathology of kidney transplantation**

**ROOM 1**

- **MODERATOR(S):** Hyun Joo Jeong (Korea), Dong Wan Chae (Korea)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:40-16:10</td>
<td>Update in BANFF criteria</td>
<td>Yong-Jin Kim</td>
<td>Korea</td>
</tr>
<tr>
<td>16:10-16:40</td>
<td>Molecular diagnostics in the interpretation of renal allograft biopsies</td>
<td>Mark Haas</td>
<td>United States</td>
</tr>
<tr>
<td>16:40-17:10</td>
<td>Diagnosis of post-transplant recurrent glomerulonephritis</td>
<td>Beom Jin Lim</td>
<td>Korea</td>
</tr>
</tbody>
</table>

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
### Day 1 – December 3 (Thu)

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Moderator(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>17:10-17:20</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>15:40-17:10</td>
<td><strong>Reviewer Training Course 2 (Reviewer 인증 교육 2)</strong> KOREAN</td>
<td>Ik Jin Yun (Korea), Shin Hwang (Korea)</td>
</tr>
<tr>
<td></td>
<td><strong>MODERATOR(S):</strong></td>
<td></td>
</tr>
<tr>
<td>15:40-16:24</td>
<td>Review practice (Review 실습)</td>
<td>Sun Huh (Korea)</td>
</tr>
<tr>
<td>16:24-16:47</td>
<td>What manuscript editors expect from reviewers (원고편집인이 Reviewer에게 바라는 점)</td>
<td>Hye Min Cho (Korea)</td>
</tr>
<tr>
<td>16:47-17:10</td>
<td>Certification examination (인증 평가)</td>
<td>Ik Jin Yun (Korea)</td>
</tr>
<tr>
<td></td>
<td><em>Please download the files in advance to participate in 'Review practice (Review 실습)' lecture at the Notice of ATW 2020 online platform. (<a href="http://www.atweek.cf-air.com">www.atweek.cf-air.com</a>).</em></td>
<td></td>
</tr>
<tr>
<td>17:10-17:20</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>17:20-18:20</td>
<td><strong>Opening Symposium</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MODERATOR(S):</strong></td>
<td>Jongwon Ha (Korea)</td>
</tr>
<tr>
<td>17:20-17:30</td>
<td>Opening remarks</td>
<td>Suk-Koo Lee (Korea)</td>
</tr>
<tr>
<td>17:30-18:00</td>
<td>Strategy for post-pandemic society</td>
<td>Yun-Chul Hong (Korea)</td>
</tr>
<tr>
<td>18:00-18:20</td>
<td>Opening performance - The Sound of Life Choir</td>
<td></td>
</tr>
<tr>
<td>18:20-18:30</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>18:30-19:30</td>
<td><strong>KST Board Meeting</strong></td>
<td></td>
</tr>
</tbody>
</table>

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00-09:50</td>
<td>Plenary Session 1</td>
<td>ROOM 1</td>
</tr>
<tr>
<td></td>
<td>MODERATOR(S)  Jongwon Ha (Korea)</td>
<td></td>
</tr>
<tr>
<td>09:00-09:50</td>
<td>Changes of the immune system in aging require modifications in immunosuppression Stefan Tullius (United States)</td>
<td></td>
</tr>
<tr>
<td>09:50-09:55</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>09:55-10:55</td>
<td>COVID-19 Session</td>
<td>ROOM 1</td>
</tr>
<tr>
<td></td>
<td>MODERATOR(S)  Sang Il Kim (Korea)</td>
<td></td>
</tr>
<tr>
<td>09:55-10:15</td>
<td>Immunological understanding of COVID-19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eui-Cheol Shin (Korea)</td>
<td></td>
</tr>
<tr>
<td>10:15-10:35</td>
<td>Infection control in pre-and post-transplant periods: facility, clinicians, and patients</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kyungmin Huh (Korea)</td>
<td></td>
</tr>
<tr>
<td>10:35-10:55</td>
<td>Preparedness in transplant field during COVID era</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Juhan Lee (Korea)</td>
<td></td>
</tr>
<tr>
<td>10:55-11:00</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>11:00-12:00</td>
<td>Special Session</td>
<td>ROOM 1</td>
</tr>
<tr>
<td></td>
<td>Adapting to the new normal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MODERATOR(S)  Soon-II Kim (Korea), Young Tae Kim (Korea)</td>
<td></td>
</tr>
<tr>
<td>11:00-11:20</td>
<td>Emerging infectious diseases: global situation and key characteristics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Young Kyung Yoon (Korea)</td>
<td></td>
</tr>
<tr>
<td>11:20-11:40</td>
<td>Healthcare mega trend 1: social and economic aspect</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chiweon Kim (Korea)</td>
<td></td>
</tr>
<tr>
<td>11:40-12:00</td>
<td>Healthcare mega trend 2: new technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>KyungWoo Park (Korea)</td>
<td></td>
</tr>
<tr>
<td>12:00-12:05</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>12:05-13:05</td>
<td>Industry Symposium 2 (Astellas)</td>
<td>ROOM 1</td>
</tr>
<tr>
<td></td>
<td>MODERATOR(S)  Jongwon Ha (Korea), Jong Soo Lee (Korea)</td>
<td></td>
</tr>
<tr>
<td>12:05-12:45</td>
<td>Optimal Level of Tacrolimus in Kidney Transplantation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jang-Hee Cho (Korea)</td>
<td></td>
</tr>
</tbody>
</table>
Day 2 – December 4 (Fri)

<table>
<thead>
<tr>
<th>Time</th>
<th>Concurrent Symposium 1 (Kidney)</th>
<th>ROOM 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:10-14:40</td>
<td><strong>New trials in the field of kidney transplantation</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MODERATOR(S)  Jaeseok Yang (Korea), Kyu Ha Huh (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:10-13:40</td>
<td>Biomarkers for tolerance induction in kidney transplantation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sangho Lee (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:40-14:10</td>
<td>CAR-Treg-based therapy in transplantation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Megan Levings (Canada)</td>
<td></td>
</tr>
<tr>
<td>14:10-14:40</td>
<td>Inducing transient mixed chimerism for allograft survival without maintenance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>immunosuppression</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kyo Won Lee (Korea)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Concurrent Symposium 2 (Lung)</th>
<th>ROOM 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:10-14:40</td>
<td><strong>Early post-lung transplant care</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MODERATOR(S)  Do Hyung Kim (Korea), Moo Suk Park (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:10-13:35</td>
<td>Primary graft dysfunction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Young-Jae Cho (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:35-14:00</td>
<td>Acute lung transplant rejection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alice Lee Gray (United States)</td>
<td></td>
</tr>
<tr>
<td>14:00-14:25</td>
<td>Airway problems in lung transplantation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sehoon Choi (Korea)</td>
<td></td>
</tr>
<tr>
<td>14:25-14:40</td>
<td>Panel Discussion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sun Mi Choi (Korea), Woo Hyun Cho (Korea), Sung-Hoon Park (Korea)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Concurrent Symposium 3 (Liver)</th>
<th>ROOM 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:10-14:40</td>
<td><strong>Updates in management protocol: This is an actual protocol of our center</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MODERATOR(S)  Hee Jung Wang (Korea), Deok-bog Moon (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:10-13:28</td>
<td>ABOi LT: routine preparation and management in special situation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gi-Won Song (Korea)</td>
<td></td>
</tr>
<tr>
<td>13:28-13:46</td>
<td>Post-transplant immunosuppression: routine protocol and special consideration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Toshimi Kaido (Japan)</td>
<td></td>
</tr>
</tbody>
</table>
Day 2 – December 4 (Fri)

13:46-14:04  Prophylaxis and management of post-transplant infections  
Albert Chan (Hong Kong)

14:04-14:22  Long-term medical care & cancer surveillance of the recipient  
Geun Hong (Korea)

14:22-14:40  Long-term follow-up and support for the living donor  
Prashant Bhangui (India)

14:40-14:50 Break

14:50-15:50 Oral Presentation 1 (Kidney1)  
ROOM 1

MODERATOR(S)  Joong Kyung Kim (Korea), Cheol Woong Jung (Korea)

14:50-15:02  Impact of treatment of subclinical rejection at 2-weeks after kidney transplantation, compared by analysis of 1-year histologic outcomes  
Okjoo Lee (Korea)

Juhan Lee (Korea)

15:14-15:26  Impact of kidney and recipient weight incompatibility on the allograft outcomes in kidney transplant recipients with pre-transplant diabetes mellitus: a Single Center Retrospective Cohort Study  
Yohan Park (Korea)

15:26-15:38  Combined impact of pre-sensitization and delayed graft function on the development of allograft rejection in deceased donor kidney transplantation: nationwide cohort study  
Hanbi Lee (Korea)

14:50-15:50 Oral Presentation 2 (Thoracic)  
ROOM 2

MODERATOR(S)  Jin Gu Lee (Korea), Hyun-Jai Cho (Korea)

14:50-15:02  Performance changes following the revision of organ allocation system of lung transplant: analysis of Korean Network for Organ Sharing (KONOS) data  
Sung Kwang Lee (Korea)

15:02-15:14  Postop pulmonary artery stenosis in lung transplantation recipients; Review of case series  
Seung Hyun Yong (Korea)

15:14-15:26  Low 25-OH Vitamin D level are associated with increased post-operative acute kidney injury, bronch pleural fistula after lung transplantation  
NamEun Kim (Korea)
Day 2 – December 4 (Fri)

15:26-15:38  Incidence, characteristics and outcome of post-heart transplant malignancy  
Jong-Chan Youn (Korea)

14:50-15:50  Oral Presentation 3 (Liver1)  
ROOM 3  
MODERATOR(S)  Jong Man Kim (Korea)

14:50-15:02  Preoperative prediction score of hepatocellular carcinoma recurrence in living donor liver transplantation: Validation of SNAPP score Developed at Asan Medical Center  
Seok-Hwan Kim (Korea)

15:02-15:14  Renal safety of tenofovir disoproxil fumarate and entecavir in liver transplant patients: a nationwide Korean registry study  
Juhan Lee (Korea)

15:14-15:26  Safety and efficacy of conversion to once-daily tacrolimus from twice-daily tacrolimus in pediatric liver transplant recipients  
Sung Hyo An (Korea)

15:26-15:38  Liver stiffness measurement and outcomes of living donor liver transplantation  
Sang Jin Kim (Korea)

15:38-15:50  Clinical analysis of the prognosis after receiving a liver graft that abandoned transplantation due to poor graft conditions in the centers allocated as a priority  
Ho Joong Choi (Korea)

15:50-16:00  Break
### Day 2 – December 4 (Fri)

<table>
<thead>
<tr>
<th>Time</th>
<th>Concurrent Symposium 4 (Kidney)</th>
<th>ROOM 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>16:00-17:30</td>
<td><strong>More expanding donor pool</strong></td>
<td></td>
</tr>
<tr>
<td>MODERATOR(S)</td>
<td>Chang-kwon Oh (Korea), Yeong Hoon Kim (Korea)</td>
<td></td>
</tr>
<tr>
<td>16:00-16:30</td>
<td>Elderly donor: Is it acceptable?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Myung-Gyu Kim (Korea)</td>
<td></td>
</tr>
<tr>
<td>16:30-17:00</td>
<td>Kidney donors with viral infections - HIV, HCV, and HBV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Daniel Tak Mao Chan (Hong Kong)</td>
<td></td>
</tr>
<tr>
<td>17:00-17:30</td>
<td>Donors with history of malignancy or concurrent small RCC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sangil Min (Korea)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Concurrent Symposium 5 (Heart)</th>
<th>ROOM 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>16:00-17:30</td>
<td><strong>Controversies and advances in heart transplantation</strong></td>
<td></td>
</tr>
<tr>
<td>MODERATOR(S)</td>
<td>Eun-Seok Jeon (Korea), Hae-Young Lee (Korea)</td>
<td></td>
</tr>
<tr>
<td>16:00-16:25</td>
<td>What is the optimal donor heart management?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sung-Ho Jung (Korea)</td>
<td></td>
</tr>
<tr>
<td>16:25-16:50</td>
<td>What is the optimal approach to sensitized patients?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jon Kobashigawa (United States)</td>
<td></td>
</tr>
<tr>
<td>16:50-17:15</td>
<td>What is the optimal immunosuppression in heart transplant?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jong-Chan Youn (Korea)</td>
<td></td>
</tr>
<tr>
<td>17:15-17:18</td>
<td>Panel Discussion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In-Cheol Kim (Korea)</td>
<td></td>
</tr>
<tr>
<td>17:18-17:21</td>
<td>Panel Discussion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jaewon Oh (Korea)</td>
<td></td>
</tr>
<tr>
<td>17:21-17:24</td>
<td>Panel Discussion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Woo Sung Jang (Korea)</td>
<td></td>
</tr>
<tr>
<td>17:24-17:30</td>
<td>Q&amp;A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Concurrent Symposium 6 (Liver)</th>
<th>ROOM 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>16:00-17:30</td>
<td><strong>COVID-19 and liver transplantation</strong></td>
<td></td>
</tr>
<tr>
<td>MODERATOR(S)</td>
<td>Myoung Soo Kim (Korea), Dong-sik Kim (Korea)</td>
<td></td>
</tr>
<tr>
<td>16:00-16:18</td>
<td>COVID-19: Impact on patients with chronic liver disease and liver cancer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marina Berenguer (Spain)</td>
<td></td>
</tr>
</tbody>
</table>
Day 2 – December 4 (Fri)

16:18-16:36  Considerations for DDLT at the time of COVID-19  
Varvara A. Kirchner (United States)

16:36-16:54  Considerations for LDLT at the time of COVID-19  
Joo Dong Kim (Korea)

16:54-17:12  COVID-19: Epidemiology, Prevention and Treatment  
Michael G Ison (United States)

17:12-17:30  COVID-19: Regulation and oversight  
David C Mulligan (United States)

17:40-18:30  KST General Assembly  ROOM 1
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Description</th>
<th>Room</th>
<th>Moderator(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00-10:30</td>
<td>Concurrent Symposium 7 (Kidney) Problem solving cases in kidney transplantation</td>
<td>ROOM 1</td>
<td>Chul Woo Yang (Korea), Jong Soo Lee (Korea)</td>
</tr>
<tr>
<td>09:00-09:15</td>
<td>Differential diagnosis and evaluation of TMA in KT recipient</td>
<td></td>
<td>Byung Ha Chung (Korea)</td>
</tr>
<tr>
<td>09:15-09:20</td>
<td>Differential diagnosis and evaluation of TMA in KT recipient</td>
<td></td>
<td>Yeong-Jin Choi (Korea)</td>
</tr>
<tr>
<td>09:20-09:40</td>
<td>Panel Discussion</td>
<td></td>
<td>Hideki Ishida (Japan), Beom Seok Kim (Korea), Hye Ryeon Jang (Korea)</td>
</tr>
<tr>
<td>09:40-09:45</td>
<td>Q&amp;A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09:45-10:00</td>
<td>Not all recurrences are glomerular diseases</td>
<td></td>
<td>Hajeong Lee (Korea)</td>
</tr>
<tr>
<td>10:00-10:05</td>
<td>Not all recurrences are glomerular diseases</td>
<td></td>
<td>Kyung Cheol Moon (Korea)</td>
</tr>
<tr>
<td>10:05-10:25</td>
<td>Panel Discussion</td>
<td></td>
<td>Natavudh Townamchai (Thailand), Hyo Sang Kim (Korea), Jang Hee Cho (Korea)</td>
</tr>
<tr>
<td>10:25-10:30</td>
<td>Q&amp;A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09:00-10:30</td>
<td>KOTRY Joint Session</td>
<td>ROOM 2</td>
<td>Cuire Ahn (Korea), Myoung Soo Kim (Korea)</td>
</tr>
<tr>
<td>09:00-09:30</td>
<td>Transplantation genome-wide association study using Korea Biobank Array</td>
<td></td>
<td>Young Jin Kim (Korea)</td>
</tr>
<tr>
<td>09:30-10:00</td>
<td>Preliminary results of genomic study using KOTRY genetic samples</td>
<td></td>
<td>Jong Cheol Jeong (Korea)</td>
</tr>
<tr>
<td>10:00-10:30</td>
<td>OVID-19 Pandemic in Asia: Opportunities to come together for the Asian Transplantation Registry</td>
<td></td>
<td>Terence Kee Yi Shern (Singapore)</td>
</tr>
<tr>
<td>09:00-10:30</td>
<td>Concurrent Symposium 8 (Basic) Tregs in transplantation</td>
<td>ROOM 3</td>
<td>Jaeseok Yang (Korea)</td>
</tr>
<tr>
<td>09:00-09:22</td>
<td>Homeobox protein Hhex negatively regulates Treg cells by inhibiting Foxp3 expression and function</td>
<td></td>
<td>Gap Ryol Lee (Korea)</td>
</tr>
</tbody>
</table>
Day 3 – December 5 (Sat)

09:22-09:44 Clinical application of IL-10 producing regulatory cells
Silvia Gregori (Italy)

09:44-10:06 Treg therapy to enable allo-transplantation
Yong Chan Kim (United States)

10:06-10:28 Activation of mevalonate pathway via LKB1 is essential for stability of Treg cells
Jae-Hoon Chang (Korea)

10:30-10:40 Break

10:40-12:10 Concurrent Symposium 9 (Pancreas/Islet)
Practical points of pancreas transplantation

ROOM 1

MODERATOR(S) Samuel Lee (Korea), Jae Berm Park (Korea)

10:40-11:10 Indications for pancreas transplantation
Hye Seung Jung (Korea)

11:10-11:40 Induction and maintenance immunosuppression for pancreas transplantation
Sung Shin (Korea)

11:40-12:10 Monitoring and treatment for pancreas allograft rejection
Raja Kandaswamy (United States)

10:40-12:10 Concurrent Symposium 10 (Liver)
Liver immunology in liver transplantation

ROOM 2

MODERATOR(S) Kyung Suk Suh (Korea), Hee Chul Yu (Korea)

10:40-11:02 Current view on rejection pathology
Hyo Jeong Kang (Korea)

11:02-11:24 Update protocol of acute cellular rejection in liver transplantation
Eleonora De Martin (France)

11:24-11:46 Challenge to ABO blood type barrier in living donor liver transplantation
Hiroto Egawa (Japan)

11:46-12:08 The role of donor specific antibody in liver transplant
Dong Jin Joo (Korea)
## Day 3 – December 5 (Sat)

### Concurrent Symposium 11 (Pediatric)-1
Living donors under the age of 19  
ROOM 3

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Moderators and Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:40-11:30</td>
<td><strong>Concurrent Symposium 11 (Pediatric)-1</strong></td>
<td><strong>MODERATOR(S)</strong> Kyung Mo Kim (Korea), Kwang-Woong Lee (Korea)</td>
</tr>
<tr>
<td>10:40-10:50</td>
<td>Organ donation of living donors under the age of 19</td>
<td>Jong Man Kim (Korea)</td>
</tr>
<tr>
<td>10:50-11:00</td>
<td>Mental health problem on young donors long-term problem after donation under 19</td>
<td>Seockhoon Chung (Korea)</td>
</tr>
<tr>
<td>11:00-11:10</td>
<td>People's attitudes toward to live organ donation of minors; Korean Survey</td>
<td>YoungRok Choi (Korea)</td>
</tr>
<tr>
<td>11:10-11:30</td>
<td>Panel Discussion</td>
<td>Ik Jin Yun (Korea), Dong-Sik Kim (Korea), Seo Hyeong Kim (Korea), Dae-Cheong Ha (Korea), Sangil Min (Korea), Min Hyun Cho (Korea)</td>
</tr>
</tbody>
</table>

11:30-11:40 Break

11:40-12:10 Concurrent Symposium 11 (Pediatric)-2
Update in pediatric transplantation  
ROOM 3

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Moderators and Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:40-12:10</td>
<td><strong>Concurrent Symposium 11 (Pediatric)-2</strong></td>
<td><strong>MODERATOR(S)</strong> Myoung Soo Kim (Korea)</td>
</tr>
<tr>
<td>11:40-12:10</td>
<td>De novo cancer &amp; PTLD after pediatric transplantation; surveillance, prophylaxis, management</td>
<td>Hee Gyung Kang (Korea)</td>
</tr>
</tbody>
</table>

12:10-12:15 Break

12:15-13:15 Industry Symposium 3 (Sanofi)  
ROOM 1

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Moderators and Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:15-13:00</td>
<td>Precision medicine in kidney transplantation</td>
<td>Sung Shin (Korea)</td>
</tr>
</tbody>
</table>

13:15-13:20 Break

13:20-14:20 Oral Presentation 4 (Kidney2)  
ROOM 1

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Moderators and Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:20 - 13:32</td>
<td>Human leukocyte antigen-DR/DQ eplet mismatch analysis for primary alloimmune risk stratification of non-sensitized kidney transplant recipients</td>
<td>Hyeyoung Lee (Korea)</td>
</tr>
</tbody>
</table>
Day 3 – December 5 (Sat)

13:32-13:44  Pure T-cell-mediated rejection following kidney transplant according to the response to treatment in the era of antibody-mediated rejection
   Hyunwook Kwon (Korea)

13:44-13:56  The effect of hyperfiltration mechanism on kidney function in Living-Donor Kidney Transplantation in Cipto Mangunkusumo Hospital, Jakarta, Indonesia: Study on renal arterial resistive Index, Urinary VEGF, NGAL and Heparan Sulfate
   Maruhum Bonar Marbun (Indonesia)

13:56-14:08  Comparison of different induction dosing of CD3+ cell count based anti-thymocyte globulin for deceased donor kidney transplantation (Single center experience)
   Joon Seok Oh (Korea)

13:20-14:20  Oral Presentation 5 (Liver2)  ROOM 2
   MODERATOR(S)  Nam-Joon Yi (Korea), Young-kyoung You (Korea)

   Changho Seo (Korea)

   Joo Dong Kim (Korea)

13:44-13:56  Difficulty scoring system of Pure laparoscopic donor right hemihepatectomy
   Jeong-Moo Lee (Korea)

13:56-14:08  Vascular reconstruction and long-term outcome of living domino liver transplantation in children
   Seiichi Shimizu (Japan)

14:08-14:20  Venous outflow congestion is related to poor recurrence-free survival of living donor liver transplantation recipients with hepatocellular carcinoma
   Jinsoo Rhu (Korea)

13:20-14:50  Concurrent Symposium 12 (Coordinator)  KOREAN  ROOM 3
   MODERATOR(S)  Hea Seon Ha (Korea), Seung Heui Hong (Korea)

13:20-13:50  Professionalism of organ transplant coordinators as nursing professionals
   Sunyoung Son (Korea)

13:50-14:20  Directions for specialization and career management of organ transplant coordinators
   Hyung Sook Kim (Korea)
### Day 3 – December 5 (Sat)

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:20-14:50</td>
<td>Latest issues and alternatives to organ transplant sites</td>
</tr>
<tr>
<td></td>
<td>In Ok Kim (Korea)</td>
</tr>
<tr>
<td>14:20-14:30</td>
<td>Break</td>
</tr>
<tr>
<td>14:30-15:30</td>
<td><strong>Oral Presentation 6 (Basic / Other)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>ROOM 1</strong></td>
</tr>
<tr>
<td>MODERATOR(S)</td>
<td>Kyungho Choi (Korea), Beom Seok Kim (Korea)</td>
</tr>
<tr>
<td>14:30-14:42</td>
<td>Effects on tolerance of chimerism &amp; GVHD in vascularized bone marrow</td>
</tr>
<tr>
<td></td>
<td>allotransplantation</td>
</tr>
<tr>
<td></td>
<td>Jong Won Hong (Korea)</td>
</tr>
<tr>
<td>14:42-14:54</td>
<td>Predictability of eplet mismatch to acute rejection in low level</td>
</tr>
<tr>
<td></td>
<td>HLA antigen mismatched kidney transplantation: Validation analysis</td>
</tr>
<tr>
<td></td>
<td>of Korean organ transplantation registry (KOTRY) data</td>
</tr>
<tr>
<td></td>
<td>Jong Cheol Jeong (Korea)</td>
</tr>
<tr>
<td>14:54-15:06</td>
<td>The organic preservation effect of hemodilution</td>
</tr>
<tr>
<td></td>
<td>Do Xuan Hai (Vietnam)</td>
</tr>
<tr>
<td>15:06-15:18</td>
<td>Prevalence and clinical significance of pancreatic cystic lesions</td>
</tr>
<tr>
<td></td>
<td>in immunosuppressed patients with solid organ transplantation</td>
</tr>
<tr>
<td></td>
<td>Young-Dong Yu (Korea)</td>
</tr>
<tr>
<td>15:18-15:30</td>
<td>Preliminary T and B flow cytometry crossmatch results affecting</td>
</tr>
<tr>
<td></td>
<td>kidney allocation and transplants from deceased donors</td>
</tr>
<tr>
<td></td>
<td>Myoung Hee Park (Korea)</td>
</tr>
<tr>
<td>14:30-15:30</td>
<td><strong>Oral Presentation 7 (Donation)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>ROOM 2</strong></td>
</tr>
<tr>
<td>MODERATOR(S)</td>
<td>Hyung Joon Ahn (Korea)</td>
</tr>
<tr>
<td>14:30-14:42</td>
<td>Healthcare resource utilization after living liver donation: A</td>
</tr>
<tr>
<td></td>
<td>retrospective case-control study</td>
</tr>
<tr>
<td></td>
<td>Hyunjae Im (Korea)</td>
</tr>
<tr>
<td>14:42-14:54</td>
<td>Skeletal muscle mass effects on estimated-GFR decrement after donor</td>
</tr>
<tr>
<td></td>
<td>nephrectomy</td>
</tr>
<tr>
<td></td>
<td>Joon Chae Na (Korea)</td>
</tr>
<tr>
<td>14:54-15:06</td>
<td>The first donation after circulatory death following withdrawal of</td>
</tr>
<tr>
<td></td>
<td>life-sustaining treatment in Korea</td>
</tr>
<tr>
<td></td>
<td>Jae-myeong Lee (Korea)</td>
</tr>
<tr>
<td>15:06-15:18</td>
<td>Analysis for factors of brain death donor processing for face/hand</td>
</tr>
<tr>
<td></td>
<td>transplantation in Korea - How much time will be available from</td>
</tr>
<tr>
<td></td>
<td>brain death to transplantation?</td>
</tr>
<tr>
<td></td>
<td>Jong Won Hong (Korea)</td>
</tr>
</tbody>
</table>

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
### Day 3 – December 5 (Sat)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
</table>
| 15:18-15:30 | Change in allocation pattern of pediatric brain-dead donor kidneys following implementation of new allocation policy with pediatric priority  
Sanghoon Lee (Korea) |
| 15:30-15:40 | Break                                                                   |
| 15:40-16:40 | **Plenary Session 2 (Best Papers)**                                        |
| MODERATOR(S) | Jongwon Ha (Korea), Myoung Soo Kim (Korea)                               |
| 15:40-15:55 | Gut *faecalibacterium* may improve impaired tacrolimus metabolism in kidney transplant recipients with cytochrome polymorphism  
Ji Eun Kim (Korea) |
| 15:55-16:10 | Re-do hepatic artery reconstruction for thrombosis can save grafts and patients without retransplantation: lessons learned from 1,355 adult living donor liver transplantations  
Su Young Hong (Korea) |
| 16:10-16:25 | The assessment and outcomes of HLA mismatches of lung transplantation in Korean patients  
Ha Eun Kim (Korea) |
| 16:25-16:40 | Organ donation from donors with viral hepatitis in South Korea: a 2013–2017 nationwide data analysis  
Hoon-sung Park (Korea) |
| 16:40-16:50 | Break                                                                   |
| 16:50-17:00 | Closing                                                                 |

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
This Supplement contains the abstracts of the Oral Scientific Sessions and Poster Sessions of the ATW 2020 held in Seoul, Korea on December 3-5, 2020.

**Oral Scientific Sessions**

**S1** Impact of treatment of subclinical rejection at 2 weeks after kidney transplantation, compared by analysis of 1-year histologic outcomes  
Okjoo Lee, Kyo Won Lee, Jae Berm Park, Jung Eun Lee, Na Young Hwang, Kyunga Kim

**S2** Impact of donor kidney weight to recipient body weight ratio on long-term graft outcomes in live donor kidney transplantation  
Juhan Lee, Seok Jeong Yang, Eun Jin Kim, Beom Seok Kim, Myoung Soo Kim, Soon Il Kim, Yu Seun Kim, Kyu Ha Huh

**S3** Impact of kidney and recipient weight incompatibility on the allograft outcomes in kidney transplant recipients with pre-transplant diabetes mellitus: a single center retrospective cohort study  
Yohan Park, Hanbi Lee, Eun Jeong Ko, Chul Woo Yang, Byung Ha Chung

**S4** Combined impact of pre-sensitization and delayed graft function on the development of allograft rejection in deceased donor kidney transplantation: nationwide cohort study  
Hanbi Lee, Yohan Park, Tae Hyun Ban, Sang Heon Song, Seung Hwan Song, Jaeseok Yang, Curie Ahn, Chul Woo Yang, Byung Ha Chung

**S5** Performance changes following the revision of organ allocation system of lung transplant: analysis of Korean Network for Organ Sharing (KONOS) data  
Sung Kwang Lee, He Ju Yeo, Woo Hyun Cho, Do Hyung Kim

**S6** Postoperative pulmonary artery stenosis in lung transplantation recipients: review of case series  
Seung Hyun Yong, Song Yee Kim, Jin Gu Lee, Hyo Chae Baek, Moo Suk Park

**S7** Low 25-OH vitamin D level are associated with increased postoperative acute kidney injury, brochopleural fistula after lung transplantation  
Nam Eun Kim, Ha Eun Kim, Song Yee Kim, Beom Seok Kim, Jung Tak Park, Jin Gu Lee, Hyo Chae Paik, Moo Suk Park

**S8** Incidence, characteristics, and outcome of post-heart transplant malignancy  
Jong-Chan Youn, In-Cheol Kim, Jin-Jin Kim, Sang Hong Baek, Jon Kobashigawa

**S9** Preoperative prediction score of hepatocellular carcinoma recurrence in living donor liver transplantation: validation of SNAPP score developed at Asan Medical Center  
Seok-Hwan Kim, Deok-Bog Moon

**S10** Renal safety of tenofovir disoproxil fumarate and entecavir in liver transplant patients: a nationwide Korean registry study  
Juhan Lee, Shin Hwang, Kwang-Woong Lee, Jong Man Kim, Je Ho Ryu, Bong-Wan Kim, Dong Lak Choi, Young Kyoung You, Dong-Sik Kim, Myoung Soo Kim

**S11** Safety and efficacy of conversion to once-daily tacrolimus from twice-daily tacrolimus in pediatric liver transplant recipients  
Sung Hyo An, Sanghoon Lee, Jinsoo Rhu, Jong Man Kim, Gyu Seong Choi, Jae-Won Joh, Suk-Koo Lee

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Liver stiffness measurement and outcomes of living donor liver transplantation
Sang Jin Kim, Jong Man Kim, Jinsoo Rhu, Gyu-Seong Choi, Jae Berm Park, Jae-Won Joh

Clinical analysis of the prognosis after receiving a liver graft that abandoned transplantation due to poor graft conditions in the centers allocated as a priority
Ho Joong Choi, Changho Seo, Sung Eun Park, Joseph Ahn, Tae Ho Hong, Young Kyoung You

Human leukocyte antigen-DR/DQ eplet mismatch analysis for primary alloimmune risk stratification of non-sensitized kidney transplant recipients
Hyeyoung Lee, Ji Won Min, Hyunhye Kang, Chul Woo Yang, Byung Ha Chung, Eun-Jee Oh

Pure T-cell-mediated rejection following kidney transplant according to the response to treatment in the era of antibody-mediated rejection
Hyunwook Kwon, Sung Shin, Duck Jong Han, Young Hoon Kim, Joo Hee Jung, Dong Hyun Kim, Youngmin Ko, Seong Jun Lim

The effect of hyperfiltration mechanism on kidney function in Living-Donor Kidney Transplantation in Cipto Mangunkusumo Hospital, Jakarta, Indonesia: study on renal arterial resistive index, urinary vascular endothelial growth factor, neutrophil gelatinase-associated lipocalin, and heparan sulfate
Maruhum Bonar Marbun, Endang Susalit, Diana Aulia, Jacob Pandelaki, Saptawati Bardosono, Bambang Purwanto

Comparison of different induction dosing of CD3+ cell count based anti-thymocyte globulin for deceased donor kidney transplantation: single center experience
Joon Seok Oh, Joong Kyung Kim, Dong Yeol Lee, Hee Yeon Kim

Single center experience of hepatic artery reconstruction during living donor liver transplantation: microscope versus surgical loupe
Changho Seo

Impact of extended living donor criteria on donor safety in living donor liver transplantation
Joo Dong Kim, Dong Lak Choi, Eun Kyoung Jwa

Difficulty scoring system of pure laparoscopic donor right hemihepatectomy
Jeong-Moo Lee, Kyung-Suk Suh, Eunhye Shin, Suk Hee Ko, Kwanpyo Hong, Eui Soo Han, Suk Kyun Hong, YoungRok Choi, Nam-Joon Yi, Kwang-Woong Lee

Vascular reconstruction and long-term outcome of living domino liver transplantation in children
Seiichi Shimizu, Seisuke Sakamoto, Yasuyuki Kameoka, Kotaro Mimori, Hajime Uchida, Yusuke Yanagi, Akinari Fukuda, Reiko Horikawa, Mureo Kasahara

Venous outflow congestion is related to poor recurrence-free survival of living donor liver transplantation recipients with hepatocellular carcinoma
Jinsoo Rhu

Effects on tolerance of chimerism and graft-versus-host disease in vascularized bone marrow allotransplantation
Jong Won Hong, Jung Hyun Lim

Predictability of eplet mismatch to acute rejection in low level HLA mismatched kidney transplantation: validation analysis of Korean Organ Transplantation Registry (KOTRY) data
Jong Cheol Jeong, Hyeong Eun Son, Yeon Ho Park, Inwhye Park, Jae Berm Park, Dong Wan Chae, Jaeseok Yang, Yun Ji Hong, Borae G. Park

The organic preservation effect of hemodilution
Do Xuan Hai, Mai Vãn Viên

Prevalence and clinical significance of pancreatic cystic lesions in immunosuppressed patients with solid organ transplantation
Young-Dong Yu, Pyoung-Jae Park, Hye-Sung Jo, Dong-Sik Kim

Preliminary T and B flow cytometry crossmatch results affecting kidney allocation and transplants from deceased donors
Myoung Hee Park, Sohyun Kim, Eun Hee So, Kwang Woo Jeon, Boknyun Han

Healthcare resource utilization after living liver donation: a retrospective case-control study
Hyunjae Im, Ho Geol Ryu, Eun Jin Jang, Junwoo Jo, Suk Hyung Choe, Somin Joo, Hannah Lee, Seung-Young Oh, Suk Kyun Hong

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
S29 Skeletal muscle mass effects on estimated glomerular filtration rate decrement after donor nephrectomy
Joon Chae Na, Namki Hong, Min-Gee Yoon, Yumie Rhee, Woong Kyu Han

S30 The first donation after circulatory death following withdrawal of life-sustaining treatment in Korea
Eunsil Jeong, Jae-sook Oh, Yong-min Lee, Jae-myeong Lee

S31 Analysis for factors of brain death donor processing for face and hand transplantation in Korea: how much time will be available from brain death to transplantation?
Jong Won Hong, Soon Won Chung, Sung Jae Ahn, Won Jai Lee, Dae Hyun Lew, Yong Oock Kim

S32 Change in allocation pattern of pediatric brain-dead donor kidneys following implementation of new allocation policy with pediatric priority
Seonghwan Lee

S33 Gut *Faecalibacterium* may improve impaired tacrolimus metabolism in kidney transplant recipients with cytochrome polymorphism
Ji Eun Kim, Hyo-Eun Kim, Hyunjeong Cho, Ji In Park, Jang Wook Lee, Seung Hee Yang, Jung Pyo Lee, Jongwon Ha, Yon Su Kim, Hajeong Lee

S34 Redo hepatic artery reconstruction for thrombosis can save grafts and patients without retransplantation: lessons learned from 1,355 adult living donor liver transplantations
Su Young Hong, Nam-Joon Yi, Jeong-Moo Lee, Suk Kyun Hong, YoungRok Choi, Ung Sik Jin, Hak Chang, Kwang-Woong Lee, Kyung-Suk Suh, Kyung Won Minn

S35 The assessment and outcomes of human leukocyte antigen mismatches of lung transplantation in Korean patients
Ha Eun Kim, Jin Gu Lee, Song Yee Kim, Moo Suk Park, Hye Chae Paik

S36 Organ donation from donors with viral hepatitis in South Korea: a 2013–2017 nationwide data analysis
Hoon-sung Park, Eun-sil Jung, Jae-myeong Lee

**Poster Sessions**

S37 Kidney transplantation from deceased donors with bloodstream infection: a multicenter retrospective study
Hyejin Mo, Juhan Lee, Jae Berm Park, Sun Cheol Park, Young Hoon Kim, Ahram Han, In Mok Jung, Jongwon Ha, Sangil Min

S38 Recipient outcomes of kidney transplantation from older living donor
Ji-Yeon Song, Kyo-Won Lee

S39 The protective role of protocol biopsy against chronic kidney disease progression in kidney transplantation
Okjoo Lee, Kyo Won Lee, Jae Berm Park, Jung Eun Lee, Na Young Hwang, Kyunga Kim

S40 Types of anti-hypertensive medication for post-transplant hypertension and risk of graft failure
Sehoon Park, Sung Jin Kang, Ji Eun Kim, Yaerim Kim, Kwangsoo Kim, Minsu Park, Yon Su Kim, Yaeji Lee, Hajeong Lee

S41 Introducing robot-assisted laparoscopic donor nephrectomy after experience in retroperitoneal endoscopic living donor nephrectomy approach
Minh Sam Thai, Quy Thuan Chau, Khac Chuan Hoang, Xuan Thai Ngo, Trong Hien Nguyen, Kinh Luan Thai, Duc Huy Vu, Le Quy Van Dinh, Ho Yee Tiong, Thanh Tuan Nguyen

S42 Analysis of time trends in preemptive kidney transplantation and effect of pre-transplant dialysis duration on graft survival: a nationwide cohort study

S43 Robot-assisted kidney transplantation: the initial experience of single institution in Korea
Seok Jeong Yang, Kyu Ha Hur, Woo Ju Jeong, Joon Chae Na, Woong Kyu Han, Eun Jin Kim

S44 Impact of tacrolimus intra-patient variability on kidney transplant outcomes according to immunologic risk

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Kyeong Deok Kim, Kyo Won Lee, Sang Jin Kim, Okjoo Lee, Jieun Kwon, Eun Sung Jeong, Manuel Lim, Jaejun Yang, Jae Berm Park

S46 Changes of T lymphocyte subsets after kidney transplantation according to induction immunosuppressants
Hyung Duk Kim, Hyunjoo Bae, Chul Woo Yang, Eun-Jee Oh, Byung Ha Chung

S47 The clinical impact of preformed human leukocyte antigen-DQ donor-specific antibodies on graft outcomes in kidney transplantation
Sua Lee, Byung Ha Chung, Chul Woo Yang

S48 The clinical utility of preformed C1q-binding donor-specific anti-HLA antibodies in kidney transplantation
Sua Lee, Chul Woo Yang, Byung Ha Chung

S49 Cysteine as a potential donor urinary biomarker for donor acute kidney injury and recipient early graft function
Chris Tae Young Chung, Hyunmin Ko, Hye Kee Kim, Kwangwoo Choi, Ahram Han, Sangil Min, Jongwon Ha

S50 The effects of long-term eplerenone treatment in pediatric renal transplant patients
Esra Baskin, Kaan Gulleroglu, Handan Ozdemir, Aysun C Yilmaz, Ebru Ayvazoglu Soy, Gokhan Moray, Mehmet Haberal

S51 Retroperitoneal Viscum album extract injection in high drain output patient after renal transplantation
Youngjun Park, Mihyeon Kim, Kangwoong Jun, Jeongkye Hwang, Sunhong Kim, Sunchel Park, Jiil Kim, Sangseob Yoon, Insung Moon

S52 Changes in recipient body mass index for the first year after kidney transplantation are associated with intrapatient variability of tacrolimus concentration and long-term graft function
Hyunmin Ko, Chris Tae Young Chung, Hye Kee Kim, Kwang Woo Choi, Ahram Han, Jongwon Ha, Sangil Min

S53 Low dose anti-thymocyte globulin versus basiliximab as induction in standard risk kidney transplant patients: 5-year follow-up
Candy Cahilog, Romina Danguilan, Paolo Miguel David, Mel-Hatra Arakarna, Glenda Eleanor Pamugas

S54 Usefulness of pre- and post-transplant BK virus-specific ELISPOT assay for predicting the outcome of BK virus infection in kidney transplant recipients
Eun Jeong Ko, Hyunjoon Bae, Ki Hyun Park, Chul Woo Yang, Byung Ha Chung, Eun-Jee Oh

S55 COVID-19 infection in kidney transplant recipients: report from two centers of Bangladesh
Nura Afza Salma Begum, Tasnuva Sarah Kashem, Farnaz Nobi Rima, Shakib Us-Zaman Arefin, Kamrul Islam, Rezwanur Rahman, Harun Ur Rashid

S56 ABO incompatible kidney transplant after recovery from severe COVID-19 pneumonia
Irawati Waghmare, Ashay Shingare, Madan Bahadur

S57 Serum antibody screening for non-human leukocyte antigen antibodies associated with antibody-mediated rejection reveals significance of anti-collagen type I and type III antibodies
Sehoon Park, Seung-Hee Yang, Jiyeon Kim, Semin Cho, Sang-il Min, Jongwon Ha, Yon Su Kim, Kyung Chul Moon, Eun Young Seong, Hajeong Lee

S58 Clinical impact of complement deposition findings on biopsies in acute rejection episodes of pediatric renal transplant patients
Kaan Gulleroglu, Esra Baskin, Handan Ozdemir, Aysun C Yilmaz, Ebru Ayvazoglu Soy, Gokhan Moray, Mehmet Haberal

S59 Long-term outcomes of renal transplantation in pediatric patients
Aydincan Akdur, Esra Baskin, Ozlem Y Aksoy, Kaan Gulleroglu, Feza Yarbug Karakayali, Ebru Ayvazoglu Soy, Gokhan Moray, Mehmet Haberal

S60 Risk factors and outcomes of urinary tract infections after pediatric renal transplant
Kaan Gulleroglu, Esra Baskin, Aysun C. Yilmaz, Aydincan Akdur, Gokhan Moray, Mehmet Haberal

S61 Success rate of grafts with multiple renal vessels in 3,136 kidney transplants

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
S62 Post renal transplant hyperparathyroidism: Indian experience
Dwarak Sampathkumar, Krishnaswamy Sampathkumar, Andrew Rajiv, Shakthi Kumar, Senthil Kumar, Hitesh Desai, Harsha Hanumalai

S63 Analysis of screening failure of live donation for kidney transplantation: experience of a single medical center in central Taiwan
Cheng-Hsu Chen, Ya-Yun Feng, Kun-Yuan Chi, Cheng-Kuang Yang, Yi-Syuan Chen, Jia-Chian Wu, Ming-Ju Wu

S64 De novo donor-specific antibody without rejection does not always predict worse outcome in kidney transplantation
Hyo Kee Kim, Sangil Min, Chris Tae Young Chung, Hyunmin Ko, Kwang Woo Choi, Ahram Han, Sanghyun Ahn, Jongwon Ha

S65 Efficacy of lymphatic sealing using the LigaSure in kidney transplantation
Sangkyun Mok, Sun Cheol Park, Young Jun Park, Sang Seob Yun, Jang Yong Kim

S66 Improvement of cardiac functions after renal transplant in pediatric patients with severe cardiac risk
Esra Baskin, Kaan Gulleroglu, Ilkay Erdogan, Birgul Varan, Aydincan Akdur, Gokhan Moray, Mehmet Haberal

S67 Techniques of robot-assisted kidney transplantation
Seoungjun Lim, Youngmin Ko, Donghyun Kim, Joohée Jung, Hyunwook Kwon, Younghoon Kim, Duckjong Han, Sun Shin

S68 Clinical significance of late onset antibody-mediated rejection without donor-specific anti-human leukocyte antigen antibodies in kidney transplantation
Juhan Lee, Eun Jin Kim, Beom Jin Lim, Beom Seok Kim, Myoung Soo Kim, Soon Il Kim, Yu Seun Kim, Kyu Ha Huh

S69 Repeat kidney transplantation is reasonable treatment of choice after allograft loss
Namkee Oh, Kyowon Lee, Jinsoo Rhu, Jong Man Kim, Gyu-Seong Choi, Jae Bem Park, Jee-Won Joh, Hyun Cho, Sook Young Woo

S70 Induction or no induction: in modern era of triple immunosuppression
Mital Parikh

S71 Cytomegalovirus infection and risk of new-onset diabetes after transplantation: a retrospective analysis
Muhammad Tassaduq Khan

S72 Successful desensitization and transplantation of kidney transplant recipients with donor-specific antibodies
Muhammad Tassaduq Khan

S73 Outcome of living donor kidney transplantation: a single center experience from South India
Vishrut Khullar, Pradeep Shenoy M

S74 Outcomes of renal transplantation in children with cystinosis
Esra Baskin, Kaan Gulleroglu, Aysun C Yilmaz, Aydincan Akdur, Gokhan Moray, Mehmet Haberal

S75 Impact of dialysis modality on long-term outcomes in kidney transplantation recipients: a propensity-matched cohort study
Jin Hyuk Paek, Ohyun Kwon, Yaerim Kim, Woo Yeong Park, Kyubok Jin, Seungyeup Han

S76 Outcomes of renal transplant in elderly
Anvita Anne, Varun Kumar Bandi

S77 Patient and graft outcome among Filipinos with post-kidney transplant malignancy
Michelle Matematico, Concesa Cabanayan-Casasola, Marichel Pile-Coronel, Adeline Gonzales

S78 Unusual presentation of post-transplant lymphoproliferative disorder in renal transplant
Harsha Hanumalai, Krishnaswamy Sampathkumar, Andrew Rajiv, Shakthi Kumar, Senthil Kumar, Hitesh Desai, Dwarak Sampathkumar

S79 Clinical impact of serum bilirubin levels on kidney transplant outcomes
Juhan Lee, Eun Jin Kim, Jae Geun Lee, Beom Seok Kim, Kyu Han Huh, Myoung Soo Kim, Soon Il Kim, Yu Seun Kim, Dong Jin Joo

S80 A study of acute kidney injury in renal allograft recipients and its impact on short-term outcome of graft function
Manzoor Parry

S81 Cutaneous phaeohyphomycosis in renal transplant recipient

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Anvita Anne, Varun Kumar Bandi

**S82** The worth emphasizing surgical technique: ureteropyelostomy to manage urinary tract complications
Song-Yi Kim, Moonsang Ahn, Chanjoong Choi

**S83** Insulin secretion and insulin resistance trajectories over 1 year after kidney transplantation: a multicenter prospective cohort study
Jun Bae Bang, Su Hyung Lee, Ja Young Jeon, Chang-Kwon Oh

**S84** Hypothermia protects against renal fibrosis after ischemia reperfusion injury
Eunji Kim, Jin Young Jeong, Eu Jin Lee, Joing In Lee, Jae Wan Jeon, Hae Ri Kim, Youngrok Ham, Dae Eun Choi, Ki Ryang Na, Kang Wook Lee

**S85** Prophylactic treatment with antioxidant nanoparticles attenuate ischemia/reperfusion injury in BALB/c mice
Se-Hee Yoon, Won-Min Hwang, Sung-Ro Yun, Jung-hun An

**S86** Rhabdomyolysis-induced acute kidney injury was ameliorated in NLRP3 KO mice via alleviation of mitochondrial lipid peroxidation in renal tubular cells
Yang Gyun Kim, Ju-Young Moon, Hyeon Seock Hwang, Jin Sog Kim, Kyung Hwan Jeong, Sang-ho Lee

**S87** Feasibility and safety of 2-week protocol biopsy after kidney transplantation
Manuel Lim, Kyo Won Lee, Byung Kwan Park, Jae BERM Park, Sang Jin Kim, Kyeong-Deok Kim, Okjoo Lee, Jaehun Yang, Jieun Kwon, Eun sung Jung

**S88** The impact of new-onset diabetes after transplantation on survival and major cardiovascular events in Korean kidney transplantation recipients
Jangwook Lee, Dong Hyun Kang, Sehoon Park, Ji Eun Kim, Eunjeeong Kang, Yaerim Kim, Sua Lee, Yong Chul Kim, Yon Soo Kim, Yaeji Lim, Hajeong Lee

**S89** Influence of everolimus on mycophenolate mofetil pharmacokinetics in kidney transplant patients
Takahito Endo, Takuya Fujimoto, Shun Nishioka, Naoki Yokoyama, Satoshi Ogawa, Takeshi Ishimura, Masato Fujisawa

**S90** Graft-versus-host disease after deceased donor kidney transplantation
Hojong Park, Sang Jun Park, Hong Rae Cho, Kyung Sun Park, Jongha Park, Kyung Don Yoo, Jong Soo Lee

**S91** Prognostic value of postoperative proteinuria for predicting early renal outcome after kidney transplantation
Kyungho Park, Mee Yeon Park, Hyun Suk Lee, Junseok Jeon, Kyo Won Lee, Jung Eun Lee, Jae BERM Park, Woolseong Huh, Yoon Goo Kim, Hye Ryoun Jang

**S92** Refractory hyperkalemia caused by ACE gene mutation in a 3-year-old girl with kidney transplantation: a case report
Jeong Yeon Kim, Beom Hee Lee, Heeyeon Cho

**S93** Differential impact of allograft rejection on kidney transplant patients with BK virus infection
JI Won Min, Jae BERM Park, Jung Hwan Park, Jong-Won Park, Jaeseok Yang, Curie Ahn, Chul Woo Yang, Byung Ha Chung

**S94** Potential applicability of perioperative thromboelastography to access the coagulopathies in live related renal transplantation: a prospective observational pilot study
Amal Francis Sam, Sandeep Sahu, Karthik Ponnappan

**S95** Excessive positive fluid balance has a negative effect on short-term renal outcomes after kidney transplantation
Jun Gyo Gwon, Myung-Gyu Kim, Cheol Woong Jung, Chang Hun Lee

**S96** Outcome of deceased donor renal transplantation in Mongolia: a single-center experience
Lkhagchaa Od-Erdene, Tseren Khishgee, Dagvadorj Bayan-Undur, Donkhim Chuluunbaatar, Batsuuri Batsaikhan, Jigjidsuren Sarantsedges

**S97** The efficacy of klotho gene as a biomarker of cancer development in kidney transplant recipients
Woo Yeong Park, Hyn Kyo Lee, Ohyun Kwon, Yaerim Kim, Jin Hyuk Paek, Kyubok Jin, Seungyeup Han

**S98** Impact of donor factors on post-transplant delayed recovery of graft function in deceased donor kidney transplantation
Woo Yeong Park, Ohyun Kwon, Yaerim Kim, Jin Hyuk Paek, Kyubok Jin, Young-Nam Roh, U Jin Park, Hyoung Tae Kim, Seungyeup Han

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
S99 Effect of preoperative dialysis on intraoperative hemodynamics during living donor kidney transplantation
Keoung Ah Kim, Kyowon Lee, Gaabsoo Kim, Hyeryung Kang, Jaehun Yang

S100 Clinical outcomes in elderly kidney transplant recipients: emphasis on choice of induction immunosuppressive therapy
Kyeong Deok Kim, Kyo Won Lee, Sang Jin Kim, Okjoo Lee, Jieun Kwon, Eun Sung Jeong, Jaehun Yang, Manuel Lim, Jae Berm Park

S101 rs11940017 single nucleotide polymorphism of nuclear factor of kappa light polypeptide gene enhancer in B-cells 1 (NFKB1) gene is associated with post-renal transplant diabetes mellitus among Korean transplant recipients
Chan Il Park, Yunmi Kim, Taehoo Kim, Sun Woo Kang, Yeong Hoon Kim

S102 Effect of pan-caspase inhibitor in ex vivo cold ischemia-rewarming injury model
Won-Hee Cho, Jung-Woo Seo, Su Woong Jung, Sang-Ho Lee

S103 Infection complication rate in kidney transplanted patient in Mongolia in last 3 years
Khishgee Tseren, Bayan-Undur Dagvadorj, Od-Erdene Lkhaakhuu, Bat-Ireedui Badarch, Uduval Batkhuu

S104 Clinical analysis of related factor influencing the increase in body mass index after kidney transplantation
Hyo-Sin Kim, Yeon-Ho Han, Seok-Joon Sohn, Ho Kyun Lee, Soo Jin Na Choi

S105 Malakoplakia after kidney transplantation
Sang Jun Park, Hojong Park, Hong Rae Cho, Kyung Sun Park, Jongha Park, Kyung Don Yoo, Jong Soo Lee

S106 Therapeutic challenges of hepatic mucormycosis in a renal transplant recipient: a case report
Chang Hun Lee, Cheol Woong Jung, Jun Gyo Gwon, Myung Gyu Kim

S107 Outcome after kidney transplantation in hepatitis B surface antigen-positive patients
Hyejin Mo, Sangil Min, Ahram Han, In Mok Jung, Jongwon Ha

S108 Possibility of using retrograde reperfusion renal graft to reduce ischemic-reperfusion injury
Myttykbay Rysmakhonov, Gany Kuttymuratov

S109 Risk factors of delayed graft function in deceased donor kidney transplantation
Seung Hwan Song, Dami Jung, Ku Yong Chung

S110 The role of encapsulating peritoneal sclerosis for the graft dysfunction in kidney transplantation: a case report
Yi-Chou Hou, Yu-Hua Lin, Chun-Hou Liao, Kuo-Cheng Lu

S111 Direct intranodal lipiodol injection for management of lymphocele in kidney transplant recipient
Mihyeong Kim, Jeongkye Hwang

S112 Uremic cardiomyopathy may improve with kidney transplantation: a case report
Seung Hwan Song, Geun Hong, Ku Yong Chung, Dami Jung

S113 Anastomosing hemangioma mimicking renal cell carcinoma in a kidney transplant recipient: a case report
Chang Seong Kim

S114 Hyperkalemia developed from atorvastatin after kidney transplantation: a case report
Tae Hyun Ban, Bum Soon Choi, Mi-Hyeong Kim, Jeong-Kye Hwang, Jihyang Lim

S115 Comorbidities can predict the mortality of acute kidney injury requiring continuous renal replacement therapy: comparison with the Charlson comorbidity index
Jinwoo Lee, Jiyun Jung, Jangwook Lee, Jung Tak Park, Yong Chul Kim, Dong Ki Kim, Jung Pyo Lee, Sung Jun Shin, Jae Yoon Park

S116 Impact of everolimus on survival after liver transplantation for hepatocellular carcinoma
Incheon Kang, Dong Jin Joo

S117 Salvage living-donor liver transplantation and ADV score
Shin Hwang, Gi-Won Song, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Dong-Hwan Jung, Gil-Chun Park, Young-In Yoon, Sung-Gyu Lee

S118 Auxiliary partial orthotopic liver transplantation in pre-eclampsia
Sanggyun Suh, Kyung-Suk Suh, Kwang-Woong Lee, Nam-Joon Yi, YounRok Choi, Suk Kyun Hong, Jeong-Moo Lee

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
S119 Cause-specific mortality and associated factors related to death after kidney and liver transplantation: a Korean nationwide study
Junghyun Yoon, Younkyung Jung, Hanjoon Kim, Boyoung Park, Dongho Choi

S120 Long-term outcome after prevention of de novo hepatitis B in recipients of core antibody-positive livers with hepatitis B immunoglobulin only
Hye-Sol Jung, YoungRok Choi, Kwangpyo Hong, Eui Soo Han, Jeong-moo Lee, Kyung Chul Yoon, Suk Kyun Hong, Nam-joon Yi, Kwang-woong Lee, Kyung-suk Suh

S121 Can we use the peritoneum of deceased donors as the vascular substitute for reconstructing the middle hepatic vein in living donor liver transplantation?
Seok-Hwan Kim

S122 Liver tissueoid composed of electrospun multiscale fiber enhance hepatic differentiation and therapeutic function of chemical derived hepatic stem cells
Yohan Kim, Sangtae Yoon, Da Hee Hong, Myoung-Hoi Kim, Taehun Kim, Jaemin Jeong, Dongho Choi

S123 Postoperative bacteraemia is associated with early vascular complications in pediatric liver transplant recipients with biliary atresia
Kyong Ihn, Ji-Min Kang, Eun Jin Kim, Juhan Lee, Jae Geun Lee, Dong Jin Joo, Soon Il Kim, Myoung Soo Kim

S124 Changing trend in liver transplantation indications in Saudi Arabia: from hepatitis C virus to nonalcoholic fatty liver disease
Saleh A Alqahtani, Dieter C Broring, Saad A Alghamdi, Saleh I Alabbad, Khalid I Bzeizi, Ali Albenmousa, Waleed K Al-hamoudi

S125 Microsurgical hepatic artery reconstruction in deceased donor liver transplantation for reduced arterial complications
Youngin Yoon, Sung-Gyu Lee

S126 Expandable liver organoids generated from human chemically derived hepatic progenitor enable alcoholic liver modeling
Yohan Kim, Sangtae Yoon, Myoung-Hoi Kim, Da Hee Hong, Taehun Kim, Jaemin Jeong, Dongho Choi

S127 The extracorporeal circulation with transdiaphragmatic approach in living-donor liver transplantation for hepatoblastoma with atrial extension of tumor thrombus
Mureo Kasahara, Seisuke Sakamoto, Yusuke Yanagi, Hajime Uchida, Seiichi Shimizu, Kotaro Mimori, Yasuyuki Kameoka, Akinari Fukuda

S128 Patency of middle hepatic vein reconstruction using Hemashield grafts compared with ringed polytetrafluoroethylene grafts in living donor liver transplantation
Shin Hwang, Minjae Kim, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Chul-Soo Ahn, Deok-Bog Moon, Gil-Chun Park, Young-In Yoon, Sung-Gyu Lee

S129 Study on patients without underlying chronic liver disease to improve survival outcome in pediatric liver transplantation
Suk Kyun Hong, Nam-Joon Yi, Kwangpyo Hong, Eui Soo Han, Jeong-Moo Lee, YoungRok Choi, Kwang-Woong Lee, Kyung-Suk Suh

S130 Comparing survival, tacrolimus trough level, prevalence of biliary stenosis and studying for possible early detection of biliary stenosis in liver transplant recipients at First Central Hospital of Mongolia and various high-volume foreign centers
Anar Ganbold, Bayarmaa Ochirkburee, Bat-Ireedui Badarch, Batsaikhan Batsuuri, Ganzorig Batjargal, Amgalan Luvssandorj, Erdene Sandag, Erdenebileg Buvuuvaj, Chuluunbaatar Donkhim, Sergelen Orgoi

S131 Non-viral ex vivo therapeutic strategy in chemically derived hepatic progenitor with adenine base editor and prime editor
Yohan Kim, Sangtae Yoon, Myoung-Hoi Kim, Da Hee Hong, Taehun Kim, Jaemin Jeong, Dongho Choi

S132 Transfusion status in liver and kidney transplantation recipients: results from nationwide claims database
Dong Ho Choi, Boyoung Park, Junghyun Yoon, Han Joon Kim, Yun Kyung Jung, Kyeong Geun Lee

S133 Comparison of three caval reconstruction techniques in orthotopic liver transplantation: result from a university hospital from Bangkok, Thailand

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Tatsana Uthaithammarat, Methee Sutherasan, Bunthoon Nonthasoot, Wipusit Taesombat, Athaya Vorasittha, Supanit Nivatvongs, Boonchoo Sirichindakul

S134 Pure laparoscopic donor right hepatectomy for adult living donor liver transplantation: initial report from Southeast Asia liver transplant center
Worakitti Lapisatepun, Warangkana Lapisatepun, Phuriphong Chanthima, Sunhawit Jungrungsee, Anon Chotirosniramat, Settapong Boonsri, Kanya Udomsin, Suraphong Lorsomradee, Trichak Sandhu

S135 Incidence of biliary strictures in Mongolian patients who have received liver transplantation abroad
Anar Ganbold, Munkhtsetseg Chimedtseren, Odontungalag Norov, Sumiya Bayarsaikhan, Bayarmaa Ochirkhuree

S136 Over 500 liver transplants including more than 400 living-donor liver transplants in 2019 at Asan Medical Center
Youngin Yoon, Sung-Gyu Lee, Deok-Bog Moon

S137 Pure laparoscopic versus open right hepatectomy in living liver donors: which is longer bench-surgery time
Kwangpyo Hong, Suk Kyun Hong, Eui Soo Han, Sanggyun Suh, Su young Hong, Jeong-Moo Lee, YoungRok Choi, Nam-Joon Yi, Kwang-Woong Lee, Kyung-Suk Suh

S138 Liver transplantation at Baskent University
Aydincan Akdur, Emre Karakaya, Ebru Ayvazoglu Soy, Feza Yarbug Karakayali, Gokhan Moray, Adnan Torgay, Mehmet Haberal

S139 Anesthetic management in laparoscopic living donor hepatectomy, the first case-series in Thailand
Phuriphong Chanthima, Warangkana Lapisatepun, Atipa Nitayamekin, Suraphong Lorsomradee, Settapong Boonsri, Worakitti Lapisatepun, Sunhawit Jungrungsee, Anon Chotirosniramat

S140 Outcomes of living versus deceased donor liver transplantation: initial single center experience from Thailand
Worakitti Lapisatepun, Sunhawit Jungrungsee, Anon Chotirosniramat, Trichak Sundhu, Warangkana Lapisatepun, Phuriphong Chanthima, Settapong Boonsri, Suraphong Lorsomradee, Kanya Udomsin

S141 Pentoxyfylline for hepatopulmonary syndrome after liver transplantation: case report
Yi Wei Tan, Rohit Vijay Agrawal, Terry Ling Te Pan, Mark Muthiah, Weng Hoa Wong

S142 Outcomes of liver transplantation in hepatocellular carcinoma patients: a 10-year experience in a single tertiary center
Mati Rattanasakalwong, Methee Sutherasan

S143 Challenges of ABO-incompatible living donor liver transplantation in developing country (Mongolia)
Batsaikhan Bat-Erdene

S144 For the right hemiliver graft may need tissue expander after living donor liver transplantation
Batsaikhan Bat-Erdene

S145 Whole liver deceased donor liver transplantation for pediatric recipients: single-center experience for 20 years
Sung-Min Kim, Shin Hwang, Jung-Man Namgung, Dae-Yeon Kim, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Gil-Chun Park, Kyung Mo Kim, Seak Hee Oh

S146 A genome-wide association study identified genetic loci for end-stage liver disease in the Korean population
Hye-Mi Jang, Dong Jin Joo, Sung Min Kim, Hyun-Young Park, Bong-Jo Kim, Myoung Soo Kim, Young Jin Kim

S147 Machine-learning models to predict tacrolimus dosage in liver transplant recipients
Jeong-Moo Lee, Soo Bin Yoon, Hyung-Chul Lee, Chul-Woo Jung, Suk Kyun Hong, Jae-Hyung Cho, Nam-Joon Yi, Kwang-Woong Lee

S148 Feasibility, safety, and indications for pure laparoscopic donor right posterior sectionectomy based on surgical techniques and outcomes of donors and recipients after living donor liver transplantation
Chan Woo Cho, Gyu-Seong Choi, Kyeong Sik Kim

S149 Korea-nationwide incidence of pediatric deceased donors and single-institutional status of liver transplantation using pediatric donor liver grafts
Geunhyeok Yang, Shin Hwang, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Dea-Yeon Kim, Sung-Gyu Lee

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
S150 Long term outcomes of abdominal wall closure with ePTFE Gore-Tex Mesh in pediatric liver transplantation
Jeong-Moo Lee, Jyoung Kim, Nam-Joon Yi, Suk Kyun Hong, Kwangpyo Hong, Eui Soo Han, Kwang-Woong Lee, Kyung-Suk Suh

S151 Liver imaging reporting and data system category on magnetic resonance imaging predicts recurrence of hepatocellular carcinoma after liver transplantation within the Milan criteria: a multicenter study
Sunyoung Lee, Kyong Won Kim

S152 Outcomes of deceased donor liver transplantation from elderly donors
Minjae Kim, Shin Hwang, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Gil-Chun Park, Sung-Gyu Lee

S153 Treatment and outcomes of extrahepatic malignancy incidentally diagnosed during pretransplant evaluation for living donor liver transplantation
Geunhyeok Yang, Shin Hwang, Gi-Won Song, Dong-Hwan Jung, Deok-Bog Moon, Chul-Soo Ahn, Ki-Hun Kim, Tae-Yong Ha, Young-In Yoon, Sung-Gyu Lee

S154 Prognosis of split liver transplantation compared with whole liver transplantation in adult patients: single-center results under the Korean MELD score-based allocation policy
Sung-Min Kim, Shin Hwang, Gil-Chun Park, Gi-Won Song, Dong-Hwan Jung, Tae-Yong Ha, Chul-Soo Ahn, Deok-Bog Moon, Ki-Hun Kim, Sung-Gyu Lee

S155 Pretransplant hepatic malignancy increases risk of de novo malignancy after liver transplantation
Geunhyeok Yang, Shin Hwang, Gil-Chun Park, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Sung-Gyu Lee

S156 Prognostic impact of model for end-stage liver disease (MELD) scores greater than 40 in deceased donor liver transplant recipients
Byeong-Gon Na, Shin Hwang, Gil-Chun Park, Gi-Won Song, Dong-Hwan Jung, Tae-Yong Ha, Chul-Soo Ahn, Deok-Bog Moon, Ki-Hun Kim, Sung-Gyu Lee

S157 Reuse of liver allograft from a brain-dead recipient: a case report
Min-Jae Kim, Shin Hwang, Dong-Hwan Jung, Gil-Chun Park, Gi-Won Song, Hwui-Dong Cho, Sung-Gyu Lee

S158 Impact of MELD allocation system on the outcomes of deceased donor liver transplantation: a single-center experience
Jeong-Moo Lee, Han Sang Park, Kwangpyo Hong, Eui Soo Han, Suk Kyun Hong, Nam-Joon Yi, Kwang-Woong Lee, Kyung-Suk Suh

S159 Steroid resistant rejection in liver transplantation: a single center study for risk factor and second line treatment
Tae Yun Lee

S160 Outflow vein venoplasty of left lateral section graft for living donor liver transplantation in infant recipients
Sang Hoon Kim, Shin Hwang, Jung-Man Namgoong, Gil-Chun Park, Chul-Soo Ahn, Ki-Hun Kim, Hyunhee Kwon, Yong Jae Kwon

S161 Standard framework and experience of living donor liver transplantation for overseas non-Korean patients at Asan Medical Center
Sang-Hoon Kim, Shin Hwang, Gi-Won Song, Dong-Hwan Jung, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gil-Chun Park, Sung-Gyu Lee

S162 Refined surgical techniques to improve the patency of cryopreserved iliac artery homografts for middle hepatic vein reconstruction during living donor liver transplantation
Byeong-Gon Na, Shin Hwang, Gil-Chun Park, Dong-Hwan Jung, Tae-Yong Ha, Gi-Won Song, Chul-Soo Ahn, Deok-Bog Moon, Ki-Hun Kim, Sung-Gyu Lee

S163 Living donor liver transplantation at the Pusan National University Yangsan Hospital, Korea: result of living donor hepatectomy in a single center
Hyo Jung Ko, Je Ho Ryu, Kwanghoo Yang, Byung Hyun Choi, Tae Beom Lee, Jae Ryong Sim

S164 The impact of model for end-stage liver disease (MELD) score on liver transplant outcomes in low volume liver transplantation center: single center experience
Shin Hoo Pyo, Doojin Kim, Dooho Lee, Sang Tae Choi, Yeon Ho Park

S165 Association between pretransplant serum soluble programmed death protein 1 level and prognosis

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
following liver transplantation in patients with hepatocellular carcinoma
Kibong Oh, Shin Hwang, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Kyung Jin Lee, Eunyoung Tak

S166 Simultaneous liver-kidney transplantation: a single-center experience in Korea
Minjae Kim, Shin Hwang, Chul-Soo Ahn, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Sung Shin, Young Hoon Kim, Duck Jong Han, Sung-Gyu Lee

S167 Fates of retained hepatic segment IV and its prognostic impact in adult split liver transplantation using an extended right liver graft
Sung-Min Kim, Shin Hwang, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Gil-Chun Park, Sung-Gyu Lee

S168 Technical refinement of prosthetic vascular graft anastomosis to recipient inferior vena cava for secure middle hepatic vein reconstruction in living donor liver transplantation
Sang Hoon Kim, Shin Hwang, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Gil-Chun Park, Chul-Soo Ahn, Deok-Bog Moon, Young-In Yoon, Sung-Gyu Lee

S169 Pediatric liver transplantation with hyperreduced left lateral segment graft
Byeong-Gon Na, Shin Hwang, Jung-Man Namgoong, Gi-Won Song, Dae-Yeon Kim, Tae-Yong Ha, Dong-Hwan Jung, Kyung Mo Kim, Seak Hee Oh

S170 Hepatitis B virus (HBV) immunoglobulin effect on HBV and hepatitis D virus reactivation after liver transplantation
Anar Ganbold, Mukhtsetseg Chimedseren, Odontungalag Norov, Sumiya Bayarsaikhan, Bayarmaa Ochirkhuree

S171 Blood product transfusion in liver transplantation in First Clinical Hospital of Mongolia
Bazarragchaa Regjii, Tseyenpiljee Amgaa, Bayalagmaa Khuvtsagaan, Chuluunbaatar Donkhim, Ganbold Lundeg

S172 Challenge to establish the liver transplantation in developing country (Mongolia) progress of the liver transplantation program in Mongolia
Undarmaa Zandanbazar, Batsaikhan Bat-Erdene, Bat-Ireeduu Badarch, Batsaikhan Batsuuri, Sergelen Orgoi

S173 Prognosis of hepatic epithelioid hemangioendothelioma after living donor liver transplantation
Kibong Oh, Shin Hwang, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Gil-Chun Park, Sung-Gyu Lee

S174 Prognostic impact of perioperative sputum colonization on early outcome after lung transplant
Taehwa Kim, Hye Ju Yeo, Do Hyung Kim, Jin Ho Jang, Eunjeong Son, Jin ok Jang, Yun Seong Kim, Woo Hyun Cho

S175 Tacrolimus-induced severe cerebral and coronary vasospasm
Laeun Kim, Hye Won Lee

S176 Modified rat limb transplantation model for VCA experiments: difficulties and know-how of vascularized bone marrow flap
Jong Won Hong, Jung Hyum Lim, Won Jai Lee

S177 Rat model of heterotopic heart transplantation to investigate relevant donor heart harvesting method
Mukhammad Kayumov, Hwa-Jin Cho, Do-Wan Kim, Kyoo-Seon Lee, In-Seok Jeong

S178 Protective effect of fucoidan against tacrolimus-induced nephrotoxicity in LLC-PK1 cells
Hyuk Jai Jang

S179 Toll-like receptor 4 blockade protects kidneys against ischemia-reperfusion injury
Won-Hee Cho, Jung-Woo Seo, Seon Hwa Park, Yang Gyun Kim, Ju-Young Moon, Sang-Ho Lee

S180 Discard of organs is the Achilles heel of deceased donor organ transplantation program: a study of ethology and predictors of organ discard from South India
Banigallapati Vijay Kiran

S181 Safety and efficacy of enhanced recovery after surgery (ERAS) program after donor hepatectomy: a propensity-matched analysis
Sung Eun Park, Ho Joong Choi

S182 Usefulness of preoperative magnetic resonance spectroscopy in improving the safety of a living liver donor
Jae Ryong Shim, Hyo Jung Ko, Tae Beom Lee, Byung Hyun Choi, Kwangho Yang, Je Ho Ryu

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
S183 Single-institution analysis of willingness of waitlist patients to undergo kidney transplantation with expanded criteria brain-dead donors
Jung Ja Hong, Sae Rom Lee, Ah Young Lee, Ji Won Woo, Seon Bin Park, Shin Hwang, Young Hoon Kim

S184 A narrative study on the life of organ procurement coordinator
Ha Young Song, Han Ik Cho, Wonhun Cho, Chunhee Bok

S185 Withdraw life sustaining treatment and organ donation
Seungyong Jeong, Youngwhwan Hwang, Minyoung Choi, Ohhyuk Yun, Youngsoon Jeong, Jeongrim Lee, Won-Hyun Cho

S186 Causes of lowered family consent rate for organ donation
Eunsuk Yu, Yukyoung Son, Kyeonghee Han, Myounghwa Lee, Yuri Chong, Youngsoon Jeong, Jeongrim Lee, Wonhyun Cho

S187 Cellular immune monitoring for prediction of cytomegalovirus and BK viral reactivation after kidney transplantation
Kyung-Hwa Shin, Jin Hyeon Lee, Sang Heon Song, Eun Young Seong, Miyeun Han, Hyung-Hoi Kim

S188 Development and validation of an algorithm to estimate eplet mismatch by substituting imputation of HLA antigens for high-resolution HLA typing based on Korean HLA frequencies
Soo-Kyung Kim, Borae G. Park, Hyung Eun Son, Jong Cheol Jeong, Yun Ji Hong, Dong Wan Chae

S189 Outcome of ABO-incompatible kidney transplantation depending on the ABO type of transfused plasma: comparative analysis between the universal AB plasma and donor type plasma
Han Joo Kim, Jin Seok Kim, John Jeongseok Yang, Yousun Chung, Hyungsuk Kim, Sung Shin, Young Hoon Kim, Sang-Hyun Hwang, Heung-Bum Oh, Dae-Hyun Ko

S190 How we achieved 0% of thrombotic graft loss: the initial 60 cases of pancreas transplant
Byung Hyun Choi

S191 Serial postoperative donor-derived cell-free DNA in recipients undergoing pancreas transplantation
Hyun-Ji Lee, Byung Hyun Choi, Kyong-Hwa Shin, In-Suk Kim, Hyoung-Hoi Kim

S192 Pancreas transplant in a young patient: an option
Muhammad Zakria

S193 High success rate of liver transplantation during seven months COVID-19 period
Emre Karakaya, Aydincan Akdur, Ebru Ayvazoglu Soy, Feza Yarbug Karakayali, Sedat Yildirim, Adnan Torgay, Cihat Burak Sayin, Gokhan Moray, Mehmet Haberal

S194 Correlation of brain-dead organ donors' age and time period between admission and the first brain death examination: 5 years data of Korea
Eun-sil Jeong, A. S. M. Tanim Anwar, Jae-myung Lee

S195 Nine years experiences of solid organ xenotransplantation
Hye Sun Shin, Ik Jin Yun, Hyun Keun Chee, Jun Seok Kim, Jung Hwan Park, Hyun Suk Yang, Wan Seop Kim, Ki Cheul Shin, Kyoung Sik Park, Keon Bong Oh

S196 Enhanced HLA typing performance of Korea Biobank Array with large scale reference panel
Sung Min Kim, Jong Cheol Jeong, Dong Jin Joo, Jaesok Yang, Myounghwa Lee, Hye-Myi Jang, Hyun-Young Park, Bong-Go Kim, Young Jin Kim

S197 First experience of 1,3-galactosyltransferase gene-knockout (GTKO) transgenic pig to nonhuman primate lamellar corneal xenotransplantation
Ik Jin Yun, Ki Cheul Shin, Hye Sun Shin, Wan Seop Kim, Madhuri Saindane, Keon Bong Oh, Hee Jung Kang, Yu Rim Ahn

S198 Activation of transforming growth factor-β and epithelial-mesenchymal transition enhance regulatory T cells-mediated metastasis
Arum Yoon, JinWoo Hong, Chae-Ok Yun

S199 Mesenchymal stem cells enable delivery of an oncolytic adenovirus specifically to the tumor without posing any risk associated with systemic administration of naked virions to the host
Arum Yoon, JinWoo Hong, Chae-Ok Yun

S200 The influence of healthcare provider's autonomy support, autonomous motivation and competence on self-care behaviors in kidney transplant patients based on self-determination theory
Sunyoung Son, Man ki Ju, Mi Kyung Sim

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Impact of treatment of subclinical rejection at 2 weeks after kidney transplantation, compared by analysis of 1-year histologic outcomes

Okjoo Lee¹, Kyo Won Lee¹, Jae Berm Park¹, Jung Eun Lee², Na Young Hwang³, Kyunga Kim³

¹Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea
²Division of Nephrology, Department of Internal Medicine, Samsung Medical Center, Seoul, Korea
³Department of Biostatistics, Samsung Medical Center, Seoul, Korea

Background: Subclinical rejection (SCR) is associated with chronic allograft nephropathy, which is the most common cause of allograft failure in kidney transplantation (KT). Therefore, early detection and treatment of SCR through protocol biopsy can reduce the incidence of chronic allograft nephropathy and the improvement of graft survival. This study aims to evaluate the effective early detection role of routine protocol biopsy by comparing the pathologic outcome.

Methods: We retrospectively analyzed 914 KT recipients in Samsung Medical Center between August 2012 and December 2018. Of these, pediatric cases, re-transplantations and multi-organ transplantation, cyclosporine and azathioprine users, patients who were not underwent protocol biopsy, and diagnosed rejection but not treated patients were excluded. Finally, a total of 624 adult patients who were underwent protocol biopsy at post KT 2 weeks and 1 year were analyzed.

Results: After propensity score matching, patients were divided into two groups, 2-week protocol biopsy proven normal group (n=256) and rejection group (n=96). Before propensity matching, normal group was significant higher recipient age and ABO incompatible KT, rejection group was higher human leukocyte antigen II mismatch and proportion of deceased donor KT, the difference was corrected through matching. Rejection group showed no significant difference from normal group in the tendency of graft function (estimated glomerular filtration rate), and Kaplan-Meier curve also shown that in graft survival. In the pathologic outcomes between two groups and two periods, the pathological differences between two groups showed a decrease between two periods.

Conclusions: SCR treatment through protocol biopsy can contribute to maintenance of graft function and improvement of pathologic change.

Corresponding author: Kyo Won Lee
E-mail: kw1980.lee@samsung.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Impact of donor kidney weight to recipient body weight ratio on long-term graft outcomes in live donor kidney transplantation

Juhan Lee¹, Seok Jeong Yang¹, Eun Jin Kim¹, Beom Seok Kim², Myoungh Soo Kim¹, Soon Il Kim¹, Yu Seun Kim¹, Kyu Ha Huh¹

¹Division of Transplantation, Department of Surgery, Severance Hospital, Seoul, Korea
²Division of Nephrology, Department of Internal Medicine, Severance Hospital, Seoul, Korea

Background: Kidney weight has been suggested as a surrogate marker for nephron numbers and renal function. Small donor kidney sizes relative to recipient body size is an important contributor to short-term graft renal function, but the impact of size mismatching on long-term graft outcomes remains unknown. This study is aimed to evaluate the impact of the donor kidney weight to recipient body weight ratio (KW/BW) on long-term graft survival in live donor kidney transplantation.

Methods: We performed a longitudinal cohort study in 1,397 patients who underwent live donor kidney transplantation between 2000 and 2016 at Severance Hospital. Following cold perfusion and back table surgery, the kidney was weighted on the same electronic weighting scale by the surgeon. Patients were grouped into four groups according to KW/BW quartiles.

Results: During a median follow-up period of 127 months, 245 graft losses occurred (172 graft failures and 73 patient deaths). The 10-year death-censored graft survival rates were 86.9% in the lowest quartile, 90.4% in the second quartile, 90.5% in the third quartile, and 92.4% in the highest quartile (P=0.002). Multivariable analysis revealed that the lowest KW/BW (hazard ratio [HR], 2.16; 95% confidence interval [CI], 1.33–3.48; P=0.002) and second lowest KW/BW (HR, 1.69; 95% CI, 1.06–2.70; P=0.029) groups were significantly associated with death-censored graft failure compared with the highest KW/BW group. Patients with lower KW/BW exhibited consistently lower estimated glomerular filtration rates than those with higher KW/BW.

Conclusions: Low KW/BW ratio is significantly associated with long-term graft outcome in live donor kidney transplantation.

Corresponding author: Juhan Lee
E-mail: juhan1108@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Impact of kidney and recipient weight incompatibility on the allograft outcomes in kidney transplant recipients with pre-transplant diabetes mellitus: a single center retrospective cohort study

Yohan Park, Hanbi Lee, Eun Jeong Ko, Chul Woo Yang, Byung Ha Chung

Division of Nephrology, Department of Internal Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Background: The aim of this study was to analyze the impact on the adverse allograft outcome of transplanting relatively small kidneys in patients with pre-transplant diabetes mellitus (DM).

Methods: From January 2010 to December 2018, 1,290 kidney transplants (KTs) were performed in Seoul St. Mary’s Hospital. Of these, 793 cases of non-sensitized living donor KT recipients were enrolled. They were divided into four groups (non-DM large kidney, non-DM small kidney, DM large kidney, and DM small kidney) according to the median kidney weight and recipient weight ratio (2.9 g/kg) and presence or absence of pre-transplant DM. The primary outcome of this study was death censored graft loss (DCGL) rate.

Results: There was no significant difference in the biopsy-proven acute rejection rate among the four groups. DM small kidney group showed the highest DCGL rate (18/131 [13.7%], P=0.004) and was to be the independent risk factor for DCGL (adjusted hazard ratio, 2.829; P=0.003). Moreover, renal function after 4 years of transplantation worsened faster in the DM small kidney group compared to other groups, and allograft survival decreased after 1 year of transplantation.

Conclusions: Our results suggest that transplanting large kidneys rather than small kidneys is considered to have an advantage in terms of allograft outcome in pre-transplant DM patients, and this should be considered in donor selection.

Corresponding author: Byung Ha Chung
E-mail: chungbh@catholic.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Combined impact of pre-sensitization and delayed graft function on the development of allograft rejection in deceased donor kidney transplantation: nationwide cohort study

Hanbi Lee¹, Yohan Park¹, Tae Hyun Ban², Sang Heon Song³, Seung Hwan Song⁴, Jaeseok Yang⁵, Curie Ahn⁵, Chul Woo Yang¹, Byung Ha Chung¹

¹Division of Nephrology, Department of Internal Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
²Division of Nephrology, Department of Internal Medicine, Eunpyeong St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
³Division of Nephrology, Department of Internal Medicine, Pusan National University Hospital, Busan, Korea
⁴Department of Surgery, Ewha Womans University Seoul Hospital, Seoul, Korea
⁵Division of Nephrology, Department of Internal Medicine, Seoul National University Hospital, Seoul, Korea

Background: Both pre-sensitization to human leukocyte antigen and delayed graft function (DGF) is well documented to be associated with poor allograft outcome. The aim of this study is to investigate whether development of DGF and pre-transplant highly sensitization has synergistic adverse effect on the allograft outcome after deceased donor kidney transplantation (DDKT) using Korean Transplant Registry (KOTRY) database, the nationwide prospective cohort.

Methods: Between May 2014 and June 2019, total 1,945 DDKT were registered in KOTRY database and out of them, 1,370 cases were included in this study. According to pre-sensitization status and development of DGF post-transplant, they were divided into four groups: non-pre-sensitized-DGF(–) (n=1,100), non-pre-sensitized-DGF(+) (n=133), pre-sensitized-DGF(–) (n=116), and pre-sensitized-DGF(+) (n=21). We compared allograft rejection, the change of allograft function, allograft survival, patient survival, and post-transplant complications across four groups.

Results: The incidence of overall biopsy-proven rejection and acute antibody-mediated rejection (ABMR) was significantly higher in the pre-sensitized-DGF(+) group than the other three groups. In addition, multivariable analysis demonstrated that pre-sensitization combined with DGF is an independent risk factor for both overall rejection and ABMR compared to non-pre-sensitized-DGF(–) group (hazard ratio, 10.769; 95% confidence interval, 3.717–31.198; P<0.001). Moreover, DGF and pre-sensitization showed statistically significant interaction each other (P for interaction <0.001). Pre-sensitization combined with DGF did not show a significant impact on allograft function and allograft or patient survival in this study.

Conclusions: In conclusion, pre-sensitization and DGF show a synergistic adverse impact on the post-transplant allograft outcome in terms of allograft rejection after DDKT. Therefore, we suggest when DGF occurred in DDKT with pre-sensitization, more careful monitoring or surveillance for allograft rejection is required.

Corresponding author: Byung Ha Chung
E-mail: chungbh@catholic.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Performance changes following the revision of organ allocation system of lung transplant: analysis of Korean Network for Organ Sharing (KONOS) data

Sung Kwang Lee, He Ju Yeo, Woo Hyun Cho, Do Hyung Kim

Department of Thoracic and Cardiovascular Surgery, Pusan National University Yangsan Hospital, Yangsan, Korea

Background: There is currently a lack of data reporting the assessment of transplant performances based on revision of the current lung allocation system in Korea.

Methods: We conducted a retrospective analysis of transplant candidates and transplant patients registered in Korean Network for Organ Sharing between July 2015 and July 2019. Study periods were classified according to the introduction of the revised lung allocation system as follows: period 1 from July 2015 to June 2017 and period 2 from August 2017 to July 2019.

Results: During the study period, a total of 627 patients were on the waiting list, of which 398 lung transplantations were performed. Total waiting list size increased by 98.6% from 210 in period 1 to 417 in period 2. The number of transplant patients also increased by 32.7% from 171 in period 1 to 227 in period 2. The number of donors decreased from 1,042 to 878, whereas the usage rate, i.e., the number of lung donors used for transplantation among the total number of reported lung donors, increased from 16.4% to 25.9%. The use of marginal donor lungs increased from 29.8% to 53.7% (P<0.001). No significant difference was observed in mortality on the waiting list between the two periods (17.1% vs. 19.4%, P=0.489). The 1-year survival rate also showed no significant differences between the two periods.

Conclusions: The recent revision of the lung allocation system in Korea did not change the performance of lung transplant in terms of waiting list mortality and 1-year survival. The rapid increase in the volume of waiting list between the two periods increased the waitlist time, transplantation of high-urgency patients, and use of marginal lung donors.

Corresponding author: Sung Kwang Lee
E-mail: drlsk@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Postoperative pulmonary artery stenosis in lung transplantation recipients: review of case series

Seung Hyun Yong¹, Song Yee Kim¹, Jin Gu Lee², Hyo Chae Baek², Moo Suk Park¹

¹Division of Pulmonology, Department of Internal Medicine, Yonsei University College of Medicine, Seoul, Korea
²Department of Thoracic and Cardiovascular Surgery, Yonsei University College of Medicine, Seoul, Korea

**Background:** Postoperative pulmonary artery stenosis (PAS) is rare complication that can appear lung transplant recipients due to inappropriate donor to recipient lung size matching. In this study, we retrospectively reviewed patients who were diagnosed PAS after lung transplantation.

**Methods:** Medical records were retrospectively reviewed in the group of lung transplant recipients from 2012 to 2019 in Severance Hospital, Korea.

**Results:** Among 267 recipients who underwent lung transplantation from October 2012 to December 2019, 12 patients were diagnosed PAS and treated accordingly. Four patients received surgical treatment. Six patients were successfully received interventional therapy: pulmonary angioplasty or pulmonary artery (PA) stent insertion. Two patients were under observation due to benign progress. Mortality were observed in three patients, and one death was related to PAS. Three patients had either left or right donor-to-recipient PA mismatch and four patients had donor lung size mismatch. After excluding the mortality and observant cases, eight patients had relief of symptoms and five patients showed increased outcome in before-and-after perfusion scan. Most common initial manifestation was progressive dyspnea and chest discomfort (seven cases), while median time of diagnosis-to-treatment was 36 days. Seven patients were diagnosed PAS in 2 weeks from day of lung transplantation. In this group, most common clue for diagnosis was acute change of chest X-ray (increased haziness) and hypoxemia. On contrary, five patients who were diagnosed after 2 weeks tended to not show acute change in chest X-ray, rather most common phenomenon was progressive dyspnea, chest discomfort, and prolonged pneumonia.

**Conclusions:** PAS after lung transplantation can be managed by either PA intervention or surgical approach depending on circumstance of patients. Mortality were most likely associated with underlying patient’s condition such as septic shock. Progressive dyspnea, chest discomfort, hypoxemia, and left lung haziness in chest X-ray may indicate PAS. Early diagnosis-to-treatment is vital for favorable outcome.

**Corresponding author:** Moo Suk Park
**E-mail:** PMS70@yuhs.ac

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Low 25-OH vitamin D level are associated with increased postoperative acute kidney injury, broch pleural fistula after lung transplantation

Nam Eun Kim¹, Ha Eun Kim², Song Yee Kim¹, Beom Seok Kim³, Jung Tak Park³, Jin Gu Lee², Hyo Chae Paik³, Moo Suk Park¹

¹Division of Pulmonology, Department of Internal Medicine, Severance Hospital, Seoul, Korea
²Department of Thoracic and Cardiovascular Surgery, Severance Hospital, Seoul, Korea
³Division of Nephrology, Department of Internal Medicine, Severance Hospital, Seoul, Korea

Background: Vitamin D (Vit D) deficiency is found in over two-thirds of lung transplantation (LT) candidates, which is greater than in general population. In addition to bone metabolism, low serum level of 25-hydroxyvitamin D[25(OH)D] is known to be associated with higher incidence of infections, cancer, and cardiovascular disease. So, it is important to investigate association between Vit D level and post LT complications.

Methods: In this single-center study, we reviewed 237 LT patients from January 2013 to July 2019 at Severance Hospital, Seoul, Korea. Thirty-nine patients were excluded due to missed level of preoperative Vit D. Enrolled patients were divided into Vit D deficiency group (range, 0–10 ng/mL), Vit D insufficiency (range, 10–30 ng/mL), and Vit D sufficiency group (>30 ng/mL). Analysis of variance and chi-square tests were used for comparing variables.

Results: Forty-nine patients (24.7%) were Vit D deficiency, 128 patients (64.6%) were Vit D insufficiency, and 21 patients (10.6%) were Vit D sufficiency. There were no significant differences between three groups with respect to age, sex, comorbidities, and primary lung disease. Low Vit D level was associated higher occurrence of postoperative acute kidney injury (AKI; deficiency vs. insufficiency vs. sufficiency, 10 [22.2] vs. 11 [9.5] vs. 1 [5.0]; P<0.05). Prevalence of broncho pleura fistula was higher in Vit D deficiency group: deficiency vs. insufficiency vs. sufficiency, 0 (0.0) vs. 14 (10.9) vs. 0 (0.0); P=0.016. We further evaluate postoperative broch pleural fistula (BPF) in Vit D increase and Vit D decrease group within 6-month follow-up, and Vit D decrease group show high prevalence of BPF: decrease vs. increase, 9 (12.3) vs. 1 (1.1); P=0.002. Low Vit D level was also associated with postoperative anxiety, but it was not statically meaning.

Conclusions: Low 25-OH Vit D level is associated with increased incidence of post LT complications such as AKI, BPF, and anxiety. Also, Vit D decrease during postoperative period showed higher incidence of BPF.

Corresponding author: Moo Suk Park
E-mail: PMS70@yuhs.ac

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Incidence, characteristics, and outcome of post-heart transplant malignancy

Jong-Chan Youn¹, In-Cheol Kim², Jin-Jin Kim¹, Sang Hong Baek¹, Jon Kobashigawa³

¹Division of Cardiology, Department of Internal Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
²Division of Cardiology, Department of Internal Medicine, Keimyung University Dongsan Medical Center, Daegu, Korea
³Division of Cardiology, Department of Internal Medicine, Cedars-Sinai Medical Center, Beverly Hills, CA, USA

Background: Post-transplant malignancy (PTM) has been an important cause of long-term morbidity and mortality in heart transplant (HTx) recipients. However, the detailed characteristics of PTM are largely unknown. We aimed to describe the characteristics, outcomes, and predictors of de novo PTM in HTx recipients.

Methods: We analyzed 989 consecutively enrolled HTx recipients without pre-transplant history of malignancy between 1997 and 2013. Main outcomes included the incidence, characteristics, outcomes, and predictors of PTM.

Results: During a median follow-up period of 11.5 years, 206 patients (20.8%) had de novo PTMs (241 cancer cases). PTM patients, compared with non-PTM patients, showed older age, longer time on immunosuppression, and higher proportion of male and white patients. Skin cancers were the most frequent types of malignancy (60.6%) followed by prostate cancers (9.5%), lung cancers (7.1%), and breast cancers (4.1%). While most of the cancers (88.8%) were surgically resected at the initial presentation, about half of cancers (47.3%) showed recurrence or disease progression. Both patients with skin cancer and non-skin cancer, compared to patients without PTM, revealed a significantly lower overall survival (P<0.001). Multivariable analysis revealed older age (P<0.001), white race (P=0.001), and longer time on immunosuppression (P<0.001) were independent predictors for PTM.

Conclusions: Older, white recipients with longer time on immunosuppression were independent risk factors for PTM, which was associated with increased mortality. Enhanced cancer screening and individualized immunosuppression in these high-risk patients should be studied to improve the outcomes.

Corresponding author: Jong-Chan Youn
E-mail: jong.chan.youn@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Preoperative prediction score of hepatocellular carcinoma recurrence in living donor liver transplantation: validation of SNAPP score developed at Asan Medical Center

Seok-Hwan Kim¹, Deok-Bog Moon²

¹Division of Transplantation, Department of Surgery, Chungnam National University Hospital, Daejeon, Korea
²Division of Transplantation, Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: The previously proposed scoring systems are not readily available due to the lack of simplicity for predicting hepatocellular carcinoma (HCC) recurrence. We aimed to develop and validate the new score system, which can predict HCC recurrence after living donor liver transplantation (LDLT) by using morphologic and biologic data.

Methods: Predictors for HCC recurrence after LDLT were developed (n=627) and validated (n=806) in 1,433 patients who could collect information to date between 2007 and 2016 at Asan Medical Center to create the Score for Neonatal Acute Physiology (SNAPP) score (tumor size and number, alpha-fetoprotein, vitamin K absence-II, and positron emission tomography).

Results: On logistic regression based on 3-year recurrence-free survival, the SNAPP factors were independently associated with HCC recurrence. The SNAPP score was highly predictive of HCC recurrence (C statistic, 0.920), and 5-year post-liver transplantation recurrence rates were significantly different between low, intermediate, and high SNAPP score groups. The performance of the SNAPP scores (C-index, 0.840; 95% confidence interval, 0.801–0.876) on predicting tumor recurrence after LDLT was better than that of the NYCA (New York/California), the RETREAT (Risk Estimation of Tumor Recurrence after Transplant), and the MoRAL (Model of Recurrence after Liver Transplant) scores.

Conclusions: The SNAPP score provides excellent prognostication after LDLT for HCC patients. Hence, we can help voluntary patients’ decisions about whether to undergo LDLT or not.

Corresponding author: Deok-Bog Moon
E-mail: mdb1@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Renal safety of tenofovir disoproxil fumarate and entecavir in liver transplant patients: a nationwide Korean registry study

Juhan Lee¹, Shin Hwang², Kwang-Woong Lee³, Jong Man Kim⁴, Je Ho Ryu⁵, Bong-Wan Kim⁶, Dong Lak Choi⁷, Young Kyoung You⁸, Dong-Sik Kim⁹, Myoung Soo Kim¹

¹Division of Transplantation, Department of Surgery, Severance Hospital, Seoul, Korea
²Division of Hepatobiliary, Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea
³Division of Hepatobiliary, Department of Surgery, Seoul National University Hospital, Seoul, Korea
⁴Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea
⁵Division of Hepatobiliary, Department of Surgery, Pusan National University Yangsan Hospital, Yangsan, Korea
⁶Division of Hepatobiliary, Department of Surgery, Ajou University School of Medicine, Suwon, Korea
⁷Division of Hepatobiliary, Department of Surgery, Daegu Catholic University Medical Center, Daegu, Korea
⁸Division of Hepatobiliary, Department of Surgery, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
⁹Division of Hepatobiliary, Department of Surgery, Korea University College of Medicine, Seoul, Korea

Background: Entecavir and tenofovir are currently the first-line drugs in liver transplantation (LT) patients for the prevention of hepatitis B virus recurrence. Despite its proven efficacy, the renal safety of tenofovir in LT patients has not been well defined. We aimed to assess the impact of tenofovir on renal function compared to that of entecavir after LT.

Methods: We analyzed 817 LT patients treated with entecavir (n=366) or tenofovir (n=451) between 2014 and 2017. The estimated glomerular filtration rate (eGFR) was calculated using the Chronic Kidney Disease Epidemiology Collaboration equation. Renal function deterioration was defined as progression of chronic kidney disease stage and ≥20% eGFR decline from 1 month after LT.

Results: Mean eGFR at 1 month after LT was 91.1±22.0 mL/min/1.73 m² for entecavir and 89.1±23.7 mL/min/1.73 m² for tenofovir group (P=0.312). During a median follow-up of 29 months, the cumulative incidence of renal function deterioration was significantly higher in the tenofovir group than in the entecavir group (355.5% vs. 27.1%, P=0.01). Tenofovir (odd ratio [OR], 1.52; 95% confidence interval [CI], 1.11–2.08; P=0.009), old age (OR, 1.45; 95% CI, 1.01–2.09; P=0.044), low body mass index (OR, 2.02; 95% CI, 1.44–2.84; P<0.001), and diabetes mellitus (OR, 1.68; 95% CI, 1.18–2.08; P=0.009) were independent risk factors for renal function deterioration.

Conclusions: The use of tenofovir was significantly associated with renal function deterioration in LT patients. In the setting of LT, tenofovir should be used with caution in high-risk patients and renal function should be carefully monitored.

Corresponding author: Juhan Lee
E-mail: juhan1108@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Safety and efficacy of conversion to once-daily tacrolimus from twice-daily tacrolimus in pediatric liver transplant recipients

Sung Hyo An¹, Sanghoon Lee², Jinsoo Rhu³, Jong Man Kim³, Gyu Seong Choi³, Jae-Won Joh³, Suk-Koo Lee⁴

¹Department of Surgery, Samsung Medical Center, Seoul, Korea
²Division of Pediatric Surgery, Department of Surgery, Samsung Medical Center, Seoul, Korea
³Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea
⁴Division of Transplantation, Department of Surgery, Vinmec Healthcare System, Hanoi, Vietnam

Background: Nonadherence of immunosuppression is the most common cause of late acute rejection in pediatric liver recipients. Simpler dosing regimens promote better compliance behavior, especially in pediatric patients.

Methods: We screened 182 pediatric liver transplant (LT) recipients converted from twice daily tacrolimus (TD-TAC, Prograf) to once daily tacrolimus (OD-TAC, Advagraf) between February 2011 and September 2019. Tacrolimus trough levels, doses of tacrolimus, and liver function tests (LFT) were recorded in 3 months intervals 18 months before and after conversion.

Results: One hundred and seventy-nine patients were converted to OD-TAC and followed for 18 months. One hundred and fifty-four out of 179 patients (86.0%) converted to OD-TAC and were uneventful during follow-up. Twenty-one patients had LFT elevation above 80 U/L. These patients’ LFT normalized after OD-TAC dose adjustment (n=12) or switching back to TD-TAC (n=9). Four patients had biopsy-proven acute rejection within 6 months after conversion, and all of which were successfully treated with steroid pulse. Currently, 166 out of 179 patients (92.7%) remain on OD-TAC and 13 patients (7.3%) were switched back to TD-TAC. Mean tacrolimus trough level significantly decreased at 3 months (3.14±1.9 ng/mL) following conversion compared to pre-conversion level (3.69±1.98 ng/mL). Mean tacrolimus trough levels remained unchanged from 3 to 12 months following conversion. Mean daily tacrolimus dosage was increased from pre-conversion dosage (1.60±1.29 mg) to initial conversion dose (1.76±1.31 mg) and once again at 3 months (1.80±1.23 mg) following conversion. Tacrolimus dosage remained unchanged from 3 to 12 months. Percent coefficient of variation of tacrolimus trough levels was significantly decreased from 32.5±16.4 to 27.5±15.6 ng/mL after conversion to OD-TAC, reflecting the decrease in variation of tacrolimus trough levels following conversion.

Conclusions: Conversion to OD-TAC in pediatric LT recipients with stable graft function is safe and effective.

Corresponding author: Sanghoon Lee
E-mail: sanghoone.lee@samsung.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Liver stiffness measurement and outcomes of living donor liver transplantation

Sang Jin Kim, Jong Man Kim, Jinsoo Rhu, Gyu-Seong Choi, Jae Berm Park, Jae-Won Joh

Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea

Background: Liver stiffness measurement (LSM) is a non-invasive method for evaluating liver fibrosis. The aim of this study was to evaluate the correlation between LSM and outcomes of living donor liver transplantation.

Methods: From January 1, 2014 to May 30, 2019, patients who received living donor liver transplantation were evaluated by Fibroscan. Baseline characteristics, preoperative donor LSM, and recipient 1-month and 1-year postoperative LSM were evaluated. Graft survival, patient survival, HCC recurrence, and rejection were analyzed with LSM values.

Results: Total 237 patients who received living donor liver transplantation were included, retrospectively. One hundred and seventy-four patients were infected with hepatitis B virus. Donor LSM was evaluated in 233 patients, 1-month LSM in 206 patients, and 1-year LSM in 62 patients. Either donor LSM, recipient 1-month, or 1-year LSM did not significantly affect graft survival and HCC recurrence. High donor LSM was associated with patient death, especially when donor LSM was more than 5 kPa (hazard ratio [HR], 3.58; P=0.004). Regarding T-cell mediated rejection (TCMR), high 1-year LSM was associated with high risk, especially when the 1-year LSM was more than 8 kPa (HR, 5.42; P=0.008; multivariate). One-year LSM (>8 kPa) was also associated with TCMR occurring after 1 year (HR, 7.01; P=0.047; multivariate). In hepatitis B virus patients, LSM had a greater influence on patient death and TCMR.

Conclusions: Preoperative donor LSM more than 5 kPa was significantly associated with patient death. Recipient 1-year LSM more than 8 kPa was associated with both TCMR over the entire period and TCMR 1-year after transplantation. This tendency was slightly more pronounced when patients were infected with hepatitis B virus.

Corresponding author: Jong Man Kim
E-mail: yjongman21@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Clinical analysis of the prognosis after receiving a liver graft that abandoned transplantation due to poor graft conditions in the centers allocated as a priority

Ho Joong Choi, Changho Seo, Sung Eun Park, Joseph Ahn, Tae Ho Hong, Young Kyoung You

Division of Hepatobiliary, Department of Surgery, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

**Background:** Liver transplantation (LT) has the limitation of lack of donors compared to those waiting for a transplant. Depending on the recipient’s condition, even liver grafts with poor conditions may need to be transplanted. This study was conducted to analyze the prognosis after LT that abandoned transplantation due to poor graft conditions at the preceding centers.

**Methods:** From January 2010 to September 2020, deceased-donor LT was performed in 161 patients in Seoul St. Mary’s Hospital. Among them, 127 patients (allocated group) were preferentially allocated to our center by Korean Network for Organ Sharing and the remaining 34 patients (21.1%, abandoned group) received liver grafts that were abandoned by other transplant centers due to poor organ conditions. To compare and analyze the clinical prognosis of the allocated group and the abandoned group, various perioperative factors and postoperative outcomes were evaluated.

**Results:** The average ages of the allocated and abandoned groups were 52.3 and 51.6 years, respectively (P=0.65). The preoperative Model for End-stage Liver Disease score was 27.3±10.6 in the allocation group and 25.8±11.3 in the abandoned group (P=0.49). There was no difference between the two groups in operation time (P=0.14) and intraoperative PRC transfusion (P=0.94). There was no difference between the two groups in intensive care unit stay (P=0.91) and hospital stay (P=0.86). In-hospital mortality occurred in 17 patients (13.4%) in the allocated group and three patients (8.8%) in the abandoned group, so there was no difference between the two groups (P=0.47). The 5-year survival rate was 72.4% in the allocated group and 78.2% in the abandoned group, with no difference between the two groups (P=0.25).

**Conclusions:** Even if the graft that was abandoned due to poor condition, good results can be obtained if the transplant is carried out according to the recipient state. And as a result, it is expected that the discarded graft can be reduced.

Corresponding author: Ho Joong Choi
E-mail: hopej0126@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Human leukocyte antigen-DR/DQ eplet mismatch analysis for primary alloimmune risk stratification of non-sensitized kidney transplant recipients

Hyeyoung Lee¹, Ji Won Min², Hyunhye Kang³, Chul Woo Yang⁴, Byung Ha Chung⁴, Eun-Jee Oh³

¹Department of Laboratory Medicine, International St. Mary’s Hospital, Catholic Kwandong University College of Medicine, Incheon, Korea
²Division of Nephrology, Department of Internal Medicine, Bucheon St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Bucheon, Korea
³Department of Laboratory Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
⁴Division of Nephrology, Department of Internal Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Background: Human leukocyte antigen (HLA) analysis has been suggested as a predictive tool for alloimmune risk stratification in kidney transplantation (KT). We investigated whether the whole or single molecule HLA class II eplet mismatch was related to de-novo donor-specific-antibody (dnDSA) development or antibody-mediated rejection (AMR).

Methods: Total 300 kidney transplants performed at Seoul St. Mary’s Hospital between 2016 December and 2020 January without preformed DSA have been analyzed. HLA class II eplet mismatches were determined by high resolution HLA DRB1/DQB1 typing results and HLA Matchmaker program.

Results: During the 22.6 months (median) follow-up period, 24 recipients developed HLA class II dnDSA and 20 patients diagnosed as AMR. Using receiver operating characteristic analysis, we identified eplet mismatch thresholds associated with dnDSA development and stratified recipients into low-, intermediate-, and high-risk categories. In whole eplet mismatch analysis, risk categories were significantly correlated with dnDSA development (log-rank P-value <0.001). High-risk group (n=124) with HLA-DR 0–13 and HLA-DQ 7–31 significantly increased risk of dnDSA development compared to intermediate risk group with HLA-DR ≥14 and HLA-DQ ≤7, or HLA-DR 0–13 and HLA-DQ ≤7 (n=86) (P=0.046). HLA class II eplet mismatches with HLA-DR 0–45 and HLA DQ >8 predicted dnDSA development with 75% sensitivity and 63.4% specificity. Risk categories by single molecular eplet mismatch also had significant correlation with dnDSA development (log-rank P-value= 0.001) with significant difference between low (HLA-DR ≤7 and HLA-DQ ≤4) (n=78) and intermediate (HLA-DR ≥8 and HLA-DQ ≤6 or HLA-DR 0–7 and HLA-DQ 5–6) (n=95) group (P=0.026). High-risk group (HLA-DR 0–20 and HLA DQ 7–17) predicted dnDSA development with 75% sensitivity and 60.5% specificity. Both eplet mismatch risk categories were significantly associated with AMR, but no differences were found among risk groups.

Conclusions: HLA class II eplet mismatches showed the possibility of being used as a clinically relevant parameter in alloimmune risk assessments of KT.

Corresponding author: Eun-Jee Oh
E-mail: ejoh@catholic.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Pure T-cell-mediated rejection following kidney transplant according to the response to treatment in the era of antibody-mediated rejection

Hyunwook Kwon, Sung Shin, Duck Jong Han, Young Hoon Kim, Joo Hee Jung, Dong Hyun Kim, Youngmin Ko, Seong Jun Lim

Division of Transplantation, Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Currently, we live in an era of antibody-mediated rejection (ABMR), while the effect of T-cell-mediated rejection (TCMR) on graft survival (GS) is gradually decreasing. However, acute pure TCMR is still described in histologic reports even a long time after transplant. The purpose of this study was to evaluate the effect of pure TCMR on GS according to the treatment response. We also performed molecular diagnosis using a molecular microscope diagnostic system (MMDx) to determine the accuracy of the histologic diagnosis of pure TCMR.

Methods: A total of 63 patients were divided into the non-responder group (n=22) and responder group (n=44) according to the response to rejection treatment. Molecular diagnosis and histologic diagnosis were conducted simultaneously on additional 23 patients.

Results: The rejection time since treatment was shorter in the non-responder group than in the responder group. In addition, the cumulative incidence of recurrent rejection after treatment was significantly higher in the non-responder group. The glomerular filtration rate (GFR) at biopsy, ΔGFR (baseline GFR–GFR at biopsy), TCMR within 1 year, t score, and interstitial fibrosis/tubular atrophy score were significant factors associated with the non-responder group. In comparison with the non-responder group, the responder group showed a significantly superior overall GS rate. Molecular assessment using MMDx showed a good correlation with the histologic diagnosis of ABMR but not TCMR.

Conclusions: Our study found that acute pure TCMR was a significant risk factor for graft failure in patients who did not respond to rejection treatment. Molecular analysis using MMDx showed that acute pure TCMR at 1 year after transplant in the histologic report must be interpreted cautiously.

Corresponding author: Young Hoon Kim
E-mail: gskyh@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The effect of hyperfiltration mechanism on kidney function in Living-Donor Kidney Transplantation in Cipto Mangunkusumo Hospital, Jakarta, Indonesia: study on renal arterial resistive index, urinary vascular endothelial growth factor, neutrophil gelatinase-associated lipocalin, and heparan sulfate

Maruhum Bonar Marbun¹, Endang Susalit¹, Diana Aulia², Jacob Pandelaki³, Saptawati Bardosono⁴, Bambang Purwanto⁵

¹Department of Internal Medicine, Cipto Mangunkusumo Hospital, Jakarta, Indonesia
²Department of Clinical Pathology, Cipto Mangunkusumo Hospital, Jakarta, Indonesia
³Department of Radiology, Cipto Mangunkusumo Hospital, Jakarta, Indonesia
⁴Department of Nutrition, Cipto Mangunkusumo Hospital, Jakarta, Indonesia
⁵Department of Internal Medicine, Faculty of Medicine Universitas Sebelas Maret, Surakarta, Indonesia

Background: While adequate donors' kidney function after donation is desired, some may recover incompletely and develop chronic kidney diseases. Hyperfiltration is an adapting mechanism to overcome nephrectomy-related kidney function loss. This study aims to explain adaptive and maladaptive hyperfiltration mechanism during the first 30 days postnephrectomy.

Methods: Longitudinal observational study was conducted on 46 kidney donors in Cipto Mangunkusumo Hospital in April–December 2019. Estimated glomerular filtration rate (eGFR) and albumin-creatinine ratio (ACR) were examined serially. Subjects were divided into adaptive (eGFR >60 mL/min/1.73 m² and/or ACR <30 mg/g on day 30) and maladaptive group (eGFR <60 mL/min/1.73 m² and/or ACR >30 mg/g on day 30). Kidney resistive index (RI), urinary vascular endothelial growth factor (VEGF), and heparan sulfate (HS) were examined prenephrectomy and on day-2, day-7, and day-30 postnephrectomy. Urinary neutrophil gelatinase-associated lipocalin (NGAL) level was measured before and 6-hour postnephrectomy. Donors' characteristic variables were analyzed using chi-square or Fisher test and logistic regression. Difference of RI, VEGF, NGAL, and HS between two groups were analyzed using Mann-Whitney or independent t-test.

Results: Out of 46 subjects, 40 were included in the final analysis. Nineteen donors (47.5%) underwent maladaptive hyperfiltration. Prenephrectomy eGFR was significantly different with value of 111.17 (11.38) mL/min/1.73 m² and 92.94 (13.21) mL/min/1.73 m² and cutoff of 104.60 mL/min/1.73 m². Outcomes of donors aged >45 years and arterial stiffness >50th percentile were significantly different (P=0.03 and P=0.01). Hyperfiltration was evidenced by significant changes in RI, VEGF, NGAL, and HS after nephrectomy. Significant difference between arcuate artery RI on day-2 and day-30 was found only in adaptive group.

Conclusions: Hyperfiltration does not alter kidney function on day-30 postnephrectomy. Prenephrectomy eGFR, age >45 years, and arterial stiffness are associated with day-30 postnephrectomy kidney function. RI of arcuate artery changes more prominently and rapidly in adaptive group. Further study evaluating kidney function and interfering variables within longer period is necessary.

Corresponding author: Maruhum Bonar Marbun
E-mail: mbhmarbun@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Comparison of different induction dosing of CD3+ cell count based anti-thymocyte globulin for deceased donor kidney transplantation: single center experience

Joon Seok Oh, Joong Kyung Kim, Dong Yeol Lee, Hee Yeon Kim

Division of Nephrology, Department of Internal Medicine, Bongseng Memorial Hospital, Busan, Korea

Background: The rabbit anti-thymocyte globulin (ATG) is the most widely used lymphocyte depleting agent in renal transplantation. This can be expected to have a profound immune inducing effect, but it has been not widely used in Korea due to concerns about side effects such as leukopenia, thrombocytopenia, and infection. This has made it necessary to find the minimum dosing to show adequate immunosuppressive effects. So, we compared the clinical features of CD3+ cell count based ATG use with a cumulative dose of 3 mg/kg and 4 mg/kg as an induction immunosuppressant.

Methods: Fifty-one patients have received deceased donor kidney transplantation with ATG induction therapy in Bongseng Memorial Hospital from 2013 to 2020. And they were divided into two groups: patients who treated with cumulative dose 3.0 mg/kg of ATG (group A) and 4.0 mg/kg (group B). We compared patient’s survival and graft’s survival in both groups. The data were collected regarding recipients’ panel reactive antibody, CD3+ lymphocyte count, immunosuppressant, viral infection, acute rejection, and adverse events.

Results: The demographic characteristics of the two groups were comparable. The incidence of delayed graft function was statistically significantly lower in the cumulative dose 4 mg/kg group. There was no statistically significant difference in the graft’s survival and serum creatinine between the two groups, but it was slightly better in 4 mg/kg group. The incidence rates of acute rejection and infectious events as cytomegalovirus disease or urinary tract infection were not significantly different between the two groups. CD3+ lymphocyte count was statistically significantly decreased until 6 months after transplantation in both groups compared to before transplantation.

Conclusions: We suggest that ATG induction with cumulative dose of 4 mg/kg would be safe and effective for deceased donor kidney transplantation in Korea.

Corresponding author: Joon Seok Oh
E-mail: j-seok@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Single center experience of hepatic artery reconstruction during living donor liver transplantation: microscope versus surgical loupe

Changho Seo

Division of Hepatobiliary, Department of Surgery, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Background: Hepatic artery (HA) reconstruction during living donor liver transplantation (LDLT) is the key step due to the small diameter of the artery and risk of HA thrombosis (HAT). To overcome this risky procedure, it has been preferred to using microscope during HA reconstruction by experienced microsurgeon. However, it takes long time to complete the procedure and has long and steep learning curve. To make this procedure simple, some transplant surgeons recently try the procedure using surgical loupe. We conduct this study to compare the outcomes after HA reconstruction using conventional microscope versus surgical loupe.

Methods: We retrospectively reviewed outcomes of 300 LDLTs at Seoul St. Mary’s Hospital from April 2014 to July 2020. From April 2014 to September 2017 (era 1), HA reconstruction was performed with conventional microscope by an experienced plastic surgeon. From September 2017 to end date (era 2), it was performed with surgical loupe (×5.0) by an experienced transplantation surgeon.

Results: There was no difference in most perioperative outcomes between two groups including major postoperative complications: HAT (2/150 vs. 1/150, P=0.562), postoperative bleeding (13/150 vs. 6/150, P=0.097), and biliary leak (18/150 vs. 13/150, P=0.343). It was statistically significant between two groups for total operation time (436.66±83.91 minutes vs. 415.35±68.55 minutes, P=0.035). Multivariable regression modeling to adjust for baseline differences showed that the use of surgical loupe was not associated with HA thrombosis.

Conclusions: HA reconstruction with surgical loupe makes results as good as with microscope for the transplant surgeon and contributes to reducing operating time.

Corresponding author: Changho Seo
E-mail: schjee17@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Impact of extended living donor criteria on donor safety in living donor liver transplantation

Joo Dong Kim, Dong Lak Choi, Eun Kyoung Jwa

Department of Surgery, Catholic University of Daegu School of Medicine, Daegu, Korea

Background: Donor safety is primary concern during living donor liver transplantation (LDLT) and most transplant centers accept strict selection criteria although some centers have been trying to modify these strict criteria to expand donor pools. Herein, we describe the experience of Daegu Catholic University Medical Center for extended living donor criteria for LDLT focusing on donor safety.

Methods: We retrospectively reviewed the outcomes of 424 living donor right hepatectomy (LDRH) including 105 donors under extended criteria at our institution from January 2010 to June 2019. Extended donor was defined with criteria as follows: old donor (age >40 years) with remnant liver volume of <35%; young donor (age ≤40 years) with remnant liver volume <29% and minimal fatty change (<15%); and young donor with mild hepatosteatosis (15%–30%) and remnant liver volume of <35%. The outcomes in extended living donors were compared with those in living donors under conventional criteria focusing on donor safety. We also analyzed risk factors related to posthepatectomy liver failure (PHLF).

Results: PHLF occurred in 43 donors (10.1%) and most cases were grade A except one case in conventional donor group (grade B). PHLF did not occur more frequently in extended donor group (7.6% vs. 11.0%, P=0.32) and the incidence of major postoperative complications did not differ between the two groups. Moreover, no difference in either posttransplant graft function or survival was apparent between the two groups. In multivariate logistic regression analyses, only the event for major complications (odds ratio, 3.002; 95% confidence interval, 1.042–8.649; P=0.042) was associated with PHLF but not related to extended criteria.

Conclusions: LDRH under our extended criteria could be performed to expand donor pools without adverse effects on donor safety.

Corresponding author: Joo Dong Kim
E-mail: milledr1127@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Difficulty scoring system of pure laparoscopic donor right hemihepatectomy

Jeong-Moo Lee, Kyung-Suk Suh, Eunhye Shin, Suk Hee Ko, Kwangpyo Hong, Eui Soo Han, Suk Kyun Hong, YoungRok Choi, Nam-Joon Yi, Kwang-Woong Lee

Division of Hepatobiliary, Department of Surgery, Seoul National University Hospital, Seoul, Korea

Background: The degree of difficulty in laparoscopic liver resection depends on the location of the tumor and the extent of liver resection. However, according to the current difficulty evaluation system, laparoscopic donor hepatectomy is hard to evaluate the real difficulty level. Because the donor was usually undergone right hemihepatectomy, and there was no underlying liver disease such as cirrhosis. However, this does not mean that all liver donor hepatectomy has the same difficulty. Also, we have not known which factors are affecting surgical difficulty. Therefore, a new system is needed to evaluate the difficulty of laparoscopic donor hepatectomy. In this study, we described the new scoring system and its corresponding factors that determine the difficulty of laparoscopic donor hepatectomy.

Methods: From January 2019 to December 2019, 93 donors who underwent pure laparoscopic right hemihepatectomy in Seoul National University Hospital were enrolled. Surgical difficulty score and related factors were evaluated by a surgeon, assistant, scopist, and scrub nurse after surgery immediately. We analyzed which factors are related to surgical difficulty and the relationship between surgical difficulty, surgical outcome, operative time, and complication.

Results: Difficulty scores were divided into 5 points, 1- and 2-point groups were classified into easy case groups, and the 3, 4, and 5-point groups were classified into difficulty groups. Variation of bile ducts or hepatic vein, small abdominal cavity, and huge liver were related to surgical difficulty in multivariate analysis. Operative time and blood loss were correlated positively with our difficulty score system. However, the complication was not related significantly to surgical difficulty.

Conclusions: New surgical difficulty evaluating the system in pure laparoscopic donor right hemihepatectomy is well correlated with operative time and estimated blood loss. But the surgical difficulty was not related to donor complication.

Corresponding author: Kyung-Suk Suh
E-mail: kssuh2000@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Vascular reconstruction and long-term outcome of living domino liver transplantation in children

Seiichi Shimizu¹, Seisuke Sakamoto¹, Yasuyuki Kameoka¹, Kotaro Mimori¹, Hajime Uchida¹, Yusuke Yanagi¹, Akinari Fukuda¹, Reiko Horikawa², Mureo Kasahara¹

¹Department of Organ Transplantation Center, National Center for Child Health and Development, Tokyo, Japan
²Department of Endocrinology and Metabolism, National Center for Child Health and Development, Tokyo, Japan

Background: A native liver of maple syrup urine disease (MSUD) patients can be used as a graft to non-MSUD patients with end-stage liver disease because an extrahepatic enzyme activity can sufficiently maintain metabolic functions of these patients, so-called the second recipient. Operational procedures of second recipient in domino liver transplantation (DLT) and long-term outcome of these patients can impact on making a decision to offer this procedure to the others.

Methods: Six second recipients of DLT (patients’ age, 42.5 months old at DLT; range, 22–169 months old) received a graft of the native liver from MSUD patients at National Center for Child Health and Development between June 2014 and April 2020. We reviewed the operational procedures including vascular reconstructions and outcomes of second recipients of DLT (follow-up, 5.5 years; range, 0.4–6.3 years).

Results: Five of the six second recipients had a whole liver and one had a right lobe graft. The median operative time was 457 minutes (range, 303–750 minutes) and cold ischemia time was 264 minutes (range, 250–350 minutes). On the back table, multiple hepatic veins of the graft were unified into single orifice without any vein grafts in all cases. The recipient’s hepatic vein orifice was anastomosed to a newly-created orifice of the graft. For portal vein reconstruction, one case needed an autologous left external iliac vein as an interpositional vein graft. Arterial reconstruction was performed by the anastomosis between donor’s and recipient’s proper hepatic artery. The median hospital stay was 31 days (range, 19–80 days) without any primary non function and vascular or bile duct complications. Two patients had acute cellular rejection. All recipients were doing well without the elevation of valine, leucine, or isoleucine in the amino acid analysis.

Conclusions: Metabolic functions of second recipients have maintained within normal ranges under unrestricted protein diet. MSUD liver can be safely used and it may expand a donor-pool as an alternative graft in pediatric liver transplantation.

Corresponding author: Seiichi Shimizu
E-mail: shimizu-se@ncchd.go.jp

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Venous outflow congestion is related to poor recurrence-free survival of living donor liver transplantation recipients with hepatocellular carcinoma

Jinsoo Rhu

Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea

Background: This study analyzed the impact of venous outflow congestion in the liver graft on hepatocellular carcinoma recurrence in liver transplantation recipients.

Methods: Hepatocellular carcinoma patients who underwent living donor liver transplantation at Samsung Medical Center between 2007 and 2018 were included. The congested volume was calculated based on 2-week post-transplantation computed tomography. Recurrence-free survival and overall survival were analyzed using the multivariable Cox proportional hazard model including the degree of venous congestion.

Results: A total of 582 patients were included. There were 232 patients (39.9%) with certain degree of congestion volume. Kaplan-Meier survival analyses showed 1-, 5-, and 10-year recurrence-free survivals of 86.0%, 72.2%, and 70.7%, respectively, and overall survivals of 91.5%, 73.4%, and 68.9%, respectively. While congestion volume per 10 cm³ was a significant risk factor for recurrence-free survival (hazard ratio [HR], 1.021; 95% confidence interval [CI], 1.005–1.038; P=0.010), there was no significant relationship with overall survival (HR, 1.012; 95% CI, 0.997–1.028; P=0.111).

Conclusions: Venous outflow congestion in the liver after living donor liver transplantation was related to the poor recurrence-free survival of hepatocellular carcinoma patients.

Corresponding author: Jinsoo Rhu
E-mail: jsrrules@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Effects on tolerance of chimerism and graft-versus-host disease in vascularized bone marrow allotransplantation

Jong Won Hong¹, Jung Hyun Lim²

¹Department of Plastic and Reconstructive Surgery, Severance Hospital, Seoul, Korea
²Institute for Human Tissue Restoration, Yonsei University College of Medicine, Seoul, Korea

Background: Various studies have been performed on immune tolerance in vascularized composite tissue allotransplantation (VCA). Typical researches were the induction of immune tolerance using stem cells. However, the survival and influence period of externally injected stem cells were not so much long. We tried to find out how much immune tolerance occurs through vascularized bone marrow allotransplantation based on the femoral bone flap.

Methods: Vascularized bone marrow allotransplantation was performed. Donor used a 7–8-week-old Brown Norway rat (BN, RTn). Recipients were 7–8-week-old Lewis rats (LEW, RT11). Femoral bones were used for immune tolerance materials for living stem cells. Immunosuppression was given daily intraperitoneally with FK-506. For chimerism analysis, BN rat antigen in LEW rat blood was investigated. Tregs were measured for the role of immune tolerance. In addition, T cells, B cells, helper T (Th), cytotoxic T (Tc), and natural killer (NK) cells were analyzed. Mixed lymphocyte reaction was performed.

Results: It was difficult to conclude of changes in T cells, B cells, Th, and Tc in the individuals who survived for 8 weeks. However, Treg showed an overall increase. NK cells showed a similar pattern to Th change. Chimerism was most seen in the first week and maintained similarly from the second week. When compared with the deceased rats below 2 weeks, the increase in NK cells and Tregs was rather high.

Conclusions: When vascularized bone marrow allotransplantation was performed, there was an effect of chimerism. However, there was a limit to explaining the effect of immune tolerance with only the change in Tregs compared to those who died earlier. Further studies are needed to conclude that it increases the survival of transplants in previous many reports.

Corresponding author: Jong Won Hong
E-mail: hsaturn@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Predictability of eplet mismatch to acute rejection in low level HLA mismatched kidney transplantation: validation analysis of Korean Organ Transplantation Registry (KOTRY) data

Jong Cheol Jeong1, Hyeong Eun Son1, Yeon Ho Park2, Inwhee Park3, Jae Berrm Park4, Dong Wan Chae5, Jaeseok Yang6, Yun Ji Hong7, Borae G. Park8

1Division of Nephrology, Department of Internal Medicine, Seoul National University Bundang Hospital, Seongnam, Korea
2Department of Surgery, Gachon University Gil Medical Center, Incheon, Korea
3Division of Nephrology, Department of Internal Medicine, Ajou University School of Medicine, Suwon, Korea
4Department of Surgery, Sungkyunkwan University School of Medicine, Suwon, Korea
5Department of Internal Medicine, Seoul National University College of Medicine, Seoul, Korea
6Department of Surgery, Seoul National University Hospital, Seoul, Korea
7Department of Laboratory Medicine, Seoul National University Bundang Hospital, Seongnam, Korea
8Department of Laboratory Medicine, Korea University Guro Hospital, Seoul, Korea

Background: Epitope matching has been shown to better predict allograft survival and development of de novo donor-specific antibodies. There was no large scale Korean study for epitope matching and kidney transplantation outcomes.

Methods: Patients included in the Korean Organ Transplantation Registry (KOTRY) were used. Kidney transplant recipients who received transplants from 2014 to 2017 were enrolled. As an external validation cohort, retrospective KOTRY data (kidney transplant pairs from 2009 to 2012) were used. Human leucocyte antigen (HLA) four-digit genotypes were imputed by matching to the four-digit haplotype distribution in the Korean bone marrow donor program. DQ genotyping was imputed by linkage-disequilibrium association. The primary outcome measurement was biopsy-proven acute rejection.

Results: Among 5,872 donor-recipient pairs, four-digit haplotype pairs were successfully imputed. Mean numbers of mismatched class I and class II eplets were 10.5±6.8 (range, 0–35) and 24.1±17.4 (range, 0–85), respectively. Mean eplet mismatch numbers were increased according to the number of HLA antigen mismatches (beta, 9.340; 95% confidence interval [CI], 9.145–9.534; P<0.001). Eplet mismatch was associated with acute rejection in the unadjusted models (class I: 1.022, 95% CI, 1.011–1.033; P<0.001; class II: 1.011, 95% CI, 1.007–1.015; P<0.001). When controlled with clinical covariates and HLA mismatch numbers, eplet mismatch numbers did not show additional predictability for acute rejection (AUC comparison: eplet model vs. HLA serotype model, 0.615 [95% CI, 0.594–0.636] vs. 0.619 [95% CI, 0.598–0.640]; P=0.491). However, eplet class II mismatches over 60 were shown to be significant risk predictors in low HLA serotype mismatches (one or two mismatches) in a non-linear model.

Conclusions: In this external validation study, eplet mismatches in class II MHC were found to be significant risk factors for acute rejection with a low number of HLA mismatches (one or two mismatches).

Corresponding author: Jong Cheol Jeong
E-mail: jcj0425@empal.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The organic preservation effect of hemodilution

Do Xuan Hai¹, Mai Văn Viện²

¹Department of Practical and Experimental Surgery, Military Medical University, Hanoi, Vietnam
²Department of Thoracic Surgery, 108 Medical Central Hospital, Hanoi, Vietnam

Background: Organ donation in countries with Buddhist cultures was developed primarily from living donor. Organs from the source for brain death with a low rate and the rate of organ transplantation eligible for transplantation account for 1.8 organs/brain death donor. With the current multi-organ collection model, there are often hemodynamic abnormalities, which can cause arterial clotting, affecting the quality and function of the donor organ. This study aims to initially evaluate the multi-suberculosis method of blood dilution.

Methods: The study was conducted on experimental 30 pigs with the model of multi-organ blood dilution with the following steps: (1) animal preparation: pre-anesthesia with Atropine 1/4 mg (01 tube), Valium 10 mg (01 tube), and Ketamine 100 mg; anesthesia with Pentothal at 60 mg/kg body weight. Use Arduan 4 mg muscle relaxants and monitor over hemodynamic and central temperature. (2) Cause brain death in experimental animals using compression damage. (3) Place the cannula (20F) into the femoral artery (Scarpa triangle). Place two infusion tubes through the carotid vein and the thigh (7F). (4) Drop blood flowing slowly through the femoral cannula about 30% volume, simultaneously by intravenous (IV) infusion (Ringer lactate). Blood loss from 50%–60% began to appear hemodynamic disorders. Infuse IV Ringer lactate at 4°C. Monitor pulse, blood pressure, and central temperature. (5) Blood flows in a stream through the femoral artery, quickly transfused through two veins (with phases Heparin and Kaleorid). Monitor temperature and hemodynamics until the animal stops heart. (6) Infuse fluids and organ preservative solutions continuously. Open the chest and abdomen, take the organs in blocks (heart-lung, liver-pancreas-intestine, kidney, etc.), and bring to the dissection table. Do pathological surgery to evaluate the quality of organs.

Results: Initial results showed that the central temperature decreased from 37.8°C to 32°C, and heart rate and blood pressure were stable until 68% of the blood was withdrawn. Evaluation of donor organs: white color accounts for 29/30 (96.67%), and white-pink accounts for 1/30 (3.33%). The density of sure organs is 30/30 (100%). The results of pathological anatomy: 360 samples showed that 10/360 (2.7%) of the samples had microscopic lesions. Performing pancreatic, kidney, and lung transplant: having post-transplant function accounts for 100%. The post-transplant survival rate followed up to 72 hours was 93.3% (14/15), 100% (15/15), and 93.3% (14/15).

Conclusions: Initial results show that this is an effective multi-organ washing method.

Corresponding author: Do Xuan Hai
E-mail: bsdoxuanhai@yahoo.com.vn

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Prevalence and clinical significance of pancreatic cystic lesions in immunosuppressed patients with solid organ transplantation

Young-Dong Yu¹, Pyoung-Jae Park², Hye-Sung Jo¹, Dong-Sik Kim²

¹Division of Hepatobiliary, Department of Surgery, Korea University Anam Hospital, Seoul, Korea
²Division of Transplantation, Department of Surgery, Korea University Guro Hospital, Seoul, Korea

Background: Solid organ transplant recipients have an increased risk of cancer due to immunosuppressive therapy. Pancreatic cystic lesions (PCLs) are increasingly being detected, some with malignant potential. We aimed to determine the prevalence of these lesions and describe their clinical course in these patients.

Methods: We identified the presence of PCLs in a retrospective cohort of 804 consecutive solid organ transplant recipients from 2009 to 2019 and compared lesion characteristics at initial and follow-up imaging, when available. We also compared these features with an immunocompetent control group encompassing patients under surveillance for greater than 12 months and were matched for age and sex.

Results: There were 15 patients in the study group and 60 patients in the control group. Among the solid organ transplant recipients with PCLs, there were seven and eight patients undergoing liver and kidney transplantation, respectively. Lesion prevalence was 1.86% (15/805). Median diameter of the largest lesion was 20 mm (range, 0.2–60 mm) and most lesions were benign (9/15, simple cyst or pseudocyst). During follow-up imaging, the cysts size remained stable in 79.7%, increased in 6.6%, and decreased in 13.7%. Among patients diagnosed with intraductal papillary mucinous neoplasm (6/15), worrisome features were noted in one patient at the time of cyst diagnosis. However, due to multiple comorbidities the patient received only conservative management. There were no significantly different features including the rate of size increase or the development of worrisome features between the study and control group (P<0.05).

Conclusions: PCLs are somewhat common in solid organ transplant recipients. In lesions without high-risk features, the development of features worrisome for cancer is rare. These lesions can be managed conservatively, and their presence should not affect transplant eligibility.

Corresponding author: Young-Dong Yu
E-mail: hust1351@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Preliminary T and B flow cytometry crossmatch results affecting kidney allocation and transplants from deceased donors

Myoung Hee Park, Sohyun Kim, Eun Hee So, Kwang Woo Jeon, Boknyun Han

Department of KODA Laboratory, Korea Organ Donation Agency, Seoul, Korea

Background: For deceased donor transplantations, Korean Network for Organ Sharing (KONOS) mandates negative results of preliminary T cell anti-human globulin (AHG) crossmatch (XM) for kidney and pancreas allocation. KONOS XMs are performed by 20 laboratories using frozen stored sera of the waitlisted candidates, and XM methods vary among these laboratories. Our laboratory is performing more than 50% of the nationwide KONOS XMs and we newly adopted B-flow cytometry XM (FCXM) in addition to the previously used T-AHG and T-FCXM methods. FCXM results are not used for KONOS allocation, and transplant teams decide whether to transplant across positive FCXM results. We investigated how the T- and B-FCXM results are affecting kidney allocation and transplants from deceased donors.

Methods: Single tube T/B FCXMs were performed and the results were reported either positive or negative with strength of reaction (mean fluorescence intensity [MFI] ratio). From July 2019 to December 2019, we performed KONOS XMs for 121 deceased donors and 1,931 kidney candidates. We analyzed FCXM results of transplanted cases (n=235) and those of transplant candidates with higher priority of allocation, not receiving transplants (n=178).

Results: Among 235 transplanted cases, only eight cases (3.4%) had positive FCXM results showing relatively low MFI ratios (T; median, 2.3). Among 235 transplant candidates with higher priority of allocation and not receiving transplants, 96 cases (53.9%) had positive FCXM results showing relatively high MFI ratios for both T (±B) positive (n=77; median, 5.8) and B only positive cases (n=19; median, 15.3). These results indicate that transplant teams prefer transplanting FCXM negative cases.

Conclusions: Both T- and B-FCXM results are affecting kidney allocation and transplants, when these results are available for the transplant teams. Currently, virtual XM is not used for organ allocation in Korea and preliminary T- and B-FCXM results appear to be of help for the transplant teams in performing safer transplantation.

Corresponding author: Myoung Hee Park
E-mail: parkmhee@snu.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Healthcare resource utilization after living liver donation: a retrospective case-control study

Hyunjae Im¹, Ho Geol Ryu¹, Eun Jin Jang², Junwoo Jo³, Suk Hyung Choe¹, Somin Joo¹, Hannah Lee¹, Seung-Young Oh⁴, Suk Kyun Hong⁴

¹Department of Anesthesiology, Seoul National University Hospital, Seoul, Korea
²Department of Department of Information Statistics, Andong National University, Andong, Korea
³Department of Department of Statistics, Kyungpook National University, Daegu, Korea
⁴Department of Surgery, Seoul National University Hospital, Seoul, Korea

Background: Living liver donation is generally considered safe, but donors may experience short- or long-term complications. The purpose of this study was to assess healthcare resource utilization after liver donation in living liver donors in comparison to the general population.

Methods: Outpatient or emergency department visits and hospital admissions were compared between living liver donors who underwent hepatic resection for living liver donation between 2004 and 2018 and the matched general population. Healthcare resource utilization data for 5 years after liver donation were collected from the National Health Insurance Service (NHIS) database. For every living liver donor, four individually matched non-donors were selected from the NHIS database using age, sex, preexisting comorbidities, and previous healthcare utilization history.

Results: A total of 1,886 living liver donors and 7,309 non-donors were included. In the first year after donation, living liver donors required more outpatient department visits (7 [4–13] vs. 3 [1–7], P<0.001) and more emergency department visits (13.33% vs. 0.15%, P<0.001) compared to matched non-donors. A similar trend persisted for 5 years after donation. The number of hospital admissions of living liver donors was higher for up to 2 years after donation with longer hospital length of stay (13.0 [10.5–16.0] days vs. 5.0 [3.0–9.0] days, P<0.0001).

Conclusions: Healthcare resource utilization in living liver donors for 5 years after donation was higher compared to matched non-donors. The higher healthcare resource demand may be related to postoperative complications or lowered threshold for healthcare resource utilization after donation.

Corresponding author: Ho Geol Ryu
E-mail: hogeol@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Skeletal muscle mass effects on estimated glomerular filtration rate decrement after donor nephrectomy

Joon Chae Na¹, Namki Hong², Min-Gee Yoon¹, Yumie Rhee², Woong Kyu Han¹

¹Department of Urology, Yonsei University College of Medicine, Seoul, Korea
²Division of Endocrinology, Department of Internal Medicine, Yonsei University College of Medicine, Seoul, Korea

**Background:** Although it is well known that skeletal muscle mass influences the level of serum creatinine, the effect of skeletal muscle mass on decreased renal function after nephrectomy is not known. In this study we aimed to evaluate the effect of skeletal muscle mass on estimated glomerular filtration rate (eGFR) calculated by serum creatinine and cystatin C.

**Methods:** From our kidney donor database, 601 donors were randomly selected in even distribution across age and sex. Skeletal muscle area (SMA) and skeletal muscle density (SMD) was extracted from the L3 level slice on predonation computed tomography scan. Skeletal muscle index (SMI) was calculated by correcting SMA for height: SMA/height². The association between the skeletal parameters and predonation eGFR with decreased eGFR ratio at 6-month postdonation compared to predonation was analyzed by linear regression analysis.

**Results:** Among the selected donors, skeletal muscle parameters were extracted from 592 donors. The skeletal muscle parameters were significantly different according to sex: SMA, 168.0±23.1 cm² vs. 109.4±13.8 cm²; SMD, 45.2±5.2 Hounsfield units (HU) vs. 39.5±6.0 HU; and SMI, 57.0±7.2 cm²/m² vs. 43.1±5.1 cm²/m² (all P<0.001). All skeletal parameters were significantly associated with age, sex and body mass index. There was a significant correlation between predonation creatinine based eGFR and SMA and also SMI. No correlation was seen between skeletal muscle parameters and cystatin-based eGFR or DTPA (diethyltriaminopentaacetic acid)-measured glomerular filtration rate (GFR). SMA and SMI had negative correlation with the %change of creatinine based eGFR at 6-month postdonation in male donors but not in female donors. The association of %change of cystatin C based eGFR with all skeletal muscle parameters were not significant.

**Conclusions:** Male kidney donors with high SMA or SMI are more likely to have decreased creatinine based eGFR after donation. This phenomenon is more likely associated with skeletal muscle mass rather than a reflection of true decrease in GFR. Cystatin C based eGFR may reflect postdonation GFR more accurately in muscular male donors.

**Corresponding author:** Woong Kyu Han
E-mail: hanwk@yuhs.ac

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The first donation after circulatory death following withdrawal of life-sustaining treatment in Korea

Eunsil Jeong¹, Jae-sook Oh², Yong-min Lee², Jae-myeong Lee³

¹Transplantation Center, Korea University Anam Hospital, Seoul, Korea
²Korea Organ and Tissue Donation Agency, Seoul, Korea
³Department of Surgery, Korea University Anam Hospital, Seoul, Korea

Background: We would like to report the first case of successful organ donation after withdrawal of life-sustaining treatment (WLST) in Korea.

Methods: A 52-year-old male patient who had cerebral hemorrhage was the potential brain-dead donor. After passing the first brain death examination, according to the recommendation of a neurologist, electroencephalograms (EEG) were performed 5 times at intervals of 2 to 3 days and they did not show flat EEGs. Since the family members’ willingness to donate organs was very strong, they agreed to donation after circulatory death (DCD) after WLST in the operating room (OR) without them. The patient was transferred to the OR at 7:30 PM on July 3, 2020. Surgical drape was done for the donor. At 8:00 PM, an intensivist in charge of the patient performed extubation and stopping the vasopressors at the same time. In 1 minute, oxygen saturation (SpO₂) fell below 70%, which meant functional warm ischemia time began. At 8:15 PM, asystole was confirmed, and after a 5-minute “no touch time”, declaration of circulatory death was done by the intensivist at 8:20 PM. Afterwards, all recipient surgeons who were waiting with surgical gown at the next OR moved to the donor’s OR and performed organ procurement surgery.

Results: Aortic clamp and HTK fluid perfusion started at 8:22 PM, 2 minutes after the incision started. Liver was out at 8:56 PM and kidney was out at 9:11 PM. Organs quality were good and they were donated well to the recipients.

Conclusions: Since this case started with donation after brain-death, it is strictly categorized as DCD IV. In DCD IV, if the life-sustaining treatment is stopped due to unsuccessful brain death determination, it becomes DCD III process. All potential recipients were already arranged through KONOS. We can actively perform DCD after WLST in Korea with the set-up of laws and systems for DCD.

Corresponding author: Jae-myeong Lee
E-mail: ljm3225@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Analysis for factors of brain death donor processing for face and hand transplantation in Korea: how much time will be available from brain death to transplantation?

Jong Won Hong¹, Soon Won Chung¹, Sung Jae Ahn¹, Won Jai Lee², Dae Hyun Lew¹, Yong Oock Kim¹

¹Department of Plastic and Reconstructive Surgery, Yonsei University College of Medicine, Seoul, Korea
²Institute for Human Tissue Restoration, Yonsei University College of Medicine, Seoul, Korea

**Background:** Face and hand transplantation has naturally evolved from reconstruction and transplantation. However, few institutes or nations perform face transplantation. Difficulties in performing face transplantation limit approvals by the institution for such transplantations to take place. One issue is that the procedure is time consuming. The other is whether the non-vital organ face transplantation is suitable for the organ transplantation process. Therefore, we analyzed the process of previously donated organ from brain-dead patients and suggest its utility in such cases.

**Methods:** A retrospective data review was performed on 1,074 brain-dead patients from January 2015 to December 2016 in Korea. We analyzed brain death time from admission to transplantation donation, the cause of brain death, and the state of the transplanted organs. We also analyzed the time from admission to final brain death.

**Results:** Patients (n=1,074) were composed of 747 males and 327 females. The average period between admission to first brain death decision was 8.5 days (±15.3). The average time intervals between the first brain death decision to electroencephalography and between the first brain death decision and brain death were 16 hours 58 minutes (±14 hours 50 minutes) and 22 hours 57 minutes (±16 hours 16 minutes), respectively. The most common cause of brain death was from cerebral hemorrhage and stroke (42.3%) followed by hypoxia (30.1%) and head trauma (25.2%).

**Conclusions:** When face transplantation is performed in Korea, the transplantation team has an average of 22 hours 57 minutes to prepare after the first brain death decision. Although head trauma is not the same as facial trauma, the cause of approximately one-fourth of brain death is from head trauma; therefore, surgeons should be aware that the facial tissue may be compromised in such cases.

**Corresponding author:** Jong Won Hong
**E-mail:** hsaturn@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Change in allocation pattern of pediatric brain-dead donor kidneys following implementation of new allocation policy with pediatric priority

Sanghoon Lee

Division of Pediatric Surgery, Department of Surgery, Samsung Medical Center, Seoul, Korea

Background: The Organ Transplantation Act of Korea was amended in October 2018 to grant more priority to pediatric patients on the kidney waitlist. The amended decree states that one kidney from brain-dead donors under age 19 years (previously age 11 years) must be initially allocated to a waitlisted patient under age 19 years. This aim of this study was to analyze the change in allocation patterns of kidneys from pediatric recipients following implementation of the new policy.

Methods: Data was extracted from the KONOS database and included donor and recipient information of kidney transplants from pediatric donors (age <19 years) from October 2014 to September 2020.

Results: There were 2,958 brain-dead donors from October 2014 to September 2020. One hundred and sixty-three donors were under age 19 years (163/2,958, 5.5%). The study period was divided into two periods: before policy change (October 2014 to September 2018) and after policy change (September 2018 to September 2020). The proportion of donors under age 19 years was not different between the two periods (5.9% vs. 4.4%). Two hundred and fifty-six kidneys from 163 pediatric donors were allocated to waitlist patients. The proportion of kidneys allocated to recipients under age 19 years was significantly higher after policy change (59/65, 90.8%) compared to before policy change (28/191, 14.7%; P<0.01). The days on waitlist of adult recipients (age 19 or older) of pediatric donor kidneys were similar before and after policy change, while the days on waitlist of pediatric recipients significantly increased. However, the days on waitlist of pediatric recipients were significantly shorter than adult recipients, both before (670.0±472.2 days vs. 2,038.0±801.4 days, P<0.01) and after (929.4±451.5 days vs. 1,620.0±942.1 days, P<0.01) policy change.

Conclusions: A sharp increase in proportion of pediatric kidney recipients from pediatric donors was observed following implementation of amended allocation policy in October 2018.

Corresponding author: Sanghoon Lee
E-mail: 4hooni@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Gut *Faecalibacterium* may improve impaired tacrolimus metabolism in kidney transplant recipients with cytochrome polymorphism

Ji Eun Kim¹, Hyo-Eun Kim², Hyunjeong Cho³, Ji In Park⁴, Jang Wook Lee⁵, Seung Hee Yang⁵, Jung Pyo Lee⁵, Jongwon Ha⁶, Yon Su Kim², Hajeong Lee²

¹Division of Nephrology, Department of Internal Medicine, Korea University Guro Hospital, Seoul, Korea
²Division of Nephrology, Department of Internal Medicine, Seoul National University Hospital, Seoul, Korea
³Division of Nephrology, Department of Internal Medicine, Chungbuk National University Hospital, Cheongju, Korea
⁴Division of Nephrology, Department of Internal Medicine, Kangwon National University Hospital, Chuncheon, Korea
⁵Division of Nephrology, Department of Internal Medicine, SMG-SNU Boramae Medical Center, Seoul, Korea
⁶Division of Transplantation, Department of Surgery, Seoul National University Hospital, Seoul, Korea

**Background:** The gut microbiota alters expression of drug-metabolizing enzymes and transporters, and consequently affects therapeutic dose and response of medicines. We aimed to investigate the effect of the gut microbiome on the variation of blood tacrolimus concentration in kidney transplant (KT) recipients.

**Methods:** Metagenomes in pre- and post-transplant stool samples of KT recipients were analyzed by the Illumina MiSeq. Tacrolimus trough levels from every recipient were obtained for 1 year after KT. Additionally, archival peripheral blood of recipients was tested for CYP3A5 genotyping by SNaPshot assay.

**Results:** A total of 77 and 60 fecal samples from pre- and post-transplantation were analyzed from 77 recipients, respectively. The mean age was 48.4±12.0 years, and 59.7% was male. The recipients were classified as low- and high-variability dose groups by time-series k-means clustering through dose-adjusted concentrations of tacrolimus in 1 year. High-variability group showed higher mean (90.2±32.5 vs. 192.8±40.1, \(P<0.001\)) and standard deviation (41.4±21.9 vs. 110.7±34.8, \(P<0.001\)) of tacrolimus level compared to the low-variability group, respectively. Interestingly, only 56.5% of CYP3A5 nonexpresser (CYP3A5*3/*3) was included in low-variability group while 100% of CYP3A5 expressors (CYP3A5*1/*1 or CYP3A5*1/*3) were included in low-variability group. In order to reveal this individual difference of tacrolimus variability in CYP3A5 nonexpresser, we analyzed fecal microbiota in CYP3A5 nonexpresser and found significant inverse relationship between dose-adjusted tacrolimus level and relative abundance of *Faecalibacterium* in post-transplant fecal samples (\(P=0.018\)). In multivariable logistic analysis adjusted by age, sex and major genera, the elevation of *Faecalibacterium* in post-transplant significantly reduced the risk of high-variability group (odds ratio [OR], 0.64; 95% confidence interval [CI], 0.44–0.93; \(P=0.018\)), while the statistical significance was diminished after further adjustment of genotypes (OR, 0.46; 95% CI, 0.21–1.01; \(P=0.053\)).

**Conclusions:** Gut *Faecalibacterium* influences the metabolism of tacrolimus, and it may improve impaired metabolism of tacrolimus in CYP3A5 nonexpresser. Further studies on the mechanism of *Faecalibacterium* on tacrolimus levels are needed.

**Corresponding author:** Hajeong Lee
**E-mail:** mdhjlee@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Redo hepatic artery reconstruction for thrombosis can save grafts and patients without retransplantation: lessons learned from 1,355 adult living donor liver transplantations

Su Young Hong1, Nam-Joon Yi1, Jeong-Moo Lee1, Suk Kyun Hong1, YoungRok Choi1, Ung Sik Jin2, Hak Chang2, Kwang-Woong Lee1, Kyung-Suk Suh1, Kyung Won Minn2

1Division of Hepatobiliary and Pancreatic Surgery, Department of Surgery, Seoul National University Hospital, Seoul, Korea
2Department of Plastic and Reconstructive Surgery, Seoul National University Hospital, Seoul, Korea

Background: Hepatic artery thrombosis (HAT) after liver transplantation is associated with a marked increase in morbidity, being the main cause of graft loss and bile duct complication leading patients’ deaths. Retransplantation is often unavailable in most Asian countries due to donor organ shortage. Herein, we evaluated the outcome of patients with HAT after adult living donor liver transplantation (ALDLT) under aggressive surgical correction strategy.

Methods: From January 2000 to June 2019, 1,355 recipients underwent ALDLT in Seoul National University Hospital. Surgical redo reconstruction for HAT was applied in every case except the evidence of graft necrosis or late detection (since postoperative day 60) of HAT. Median follow-up period was 89 months. Survival outcomes and the rates of biliary complication of patients with HAT were compared with others without HAT.

Results: Postoperative HAT was developed in 33 cases (2.4%) at a median time of 3.5 days (range, 1–82 days). Overall graft survival rates were lower in patients with HAT (84.8%) than others without HAT (98.0%) (P<0.001). However, patient survival rates were similar between two groups (72.7% vs. 83.8%, P=0.115). Biliary complication rates were higher in patients with HAT (54.5%) than others without HAT (32.0%) (P=0.008). Among 33 patients with HAT, 30 patients (90.9%) underwent redo arterial reconstruction. The technical success rate of redo reconstruction was 83.3% (n=25). After redo-reconstruction, three patients (10.0%) underwent retransplantation and 76.6% of patients (n=23) were finally survived. Another three patients with HAT underwent conservative management (n=2) and retransplantation directly (n=1).

Conclusions: HAT after ALDLT was associated with increased rates of biliary complication and significantly attenuates graft survival outcome. However, aggressive surgical treatment can save the graft in 90% without retransplantation and patient survival was not affected.

Corresponding author: Nam-Joon Yi
E-mail: gsleenj@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The assessment and outcomes of human leukocyte antigen mismatches of lung transplantation in Korean patients

Ha Eun Kim¹, Jin Gu Lee¹, Song Yee Kim², Moo Suk Park², Hyo Chae Paik¹

¹Department of Thoracic and Cardiovascular Surgery, Severance Hospital, Seoul, Korea
²Division of Pulmonology, Department of Internal Medicine, Severance Hospital, Seoul, Korea

Background: The human leukocyte antigen (HLA) system is an important determinant in solid organ transplantation for allocation. In lung transplantation, HLA compatibility is not included in the lung allocation score system and is not considered when placing donor allografts for lung transplantation. However, multiple studies have suggested that HLA matching affect the outcomes of lung transplantation. This study evaluated the current status of assessment, prevalence, and effects of HLA crossmatches in lung transplantation in Korean patients using nationwide multicenter registry data.

Methods: Two hundred and twenty patients who received lung transplantation at six tertiary hospitals in South Korea between March 2015 and December 2019 are retrospectively reviewed.

Results: Complement-dependent cytotoxic crossmatch (CDC-XM) for T-lymphocyte was performed in 208 patients (94.5%) and for B-lymphocyte was performed in 154 patients (70.0%). The flow-cytometric crossmatch for T-lymphocyte was performed in 125 patients (56.8%) and for B-lymphocyte was performed in 124 patients (56.4%). Among them, nine patients (4.1%) showed T-cell and/or B-cell mismatches. The incidences of postoperative complications in mismatched patients including primary graft dysfunction, acute rejection, and bronchiolitis obliterans were not significant compared to patients without mismatches. Meanwhile, Kaplan-Meier analyses showed poorer overall survival in patients with mismatch in CDC-XM for T-lymphocyte (P=0.037) and for B-lymphocyte (P=0.085) compared to patients without mismatches. The median follow-up was 246.8 days for patients without mismatches and 73.3 days for patients with mismatches.

Conclusions: HLA compatibility is important determinants of lung transplant survival, even with the small number of mismatched patients with relatively short follow-up period. HLA crossmatch should be treated considerably in lung transplantation.

Corresponding author: Jin Gu Lee
E-mail: csjglee@yuhs.ac

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Organ donation from donors with viral hepatitis in South Korea: a 2013–2017 nationwide data analysis

Hoon-sung Park¹, Eun-sil Jung², Jae-myeong Lee¹

¹Department of Surgery, Korea University College of Medicine, Seoul, Korea
²Department of Transplantation Center, Korea University Anam Hospital, Seoul, Korea

Background: The number of organ donations from hepatitis B virus (HBV)/hepatitis C virus (HCV)-positive donors is gradually increasing; however, the current status of organ donation from brain-dead donors with hepatitis in South Korea has not been analyzed. This study aimed to analyze this.

Methods: In total, 9,210 brain deaths occurred in South Korea from January 2013 to December 2017. Based on the data from the Korean Network for Organ Sharing and Korean Organ Donation Agency, 2,460 successful transplantations from brain-dead donors have been performed, of which 333 were hepatitis carriers (HBV, n=246; HCV, n=87).

Results: There were 60 and 11 transplantations from HBV- and HCV-positive brain-dead donors, respectively. The main reasons for organ transplantation failure were donation refusal (n=90), unsuitability as donors (n=80), non-brain death (n=45), and cardiac death (n=20). There were 71 and 31 kidney and liver donations, respectively; the average number of organs donated by HBV-positive donors was higher than that donated by HCV-positive donors. HBV-positive donors donated more hearts and livers than HCV-positive donors.

Conclusions: Organ donations from brain-dead donors with hepatitis are not active in South Korea, and the main reasons for failure are refusal to receive organs from donors with hepatitis and unsuitability for donation owing to concerns regarding active viral conditions. For promoting organ transplantations from donors with viral hepatitis, reducing donation refusal rates by educating recipients and their families on the outcomes of organ donation from hepatitis carriers, establishing treatment protocols for infection management after organ transplantations from HBV/HCV brain-dead donors, and accumulating relevant experience are necessary.

Corresponding author: Jae-myeong Lee
E-mail: ljm3225@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Kidney transplantation from deceased donors with bloodstream infection: a multicenter retrospective study

Hyejin Mo¹, Juhan Lee², Jae Berm Park³, Sun Cheol Park⁴, Young Hoon Kim⁵, Ahram Han⁶, In Mok Jung¹, Jongwon Ha⁶, Sangil Min⁶

¹Department of Surgery, SMG-SNU Boramae Medical Center, Seoul, Korea
²Department of Surgery, Severance Hospital, Seoul, Korea
³Department of Surgery, Samsung Medical Center, Seoul, Korea
⁴Department of Surgery, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
⁵Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea
⁶Department of Surgery, Seoul National University Hospital, Seoul, Korea

Background: The use of organs from donors with infection is limited because of the possibility of transmission. Herein, we report our experience of transplantation from deceased donors with blood stream infection (BSI).

Methods: Retrospective study of patients undergoing kidney or pancreas transplantation at five tertiary centers in Korea from January 2009 and November 2019 was performed. We analyzed the outcomes of patients who received transplantation from deceased donors who had BSI before transplantation.

Results: During study period, 88 recipients received transplantation from 70 donors with BSI. The most common isolated pathogens from donors were Gram-positive bacteria (72.8%), followed by Gram-negative bacteria (22.1%), and Fungi (5.2%). Appropriate antibiotics were used in 47.1% of donors before transplantation and in 38.6% of recipients after transplantation. In the case of bacterial infection, transmission occurred only in one of 83 recipients (1.2%). A recipient from donor with carbapenem-resistant Acinetobacter baumannii developed urinary tract infection early after transplant. The infection resolved after 7 days of targeted antibiotic therapy. In the case of fungal infection, transmission of fungal infection occurred in three out of eight recipients (37.5%). One recipient had received 7 days of antifungal therapy for Candida species after transplant; however, persistent fungemia and infected endocarditis developed and required surgical treatment. The other two recipients did not receive antifungal therapy before symptom onset and subsequently died of donor-derived scedosporiosis.

Conclusions: Using organs from donors with bacteremia seems to be a safe option with low risk of transmission. Whether to use organs from donors with fungemia should be cautiously determined.

Corresponding author: Hyejin Mo
E-mail: xaviere07@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Recipient outcomes of kidney transplantation from older living donor

Ji-Yeon Song, Kyo-Won Lee

Department of Surgery, Samsung Medical Center, Seoul, Korea

Background: As a solution to the shortage of organ supply, studies on transplantation from older kidney donor are being conducted. Still, there are many controversies about safety and efficacy about this, but sufficient research has not been made.

Methods: In Samsung Medical Center, from 2000 January to 2015 May, total 906 kidney transplantation cases were elected by inclusion and exclusion criteria and analyzed by dividing into two groups according to the age of the donor: younger group (donor age, 18–59 years) and older group (donor age, ≥60 years).

Results: There was no significant difference between the two groups in patient death and postoperative complications. Older donor group had poorer acute rejection rate (P=0.028; hazard ratio [HR], 1.733), graft failure rate (P=0.032; HR, 2.31), and 10-year estimated glomerular filtration rate (eGFR; 77.75 vs. 60.30, P=0.015). There was no significant difference between the two groups in the trend of eGFR change over time.

Conclusions: In terms of safety, there is no disadvantage in renal transplantation through an elderly donor. In terms of efficacy, poorer acute rejection, graft failure rate, and 10-year eGFR suggest that kidney transplantation through elderly donors should be carried out carefully, whereas the fact that there is no difference in the trend of eGFR change over time can lead to a conclusion that it is not inferior in efficacy either. Therefore, larger studies will need to be conducted to accurately analyze the efficacy of the elderly kidney transplant.
The protective role of protocol biopsy against chronic kidney disease progression in kidney transplantation

Okjoo Lee¹, Kyo Won Lee¹, Jae Berm Park¹, Jung Eun Lee², Na Young Hwang³, Kyunga Kim³

¹Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea
²Division of Nephrology, Department of Internal Medicine, Samsung Medical Center, Seoul, Korea
³Department of Biostatistics, Samsung Medical Center, Seoul, Korea

**Background:** Subclinical rejection is associated with chronic allograft nephropathy, which is the most common cause of allograft failure in kidney transplantation (KT). Therefore, early detection and treatment of subclinical rejection through protocol biopsy can reduce the incidence of chronic allograft nephropathy and the improvement of graft survival. This study aims to evaluate the effective early detection role of routine protocol biopsy.

**Methods:** We retrospectively analyzed 1,361 KT recipients in Samsung Medical Center between July 2007 and August 2017. Of these, pediatric cases, re-transplantations and multi-organ transplantation, cyclosporine and azathioprine users, patients who were not underwent protocol biopsy, and diagnosed rejection but not treated patients were excluded. Finally, a total of 854 adult patients who were underwent protocol biopsy were analyzed.

**Results:** Patients were divided into three groups: no protocol biopsy (n=350), single protocol biopsy group (n=207), and double protocol biopsy group (n=297). Protocol biopsy group was significant higher donor and recipient age, presence of recipient diabetes mellitus and donor hypertension, presence of donor specific antigen, and ABO incompatible KT. Protocol biopsy group showed significant difference from no protocol biopsy group in the tendency of graft function (estimated glomerular filtration rate), and protective result was shown in chronic kidney disease (CKD) progression. Especially, double protocol biopsy group showed the better protective result not only in CKD progression but also in new onset CKD. But Kaplan-Meier curve showed that protocol biopsy has not significantly benefit in graft survival and patient overall survival.

**Conclusions:** Protocol biopsy can play a protective role in CKD progression in KT recipients.

**Corresponding author:** Kyo Won Lee
**E-mail:** kw1980.lee@samsung.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Types of anti-hypertensive medication for post-transplant hypertension and risk of graft failure

Sehoon Park1, Sung Jin Kang2, Ji Eun Kim3, Yaerim Kim4, Kwangsoo Kim5, Minsu Park6, Yon Su Kim7, Yaeji Lee2, Hajeong Lee7

1Division of Nephrology, Department of Internal Medicine, Korean Armed Forces Capital Hospital, Seongnam, Korea
2Department of Applied Statistics, Chung-Ang University, Seoul, Korea
3Division of Nephrology, Department of Internal Medicine, Hanyang University Guri Hospital, Guri, Korea
4Division of Nephrology, Department of Internal Medicine, Keimyung University School of Medicine, Daegu, Korea
5Transdisciplinary Department of Medicine & Advanced Technology, Seoul National University Hospital, Seoul, Korea
6Department of Statistics, Keimyung University, Daegu, Korea
7Division of Nephrology, Department of Internal Medicine, Seoul National University Hospital, Seoul, Korea

Background: Additional study is warranted to reveal an appropriate anti-hypertensive medication treatment strategy for post-transplant hypertension in kidney transplant recipients.

Methods: The study included transplant recipients who maintained functioning graft for at least 1 year from transplantation, collected from the nationwide claims database of South Korea during 2008 to 2017. The usage of antihypertensive medications between 6 months to 1 year was the main exposure, and those who had inconsistent/transient usage of antihypertensive drugs were excluded. The prognostic outcome was death-censored graft failure and we also investigated the post-transplant major adverse cardiovascular events (MACEs) outcome.

Results: We included 8,014 patients without post-transplant hypertension and 6,114 recipients who received treatments for hypertension in the post-transplant period. Among them, 1,972 patients (33%) received multiple anti-hypertensive medications, and among single-agent users, 1,690 patients (28%) received dihydropyridine-calcium-channel-blocker, 1,807 (30%) received beta-blockers, 475 (29%) received renin-angiotensin-aldosterone-blockers, and 170 (<1%) received other types of antihypertensive medications, respectively. Those with post-transplant hypertension had significantly worse risk of death-censored graft failure than those without (hazard ratio [HR], 1.25; 95% confidence interval [CI], 1.08–1.46) than those without. In addition, those who received multiple drugs showed significantly higher MACEs risk than those who did not require anti-hypertensive treatments (HR, 1.35; 95% CI, 1.01–1.81). Among the single-agent user, those who received beta-blocker showed significantly higher risk of death-censored graft failure (HR, 1.39; 95% CI, 1.12–1.72), while those who received calcium-channel blocker showed significantly lower risks (HR, 0.81; 95% CI, 0.65–1.00) than the others. The single-agent user who received renin-angiotensin-aldosterone-blockades showed similar graft prognosis with the other medication users (HR, 0.77; 95% CI, 0.52–1.14). Among the multi-antigenic users, no significant prognostic differences were identified according to the types of anti-hypertensive medications.

Conclusions: Post-transplant hypertension is associated with poor post-kidney transplant prognosis, particularly when multiple types of medications were required for treatment. This study supports that dihydropyridine calcium-channel-blocker may be considered as the initial choice for post-transplant hypertension.

Corresponding author: Sehoon Park
E-mail: mailofsehoon@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Introducing robot-assisted laparoscopic donor nephrectomy after experience in retroperitoneal endoscopic living donor nephrectomy approach

Minh Sam Thai¹, Quy Thuan Chau², Khac Chuan Hoang², Xuan Thai Ngo¹, Trong Hien Nguyen², Kinh Luan Thai¹, Duc Huy Vu², Le Quy Van Dinh², Ho Yee Tiong³, Thanh Tuan Nguyen¹

¹Department of Urology, Cho Ray Hospital, University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, Vietnam
²Department of Urology, Cho Ray Hospital, Ho Chi Minh City, Vietnam
³Department of Urology, National University Hospital, Singapore

Background: This study aims to assess safety and efficacy of introducing robot-assisted laparoscopic donor nephrectomy (RALDN) to the standard retroperitoneal endoscopic living donor nephrectomy (RELDN) at a single institution transplant program.

Methods: Data were collected prospectively from 68 consecutive living kidney donors (14 for RALDN subgroup and 54 RELDN subgroup) at a transplant center from February 2018 to September 2019. Patient baseline demographics, radiological findings, perioperative donor outcomes, recipient outcomes, and complications were recorded, and these parameters were compared between the two surgical groups.

Results: For the entire group, mean age±standard deviation was 51.4±8.9 years (range, 29–68 years); 44.1% were males; mean body mass index (BMI) was 22.6±2.3 kg/m² (range, 15.6–27.3 kg/m²); and there were 57 (84%) left kidneys. Preoperatively, there was no significant differences (P>0.05) between the two donor groups including gender, BMI, kidney side, hilar anatomy, and American Society of Anesthesiologists status. For perioperative outcomes, there was no significant differences (P>0.05) comparing RALDN and RELDN respectively for warm ischemic time (4.7±1.4 minutes vs. 4.8±1.4 minutes), operative time (232±43 minutes vs. 217±41 minutes), hemoglobin drop (7.5±5.8 g/L vs. 8.5±7.2 g/L), postoperative complications (7.1% vs. 7.4%), the donor blood creatinine at 1 month (1.13±0.22 mg/dL vs. 1.22±0.26 mg/dL), and the recipient blood creatinine at 1 month (1.25±0.28 mg/dL vs. 1.41±0.38 mg/dL).

Conclusions: This study showed that RALDN can be safely introduced into living donor program experienced in laparoscopic donor nephrectomy.

Corresponding author: Thanh Tuan Nguyen
E-mail: Thanhtuan0131@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Analysis of time trends in preemptive kidney transplantation and effect of pre-transplant dialysis duration on graft survival: a nationwide cohort study

Jeong-Hoon Lim¹, Sang-Ho Lee², Yu Ho Lee³, Jung Pyo Lee⁴, Jaeseok Yang⁵, Myoung Soo Kim⁶, Sun-Hee Park¹, Chan-Duck Kim¹, Jang-Hee Cho¹

¹Division of Nephrology, Department of Internal Medicine, School of Medicine, Kyungpook National University, Daegu, Korea
²Division of Nephrology, Department of Internal Medicine, Kyung Hee University Hospital at Gangdong, Seoul, Korea
³Division of Nephrology, Department of Internal Medicine, Bundang CHA General Hospital, Seongnam, Korea
⁴Division of Nephrology, Department of Internal Medicine, Seoul National University College of Medicine, Seoul, Korea
⁵Department of Surgery, Seoul National University Hospital, Seoul, Korea
⁶Department of Surgery, Yonsei University College of Medicine, Seoul, Korea

Background: Preemptive kidney transplantation (KT) has advantages on graft survival, quality of life, and medical expense. However, the trend of preemptive KT over time is not known. This study analyzed the time trend of preemptive KT and the effect of pre-transplant dialysis duration on post-transplant outcomes.

Methods: Using a nationwide cohort study data from 2014 to 2019, a total of 3,392 living donor KT (LDKT) patients were enrolled. The annual proportion of preemptive KT was examined by a trend analysis. Factors associated with preemptive KT were analyzed using multivariate logistic regression. Graft survival was compared using Cox proportional hazards regression according to pre-transplant dialysis duration.

Results: Preemptive KT was 816 (24.1%) among LDKT and mean estimated glomerular filtration rate was 8.0 mg/dL/1.73 m² at the time of transplant. Transplantation year was independently associated with preemptive KT (adjusted odds ratio [aOR], 0.95; 95% confidence interval [CI], 0.89–1.00; P=0.046). KT from glomerulonephritis was a predictor of preemptive KT (aOR, 1.41; 95% CI, 1.14–1.76; P=0.002); however, desensitization was associated with non-preemptive KT (aOR, 0.67; 95% CI, 0.56–0.80; P<0.001). The annual trend analysis revealed that preemptive KT gradually decreased over time; diabetes increased whereas glomerulonephritis decreased among the underlying causes of preemptive KT (all P<0.05). Patients with dialysis longer than 6 months before KT showed an increased risk of graft failure than preemptive KT (adjusted hazard ratio, 2.54; 95% CI, 1.10–5.88; P=0.029); however, pre-transplant dialysis less than 6 months showed comparable graft survival with preemptive KT.

Conclusions: Preemptive KT is declining every year, associated with an increase in diabetes and a decrease in glomerulonephritis as underlying cause of KT. Short period of dialysis less than 6 months does not affect graft survival compared to preemptive KT; however, dialysis longer than 6 months decreases graft survival.

Corresponding author: Jang-Hee Cho
E-mail: jh-cho@knu.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Robot-assisted kidney transplantation: the initial experience of single institution in Korea

Seok Jeong Yang¹, Kyu Ha Hur², Woo Ju Jeong³, Joon Chae Na⁴, Woong Kyu Han⁴, Eun Jin Kim²

¹Division of Transplantation, Department of Surgery, Yongin Severance Hospital, Yongin, Korea
²Division of Transplantation, Department of Surgery, Yonsei University College of Medicine, Seoul, Korea
³Department of Urology, Henry Ford Hospital, Detroit, MI, USA
⁴Department of Urology, Severance Hospital, Seoul, Korea

Background: Minimally invasive approach using the robotic system has recently been introduced in kidney transplantation to reduce the morbidity of the open kidney transplantation and get rapid recovery after kidney transplantation. We have performed the first robotic kidney transplantation (RKT) in Korea. The aim of this study is to share initial experience and evaluate the surgical results of RKT performed in our institution.

Methods: A total of eight patients with end-stage renal disease underwent de novo living donor RKT (da Vinci surgical system) from 11th November 2019 to 25th April 2020 in Severance Hospital. RKT was done with regional hypothermia through a transperitoneal approach following a step-by-step description of the Vattikuti Urology Institute-Medanta technique. The demographics, perioperative and short-term transplant outcomes were analyzed.

Results: All eight patients successfully underwent RKT without open conversion or other surgical complications such as postoperative bleeding, leakage, and lymphocele. The incision length was about 7 cm. The mean console time was 301.2 minutes (range, 245–375 minutes) and cold ischemia time 38.7 minutes (range, 34–45 minutes), rewarming time 73.7 minutes (range, 54–88 minutes) were noted. There was no delayed graft function showing immediate graft function. However, two patients developed thrombotic microangiopathy. Except these unusual TMA cases, six patients were discharged in postoperative day 8 to 9 with mean creatinine 0.96 mg/dL (range, 0.68–1.27 mg/dL).

Conclusions: RKT with regional hypothermia may be a safe and effective minimally invasive approach in a selected group of patients showing good surgical outcomes.

Corresponding author: Kyu Ha Hur
E-mail: khhuh@yuhs.ac

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Impact of tacrolimus intra-patient variability on kidney transplant outcomes according to immunologic risk

Eun Jin Kim, Juhan Lee, Soo Jin Kim, Jae Geun Lee, Beom Seok Kim, Dong Jin Joo, Kyu Ha Huh, Myoung Soo Kim, Soon Il Kim, Yu Seun Kim

Division of Transplantation, Department of Surgery, Yonsei University College of Medicine, Seoul, Korea

Background: High intra-patient variability (IPV) of tacrolimus trough concentrations is increasingly recognized as a predictor of poor long-term outcomes in kidney transplant recipients. However, there is a lack of information regarding the impact of tacrolimus IPV on graft outcomes according to immunological risk. We hypothesized that tacrolimus IPV has different effects on graft outcomes based on the patient’s individualized immunological risk.

Methods: We analyzed tacrolimus IPV using the coefficient of variability from months 6–12 after transplantation in adult kidney transplant recipients. Patients were divided into two immunological risk groups based on penel reactive antibodies and presence of donor specific antibodies.

Results: A cohort of 1,080 kidney transplant recipients with 9,059 tacrolimus trough levels were analyzed. The effects of tacrolimus IPV on graft outcomes was significantly different between low and high immunological risk patients. Overall graft survival of high immunological risk group was significantly impaired with high tacrolimus IPV (P<0.001). A multivariable Cox regression confirmed high tacrolimus IPV was independent risk factor for graft loss in the high-risk group (hazard ratio [HR], 2.94; 95% confidence interval [CI], 1.42–6.08; P=0.004). High tacrolimus IPV was also significantly associated with increased risk of late-onset rejection in the high-risk group (P=0.006). In contrast, overall graft survival and cumulative probability of late-onset rejection of low immunological risk group was not significantly different according to tacrolimus IPV. Low hematocrit at 12 months was a significant risk factor for high tacrolimus IPV.

Conclusions: Tacrolimus IPV has significant impact on late-onset rejection and graft loss in patients with high immunological risk.

Corresponding author: Juhan Lee
E-mail: laplaine@yuhs.ac

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Kyeong Deok Kim, Kyo Won Lee, Sang Jin Kim, Okjoo Lee, Jieun Kwon, Eun Sung Jeong, Manuel Lim, Jaehun Yang, Jae Berm Park

Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea

Background: The use of kidneys from donation-after-brain-death (DBD) donors with acute kidney injury (AKI) is a strategy to expand the donor pool. However, debate continues about the use of donors with AKI. The aim of this study was to evaluate how kidney transplantation (KT) from a donor with AKI affects long-term graft survival in various situations.

Methods: All patients who underwent KT from DBD donors between June 2003 and April 2016 were retrospectively reviewed. The KDIGO (Kidney Disease: Improving Global Outcomes) criteria were used to classify donor AKI.

Results: The cohort included 376 donors (no AKI group, n=117 [31.1%]; AKI group, n=259 [68.9%]). The delayed graft function (DGF) rate was significantly higher in the AKI group (P<0.001) and tended to increase with AKI stage (P<0.001). Death-censored graft survival was similar according to the presence of AKI, AKI severity, and the AKI trend (P=0.929, P=0.077, and P=0.658, respectively). In addition, death-censored graft survival was similar in expanded criteria donor KT (P=0.617) and the high kidney donor profile index (≥80) group (P=0.420). In the multivariate analysis, patients whose donors had AKI who received using low dose (1.5 mg/kg for 3 days) rabbit anti-thymocyte globulin (r-ATG) as the induction agent had significantly superior death-censored graft survival compared with patients in that group who received basiliximab (P=0.039).

Conclusions: AKI in DBD donors negatively affected the DGF rate. However, it did not affect long-term death-censored graft survival. Low-dose r-ATG can be used for induction immunosuppression in recipients receiving kidneys with AKI because it showed better graft survival than basiliximab.

Corresponding author: Kyo Won Lee
E-mail: kw1980.lee@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Changes of T lymphocyte subsets after kidney transplantation according to induction immunosuppressants

Hyung Duk Kim¹, Hyunjoo Bae², Chul Woo Yang¹, Eun-Jee Oh³, Byung Ha Chung¹

¹Division of Nephrology, Department of Internal Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
²Department of Biomedical Science, College of Medicine, The Catholic University of Korea, Seoul, Korea
³Department of Laboratory Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Background: The aim of this study is to investigate the change of T cell subsets during early post-transplant period according to the type of induction therapy (anti-thymocyte globulin [ATG] vs. basiliximab).

Methods: We conducted prospective observational study for 174 patients who underwent kidney transplantation and in Seoul St. Mary’s Hospital from May 2018 to January 2020. A baseline blood sample was collected within 5 days before the kidney transplant, and additional blood samples were collected and analyzed at 4 weeks and 12 weeks after the kidney transplant. Flow cytometric study of peripheral blood mononuclear cells was performed using anti-CD3, -CD4, -CD57, -CD127, -CD161, -CD45RA, and -CCR7 in order to analyze T cell subsets. We compared the change of each T cell subsets between patients who took ATG (n=61) and basiliximab (n=113).

Results: At baseline, all of the CD4+ and CD8+ T cell subsets did not show significant differences. However, changing pattern of T cell subsets showed significant difference according to the type of induction therapy at 4 weeks and 12 weeks after kidney transplantation. In the ATG group, at 4 weeks, the expression of CD4+CD161+, CD4+CD25+CD127low, and CD8+CD45RA+CCR7- T cells increased, and CD8+CD28nullCD57+ T cells decreased. At week 12, CD4+CD161+, CD4+CD25+CD127low, CD8+CD45RA+CCR7-, CD8+CD45RA-CCR7- T cells significantly increased and CD8+CCR7+ T cells decreased. In basiliximab group, CD8+CCR7+ T cell expression decreased and CD8+CD45RA-CCR7- T cell increased at 12 weeks compared to baseline.

Conclusions: In this study, we observed CD4+CD161+ and CD4+CD25+CD127low T cells activation and increase of CD8+CD45RA+CCR7- T cells in patients with ATG induction in comparison with basiliximab. The correlation between T cell subset changes and clinical outcome could not be confirmed in our study. Further long-term study is required to determine the effect of T cell subsets changes on clinical outcomes.

Corresponding author: Hyung Duk Kim
E-mail: scamph@catholic.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The clinical impact of preformed human leukocyte antigen-DQ donor-specific antibodies on graft outcomes in kidney transplantation

Sua Lee¹, Byung Ha Chung², Chul Woo Yang²

¹Division of Nephrology, Department of Internal Medicine, Seoul National University Hospital, Seoul, Korea
²Division of Nephrology, Department of Internal Medicine, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Background: De-novo human leukocyte antigen (HLA)-DQ donor-specific antibody (DSA) is well known as a risk factor for graft dysfunction and graft loss in kidney transplantation (KT). Recently, the influence of preformed HLA-DQ DSA has been discussed. This study aimed to investigate the clinical impact of preformed HLA-DQ DSA on graft outcomes.

Methods: We evaluated 1,303 recipients who underwent KT at Seoul St. Mary’s Hospital from January 2010 to December 2018. ABO incompatible KT was excluded. Finally, 990 recipients were included. According to the result of DSA using Luminex single antigen bead assay, recipients were classified as no DSA, only DQ, and only non-DQ groups. Primary outcome was biopsy-proven acute antibody-mediated rejection (AMR).

Results: Recipients were classified as no DSA (903 recipients, 91.2%), only DQ (23 recipients, 2.3%) and only non-DQ (56 recipients, 5.7%). The incidence of acute rejection in only DQ and only non-DQ groups were significantly higher than in no DSA group (P=0.047 and P=0.021, respectively). Especially, the incidence of acute AMR in only DQ and only non-DQ groups were significantly higher than in no DSA group (P=0.028 and P<0.001, respectively). In logistic regression analysis, the presence of anti-HLA DQ DSA was presented as a risk factor for increased incidence of acute AMR (hazard ratio, 1.72; P=0.029). In Kaplan-Meier analysis, the cumulative incidences of acute AMR in only DQ and only non-DQ groups were significantly higher than in no DSA group (P=0.010 and P<0.001, respectively). There were no significant differences in graft loss and mortality.

Conclusions: Preformed anti-HLA DQ DSA could affect the development of acute rejection, especially acute AMR, as much as anti-HLA A, B and DR DSA. Therefore, the identification of preformed HLA-DQ DSA can help improve graft outcomes.
The clinical utility of preformed C1q-binding donor-specific anti-HLA antibodies in kidney transplantation

Sua Lee¹, Chul Woo Yang², Byung Ha Chung²

¹Division of Nephrology, Department of Internal Medicine, Seoul National University Hospital, Seoul, Korea
²Division of Nephrology, Department of Internal Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Background: The role of C1q-binding donor-specific antibody (DSA) in antibody-mediated rejection (AMR) is considered important. De novo C1q-binding DSA is well known as an associated factor for increased risk of AMR and graft loss. However, the impact of preformed C1q-binding DSA is not yet clear. We investigated the clinical utility of identification of preformed C1q-binding DSA for predicting graft outcomes in kidney transplantation (KT).

Methods: From December 2016 to December 2019, 373 recipients underwent living-donor KT at St. Mary’s Hospital. If the result of panel reactive antibody was positive in the pre-transplant, DSA and C1q-binding DSA were performed using Luminex single antigen bead assay. According to the presence of C1q-binding DSA, recipients were classified as C1q-positive and C1q-negative groups. Primary outcome was biopsy-proven acute AMR.

Results: Of 373, 75 recipients (20.1%) had preformed DSA. Among them, 16 recipients (4.3%) had preformed C1q-binding DSA. C1q-positive group had more positive panel reactive antibody (PRA) class II and DSA class II with statistical significance (P=0.036 and P=0.050, respectively). DSA class II mean fluorescence intensity in C1q-positive group was significantly higher than in C1q-negative group (median [interquartile range], 13,796 [10,746–22,883] vs. 5,055 [1,247–7,697]; P<0.001). The incidence of acute rejection in C1q-positive group was significantly higher than in C1q-negative group (P=0.037 and P=0.040, respectively). In Kaplan-Meier analysis, the cumulative incidence of acute AMR in C1q-positive group was significantly higher than in C1q-negative group (P=0.012). In univariate logistic regression analysis, C1q-binding DSA was related with an increased risk of acute AMR (hazard ratio, 3.81; P=0.023).

Conclusions: Preformed C1q-binding DSA would be associated with an increased risk of acute AMR. Surveillance, such as protocol allograft biopsy, can help to detect acute AMR early in recipients with preformed C1q-binding DSA.

Corresponding author: Sua Lee
E-mail: soulmysoul27@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Cysteine as a potential donor urinary biomarker for donor acute kidney injury and recipient early graft function

Chris Tae Young Chung, Hyunmin Ko, Hyo Kee Kim, Kwangwoo Choi, Ahram Han, Sangil Min, Jongwon Ha

Division of Transplantation, Department of Surgery, Seoul National University Hospital, Seoul, Korea

Background: In deceased donor kidney transplantation, there is an increase in the use of marginal kidneys from donors with acute kidney injury with higher chance of delayed graft function (DGF). N-acetyl cysteine, a prodrug to cysteine and also a precursor to intracellular antioxidant glutathione, is known to have protective effects in different models of ischemic reperfusion injury. In this study, we aim to investigate cysteine as a potential donor urinary biomarker to predict acute kidney injury in donors and early graft function in recipients.

Methods: Kidney transplant recipients from deceased donors with urine samples at a single institution from 2015 to 2019 were included. Cysteine analysis was performed using a cysteine targeting fluorescence probe from previous studies. Donor risk factors associated with donor acute kidney injury (AKI) and short term outcomes such as DGF, acute rejection and graft function over time were analyzed using multivariate logistic regression.

Results: Ninety-one patients who underwent deceased donor kidney transplantation had donor urine samples. The mean fluorescent intensity of cysteine in urine samples from these cadaver donors was higher compared to that of normal living donors (3,145 vs. 687.3 AU; P<0.001). In the multivariate analysis, donor factors significantly associated with AKI of donors were final serum creatinine before organ procurement, cold ischemic time and cysteine level <1,500. Within the donor AKI group, cysteine level >1,500 was associated with acute rejection in the protocol biopsy at postoperative day 10.

Conclusions: This study provides the hypothesis that cysteine levels in cadaver donors increase in response to ischemic damage and decreases in order to reduce ischemic damage in donors with AKI. Donor urinary cysteine could be a potential predictive factor for donor AKI, early acute rejection and possibly DGF with the support of future in vivo and clinical studies.

Corresponding author: Chris Tae Young Chung
E-mail: tylight8@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The effects of long-term eplerenone treatment in pediatric renal transplant patients

Esra Baskin¹, Kaan Gulleroglu¹, Handan Ozdemir², Aysun C Yilmaz¹, Ebru Ayvazoglu Soy³, Gokhan Moray³, Mehmet Haberal³

¹Department of Pediatric Nephrology, Baskent University Hospital, Ankara, Turkey
²Department of Pathology, Baskent University Hospital, Ankara, Turkey
³Department of General Surgery, Baskent University Hospital, Ankara, Turkey

Background: Previous data strongly suggest that mineralocorticoid receptor (MCR) antagonists prevents acute kidney injury, proteinuria, and progressive renal disease. However, there is little information about this approach in renal transplant patients. Eplerenone is a potent and high selective MCR antagonist. In this study we aimed to investigate the effect of long-term eplerenone administration in children with chronic allograft dysfunction.

Methods: Twenty-five of 165 renal transplant children with biopsy-proven chronic allograft dysfunction and glomerular filtration rate >40 mL/min/1.73 m² were included to the study. Eight patients received additional 25 mg/day eplerenone for 3 years (group 1), 17 patients did not receive eplerenone (group 2). Kidney biopsy samples were evaluated at baseline and after 36 months. The outcomes and laboratory findings of patients were compared.

Results: There were no differences in age, sex, type of immunosuppression, donor type, follow-up time, and serum K levels. Although basal serum creatinine values and spot urine protein-creatinine ratio were similar in both groups, they increased significantly in group 2 at 36 months (P<0.05).

Conclusions: Our study showed that the long-term eplerenone administration decreased proteinuria and attenuates the progression of chronic allograft dysfunction in selected pediatric transplant patients. Further studies are needed for determining the potential benefit of MCR antagonists in pediatric patients.

Corresponding author: Esra Baskin
E-mail: rectorate@baskent.edu.tr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Retroperitoneal *Viscum album* extract injection in high drain output patient after renal transplantation

Youngjun Park¹, Mihyeong Kim², Kangwoong Jun³, Jeongkye Hwang², Sangdong Kim⁴, Suncheol Park¹, Jiil Kim⁵, Sangseob Yoon¹, Insung Moon⁶

¹Division of Transplantation, Department of Surgery, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
²Division of Transplantation, Department of Surgery, Eunpyeong St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
³Division of Transplantation, Department of Surgery, Bucheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Bucheon, Korea
⁴Division of Transplantation, Department of Surgery, Incheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Incheon, Korea
⁵Division of Transplantation, Department of Surgery, Uijeongbu St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Uijeongbu, Korea
⁶Division of Transplantation, Department of Surgery, Yeouido St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

**Background:** After renal transplantation, high drain output of lymph fluid is one of the causes of delaying postoperative recovery with longer hospital stay. *Viscum album* extract (sold under the brand name Helixor M) is one of the agents used in pleurodesis procedure when treating malignant pleural effusion, and we evaluated efficacy of this agent in reducing drainage volume and incidence of lymphocele after renal transplantation.

**Methods:** We retrospectively reviewed medical records of patients with high drain output (>100 mL at postoperative day [POD] 7) after renal transplantation who underwent *Viscum album* extract injection via drain (n=23) or conservative care (n=23). The primary end point is reduced volume in drain output at POD 14 from POD 7. The secondary end point was postoperative recovery as reflected by the duration of hospitalization and incidence of lymphocele during 3 months after operation.

**Results:** Reduction in drain output at POD 14 from POD 7 was larger in the *Viscum album* extract injection group than in the conservative care group (226.5 mL vs. 83.3 mL; P=0.010). Duration of hospitalization after operation was shorter in the *Viscum album* extract injection group than in the conservative care group (16.0 days vs. 19.5 days; P=0.012). Ratio of patients who discharge with drain kept was also less in the *Viscum album* extract injection group than in the conservative care group (17.4% vs. 52.2%; P=0.029).

**Conclusions:** In this study, reduction in drain output at POD 14 from POD 7 was larger and duration of hospitalization was shorter after renal transplantation when *Viscum album* extract was injected via drain, suggesting that *Viscum album* extract injection could be considered for faster postoperative recovery in high drain output patients after renal transplantation.

**Corresponding author:** Youngjun Park  
**E-mail:** cmc201133035@gmail.com

© The Korean Society for Transplantation  
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Changes in recipient body mass index for the first year after kidney transplantation are associated with intrapatient variability of tacrolimus concentration and long-term graft function

Hyunmin Ko, Chris Tae Young Chung, Hyo Kee Kim, Kwang Woo Choi, Ahram Han, Jongwon Ha, Sangil Min

Department of Surgery, Seoul National University Hospital, Seoul, Korea

**Background:** The aim of this study was to investigate the 5-year outcome of kidney transplant recipient according to the weight changes for the first year after kidney transplantation.

**Methods:** Data were retrospectively collected for 289 kidney transplant recipients between January 2012 and December 2014 in Seoul National University Hospital. Body mass index (BMI) was assessed at pre-transplant and before discharge, 1-month, 3-month, 6-month, and 12-month post-transplant. Intrapatient variability (IPV) was calculated as a coefficient of variation (CV), and outcome was evaluated as graft survival, estimated glomerular filtration rate (eGFR), and viral infection. The two groups according to the BMI changes during 1 year were divided as follows: group I (BMI change ≤−1.5 kg/m$^2$ or ≥+1.5 kg/m$^2$) and group II (−1.5 kg/m$^2$ < BMI change <+1.5 kg/m$^2$).

**Results:** BMI declined to its lowest level at discharge (21.04±3.59 kg/m$^2$) and gradually increased to one year (22.38±3.18 kg/m$^2$). There was no significant correlation between IPV and BMI change (rho=0.19, P=0.757). However, the proportion of patients with high IPV (CV>25%) was higher in group I (P=0.008). There was no difference in graft survival between the two groups (P=0.646). The amount of change in eGFR (5-year eGFR to 1-year eGFR) tended to decrease to −3.29±25.65 mL/min/1.73 m$^2$ (P=0.185) in group I, whereas it tended to slightly increase to 0.78±18.38 mL/min/1.73 m$^2$ (P=0.583) in group II. However, there was no statistically significant difference between the two groups (P=0.154). There was no significant difference between the two groups in the incidence of viral infection (any virus, P=0.928; cytomegalovirus, P=0.830).

**Conclusions:** Our data demonstrated that recipients were more likely to have high IPV when the change in BMI was greater than ±1.5 kg/m$^2$ during 1 year after kidney transplantation. In addition, there was a tendency for the 5-year eGFR to decrease in those patients.

**Corresponding author:** Hyunmin Ko
**E-mail:** kohyunmin@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Low dose anti-thymocyte globulin versus basiliximab as induction in standard risk kidney transplant patients: 5-year follow-up

Candy Cahilog, Romina Danguilan, Paolo Miguel David, Mel-Hatra Arakama, Glenda Eleanor Pamugas

Department of Adult Nephrology, National Kidney and Transplant Institute, Quezon City, Philippines

Background: Kidney transplantation has significantly improved survival and quality of life of patients with end-stage renal disease and is considered the best form of renal replacement therapy. Rabbit anti-thymocyte globulin (rATG) has commonly been reserved for high immunologic risk patients and the resulting profound depression in immune response is associated with an increased risk for infection.

Methods: A retrospective cohort of patients transplanted from June 2012 to December 2014 was done to evaluate the short- and long-term outcome and efficacy of low dose rATG versus basiliximab as induction. CNI-based triple immunosuppression was given to the majority of patients.

Results: Among 165 patients in the study, 131 were given basiliximab and 34 were given low dose rATG (1–1.5 mg/kg/day for 3 days). The two groups were similar in mean age, native kidney disease, and cytomegalovirus (CMV) status. Higher proportion of patients who received rATG had positive panel reactive antibody (P=0.0003), higher human leucocyte antigen mismatches (P=0.0023), and non-related donors (P=0.025). Low dose rATG and basiliximab as induction therapy resulted in comparable outcomes including DGF, graft function, proteinuria, incidence of acute rejection and post-transplant malignancy. Incidence of infection was significantly higher in basiliximab group at 3-year post-KT: 11.5% vs. 0, P=0.04. CMV infection occurred very low at an overall rate of 0.6% at 1- and 3-year post-KT. Graft and patient survival at 5-year post-KT were 96.9% vs. 97.1%, P=0.99 and 99% vs. 100%, P=0.57, respectively.

Conclusions: Both low dose rATG and basiliximab induction resulted in excellent long-term outcomes. Low dose rATG was not associated with higher infection rates and can be used safely in standard risk patients.

Corresponding author: Candy Cahilog
E-mail: candycahilogmd@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Usefulness of pre- and post-transplant BK virus-specific ELISPOT assay for predicting the outcome of BK virus infection in kidney transplant recipients

Eun Jeong Ko¹, Hyunjoon Bae², Ki Hyun Park², Chul Woo Yang¹, Byung Ha Chung¹, Eun-Jee Oh²

¹Division of Nephrology, Department of Internal Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea
²Department of Laboratory Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Background: To investigate if BK virus (BKV)-specific T cell immunity measured by an interferon-γ enzyme-linked immunospot (ELISPOT) assay at pre- and post-transplant can predict the outcome of BKV infection in kidney transplant recipients (KTRs).

Methods: We included 60 KTRs with BK viremia and checked BKV ELISPOT assay at pre- and post-transplant 1 month, 3 months, and the time of BKV viremia detected. All participants were divided into persistent-viremia group (>3 months) and cleared-viremia group (<3 months) according to sustained duration of BKV infection. We compared pre- and post-transplant BKV-ELISPOT results against five BKV peptide mixes (LT, St, VP1–3), and fluorescence-activated cell sorting (FACS) of immune cell results.

Results: The pre-transplant BKV-ELISPOT results were lower in persistent-viremia group than those of cleared-viremia group (P=0.054). Also, they tends to be lower in BKV-associated nephropathy (BKVN) group compared to those of No-BKVN group (P=0.133). At the time of the first BK viremia detected, BKVN group had tendency of lower St, VP1-ELISPOT results compared to No-BKVN group (P=0.075, P=0.071, respectively). In FACS analysis at the time of viremia, persistent-viremia group showed higher portion of CD8+ T cell, and CD3+CD4+CD57+CD28nullCD161+ cell compared to cleared-viremia group (P=0.014, P=0.019, respectively).

Conclusions: Pre- and post-transplant BKV-ELISPOT assay may be effective in predicting clinical outcomes of BKV infection in terms of clearance of BKV and development of BKVN.

Corresponding author: Eun Jeong Ko
E-mail: neat0505@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
COVID-19 infection in kidney transplant recipients: report from two centers of Bangladesh

Nura Afza Salma Begum¹, Tasnuva Sarah Kashem¹, Farnaz Nobi Rima¹, Shakib Uz-Zaman Arefin³, Kamrul Islam², Rezwanur Rahman², Harun Ur Rashid¹

¹Department of Nephrology and Transplantation, Kidney Foundation Hospital and Research Institute, Dhaka, Bangladesh
²Department of Nephrology, Urology and Transplantation, Center for Kidney Diseases and Urology, Dhaka, Bangladesh

Background: The novel coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) had affected people around the globe including transplant recipients. Here we report our experience of coronavirus 2019 (COVID-19) infection in kidney transplant recipients of Bangladesh.

Methods: This prospective observational study was performed in two specialized kidney hospitals of Dhaka, Bangladesh from May 2020 to August 2020.

Results: In these two centers about 1,043 kidney transplant recipients were regularly followed up. Among them 31 patients (2.97%) developed COVID-19 infection during the study period. Of them 23 patients were test positive and the remaining test negative but suspected clinically and radiologically. Average age of recipients was 38.3±6.9 years (23–53). Twenty-eight recipients were male (90.3%) and three were female (9.7%). Fever was the most common presentation (100%), followed by cough (80.6%), shortness of breath (35.5%), diarrhoea (12.9%), generalized weakness (12.9%), loss of taste (9.7%), headache (6.5%), body ache (6.5%), throat pain (3.2%), chest pain (3.2%), abdominal pain (3.2%), and orbital cellulitis (3.2%). On investigation, leukocyte count was normal in 77% cases and raised in 19.2% cases and lymphopenia was observed in 69.2% cases. C-reactive protein (CRP) was found high in 63.6% recipients. Chest X-ray showed pneumonic changes in 80.6% (25/31) cases. Flavipiravir was given to 20 transplant recipients (64.5%). Five patients (16.1%) developed acute kidney injury (AKI); one patient improved and four patients (80%) had died, three patients required dialysis. The overall mortality rate was 22.6% (7 out of 31); three patients had severe AKI (42.8%), two developed acute respiratory distress syndrome (28.6%) and two developed cerebrovascular disease (28.6%).

Conclusions: In summary kidney transplant recipients in our centers had a higher rate of COVID-19 infection and higher rate of mortality than the general population (22.6% vs. 1.4%). Patients who developed AKI had a higher mortality rate.

Corresponding author: Nura Afza Salma Begum
E-mail: nuraafzanupur@yahoo.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
ABO incompatible kidney transplant after recovery from severe COVID-19 pneumonia

Irawati Waghmare, Ashay Shingare, Madan Bahadur

Department of Nephrology, Jaslok Hospital and Research Centre, Mumbai, India

**Background:** In the current coronavirus 2019 (COVID-19) pandemic, hemodialysis patients are at increased risk of acquiring COVID-19 infection. Many patients awaiting transplant may have already contracted COVID-19 infection. Hence, deciding the “right time” to transplant is important.

**Methods:** We describe the first case report of a patient who recovered from severe COVID-19 infection and later successfully underwent living donor ABO incompatible (ABOi) kidney transplant (KT).

**Results:** A 46-year-old man on hemodialysis was planned for ABOi KT, with mother as prospective donor. Unfortunately, the patient developed COVID-19 pneumonia on May 11, 2020 and required intensive care unit care with noninvasive ventilator support in the second week of infection. He recovered clinically and nasopharyngeal swab was negative on June 14, 2020. However, due to persistently high C-reactive protein (CRP) and D-dimer, we waited for additional 2 months after COVID-19 negative report till markers had settled. By this time, markers had decreased from peak CRP 67.55 mg/L and D-dimer 3,970 ng/mL to nadir CRP 6.9 mg/L and D-dimer 881 ng/mL high. Baseline anti-B titers were IgM 1:64 and IgG 1:2048. Three plasma exchange sessions and one session of 7.5 hours of double filtration plasmapheresis were done. Anti-B antibody titers decreased to IgM nil and IgG 1:4 and he underwent B to O blood group ABOi KT on August 14, 2020. Surgery and post-transplant period were uneventful. At 1-month post-transplant, his serum creatinine was 1.03 mg/dL.

**Conclusions:** In recent COVID-19 recovered patients undergoing KT, ongoing inflammatory and procoagulatory states are additional risk factors for rejection and acute tubular injury. We suggest monitoring of inflammatory and procoagulatory markers in post-COVID-19 infection period and to plan KT only after these markers have settled. In high risk ABOi transplant, the use of anti-blood group immunoadsorption column offers selective removal of anti-blood group antibodies and would theoretically preserve the protective anti-COVID-19 antibodies.

**Corresponding author:** Irawati Waghmare
**E-mail:** kanki4u@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Serum antibody screening for non-human leukocyte antigen antibodies associated with antibody-mediate rejection reveals significance of anti-collagen type I and type III antibodies

Sehoon Park¹, Seung-Hee Yang², Jiyeon Kim², Semin Cho³, Sang-il Min⁴, Jongwon Ha⁴, Yon Su Kim³, Kyung Chul Moon⁵, Eun Young Seong⁶, Hajeong Lee³

¹Division of Nephrology, Department of Internal Medicine, Korean Armed Forces Capital Hospital, Seongnam, Korea
²Kidney Research Institute, Seoul National University Hospital, Seoul, Korea
³Department of Internal Medicine, Seoul National University Hospital, Seoul, Korea
⁴Division of Transplantation, Department of Surgery, Seoul National University Hospital, Seoul, Korea
⁵Department of Pathology, Seoul National University Hospital, Seoul, Korea
⁶Department of Laboratory Medicine, Seoul National University Hospital, Seoul, Korea

Background: Additional study is warranted to determine the clinical significance of various non-human leukocyte antigen (HLA) antibodies on their association with the antibody-mediated rejection (ABMR) in kidney allografts.

Methods: The study included transplant recipients in one of the tertiary hospitals in Korea. We collected post-transplant sera from 68 ABMR, 67 T-cell mediated rejection (TCMR), and 83 controls without rejection cases and screened titers 39 non-HLA antibodies. We compared the non-HLA antibody titers among the study groups. We investigated their association with the risk of death-censored graft failure within the ABMR cases.

Results: The ABMR cases were diagnosed in later periods from transplantation and had a higher proportion of HLA-mismatched or HLA donor-specific antibody (DSA) positive cases when compared to the controls. Among the measured antibodies, anti-collagen type I (P=0.001) and type III antibody (P<0.001) titers were significantly higher in the ABMR cases when compared to the TCMR or no rejection controls. The both titers of anti-collagen type I (per 1 standard deviation [SD]; adjusted odds ratio [OR], 10.45; 95% confidence interval [CI], 2.52–66.62) and type III (per 1 SD; adjusted OR, 5.88; 95% CI, 1.84–28.98) antibody were significantly associated with presence of ABMR even after adjusting the presence of HLA-DSAs or other clinicopathologic findings. Within the ABMR group, a higher titer of anti-collagen type I (adjusted hazard ratio [HR], 1.82; 95% CI, 1.28–2.58) or type III (adjusted HR, 1.53; 95% CI, 1.14–2.07) antibody was associated with higher risk of death-censored graft failure.

Conclusions: Post-transplant anti-collagen I and collagen III antibodies may be novel non-HLA antibodies that are related to ABMR of kidney allografts.

Corresponding author: Sehoon Park
E-mail: mailofsehoon@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Clinical impact of complement deposition findings on biopsies in acute rejection episodes of pediatric renal transplant patients

Kaan Gulleroglu¹, Esra Baskin¹, Handan Ozdemir², Aysun C Yilmaz¹, Ebru Ayvazoglu Soy³, Gokhan Moray³, Mehmet Haberal³

¹Department of Pediatric Nephrology, Baskent University Hospital, Ankara, Turkey
²Department of Pathology, Baskent University Hospital, Ankara, Turkey
³Department of General Surgery, Baskent University Hospital, Ankara, Turkey

Background: Complement as a part of innate immunity, plays an important role in immune pathologies. Complement C3 activation is related with renal fibrosis. Locally synthetized C3 is more effective than circulating C3 on rejection. C4d staining is accepted as a histological finding of humoral rejection. We evaluate clinical impact of complement deposition findings on biopsies in acute rejection episodes of pediatric renal transplant patients.

Methods: Demographics of the patients, graft functions, infections, acute rejection episodes, and graft loss were recorded from data files of 165 pediatric renal transplant patients. Ninety-eight renal biopsies findings were retrospectively evaluated.

Results: Thirty-three (20 males and 13 females) patients with kidney transplant had different acute rejection episodes (32 cellular acute rejection episodes/12 humoral acute rejection episodes) which proven by biopsy. Mean age of patients with acute rejection episodes at the time of the transplantation was 12.82±3.87 years. Mean follow-up time after transplantation was 7.46±4.79 years. Glomerular filtration rate (GFR) value at 3 years of follow-up was 64.13±20.86 mL/min and 5 years of follow-up was 41.40±27.18 mL/min. Complement deposition (C1q, C3 and C4 staining) was positive in 22 patients. Twenty-six patients had graft fibrosis. A significant relation between complement deposition and graft fibrosis could not be demonstrated. GFR values were similar at 3 and 5 years of follow-up between patients with and without complement deposition. All patients had a significant decrease in GFR value during follow-up. Patients who had not fibrotic changes in first biopsy had same deterioration of GFR when compared with patient who had fibrotic changes in first biopsy. Graft fibrosis rates were similar for cellular (78.12%) and humoral (75.00%) acute rejection episodes.

Conclusions: Our data demonstrated that graft outcomes and graft loss after acute rejection episodes cannot be predicted with complement deposition on graft during rejection episode or graft fibrosis. Each patient must be evaluated independently. Future studies can be helpful for determining dependent indicators of graft outcomes.

Corresponding author: Kaan Gulleroglu
E-mail: rectorate@baskent.edu.tr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Long-term outcomes of renal transplantation in pediatric patients

Aydincan Akdur¹, Esra Baskin², Ozlem Y Aksoy², Kaan Gulleroglu², Feza Yarbug Karakayali¹, Ebru Ayvazoglu Soy¹, Gokhan Moray¹, Mehmet Haberal¹

¹Department of General Surgery, Baskent University Hospital, Ankara, Turkey
²Department of Pediatric Nephrology, Baskent University Hospital, Ankara, Turkey

Background: Renal transplantation is the best option for treatment of children with end-stage renal disease and it provides a long-term survival. However the chronic immunosuppression exposes children to multiple complications and side effects. Long-term outcome results are scarce. We aimed to analyze retrospectively long-term outcomes and characteristics of 184 pediatric renal transplant recipients at our center.

Methods: In 1975, we performed the first living-related renal transplant in Turkey which was also a pediatric kidney transplant. Since 1975 we have performed 3,109 kidney transplantation at Hacettepe University (1975 to 1985) and Baskent University, 360 of them were pediatric kidney transplantation. Medical records of the pediatric patients who underwent renal transplantation between 1999 to 2020 were retrospectively analyzed at single center. One hundred eighty-four pediatric renal transplant recipients were defined as study group. Medications, rejection episodes, patient and graft survival rates, complications such as hypertension, obesity, diabetes mellitus, growth retardation, and infections were recorded.

Results: Mean age of the patients was 13.8±6.7 (range, 1.5–21 years). One hundred two of 184 pediatric transplant patients were male and 82 were female. The follow-up period ranged from 6 to 245 months (mean, 69.1±38.8 months). Donor types were living-related in 77% (141 patients) and deceased donor in 23% (43 patients). Immunosuppressive medications were tacrolimus in 122 patients, cyclosporine-A in 56 patients, sirolimus in three patients, and everolimus in three patients. Induction treatment was administered to 51 of the subjects. The 1-, 3-, 5-, 10-, and 15-year graft survival rates were 99%, 92%, 86%, and 76%, respectively, and the 1-, 3-, 5-, 10-, and 15-year patient survival rates were 100%, 98%, 95%, and 92%, respectively. Hypertension was defined in 53 (29%), infections in 52 (28.8%), obesity in 24 (13%), new-onset diabetes in 7 (3.8%), growth failure in 7 (3.8%) patients. Overall mortality was 2.7%.

Conclusions: Kidney transplantation in pediatric patients is successful and long-term outcomes have improved significantly over the years. Advanced immunosuppressive strategies, improved peri- and post-transplantation care, closer monitoring of patients and better donor selection have led to an enhanced graft and patient survival rate. Our current objective should be achievement of optimal patient and graft survival rates with low rate of complications.

Corresponding author: Aydincan Akdur
E-mail: rectorate@baskent.edu.tr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Risk factors and outcomes of urinary tract infections after pediatric renal transplant

Kaan Gulleroglu¹, Esra Baskin¹, Aysun C. Yilmaz¹, Aydincan Akdur², Gokhan Moray², Mehmet Haberal²

¹Department of Pediatric Nephrology, Baskent University Hospital, Ankara, Turkey
²Department of General Surgery, Baskent University Hospital, Ankara, Turkey

**Background:** Recurrent urinary tract infections are a common and important problem after renal transplant. We evaluate risk factors and outcomes of urinary tract infections after pediatric renal transplant.

**Methods:** We retrospectively evaluated the data files from 165 pediatric renal transplant patients. Patients with and without urinary tract infections after renal transplant were divided into two groups. Demographics of the patients, graft functions, infections, acute rejection episodes, and graft loss were recorded.

**Results:** One hundred sixty-five children (92 males and 73 females) with kidney transplant were enrolled to the study, 61 of them had urinary tract infection after renal transplant. Mean age at the time of the transplantation was 12.92±4.73 years. Mean follow-up time after transplantation was 6.36±4.45 years. Mean episode of urinary tract infection was 3.60±3.05 episode/patient. Although urinary tract infections rate was significantly higher in patients with lower urinary tract dysfunction, 35% of patient without lower urinary tract dysfunction had urinary tract infection after renal transplant. Urinary tract infection risk was 2.58 times higher for girls when compared with boys. There was any significant difference between two groups for immunosuppressive treatment. Glomerular filtration rate (GFR) values at 3 years (76.10±31.30 mL/min vs. 76.74±30.20 mL/min; P=0.90) and 5 years of follow-up (68.43±33.50 mL/min vs. 59.63±32.15 mL/min; P=0.20) of two groups was similar. There was any significant difference between two groups for rejection episodes. Eight patients (4.84%) were lost their graft during 5 years of follow-up. Three of these patients was also in urinary tract infection group and one of them has lower urinary tract dysfunction.

**Conclusions:** Lower urinary tract dysfunction and female gender are major risk factors for recurrent urinary tract infections after renal transplant. Renal transplant has similar outcomes, with similar GFR levels and acute rejection episode rate in children with and without urinary tract infection. Close monitoring, adequate treatment and appropriate prophylaxis of urinary tract infection will improve outcomes of renal transplant.

**Corresponding author:** Kaan Gulleroglu
E-mail: rectorate@baskent.edu.tr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Success rate of grafts with multiple renal vessels in 3,136 kidney transplants

Emre Karakaya, Aydincan Akdur, Ebru Ayvazoglu Soy, Gokhan Moray, Mehmet Haberal

Department of General Surgery, Baskent University Hospital, Ankara, Turkey

Background: Multiple renal vessels are often detected in living and deceased organ donors. In the past, transplant with multiple renal vessel grafts has been a contraindication because of high vascular and urological complication rates. However, improvements in vascular reconstruction and anastomosis techniques have allowed graft function to be maintained for many years. Here, we retrospectively evaluated transplant of multiple renal vessel grafts and graft survival and postoperative vascular and urological complications.

Methods: From November 1975 to July 2020, there were 3,136 renal transplants (716 deceased donors and 2,420 living donors) performed in our center. There were 2,167 living donors and 643 deceased donors with single renal vessel grafts and 253 living donors and 73 deceased donors with multiple renal vessel grafts. For anastomoses, external iliac, internal iliac, common iliac, and inferior epigastric arteries, and external iliac veins were used. Cold ischemia time, anastomosis time, postoperative vascular and urological complications, acute tubular necrosis, creatinine clearance, serum creatinine levels, graft rejection episodes, and graft and patient survival rates were evaluated.

Results: With regard to creatinine clearance, cold ischemia and anastomosis time, acute tubular necrosis, rejection episodes, and 1-, 2-, and 5-year post-transplant serum creatinine levels, there were no significant differences between the groups. Graft survival rates in the single renal vessel group were 92.9% at 1-year post-transplant and 78.3% at 5-year post-transplant; rates in the multiple renal vessel group were 93.1% at 1-year and 79.7% at 5-year. The corresponding patient survival rates were 95.5% (1-year) and 92.9% (5-year) for the single renal vessel group and 96.9% (1-year) and 87.2% (5-year) for the multiple renal vessel group.

Conclusions: Improved anastomosis and reconstruction techniques have allowed the safe transplant of multiple renal vessel grafts that may remain functional for many years.

Corresponding author: Emre Karakaya
E-mail: rectorate@baskent.edu.tr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Post renal transplant hyperparathyroidism: Indian experience

Dwarak Sampathkumar, Krishnaswamy Sampathkumar, Andrew Rajiv, Shakthi Kumar, Senthil Kumar, Hitesh Desai, Harsha Hanumaiah

Department of Nephrology, Meenakshi Mission Hospital and Research Centre, Madurai, India

**Background:** Progressive chronic kidney disease (CKD) results in secondary hyperparathyroidism (SHPT). After a successful renal transplant, theoretically SHPT should rapidly regress. But residual parathyroid overactivity may persist. Indian reports of post-transplant hyperparathyroidism (PTHP) are sparse.

**Methods:** A cross sectional study was undertaken to identify the prevalence, clinical features, and risk factors for PTHP. One hundred twelve consecutive patients who underwent renal transplantation in our unit from 2014 to 2018 and completed 3 months of post-transplant period were included. We excluded patients with allograft dysfunction, active infections, and malignancy.

**Results:** The total number of patients was 112; mean age 38±12 years; 88 males and 24 females; crescentic glomerulonephritis, diabetic nephropathy, and CKD of unknown etiology were 61%, 18%, and 16%, respectively. Transplant vintage was 48±44 months. Mean estimated glomerular filtration rate (GFR) was 71±28 mL/min/1.73 m². Sixty-two percent of them had raised intact parathyroid hormone (PTH) levels. Only two out of the 76 cases of PTHP patients had raised serum calcium above 10.5 mg/dL with a poor sensitivity of 2.63% and with 98% specificity. Serum phosphorus of less than 2.5 mg/dL was encountered in only 14 out of 76 cases of hyperparathyroidism with a low sensitivity of 18% and specificity of 88%. In the hyperparathyroid group there was a significant reduction of 25-OHD3 (serum 25-hydroxyvitamin D3) levels when compared to control group (30±5 ng/mL vs. 23±8 ng/mL; P<0.0001). ANOVA showed a significant association between PTH levels and female sex, estimated GFR levels, hemoglobin, calcium, and 25-OHD3 levels. PHD concentrations were significantly negatively correlated with serum calcium (r=−0.39, P=0.002) and vitamin D levels (r=−0.50, P=0.002).

**Conclusions:** Hyperparathyroidism is common in post renal transplant setting. Serum calcium and phosphorus levels fared poorly as screening tests. Vitamin D deficiency should be addressed in post-renal transplant setting to prevent this condition.

**Corresponding author:** Dwarak Sampathkumar
**E-mail:** dwarak.acf@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Analysis of screening failure of live donation for kidney transplantation: experience of a single medical center in central Taiwan

Cheng-Hsu Chen¹, Ya-Yun Feng², Kun-Yuan Chiu³, Cheng-Kuang Yang³, Yi-Syuan Chen², Jia-Chian Wu², Ming-Ju Wu¹

¹Division of Nephrology, Department of Internal Medicine, Taichung Veterans General Hospital, Taichung City, Taiwan
²Committee of Transplant Medicine, Taichung Veterans General Hospital, Taichung City, Taiwan
³Division of Urology, Taichung Veterans General Hospital, Taichung City, Taiwan

Background: The organ shortage and long waiting list are global burden in treatment for end-stage renal disease (ESRD), thus, live kidney donation is currently available option with superior outcome and quick to improve quality of life. We hope to understand the causes of screening failure of live donation and to establish better standard operating procedures to enhance success of live kidney donation.

Methods: This study is retrospective evaluation conducted in Taichung Veterans General Hospital from January 2018 to September 2020. Subjects were recruited donor-recipient pairs pursuing living kidney transplantation (LKTx). The screening failure defined as donor-recipient pairs not to perform following LKTx after initial evaluation and analyzed the medical and non-medical factors of screening failure. We arbitrary divided 6 categories from recipients’ aspects and seven categories from donors’ aspects for analysis of screening failure for LKTx.

Results: A total of 203 donor-recipient pairs came for work-up process of LKTx at our transplant center, finally, only 48 pairs (23.6%) underwent surgery and 155 pairs did not. The rate of screening failure was 76.4%, and the affecting factors were 105 pairs (67.7%) from recipients and 50 pairs (32.3%) from donors. The most common concern from recipients were the unwilling of LKTx (fear of risk and reluctance of donor) (44.8%), high immunological risk of rejection (20.0%), and impaired cardiopulmonary function (9.5%), on the contrary, the most common regards of potential donors were the uncertain wills of donation (24.0%), underlying diseases (24.0%), and suboptimal renal function (18.0%).

Conclusions: In this study, we demonstrated the major causes of screening failure of LKTx in our institute. The unwilling of LKTx of recipients and uncertain wills of donation of donors were major conflict of success of pre-transplant survey. Further efforts should emphasize on how to break their concerns and barriers in order to benefit their quality of life and long-term survival.

Corresponding author: Cheng-Hsu Chen
E-mail: cschen920@yahoo.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
De novo donor-specific antibody without rejection does not always predict worse outcome in kidney transplantation

Hyo Kee Kim, Sangil Min, Chris Tae Young Chung, Hyunmin Ko, Kwang Woo Choi, Ahram Han, Sanghyun Ahn, Jongwon Ha

Division Transplantation, Department of Surgery, Seoul National University Hospital, Seoul, Korea

**Background:** De novo donor-specific antibodies (dnDSA) have been reported as a risk factor for graft injury and failure in kidney transplantation. However, there are only a few studies on how to manage the patients who have dnDSA without any rejection episodes. We compared the long-term results of patients with dnDSA with respect to the occurrence of biopsy proven rejection.

**Methods:** From January 2010 to December 2017, total of 1,172 patients received kidney transplantation in Seoul National University Hospital. Among the cohort, we included patients who had both dnDSA and kidney biopsy and classified the patients into groups according to the state of rejection.

**Results:** A total of 53 patients had dnDSA with biopsy. Among them, 28 patients had rejection (Rejection group), 13 patients had borderline rejection and 12 patients had no pathological abnormality (No rejection group). One-year and 3-year eGFR (estimated glomerular filtration rate) from detected dnDSA were not different between Rejection group and No rejection group (Rejection vs. No rejection: 1-year eGFR, 49.00±19.56 mL/min/1.73 m² vs. 42.17±23.37 mL/min/1.73 m², P=0.403; 3-year eGFR, 46.62±29.86 mL/min/1.73 m² vs. 49.28±20.44 mL/min/1.73 m², P=0.861). However, there was a difference in graft survival between the Rejection group and the No rejection group (3-year survival: 80% vs. 100%, P=0.048). In the multivariate analysis, recipients age (hazard ratio [HR], 0.927; 95 confidence interval [CI], 0.882–0.974; P=0.003) and ATMR (HR, 10.631; 95% CI, 1.931–58.539; P=0.007) were significant risk factors for graft failure, but there was no association between DSA (class I/II, sum of MFI, persistence of DSA, days until DSA detection) and graft failure.

**Conclusions:** The prognosis of patients with dnDSA but no rejection episodes within 6 months was better than those with rejections. These results suggest that dnDSA alone cannot always predict worse long-term outcome but further larger prospective studies are needed to support this conclusion.

**Corresponding author:** Hyo Kee Kim  
**E-mail:** gogohyohyo@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Efficacy of lymphatic sealing using the LigaSure in kidney transplantation

Sangkyun Mok, Sun Cheol Park, Young Jun Park, Sang Seob Yun, Jang Yong Kim

Department of Surgery, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

**Background:** Iliac vessel lymphatic ligation is extremely important, as it is associated with the occurrence of lymphocele in kidney transplantation. Conventional silk tie ligation is mainly used in lymphatic ligation; however, the LigaSure (vessel-sealing device) is also effective for lymphatic ligation. This study aimed to evaluate the efficacy of lymphatic sealing using the LigaSure in kidney transplantation.

**Methods:** This retrospective study included patients who underwent kidney transplantation from the prospectively registered database at Seoul St. Mary’s Hospital, South Korea, between January 1, 2020 and September 2, 2020. We analyzed comorbidities, primary renal disease, transplant variables, and post-transplantation outcomes.

**Results:** Seventy-one patients were enrolled in this study. The mean age of the patients was 48 years. The LigaSure and conventional groups comprised of 30 (42%) and 41 (58%) patients, respectively. There were no statistically significant differences in clinical characteristics except hypertension and induction agent. There was no difference in the occurrence of lymphoceles, postoperative day 1 (P=0.810) and day 7 (P=0.798) drain volume and drain removal length (P=0.947) between the two groups during the observation period was observed.

**Conclusions:** The results of our study show that LigaSure was comparable with conventional lymphatic ligation. There was no difference in the postoperative outcomes. Therefore, LigaSure-based iliac lymphatic ligation can be safely used in kidney transplantation.

**Corresponding author:** Sangkyun Mok
**E-mail:** skmok81@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Improvement of cardiac functions after renal transplant in pediatric patients with severe cardiac risk

Esra Baskin1, Kaan Gulleroglu1, Ilkay Erdogan2, Birgul Varan2, Aydincan Akdur3, Gokhan Moray3, Mehmet Haberal3

1Department of Pediatric Nephrology, Baskent University Hospital, Ankara, Turkey
2Department of Pediatric Cardiology, Baskent University Hospital, Ankara, Turkey
3Department of General Surgery, Baskent University Hospital, Ankara, Turkey

Background: Patients with chronic kidney disease (CKD) are at increased risk for cardiovascular morbidity and mortality. The surgical procedure is risky in these patients, but renal transplant (RTX) reduces cardiac mortality and the risk for development of chronic cardiac insufficiency compared with long-term dialysis. We presented patients with high cardiovascular risk and the success of RTX on the cardiac functions.

Methods: Since 1975, our center has performed 3,109 kidney transplant procedures, with 360 involving pediatric patients. We retrospectively evaluated data from the past 10 years for 165 pediatric patients with RTX. Cardiac functions of the patients were evaluated in detail before and after RTX. Patients with severe cardiac risk were identified, and the effects of successful RTX on cardiac functions were investigated.

Results: Severe cardiac risk was detected in 11 patients (six females and five males). Mean age of patients at transplant was 12.48±3.60 years, and mean follow-up period was 4.16±1.34 years after transplant. Preoperative mean ejection fraction significantly increased after RTX within 6 months (37.45%±9.77% and 66.45%±8.39%, respectively; P<0.01) and mean left ventricle diastolic and systolic diameter were significantly decreased, after RTX within 6 months (52.58±8.58 mm vs. 42.86±9.25 mm and 42.57±8.16 mm vs. 27.05±8.24 mm, respectively; P<0.01). This significant improvement on cardiac functions persisted 2 years after RTX.

Conclusions: After RTX, cardiac functions improved markedly in patients with end-stage renal disease and severe cardiac risk. We suggest that although the surgical procedure is risky, RTX should be considered the treatment of choice for these patients, because a longer duration of dialysis in these patients may result in progressive and ultimately irreversible myocardial dysfunction.

Corresponding author: Esra Baskin
E-mail: rectorate@baskent.edu.tr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Techniques of robot-assisted kidney transplantation

Seoungjun Lim, Youngmin Ko, Donghyun Kim, Joohee Jung, Hyunwook Kwon, Younghoon Kim, Duckjong Han, Sung Shin

Division of Transplantation, Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: This article shows the details of robot-assisted kidney transplantation (RAKT) from a living donor. RAKT was performed with Da Vinci Si.

Methods: The patient was placed supine with the legs parted and in Trendelenburg position. The Da Vinci robot was docked between the legs. Kidney allograft was given from a living donor. Before vascular anastomosis, a kidney allograft was prepared on the back table including insertion of a double-J stent in the ureter. The kidney allograft was wrapped in an ice-packed gauze to lower the temperature during the anastomosis time. A 12-mm port for robotic camera, three 8-mm ports for robotic arms, and a 12-mm port for an assistant were placed. After creating peritoneal pouch for the kidney allograft, dissection of iliac vessels and bladder was performed. Through a 6-cm Pfannenstiel incision, the kidney was inserted into the peritoneal pouch lateral to right iliac vessels. After the external iliac vein was clamped with Bulldogs clamps, a venotomy was given and the graft renal vein was anastomosed to the external iliac vein in an end-to-side continuous manner with a 6/0 Gore-TEX CV-6 (W.L. Gore and Associates Inc., Flagstaff, AZ, USA). After the graft renal vein was clamped, the iliac vein was declamped. Similarly, clamping of the external iliac artery, arteriotomy, arterial anastomosis with a 6/0 Gore-TEX CV-6, clamping of the graft renal artery, and declamping of the external iliac artery were performed. Reperfusion was done and ureteroneocystostomy was performed according to the Lich-Gregoir technique. Jackson-Pratt drain was placed through one of working ports and the peritoneum was closed at a few locations with Hem-o-lok.

Results: Three patients were operated with RAKT. The mean surgery duration was 441 minutes. The mean postoperative hospital days were 7.3 days. The mean of lowest post-operation creatine was 1.38 mg/dL.

Conclusions: RAKT could be an alternative method in kidney transplantation.

Corresponding author: Seoungjun Lim
E-mail: dkhe1986@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Clinical significance of late onset antibody-mediated rejection without donor-specific anti-human leukocyte antigen antibodies in kidney transplantation

Juhan Lee¹, Eun Jin Kim¹, Beom Jin Lim², Beom Seok Kim³, Myoung Soo Kim¹, Soon Il Kim¹, Yu Seun Kim¹, Kyu Ha Huh¹

¹Division of Transplantation, Department of Surgery, Severance Hospital, Seoul, Korea
²Department of Pathology, Yonsei University College of Medicine, Seoul, Korea
³Division of Nephrology, Department of Internal Medicine, Severance Hospital, Seoul, Korea

Background: Late onset antibody-mediated rejection (AMR) is a leading cause of kidney allograft failure. Its diagnosis has been based on a combination of morphologic, immunohistologic findings, and presence of donor-specific anti-human leukocyte antigen antibodies (DSA). Although the presence of DSA is no longer required for AMR diagnosis according to the Banff 2017 classification, the clinical significance of late onset AMR without DSA remains unclear. Here we compared clinical outcomes of late onset AMR with and without DSA.

Methods: We analyzed 126 cases of late 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=103) and DSA-negative (n=23) AMR groups. The estimated glomerular filtration rate (eGFR) was calculated using the Chronic Kidney Disease Epidemiology Collaboration equation.

Results: The histological picture did not differ between DSA-negative and DSA-positive AMR, with the exception of increased level of peritubular capillaritis in DSA-positive AMR. Median time from transplant to AMR diagnosis was 80 months (interquartile range, 39–118 months). At the time of AMR diagnosis, both groups had similar graft function (36.3±16.0 mL/min/1.73 m² for DSA-negative and 39.7±20.2 mL/min/1.73 m² for DSA-positive AMR; P=0.408). Mean eGFR after AMR were similar irrespective of the presence of DSA. There were 28 (26.2%) graft failures in the DSA-negative and 8 (27.6%) graft failures in the DSA-positive AMR groups, which was not statistically different (P=0.981).

Conclusions: In late onset AMR, there was no significant difference between AMR with and without DSA in clinical outcomes.

Corresponding author: Juhan Lee
E-mail: juhan1108@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Repeat kidney transplantation is reasonable treatment of choice after allograft loss

Namkee Oh¹, Kyowon Lee¹, Jinsoo Rhu¹, Jong Man Kim¹, Gyu-Seong Choi¹, Jae Berm Park¹, Jae-Won Joh¹, Hyun Cho², Sook Young Woo²

¹Department of Surgery, Samsung Medical Center, Seoul, Korea
²Department of Statistics and Data Center, Samsung Medical Center, Seoul, Korea

Background: The number of patients relisting on kidney transplantation (KT) wait list due to prior allograft loss is increasing which accounts for 9.2% according to the Korean Network for Organ Sharing (KONOS) data. Therefore, this study is designed to understand the outcomes of second KT compared to first KT as the needs for repeat transplantation are increasing.

Methods: Data were collected retrospectively for 1,429 living donor KT, performed from 1995–2020 at Samsung Medical Center. Demographics of recipients and donors, immunologic factors and outcomes of retransplantation group were compared to first transplant. Primary outcomes are death-censored graft survival and patient survival.

Results: Among 1,429 cases, first KT were 1,355 and second KT were 74. Five- and 10-year graft survival of patients with first KT are 94.26% and 83.54%, those of second KT are 96.12% and 85.95%, showing no statistically significant differences (P=0.3988). Five-year patient survival of first KT was 97.7% and that of second KT was 96.27%, and 10-year survival of first KT was 94.22% and that of second KT was 92.57%, which show no statistically significant differences (P=0.7657). This study analyzed changes of serum creatinine after transplantation for 10 years to evaluate trends of graft function over time. As time goes, serum creatinine levels of both groups were tended to increased, however, there was no significant differences in rate of changes between two groups. Multivariate analysis confirmed that age of donor (hazard ratio [HR], 1.0289) and number of mismatched human leukocyte antigen (HLA) class II (HR, 1.634) increase risk of graft failure. Age of recipient, diabetes mellitus (recipient), hypertension (donor), and number of HLA class II mismatch are associated with higher risk of mortality. History of previous transplantation was not a risk factor of any outcomes.

Conclusions: This study revealed that repeat renal transplantation with living donor kidney offers comparable graft and patient survival to first transplantation. Therefore, repeat KT with living donor is reasonable treatment of choice.

Corresponding author: Namkee Oh
E-mail: ngnyou@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Induction or no induction: in modern era of triple immunosuppression

Mital Parikh

Department of Nephrology, Shree Krishhna Hospital, Karamsad, India

Background: Majority of kidney transplants today use induction agents to reduce the incidence of acute rejections, however there has been simultaneous increase in infections and costs of transplantation.

Methods: We retrospectively collected data of renal transplant patients from April 2007 to August 2012 and analyzed them with respect to whether they received any induction agent or not and compared their outcomes over 5 years in terms of rejection episodes, graft loss, mortality, infections.

Results: We could extract data of 379 patients. ATG (Thymo) was given in 29 patients, Basiliximab (Simulect) in 42 and Daclizumab was given to 22 patients. Their mean age was 36.57±11.5 years with mean follow-up duration of 46.2±29.5 months. There was significant reduction in acute rejections at 1 month (4.3% vs. 17.48%, P=0.001) and lower mean serum creatinine at 5 year post transplant (1.3 mg/dL [0.8–1.8] vs. 1.43 mg/dL [0.8–2.07]) in the induction group compared to no induction group, but overall there was no significant difference in rejection episodes, patient and graft survival. There was significantly higher total infections (41.93% vs. 26.22%, P=0.006), cytomegalovirus (CMV) infection (11.8% vs. 3.14%, P=0.001) and trend towards higher BKV (5.3% vs. 1.3%, P=0.03) in the induction group.

Conclusions: In the present scenario of triple immunosuppression, the use of induction agents is associated with increased costs and serious infections like CMV with no significant benefits of improved patient and graft survival.

Corresponding author: Mital Parikh

E-mail: mitalparikh1@yahoo.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Cytomegalovirus infection and risk of new-onset diabetes after transplantation: a retrospective analysis

Muhammad Tassaduq Khan

Department of Renal Transplant Unit, Dow University Hospital, Karachi, Pakistan

Background: New-onset diabetes after transplantation (NODAT) is a well-established complication among kidney transplant recipients and is considerably associated with high risk of infectious disease complications. The present research study was aimed to identify whether cytomegalovirus (CMV) infection acts as risk factor for NODAT development in kidney transplant recipients.

Methods: This retrospective study recruited 59 kidney transplant recipients (43 males and 16 females) between March 2017 and February 2019. The diagnosis of NODAT was established if two fasting plasma glucose readings were ≥126 mg/dL after the 3rd month of post-transplantation. We carefully monitored recipients for CMV viremia (CMV DNA copies/mL) in the plasma through quantitative polymerase chain reaction (qPCR). The 1-year post-transplantation allograft outcomes due to CMV viremia were also measured: estimated glomerular filtration rate (the Chronic Kidney Disease Epidemiology Collaboration method), allograft and transplant patient survival.

Results: The mean age of the kidney transplant patients was 43.4±6.2 years. In the present study, 45 patients (76.3%) were found to have no NODAT (controls), while 14 patients (23.7%) were diagnosed with NODAT. The CMV load and CMV viremia was elevated in NODAT cohort in comparison with their control counterparts (4,000 vs. 3,600 and 51.1 vs. 47.6, respectively); however, no statistical relationship was observed (P=0.79 and P=0.84, respectively). We witnessed that there was significantly high CMV DNA replication in first (1–6 months) half of the post-transplant period in both controls and NODAT patients; however, statistically significant CMV DNA replication was only observed for NODAT cohort (P<0.001). Majority of the NODAT diagnosis; nine out of 14 (64.3%), in our cohort was made during the first 6 months of kidney transplantation (P<0.001).

Conclusions: the present study demonstrated that CMV infection is not a risk factor for NODAT development among kidney transplant recipients. The early diagnosis and rigorous treatment and control of both CMV infection and NODAT could potentially improve the allograft and patient survival.

Corresponding author: Muhammad Tassaduq Khan
E-mail: Muhammad.tassaduq@duhs.edu.pk

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Successful desensitization and transplantation of kidney transplant recipients with donor-specific antibodies

Muhammad Tassaduq Khan

Department of Renal Transplant Unit, Dow University Hospital, Karachi, Pakistan

Background: Kidney transplantation has indisputably changed the dynamics of renal medicine and restored hope among patients coming across fatal end-stage renal disease (ESRD). However, sensitization of human leukocyte antigen (HLA) hampers kidney transplantation. Our transplant center used a modified desensitization protocol.

Methods: Desensitization protocol in our transplant center encompassed following mentioned strategy to achieve mean fluorescence intensity (MFI) values <1,000 and negative complement-dependent cytotoxicity (CDC) crossmatch for both T and B lymphocytes before proceeding for kidney transplantation: two sessions of plasmapheresis on days 1 and 2 → injection rituximab on day 2 after plasmapheresis → no plasmapheresis on day 3 → eight sessions of plasmapheresis after day 3 and intravenous immunoglobulin (IVIG) 100 mg/kg/dose after each session of plasmapheresis → repeat HLA antibody detection test to confirm if donor-specific antibodies (DSAs) are present against HLA with MFI values <1,000 and CDC crossmatch is negative for both T and B lymphocytes; if "No" then continue plasmapheresis sessions with IVIG 100 mg/kg/dose till MFI values are <1000 and CDC crossmatch is negative for both T and B lymphocytes or if "Yes" then proceed for transplantation → repeat dose of rituximab post-transplantation.

Results: All the six cases had moderate levels of DSAs against HLA except for one case with MFI value of 17,962. With implementation of our modified desensitization protocol, we achieved low levels of DSAs with MFI value <1,000. Patients were successfully transplanted with no adverse outcomes, such as kidney allograft rejection, on follow-up.

Conclusions: In our transplant center, we successfully desensitized and transplanted six HLA sensitized kidney transplant candidates with moderate to high DSAs and T and B lymphocyte positive CDC crossmatch. Our desensitization protocol comprised of multiple plasmapheresis sessions with simultaneous low dose IVIG and rituximab. Upon follow-up, we did not witness any significant transplant related event such as allograft dysfunction or rejection.

Corresponding author: Muhammad Tassaduq Khan
E-mail: Muhammad.tassaduq@duhs.edu.pk

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Outcome of living donor kidney transplantation: a single center experience from South India

Vishrut Khullar¹, Pradeep Shenoy M²

¹Department of Internal Medicine, K.S. Hegde Medical Academy, Mangalore, India
²Department of Nephrology, K.S. Hegde Medical Academy, Mangalore, India

Background: Kidney transplantation remains the treatment of choice for patients with end-stage renal disease (ESRD). However, challenges faced by nephrologists in post-kidney transplant recipients in developing countries are more, mainly due to increased risk of infections which can affect the outcome of such patients. Our objective was to determine the outcome of living donor kidney transplantation including post-operative complications and survival of transplant recipients.

Methods: We conducted a retrospective study of living donor kidney transplantation done in our center Justice K.S. Hegde Charitable Hospital in Mangalore which is a tier two city in India and kidney transplantation was recently started at our center. The transplants done between January 2011 and December 2019 were included. The patient details including out-patient and in-patient records were used to determine recipient and donor characteristics and outcome variables.

Results: Of 34 transplants carried out, 24 (70.6%) were males and 10 (29.4%) were female recipients. The mean age was 34±11.37 years. Mean duration of hemodialysis was 17.4 months. Cause of ESRD in recipients was unknown in 20 patients (58.8%) followed by immunoglobulin A (IgA) nephropathy in three patients (8.82%). Majority of donors were females (85.3%). Most common complication seen was urinary tract infections in 32.4% of the recipients. Acute rejection was seen in four cases (11.8%) which were proved by biopsy. Six patients (17.6%) had expired while the remaining 28 (82.4%) were alive at time of analysis. The most common cause of death was infections in five (83.3%) out of six deaths. Of the 28 cases who survived, 23 (82.1%) had functioning grafts and remaining five had been restarted on hemodialysis. The 3-year chance of survival of recipients was 91.17% and 5-year chance of survival was 82.35%.

Conclusions: Living donor kidney transplantation is a good option for patients with ESRD even though it is associated with complications, most commonly infections.

Corresponding author: Vishrut Khullar
E-mail: vishrut.khullar@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Outcomes of renal transplantation in children with cystinosis

Esra Baskin¹, Kaan Gulleroglu¹, Aysun C Yilmaz¹, Aydincan Akdur², Gokhan Moray², Mehmet Haberal²

¹Department of Pediatric Nephrology, Baskent University Hospital, Ankara, Turkey
²Department of General Surgery, Baskent University Hospital, Ankara, Turkey

Background: Cystinosis is a rare lysosomal storage disease due to mutations in the CTNS gene. Although systemic disease manifestations continue, renal disease recurrence is not expected after transplant. We evaluate outcomes of renal transplant in children with cystinosis.

Methods: We retrospectively evaluated the data files from 165 pediatric renal transplant patients. Patients with cystinosis and patients with other etiologies of chronic renal failure were divided into two groups. Demographics of the patients, graft functions, infections, acute rejection episodes, and graft loss were recorded.

Results: One hundred sixty-five children (92 males and 73 females) with kidney transplant were enrolled to the study, eight of them had cystinosis. Although patients with cystinosis were youngest at the time of diagnosis when compared other patients (0.69±0.42 years vs. 7.76±5.20 years; P=0.00), mean ages at the time of the transplantation were similar (12.28±4.57 years vs. 12.95±4.75 years; P=0.69). Mean follow-up time after transplantation was 6.36±4.45 years. Acute rejection episode rate was two times higher in patients with other etiologies (12.55% vs. 24.87%). Glomerular filtration rate values at 3 years (73.90±43.62 mL/min vs. 76.61±30.08 mL/min; P=0.84) and 5 years of follow-up (62.37±41.42 mL/min vs. 62.82±32.82 mL/min, p=0.98) of two groups was similar. Eight patients (4.84%) were lost their graft during 5 years of follow-up. One of these patients was in cystinosis group.

Conclusions: Renal transplant has similar outcomes, with lowest acute rejection episode rate in children with cystinosis when compared with other patients with different etiology of chronic renal failure.

Corresponding author: Esra Baskin
E-mail: rectorate@baskent.edu.tr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Impact of dialysis modality on long-term outcomes in kidney transplantation recipients: a propensity-matched cohort study

Jin Hyuk Paek, Ohyun Kwon, Yaerim Kim, Woo Yeong Park, Kyubok Jin, Seungyeup Han

Division of Nephrology, Department of Internal Medicine, Keimyung University Dongsan Medical Center, Daegu, Korea

Background: Kidney transplantation (KT) is the ideal therapy for patients with end stage renal disease. However, pre-emptive KT is not always possible, most patients undergo peritoneal dialysis (PD) or hemodialysis (HD) while awaiting KT. Previous studies analyzing the impact of pre-transplant dialysis modality on patient and graft survival were conflicting and follow-up period is not sufficient. We evaluated the relationship of pre-transplant dialysis modality with long-term clinical outcomes by using propensity score matching method.

Methods: We conducted a retrospective cohort study of 590 patients who underwent KT at Keimyung University Dongsan Medical Center from 2003 to 2016. Of the 590 KT recipients, we excluded pre-emptive KT, second or third KT and 470 recipients were analyzed.

Results: Among 470 KT recipients, 95 recipients (20.2%) were treated with PD before KT. After using propensity score matching method, 93 recipients were included in each group. The mean follow-up duration was 98.6±47.3 months. In the entire cohort, PD group had lower creatinine level at 3 years after KT than HD group (P=0.030). However, there was no significant differences between two groups after matching (P=0.055). Delayed graft function (P=0.662) and biopsy proven acute rejection within 1 year after KT (P=0.445) were comparable between the groups. Ten-year patient survival rates (P=0.521) and 10-year death-censored graft survival rates (P=0.407) were similar between two group. In Cox proportional hazard model, pre-transplant dialysis modality was not an independent risk factor for the patient mortality, graft failure, and death-censored graft failure.

Conclusions: Pre-transplant dialysis modality of PD or HD did not influence on the long-term patient and graft survival after KT. Moreover, short-term complications were similar between two groups.

Corresponding author: Jin Hyuk Paek
E-mail: novawang@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Outcomes of renal transplant in elderly

Anvita Anne, Varun Kumar Bandi

Department of Nephrology, Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation, Chinoutpalli, India

**Background:** The number of people requiring renal replacement therapy is on a rise, and the elderly population is among the rapidly growing groups, especially in the western world.

**Methods:** All renal transplants done at our center between 2004 to 2018 were reviewed. Transplant recipients with age >60 years were included for analysis and follow-up data was collected. Patients with incomplete data were excluded from analysis.

**Results:** A total of 22 patients were identified, of whom four were excluded due to incomplete data. The mean age was 63 years, with one among the 18 recipients being female. The 72.2% were between 60–64 years of age, while 22.2% were between 65–69 years of age, and one was >70 years of age. Live transplant was done in 44.4%, with wife and son being most common donors (16.7% each), followed by one each from daughter and brother. The 1-, 3-, and 7-year patient survival were 83.3%, 66.7%, and 25%, respectively, while 1-, 3-, and 7-year graft survival were 88.9%, 60%, and 25%, respectively. Death with a functioning graft was present in 27.8% of patients. The patient and graft survival at 3 years were better with live donors compared to deceased donors. The major causes for mortality were sepsis (50%) followed by cardiovascular death (31.3%), with respiratory infection being the most common cause of sepsis related death (25%). The cost analysis of patients receiving renal replacement therapy showed high initial costs with renal transplant, which reduced over long term and equals that of hemodialysis by about 26 months post-transplant.

**Conclusions:** With ageing general population, physicians are expected to make increasing number of decisions regarding transplantation candidacy in elderly patients. Elderly patients have good survival with kidney transplantation, and it also an economically more viable option.

**Corresponding author:** Anvita Anne
**E-mail:** aanvita1996@gmail.com

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Patient and graft outcome among Filipinos with post-kidney transplant malignancy

Michelle Matematico, Concesa Cabanayan-Casasola, Marichel Pile-Coronel, Adeline Gonzales

Department of Adult Nephrology, National Kidney and Transplant Institute, Quezon City, Philippines

Background: Improvements in the care of kidney transplant recipients (KTRs) resulted to longer life expectancy and increased survival rate. However, studies showed an increase in the incidence of post-kidney transplant malignancy (PTM) affecting the survival and quality of life of the said patients.

Methods: This is a retrospective cross-sectional study among 91 patients in a tertiary referral center. The primary endpoints were patient and graft survival at 12 and 24 months after diagnosis and/or treatment of malignancy. Kaplan-Meier analysis was applied to estimate probabilities of survival.

Results: The overall incidence of patients developing malignancy after kidney transplant was 1.4% with patient median age at 57 years on diagnosis. The median period from kidney transplant to malignancy diagnosis was at 7.39±5.94 years. The most common primary sites of malignancy seen were colorectal, breast, and renal malignancies. The overall graft survival probability of PTM patients was 98.6% and 93.6% at 12 and 24 months, while the overall patient survival probability of PTM patients was 75.5%, 63.3%, and 48.8% at 12, 24, and 64 months, respectively.

Conclusions: The incidence of PTM in our study was lower compared with other countries. The overall patient survival rate, however, was much lower than those who did not develop PTM. Moreover, our study showed lower patient survival rate compared with other countries. Routine screening for cancers among our KTRs following our local guidelines should be adhered to. The type of cancer among Filipino KTRs were also different from what were reported in other publications. Further studies that will look into risk factors to developing malignancy after KT among Filipinos and the role of type and dose of immunosuppressant is recommended.

Corresponding author: Michelle Matematico
E-mail: drmitchmatematico@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Unusual presentation of post-transplant lymphoproliferative disorder in renal transplant

Harsha Hanumaiah, Krishnaswamy Sampathkumar, Andrew Rajiv, Shakthi Kumar, Senthil Kumar, Hitesh Desai, Dwarak Sampathkumar

Department of Nephrology, Meenakshi Mission Hospital and Research Centre, Madurai, India

Background: Significantly increased malignancy risk exists in patients who undergo renal transplantation. Post-transplant lymphoproliferative disorder (PTLD) is a relatively rare but potentially fatal condition arising after renal transplant. While majority are related to Epstein–Barr virus (EBV), EBV negative cases do occur. Three types are described. Early lesion consists of infectious mononucleosis type. Polymorphic PTLD shows malignant lymphoid infiltrates with mono or polyclonality not meeting all criteria. Monomorphic PTLD show malignant transformation of monoclonal B, T or natural killer cell lines meeting the criteria.

Methods: The patient was a 53-year-old male who underwent a deceased donor renal transplant 4 years ago. He was on maintenance doses of triple immunosuppression consisting of tacrolimus, mycophenolate mofetil, and prednisolone. Three years later he developed fungal infection involving right knee joint (mucormycosis) which was treated liposomal amphotericin B. Six months later he presented with rapidly enlarging multiple nodular lesions over the right knee joint which was initially mistaken as recurrence of fungal infection. The biopsy from the lesion was diagnostic of large B cell lymphoma (co-expression of CD20 and CD45). Serum antibodies for EBV was negative. He was positive for immunoglobulin G antibodies against cytomegalovirus. The donor EBV status was unknown.

Results: Immunosuppressives were withheld and chemotherapy regimen of rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisolone was initiated. Tragically, he succumbed to the illness 3 months later with multiple metastases involving brain and lungs.

Conclusions: PTLD is rare but serious complication which supervenes early in the post-transplantation course within 3–5 years. The site of origin of the tumor in the skin over knee joint is unusual in this case. Aggressive policy of early biopsy in suspicious nodules should be undertaken for early diagnosis of PTLD to improve the prognosis. The mortality is high in late stages.

Corresponding author: Harsha Hanumaiah
E-mail: harshahanumaiah@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Clinical impact of serum bilirubin levels on kidney transplant outcomes

Juhan Lee¹, Eun Jin Kim¹, Jae Geun Lee¹, Beom Seok Kim², Kyu Ha Huh¹, Myoung Soo Kim¹, Soon Il Kim¹, Yu Seun Kim¹, Dong Jin Joo¹

¹Division of Transplantation, Department of Surgery, Severance Hospital, Seoul, Korea
²Division of Nephrology, Department of Internal Medicine, Severance Hospital, Seoul, Korea

Background: Serum bilirubin, a potent endogenous antioxidant, has been associated with decreased risks of cardiovascular disease, diabetes, and chronic kidney disease. However, the effects of serum bilirubin on long-term kidney transplant outcomes remain undetermined.

Methods: We analyzed 1,628 patients who underwent kidney transplantations between 2003 and 2017. Total serum bilirubin levels were assessed every month for the first post-transplantation year. Patients were grouped into sex-specific quartiles according to mean serum bilirubin levels assessed between 3 and 12 months post-transplantation.

Results: Median bilirubin levels were 0.66 mg/dL (interquartile range, 0.50–0.85 mg/dL) in males and 0.60 mg/dL (interquartile range, 0.50–0.74 mg/dL) in females. The intra-individual variability of serum bilirubin levels was low (9%). Serum bilirubin levels were inversely associated with graft loss, death-censored graft failure, and all-cause mortality, independent of renal function, donor status, human leukocyte antigen mismatch, and transplant characteristics. Multivariable analysis revealed that the lowest serum bilirubin quartile was associated with increased risk of graft loss (hazard ratio [HR], 2.63; 95% confidence interval [CI], 1.67–4.16; P<0.001), death-censored graft failure (HR, 2.96; 95% CI, 1.62–5.40; P<0.001), and all-cause mortality (HR, 2.07; 95% CI, 1.01–4.23; P=0.046). Patients with lower serum bilirubin levels were also at greater risk of late-onset rejection and exhibited consistently lower estimated glomerular filtration rates than those with higher serum bilirubin levels.

Conclusions: Serum bilirubin levels were significantly associated with transplantation outcomes, suggesting that bilirubin could represent a therapeutic target for improving long-term transplant outcomes.

Corresponding author: Juhan Lee
E-mail: juhan1108@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
A study of acute kidney injury in renal allograft recipients and its impact on short-term outcome of graft function

Manzoor Parry

Department of Nephrology, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, India

Background: Renal allograft recipients (RAR) are at high risk of acute kidney injury (AKI). The etiology, risk factors, and outcomes of AKI in RAR differ from that of AKI in the community setting. This study aimed to evaluate the spectrum and impact of AKI episodes on RAR outcome.

Methods: This was a single-center, prospective observational study on 84 live RAR patients who developed 105 AKI episodes as per Kidney Disease Improving Global Outcome (KDIGO) criteria between January 2018 to December 2019. These patients were followed for 3 months after AKI episodes.

Results: The mean age of our study populations was 38.1±13.2 years. Mean serum creatinine at the time of AKI episode was 2.63±0.95 mg/dL. The causes of AKI in our study population were infections (n=48, 45.7%), dehydration (n=25, 23.8%), biopsy-proven rejection (n=9, 8.6%) calcineurin inhibitor toxicity (n=10, 9.5%), biopsy-proven acute tubular necrosis (n=4, 3.8%), recurrence of native kidney disease (n=4, 3.8%), and miscellaneous causes (n=5, 4.8%). Most of the AKI episodes (62.9%) developed in the first year of the transplant, while as 29 cases (27.6%) developed between first and second post-transplant year and 10 cases (9.5%) developed AKI beyond 2 years post-transplant. Sixty-four cases (60.9%) of AKI were in KDIGO stage 1, 30 cases (28.6%) were in AKI stage 2, and 11 cases (10.5%) were in AKI stage 3. Previous episodes of AKI (P=0.004), need for dialysis at the time of AKI (p=0.002), and recurrence of native kidney disease (P=0.0001) were the factors associated with non-recovery of graft functions at 3 months of follow-up. At 3 months of follow-up, AKI had a significant impact on allograft function.

Conclusions: In our study, AKI in RAR had a significant impact on allograft function.

Corresponding author: Manzoor Parry
E-mail: maparry33@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Cutaneous phaeohyphomycosis in renal transplant recipient

Anvita Anne, Varun Kumar Bandi

Department of Nephrology, Dr. Pinnamaneni Siddhartha Institute of Medical Sciences & Research Foundation, Chinoutpalli, India

**Background:** Phaeohyphomycosis is a group of mycotic infections caused by dematiaceous fungi (pigmented). It is a rare infection affecting the skin and subcutaneous tissue predominantly, with a wide presentation ranging from subcutaneous nodules to deep abscesses.

**Methods:** We report a case of phaeohyphomycosis occurring in a renal transplant recipient.

**Results:** A 48-year-old female with chronic kidney disease secondary to presumed chronic glomerulonephritis underwent live-related renal transplant 4 years back, with brother being the donor. She had not received any pre-transplant induction therapy, and was on triple immunosuppression with cyclosporine, mycophenolate mofetil, and prednisolone. She did not have any episodes of acute rejection and had a stable graft function with a serum creatinine of 1.4 mg/dL. She presented with history of multiple blackish swellings over the body for 1 month, present over the neck, forearms, and abdomen, not associated with fever discharge. Excision biopsy of the lesion was done, which revealed presence of phaeohyphomycosis with fungal culture growing Exophiala. She was treated with posaconazole due to multiple lesions which were not excised. She had no recurrence of symptoms and the minor lesions regressed with therapy.

**Conclusions:** Early suspicion of phaeohyphomycosis in transplant patients is important, as the immunosuppressed state can predispose to systemic spread and severe disease. Treatment consists of simple excision for localized lesions, and posaconazole therapy has showed good results for diffuse disease. Histopathological examination is sufficient for diagnosis when phaeohyphomycosis is suspected. Despite a difficult diagnosis and a rare occurrence, physicians and surgeons should be aware of infection with this emerging fungus, especially in transplant recipients.

**Corresponding author:** Anvita Anne
E-mail: aanvita1996@gmail.com
The worth emphasizing surgical technique: ureteropyelostomy to manage urinary tract complications

Song-Yi Kim¹, Moonsang Ahn², Chanjoong Choi²

¹Division of Transplantation, Department of Surgery, Chungnam National University Hospital, Daejeon, Korea
²Department of Surgery, Chungnam National University School of Medicine, Daejeon, Korea

Background: Injury of the ureteral supplying artery usually causes ischemic injury of allograft ureter after renal transplantation. In the process of resolving the ischemic injury of the allograft ureter, because it can lead to allograft kidney damage, prompt treatment is necessary. The ureteropyelostomy using the recipient’s ipsilateral native ureter is the best choice of several treatments that can salvage an allograft kidney. The aim of this report proves that the ureteropyelostomy using a native ureter is the surgical technique to be feasible management of urinary tract complications after renal transplantation.

Methods: A 41-year-old male undergone second renal transplantation in 2017. Initial transplantation was performed in 1992, with allograft in the right iliac fossa. Although no definite ischemic injury of allograft ureter was observed, injury of the ureteral supplying artery was observed during bench-work. The allograft ureter was anastomosed to the bladder and a double-J catheter was inserted in the allograft ureter. After anastomosis of the allograft ureter, it was judged that blood supply was somewhat adequate. However, 18 days postoperative, he presented an abdominal pain with oozing on the surgical incision site. On computed tomography, there was a ureteral rupture and perirenal hematoma of the allograft. The ureteropyelostomy using a native ipsilateral ureter was performed successfully without any complications such as ureteral necrosis, urinary leakage, and urinary stricture.

Results: After 3 years of follow-up, he had a well-functioning allograft with a serum creatinine level of 1.59 mg/dL.

Conclusions: The ureteropyelostomy using a native ipsilateral ureter can be a safe and feasible surgical technique that treated urinary ischemic complications due to injury of the ureteral supplying artery and resulted in good graft and patient survival.

Corresponding author: Song-Yi Kim
E-mail: ray9060@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Insulin secretion and insulin resistance trajectories over 1 year after kidney transplantation: a multicenter prospective cohort study

Jun Bae Bang¹, Su Hyung Lee¹, Ja Young Jeon², Chang-Kwon Oh¹

¹Division of Transplantation, Department of Surgery, Ajou University School of Medicine, Suwon, Korea
²Division of Endocrine, Department of Internal Medicine, Ajou University School of Medicine, Suwon, Korea

Background: We investigated the changing patterns of insulin secretion and resistance and risk factors contributing to the development of post-transplant diabetes mellitus (PTDM) in kidney recipients under tacrolimus-based immunosuppression regimen during 1 year after transplantation.

Methods: This was a multicenter prospective cohort study. Of the 168 subjects enrolled in this study, we analyzed a total 87 kidney transplant recipients without diabetes which was assessed by oral glucose tolerance test before transplantation. We evaluated the incidence of PTDM and followed up the index of insulin secretion (insulinogenic index [IGI]) and resistance (homeostatic model assessment for insulin resistance [HOMA-IR]) at 3 months, 6 months, 9 months, and 1 year after transplantation by oral glucose tolerance test and diabetes treatment. We also assessed the risk factors for incident PTDM.

Results: PTDM developed in 23 of 87 subjects (26.4 %) during 1 year after transplantation. More than half of total PTDM (56.5%) occurred in the first 3 months after transplantation. During 1 year after transplantation, insulin resistance (HOMA-IR) was increased in both PTDM and no PTDM group. In no PTDM group, the increase in insulin secretory function to overcome insulin resistance was also observed. However, PTDM group showed no increase in insulin secretion function (IGI). Old age, status of prediabetes and episode of acute rejection were significantly associated with the development of PTDM.

Conclusions: In tacrolimus-based immunosuppressive drugs regimen, impaired insulin secretory function for reduced insulin sensitivity contributed to the development of PTDM than insulin resistance during 1 year after transplantation.

Corresponding author: Jun Bae Bang
E-mail: bjb425@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Hypothermia protects against renal fibrosis after ischemia reperfusion injury

Eunji Kim¹, Jin Young Jeong², Eu Jin Lee¹, Joing In Lee¹, Jae Wan Jeon³, Hae Ri Kim³, Youngrok Ham¹, Dae Eun Choi¹, Ki Ryang Na¹, Kang Wook Lee¹

¹Division of Nephrology, Department of Internal Medicine, Chungnam National University Hospital, Daejeon, Korea
²Department of Medical Science, Chungnam National University College of Medicine, Daejeon, Korea
³Division of Nephrology, Department of Internal Medicine, Sejong Chungnam National University Hospital, Sejong, Korea

Background: Although hypothermia protects against the renal injury induced by ischemia reperfusion, the detailed molecular pathway(s) involved in the process remain unknown. Proliferator-activated receptor-gamma coactivator 1alpha (PGC-1α) is known to protect against renal injury. Furthermore, hypothermia may induce PGC-1α in the brain and the kidneys. We evaluated the role of PGC-1α in hypothermia protection against renal ischemia reperfusion injury (IRI).

Methods: We prepared a fibrosis model by inducing ischemia reperfusion injury. C57BL/6 mice were divided into the following groups: sham mice and ischemia reperfusion injury mice (37°C vs. 32°C). The kidneys were harvested 20 minutes after the induction of renal ischemia and on day 1, day 3, day 7, and after IRI. Fibrosis markers and the renal injury score were evaluated.

Results: The blood urea nitrogen levels, and serum creatinine levels, and the histologic renal injury scores were significantly lower in the 32°C IRI groups than in the 37°C ischemia reperfusion injury groups. The protein levels of fibrosis markers were significantly decreased, while the bone morphogenetic protein 7 (BMP7) and PGC-1α level was significantly increased in the 32°C ischemia reperfusion injury mice group. Hypothermia increased the PGC-1α both, in vivo and in vitro. Knock down of PGC-1α expression increased in vitro renal fibrosis.

Conclusions: Hypothermia ameliorates renal function deterioration and renal fibrosis in renal IRI mice kidneys. Moreover, hypothermia increases PGC-1α in renal IRI mice kidneys. Therefore, PGC-1α may play a role in hypothermic protection in renal fibrosis following IRI.

Corresponding author: Dae Eun Choi
E-mail: daenli@cnu.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Prophylactic treatment with antioxidant nanoparticles attenuate ischemia/reperfusion injury in BALB/c mice

Se-Hee Yoon, Won-Min Hwang, Sung-Ro Yun, Jung-hun An

Division of Nephrology, Department of Internal Medicine, Konyang University College of Medicine, Daejeon, Korea

Background: Ischemia/reperfusion (I/R) injury is one of the important cause of delayed graft function, graft rejection and chronic graft dysfunction. Ceria nanoparticle is known that exhibit free radical scavenger and catalytic activities. When zirconia attached to ceria nanoparticles, the ceria atom tend to remain Ce³⁺ and the efficacy as a free radical scavenger increase. We studied whether ceria and ceria-zirconia nanoparticles (CZ NPs) as an antioxidant are effective to protect I/R injury in kidneys.

Methods: BALB/c mice were randomized into four groups: group 1 (control, normal saline pretreatment plus sham operation; n=6), group 2 (CZ NPs pretreatment plus sham operation; n=6), group 3 (normal saline pretreatment plus I/R; n=6) and group 4 (CZ NPs pretreatment plus I/R; n=6).

Results: The levels of plasma blood urea nitrogen (BUN) and creatinine of group 3 (I/R operation) were significantly increased when compared to group 1 (control, sham operation). However, in group 4 (CZ NPs plus I/R operation), the plasma levels of BUN and creatinine were significantly decreased when compared to group 3 (I/R operation). In Hematoxylin and Eosin staining for analyzing histologic changes there was no significant difference between group 1 and group 2, but tubular dilatation, cellular casts, loss of tubular brush borders, vacuolar degeneration and tubular epithelial cell shedding were observed in group 3. In group 4, tubular damage was restored when compared to group 3. To detect apoptotic changes in kidney cells, terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL) assay was done. In group 3, there was a significant number of positive cells in the TUNEL staining, whereas in group 4, the number of TUNEL positive cells was significantly decreased.

Conclusions: Collectively, CZ NPs were successfully uptaken into kidney cells and effectively attenuated I/R induced acute kidney injury in vivo, suggesting that could be a novel approach to control I/R injury induced graft injury.

Corresponding author: Se-Hee Yoon
E-mail: sehei@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Rhabdomyolysis-induced acute kidney injury was ameliorated in NLRP3 KO mice via alleviation of mitochondrial lipid peroxidation in renal tubular cells

Yang Gyun Kim, Ju-Young Moon, Hyeon Seock Hwang, Jin Sug Kim, Kyung Hwan Jeong, Sang-ho Lee

Division of Nephrology, Department of Internal Medicine, Kyung Hee University School of Medicine, Seoul, Korea

Background: A recent study showed early renal tubular injury in rhabdomyolysis-induced acute kidney injury (RIAKI) was ameliorated in NOD-like receptor pyrin domain-containing protein 3 (NLRP3) KO mice. However, the precise mechanism has not been determined. Therefore, we investigated the role of NLRP3 in renal tubular cell in RIAKI.

Methods: A glycerol-induced RIAKI was generated in NLRP3 KO and wild type mice. The mice were euthanized 24 hours after glycerol injection, and both kidneys and plasma were collected. HKC-8 cells were treated with ferrous myoglobin to mimic the rhabdomyolysis environment.

Results: The glycerol injection led to increase serum creatinine, aspartate aminotransferase (AST), renal kidney injury molecule-1 (KIM-1), renal tubular necrosis, and apoptosis. Renal injuries were attenuated in NLRP3 KO mice, while muscle damage and renal neutrophil recruitment did not differ from wild type mice. Following glycerin injection, cleaved caspase-3, poly(ADP-ribose) polymerase (PARP), and acyl-CoA synthetase long chain family member 4 (ACSL4) were increased, and glutathione peroxidase 4 (GPX-4) was decreased in RIAKI kidney, and these changes were alleviated in NLRP3 KO kidney. NLRP3 was up-regulated, and cell viability was suppressed in HKC-8 cells under ferrous myoglobin circumference. Myoglobin induced apoptosis and lipid peroxidation was significantly lessened in siNLRP3 treated HKC-8 cells. Myoglobin caused to reduce mitochondrial membrane potential, increase mitochondrial fission, reactive oxygen species, and lipid peroxidation, which were recovered in NLRP3 depleted HKC-8 cells.

Conclusions: NLRP3 depletion ameliorated renal tubular injuries in the murine glycerol-induced AKI model. NLRP3 absence affected to improve tubular cell viability via attenuation of myoglobin-induced mitochondrial injuries and lipid peroxidation, which might be the critical factor in protecting the kidney.

Corresponding author: Yang Gyun Kim
E-mail: apple8840@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Feasibility and safety of 2-week protocol biopsy after kidney transplantation

Manuel Lim¹, Kyo Won Lee¹, Byung Kwan Park², Jae Berm Park¹, Sang Jin Kim¹, Kyeong-Deok Kim¹, Okjoo Lee⁴, Jaehun Yang³, Jeun Kwon³, Eun sung Jung¹

¹Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea
²Department of Radiology, Samsung Medical Center, Seoul, Korea

Background: Protocol biopsies to detect and treat subclinical rejection early after kidney transplantation are useful for improving outcomes. However, there have been few studies on the optimal timing of early protocol biopsy. In this study, the results of 2-week and 1-year biopsies were analyzed in terms of technical feasibility, complications, and outcomes.

Methods: Allograft protocol biopsies were performed in 916 adult recipients of kidney transplantation between 2012 and 2019 in our center. Retrospective analysis of complications and clinical outcomes of 880 2-week biopsies and 556 1-year biopsies were performed.

Results: There were no significant difference between the median number of biopsy cores and sampled glomeruli of 2-week biopsies and 1-year biopsies. All allograft biopsies were technically successful. Total complication rates of 2-week and 1-year biopsies were 27.5% (242/880) and 15.5% (86/556). Major complication (Clavien-Dindo grading III–IV) rates of 2-week and 1-year biopsies were 0.23% (2/880) and 0.18% (1/556). There were only two major complication cases in 2-week biopsies: bleeding requiring surgical exploration (n=1) and bleeding requiring radiological intervention (n=1), and was only one major complication case in 1-year biopsies: allograft failure (n=1). There was no significant risk factor for major complication, even though immunologic factors, pre-biopsy laboratory results, basic characteristics are analyzed with univariate and multivariate analysis. Detection rates of subclinical rejection was 16.5% (145/880) for 2-week biopsies and 32.9% (183/556) for 1-year biopsies.

Conclusions: The 2-week protocol biopsy is as feasible and safe as the 1-year protocol biopsy in kidney transplant. It contributes to early detection of a significant number of subclinical rejection after kidney transplantation.

Corresponding author: Manuel Lim
E-mail: ykcywbd@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The impact of new-onset diabetes after transplantation on survival and major cardiovascular events in Korean kidney transplantation recipients

Jangwook Lee¹, Dong Hyun Kang², Sehoon Park³, Ji Eun Kim⁴, Eunjeong Kang⁵, Yaerim Kim⁶, Sua Lee¹, Yong Chul Kim¹, Yon Su Kim¹, Yaeji Lim², Hajeong Lee¹

¹Department of Internal Medicine, Seoul National University Hospital, Seoul, Korea
²Department of Applied Statistics, Chung-Ang University, Seoul, Korea
³Department of Internal Medicine, Armed Forces Capital Hospital, Seongnam, Korea
⁴Department of Internal Medicine, Korea University Guro Hospital, Seoul, Korea
⁵Department of Internal Medicine, Ewha Womans University Seoul Hospital, Seoul, Korea
⁶Department of Internal Medicine, Keimyung University Dongsan Medical Center, Daegu, Korea

Background: New-onset diabetes after transplantation (NODAT) is a frequent complication in kidney transplant (KT) recipients with unfavorable outcomes, although a nationwide study on epidemiology and clinical outcome of NODAT in Korean KT recipients remain rare.

Methods: We identified KT recipients by using the Health Insurance Review and Assessment Service of South Korea from the year of 2008 to 2017. We excluded patients with preexisting diabetes, multi-organ transplantation, and being progressed to graft failure less than 1 year after KT. NODAT was defined as consecutive 30 days prescription history of antidiabetic medication after KT. We analyzed the impact of NODAT on death censored graft failure (DCGF), death without graft failure (DWGF), and major adverse cardiovascular events (MACE) by time-dependent Cox analysis.

Results: Among a total of 16,719 KT recipients, 10,311 were included after exclusion. The 19.8% of KT recipients were diagnosed to NODAT. The proportion of patients developing NODAT tended to increase, and 64% of NODAT was diagnosed within the first 6-months after KT. NODAT patients were older, more men, having longer pre-KT dialysis vintages, and being exposed more basiliximab induction and more rejection episodes requiring high-dose steroids treatment after KT. During follow-up, 520 DCGF, 180 DWGF, and 213 MACE events were occurred. NODAT patients showed higher risks of DCGF (adjusted hazard ratio [aHR], 1.87; 95% confidence interval [CI], 1.52–2.3; P<0.001), DWGF (aHR, 1.77; 95% CI, 1.28–2.43; P<0.001), and MACE (aHR, 1.46; 95% CI, 1.08–1.96; P=0.013) than patients without NODAT. Twenty-one percent of NODAT patients could be stopped their anti-diabetic medications after the diagnosis, although this did not affect the clinical outcomes.

Conclusions: About 20% of diabetes-naive KT recipients were diagnosed with NODAT with a recently increasing pattern. NODAT in KT recipients affected worse graft and patients outcomes as well as MACE.

Corresponding author: Jangwook Lee
E-mail: dive2inf@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Influence of everolimus on mycophenolate mofetil pharmacokinetics in kidney transplant patients

Takahito Endo, Takuya Fujimoto, Shun Nishioka, Naoki Yokoyama, Satoshi Ogawa, Takeshi Ishimura, Masato Fujisawa

Department of Urology, Kobe University Hospital, Kobe, Japan

**Background:** The objective of this study was to assess the effect of everolimus (EVR) on the pharmacokinetic parameters of mycophenolate mofetil (MMF) in patients who underwent kidney transplantation (KTx).

**Methods:** Ten patients underwent KTx under triple immunosuppression which comprised of tacrolimus (Tac), MMF, and methylprednisolone (mPSL), and EVR was added at 3–6 months after KTx. The EVR dose was 1.5 mg/day and was adjusted to maintain the targeted trough blood concentration (C0) of 3–8 ng/mL. At 4 weeks before and after the initiation of EVR, blood concentrations of Tac and MMF were measured before and 1, 2, 4, and 6 hours after administration, and the estimated value of the area under the concentration-time curve from 0 to 12 hours (AUC0–12) was calculated. We compared the C0 and AUC0–12 per dose of Tac and MMF before and after the initiation of EVR. We did not change the dose of Tac, MMF, and mPSL until 4 weeks after the initiation of EVR.

**Results:** The C0 of EVR at 4 weeks after EVR addition was 5.1±1.3 ng/mL, which was within the targeted range in all patients. The mean estimated glomerular filtration rate at 4 weeks before and after the initiation of EVR was almost at the same level. The mean dose of Tac and dose per weight of MMF during the observation period were 7.2±4.2 mg/day and 19.0±6.5 mg/kg/day, respectively. The Tac C0 per dose and the Tac AUC per dose before and after EVR addition were 1.16±0.57 and 1.18±0.68 ng/mL/mg and 46.3±18.0 and 48.1±22.9 ng·hr/mL/mg, respectively. The MMF C0 per dose and the MMF AUC per dose before and after EVR addition were 19.0±0.63 and 22.0±1.3 ng/mL/g and 43.0±20.0 and 51.0±15.0 ng·hr/mL/g, respectively.

**Conclusions:** The EVR administration has no significant influence on the pharmacokinetics of MMF.

**Corresponding author:** Takahito Endo
**E-mail:** takahito_do@yahoo.co.jp

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Graft-versus-host disease after deceased donor kidney transplantation

Hojong Park¹, Sang Jun Park¹, Hong Rae Cho¹, Kyung Sun Park², Jongha Park², Kyung Don Yoo², Jong Soo Lee²

¹Department of Surgery, Ulsan University Hospital, Ulsan, Korea
²Division of Nephrology, Department of Internal Medicine, Ulsan University Hospital, Ulsan, Korea

Background: Graft-versus-host disease (GVHD) is a rare complication after solid organ transplantation. We report a case of GVHD in recipient after deceased donor kidney transplantation.

Methods: The recipient was a 49-year-old female patient with end-stage renal disease due to hypertension and chronic glomerulonephritis. She was on hemodialysis for 11 years. The donor was a 45-year-old male. The deceased donor kidney transplantation was performed on February 22, 2020. Two months postoperatively she developed anorexia and severe epigastric pain. An esophagogastroduodenoscopy was performed and revealed multiple shallow ulcerative lesion were noted at fundus, high body, mid-body. Since it was in the early stage of transplantation, it was considered as a steroid induced ulcer. After taking ulcer medication, the symptoms did not improved even after 1 week. The biopsy was performed after retesting the endoscope. Biopsy findings were consistent with GVHD. When the patient was examined closely and in detail, skin lesions on trunk and thigh were found. Skin biopsy was performed for differential diagnosis, and favored GVHD. Aggressive immunosuppressive therapy was instituted with a good response.

Results: The anorexia and epigastric pain resolved, and she was discharged on hospital day 38. Three months later, there had been no recurrence of anorexia, epigastric pain. A repeat endoscopy revealed complete resolution of the initial endoscopic abnormalities, and there were no GVHD findings on biopsy. Eight months after transplantation, the patient was asymptomatic with normal graft function.

Conclusions: GVHD after kidney transplantation is rare. In particular, in the case of gastric GVHD, it may be difficult to discriminate due to immunosuppressants such as steroids at the early stage of transplantation. If symptoms do not improve even after ulcer treatment, it is important to actively perform endoscopy and biopsy for early diagnosis and treatment.

Corresponding author: Hojong Park
E-mail: 0732840@uuh.ulsan.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Prognostic value of postoperative proteinuria for predicting early renal outcome after kidney transplantation

Kyungho Park¹, Mee Yeon Park¹, Hyun Suk Lee¹, Junseok Jeon¹, Kyo Won Lee², Jung Eun Lee¹, Jae Berm Park², Woosong Huh¹, Yoon Goo Kim¹, Hye Ryoun Jang¹

¹Division of Nephrology, Department of Internal Medicine, Samsung Medical Center, Seoul, Korea
²Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea

Background: Proteinuria in kidney transplant recipients (KTRs) was reported to predict poor clinical outcomes. In this single-center retrospective cohort study, we investigated the prognostic value of spot urine protein to creatinine ratio (PCR) or albumin to creatinine ratio (ACR) during early postoperative period.

Methods: A total of 353 KTRs with urine PCR or ACR data within postoperative day 7 after KT between 2014 and 2017 were included in the final analyses. PCR and ACR were serially followed up during the immediate postoperative period (within postoperative day 7), before discharge (postoperative 2–3 weeks), and at postoperative 3–6 months. Primary and secondary outcomes were estimated glomerular filtration rate (eGFR) at 1 year after KT and the incidence of delayed graft function (DGF), respectively.

Results: After adjusting for sex, age, donor status, and acute rejection within 3 months, KTRs with higher PCR (β coefficient=-8.66, P=0.01) or ACR (β coefficient=-6.97, P<0.001) at postoperative 3–6 months showed lower eGFR at 1 year after KT. Deceased donor kidney transplantation (DDKT) recipients with immediate postoperative PCR ≥ 3 mg/mg showed higher incidence of DGF (PCR <3 mg/mg vs. PCR ≥3 mg/mg, 12% vs. 39%; P<0.001) and lower eGFR before discharge (64.2 [range, 49.7–85.4] vs. 49.6 [range, 35.8–66.5]; P=0.001) compared to KTRs with immediate postoperative PCR <3 mg/mg.

Conclusions: Proteinuria at postoperative 3–6 months was identified as a potential surrogate marker predicting early renal outcome after KT. Heavy proteinuria during the immediate postoperative period may be a potential predictor of DGF in DDKT recipients. Our study suggests that early postoperative proteinuria may be a useful biomarker for predicting early renal outcome after KT.

Corresponding author: Kyungho Park
E-mail: ds3ixc@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Refractory hyperkalemia caused by ACE gene mutation in a 3-year-old girl with kidney transplantation: a case report

Jeong Yeon Kim¹, Beom Hee Lee², Heeyeon Cho¹

¹Division of Nephrology, Department of Pediatrics, Samsung Medical Center, Seoul, Korea
²Department of Pediatrics, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Renal tubular dysgenesis (RTD) is rare and mostly fatal disease caused by genetic defect in renin-angiotensin system (RAS) presenting poor or absent development of proximal tubule. We report a child with non-fatal clinical course who was confirmed as RTD after kidney transplantation (KT).

Methods: Medical record of a child who diagnosed as RTD with ACE gene mutation after KT was retrospectively reviewed. The whole exome sequencing was performed to confirm genetic mutation with DNA extracted from saliva.

Results: In this patient, severe oligohydramnios was detected at gestation age of 17 weeks and due to persistent oligohydramnios her mother went emergency cesarean section at the 32 weeks of gestation. After a week after birth, diuretic resistant oliguria developed and continuous renal replacement therapy was applied for a week. Although urination recovered, renal insufficiency persisted. At the age of 7 months, peritoneal dialysis was initiated. At the age of 3 years, she received a KT from a deceased donor. Immediately after surgery, she had no complication and discharged. A week after discharge, severe hyponatremia, hyperkalemia, azotemia with metabolic acidosis was detected with polydipsia and polyuria. After intravenous hydration with normal saline and kalimate administration, laboratory values were adjusted. This event was repeated twice more, and polyuria was considered the cause. Nephrectomy for both native kidney was done at 80 days after KT to control polyuria. Nevertheless, electrolyte imbalance, metabolic acidosis, and azotemia persisted. To verify the reason for hyperkalemia, renin activity and aldosterone was evaluated and renin activity was increased (25.33 ng/mL/hr) with decreased aldosterone level (2.6ng/dL). Fludrocortisone was added and laboratory values were improved. She underwent whole exome sequencing to verify cause of hypoaldosteronism and homozygous ACE gene mutation (p.Ser486PhefsTer29) was revealed.

Conclusions: As RTD can be presented in non-fatal form, RAS defect should be considered in KT patients with refractory hyperkalemia.

Corresponding author: Jeong Yeon Kim
E-mail: kim.jy1117@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Differential impact of allograft rejection on kidney transplant patients with BK virus infection

Ji Won Min¹, Jae Berm Park², Jung Hwan Park³, Jong-Won Park⁴, Jaeseok Yang⁵, Curie Ahn⁶, Chul Woo Yang⁷, Byung Ha Chung⁷

¹Division of Nephrology, Department of Internal Medicine, Bucheon St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Bucheon, Korea
²Department of Surgery, Samsung Medical Center, Seoul, Korea
³Division of Nephrology, Department of Internal Medicine, Konkuk University Medical Center, Seoul, Korea
⁴Division of Nephrology, Department of Internal Medicine, Yeungnam University Medical Center, Daegu, Korea
⁵Department of Surgery, Seoul National University Hospital, Seoul, Korea
⁶Division of Nephrology, Department of Internal Medicine, Seoul National University Hospital, Seoul, Korea
⁷Division of Nephrology, Department of Internal Medicine, Seoul St. Mary’s Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Background: BK virus-associated nephropathy (BKVAN) is a known risk factor for allograft dysfunction and graft failure in kidney transplant recipients. The mainstay of treatment for BKVAN is reduction of immunosuppression and this may increase risk for acute rejection. We proposed to observe the effects of acute rejection on patients with BKVAN.

Methods: Using data from the Korean Organ Transplantation Registry, a nationwide organ transplantation database, we compared graft function, and allograft survival in BKVAN patients with or without biopsy proven acute rejection (BPAR).

Results: Among the 5,403 patients who received kidney transplantation between 2014 and June 2019, a total of 97 patients were diagnosed with BKVAN. Twenty-six patients (27%) developed BPAR within 6 months of BKVAN diagnosis, 71 patients did not. There were no differences in baseline characteristics, immunosuppression or BKVAN treatment methods between the BPAR and no BPAR groups. There was a significant decrease in allograft function in the BPAR group compared to the no BPAR group in both the 1-year (BPAR creatinine [Cr], 2.5±1.9 mg/dL vs. no BPAR Cr, 1.9±0.9 mg/dL; P=0.044) and 2-year follow-up period (BPAR Cr, 3.8±3.6 mg/dL vs. no BPAR Cr, 2.2±1.0 mg/dL; P=0.015). The BPAR group had lower allograft survival rates compared to the no BPAR group, although not statistically significant (P=0.474). On multivariate Cox regression analysis, MMF discontinuation was observed as a significant risk factor for rejection in BKVAN patients (hazard ratio, 4.000; 95% confidence interval [CI], 1.014–15.775; P=0.048).

Conclusions: Acute rejection with BKVAN is associated with poorer allograft function and survival. Also, discontinuation of MMF as treatment for BKVAN increases risk for acute rejection.

Corresponding author: Byung Ha Chung
E-mail: Chungbh@catholic.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Potential applicability of perioperative thromboelastography to access the coagulopathies in live related renal transplantation: a prospective observational pilot study

Amal Francis Sam1, Sandeep Sahu2, Karthik Ponnappan1

1Department of Anaesthesia, Institute of Liver and Biliary Sciences, New Delhi, India
2Department of Anaesthesiology and Critical Care, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India

Background: Organ transplantation is associated with ischemic and reperfusion injury. Ischemic reperfusion injury (IRI) during liver transplantation results in coagulopathy caused by the release of heparin like substances and platelet trapping. During renal transplantation IRI may be associated with a similar phenomenon, and thromboelastography (TEG) can be used to detect and manage coagulopathy in renal transplantation surgeries.

Methods: TEG was done on pre-operative, immediate post-reperfusion and post-operative day 1 (POD1), for 25 consecutive cases of live related renal transplantation. Coagulopathy was defined as deranged and abnormal TEG variables and supported by the clinical presence of non-surgical oozing and bleeding in the surgical field.

Results: The post reperfusion TEG values showed coagulopathic changes. The 64% patients had R-time (RT) more than 12 minutes, 64% patients showed maximum amplitude (MA) less than 55 mm, and 76% patients had alpha angle less than 55°. The pre-operative TEG coagulation index (CI) was 2.45±1.25, post-reperfusion CI was –1.96±4.54 and POD1 CI was 4.02±1.35. Univariate analysis revealed anti-thymocyte globulin (ATG) and etiology other than chronic glomerulonephritis, as risk factors for the hypocoagulable CI in the post reperfusion phase. Changes in CI did not translate into symptomatic non-surgical bleeding in the surgical field ($\chi^2=0.17; P=0.67$).

Conclusions: Ischemic reperfusion injury in renal transplantation is associated with transient self-limiting coagulopathy as detected by TEG. CI values in POD1 indicate a hypercoagulable or prothrombotic state. Whereas immediate post-reperfusion CI values show hypocoagulable state. Magnitude of changes shown by TEG did not translate into requirement of blood product transfusion.

Corresponding author: Amal Francis Sam
E-mail: amalfsam@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Excessive positive fluid balance has a negative effect on short-term renal outcomes after kidney transplantation

Jun Gyo Gwon¹, Myung-Gyu Kim², Cheol Woong Jung¹, Chang Hun Lee³

¹Division of Transplantation, Department of Surgery, Korea University Anam Hospital, Seoul, Korea
²Division of Nephrology, Department of Internal Medicine, Korea University Anam Hospital, Seoul, Korea

Background: Optimized postoperative fluid management is important in maintaining early allograft function after kidney transplantation (KT). However, there is still no clear guidance on how to treat fluid after KT. In this study, we investigated the effect of fluid balance on postoperative allograft function.

Methods: Recipients underwent KT between March 2012 and August 2018 were included and their medical records were reviewed retrospectively. We calculated fluid balance, which is the difference between total input and output during 3 days after KT, and analyzed the change of estimated glomerular filtration rate (eGFR) according to fluid balance.

Results: A total of 178 patients were included, except those with delayed graft function or urine output less than 2,000 mL on the first day after KT. Among them, 116 received kidneys from living donors and 62 from deceased donors. The total fluid balance up to day 3 was 4,236.9±2,830.4 mL. Old age, high body mass index (BMI), excessive positive fluid balance of recipient and high final creatinine of donor were significantly associated with low eGFR at 1 week. In addition, age, BMI, and fluid balance predicted 1-month eGFR. In multivariate analysis, an excessive positive fluid balance was an independent factor to predict low 1-week eGFR (P=0.031). In particular, this positive correlation was evident in the living donor KT recipients, suggesting that excessive positive fluid balance at early postoperative period can delay functional recovery of the transplanted kidney, regardless of donor kidney status.

Conclusions: We have demonstrated that excessive positive fluid balance can negatively affect early graft function after KT. Therefore proper fluid management strategies based on volume conditions may provide new therapeutic opportunities to improve early renal outcomes after KT.

Corresponding author: Jun Gyo Gwon
E-mail: doctorgjg@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Outcome of deceased donor renal transplantation in Mongolia: a single-center experience

Lkhaakhuu Od-Erdene, Tseren Khishgee, Dagvadorj Bayan-Undur, Donkhim Chuluunbaatar, Batsuuri Batsaikhan, Jigjidsuren Sarantsetseg

Organ transplantation Center, First Central Hospital of Mongolia, Ulaanbaatar, Mongolia

**Background:** Renal transplantation (RTx) has now become an accepted therapeutic modality of choice for end-stage renal disease (ESRD) patients in Mongolia. In last 5 years very fast developed organ transplantation system in Mongolia. In this time we can increase number of RTx from deceased donors in Mongolia. This single-center study was to evaluate the outcome of deceased donors RTx in ESRD patients.

**Methods:** We analyzed the outcome of 223 RTx (195 living donor and 29 deceased donors in ESRD patients at the time of transplantation between 2008 and 2020. Approval by the Internal Review Board and written informed consent from all patients were obtained.

**Results:** A total of 29 deceased donors at our center: the mean donor age was 47.2 years and 41.4 years in the recipients. Male recipients constituted 82.7 % and 46.6% in deceased donors. In deceased donor RTx, 1-, 3- and 5-year patient survival was 93.2%, 89.6% and 86.2% respectively and graft survival in 1, 3, 5 and 10 years was 96.5%, 89.6%, 89.6%, and 82.8% respectively. Induction immunosuppressant /IS/ was Basiliximab with steroid for all case and posttransplant maintenance consisted of calcineurin inhibitor-based regimen and MMF with low dose steroid. Cause of ESRD was 79.4% chronic glomerulonephritis, 6.8% diabetic mellitus type 2, 3.5% polycystic kidney disease and urine system abnormality. Mean duration dialysis treatment time for recipients was 39.9 months. Percentage of dialysis modality was PD 17.3% and HD 82.7%. Complication was TCMR one case, infection complication included urine tract, herpes simples virus, H1N1, hepatitis C virus, and hepatitis B virus. Patient death cause was heart failure, respiratory infection, suicide, traffic accident.

**Conclusions:** Deceased donor RTx in ESRD patients has acceptable patient and graft survival in Mongolia. But the number of deceased donors is still low. We need develop system of organ donation.

**Corresponding author:** Lkhaakhuu Od-Erdene
**E-mail:** odnoo_dashka@yahoo.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The efficacy of klotho gene as a biomarker of cancer development in kidney transplant recipients

Woo Yeong Park\textsuperscript{1}, Hyn Kyo Lee\textsuperscript{2}, Ohyun Kwon\textsuperscript{1}, Yaerim Kim\textsuperscript{1}, Jin Hyuk Paek\textsuperscript{1}, Kyubok Jin\textsuperscript{1}, Seungyeup Han\textsuperscript{1}

\textsuperscript{1}Division of Nephrology, Department of Internal Medicine, Keimyung University Dongsan Medical Center, Daegu, Korea
\textsuperscript{2}Department of Biochemistry & Molecular Biology, TRS Lab., Daegu, Korea

\textbf{Background:} The klotho gene is known as a co-receptor of FGF23 in the chronic kidney disease-mineral bone disease, but recently, it has been reported that klotho is associated with the occurrence of cancer in the general population. However, the association between klotho gene and the development of cancer in kidney transplant recipients (KTRs) is uncertain. Therefore, we aimed to investigate the effect of klotho gene as a biomarker of the cancer development and the factors associated with the development of cancer in KTRs.

\textbf{Methods:} We investigated a total of 45 non-dialysis chronic kidney disease (ND-CKD) patients, dialysis patients, and KTRs diagnosed and treated for gastric cancer, thyroid cancer, and kidney cancer at Keimyung University Dongsan Medical Center from January 2009 to December 2018. We measured the serum klotho level and expression status in the tissue, the serum levels of malondialdehyde (MDA), and superoxide dismutase (SOD) as oxidative stress markers, with the stored samples in the biobank.

\textbf{Results:} The serum klotho level was the lowest in kidney cancer compared to gastric and thyroid cancer, whereas the level of oxidative stress markers was the highest in kidney cancer. In 12 patients diagnosed to kidney cancer, the serum klotho level was the lowest and MDA level was the highest in KTRs, but SOD showed no difference among them. Comparing normal and tumor tissues by western blot analysis, klotho expression was decreased in tumor tissues compared to normal tissues in all three groups, but klotho expression in KTRs only was deceased in tumor tissues compared to normal tissues by real-time polymerase chain reaction. This shows the relationship between the development of kidney cancer and inhibition of klotho gene in KTRs through the mechanism of oxidative stress.

\textbf{Conclusions:} The klotho gene may play a role as a biomarker of cancer development with the mechanism of oxidative stress in KTRs.

\textbf{Corresponding author:} Seungyeup Han
\textbf{E-mail:} hansy@dsmc.or.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Impact of donor factors on post-transplant delayed recovery of graft function in deceased donor kidney transplantation

Woo Yeong Park¹, Ohyun Kwon¹, Yaeirim Kim¹, Jin Hyuk Paek¹, Kyubok Jin¹, Young-Nam Roh², Ui Jun Park², Hyoung Tae Kim², Seungyeup Han¹

¹Division of Nephrology, Department of Internal Medicine, Keimyung University Dongsan Medical Center, Daegu, Korea
²Division of Transplantation, Department of Surgery, Keimyung University Dongsan Medical Center, Daegu, Korea

Background: Deceased donor (DD) factors influence absolutely the post-transplant delayed recovery of graft function (DGF) in deceased donor kidney transplantation (DDKT). Although there are some tools for the status of DD such as expanded criteria donor criteria or kidney donor profile index score, but these tools do not fully reflect impact of DD factors on post-transplant DGF. Therefore, we aimed at investigating the DD factors related with the occurrence of DGF in DDKT.

Methods: We retrospectively analyzed the medical records of DDKT performed at Keimyung University Dongsan Medical Center between February 2014 and September 2019. Our study enrolled 186 kidney transplant recipients (KTRs), with median follow-up of 45 months after DDKT.

Results: Eighty-seven DDs (46.5%) had a documented history of smoking; 108 (57.8%), proteinuria; 80 (42.8%), transfusion; 95 (50.8%), acute kidney injury (AKI); and continuous renal replacement therapy (CRRT), 18 (9.6%). The incidence of DGF was significantly higher in KTRs from DDs with CRRT compared to those from DDs without CRRT (P=0.002). The incidence of DGF was also higher in KTRs from DDs with smoking history, but there were no significant association with the presence and amount of proteinuria and transfusion. Allograft function was significantly lower in the KTRs with DGF until 1 month after KT compared to those without DGF, but there was no significant difference of allograft function between the two groups at 12 months after KT. In Kaplan-Meier analysis, graft and patient survivals did not show the differences according to the characteristics of DDs with smoking, proteinuria, transfusion, AKI, and CRRT. In multivariate logistic analysis, AKI, CRRT, smoking, and donor hypertension were independent risk factors for DGF.

Conclusions: DDs with AKI, CRRT, smoking, and hypertension can increase the risk of occurrence of DGF in KTRs. Therefore, DDKT from DDs with significant risk factors should be performed carefully.

Corresponding author: Woo Yeong Park
E-mail: wy-my@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Effect of preoperative dialysis on intraoperative hemodynamics during living donor kidney transplantation

Keoung Ah Kim\(^1\), Kyowon Lee\(^2\), Gaabsoo Kim\(^1\), Hyeryung Kang\(^1\), Jaehun Yang\(^2\)

\(^1\)Department of Anesthesiology, Samsung Medical Center, Seoul, Korea  
\(^2\)Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea

**Background:** End-stage renal disease patients on dialysis typically have an advanced disease status and many cardiovascular complications. We aimed to compare the intraoperative hemodynamics between non-preemptive (with preoperative dialysis) and preemptive (without preoperative dialysis) recipients of living donor kidney transplantation (LDKT).

**Methods:** This was a single center retrospective study. The recipients of LDKT were included and all data were collected by electronic medical record. Recipients were divided in two groups: preemptive and non-preemptive kidney transplantation. After comparing the potential risk factors between two groups, we performed a propensity score-matching analysis to reduce the differences of baseline characteristics. The primary outcome was intraoperative hemodynamic events such as the prevalence of the intraoperative hypotension; electrolyte; frequency of inotropes or vasopressors use; and acid-base status. Secondary outcome was immediate graft function by nadir creatinine (Cr), time to nadir Cr. Estimated blood loss, surgical time, postoperative bleeding and re-operation were also investigated.

**Results:** We analyzed data from 541 patients after propensity score matching: 388 and 153 patients in non-preemptive and preemptive groups, respectively. The multivariable analysis revealed the AUT of the preemptive group was significantly greater than those of non-preemptive group at thresholds absolute 70 and more inotropes and vasopressors were administered to the preemptive group. Furthermore, base excess in the preemptive group was lower than non-preemptive group. Postoperative nadir Cr concentration, the time to nadir Cr were not different between two groups significantly. Estimated blood loss, surgical time, postoperative bleeding, re-operation were also not different between two groups.

**Conclusions:** Intraoperative hypotension and acidosis occurred more frequently in recipients without preoperative dialysis during LDKT. With this finding in mind, anesthesiologists should prepare for situations where intraoperative hypotension may occur.

**Corresponding author:** Kyowon Lee  
**E-mail:** kw1980.lee@samsung.com

© The Korean Society for Transplantation  
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Clinical outcomes in elderly kidney transplant recipients: emphasis on choice of induction immunosuppressive therapy

Kyeong Deok Kim, Kyo Won Lee, Sang Jin Kim, Okjoo Lee, Jieun Kwon, Eun Sung Jeong, Jaehun Yang, Manuel Lim, Jae Berm Park

Division of Transplantation, Department of Surgery, Samsung Medical Center, Seoul, Korea

Background: Patients waiting for kidney transplantation (KT) and recipients who underwent KT over age of 60 years are increasing annually. The increased age of the recipients is known to be associated with decrease in the rejection rate. However, infections are more frequent in older recipients. The aim of this study was to evaluate the infection and rejection rate according to the recipients’ age and induction agents.

Methods: All patients who underwent KT from June 2011 and April 2019 were retrospectively reviewed. The patients were divided into four groups according to their age (< 60 years and 60 years) and the type of induction agents used (basiliximab 20 mg twice and rabbit anti-thymocyte globulin [r-ATG] 1.5 mg/kg for 3 days).

Results: The 704 recipients were included (basiliximab and young age group, n=287 [40.8%]; basiliximab and old age group, n=59 [8.4%]; r-ATG and young age group, n=238 [33.8%]; basiliximab and old age group, n=120 [17.0%]). The rejection rate within 1 year was similar between young and old age group regardless of the type of induction agents. Cytomegalovirus antigenemia, BK viremia, Pneumocystis carinii pneumonia, pneumonia, and bloodstream infection rate within 1 year were similar between young and old age group in basiliximab (P=0.200, P=0.244, P=0.312, P=0.248, and P=0.064 respectively); however, they were significantly higher in the old age group in r-ATG (P<0.001, P=0.036, P=0.037, P=0.049 and P=0.008 respectively).

Conclusions: The rejection rate and most of the infections were not influenced by age when basiliximab was used as an induction agent. The rejection rate was not significantly different between the young and old age group; however, most of the infections were more common in old age group when r-ATG was used as an induction agent. Thus, dose reduction of r-ATG might be needed for elderly patients.

Corresponding author: Kyo Won Lee
E-mail: kw1980.lee@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
rs11940017 single nucleotide polymorphism of nuclear factor of kappa light polypeptide gene enhancer in B-cells 1 (NFKB1) gene is associated with post-renal transplant diabetes mellitus among Korean transplant recipients

Chan Il Park, Yunmi Kim, Taehee Kim, Sun Woo Kang, Yeong Hoon Kim

Division of Nephrology, Department of Internal Medicine, Inje University Busan Paik Hospital, Busan, Korea

**Background:** The post-renal transplant diabetes mellitus (PTDM) results from insulin resistance after renal transplantation. Recent studies suggested that genetic polymorphisms of specific genes may be contributed to development of PTDM. The purpose of this study was to investigate the relationship with polymorphisms of nuclear factor of kappa light polypeptide gene enhancer in B-cells 1 and 2 (NFKB1 and NFKB2 gene) to the development of PTDM.

**Methods:** We selected the promoter polymorphisms (rs11940017 of NFKB1 gene, and rs12769316 of NFKB2 gene) and recruited the 256 non-PTDM subjects and 54 PTDM patients among Korean transplant recipients. Genotype of each single nucleotide polymorphism (SNP) was performed using direct sequencing. SNPstats and PASW ver. 18.0 program were used for genetic analysis.

**Results:** C allele distribution of rs11940017 in NFKB1 gene in the PTDM group (8.3%) showed significantly higher compared to that of the non-PTDM group (3.7%) (odds ratio [OR], 2.36; 95% confidence interval [CI], 1.04–2.37; P=0.041). The genotype distribution also associated with PTDM (OR, 2.99; 95% CI, 1.19–7.50; P=0.02 in codominant model [T/T vs. T/C]; OR, 2.64; 95% CI, 1.08–6.49; P=0.042 in dominant model [T/T vs. T/C and C/C]). However, NFKB2 gene did not find any significant association with PTDM.

**Conclusions:** This study suggests that NFKB1 gene polymorphism may be contributed to development of PTDM in Korean population.

**Corresponding author:** Sun Woo Kang
**E-mail:** kswnephrology@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Effect of pan-caspase inhibitor in ex vivo cold ischemia-rewarming injury model

Won-Hee Cho, Jung-Woo Seo, Su Woong Jung, Sang-Ho Lee

Division of Nephrology, Department of Internal Medicine, Kyung Hee University Hospital at Gangdong, Seoul, Korea

**Background:** Although the mouse model of vascularized kidney transplantation is a powerful tool for investigating the mechanisms of cold ischemia-reperfusion injury (IRI), the surgery is technically difficult. Here, we evaluated the utility of ex vivo cold IRI model with pan-caspase inhibitor (Z-VAD-FMK), which is effective in cold IRI using mice.

**Methods:** We subjected C57BL/6 mice to intracardiac injection of pan-caspase inhibitor or vehicle. After 24 hours of incubation in 4°C histidine-tryptophan-ketoglutarate solution, the kidney tissue was suspended on a 96-well plate. So, incubation was performed at 37°C for 3, 6, and 9 hours, respectively. Then the kidneys were harvested for histology, western blot, reverse transcription polymerase chain reaction, and immunostaining to assess the effects of pan-caspase inhibitor.

**Results:** The pan-caspase inhibitor-treated group did not significantly improve histological tubular injury than that of the control group. However, pan-caspase inhibitor ameliorated the magnitude of an increase in kidney injury molecule-1 levels in culture media at 3, 6, and 9 hours after rewarming and was significant at 6 hours. In addition, pan-caspase inhibitor did not show a decrease in proinflammatory cytokines but attenuated apoptosis in renal tubular cells.

**Conclusions:** Our data demonstrated that pan-caspase inhibitor reduced tubular injury in the ex vivo rewarming model after mouse kidney cold preservation.

**Corresponding author:** Sang-Ho Lee

**E-mail:** lshkidney@khu.ac.kr

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Infection complication rate in kidney transplanted patient in Mongolia in last 3 years

Khishgee Tseren, Bayan-Undur Dagvadorj, Od-Erdene Lkhaakhuu, Bat-Ireedui Badarch, Udval Batkhuu

Organ Transplantation Center, First Central Hospital of Mongolia, Ulaanbaatar, Mongolia

Background: Infection remains a significant cause of morbidity and mortality in renal transplant recipients. In Mongolia, mean cause of kidney graft dysfunction is infection.

Methods: We studied a total of 72 patients who underwent a kidney transplant from 2017 to 2019. Demographic data was investigated as follows: age, sex, region from transplant center, body mass index, bacteriology culture post-kidney transplantation of early period (1–6 months) and late period (more than 6 months), epidermal growth factor receptor, induction and maintenance immunosuppressive medication, number of hospitalization, surgical complication, vaccination, etc.

Results: Overall mean age of subjects was 34.6±3.5 years; females were 14 (19.4%) and males were 58 (80.6%). With living donor recipients were 59 (81.9%), deceased donor recipients were 13 (18.1%). Region location from transplantation center was 40 patients (55.6%) living in Ulaanbaatar City and 32 patients (44.4%) living so far from Ulaanbaatar in region. The number of early-period infection complications was 81 bacterial (98.8%) and one virus (1.2%). From bacterial infections, urine tract infections were 26 (32.1%), respiratory infections were 52 (64.2%), and tuberculosis, pyodermatitis, pneumonia, and cytomegalovirus infection were one (1.2%), respectively. From late-period 67 infections, 64 (95.5%) were bacterial, three (4.5%) were virus infections, and from all this 23 (35.9%) were urine tract, 32 (50.0%) were respiratory, four (6.3%) were pyodermatitis, and H1N3 virus etiology pneumonia, herpes zoster, varicella zoster were one (1.5%), respectively. From all of 72 infected patient, graft loss was one patient. Main bacterial etiology in both periods was Escherichia coli, Klebsiella pneumoniae extended-spectrum β-lactamases, etc. Number of hospitalization in infected 26 patients was 46.

Conclusions: Infection complications in Mongolia for post-kidney transplant are still common, particularly urinary tract infections.

Corresponding author: Khishgee Tseren
E-mail: Ts.Khishgee@fchm.edu.mn

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Clinical analysis of related factor influencing the increase in body mass index after kidney transplantation

Hyo-Sin Kim¹, Yeon-Ho Han², Seok-Joon Sohn², Ho Kyun Lee¹, Soo Jin Na Choi¹

¹Department of Surgery, Chonnam National University Medical School, Gwangju, Korea
²Department of Preventive Medicine, Chonnam National University Medical School, Gwangju, Korea

Background: Increased bodyweight after kidney transplantation lowers the quality of life and significantly reduces the survival rate of transplanted kidneys. The aim of the study was to evaluate factors related to body mass index (BMI) increase after kidney transplantation.

Methods: From 2014 to 2017, among the 110 patients who underwent kidney transplantation was selected. BMI was compared at 6 months, 1 year, and 2 years after surgery according to the postoperative period; 6 months, 1 year, and 2 years. Multivariate analysis was performed to identify factors related to changes in BMI after surgery.

Results: According to the elapsed time after surgery, the BMI increased to 22.5 kg/m² after 6 months, 22.8 kg/m² after 1 year, 23.1 kg/m² after 2 years (P<0.001). The factor influencing the increase in BMI were female sex, level of low-density lipoprotein cholesterol, steroid use, and medication of statin.

Conclusions: To prevent an increase in BMI after kidney transplant, appropriate exercise and diet, medication for hyperlipidemia, and steroid tapering as soon as possible are required.

Corresponding author: Hyo-Sin Kim
E-mail: gideon0504@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Malakoplakia after kidney transplantation

Sang Jun Park, Hojong Park, Hong Rae Cho, Kyung Sun Park, Jongha Park, Kyung Don Yoo, Jong Soo Lee

1Department of Surgery, Ulsan University Hospital, Ulsan, Korea
2Division of Nephrology, Department of Internal Medicine, Ulsan University Hospital, Ulsan, Korea

Background: Malakoplakia is a rare pseudotumor that arises in the context of recurrent infections, particularly in the immunocompromised setting. We report a case of renal allograft parenchymal malakoplakia.

Methods: A 59-year-old woman had received cadaveric renal transplant due to diabetes in June 2018. Her creatinine remained relatively stable postoperatively. Two months after transplantation, she was treated with urinary tract infection (UTI). In March 2019, she had allograft biopsy for increasing creatinine. The biopsy identified acute T-cell mediated rejection and steroid pulse therapy was performed. In December 2019, she was hospitalized for right flank pain and pyuria. Her creatinine level was 1.9 mg/dL. Ultrasound (US) renal Doppler and computed tomographic findings were likely to be hematoma or abscess in the perirenal area, and septated fluid collection was suspected. The lesion was connected to renal parenchyma. We thought that she was not the case of pyogenic abscess, so she had to undergo a biopsy because she needed to identify other causes. Biopsy results suggested malakoplakia and von Kossa stain with positive Michaelis-Gutmann bodies. The tissue culture found Escherichia coli, and this was treated with antibiotics. The dose of tacrolimus was reduced.

Results: After 1 month of hospitalization, she was discharged, and maintained oral antibiotics. In follow-up imaging, extent of lesion has increased, so we performed surgical resection and abscess drainage on February 3, 2020. Although there is still renal parenchymal involvement, the size is decreasing after 2 months of serial observation with US.

Conclusions: Malakoplakia is a rare condition, particularly kidney transplantation, where a differential diagnosis of recurrent UTI with graft dysfunction and the presence of pseudotumoral lesions should be considered. The treatment is reduction in immunosuppression; a good response is achieved with medical therapy using long-term antibiotic treatment. However, early surgical treatment must be considered for refractory cases.

Corresponding author: Hojong Park
E-mail: hjpark@uuh.ulsan.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Therapeutic challenges of hepatic mucormycosis in a renal transplant recipient: a case report

Chang Hun Lee1, Cheol Woong Jung1, Jun Gyo Gwon1, Myung Gyu Kim2

1Division of Transplantation Vascular Surgery, Department of Surgery, Korea University College of Medicine, Seoul, Korea
2Division of Nephrology, Department of Internal Medicine, Korea University College of Medicine, Seoul, Korea

Background: Mucormycosis is a rare, highly lethal opportunistic fungal disease affecting immune-compromised patients. It accounts for about 2% of invasive fungal infections occurring within 1 year after solid organ transplantation. We report here a case of successful treatment for hepatic mucormycosis with abscess formation that occurred 2 months after kidney transplantation.

Methods: A 59-year-old woman who underwent a deceased donor kidney transplantation 2 months ago was hospitalized with abdominal pain and fever. She had thymoglobulin induction therapy and was on conventional maintenance immunosuppressive therapy to prevent rejection. There were no specific complications except delayed graft function after kidney transplantation. The computed tomography (CT) scan was performed, demonstrating a 7.7 cm-sized abscess in the S5/8 segment of the liver. Percutaneous drainage was performed, and the culture result from the drainage came out as Rhizopus microsporus.

Results: Liposomal amphotericin B was administered intravenously at a dose of 5 mg/kg daily, and serial CTs were performed. Since the antifungal agent was initiated, the size of the lesions continuously decreased down to 5.8 cm; however, there was no significant change thereafter. Accordingly, we decided to perform surgical resection for the lesion. Following approximately 3 months of antifungal therapy, the right anterior sectionectomy of the liver was performed. The antifungal agent was continuously used for 3 months after surgery. Kidney function was well preserved and there was no evidence of recurrences until 4 months after liver resection.

Conclusions: Optimal treatment strategies for mucormycosis in a renal transplant recipient have not yet been defined. In this case, even though, we were able to minimize the extent of liver resection by using an antifungal agent for a long period of time and successfully treat mucormycosis without damage of transplanted kidney. Early surgical intervention for the lesion could be a more valid option of treatment to shorten the duration of the disease and reduce medical expense.

Corresponding author: Cheol Woong Jung
E-mail: cwjung@korea.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Outcome after kidney transplantation in hepatitis B surface antigen-positive patients

Hyejin Mo¹, Sangil Min², Ahram Han², In Mok Jung¹, Jongwon Ha²

¹Department of Surgery, SMG-SNU Boramae Medical Center, Seoul, Korea
²Department of Surgery, Seoul National University Hospital, Seoul, Korea

Background: Few reports detail the actual outcome of hepatitis B surface antigen (HBsAg)-positive patients after kidney transplant. This study aimed to provide real-world outcomes of HBsAg-positive patients after kidney transplant.

Methods: HBsAg-positive patients who underwent kidney transplants between January 1999 and December 2018 at a single institution were enrolled retrospectively. Outcomes including hepatitis B virus (HBV) reactivation rate, risk factors for reactivation, and patient and graft survival rates were analyzed. Patient and graft survival rates for positive patients were compared to those of propensity score-matched negative patients.

Results: Seventy-seven patients were enrolled (age, 47.1±11.5 years). Patients received ABO-incompatible (n=5), crossmatch positive transplant (n=2), and re-transplant (n=4). Three patients received rabbit anti-thymocyte globulin, and 10 received rituximab. Forty-six patients received prophylactic, 19 received medication at least 3 months before the transplant, and 12 did not receive medication. Seventeen out of 76 patients developed reactivation post-transplant. Of HBV reactivation, 52.9% was accompanied by hepatitis. Inappropriate, other than lifelong prophylactic, antiviral agents (hazard ratio [HR], 7.34; 95% confidence interval [CI], 1.51–35.69; P=0.01) and high hepatitis DNA (≥1,000 IU/mL) pre-transplant (HR, 4.39; 95% CI, 1.08–17.81; P=0.04) increased reactivation risk. There was no significant difference in patient survival between antigen-positive patients who received antiviral agent and propensity score-matched negative patients.

Conclusions: HBsAg positivity in kidney transplant recipients is associated with substantial HBV reactivation rate. Lifelong antiviral therapy is mandatory, and patients with high preoperative HBV titer should be monitored closely for HBV reactivation.
Possibility of using retrograde reperfusion renal graft to reduce ischemic-reperfusion injury

Myltykbay Rysmakhanov, Gany Kuttymuratov

Department of General Surgery and Transplantation, Aktobe Medical Center, Aktobe, Kazakhstan

Background: Today, ischemic-reperfusion injury (IRI) of a renal graft remains an urgent problem. The aim was to study the possibility of the effect of retrograde reperfusion of a renal transplant on the reduction of IRI in kidney transplantation.

Methods: We performed 72 living-donor kidney transplants using retrograde graft reperfusion methods. After standard laparoscopic nephrectomy, the renal graft was flushed with histidine-tryptophan-ketoglutarate solution with heparin. The mean time of cold ischemia was 28±11 minutes, and the duration of secondary warm ischemia was 22±8 minutes. After the venous anastomosis of the “end-to-side” type was applied between the vein of the donor kidney and the external iliac vein of the recipient, retrograde reperfusion of the kidney with venous blood was performed. Anastomosis was then initiated between the renal artery and the external or common iliac artery of the recipient. The average duration of the arterial anastomosis was 15±2.6 minutes. Thereafter, antegrade arterial renal reperfusion was performed.

Results: In all cases, the graft function was satisfactory. Complications in the form of vascular thrombosis were not observed, during the operation there were no reanastomoses. Immunosuppression was carried out according to a three-component scheme; calcineurin inhibitor+mycophenolate mofetil+steroid with induction by basiliximab. The normalization of serum creatinine and urea levels was noted on average on the 4th day after surgery. On postoperative days 9–11 in three patients were diagnosed with urological complications—urinary leakage. Complications were eliminated by surgery. There were no indications for diagnostic biopsy of the renal graft.

Conclusions: The results of the analysis of the initial experience of kidney transplantation using retrograde reperfusion underline the fact that this technique does not impair graft function. The positive effect of retrograde reperfusion in reducing the IRI of the kidney transplant will be the subject of our further research.

Corresponding author: Mylytkbay Rysmakhanov
E-mail: mrtransplantolog@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Risk factors of delayed graft function in deceased donor kidney transplantation

Seung Hwan Song¹, Dami Jung², Ku Yong Chung²

¹Division of Transplantation Surgery, Department of Surgery, Ewha Womans University Seoul Hospital, Seoul, Korea
²Division of Transplantation Surgery, Department of Surgery-Transplantation, Ewha Womans University Mokdong Hospital, Seoul, Korea

Background: The most significant complication is delayed graft function (DGF) on deceased donor kidney transplantation (DDKT). Multiple factors belonging to donor, recipient, and transplant procedures have an effect on the development of DGF. We aim to evaluate the predictable risk factors of DGF and its effects on the graft function and survival in our country.

Methods: Between January 2008 and October 2020, a total of 99 recipients who underwent DDKT were retrospectively reviewed. We classified recipients into two groups; DGF(−) vs. DGF(+). The risk factors of DGF associated with donor and recipient were analyzed. The effects of DGF were examined on the graft function and survival.

Results: We included 99 DDKT cases. Among 99 DDKT, 35 cases were included in DGF(+), and the others were in DGF(−) (n=64). A cold ischemic time (CIT) of the DGF(+) group was 297.4±96.2 minutes, compared to 248.2±60.7 minutes of the DGF(−) group (P=0.002). Shorter dialysis duration and marginal donors were observed to be statistically significant compared to recipients without DGF (P=0.05). The serum creatinine level before donor nephrectomy of the DGF(+) group was significantly higher (1.7±1.1 mg/dL) than that of the DGF(−) group (1.0±0.5 mg/dL, P<0.0001). There was no significant difference in graft function and survival between DGF(+) and DGF(−) group.

Conclusions: Longer CIT, marginal donor, and the serum creatinine level before donor nephrectomy are the most important risk factors for DGF. There was no significant difference in graft function and survival between DGF(+) and DGF(−) group.

Corresponding author: Seung Hwan Song
E-mail: seunghwanhappy@ewha.ac.kr
The role of encapsulating peritoneal sclerosis for the graft dysfunction in kidney transplantation: a case report

Yi-Chou Hou¹, Yu-Hua Lin², Chun-Hou Liao², Kuo-Cheng Lu³

¹Department of Internal Medicine, Cardinal Tien Hospital, New Taipei City, Taiwan
²Department of Urology, Cardinal Tien Hospital, New Taipei City, Taiwan
³Department of Nephrology, Taipei Tzu Chi Hospital, New Taipei City, Taiwan

Background: Among the complications within the renal transplantations, early or delayed graft dysfunction is important issue because of its predictive value for chronic graft loss. Encapsulated peritoneal sclerosis (EPS) is the fibrotic change of the peritoneum in peritoneal dialysis (PD) patients. The longer duration of PD treatment is related to the occurrence of the EPS. Based on the lacking understanding of the EPS and its effect on the graft, we would like to present a case with pre-transplantation EPS, which caused delayed graft function by persistent ascites drainage.

Methods: A 52-year-old female received maintained PD since 2010 due to diabetic nephropathy with end-stage renal disease. The patient received PD with the following regimen; 2.5% Dianeal 2 L with duration of 4 hours for each session. Pre-transplantation EPS was noted. On January 7, 2020, the patient received a living-unrelated renal transplant.

Results: One day after transplantation, the patient’s serum creatinine was still 10 mg/dL. Oliguria was noted. Persistent exudative drainage from peritoneal cavity was noted. The daily output was 1,000 mL/day. After intravenous fluid was given, serum creatinine regressed. The daily amount of dialysate output decreased at the same time. In August 2020, the follow-up computer tomography demonstrated the regression of encapsulated sclerotic change. Serum creatinine regressed to 1.3 mg/dL.

Conclusions: EPS is an important complication during the treatment of PD therapy. Persistent abdominal fluid drainage by ascites by EPS is rare and is a neglected etiology for delayed graft function. Further focus on the pre-transplantation EPS is needed.

Corresponding author: Yi-Chou Hou
E-mail: athletics910@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Direct intranodal lipiodol injection for management of lymphocele in kidney transplant recipient

Mihyeong Kim, Jeongkye Hwang

Division of Transplantation Surgery, Department of Surgery, The Catholic University of Korea, St. Paul’s Hospital, Seoul, Korea

**Background:** Lymphocele developed after kidney transplantation is benign in most patients but sometimes needs fenestration surgery in uncontrolled cases. We managed a lymphocele with simple intervention and report the results.

**Methods:** Sixty-seven years-old man underwent deceased donor kidney transplantation. He had diabetes, atrial flutter, hypothyroidism and was obese (body mass index, 34.7 kg/m²). Large amount of lymphatics was drained through the Jackson-Pratt catheter about 400–800 mL/day and he kept catheter at discharge (postoperative day [POD] 19). Two days later, he revisited hospital for catheter site oozing and we tried to induce peri-graft adhesion by injection of *Viscum album* through the catheter. However, the amount of drainage was not reduced and 400–700 mL/day was drainage. At POD 36, we punctured right inguinal lymph node directly under sono-guidance and did lymphangiography and found contrast leakage at iliac lymphatic vessels. We injected 5 mL of lipiodol very slowly over 5 minutes.

**Results:** The amount of drainage was decreased remarkably under 100 mL/day and drainage catheter was removed. Sixteen days later, moderate amount of lymphocele (6×10 cm sized) was found on follow-up computed tomography and we inserted percutaneous drainage and 360 mL of lymphatics was drained. Three days later, we performed sclerotherapy using alcohol and he was discharged without drainage.

**Conclusions:** Direct intranodal lipiodol injection is simple and safe method to reduce the amount of lymphatic drainage. It may need additional sclerotherapy or percutaneous drainage, but useful method before considering surgery in uncontrolled lymphocele patients.

**Corresponding author:** Mihyeong Kim

**E-mail:** mhkim@catholic.ac.kr

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Uremic cardiomyopathy may improve with kidney transplantation: a case report

Seung Hwan Song¹, Geun Hong², Ku Yong Chung², Dami Jung²

¹Division of Transplantation Surgery, Department of Surgery, Ewha Womans University Seoul Hospital, Seoul, Korea
²Division of Transplantation Surgery, Department of Surgery, Ewha Womans University Mokdong Hospital, Seoul, Korea

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 man, who received deceased donor KT on January 20, 2019. Time on dialysis before KT was 73 months. The cause of CKD was immunoglobulin A 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.

Results: He underwent a deceased donor KT from marginal donor and produced urine soon after the transplantation. He was treated with the immunosuppression regimen, which included prednisone, mycophenolate mofetil, and tacrolimus. Patient was also receiving other medicines than immunosuppressants such as antihypertensive drugs, taken both before and after KT. Successful KT improved his cardiac symptoms and increased his LVEF to 16% on postoperative day 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.

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.

Corresponding author: Seung Hwan Song
E-mail: seunghwanhappy@ewha.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Anastomosing hemangioma mimicking renal cell carcinoma in a kidney transplant recipient: a case report

Chang Seong Kim

Background: An anastomosing hemangioma is a very rare and benign vascular neoplasm, which is associated with end-stage kidney disease. Although there have been reports of anastomosing hemangiomas incidentally detected in the kidney or adrenal gland, previous studies have not reported anastomosing hemangioma misdiagnosed as a renal cell carcinoma in a patient before kidney transplantation.

Methods: A 35-year-old woman with lupus nephritis was admitted to the emergency room for suspected uremic symptoms of nausea and general weakness. She had received hemodialysis due to end-stage kidney disease, and a living-donor kidney transplantation from her father was planned. Contrast-enhanced computed tomography and magnetic resonance imaging findings indicated a 1.7-cm renal cell carcinoma in the right kidney during the pre-kidney transplantation work-up. However, after nephrectomy, irregularly shaped vascular spaces of various sizes were observed; these spaces showed an anastomosing pattern. The radiological imaging findings of the anastomosing hemangioma are similar to those of a renal cell carcinoma. Therefore, histologic confirmation is necessary to prevent delay in listing for kidney transplantation.

Results: After kidney transplantation, kidney function is well and no tumor recurrence has been detected. Long-term surveillance is needed to detect anastomosing hemangiomas after kidney transplantation.

Conclusions: Here, we report a case of anastomosing hemangioma confirmed by radical nephrectomy performed simultaneously with a living-donor kidney transplantation in a 35-year-old woman. The case findings indicate that prompt surgical resection of an enhancing renal mass is necessary for patients who are scheduled to undergo kidney transplantation and may reduce the waiting period for kidney transplantation.

Corresponding author: Chang Seong Kim
E-mail: laminion@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Hyperkalemia developed from atorvastatin after kidney transplantation: a case report

Tae Hyun Ban1, Bum Soon Choi1, Mi-Hyeong Kim2, Jeong-Kye Hwang2, Jihyang Lim3

1Division of Nephrology, Department of Internal Medicine, The Catholic University of Korea, Eunpyeong St. Mary’s Hospital, Seoul, Korea
2Division of Transplantation Surgery, Department of Surgery, The Catholic University of Korea, Eunpyeong St. Mary’s Hospital, Seoul, Korea
3Department of Laboratory Medicine, The Catholic University of Korea, Eunpyeong St. Mary’s Hospital, Seoul, Korea

Background: Hyperkalemia early after kidney transplantation (KT) is one of common complications owing to immunosuppressive agents, prophylactic antibiotics, and uncontrolled diabetes. However, it is difficult to predict that uncommon origins are the primary cause of hyperkalemia. Here we report a case of hyperkalemia in a KT recipient after administering atorvastatin.

Methods: A 64-year-old male patient, who underwent hemodialysis for 54 months due to end-stage kidney disease by type 2 diabetes, received deceased donor KT. After transplantation, he was considering discharge without any complications. But his laboratory results showed severe hyperkalemia right before discharge.

Results: The patient showed hypokalemia for 1 week after KT, but his laboratory results revealed hyperkalemia of 6.4 mmol/L on the 12th day. Therefore, he was treated four times a day with Kayexalate enema and oral Kayexalate supplementation. However, serum potassium level increased to 7.3 mmol/L on the 13th day. Until that time, serum tacrolimus level was continuously maintained between 5 and 9 ng/mL under trimethoprim-sulfamethoxazole administration and proper control of diabetes via basal insulin. Serum renin, aldosterone, and aldosterone-to-renin ratio were normal. There was an addition of atorvastatin 4 days before the onset of hyperkalemia. After review of rationale, atorvastatin was discontinued due to the possibility of causative agent of hyperkalemia. The transtubular potassium gradient (TTKG) decreased from 7 for the 1st day and 5 for the 5th day to 1 on the 13th day after transplantation. Serum potassium level of the patient was maintained at 5 mmol/L under potassium lowering agent on the 16th day. Three weeks after transplantation, the TTKG was 2 and serum potassium level was 5.4 mmol/L. At 9 weeks after KT, the TTKG was at 3 and serum potassium level was maintained at 5.0 mmol/L.

Conclusions: Identifying the uncommon causes of severe hyperkalemia may help recovery of the patient and shorten hospitalization after KT.

Corresponding author: Bum Soon Choi
E-mail: sooncb@catholic.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Comorbidities can predict the mortality of acute kidney injury requiring continuous renal replacement therapy: comparison with the Charlson comorbidity index

Jinwoo Lee¹, Jiyun Jung², Jangwook Lee³, Jung Tak Park⁴, Yong Chul Kim⁵, Dong Ki Kim⁵, Jung Pyo Lee⁵, Sung Jun Shin⁶, Jae Yoon Park⁶

¹Division of Nephrology, Department of Internal Medicine, Dongguk University College of Medicine, Gyeongju, Korea
²Department of Biostatistics, Dongguk University Ilsan Hospital, Goyang, Korea
³Division of Nephrology, Department of Internal Medicine, Seoul National University College of Medicine, Seoul, Korea
⁴Department of Internal Medicine, Yonsei University College of Medicine, Seoul, Korea
⁵Department of Internal Medicine, Seoul National University College of Medicine, Seoul, Korea
⁶Department of Internal Medicine, Dongguk University College of Medicine, Gyeongju, Korea

Background: Comorbid conditions are important in the survival of patients with severe acute kidney injury (AKI) requiring continuous renal replacement therapy (CRRT). The weights assigned to comorbidities to predict survival may vary based on the type of index disease and advances in the management of comorbidities. We developed a modified Charlson comorbidity index (mCCI) in patients with AKI requiring CRRT (mCCI-CRRT), thereby improving risk stratification for mortality.

Methods: A total of 1,583 patients received CRRT from 2008 to 2016 from two university hospital cohort were included to develop a comorbidity score. The weights of the comorbidities, per the CCI, were recalibrated using a Cox proportional hazards model including age, sex, albumin, hemoglobin, and 15 types of CCI disease. The modified index was validated by 419 patients received CRRT from 2008 to 2016 from other two university hospital cohort. The c statistic of the area under curve as well as the net reclassification improvement values were confirmed in order to test the accuracy of the classification by CCI and mCCI-CRRT.

Results: A total of 1,583 participants were included in development cohort where average age was 62.04±14.29 years, males were 970 (61.3%), 777 deaths (49%) occurred, and average following days were 17.59±1.68. The patients of 33% had cancer. The mCCI-CRRT showed no difference in c statistics (0.73) compared with the original CCI, but improved net mortality risk reclassification by 25.27% (95% confidence interval, 0.0878–0.4176; P=0.00267) relative to the original CCI. When stratified by CCI and mCCI-CRRT score, the survival probability of CRRT patients was well-categorized according to the mCCI-CRRT score while CCI does not adequately classify the survival probability by score.

Conclusions: The mCCI-CRRT stratifies the risk for mortality in AKI patients who requiring CRRT better than the original CCI, suggesting that it may be a preferred index for use in clinical practice.

Corresponding author: Jae Yoon Park
E-mail: nephrojyp@gmail.com

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Impact of everolimus on survival after liver transplantation for hepatocellular carcinoma

Incheon Kang¹, Dong Jin Joo²

¹Division of Transplantation, Department of Surgery, CHA Bundang Medical Center, Seongnam, Korea
²Division of Transplantation, Department of Surgery, Yonsei University College of Medicine, Seoul, Korea

Background: The objective of this study was to investigate whether everolimus (EVR) use affects long-term survival after liver transplantation (LT) in patients with hepatocellular carcinoma (HCC).

Methods: Data from 303 consecutive patients with HCC who underwent LT were retrospectively reviewed. The patients were divided into two groups: (1) patients treated with EVR in combination with calcineurin inhibitors (CNI) (EVR group, n=114), and (2) patients treated with CNI-based therapy without EVR (non-EVR group, n=189). Disease-free survival (DFS) and overall survival (OS) were compared between two groups, and prognostic factors for DFS and OS were evaluated.

Results: The EVR group exhibited more aggressive tumor biology than the non-EVR group, including a higher number of tumors (P=0.003), a higher prevalence of microscopic vascular invasion (P=0.017), and cases exceeding Milan criteria (P=0.029). Compared with the non-EVR group, the EVR group had significantly better DFS (P=0.029) and OS (P<0.001). In multivariate analysis, use of EVR was identified as an independent prognostic factor for DFS (hazard ratio [HR], 0.248; P=0.001) and OS (HR, 0.145; P<0.001).

Conclusions: In combination with CNI, EVR has the potential to prolong long-term survival in patients undergoing LT for HCC. These findings warrant further investigation in a well-designed prospective study.

Corresponding author: Dong Jin Joo
E-mail: djoo@yuhs.ac

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Salvage living-donor liver transplantation and ADV score

Shin Hwang, Gi-Won Song, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Dong-Hwan Jung, Gil-Chun Park, Young-In Yoon, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Salvage liver transplantation is a definite treatment for recurrent hepatocellular carcinoma (HCC) after hepatectomy. ADV score is calculated by multiplying α-fetoprotein and des-γ-carboxyprothrombin concentrations and tumor volume. Prognostic accuracy of ADV score was assessed in patients undergoing salvage living-donor liver transplantation (LDLT) and their outcomes were compared with patients undergoing primary LDLT.

Methods: This study was retrospective single-center case-controlled study. Outcomes were compared in 125 patients undergoing salvage LDLT from 2007 to 2018 and in 500 propensity score-matched patients undergoing primary LDLT.

Results: In patients undergoing salvage LDLT, median intervals between hepatectomy and tumor recurrence, between first HCC diagnosis and salvage LDLT, and between hepatectomy and salvage LDLT were 12.0, 37.2, and 29.3 months, respectively. Disease-free survival (DFS, P=0.98) and overall survival (OS, P=0.44) rates did not differ significantly in patients undergoing salvage and primary LDLT. Pre-transplant and explant ADV scores were significantly predictive of DFS and OS in patients undergoing salvage and primary LDLT (P<0.001). DFS after prior hepatectomy (P=0.52) and interval between hepatectomy and LDLT (P=0.82) did not affect DFS after salvage LDLT. Milan criteria and ADV score were independently prognostic of DFS and OS following salvage LDLT, and prognosis of patients within and beyond Milan criteria could be further stratified by ADV score.

Conclusions: The risk factors and post-transplant outcomes were similar in patients undergoing salvage and primary LDLT. ADV scores were shown to be an integrated surrogate biomarker for post-transplant prognosis in salvage and primary LDLT recipients. This prediction model using pre-transplant and explant ADV scores can therefore provide reliable information on the post-transplant prognosis, thus assisting in the decision whether to perform salvage LDLT.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Auxiliary partial orthotopic liver transplantation in pre-eclampsia

Sanggyun Suh, Kyung-Suk Suh, Kwang-Woong Lee, Nam-Joon Yi, YounRok Choi, Suk Kyun Hong, Jeong-Moo Lee, Kwangpyo Hong, Eui Soo Han

Division of Hepatobiliary, Department of Surgery, Seoul National University Hospital, Seoul, Korea

Background: Auxiliary partial orthotopic liver transplantation (APOLT) is a technically challenging procedure in which a segmental liver graft is implanted orthotopically following a native liver partial hepatectomy. Despite being considered an innovative technique, it is gradually gaining acceptance as a bridge therapy in acute liver failure with the possibility of immunosuppression free survival. Herein, we report a 35-year-old pregnant woman with HELLP syndrome who underwent APOLT.

Methods: She was diagnosed with HELLP syndrome because of hemolysis (hemoglobin, 6.3 g/dL), elevated liver enzyme (aspartate aminotransferase/alanine aminotransferase, 11,783/8,288 IU/L), and low platelet count (56×10³/μL) without evidence of other causes of hepatitis. She developed hepatic encephalopathy and eventually required ventilator and renal replacement therapy. After emergent C-section, she referred to acute to our center for management of fulminant liver failure (United Network for Organ Sharing status 1).

Results: She underwent APOLT from a 35-year-old deceased donor on hospital day 9. After right hemihepatectomy of the recipient, a right trisection segment graft was transplanted orthotopically. Cold ischemic time was not recorded and warm ischemic time was 33 minutes. Operation time of the recipient was 530 minutes and estimated blood loss was 5,000 mL. She was discharged on postoperative day 51. Initially she took triple therapy of immunosuppressants (tacrolimus, steroid, and mycophenolate mofetil) with Simulect. Her immunosuppressants were tapered down to tacrolimus monotherapy. Three-year follow-up biopsy of both livers showed acute cellular rejection of the graft and native liver well functioned. Thus, it was not treated. On a 5-year follow-up computed tomography scan, the graft liver showed atrophy. She is free from immunosuppressants without complication related to graft and native liver on a 7-year follow-up.

Conclusions: APOLT is technically challenging procedure, but there is chance of immunosuppression-free survival. So we have to consider about APOLT as option for acute liver failure patient.

Corresponding author: Nam-Joon Yi
E-mail: gsleenj@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Cause-specific mortality and associated factors related to death after kidney and liver transplantation: a Korean nationwide study

Junghyun Yoon, Younkyung Jung, Hanjoon Kim, Boyoung Park, Dongho Choi

1Department of Preventive Medicine, Hanyang University College of Medicine, Seoul, Korea
2Department of Surgery, Hanyang University College of Medicine, Seoul, Korea

Background: Although the demand for organ transplantation increased, the survival rate of transplants was insufficient compared to the general population due to the use of immunosuppressants. Few studies have been published in Korea related to death and were limited to single institutions and small cohorts. The purpose of this study was to analyze the mortality rate, cause of death, and the factors associated with death in kidney and liver transplant recipients.

Methods: Study population was the recipient of kidney and liver transplants from National Health Insurance Service database between 2006 and 2017. A total of 17,446 kidney transplants and 11,590 liver transplants were identified, and the transplants were linked to data on the cause of death from Statistics Korea. The cause of death of kidney and liver transplantation were classified into renal and non-renal, hepatic and non-hepatic, respectively, based on International Classification of Diseases (ICD).

Results: In kidney transplants, renal death was 35%-42%, of which chronic kidney disease is the main cause. The proportion of non-renal death was highest in the order of malignancy and infection. In liver transplants, hepatic death accounted for 65%-67%. Among them, hepatic malignancy was high in 5-year mortality and death from cirrhosis or alcoholic liver disease were higher in overall mortality. Infection was the leading cause of death in non-hepatic, with 22% at 5-year mortality and 17% in overall mortality. In the underlying etiology, the risk of death was high in kidney transplants with diabetes and liver transplants with malignancy.

Conclusions: After kidney and liver transplantation, the most common cases of death were each primary disease, and there were differences in death patterns of malignancy, infections, and cardiovascular diseases according to organ characteristics. Since the distribution of causes of death varies depending on the period after transplantation, the survival rates can be improved through appropriate interventions at each time.

Corresponding author: Dongho Choi
E-mail: crane87@hanyang.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Long-term outcome after prevention of de novo hepatitis B in recipients of core antibody-positive livers with hepatitis B immunoglobulin only

Hye-Sol Jung¹, YoungRok Choi¹, Kwangpyo Hong¹, Eui Soo Han¹, Jeong-moo Lee¹, Kyung Chul Yoon², Suk Kyun Hong¹, Nam-joon Yi¹, Kwang-woong Lee¹, Kyung-suk Suh¹

¹Department of Surgery, Seoul National University Hospital, Seoul, Korea
²Department of Surgery, SMG-SNU Boramae Medical Center, Seoul, Korea

Background: Anti-HBc positive donors represent an important source of organs in hepatitis B virus (HBV) endemic areas despite the risk of occult HBV infection. We analyzed long-term outcome of prevention for de novo HBV with hepatitis B immunoglobulin (HBIG) only after liver transplantation (LT) using core-positive grafts.

Methods: We retrospectively reviewed the prospective collected data of 1,479 recipients between 1988 and 2018 at Seoul National University Hospital. 1,458 were eligible and enrolled. If either donor or recipient had core antibody, HBIG 4000 IU was administered 4 times until postoperative day 3.

Results: Of 1,458 LTs, 478 (32.8%) used anti-HBc positive grafts. Three hundred twenty-six (68.2%) was allocated to hepatitis B surface antigen (HBsAg)-positive recipients, with 152 (31.8%) to HBs-negative recipients. 21 (13.8%) of de novo HBV infection occurred in 152 core-positive grafts. One (25%), 11 (22.4%), 0, 9 (9.2%) was diagnosed of de novo HBV infection in 4 of hepatitis B surface antigen (HBcAb) and HBsAb negative, 49 of HBcAb-negative and HBsAb-positive, 1 of HBcAb-positive and HBsAb-negative, 98 of HBcAb and HBsAb positive recipients respectively. Anti-HBc negative recipients were more likely to develop de novo HBV infection compared with anti-HBc positive recipients (22.6% vs. 9.1%, P=0.021). Incidence of de novo HBV infection did not differ by recipient HBsAb status (P=0.530). The median follow-up time was 69 months (range, 29–165 months). The median time to detection of HBsAg seropositivity was 18 months (range, 8–55 months). Two had no treatment, twelve were treated with nucleoside analogs (NA) monotherapy, and seven were treated with NA plus HBIG. The median treatment duration was 41 months. Seven acquired seroconversion. There were 42 (8.8%) of graft losses in study period. The 1-, 5-, 10-year patient survival with anti-HBc positive liver were 97.5%, 93.2%, and 90.5%. No patient died of de novo HBV infection.

Conclusions: De novo HBV did not affect patient survival. However, HBIG only prophylaxis was not enough to prevent de novo HBV development in the era of NA.

Corresponding author: YoungRok Choi
E-mail: choiyoungrok@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Can we use the peritoneum of deceased donors as the vascular substitute for reconstructing the middle hepatic vein in living donor liver transplantation?

Seok-Hwan Kim

Division of Transplantation, Department of Surgery, Chungnam National University Hospital, Cheongju, Korea

Background: The interest in vascular substitutes has recently increased. We evaluated the feasibility of using a homologous parietal peritoneum (HPP) as a vascular substitute for venous reconstruction during abdominal surgery.

Methods: The inferior vena cava was replaced with an HPP after cross-linking with glutaraldehyde in 15 rabbits. At 7, 14, and 28 days, the patency rate, outer and inner graft diameters, histology, and immunohistochemistry were evaluated.

Results: Both the 7- and 14-day groups maintained vascular patency. Vascular patency was maintained in three rabbits in the 28-day group. The inner diameters of the anastomotic sites were 6.12±0.20 mm, 5.63±0.14 mm, and 2.22±0.23 mm in the 7-, 14-, and 28-day groups, respectively. The mid-point inner diameters of the HPP grafts were 6.21±0.13 mm, 5.82±0.16 mm, and 2.12±0.24 mm in each group, respectively. Endothelial cell proliferation on the HPP graft surfaces in all groups was based on the histological findings from the first group. Multiple neo-vascularizations of the HPP graft were found in the 14- and 28-day groups, indicating neo-media formation. Acute inflammation appeared to progress to the entire layer of the HPP graft without an intraluminal thrombus, but the graft was patent in the 14-day group. In the 28-day group, two rabbits showed near-total occlusion and a thrombus formed in the HPP graft at the anastomosis site with severe stricture; however, the rabbits were alive and had collateral vessel formation.

Conclusions: Use of the HPP is feasible for venous reconstruction in abdominal surgery.

Corresponding author: Seok-Hwan Kim
E-mail: kjxh7@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Liver tissueoid composed of electrospun multiscale fiber enhance hepatic differentiation and therapeutic function of chemical derived hepatic stem cells

Yohan Kim, Sangtae Yoon, Da Hee Hong, Myoung-Hoi Kim, Taehun Kim, Jaemin Jeong, Dongho Choi

Division of Hepatobiliary, Department of Surgery, Hanyang University College of Medicine, Seoul, Korea

Background: Artificial tissueoid has tissue-like properties that consist of multicellular component and three-dimension microenvironments. This model recapitulated the in situ environment interactions by providing structure, physiology, and arrangement of individual cells. Here we introduce a novel artificial liver tissueoid platform which can provide in vivo liver multicellular microenvironments and modulate hepatocytes behavior.

Methods: The liver tissueoid was hierarchically assembled with cell-laden sheets of which base structures were composed of extracellular matrix (ECM) mimicking electrospun fiber mats. To generate liver tissueoid, human chemically-derived hepatic progenitors (hCdHs) are generated by small molecules as our previously reported. The microfabricated edge-framework for the fiber mat enabled not only stable culture of the functionalized cells but also multilayering construction of cell-laden complexes even including heterogeneous composition of assembly.

Results: The heterogeneous multilayer stacking, assembling multi-layer stacking with both hCdHs and endothelial cells (HUVECs), significantly enhanced the functional properties of hCdHs to differentiate into hepatocytes and affect survival of mice in acute injury model. Especially, the differentiation potential of hCdHs was associated with OSM downstream signaling pathways. Interestingly, single layered liver tissueoid without HUVECs additionally more activated OSM-downstream signaling pathways, whereas double and triple layered liver tissueoid with HUVECs included both OSM-dependent and OSM-independent pathway which was mediated by selective activation of AKT signaling.

Conclusions: Overall, our results suggested that liver tissueoid showed efficient hepatic differentiation capacity of hCdHs and exhibited therapeutic effect after transplantation into liver injury mouse.

Corresponding author: Yohan Kim
E-mail: ambition779@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Postoperative bacteremia is associated with early vascular complications in pediatric liver transplant recipients with biliary atresia

Kyong Ihn¹, Ji-Man Kang², Eun Jin Kim¹, Juhan Lee¹, Jae Geun Lee¹, Dong Jin Joo¹, Soon Il Kim¹, Myoung Soo Kim¹

¹Division of Transplantation, Department of Surgery, Severance Hospital, Seoul, Korea
²Division of Infection, Department of Pediatrics, Severance Hospital, Seoul, Korea

Background: Bacteremia after liver transplantation (LT) frequently occurs and is a potentially severe complication affecting patient and graft survival. Children with biliary atresia (BA) have an increased risk of recurrent cholangitis and heightened risk of clinically significant infections. This study evaluated the impact of bacteremia after pediatric LTs on clinical outcomes.

Methods: After the exclusion of retransplantation, a total of 63 patients with BA less than 18 years-old were performed LT between April 2006 and September 2019. The patients were divided into two groups, according to the occurrence of post-LT bacteremia within 1 month (bacteremia vs. no bacteremia: 14 [22.2%] vs. 49 [77.8%]).

Results: Compared with BA patients with no post-LT bacteremia, BA patients with bacteremia were significantly younger at the time of LT (1.67 years vs. 3.71 years, P=0.024), and had higher preoperative serum total bilirubin (12.6 mg/dL vs. 7.6 mg/dL, P=0.007), higher GRWR (graft-versus-recipient weight ratio; 3.25 vs. 2.37, P=0.020), higher frequency of pre-LT bacteremia within 1 month (28.6% vs. 4.1%, P=0.019). Three-year overall survival rates were similar (85.% vs. 79.1%, P=0.688), but vascular complications and reoperations were significantly frequent in BA patients with bacteremia (57.1% vs. 26.5%, P=0.032; 42.9% vs. 4.1%, P=0.001, respectively).

Conclusions: The occurrence of bacteremia after pediatric LT was associated with increased numbers of vascular complications and reoperations. Although challenging, proper control of bacterial infections and early LT before developing uncontrolled cholangitis may be useful in reducing vascular complications and unexpected reoperations for patients with BA.

Corresponding author: Myoung Soo Kim
E-mail: ysms91@yuhs.ac

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Changing trend in liver transplantation indications in Saudi Arabia: from hepatitis C virus to nonalcoholic fatty liver disease

Saleh A Alqahtani, Dieter C Broring, Saad A Alghamdi, Saleh I Alabbad, Khalid I Bzeizi, Ali Albenmousa, Waleed K Al-hamoudi

Department of Liver Transplant Centre, King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia

**Background:** The indications for liver transplantation (LT) in Saudi Arabia have changed in recent years. We analyzed the trends in the frequency of indications for LT among adult Saudi patients in the last 19 years while determining the association between etiologic-specific trends and essential clinicodemographic characteristics.

**Methods:** This retrospective study reviewed the clinical and surgical data of adult patients who underwent LT for various indications at the King Faisal Specialist Hospital and Research Centre, Riyadh, between 2001 and 2019. The proportion of LT indications was stratified according to the LT year and hepatocellular carcinoma status, and changing trends in the indications were analyzed.

**Results:** A total of 1,009 adult patients underwent LT, with a median age of 55 years (range, 45–62 years), median body mass index of 26.1 (range, 22.9–30.5) and male predominance of 62.8%. During 2001–2010, the main indications for LT were hepatitis C virus (HCV, 41.9%) and hepatitis B virus (21.1%). During 2011–2019, nonalcoholic steatohepatitis (NASH, 29.7%) overtook HCV (23.7%) as the leading indication. This change in trend was significant in correlation analyses (incidence rate ratio: NASH, 1.09 [1.06–1.13]; HCV, 0.93 [0.91–0.95]). Joinpoint regression analysis showed significant increases from 2006 to 2012 for NASH (+32.1%) and decreases for HCV from 2004 to 2007 (-19.6%) and 2010 to 2019 (-12.1%). Comparison of LT etiologies before (pre-2014) and after (2014–2019) the availability of directly-acting antivirals and by stratification based on hepatocellular carcinoma status showed similar patterns.

**Conclusions:** NASH is emerging as the leading indication for LT in Saudi Arabia in recent years. The analysis of this changing trend is crucial towards reducing the burden of the disease and managing associated complications.

**Corresponding author:** Saleh A Alqahtani

**E-mail:** salalqahtani@kfshrc.edu.sa

© The Korean Society for Transplantation

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Microsurgical hepatic artery reconstruction in deceased donor liver transplantation for reduced arterial complications

Youngin Yoon, Sung-Gyu Lee

Division of Hepatobiliary, Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Korea

Background: Aberrant donor hepatic artery anatomy or hepatic artery injury during organ procurement or recipient preparation poses a surgical challenge during deceased donor liver transplantation. In this study, we aimed to investigate arterial reconstruction using microvascular techniques during deceased donor liver transplantation and to suggest reasonable indications for the microsurgical approach in this setting.

Methods: We retrospectively reviewed the outcomes of 470 deceased donor liver transplantations performed at our institution between July 2011 and December 2015. Of these, 128 recipients underwent microsurgical hepatic artery reconstruction and 342 underwent reconstruction with surgical loupes.

Results: Thirty-two patients (6.8%) experienced hepatic artery-related complications, including hepatic artery thrombosis (n=8, 1.7%). In the propensity score-matched cohort, the surgical loupe group showed a higher complication rate (P=0.782). On multivariate analysis, cold ischemia time (odds ratio, 0.995; 95% confidence interval, 0.992–0.999; P=0.009) and use of aortohepatic conduits (odds ratio, 5.254; 95% confidence interval, 1.878–14.699; P=0.002) were independent predictors of arterial complications.

Conclusions: The low incidence of hepatic artery complications in this study is likely attributable to the active application of microsurgical techniques. Active application of backtable microsurgical plasty and selective application of microsurgical techniques for main arterial reconstruction may help minimize operative difficulties and arterial complications.

Corresponding author: Sung-Gyu Lee
E-mail: sglee2@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Expandable liver organoids generated from human chemically derived hepatic progenitor enable alcoholic liver modeling

Yohan Kim, Sangtae Yoon, Myoung-Hoi Kim, Da Hee Hong, Taehun Kim, Jaemin Jeong, Dongho Choi

Division of Hepatobiliary, Department of Surgery, Hanyang University College of Medicine, Seoul, Korea

**Background:** Liver organoids, an attracting source for studying cell to cell interaction, drug screening, and disease modeling in three-dimension systems were demonstrated to be developed from EpCAM⁺ cells. Our group previously reported chemically derived hepatic progenitors (hCdHs), reprogrammed from human primary hepatocytes with bi-potent differentiation capacity and EpCAM⁺ feature. Therefore, we aimed to generate organoids showing characteristics of liver organoids using hCdHs.

**Methods:** To generate hCdHs, human primary hepatocytes were cultured with reprogramming medium including HGF, A83-01 and CHIR99021 for 7 days. Isolated human liver cells and hCdHs were cultured on Matrigel with organoid medium to generate human adult liver organoids and hCdHs derived liver organoids (hCdHO).

**Results:** hCdHO were morphologically undistinguished and showed high generation efficiency compared with human adult liver organoids. hCdHO were stably expanded over a 6-month period and expressed liver organoid-specific markers. hCdHO cultured in hepatic differentiation medium showed increased expression of hepatic markers and functional capacity such as CYP activity. Upon transplantation in FRG mice models, hCdHO effectively repopulated the injured liver. We further developed an alcoholic liver model using hCdHO cultured in hepatic differentiation medium under ethanol treatment which presented us with alcoholic liver disease associated alternations in mitochondrial membrane potential.

**Conclusions:** Our studies suggest that hCdHO have a potential to be a novel liver organoid cell source for performing disease modeling.

**Corresponding author:** Dongho Choi  
**E-mail:** crane87@hanyang.ac.kr

© The Korean Society for Transplantation  
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The extracorporeal circulation with transdiaphragmatic approach in living-donor liver transplantation for hepatoblastoma with atrial extension of tumor thrombus

Mureo Kasahara, Seisuke Sakamoto, Yusuke Yanagi, Hajime Uchida, Seiichi Shimizu, Kotaro Mimori, Yasuyuki Kameoka, Akinari Fukuda

Department of Organ Transplantation, National Center for Child Health and Development, Tokyo, Japan

Background: Surgical intervention for hepatoblastoma (HB) with tumor thrombi extending into the inferior vena cava (IVC) and the right atrium (RA) might require careful planning of the surgical procedures, including vascular reconstruction and extracorporeal circulation.

Methods: We herein report a successful case of living-donor liver transplantation (LDLT) for HB with atrial extension of a tumor thrombus by extracorporeal circulation with a transdiaphragmatic approach.

Results: The patient was a 5-year-old boy with PRETEXT IV HB with a tumor thrombus that extended into the IVC and the RA. After four cycles of chemotherapy (PHITT group D: high-risk protocol) and resection of bilateral lung metastases, the size of the primary HB tumor decreased. As the tumor extension from the left hepatic vein to the RA had decreased but was still present, we performed LDLT with tumor thrombectomy. The central part of the diaphragm was sagittally incised to expose the suprahepatic IVC and the RA. Venovenous bypass was achieved from the right femoral vein and inferior mesenteric vein to the RA. En bloc resection of the native liver with the tumor thrombus was then performed. Hepatic vein anastomosis was made between the newly created orifice on the IVC and the graft left hepatic vein. The duration of LDLT was 10 hours and 44 minutes (extracorporeal circulation time, 78 minutes).

Conclusions: Pediatric liver transplantation for HB with the extension of tumor thrombi into the RA under extracorporeal circulation is a feasible option and allows for the expansion of the indications for transplantation for children with unresectable liver tumors.

Corresponding author: Mureo Kasahara
E-mail: kasahara-m@ncchd.go.jp

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Patency of middle hepatic vein reconstruction using Hemashield grafts compared with ringed polytetrafluoroethylene grafts in living donor liver transplantation

Shin Hwang, Minjae Kim, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Chul-Soo Ahn, Deok-Bog Moon, Gil-Chun Park, Young-In Yoon, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Because of supply shortage for homologous vein allografts, we had used ringed Goretex vascular grafts for middle hepatic vein (MHV) reconstruction in living donor liver transplantation. However, owing to unavailability of ringed Gore-Tex grafts, we replaced them with Hemashield vascular grafts. This study aimed to compare the patency and complication of Hemashield grafts with that of ringed Gore-Tex grafts.

Methods: This was a retrospective double-arm study between the study group that used Hemashield grafts (n=157) and the propensity score-matched control group that used ringed Gore-Tex grafts (n=157).

Results: In the Hemashield and Goretex groups, the mean recipient age was 54.7±9.4 years and 53.3±6.3 years; model for end-stage liver disease score was 15.9±9.2 and 16.9±8.3; and graft-recipient weight ratio was 1.07±0.24 and 1.10±0.23, respectively. In the Hemashield group, V5 reconstruction was done in single (n=113, 72.0%), double (n=39, 24.8%) and triple (n=2, 1.3%). The proportions of double or triple anastomosis for V5 or V8 were higher in the Hemashield group. Two patients (1.3%) required MHV conduit stenting owing to early thrombosis of the Hemashield conduit. There was no difference in conduit occlusion-free patient survival rate between two groups (P=0.91). The incidence of conduit migration was 0 and 2 (1.3%) in the Hemashield and Gore-Tex groups, respectively.

Conclusions: MHV reconstruction using Hemashield grafts demonstrated acceptably high short- and mid-term patency rates with no incidence of conduit migration and easy handling and wide flexibility in length adjustment. Therefore, we suggest that Hemashield graft is the most preferable prosthetic material for MHV reconstruction.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Study on patients without underlying chronic liver disease to improve survival outcome in pediatric liver transplantation

Suk Kyun Hong, Nam-Joon Yi, Kwangpyo Hong, Eui Soo Han, Jeong-Moo Lee, YoungRok Choi, Kwang-Woong Lee, Kyung-Suk Suh

Department of Surgery, Seoul National University Hospital, Seoul, Korea

**Background:** Although liver transplantation (LT) is currently the standard treatment for pediatric end-stage liver disease (PELD), it remains associated with significant complications. This study aimed to identify risk factors affecting the outcomes of pediatric LT.

**Methods:** Data from pediatric patients who underwent primary LT from March 1988 to December 2018 were retrospectively analyzed. Chronic liver disease was defined as an explanted liver showing fibrosis regardless of grade, cirrhosis, or any other underlying disease that may cause progressive liver injury leading to fibrosis or cirrhosis.

**Results:** A total of 255 pediatric patients underwent LT during the study period. Their 1-, 5-, and 10-year overall survival rates were 90.5%, 88.4%, and 87.8%, respectively, while the 1-, 5-, and 10-year graft survival rates were 89.7%, 88.5%, and 87.2%, respectively. Multivariate analysis showed that liver disease without underlying chronic liver disease (P=0.024) and PELD score ≥30 (P=0.036) were associated with worse survival. Furthermore, bodyweight <6 kg (P=0.050), whole-liver deceased donor LT compared to living donor LT (P=0.008), fulminant liver failure (P=0.008), and postoperative hepatic artery complications (P<0.001) were risk factors for graft survival. Liver disease without underlying chronic liver disease was the only factor independently associated with hepatic artery complications (P=0.003).

**Conclusions:** Greater caution is recommended in pediatric patients with liver disease unaccompanied by underlying chronic liver disease, high PELD score, or low body weight to improve survival after LT. Hepatic artery complications were the only surgical complications affecting graft survival, especially in patients with liver disease but no underlying chronic liver disease.

**Corresponding author:** Nam-Joon Yi
E-mail: gsleenj@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Comparing survival, tacrolimus trough level, prevalence of biliary stenosis and studying for possible early detection of biliary stenosis in liver transplant recipients at First Central Hospital of Mongolia and various high-volume foreign centers

Anar Ganbold1, Bayarmaa Ochirkhuree1, Bat-Ireedui Badarch2, Batsaikhan Batsuuri2, Ganzorig Batjargal3, Amgalan Luvsandorj3, Erdene Sandag3, Erdenebileg Bavuujav3, Chuluunbaatar Donkhim4, Sergelen Orgoi3

1Department of Gastroenterology, First Central Hospital of Mongolia, Ulaanbaatar, Mongolia
2Department of Transplantation, First Central Hospital of Mongolia, Ulaanbaatar, Mongolia
3Department of Surgery, First Central Hospital of Mongolia, Ulaanbaatar, Mongolia
4Department of Anesthesia, First Central Hospital of Mongolia, Ulaanbaatar, Mongolia

Background: Since 2015, First Central Hospital of Mongolia independently transplanted 62 living donor liver grafts in 60 adult and pediatric patients (domestic-group). Separately, First Central Hospital of Mongolia follows-up on 243 Mongolian post-transplant patients from foreign clinics (foreign-group).

Methods: In this study, we compared these two groups for 1-year graft and patient survival, prevalence of biliary stenosis (BS), tacrolimus oral dose and trough levels, transaminase and creatinine levels. Alkaline phosphatase (ALP) of patients with radiologically diagnosed and endoscopically treated BS were compared to non-stenotic patients from 1 to 12 months postoperative in a bid to correlate its change with BS later on.

Results: One-year recipient and graft survival in the domestic-group was 90% and 87%, respectively. Prevalence of BS in this group was 28.5%, while in the foreign-group it was 17.2%. ALP in the BS group tended to increase from the second month on and reached statistical significance on 3rd month compared (215.7 u/L; standard error of the mean [SEM], ±36.76) to control group (108.7 u/L, SEM±19.85, P=0.039). Trough tacrolimus level at 3rd year in domestic-group was 6.3 ng/mL (standard deviation [SD], ±2.9), while in foreign-group it was 3.9 (SD±1.6) ng/mL. Daily oral tacrolimus level at 3rd year in the domestic-groups was 3.8 mg/day, while in the foreign-group it was 2.4 mg/day.

Conclusions: There was no significant difference in transaminases and creatinine between the groups. Survival of recipients depend not only the surgical technique, but also on quality of follow-up. Therefore, for the domestic-group tighter adherence to scheduled check-ups and better collection of information is required. BS that would require endoscopic intervention is likely to manifest itself with a 2xULN change in ALP as early as 3rd month. Physician-controlled immunosuppressant minimization is not only safe but also is required to avoid long-term side-effects.

Corresponding author: Anar Ganbold
E-mail: g.anar@fchm.edu.mn

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Non-viral ex vivo therapeutic strategy in chemically derived hepatic progenitor with adenine base editor and prime editor

Yohan Kim, Sangtae Yoon, Myoung-Hoi Kim, Da Hee Hong, Taehun Kim, Jaemin Jeong, Dongho Choi

Division of Hepatobiliary, Department of Surgery, Hanyang University College of Medicine, Seoul, Korea

**Background:** The adenine base editor (ABE) and prime editing converts nucleotide in living cells without double strand DNA breaks. Chemically derived stem/progenitor cells are attracting attention as the most applicable cell sources for clinical trials. Combining these attracting techniques, we show an ex vivo therapeutic strategy to treat hereditary disease.

**Methods:** We generate chemically derived hepatic progenitors (CdHs) from a tyrosinemia mouse model caused by a mutation in base pair A into G, correcting it via ABE and prime editing, and then transplanting it into the model mouse to cure it.

**Results:** Corrected CdHs with ABE repopulated the liver with fumarylacetoacetate hydrolase-positive cells after transplantation and increased survival rate. In addition, the substitution of non-target A in ABE editing window of the CdHs is reduced after transplantation.

**Conclusions:** This strategy offers a safer and specific way to apply a base editor to clinical applications.

**Corresponding author:** Dongho Choi  
**E-mail:** crane87@hanyang.ac.kr

© The Korean Society for Transplantation  
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Transfusion status in liver and kidney transplantation recipients: results from nationwide claims database

Dong Ho Choi¹, Boyoung Park², Junghyun Yoon², Han Joon Kim¹, Yun Kyung Jung¹, Kyeong Geun Lee¹

¹Division of Hepatobiliary, Department of Surgery, Hanyang University Medical Center, Seoul, Korea
²Department of Preventive Medicine, Hanyang University College of Medicine, Seoul, Korea

Background: This study analyzed the status and trends of transfusion and its associated factors among liver and kidney transplantation recipients.

Methods: A total of 10,858 and 16,191 naïve liver or kidney transplantation recipients from 2008 to 2017 were identified through the National Health Insurance Service database. The prescription code for transfusion and the presence, number, and amount of each type of transfusion were noted. The odds ratios and 95% confidence intervals were determined to identify significant differences in transfusion and blood components by liver and kidney transplantation recipient characteristics.

Results: In this study, 96.4% of liver recipients and 59.7% of kidney recipients received transfusions related to the transplantation operation, mostly platelet and fresh frozen plasma. Higher perioperative transfusion in women and declining transfusion rates from 2008 to 2017 were observed in both liver and kidney recipients. In liver recipients, the transfusion rate in those who received organs from deceased donors was much higher than that in those who received organs from living donors; however, the mortality rate according to transfusion was higher in recipients of deceased donor organs. In kidney recipients, a higher mortality rate was observed in those receiving transfusion than that in patients without transfusion.

Conclusions: In Korea, the transfusion rates in liver and kidney recipients were relatively higher than those in other countries. Sociodemographic factors, especially sex and year of transplantation, were associated with transfusion in solid organ recipients, possibly as surrogates for other causal clinical factors.

Corresponding author: Dong Ho Choi
E-mail: crane87@hanyang.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Comparison of three caval reconstruction techniques in orthotopic liver transplantation: result from a university hospital from Bangkok, Thailand

Tatsana Uthaithammarat, Methee Sutherasan, Bunthoon Nonthasoot, Wipusit Taesombat, Athaya Vorasittha, Supanit Nivatvongs, Boonchoo Sirichindakul

Department of Surgery, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand

Background: In orthotopic liver transplantation, three caval reconstruction techniques are commonly being performed worldwide. These are conventional, piggyback technique and side-to-side cavocaval anastomosis (STSCCA). Each has its own advantages and drawbacks. Herein we report the result from our hospital comparing the three techniques.

Methods: We retrospectively reviewed the detail of orthotopic liver transplantations performed in our hospital from January 2008 to March 2020. Data being collected were type of caval reconstruction, blood loss, operative time, ischemic time, length of intensive care unit stay and total hospital stay, and several immediate and early postoperative complications.

Results: In the given period, 11 conventional, 89 piggyback and 119 STSCCA caval reconstruction were done. There were no statistically significant difference in blood loss, operative time, cold ischemic time, length of intensive care unit stay and hospital stay. The STSCCA has the lowest warm ischemic time (40 minutes) followed by the piggyback technique (43 minutes) and the conventional technique (47 minutes) (P<0.001). Regarding postoperative complications, there were no statistically significant difference in rate of primary nonfunction, early allograft dysfunction, reperfusion syndrome, hepatic artery/portal vein/biliary complication or rate of acute kidney injury. The rate of acute cellular rejection in STSCCA was lowest (2.63%) followed by conventional (9.09%) and piggyback technique (12.5%) (P=0.024). The outflow complication rate was indifference between three groups (conventional 9.09%, piggyback 0%, and STSCCA 1.75%, P=0.466).

Conclusions: Our study has showed no difference in outflow obstruction rate among three techniques. The choice for reconstruction should rely on the preference of each institute and the suitability of each patient. However, STSCCA may provide the lowest warm ischemic time.

Corresponding author: Tatsana Uthaithammarat
E-mail: gonkpai@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Pure laparoscopic donor right hepatectomy for adult living donor liver transplantation: initial report from Southeast Asia liver transplant center

Worakitti Lapisatepun¹, Warangkana Lapisatepun², Phuriphong Chanthima², Sunhawit Junrungsee¹, Anon Chotirosniramit¹, Settapong Boonsri², Kanya Udomsin¹, Suraphong Lorsomradee², Trichak Sandhu¹

¹Department of Surgery, Chiang Mai University, Chiang Mai, Thailand
²Department of Anesthesiology, Chiang Mai University, Chiang Mai, Thailand

Background: Living donor liver transplantation (LDLT) is widely performed especially in the area which deceased liver donor was scanty including Thailand. Currently, minimally invasive donor hepatectomy is becoming more popular. We began our LDLT program and minimally invasive liver surgery simultaneously on 2015. We started the first case of pure laparoscopic donor right hepatectomy in 2020. The aim of this study is to present an experience on developing pure laparoscopic donor right hepatectomy for adult living donor liver transplantation in small size living donor liver transplantation center.

Methods: We collected all living liver donors who underwent donor right hepatectomy for modified right lobe graft in our institute from January 1, 2015 to June 30, 2020. The baseline characteristics and surgical outcomes of donors and recipients between conventional open donor right hepatectomy (CODRH) and pure laparoscopic donor right hepatectomy (PLDRH) group were compared.

Results: There were 51 cases of liver transplantation in our center during that period. There were 21 cases of CODRH and four cases of PLDRH using modified right lobe graft. There was neither hand assisted nor laparoscopic assisted donor right hepatectomy in our series. There was no conversion in PLDRH group. Baseline characteristic, Perioperative data and laboratory investigations were not significance difference between two groups. Overall complications after donor right hepatectomy were 33.3% in CODRH group and 25% in PLDTH group (P=0.743). The major complication and mortality of the recipient were not significant difference between both groups.

Conclusions: In well-established living donor liver transplantation center which have surgeons who experienced in hepato-biliary and minimally invasive liver surgery. PLDRH can be done safely after the surgeon have trained from high volume LDLT center which had well-established minimally invasive donor hepatectomy program. However, PLDRH should be started in donor who had no anatomical variation.

Corresponding author: Worakitti Lapisatepun
E-mail: wlapisatepun@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Incidence of biliary strictures in Mongolian patients who have received liver transplantation abroad

Anar Ganbold, Munkhtsetseg Chimedtseren, Odontungalag Norov, Sumiya Bayarsaikhan, Bayarmaa Ochirkhuree

Department of Gastroenterology, First Central Hospital of Mongolia, Ulaanbaatar, Mongolia

Background: Biliary stricture is the most common post living donor liver transplant (LDLT) surgical complication with 28%−32% of patients suffering from various degrees of strictures. Incidence of biliary stricture varies significantly between centers and decreases within centers as experience grows. In this study, we compare incidence of biliary stenosis among Mongolian patients under our follow-up that have underwent LDLT at various centers abroad.

Methods: We retrospectively analyzed the records of 185 patients who have received LDLT in three South Korean and six Indian centers. We chose centers with more than five Mongolian LDLT patients. Centers with less than five patients under our follow-up were discounted. Except two patients who had dual lobe transplant and two pediatric patients, all patients received right lobe liver transplant. Patients with computed tomography or magnetic resonance imaging diagnosed bile stricture were counted depending on which procedure they had (endoscopic retrograde cholangiopancreatography [ERCP] procedure or percutaneous transhepatic biliary drainage [PTBD]). The number patients undergoing ERCP and/or PTBD were divided by total number of patients to receive percentage of patients experiencing biliary strictures that require intervention.

Results: From center to center, biliary strictures that required intervention ranged from 2.77% to 37.5%. The average was 19.79% (standard error of the mean, ±4.15). The numbers (%) of ERCP/PTBD by centers are as follows. Korea A (N=12): 1 (8.3%); Korea B (N=21): 1 (4.7%); Korea C (N=9): 3 (33.3%); India A (N=7): 2 (28.5%); India B (N=8): 3 (37.5%); India C (N=72): 2 (2.77%); India D (N=17): 3 (17.6%); India E (N=30): 7 (23.3%); India F (N=9): 2 (22.2%).

Conclusions: Biliary stricture is a common complication in LDLT. However, the rate of biliary stricture varies significantly among the surgeons since surgical technique and experience varies. This study helps advise LDLT candidates for suitable centers.

Corresponding author: Anar Ganbold
E-mail: g.anar@fchm.edu.mn

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Over 500 liver transplants including more than 400 living-donor liver transplants in 2019 at Asan Medical Center

Youngin Yoon, Sung-Gyu Lee, Deok-Bog Moon

Division of Hepatobiliary, Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: More than 400 liver transplants were performed at Asan Medical Center (AMC) in 2011, and over 500 liver transplants including 420 living-donor liver transplants (LDLTs) were performed in 2019. Herein, we report the methodology of these procedures.

Methods: Since the first adult LDLTs at AMC using the left and right lobes were successfully performed, various innovative techniques and approaches have been developed: modified right lobe, dual graft, donor exchange for ABO incompatibility, expansion of indications and no-touch techniques for hepatocellular carcinoma, intraoperative cine-portogram and additional intervention for large collaterals, management of portal vein thrombosis (PVT) and stenosis, salvage LDLT after major hepatectomy, and timely LDLT for patients with acute-on-chronic liver failure.

Results: Four hundred twenty LDLTs in 403 adult and 17 pediatric patients and 85 deceased-donor liver transplants in 74 adult and 11 pediatric patients were performed. The number of deceased-donor liver transplants remained constant since 2011, but the number of LDLTs increased steadily. One hundred thirty patients (25.7%) required urgent liver transplantations and 24 patients with acute-on-chronic liver failure underwent LDLT. PVT including grade 1, 2, 3, and 4 was reported in 91 patients (18.0%), and Yerdel's grade 2, 3, and 4 PVT was reported in 47 patients (51.6%); all patients with PVT were successfully treated. Adult LDLTs for hepatocellular carcinoma and ABO incompatibility accounted for 52.6% and 24.3% of the cases, respectively. In-hospital mortality in 2019 was 2.97%.

Conclusions: Continual efforts to overcome challenging problems in LDLT with various innovations and dedication of the team members during the perioperative period to improve patient outcomes were crucial in increasing the number of liver transplantations at Asan Medical Center.

Corresponding author: Deok-Bog Moon
E-mail: mdb1@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Pure laparoscopic versus open right hepatectomy in living liver donors: which is longer bench-surgery time

Kwangpyo Hong, Suk Kyun Hong, Eui Soo Han, Sanggyun Suh, Su young Hong, Jeong-Moo Lee, YoungRok Choi, Nam-Joon Yi, Kwang-Woong Lee, Kyung-Suk Suh

Division of Hepatobiliary, Department of Surgery, Seoul National University College of Medicine, Korea

Background: The aim of the study was to measure bench-surgery time in pure laparoscopic donor right hepatectomy (PLDRH) in comparison with those of conventional donor right hepatectomy (CDRH).

Methods: We retrospectively reviewed the medical records of 514 donors who underwent living donor liver transplantation between January 2012 and December 2019 at Seoul National University Hospital. We divided it into two periods: when almost only CDRH was performed and the second period during which PLDRH was standardized.

Results: The mean bench-surgery time (49.3 vs. 39.5 minutes; P=0.00) was longer in the PLDRH group than the CDRH group. We performed the analysis while excluding the factors affecting the bench-surgery time in both groups. First, we analyzed except the patients who had undergone direct venoplasty or Y-graft patch reconstruction of two portal veins. After that, we excluded the patients who had reconstruction of more than three openings of middle hepatic vein tributaries and no reconstruction of those (right hemi-liver graft). Lastly, we excluded the patients who underwent venoplasty of inferior hepatic vein(s) in back-table procedures. In all three subgroup analyses, the mean bench-surgery time was also longer in the PLDRH group than the CDRH group (47.4 vs. 38.4 minutes, P=0.00; 48.7 vs. 37.4 minutes, P=0.00; 48.3 vs. 36.6 minutes, P=0.00).

Conclusions: The bench-surgery time takes longer in the PLDRH group regardless of reconstruction of type II or III portal vein variations and liver graft outflow or not.

Corresponding author: Suk Kyun Hong
E-mail: nobel1210@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Liver transplantation at Baskent University

Aydnican Akdur1, Emre Karakaya1, Ebru Ayvazoglu Soy1, Feza Yarbug Karakayali1, Gokhan Moray1, Adnan Torgay2, Mehmet Haberal1

1Department of General Surgery, Baskent University Hospital, ___, Turkey
2Department of Anaesthesia and Reanimation, Baskent University Hospital, ___, Turkey

Background: The only potentially lifesaving intervention for acute liver failure or end-stage liver disease is liver transplant. All over the world, the common indications for liver transplant include hepatitis B, hepatitis C, alcoholic cirrhosis, and hepatocellular carcinoma. However, some more unusual liver diseases, such as liver-based metabolic abnormalities and tumor metastasis, can be treated with liver transplant. The aim of this study was to evaluate the outcomes of liver transplant at our center.

Methods: The liver transplantation program at Baskent University began in December 1988. After this transplantation the first LDLT in children in Turkey, the Middle and Near East, and Europe was performed in March 1990, the first LDLT in adult in the World was performed in April 1990, first combined liver-kidney transplantation was performed in the World in May 1992 at Baskent University. We retrospectively analyzed the results of 672 patients who underwent liver transplant from 1988 to October 2020 at our liver transplant center in Turkey.

Results: Four hundred fifty-eight of the patients were living donor LT, 214 of them were deceased donor LT. Three-hundred and eleven (46.2%) of the patients were pediatric, 361 (53.8%) of them were adult. The most common etiology for pediatric liver transplantation was biliary atresia (20%) and, hepatitis B (57%) for adult liver transplantation. In the pediatric group, 5-year survival rates of patients was 90%, and 10-year survival rates of patients was 81%, in the adult group, the 5-year survival rate was 79.3% and the 10-year survival rate was 74%.

Conclusions: In our center, we perform living-donor liver transplants more than deceased-donor liver transplant because of the paucity of organ donation. Considering acceptable postoperative complications, liver transplant is a lifesaving treatment for liver failure. Careful evaluation of recipients before transplant plays a critical step in curative treatment.

Corresponding author: Aydnican Akdur
E-mail: rectorate@baskent.edu.tr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Anesthetic management in laparoscopic living donor hepatectomy, the first case-series in Thailand

Phuriphong Chanthima¹, Warangkana Lapisatepun¹, Atipa Nitayamekin¹, Suraphong Lorsomrudee¹, Settapong Boonsri¹, Worakitti Lapisatepun², Sunhawit Junrungsee², Anon Chotirosniramit²

¹Department of Anesthesiology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand
²Department of Surgery, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

Background: Laparoscopic living donor hepatectomy began early in 2020 at our institution. This surgery was the first case and a new experience in Thailand. Perioperative and anesthetic management should not only concern anesthetic and surgical complications but also graft function, including ischemic time. In this paper, we review anesthetic considerations and perioperative management in laparoscopic living donor hepatectomy as a new experience in Thailand.

Methods: All four living donors were selected and underwent elective laparoscopic living donor hepatectomy at the university hospital.

Results: Differences in anesthetic considerations between laparoscopic liver resection in pathologic livers versus donor liver graft typically include heparin administration, intravenous indocyanine green, and prolong ischemic time after major vessels clamping. During the operation, only one case had subcutaneous emphysema and one other case had oliguria. There were no intraoperative hypothermia in all cases. All the patients were able to be extubated at the end of surgery inside the operation room. For postoperative pain control, two cases were given intravenous morphine patient-controlled analgesia, while the others were given continuous intravenous morphine infusion. However, emergent explore laparotomy was performed in one case to stop postoperative bleeding from the surgical site.

Conclusions: The advantages of minimal invasive technique include a potential reduction in blood loss and transfusion requirement, lower incidence of intraoperative hypothermia, as well as decreased postoperative pain and opioid consumption. However, complications that must be taken into account include the effect of pneumoperitoneum, patient’s positioning, and emergent conversion to open surgery. As this surgery is largely dependent on the surgeon’s experience, operation time may be extended in some cases. As an anesthesiologist, practical and effective anesthetic management is essential to improve patient outcomes.

Corresponding author: Warangkana Lapisatepun
E-mail: warangkana.c@cmu.ac.th

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Outcomes of living versus deceased donor liver transplantation: initial single center experience from Thailand

Worakitti Lapisatepun¹, Sunhawit Jungrungsee¹, Anon Chotirosniramit¹, Trichak Sundhu¹, Warangkana Lapisatepun², Phuriphong Chanthima², Settaphong Boonsri², Suraphong Lorsomradee², Kanya Udomsin¹

¹Department of Surgery, Chiang Mai University, Chiang Mai, Thailand
²Department of Anesthesiology, Chiang Mai University, Chiang Mai, Thailand

Background: The availability of deceased donor in the northern region of Thailand is limited. In 2015, we initiated the adult to adult living donor liver transplantation program. To date, we are the only active adult to adult living donor liver transplantation program in Thailand. We evaluated the short-term outcomes after liver transplantation compare between living and deceased donor liver transplantation.

Methods: Retrospective study of adult liver transplantation in our center since 2014. The patients were divided into a living donor liver transplantation (LDLT) and deceased donor liver transplantation (DDLT). Baseline characteristic, perioperative data and 1-year survival were compared between two groups.

Results: There were 37 cases underwent LT in our hospital since October 2014 (20 DDLT cases and 17 LDLT cases). Baseline characteristics between two groups were not significantly different. The operative time was longer in LDLT group (P<0.001). However, cold and warm ischemic time were shorter in LDLT group (P<0.001 and P=0.026, respectively). The median ventilator, intensive care unit and hospital stay were similar. The incidence of biliary complication was higher in LDLT group (47% vs 10%, P<0.001). The vascular related complications were not significant difference. Ninety-day and 1-year survival were not significant difference between LDLT and DDLT group (84.6% vs. 84.2% and 76.9% vs. 84.2% respectively, P=0.706).

Conclusions: In the region where deceased donor shortage, LDLT showed similar results compare to DDLT in terms of peri-operative outcomes and patient survival even done by the beginner LDLT program. However, the incidence of biliary related complication was significant higher in LDLT group.

Corresponding author: Worakitti Lapisatepun
E-mail: wlapisatepun@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Pentoxyfylline for hepatopulmonary syndrome after liver transplantation: case report

Yi Wei Tan¹, Rohit Vijay Agrawal¹, Terry Ling Te Pan¹, Mark Muthiah², Weng Hoa Wong¹

¹Department of Anaesthesia, National University Hospital, Singapore
²Department of Gastroenterology, National University Hospital, Singapore

Background: Hepatopulmonary syndrome (HPS) is characterized by abnormal arterial oxygenation caused by intrapulmonary vascular dilatations in the setting of liver disease. Even after liver transplantation (LT), recovery from HPS can be protracted. The pathogenesis of HPS is unclear. Several mediators, including tumor necrosis factor-α (TNF-α), nitric oxide, endothelin-1, and vascular endothelial growth factor, have been implicated. Pentoxyfylline is a phosphodiesterase inhibitor with inhibitory effects on TNF-α and NO, and has been linked to improved oxygenation in HPS. Small uncontrolled trials have investigated the effect of pentoxyfylline in patients with HPS who had not undergone LT. However, no trials have yet been conducted to investigate the benefit of pentoxyfylline in aiding recovery from HPS post-LT.

Methods: We report a case of a 49-year-old man with residual HPS post-LT, who was treated with pentoxyfylline and achieved marked improvement in oxygenation. Our patient was diagnosed with Child’s B cirrhosis from chronic hepatitis C infection at the age of 44. While awaiting transplantation, he was diagnosed with severe HPS. He underwent a deceased donor LT at age 49.

Results: Preoperatively, his PaO₂ was 95 mmHg on 4 L/min supplemental oxygen via nasal prongs. Postoperatively, his requirements rose significantly—he required 100% inspired oxygen via a non-rebreather mask to maintain his SpO₂ at 92% and above. Pentoxyfylline was started on postoperative day 6 and continued for 2 weeks. During this period, his oxygen requirements returned to his pre-operative levels, and by 2 months post-LT, he was no longer oxygen-dependent at rest. Pentoxyfylline was well-tolerated by the patient. There were no deleterious effects on the liver graft and no apparent adverse drug interactions. While his improvement in oxygenation could entirely have been a consequence of his LT, the sequence of events suggests pentoxyfylline may have had a role to play.

Conclusions: Pentoxyfylline may hasten recovery in patients with residual HPS post-LT.

Corresponding author: Yi Wei Tan
E-mail: tanyiwei@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Outcomes of liver transplantation in hepatocellular carcinoma patients: a 10-year experience in a single tertiary center

Mati Rattanasakalwong, Methee Sutherasan

Department of Surgery, Chulalongkorn University, Bangkok, Thailand

Background: Liver transplantation is the gold standard treatment for patients with unresectable hepatocellular carcinoma (HCC), which are within Milan criteria. The recurrence rate after liver transplant was about 16% and the prognosis is poor. Predictors of recurrence after liver transplant have been widely studied, which are both morphologic features (tumor number and size), and biologic features (histopathology, tumor marker, and response to pretransplant treatment). This study aimed to report the outcomes of liver transplantation for HCC and determine the predictors of recurrence HCC after liver transplantation.

Methods: We performed a retrospective single-center of consecutive patients with HCC who underwent liver transplantation from 2009 to 2019. Demographic data, cause of HCC, tumor characteristics, and pathology of liver explants were collected. Primary outcomes were overall survival and disease-free survival. Predictors of recurrence were tested.

Results: Over a 10-year period, 105 patients underwent liver transplantation for HCC in our institution. The mean age was 57 years old. 73.3% (77/105) of patients were male. There were vascular invasions in 23.8% (25/105) of patients. Complete pathological response was found in 22.8% (24/105) of patients. 32.3% of patients were beyond Milan criteria. There were four recurrences (3.8%) and 11 deaths (10.5%) in this study. Median survival after recurrence was 11.5 months. Five-year OS and 5-year DFS were 88.2% and 89%, respectively. Number of HCC (>3 tumors) and vascular invasion were associated with recurrence odds ratio (OR) 17.2 (95% confidence interval [CI], 1.6–176.5; P=0.015) and OR 10.7 (95% CI, 1.06–108.7; P=0.041), respectively. In recurrence patients, there were more patients beyond Milan criteria and there was no complete pathological response but no statistical significance. No factor associated with overall survival was found.

Conclusions: In our data, the number of HCC more than three and vascular invasion were associated with HCC recurrence after liver transplantation.

Corresponding author: Methee Sutherasan
E-mail: matisurg@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Challenges of ABO-incompatible living donor liver transplantation in developing country (Mongolia)

Batsaikhan Bat-Erdene

Department of Surgery, Mongolian National University of Medical Science, Ulaanbaatar, Mongolia

**Background:** In Mongolia, there is a high prevalence of hepatitis B virus (HBV), hepatitis C virus (HCV) and hepatocellular carcinoma (HCC), which is the main reason of liver cirrhosis. The most effective treatment of end stage liver disease (ESLD) is liver transplantation (LT). There are many difficulties with LT in low and middle income countries (LMIC) such as Mongolia including cost to patients, cost to the healthcare system, and lifelong follow-up. Despite these challenges, Mongolia successfully started a LT program in 2011 as a collaboration between Mongolian National University of Medical Science, Mongolian First Central Hospital and Asan Medical Center. Since 2011 the Mongolian transplantation team had done 80 cases, however there are deficit of donor for LT. The Mongolian LT team first time had done successfully ABO-incompatible case.

**Methods:** A 55 year old male patient with liver cirrhosis due to HBV, HDV and HCV, with HCC (Child-Pugh score-B, model for end-stage liver disease-16). Blood type was O+, EVL1 splenomegaly, ascites, hepatic encephalopathy, recurrent HCC in the S2/S4 sp TACE/S8. His body weight is 66, Ht 170 cm, BMI 22.8, BSA 1.77 m².

**Results:** Complete the ABO-incompatible living donor LT is much expensive than compatible living donor LT in developing country, however reducing of donor deficit is a good point. Because of the Mongolian religious mindset, most of the families do not agree to donate the liver from the dead body, so that hospital cannot have a enough stock of the cadaveric donor. There is no difference from surgical side for the ABO-incompatible LT, blood transfusion should be focused carefully postoperative days.

**Conclusions:** Although ABO-incompatible LT has high cost, it will reduce the donor deficit in developing country like Mongolia.

**Corresponding author:** Batsaikhan Bat-Erdene
**E-mail:** Batsaikhan@mnums.edu.mn
For the right hemiliver graft may need tissue expander after living donor liver transplantation

Batsaikhan Bat-Erdene

Department of Surgery, Mongolian National University of Medical Science, Ulaanbaatar, Mongolia

Background: The number of liver transplantation (LT) increases last few years, which is related with populating the high surgical technology in developing country like in Mongolia. The main reason of LT is a hepatitis B virus-related liver cirrhosis in Mongolia. LT had started since 2011 under the support of Professor Sung Gyu Lee from hepatobiliary surgery and LT of Asan Medical Center. Veno-occlusive disease, Budd-Chiari syndrome, and congestive hepatopathy, all of which results in hepatic venous outflow obstruction (HVOO). The early HVOO is rare, however that could raise a serious complication as a graft failure and eventual lose. We report a case of early HVOO, which may result of size mismatch of abdominal cavity. Acute cellular rejection of liver allograft may influenced due to graft malposition, which unsized upper part of abdomen between donor and recipient after living donor LT. The size mismatch of body may produce kinking syndrome after right lobe living donor LT, which reveals the HVOO without anastomosis complication.

Methods: A 38-year-old male patient with liver cirrhosis due to hepatitis B virus, HDV, hepatocellular carcinoma in S8 of the liver (Child-Pugh score-B, Model For End-Stage Liver Disease-18). On the first postoperative day the patient developed impairment of the liver function. Doppler ultrasound showed the different speed of right hepatic vein preanastomosis and postanastomosis field. This was diagnosed acute liver failure due to veno-oclusive disease, after that started intensive therapy.

Results: Kinking or twisting of the venous anastomosis is related with anatomical mismatch between the graft and the recipient abdomen, even though transplanted the right hemiliver graft. HVOO results acute cellular rejection, which treated by pulse therapy. However it should be managed by surgically, put the tissue expander.

Conclusions: We report the right graft needs the tissue expander for mismatching between the graft and recipient abdomen.

Corresponding author: Batsaikhan Bat-Erdene
E-mail: Batsaikhan@mnums.edu.mn

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Whole liver deceased donor liver transplantation for pediatric recipients: single-center experience for 20 years

Sung-Min Kim¹, Shin Hwang¹, Jung-Man Namgung¹, Dae-Yeon Kim¹, Tae-Yong Ha¹, Gi-Won Song¹, Dong-Hwan Jung¹, Gil-Chun Park¹, Kyung Mo Kim², Seak Hee Oh²

¹Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea
²Department of Pediatrics, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: We investigated the incidence and outcomes of pediatric deceased donor liver transplantation (DDLT) using whole liver grafts in a high-volume liver transplantation (LT) center.

Methods: The study was a retrospective single-center analysis of whole LT in pediatric recipients. The study period was set as 20 years between January 2000 and December 2019. We defined pediatric recipients and donors to be aged ≤18 years.

Results: During the study period, there were 98 cases of pediatric DDLT, and 34 patients (34.7%) received whole liver grafts. The age range of the deceased donors was 3 months to 56 years and that of pediatric recipients was 7 months to 17 years. Common primary diseases for LT were biliary atresia in 13, acute liver failure in four, Wilson disease in four, congenital portal vein agenesis in three, and genetic metabolic diseases in three. Pediatric-to-pediatric and adult-to-pediatric whole LTs were 22 (64.7%) and 12 (35.3%), respectively. A good correlation was noted between the donor and the recipient’s body weight, and the recipient’s body weight and allograft’s weight. Graft and overall patient survival rates were 91.2% and 91.2% at 1 year, 88.0% and 88.0% at 3 years, and 88.0% and 88.0% at 5 years, respectively.

Conclusions: The results of this study revealed that Korean Network for Organ Sharing (KONOS) regulations with donor-recipient body weight matching exhibited good performance. Considering the reciprocal trades of liver organs among pediatric and adult donors and recipients, it is necessary to establish a policy for pediatric donor liver grafts to pediatric recipients on a priority basis.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
A genome-wide association study identified genetic loci for end-stage liver disease in the Korean population

Hye-Mi Jang1*, Dong Jin Joo2*, Sung Min Kim1, Hyun-Young Park3, Bong-Jo Kim1, Myoung Soo Kim2, Young Jin Kim1

1Division of Genome Science, Korea National Institute of Health, Cheongwon, Korea
2Department of Surgery, Yonsei University College of Medicine, Seoul, Korea
3Department of Precision Medicine, Korea National Institute of Health, Cheongwon, Korea

Background: Liver transplantation (LT) is the most effective treatment for patients with end-stage liver diseases. To understand the contribution of genetic factors for liver diseases, several genome-wide association studies (GWAS) have been conducted. However, most of studies were conducted in Europeans. In 2014, a prospective designed version of the Korean Organ Transplantation Registry (KOTRY) was launched, supported by Korea National Institute of Health (KNIH). For GWAS on transplantation, KNIH is producing more than 9,000 KOTRY samples of genome data using Korea Biobank Array (KBA), a fully customized Single nucleotide polymorphisms (SNP) microarray for Koreans. In this study, we performed a GWAS to identify loci associated with LT in the Korean population.

Methods: All samples of cases and controls were genotyped using KBA. After quality control, there were 2,082 samples of LT cases from the KOTRY and 54,354 controls from the Korean Genome and Epidemiology Study (KoGES). Controls were selected as samples without liver diseases based on self-report survey data. Variants with minor allele frequency ≥1% were selected and imputed using IMPUTE v4. Logistic regression was performed by adjusting age and gender using EPACTS software.

Results: At P<5×10^{-8}, four loci including ADH1B, HLA-DPB1, ALDH2, and PNPLA3 were associated with LT. All loci were previously associated with cirrhosis and biliary cholangitis. Among them, a missense variant rs671 at ALDH2 was previously associated with hypertension, diabetes, cardiovascular diseases, alcohol dependence, liver enzymes, and lipid traits.

Conclusions: We performed GWAS on LT in Koreans and validated previously reported four liver disease related loci including ADH1B, HLA-DPB1, ALDH2, and PNPLA3. However, these loci explained only small proportion of heritability. Therefore, LT GWAS with extended sample sizes is warranted to discover hidden genetic factors.

Corresponding author: Young Jin Kim
E-mail: anwltlarkr@gmail.com
Co-Corresponding author: Myoung Soo Kim
E-mail: YSMS91@yuhs.ac

*The authors contributed equally to this paper.
This work was supported by an intramural grant from the KNIH (2019-NG-054-01).
Machine-learning models to predict tacrolimus dosage in liver transplant recipients

Jeong-Moo Lee¹, Soo Bin Yoon², Hyung-Chul Lee², Chul-Woo Jung², Suk Kyun Hong¹, Jae-Hyung Cho¹, Nam-Joon Yi¹, Kwang-Woong Lee¹

¹Division of Hepatobiliary, Department of Surgery, Seoul National University Hospital, Seoul, Korea
²Department of Anesthesiology, Seoul National University Hospital, Seoul, Korea

Background: Tacrolimus is the most widely used immunosuppressive agents to prevent rejection after solid organ transplantation. However, the use of tacrolimus should be cautious due to its narrow therapeutic index and variability of individual bioavailabilities. Machine learning techniques could be good modality to decide optimal dosage of tacrolimus, compared with traditional statistical models, have many advantages including high power and accuracy, we have implemented a new approach to find the optimal dose of tacrolimus by machine learning technique.

Methods: We retrospectively reviewed the postoperative tacrolimus levels of patients who underwent liver transplantation at the Seoul National University Hospital from March 2016 to March 2018. We implemented an artificial intelligence model predicting future tacrolimus levels by tacrolimus concentrations in the previous two days, sex, height, and daily changing body weight. We investigated hyperparameters (the number of layers in the network and the number of nodes in each layer) using a grid search and found the model with the lowest validation error.

Results: A machine learning model was derived using data from the 187 patients. As a result of testing the model with 18 patients, the predicted value of the model had an error of 1.5 ug/L from the actual measured tacrolimus level. Simulating the model in the random case with a calculated tacrolimus dose to ensure the next drug concentration to be within the therapeutic range, more than 95% of the final predicted tacrolimus level comes in the therapeutic window.

Conclusions: This is the first study to use machine learning models to predict optimal dosage after liver transplantation. The machine-learning model is useful to decide the optimal dose of tacrolimus immediate postoperative period after liver transplantation.

Corresponding author: Jeong-Moo Lee
E-mail: jmleetpl@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Feasibility, safety, and indications for pure laparoscopic donor right posterior sectionectomy based on surgical techniques and outcomes of donors and recipients after living donor liver transplantation

Chan Woo Cho¹, Gyu-Seong Choi², Kyeong Sik Kim³

¹Division of Transplantation, Department of Surgery, Yeungnam University Medical Center, Daegu, Korea
²Division of Transplant Surgery, Department of Surgery, Samsung Medical Center, Seoul, Korea
³Division of Transplantation, Department of Surgery, Soonchunhyang University Seoul Hospital, Seoul, Korea

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 volume and portal vein (PV) anomaly. However, there have been no reports regarding laparoscopic donor hepatectomy (LDH) for RPS graft. Herein, we report the results of pure laparoscopic donor right posterior sectionectomy (PLDRPS) in living donors with PV anomalies and the postoperative outcomes of donors and recipients who underwent PLDRPS and LDLT, respectively.

Methods: Seven donors (19–45 years) with PV anomaly underwent PLDRPS for seven LDLT recipients between June 2019 and June 2020. We reviewed the indications of LDH for RPS grafts, reported our experience with PLDRPS, and evaluated postoperative outcomes of donors and recipients.

Results: Indications for RPS graft selection were as follows: estimated left hemiliver volume less than 30% of whole liver volume (WL V); early branching right posterior PV such as type 2 or type 3 PV; estimated mismatch area volume less than 10% of WL V; right posterior hepatic duct running through the ventral side of the right PV; and RPS graft volume more than 40% of the recipients’ standard liver volume. There was no open conversion or perioperative blood transfusion in donors. The operation time ranged from 219 min to 405 min. Donors were discharged on postoperative days 6 to 16 without major complications. Out of seven recipients, three experienced major complications such as hepatic artery thrombosis, PV thrombosis, and bile leakage. One of these patients died of sepsis 6 months after LDLT.

Conclusions: PLDRPS in liver donors with PV anomaly was technically feasible and safe with experienced surgeons. Further evaluation of recipient outcomes in a larger number of cases is necessary to determine the usefulness of PLDRPS.

Corresponding author: Gyu-Seong Choi
E-mail: gyuseong.choi@samsung.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Korea-nationwide incidence of pediatric deceased donors and single-institutional status of liver transplantation using pediatric donor liver grafts

Geunhyeok Yang, Shin Hwang, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Dea-Yeon Kim, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: This study intended to know the allocation status of pediatric deceased donor liver allografts. We analyzed the incidence of pediatric deceased donors in Korean Network for Organ Sharing (KONOS) database and single-institutional status of liver transplantation (LT) using pediatric donors.

Methods: This study assessed the nationwide incidence of pediatric donors ≤15 years of age and conducted single-center analysis of LT using pediatric donors.

Results: Between 2010 and 2019, pediatric donors ≤15 years of age comprised 171 of 4,395 donors (3.9%) in KONOS database and 31 of 640 liver donors (4.8%) in Asan Medical Center (AMC) database. In AMC, 11 (35.5%) and 20 (64.5%) grafts were allocated to pediatric recipients aged ≤15 years and adult recipients aged ≥19 years, respectively. All nine livers from donors aged ≤5 years were implanted in pediatric recipients aged ≤5 years. In 21 donors aged ≥9 years, 16 whole liver grafts and four split extended right liver grafts were implanted to 20 adult recipients and two split left lateral section were implanted to two pediatric recipients. Remaining four split liver grafts were implanted in outside institutions. The overall patient survival rates at 1 year, 3 years and 5 years were 90.9%, 80.8% and 80.8% in pediatric-to-pediatric LT group, and 69.6%, 58.4% and 58.4% in pediatric-to-adult LT group, respectively (P=0.21).

Conclusions: The study results showed that over half of the pediatric donor livers were allocated to adult patients. Recipient criteria for allocation of liver allografts from pediatric donors needs revision for children on pediatric LT waitlist.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Long term outcomes of abdominal wall closure with ePTFE Gore-Tex Mesh in pediatric liver transplantation

Jeong-Moo Lee, Jiyoung Kim, Nam-Joon Yi, Suk Kyun Hong, Kwangpyo Hong, Eui Soo Han, Kwang-Woong Lee, Kyung-Suk Suh

Division of Hepatobiliary, Department of Surgery, Seoul National University Hospital, Seoul, Korea

Background: Massive transfusion and transient portal vein clamping during liver transplantation may cause abdominal compartment syndrome (ACS) related with mesenteric congestion. Especially in pediatric cases, the risk of ACS is increased due to the large for size syndrome caused by organ size mismatch. In the area of general pediatric surgery such as correction of gastroschisis or omphalocele, abdominal closure for correction of defect using expanded polytetrafluoroethylene (ePTFE Gore-Tex) is the well-established method. The purpose of this study is to describe the ePTFE-Gore-Tex closure method in patients with or at high risk of ACS among pediatric liver transplant patients, and to investigate the long-term prognosis and outcomes.

Methods: From March 1988 to March 2018, 253 pediatric liver transplantation were performed in Seoul National University Hospital. We reviewed the cases who underwent abdominal closure with ePTFE Gore-Tex during liver transplantation retrospectively.

Results: Total 15 cases were performed abdominal closure with ePTFE Gore-Tex graft. We usually used 2 mm×10 cm×15 cm sized Gore-Tex graft for extending abdominal cavity. Median follow up was 144.8 months, there was no ACS after transplantation, but four cases of the patients underwent repetitive exploration due to bleeding or vessel occlusion. In repetitive surgery, we reduced every Gore-Tex that had already used in previous operation. There was no infectious complication related Gore-Tex implantation. In only one case, there was persistent abdominal pain due to nerve irritation by Gore-Tex. However, the pain was improved after applying opioid-based active pain control.

Conclusions: It is important to select appropriate method for preventing ACS in pediatric liver transplantation. Abdominal closure using ePTFE Gore-Tex could be a good option for the case who have high risk factor of ACS. In terms of long-term follow-up, this method is feasible and safe.

Corresponding author: Jeong-Moo Lee
E-mail: jmleetpl@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Liver imaging reporting and data system category on magnetic resonance imaging predicts recurrence of hepatocellular carcinoma after liver transplantation within the Milan criteria: a multicenter study

Sunyoung Lee¹, Kyoung Won Kim²

¹Department of Radiology, Severance Hospital, Seoul, Korea
²Department of Radiology, University of Ulsan College of Medicine, Seoul, Korea

Background: This study aimed to investigate the association between Liver Imaging Reporting and Data System (LI-RADS) category and recurrence of hepatocellular carcinoma (HCC) after primary liver transplantation (LT) within the Milan criteria.

Methods: This multicenter retrospective study included 140 recipients who underwent living donor LT (LDLT) for treatment-naïve HCC and pretransplant contrast-enhanced magnetic resonance imaging (MRI) between 2009 and 2013. LI-RADS categories were assigned using LI-RADS version 2018. Recurrence-free survival (RFS) and associated factors were evaluated using Cox proportional hazards regression analysis, Kaplan-Meier analysis, and log-rank test. Histological grading and microvascular invasion (MVI) were analyzed on the pathologic examinations of explanted livers.

Results: The overall 1-, 3-, 5-, and 7-year RFS rates were 95.6%, 92.6%, 90.2%, and 89.3%, respectively. In the multivariable analysis, independent predictors of recurrence included HCCs categorized as LR-M (hazard ratio [HR], 18.68; 95% confidence interval [CI], 5.79–60.23; P<0.001) and the largest tumor size of ≥3 cm on MRI (HR, 4.18; 95% CI, 1.42–12.37; P=0.010). The 5-year RFS rate was significantly lower in patients with HCCs categorized as LR-M than in those with HCCs categorized as LR-5 or 4 (LR-5/4) (36.9% vs. 95.8%, respectively; P<0.001). HCCs categorized as LR-M exhibited significantly more MVI than HCCs categorized as LR-5/4 (57.1% vs. 17.5%, respectively; P=0.002).

Conclusions: Patients with HCCs categorized as LR-M using LI-RADS version 2018 may have a worse prognosis after primary LT within the Milan criteria than those with HCCs categorized as LR-5/4.

Corresponding author: Kyoung Won Kim
E-mail: kimkw@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Outcomes of deceased donor liver transplantation from elderly donors

Minjae Kim, Shin Hwang, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Gil-Chun Park, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

**Background:** Favorable outcomes achieved after deceased donor liver transplantation (DDLT) suggest that use of elderly donors may be an effective way to expand donor pool.

**Methods:** This was a retrospective analysis of adult DDLT using elderly donors. It was a double-arm study that compared post-transplant outcomes to ascertain whether use of elderly donors (aged ≥76 years) has adverse effects on outcome of DDLT. The elderly study group included 14 donors aged ≥76 years and the elderly control group comprised 39 donors aged 66–75 years.

**Results:** Mean age of the elderly and control groups was 78.2±3.1 years and 68.9±2.7 years, respectively (P<0.001). Other clinical parameters were comparable between these two groups. The 1-, 3-, and 5-year graft survival rates in the elderly study group were 83.6%, 59.7%, and 59.7%, respectively, and those in the elderly control group were 79.4%, 68.1%, and 59.6%, respectively (P=0.97). The overall 1-, 3-, and 5-year survival rates after donation from the elderly study group were 83.6%, 59.7%, and 59.7%, respectively, and those after donation from the control group were 79.3%, 72.1%, and 64.1%, respectively (P=0.74). Regarding overall patient survival, univariate analysis identified pretransplant requirement for ventilator support (P=0.021) and pretransplant renal replacement therapy (P=0.025) as statistically significant risk factors; however, neither was significant on multivariate analysis.

**Conclusions:** The data suggest that organs from elderly donors do not worsen posttransplant outcomes; thus, advanced age should not be an exclusion criterion. Indeed, using such donors could be the key to increasing the supply of liver grafts.

**Corresponding author:** Shin Hwang  
**E-mail:** shwang@amc.seoul.kr

© The Korean Society for Transplantation  
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Treatment and outcomes of extrahepatic malignancy incidentally diagnosed during pretransplant evaluation for living donor liver transplantation

Geunhyeok Yang, Shin Hwang, Gi-Won Song, Dong-Hwan Jung, Deok-Bog Moon, Chul-Soo Ahn, Ki-Hun Kim, Tae-Yong Ha, Young-In Yoon, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: This study analyzed treatment and outcomes in patients with primary extra-hepatic malignancy (EHM) incidentally diagnosed during pretransplant evaluation for living donor liver transplantation (LDLT).

Methods: Of 4,621 adult patients undergoing LDLT over 19 years, 41 were diagnosed with EHM shortly before LDLT (incidental malignancy group), and 92 had been treated for EHM more than 6 months before LDLT (treated malignancy group).

Results: Most common EHMs were colorectal, thyroid, and stomach cancers in incidental malignancy group; and stomach, breast, thyroid, colorectal, and renal cell cancers and lymphoma in treated malignancy group. Mean interval between EHM diagnosis and LDLT in the incidental malignancy group was 1.5±1.6 months. Of the 41 patients in this group, 15 (35.6%), seven (17.1%), and 16 (39.0%) underwent EHM treatment before, during, and after LDLT, respectively, whereas three (7.3%) underwent observation alone. During a mean follow-up of 70.1±50.8 months, six (14.6%) patients showed tumor recurrence, and three (7.3%) died of tumor progression. All recurrences developed in patients with tumor stages higher than the earliest stage. The mean interval between EHM diagnosis and LDLT in treated malignancy group was 79.8±79.6 months. During a mean follow-up of 63.2±54.1 months, three (3.3%) patients showed tumor recurrence and one (1.1%) died of tumor progression. The incidence of EHM recurrence was significantly higher (P=0.025), and the overall posttransplant patient survival rate significantly lower (P=0.046), in incidental malignancy than in treated malignancy group.

Conclusions: Only patients with earliest-stage EHM detected shortly before LDLT are indicated for upfront LDLT combined with peritransplant EHM treatment.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution-Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Prognosis of split liver transplantation compared with whole liver transplantation in adult patients: single-center results under the Korean MELD score-based allocation policy

Sung-Min Kim, Shin Hwang, Gil-Chun Park, Gi-Won Song, Dong-Hwan Jung, Tae-Yong Ha, Chul-Soo Ahn, Deok-Bog Moon, Ki-Hun Kim, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Split liver transplantation (SLT) has been occasionally performed in Korea. This study compared the incidence and prognosis of SLT with whole liver transplantation (WLT) in adult patients.

Methods: Between June 2016 and November 2019, 242 adult patients underwent a total of 256 deceased donor liver transplantation (DDLT) operations. SLT was performed in seven patients (2.9%).

Results: The mean age of SLT donors was 29.7±7.4 years, and the mean age of recipients was 55.7±10.6 years, with the latter having a mean model for end-stage liver disease score of 34.6±3.1. Mean split right liver graft weight was 1228.6±149.7 g and mean graft-recipient weight ratio was 1.97±0.39. Of the seven SLT recipients, Korean Network for Organ Sharing (KONOS) status was one in status 1, one in status 2 and five in status 3. The graft (P=0.72) and patient (P=0.84) survival rates were comparable in the SLT and WLT groups. Following propensity score matching, graft (P=0.61) and patient (P=0.91) survival rates remained comparable in the two groups. Univariate analysis showed that pretransplant ventilator support and renal replacement therapy were significantly associated with patient survival, whereas KONOS status category and primary liver diseases were not. Multivariate analysis showed that pretransplant ventilator support was an independent risk factor for patient survival.

Conclusions: Survival outcomes were similar in adult SLT and WLT recipients, probably due to selection of high-quality grafts and low-risk recipients. Prudent selection of donors and adult recipients for SLT may expand the liver graft pool for pediatric patients without affecting outcomes in adults undergoing SLT.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Pretransplant hepatic malignancy increases risk of de novo malignancy after liver transplantation

Geunhyeok Yang, Shin Hwang, Gil-Chun Park, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Hepatocellular carcinoma (HCC) recurrence and development of de novo malignancy (DNM) after liver transplantation (LT) are the major causes of late recipient death.

Methods: We analyzed the incidence of extrahepatic DNM following living donor LT according to the status of pretransplant hepatic malignancy. We selected 2,076 adult patients who underwent primary LDLT during 7 years from January 2010 to December 2016.

Results: The pretransplant hepatic malignancy group (n=1,012) showed 45 cases (4.4%) of the following extrahepatic DNMs: posttransplant lymphoproliferative disease (PTLD) in 10; lung cancer in 10; stomach cancer in six; colorectal cancer in five; urinary bladder cancer in three; and other cancers in 11. The pretransplant no hepatic malignancy group (n=1064) showed 25 cases (2.3%) of the following extrahepatic DNMs: colorectal cancer in three; stomach cancer in three; leukemia in three; lung cancer in three; PTLD in two; prostate cancer in two; and other cancers in nine. Incidences of extrahepatic DNM in the pretransplant hepatic malignancy and no hepatic malignancy groups were as follows: 1.1% and 0.5% at 1 year, 3.2% and 2.0% at 3 years, 4.6% and 2.5% at 5 years, and 5.4% and 2.8% at 8 years, respectively (P=0.006). Their overall patient survival rates were as follows: 97.3% and 97.2% at 1 year, 91.6% and 95.9% at 3 years, 89.8% and 95.4% at 5 years, and 89.2% and 95.4% at 8 years, respectively (P<0.001). Pretransplant hepatic malignancy was the only significant risk factor for posttransplant extrahepatic DNM.

Conclusions: Our results suggest that patients who had pretransplant hepatic malignancy be followed up more strictly because they have a potential risk of primary hepatic malignancy recurrence as well as a higher risk of extrahepatic DNM than patients without pretransplant hepatic malignancy.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Prognostic impact of model for end-stage liver disease (MELD) scores greater than 40 in deceased donor liver transplant recipients

Byeong-Gon Na, Shin Hwang, Gil-Chun Park, Gi-Won Song, Dong-Hwan Jung, Tae-Yong Ha, Chul-Soo Ahn, Deok-Bog Moon, Ki-Hun Kim, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Since 2016, Korean liver organ allocation system has been based on model for end-stage liver disease (MELD). Some patients on waiting list progressed to MELD score >40 due to serious shortage of donor organs. This study investigated prognosis of deceased donor liver transplantation (DDLT) recipients with MELD scores >40.

Methods: Data from adult patients with MELD scores ≥31 who underwent DDLT between June 2016 and November 2019 were retrospectively evaluated. Patients were categorized according to Korean Network for Organ Sharing (KONOS) status 3, 2, or MELD-over-40.

Results: During the study period, 168 DDLT operations were performed in 160 patients with KONOS status 3 in 77 (48.1%), status 2 in 65 (40.6%), and MELD-over-40 in 18 (11.3%). Graft survival rates of primary DDLT were 84.0% at 1 year and 70.7% at 3 years. Overall patient survival was 85.2% at 1 year and 70.7% at 3 years. The 3-year patient survival was 74.4%, 75.7%, and 52.7% in KONOS status 3, status 2, and MELD-over-40 groups (P=0.19). Pretransplant ventilator support was associated with inferior patient survival outcomes (P=0.043), but pretransplant renal replacement therapy showed no prognostic significance. Retransplantation showed a significant prognostic difference (P<0.001). Multivariate analysis for overall patient survival showed that pretransplant ventilator support and retransplantation were significant prognostic factors, but MELD score >40 was not seen to be an independent risk factor.

Conclusions: This analysis revealed that very high MELD scores >40 appear to confer additional risk in patients with KONOS status 2 although it was not an independent prognostic factor.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Reuse of liver allograft from a brain-dead recipient: a case report

Min-Jae Kim, Shin Hwang, Dong-Hwan Jung, Gil-Chun Park, Gi-Won Song, Hwui-Dong Cho, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: We report our first case of deceased-donor liver transplantation (LT) using a reuse liver graft after the first LT.

Methods: The recipient was a 38-year-old female with fulminant hepatic failure from toxic hepatitis.

Results: She had a history of herb intake and her liver function deteriorated progressively. She was enrolled as the Korean Network for Organ Sharing (KONOS) status 1 and the model for end-stage liver disease score was 34. The donor was a 42-year-old male patient who fell into brain death after LT for alcoholic liver cirrhosis. Donation of multiple organs including the transplanted liver graft was performed 10 days after the first LT operation. Since the liver graft appeared to be normal and frozen-section liver biopsy showed only mild fatty changes, we decided to reuse the liver graft. A modified piggy-back technique of the suprahepatic inferior vena cava reconstruction was used. Other surgical procedures were comparable to the standard deceased-donor LT procedures. The explant liver pathology revealed submassive hepatic necrosis, which was compatible with toxic hepatitis. The peak of serum liver enzyme levels were aspartate transaminase 1,063 IU/L and alanine transaminase 512 IU/L at posttransplant day 3. Since the pretransplant general condition of the recipient was very poor, hospital stay was prolonged and she was discharged 51 days after LT operation. She is currently doing well for 3 years to date.

Conclusions: Experience in our case and the literature review suggest that a reuse liver graft can be regarded as one of the marginal grafts which can be transplantable to the LT candidates requiring urgent LT.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Impact of MELD allocation system on the outcomes of deceased donor liver transplantation: a single-center experience

Jeong-Moo Lee, Han Sang Park, Kwangpyo Hong, Eui Soo Han, Suk Kyun Hong, Nam-Joon Yi, Kwang-Woong Lee, Kyung-Suk Suh

Division of Hepatobiliary, Department of Surgery, Seoul National University Hospital, Seoul, Korea

Background: The model for end-stage liver disease (MELD)-based allocation system replaced the Child-Turcotte-Pugh (CTP) score-based system for organ allocation of the liver in Korea. The aim of this study is to analyze the changes of outcomes and to describe arising issues before and after the MELD system.

Methods: From June 2014 to June 2018, 129 patients were selected from recipients who underwent deceased donor liver transplantation (DDLT) in Seoul National University Hospital. Pediatric cases were excluded. Patients were divided into two groups according to the allocation system (52 in the MELD group, 77 in the CTP group).

Results: The MELD score of the two groups differed significantly (37.8±2.0 in the MELD group, 31.0±8.2 in the CTP group, P=0.001). The etiology of patients was changed in etiology for liver transplantation, proportion of alcoholic cirrhosis is increased in the era of MELD allocation system. However, the proportion of hepatitis B related liver cirrhosis and hepatocellular carcinoma were decreased. Long-term survival rate in CTP group was 80.1% but it was decreased to 75% in MELD group. There were no differences of the complication rate in the CTP group and MELD group (35% vs. 31%).

Conclusions: The MELD allocation system distributes the liver to severely ill patients, resulting in poor performance after surgery, and as proportion of alcoholic cirrhosis increase, problems such as re-drink failure may become an issue in the future. It is necessary to adjust MELD allocation system for increasing outcomes after DDLT.

Corresponding author: Jeong-Moo Lee
E-mail: jmleetpl@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Steroid resistant rejection in liver transplantation: a single center study for risk factor and second line treatment

Tae Yun Lee

Division of Hepatobiliary, Department of Surgery, Incheon St. Mary’s Hospital, The Catholic University of Korea, Incheon, Korea

Background: Steroid-resistant rejection (SRR) in liver transplantation occurs in about 10% of T cell-mediated rejection (TCMR), prognosis of SRR is known to be worse than steroid-sensitive rejection (SSR). Only a few studies describe treatment methods or features for SRR, and there is no clear consensus yet. Therefore, the purpose of this study is to describe the difference between SSR and SRR, and to compare the effect of the SRR treatment method performed our institution.

Methods: This study is a 10-year, retrospective cohort study at Seoul St Mary’s Hospital, clinical data was collected from January 2008 to December 2017. Of total 663 cases, 154 patients (23.3%) underwent steroid pulse therapy for rejection, we excluded 30 patients who did not undergo liver biopsy. After all, 124 patients (18.7%) with biopsy proven rejection (BPR) were analyzed for this study.

Results: Child-Turcotte-Pugh (CTP) score (9.2±3.0 vs. 10.4±2.4, P=0.031), cold ischemic time (125.9±80.0 vs. 191.2±124.9, P=0.041), cytomegalovirus (CMV) infection (27.7% vs. 76.7%, P<0.001) showed a statistically significant difference in two groups. Multivariate analysis was performed on risk factors of SRR at first rejection. Then, CMV infection and total bilirubin at first rejection and numbers of rejection were significant results. Both overall survival and allograft survival rate of SSR patients is higher than SRR patients (P<0.001). Of 2nd line treatment patients, 13 patients (54.2%) were recovered and 11 patients (45.8%) were failed to recover. Survival was the highest in patients using anti-thymocyte globulin (ATG) and in patients with re-LT.

Conclusions: When the first rejection in LT occurs, patients with high bilirubin level and previous CMV infections are more likely to have SRR, so if they do not respond to steroid pulse therapy for the first time, either using ATG or re-LT preparation should be considered.

Corresponding author: Tae Yun Lee
E-mail: aroong318@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Outflow vein venoplasty of left lateral section graft for living donor liver transplantation in infant recipients

Sang Hoon Kim, Shin Hwang, Jung-Man Namgoong, Gil-Chun Park, Chul-Soo Ahn, Ki-Hun Kim, Hyunhee Kwon, Yong Jae Kwon

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

**Background:** The size of the orifice of the left hepatic vein (LHV) trunk in left lateral segment (LLS) grafts is often too small for direct anastomosis. Several methods were developed to enlarge the graft and recipient hepatic vein orifices. This study described our surgical techniques for secure hepatic vein reconstruction in infant recipients and analyzed their patency outcomes.

**Methods:** Twelve infants undergoing pediatric living donor liver transplantation (LDLT) were selected during a 2-year study period between January 2018 and December 2019. Surgical techniques and vascular complications of graft hepatic vein outflow in these recipients was analyzed.

**Results:** The mean recipient age was 12.5±4.5 months; mean body weight was 9.4±1.0 kg; and mean graft-recipient weight ratio was 2.8%±0.6%. Primary diseases were biliary atresia in six patients, metabolic disease in two, hepatoblastoma in two, and acute liver failure in two. Eight LLS grafts were recovered through an open method, and four LLS grafts were recovered through a laparoscopic method. A small superficial LHV branch was present in five of 12 LLS grafts and used to widen the graft hepatic vein orifice. Incision-and-patch venoplasty was performed in 10, incision venoplasty in one and no venoplasty in one. All four LLS grafts recovered through a laparoscopic approach required circumferential vein patch because of very short hepatic vein stump. No patient experienced graft hepatic vein-associated vascular complications.

**Conclusions:** Our surgical techniques with incision-and-patch venoplasty for LLS grafts is beneficial to reduce the risk of hepatic vein outflow obstruction in recipients receiving LLS grafts.

**Corresponding author:** Shin Hwang
**E-mail:** shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Standard framework and experience of living donor liver transplantation for overseas non-Korean patients at Asan Medical Center

Sang-Hoon Kim, Shin Hwang, Gi-Won Song, Dong-Hwan Jung, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gil-Chun Park, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Liver transplantation (LT) for foreign patients is a sensitive issue because of the possibility of transplant tourism and the difficulty in follow-up. This study describes the standard framework and experience of living donor LT (LDLT) for overseas non-Korean patients in a Korean high-volume LDLT center.

Methods: The framework and experience of LDLT for 105 non-Korean patients from 2010 to 2019 were retrospectively investigated.

Results: Only 3.1% of patients who underwent LDLT were overseas non-Koreans; of these, 83.8% were from the United Arab Emirates and Mongolia. Selection criteria for recipients and donors were the same as for Korean citizens. Of the 105 recipients, 95 (90.5%) were adults. The most common reasons for transplantation were hepatitis B or C virus-associated liver cirrhosis. Of the 95 adults, 78 (82.1%) received right liver grafts, and 16 (16.8%) received dual grafts. The most frequent donors for adult recipients were sons and daughters, whereas the most frequent donors for pediatric recipients were parents. Of the 10 pediatric patients, eight were from the United Arab Emirates; their common primary diseases were biliary atresia, acute liver failure, hepatoblastoma, and genetic metabolic diseases. The 1-, 3-, and 5-year posttransplant overall patient survival rates in all patients were 96.2%, 92.4%, and 92.4%, respectively. The 5-year overall patient survival rates were 91.8% in adult recipients and 100% in pediatric recipients (P=0.47).

Conclusions: LDLT at Korean high-volume LT centers including our institution is safe and effective for non-Korean patients with end-stage liver disease seeking alternatives not available in their own countries.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Refined surgical techniques to improve the patency of cryopreserved iliac artery homografts for middle hepatic vein reconstruction during living donor liver transplantation

Byeong-Gon Na, Shin Hwang, Gil-Chun Park, Dong-Hwan Jung, Tae-Yong Ha, Gi-Won Song, Chul-Soo Ahn, Deok-Bog Moon, Ki-Hun Kim, Sung-Gyu Lee

Background: A cryopreserved iliac artery homograft (IAH) has not been considered suitable for middle hepatic vein (MHV) reconstruction during living donor liver transplantation (LDLT), primarily due to the low patency from its small diameter. We revised our surgical techniques for MHV reconstruction using an IAH to improve its patency.

Methods: This study analyzed the causes of early conduit occlusion and developed revised techniques to address this that had clinical application.

Results: The potential risk factors for early conduit occlusion were the small IAH size, small graft V5/V8 opening, and small recipient MHV-left hepatic vein stump. These factors were reflected to our revised surgical methods which included endarterectomy of the atherosclerotic plaque, unification of the internal and external iliac artery branches for large V5, and branch-patch arterioplasty for large V8. IAH endarterectomy was applied to eight patients and resulted in a 1-month occlusion rate of 37.5%. Branch unification technique was applied to five patients and a 1-month occlusion rate of 20.0% was obtained. Branch-patch arterioplasty was applied to five patients leading to a 1-month occlusion rate of 40.0%. The overall patency rates of the IAH-MHV conduits in our 18 patients were 66.7% at 1 month, 38.9% at 3 months, and 33.3% at 1 year.

Conclusions: Our refined MHV reconstruction using an IAH improved short-term MHV conduit patency, but did not effectively prevent early conduit occlusion, particularly with a small- or medium-sized IAH. Individualized reconstruction designs during LDLT operation are needed when an IAH is used for a modified right liver graft.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Living donor liver transplantation at the Pusan National University Yangsan Hospital, Korea: result of living donor hepatectomy in a single center

Hyo Jung Ko, Je Ho Ryu, Kwangho Yang, Byung Hyun Choi, Tae Beom Lee, Jae Ryong Sim

Division of Hepatobiliary, Department of Surgery, Pusan National University Yangsan Hospital, Yangsan, Korea

Background: Living donor liver transplantation is currently the most feasible treatment method for patients with end-stage liver disease. We discuss the results of living donor hepatectomy in our single center for 10 years, including donor characteristics and postoperative outcomes, and directions for improvement.

Methods: The 261 living donors underwent liver donation surgery were reviewed retrospectively from May 2010 to May 2020 at Pusan National University Yangsan Hospital.

Results: The ages of donors ranged from 16 to 64 years old, and 182 male and 79 female. Liver grafts were five types, 110 (44.9%) in caudal middle hepatic vein trunk preserved right lobe, 105 (42.5%) in modified right lobe, 16 (6.5%) in extended right lobe, 14 (5.7%) in left lobe, and one (0.4%) in right posterior segment. The average weight of the graft was 686.2 g, the volume was 37.5%, and the average of body mass index of the donor was 23.4 kg/m². Of 261 donors, there was no mortality and no postoperative hepatic failure or multi-organ failure. The average operation time was 372.7 minutes, the mean length of hospital stay was 13.7 days, the intensive care unit (ICU) stay was 1.02 days, and the intraoperative transfusion rate was 1.5%. Postoperative complications occurred in 44 donors. According to Clavien-Dindo classification, grade I complications occurred in 29 patients (11.1%), grade II in one patient (0.4%), grade III in 15 patients (5.7%) and there was no case of grade IV and V. Grade III or more severe complications requiring invasive procedure or surgical treatment were seven cases of biliary stenosis or leakage, five portal stenosis, one duodenal ulcer bleeding, one ascites, and one bleeding.

Conclusions: Although limitations of retrospective data and short follow-up period, postoperative outcome of liver donor was relatively good. Further study with long-term follow-up and minimally invasive and refined surgical techniques to reduce minor complications are needed.

Corresponding author: Je Ho Ryu
E-mail: ryujhhim@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The impact of model for end-stage liver disease (MELD) score on liver transplant outcomes in low volume liver transplantation center: single center experience

Shin Hoo Pyo¹, Doojin Kim², Dooho Lee², Sang Tae Choi², Yeon Ho Park²

¹Department of Medicine, Gachon University College of Medicine, Incheon, Korea
²Division of Transplantation, Department of Surgery, Gachon University Gil Medical Center, Incheon, Korea

Background: In June of 2016, the model for end-stage liver disease (MELD) score was employed in Korea instead of the Child-Turcotte-Pugh (CTP) score. This study compared the outcomes of deceased donor liver transplantation (DDLT) before and after MELD system.

Methods: From January 2014 to December 2018, 48 patients were underwent DDLT in a single center. Patients were divided into two groups according in a same time period (2.5 years) from MELD allocation time (2016 June). Laboratory data and clinical outcomes were collected and analyzed retrospectively.

Results: There were 22 in the pre-MELD group and 26 in the MELD group. There was no difference in age, sex, ABO type, etiology for liver transplantation, CTP score, operation time, cold ischemic time, and amount of red blood cell transfusion. However, the MELD score of the two groups differed significantly (36.2±4.9 in the MELD group, 27.7±11.8 in the pre-MELD group, P<0.001). MELD group revealed longer intensive care unit stay and hospital stay than pre-MELD group (11.2±9.5 vs. 5.7±4.5, P=0.018; 36.8±26 vs. 22.8±9.3, P=0.016). Mean follow-up time was 32.8 months and 1-year survival rate was lower in MELD group (61.5% vs. 86.4%) although statistically insignificant (P=0.056).

Conclusions: After MELD allocation, high MELD patients increased in DDLT and consequently needed had longer recovery time. Also they might have negative results in survivals. According to a small volume center’s experience, these problems were related with severe organ shortage in Korea rather than MELD.

Corresponding author: Doojin Kim
E-mail: drkdj@gilhospital.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Association between pretransplant serum soluble programmed death protein 1 level and prognosis following liver transplantation in patients with hepatocellular carcinoma

Kibong Oh\textsuperscript{1}, Shin Hwang\textsuperscript{2}, Chul-Soo Ahn\textsuperscript{2}, Ki-Hun Kim\textsuperscript{2}, Deok-Bog Moon\textsuperscript{2}, Tae-Yong Ha\textsuperscript{2}, Gi-Won Song\textsuperscript{2}, Dong-Hwan Jung\textsuperscript{2}, Kyung Jin Lee\textsuperscript{2}, Eunyoung Tak\textsuperscript{2}

\textsuperscript{1}Department of Surgery, Anyang SAM Hospital, Anyang, Korea
\textsuperscript{2}Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: The study aimed to assess the prognostic influence of pretransplant serum soluble programmed death protein 1 (sPD-1) in patients undergoing liver transplantation (LT) for treatment of hepatocellular carcinoma (HCC).

Methods: Data from 229 patients with HCC who underwent living donor LT between January 2010 and December 2015 were retrospectively evaluated. Stored serum samples were used to evaluate sPD-1 concentrations.

Results: Tumor recurrence, overall survival, and HCC-specific survival rates were 25.5%, 94.3%, and 96.0% at 1 year; 40.8%, 78.2%, and 80.7% at 3 years; and 44.5%, 75.4%, and 77.9% at 5 years, respectively. Prognostic analysis using pretransplant serum sPD-1 with a cutoff of 93.6 \(\mu\)g/mL (median value of the study cohort) did not have significant prognostic influence on HCC recurrence, HCC-specific patient survival and post-recurrence patient survival (\(P\geq0.26\)). Prognostic analysis using sPD-1 with a cutoff of 300 \(\mu\)g/mL showed marginally higher tumor recurrence (\(P=0.069\)), similar HCC-specific patient survival (\(P=0.25\)) and higher post-recurrence patient survival (\(P=0.045\)). Multivariate analysis revealed that Milan criteria were prognostic for HCC recurrence and HCC-specific patient survival, but pretransplant sPD1 with a cutoff of 300 \(\mu\)g/mL did not become an independent prognostic factor.

Conclusions: The results of this study demonstrate that pretransplant serum sPD-1 may not have significant influences on post-transplant outcomes in patients with HCC, although there might be some potential prognostic influence from very high expression of serum sPD-1. Additional large-scale, multicenter studies and detailed mechanism studies are required to clarify the role of serum sPD-1 in LT recipients.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Simultaneous liver-kidney transplantation: a single-center experience in Korea

Minjae Kim, Shin Hwang, Chul-Soo Ahn, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Sung Shin, Young Hoon Kim, Duck Jong Han, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Simultaneous liver and kidney transplantation (SLKT) has been established as the treatment of choice for patients with concurrent end-stage liver and end-stage kidney diseases. The objective of this study was to analyze the nationwide incidence of SLKT in Korea and the outcomes of SLKT in a high-volume transplant center.

Methods: Databases of the Korean Network for Organ Sharing (KONOS) and Asan Medical Center from 2000 to 2019 were retrospectively reviewed to determine the incidence of SLKT.

Results: During 20 years from 2000 to 2019, deceased donor SLKT was performed for 38 cases in the KONOS database. The proportion of deceased donor SLKT was 0.6% (20 of 3,333) before adoption of model for end-stage liver disease (MELD) score, which was significantly increased to 1.2% (18 of 1,524) after the adoption of MELD score (P=0.034). In our institution, there were 11 cases of SLKT (two cases with deceased donors and nine cases with living donors). SLKT accounted for 0.2% (11 of 6,468) of total liver transplantation volume. During follow-up, five patients died due to hepatocellular carcinoma recurrence (n=2), infection (n=2), or unknown cause (n=1). The 1-year and 10-year overall patient survival rates were 90.9% and 81.8%, respectively.

Conclusions: Results of this study revealed that the incidence of deceased donor SLKT was very low. An increase of such incidence is not anticipated unless the number of deceased donors is markedly increased. Currently, sequential living donor liver transplantation and kidney transplantation with deceased or living donors are mainstays of transplantation rather than SLKT in our institution.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Fates of retained hepatic segment IV and its prognostic impact in adult split liver transplantation using an extended right liver graft

Sung-Min Kim, Shin Hwang, Chul-Soo Ahn, Ki-Hun Kim, Deok-Bog Moon, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Gil-Chun Park, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: When splitting a liver for adult and pediatric graft recipients, the retained left medial section (S4) will undergo ischemic necrosis and the right trisection graft becomes an extended right liver (ERL) graft. We investigated the fates of the retained S4 and its prognostic impact in adult split liver transplantation (SLT) using an ERL graft.

Methods: This was a retrospective analysis of 25 adult SLT recipients who received split ERL grafts.

Results: The mean model for end-stage liver disease (MELD) score was 27.3±10.9 and graft-recipient weight ratio (GRWR) was 1.98±0.44. The mean donor age was 26.5±7.7 years. The split ERL graft weight was 1,181.5±252.8 g, which resulted in a mean GRWR of 1.98±0.44. Computed tomography of the retained S4 parenchyma revealed small ischemic necrosis in 16 patients (64%) and large ischemic necrosis in the remaining nine patients (36%). No S4-associated biliary complications were developed. The peak liver enzyme levels were higher in the large S4 ischemic necrosis group (P≤0.002). The mean GRWR was 1.87±0.43 in the nine patients with large ischemic necrosis and 2.10±0.44 in the 15 cases with small ischemic necrosis (P=0.28). The retained S4 parenchyma showed gradual atrophy on follow-up imaging studies. The amount of S4 ischemic necrosis was not associated with graft (P=0.59) or patient (P=0.24) survival. A MELD score >30 and pretransplant ventilator support were associated with inferior outcomes.

Conclusions: The amount of ischemic necrosis of the retained S4 parenchyma is not a negative prognostic indicator in adult SLT recipients, likely due to sufficiently large GRWR. However, a high MELD score (>30) and pretransplant ventilator support are closely associated with inferior outcomes in these cases. Therefore, careful selection of donors and recipients is essential to improve the outcomes of adult SLT.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Technical refinement of prosthetic vascular graft anastomosis to recipient inferior vena cava for secure middle hepatic vein reconstruction in living donor liver transplantation

Sang Hoon Kim, Shin Hwang, Tae-Yong Ha, Gi-Won Song, Dong-Hwan Jung, Gil-Chun Park, Chul-Soo Ahn, Deok-Bog Moon, Young-In Yoon, Sung-Gyu Lee

Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Hemashield vascular grafts has been used for middle hepatic vein (MHV) reconstruction during living donor liver transplantation (LDLT). We occasionally encounter outflow disturbance of MHV conduit at the anastomotic stump of the middle-left hepatic vein (MLHV) trunk. To mitigate the disturbance, we carried out a series of studies regarding hemodynamics-compliant MHV reconstruction.

Methods: This study comprised of three parts; part 1: determining the causes of outflow disturbance; part 2: computational simulative analysis; and part 3: clinical application of our refined technique. The types of Hemashield conduit-MLHV stump reconstruction were end-to-end anastomosis (type 1), side-to-end anastomosis (type 2), and oblique cutting of the conduit end and patch plasty (type 3).

Results: In part 1 study, the reconstruction types were type 1 in 23, type 2 in 25, and type 3 in two. Significant anastomotic stenosis was identified in seven (30.4%) in type 1, six (24.0%) in type 2, and none in type 3. The size of MLHV stump was the most important factor for anastomotic stenosis. Through part 2 study, technical knacks were developed as follows: the conduit end was cut in a dumb-bell shape and a vessel patch attached; and then sutured bidirectionally from the 9 o’clock direction. In part 3 study, these knacks were applied to five patients and none of them experienced noticeable anastomotic stenosis.

Conclusions: Our refined technique to perform conduit-MLHV stump anastomosis helped to reduce the risk of anastomotic stenosis for relatively small MLHV stumps. Further experience and technical evolution will contribute to achieve failure-free MHV reconstruction during LDLT operation.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Pediatric liver transplantation with hyperreduced left lateral segment graft

Byeong-Gon Na¹, Shin Hwang¹, Jung-Man Namgoong¹, Gi-Won Song¹, Dae-Yeon Kim¹, Tae-Yong Ha¹, Dong-Hwan Jung¹, Kyung Mo Kim², Seak Hee Oh²

¹Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea
²Department of Pediatrics, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: To prevent large-for-size graft-related complications in small infant patients, the size of a left lateral segment (LLS) graft can be reduced to be a hyperreduced LLS (HRLLS) graft.

Methods: This study was intended to describe the detailed techniques for harvesting and implanting HRLLS grafts developed in a high-volume liver transplantation (LT) center.

Results: The mean recipient age was 4.0±1.7 months (range, 3–6 months) and body weight was 5.3±1.4 kg (range, 4.1–6.9 kg). Primary diagnoses of the recipients were progressive familial intrahepatic cholestasis in two and biliary atresia in one. The types of LT were living donor LT in one and split deceased donor LT in two. Non-anatomical size reduction was performed to the transected LLS grafts. The mean weight of the HRLLS grafts was 191.7±62.1 g (range, 120–230 g) and graft-recipient weight ratio was 3.75%±1.57% (range, 2.45%–5.49%). Widening venoplasty was applied to the graft left hepatic vein outflow orifice. Vein homograft interposition was used in a case with portal vein hypoplasia. Types of the abdomen wound closure were one case of primary repair, one of two-staged closure with a mesh, and one of three-staged repair with a silo and a mesh. All three patients recovered uneventfully from the LT operation and are doing well to date for more than 6 years after transplantation.

Conclusions: Making a HRLLS graft through non-anatomical resection during living donor LT and split deceased donor LT can be a useful option for treating small infant patients.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Hepatitis B virus (HBV) immunoglobulin effect on HBV and hepatitis D virus reactivation after liver transplantation

Anar Ganbold, Munkhtsetseg Chimedtseren, Odontungalag Norov, Sumiya Bayarsaikhan, Bayarmaa Ochirkhuree

Department of Gastroenterology, First Central Hospital of Mongolia, Ulaanbaatar, Mongolia

Background: Post-liver transplantation (LT) use of hepatitis B virus immunoglobulin (HBlg) is still debated in the era of highly effective nucleos(t)ide analogues. This study aims to compare presence of hepatitis B virus surface antigen (HBsAg) and HBV-DNA/HDV-RNA replications post-LT, depending on HBlg administration.

Methods: We divided patients into 125 HBV and 57 HBV/HDV-cohorts. They were operated in various centers around the world before April 1, 2018 into HBlg and non-HBlg groups. In the HBV-cohort, the HBlg-group had 31 patients, non-HBlg-group had 76 patients. Eighteen patients were not sure of their HBlg status. All patients were taking either entecavir, tenofovir alafenamide or tenofovir fumarate on a continuous basis. Any patient that suffered viral reactivation due to non-compliance was removed from analysis. The data was processed in GraphPad, Prism (GraphPad, San Diego, CA, USA).

Results: In the HBlg-group, HBsAg was tested in 20 patients and detected in three (15%), while HBV-DNA tested in 15 and was positive in two (13.33%). In non-HBlg-group, HBsAg was tested in 42 and detected in nine (21.42%), HBV-DNA was tested in 52 and detected in eight (15.38%). In HBV/HDV-cohort, 14 patients received HBlg and one (20%) had HDV-RNA replication out of five tested. Non-HBlg group had 34 patients, out of 18 tested six (33%) had HDV-RNA replication.

Conclusions: It appears that the HBsAg is found in 15%-21% patients post-LT. We found no statistically significant difference between HBlg and non-HBlg groups in terms of HBsAg positivity, HBV-DNA (P=0.37) and HDV-RNA (P=0.22) replications. This was especially true for HBV replication. However, we cannot rule out usefulness of HBlg therapy in terms of HDV replication, where number of PCRs performed were low in both HBlg and non-HBlg groups. Limiting factors were the absence of pre-LT viral load information and lack of standardized viral replication tests for this study.

Corresponding author: Anar Ganbold
E-mail: g.anar@fchm.edu.mn

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Blood product transfusion in liver transplantation in First Clinical Hospital of Mongolia

Bazarragchaa Regjii¹, Tseyenpiljee Amgaa¹, Bayalagmaa Khuvtsagaan¹, Chuluunbaatar Donkhim¹, Ganbold Lundeg²

¹Department of Anesthesia, First Central Hospital of Mongolia, Ulaanbaatar, Mongolia
²Department of Emergency Care and Anesthesia, Mongolian National University of Medical Science, Ulaanbaatar, Mongolia

Background: Liver transplantation is a well-accepted treatment of end-stage liver diseases. Seven-eight liver transplants have been performed from 2011 to June of 2019 in First Clinical Hospital of Mongolia. Numerous advances in perioperative management, like expertise in surgical techniques, better preoperative optimization, intraoperative monitoring and management, changes in immunosuppression regime and advances in postoperative management, not only increased the number of this procedure but also the outcome. The role of the anesthesiologist is to provide safe anesthesia and maintain an acceptable hemodynamic performance, ensuring sufficient perfusion to the vital organs. Estimation of the amount of blood products required during liver transplantation can help provision of adequate blood supply, minimize transfusion associated complications and plan for preventive measures in high risk patients.

Methods: Our objective is to investigate some factors impact to perioperative blood product transfusion. We used data of patients who underwent liver transplantation between October 2011 and June 2019 at First Clinical Hospital of Mongolia, were reviewed. The all amount of blood product utilized during surgery and some factors, including pretransplant laboratory data, pre-transplant clinical data were recorded.

Results: We studied 77 patients who underwent liver transplantation. The mean±standard deviation amounts of red blood cells and fresh frozen plasma transfusion during surgery were 1.64±2.36 and 2.22±2.7 liters, respectively. The mean amount of red blood cells and albumin was significantly (P<0.003 and P<0.005) correlated with model for end-stage liver disease (MELD) score of patients. The mean amount of blood products utilized during operation was decreased from 2015 to 2019 except two retransplantation patients.

Conclusions: Some preoperative factors may predict blood transfusion requirements in patients undergoing liver transplantation. Therefore, evaluation of patients before operation should be considered to provide adequate blood supply. Understanding preoperative factors associated with rate of transfusion may help us to best utilize the limited available blood resources.

Corresponding author: Bazarragchaa Regjii
E-mail: bazaraapearl@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Challenge to establish the liver transplantation in developing country (Mongolia) progress of the liver transplantation program in Mongolia

Undarmaa Zandanbazar, Batsaikhan Bat-Erdene, Bat-Ireeduu Badarch, Batsuikhan Batsuuri, Sergelen Orgoi

Department of Organ transplantation, First Central Hospital of Mongolia, Ulaanbaatar, Mongolia

Background: The history of organ transplantation in Mongolia dates back to 10 years. The number of patients with end stage liver disease increased in worldwide and Mongolia has high prevalence of hepatitis B virus, hepatitis C virus and hepatocellular carcinoma. The most effective treatment in end stage liver disease is liver transplantation (LT). It has a lot of difficulties including high financial cost, lifelong follow-up treatment and affordable choice of health insurance system in inception and setting up of LT project in developing country such as Mongolia. In Mongolia, LT project has been started from 2011 and continued successfully.

Methods: Totally 106 patients had transplanted liver from living donor, and one patient from deceased donor. Cooperation of LT project between Mongolian National University of Medical Science, Mongolian First Central Hospital and Asan Medical Center, nowadays project is going successfully.

Results: Twenty-eight of the 99 cases of LT have performed by mixed LT team, and seven other cases performed by Mongolian LT team. Thirty-four patients were received from living donor LT, and one was received from deceased donor. All of the patients who transplanted from living donor were survived and three patients died due to the laboratory deficits and, inadequate knowledge of patients. The complications which we faced were acute rejection, infection, biliary complication and sinusoidal obstructive syndrome.

Conclusions: Government support, affordable choice of health insurance system and demonstrating by experienced LT team were an important for evolving LT in low-income or developing country such as Mongolia.

Corresponding author: Undarmaa Zandanbazar
E-mail: undraa3459@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Prognosis of hepatic epithelioid hemangioendothelioma after living donor liver transplantation

Kibong Oh¹, Shin Hwang², Chul-Soo Ahn², Ki-Hun Kim², Deok-Bog Moon², Tae-Yong Ha², Gi-Won Song², Dong-Hwan Jung², Gil-Chun Park², Sung-Gyu Lee²

¹Department of Surgery, Anyang SAM Hospital, Anyang, Korea
²Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Epithelioid hemangioendothelioma (EHE) is a rare borderline vascular tumor. Due to its rarity and protean behavior, the optimal treatment of hepatic EHE has not yet been standardized. This single-center study describes outcomes in patients with hepatic EHE who underwent living donor liver transplantation (LDLT).

Methods: The medical records of patients who underwent LDLT for hepatic EHE from 2007 to 2016 were reviewed.

Results: During the 10-year period, four patients, one man and three women, of mean age 41.3±11.1 years, underwent LDLT for hepatic EHE. Based on imaging modalities, these patients were preoperatively diagnosed with EHE or hepatocellular carcinoma, with percutaneous liver biopsy confirming that all four had hepatic EHE. The tumors were multiple and scattered over the entire liver, precluding liver resection. Blood tumor markers were not elevated, except that CA19-9 was slightly elevated in one patient. Their mean model for end-stage liver disease score was 10.8±5.7. All patients underwent LDLT using modified right liver grafts, with a graft-recipient weight ratio of 1.11±0.19, and all recovered uneventfully after LDLT. One patient died due to tumor recurrence at 9 months, whereas the other three have done well without tumor recurrence, resulting in 5-year disease-free and overall patient survival rates of 75% each. The patient with tumor recurrence was classified as a high-risk patient based on the original and modified hepatic EHE-LT scoring systems.

Conclusions: LDLT can be an effective treatment for patients with unresectable hepatic EHEs that are confined within the liver and absence of macrovascular invasion.

Corresponding author: Shin Hwang
E-mail: shwang@amc.seoul.kr
Prognostic impact of perioperative sputum colonization on early outcome after lung transplant

Taehwa Kim¹, Hye Ju Yeo¹, Do Hyung Kim², Jin Ho Jang¹, Eunjeong Son¹, Jin ook Jang¹, Yun Seong Kim¹, Woo Hyun Cho¹

¹Division of Pulmonary, Department of Internal Medicine, Pusan National University Yangsan Hospital, Yangsan, Korea
²Department of Thoracic and Cardiovascular Surgery, Pusan National University Yangsan Hospital, Yangsan, Korea

Background: The case number of lung transplant is globally growing very fast. One of troublesome issue is acquired infection after lung transplant. The respiratory multi-drug resistant bacteria is a relative contra-indication for lung transplant. In the study, we aimed to assess the association between perioperative sputum colonization and clinical outcome after lung transplant.

Methods: The primary outcome was defined as the 1-year survival rate and secondary outcomes were early posttransplantation pneumonia (PTP), ventilator free day within 28 days, postoperation intensive care unit (ICU) stay and postoperative hospital of stay.

Results: A total of 76 patients underwent lung transplantation surgery from May 2013 to December 2019 in Pusan National University Yangsan Hospital. Of 76 patients, 52 patients were alive in 1-year survivor and 24 patients were not survivor. Clinical outcome had significant difference, especially early PTP and postoperative ICU stay (early PTP, P=0.009; postoperative ICU stay, P=0.001). The early posttransplant pneumonia was diagnosed 37. In the clinical outcomes according to early PTP, postoperative ICU stay, postoperative HOS and 1-year survival showed a large difference and had significant P-values (27.6±20.6 vs. 14.1±11.0, P=0.001; 76.0±50.9 vs. 50.9±31.7, P=0.011; 20 [54.1%] vs. 32 [82.1%], P=0.009). The 1-year survival rate was higher in without PTP group. The Kaplan-Meier survival curve showed patients with PTP had significantly higher 1-year mortality than without group (X²= 6.849, P=0.009).

Conclusions: Thirty-seven patients (48.7%) were developed PTP in our medical center after lung transplantation surgery. If perioperative sputum colonization of recipients was positive, PTP was more occurred well rather than donors. Sputum colonization of recipient was more important factor than donor’s. In the group with PTP, the proportion of multi-drug resistant was high than not PTP group. PTP was significantly associated with 1yr mortality. Therefore, this study suggests if perioperative sputum colonization of recipients is MDR, it need to concentration more than other microorganism.

Corresponding author: Woo Hyun Cho
E-mail: popeyes0212@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Tacrolimus-induced severe cerebral and coronary vasospasm

Laeun Kim, Hye Won Lee

Division of Cardiology, Department of Internal Medicine, Pusan National University Hospital, Busan, Korea

Background: Tacrolimus-induced reversible cerebral vasoconstriction syndrome (RCVS) and coronary vasospasm is a rare but not uncommon disease. We describe a patient who presented with tacrolimus induced RCVS and coronary vasospasm together after heart transplantation.

Methods: None.

Results: A 62-year-old female with dilated cardiomyopathy got heart transplantation. Two months later, she complained of a thunderclap headache. Brain computed tomography (CT) showed diffuse cerebral artery constriction with multifocal beaded features at distal intracranial arteries and scanty subarachnoid hemorrhage. We diagnosed it as RCVS induced by tacrolimus. She was at the early period of posttransplant with high risk of rejection, we inevitably maintained a lower level of tacrolimus. By using a vasodilator, the thunderclap headache was disappeared. Follow up brain CT showed absorption of hemorrhage and patent cerebral arteries. At 5 months after transplantation, she visited the emergency room with syncope. Shortly after admission, hemodynamic collapsed arrhythmia, and cardiac arrest occurred. We assumed this event as acute rejection and treated her with steroid pulse therapy. Biopsy proved acute rejection G2. She was still at high a risk of rejection, we had to maintain tacrolimus level as high as normal as possible. After the treatment, she complained of chest discomfort with sweating. Telemetry monitoring revealed transient ST-segment elevation when she had the symptoms. We assumed this event was associated with tacrolimus, so we reduced the tacrolimus level. Then, her cardiac symptom was relieved. By using a vasodilator, a coronary vasospasm provocation test was done and revealed severe spasms at the left anterior descending coronary artery. Twenty minutes after the examination, she rapidly collapsed complaining of chest pain. On-site cardiopulmonary resuscitation and extracorporeal membrane oxygenation (ECMO) insertion was made, but 2 days later she died of cardiogenic shock even with ECMO support.

Conclusions: In this case, early detection and withhold tacrolimus is an important strategy. When inevitably maintaining tacrolimus, one should be very cautious in monitoring drug levels and doing the provocation tests.

Corresponding author: Hye Won Lee
E-mail: lhw1400@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Modified rat limb transplantation model for VCA experiments: difficulties and know-how of vascularized bone marrow flap

Jong Won Hong¹, Jung Hyum Lim², Won Jai Lee¹

¹Department of Plastic and Reconstructive Surgery, Yonsei University College of Medicine, Seoul, Korea
²Institute for Human Tissue Restoration, Yonsei University College of Medicine, Seoul, Korea

Background: Diverse researches in vascularized composite tissue allotransplantation (VCA), represented by face/hand transplantation, is performed by a rat-based animal experiment. In the early, limb transplantation was mainly used, but in recently, a modified model is used for the proper purpose of research. We used vascularized femoral bone marrow flap for immune tolerance research. We would like to analyze and present the results of the high technique animal experiments area.

Methods: Donor used a 7-8-week-old Brown Norway rat (BN, RTn). Recipients were 7-8-week-old Lewis rats (LEW, RT1). Femoral bone was used as the target materials for the immune tolerance effect. Pedicle used femoral artery and vein. To confirm flap survival from the outside, a 2x2 cm inguinal skin flap based on a lateral circumflex vessel branching from the femoral vessel was included. Flap was classified as osteocutaneous flap. Immunosuppression, FK-506, was given daily IP. Blood samples were taken 3 days, and once a week after operation. We keep the rats for 8 weeks.

Results: Total 30 VCAs were performed. Animal experiments were performed by one surgeon (JWH). It took approximately 6 hours from initial preparation to cleaning. Vascular anastomosis was connected to one artery and one vein. Out of a total of 30 animals, five died immediately after surgery. Even if the operation was successful, 12 cases died within 2 weeks. There were many cases of death within 1-2 days after blood sampling when anesthesia was insufficient. Conversely, there were several cases of death when anesthesia was excessive. In addition, there were cases of death in lower body temperature or weight loss.

Conclusions: Vascularized bone marrow transplantation is a technically difficult and time-consuming operation. Body temperature, pain during surgery, and dietary management in postoperative period are absolutely necessary. Invasive procedures such as orbital blood sampling after surgery should also be performed delicately.

Corresponding author: Jong Won Hong
E-mail: hsaturn@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Rat model of heterotopic heart transplantation to investigate relevant donor heart harvesting method

Mukhammad Kayumov1, Hwa-Jin Cho2, Do-Wan Kim3, Kyo-Seon Lee3, In-Seok Jeong3

1Department of Thoracic and Cardiovascular Surgery, Chonnam National University Medical School, Gwangju, Korea
2Division of Cardiology, Department of Pediatrics, Chonnam National University Hospital, Gwangju, Korea
3Department of Thoracic and Cardiovascular Surgery, Chonnam National University Hospital, Gwangju, Korea

Background: Various preservation methods have been describing to elongate implantable time of the donor heart as well as to eliminate post-transplant graft failure. There have been increasing concern about hypothermic preservation technique that most of the researchers associate with increased mortality. Present study evaluates the efficacy of both hypothermic and sub-normothermic harvesting techniques on murine models.

Methods: The hearts were extracted from the donor rats (n-5/group) either after cardioplegic (CPS) infusion (HTK, 50 mL at 24°C–26°C) or topical ice slush application (0°C–4°C) without cardioplegic perfusion and heterotopically transplanted into the abdomen of the syngeneic recipients. The total donor heart ischemic time and heart beating initiation time were recorded intraoperatively. Graft function was examined by daily palpation and hearts were taken to histologic examinations after 2 weeks of survival.

Results: Nine of ten rats survived until 2 weeks without acute or chronic rejection. One rat excluded in the cardioplegia group which died in 10 days of survival after a sudden initiation of systemic inflammation. The mean ischemic time of the donor heart was 42.5 minutes in the cardioplegic group and 38 minutes in the hypothermic group. The heart generally started to beat within 5 second of reperfusion with normal rhythm in the cardioplegic group rats whereas 10 minutes of reperfusion was needed in the hypothermic group until graft reaches to the normal rhythm. All hypothermic group hearts experienced fibrillation and irregular rhythms within the 5 minutes of reperfusion and slight massage support was needed in all hypothermic rats to initiate contraction.

Conclusions: Subnormothermic CPS perfusion showed comparable results in early outcomes. We will compare the result between normothermic and hypothermic CPS perfusion methods with laboratory and histologic examinations in the next trials.

Corresponding author: In-Seok Jeong
E-mail: isjeong1201@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Protective effect of fucoidan against tacrolimus-induced nephrotoxicity in LLC-PK1 cells

Hyuk Jai Jang

Division of Transplantation, Department of Surgery, Gangneung Asan Hospital, Gangneung, Korea

Background: Tacrolimus (FK506) is an immunosuppressant agent that is frequently used to prevent rejection of solid organs upon transplant. However, nephrotoxicity due to apoptosis and inflammatory response mediated by FK506 limit its usefulness. Fucoidan (FUC) is an antioxidant and anti-inflammatory sulfated polysaccharide compound from brown seawood. In the present study, the protective effect of FUC against FK506-induced damage in LLC-PK1 pig kidney epithelial cells was investigated.

Methods: LLC-PK1 cells were exposed to FK506 with FUC and cell viability was measured. Western blotting and RT-PCR analyses evaluated protein or gene expression of HO-1, superoxide dismutase-2 (SOD-2), Bcl-2, Bax, caspase-3, inducible nitric oxide synthase (iNOS), and cyclooxygenase-2 (COX-2) expression were assessed. The number of apoptotic cells was measured using an annexin V/PI staining with flow cytometry.

Results: Reduction in cell viability by 50 mM FK506 was ameliorated significantly by cotreatment with FUC. COX-2, iNOS, Bax and cleaved caspase-3, increased markedly in LLC-PK1 cells treated with FK506 and significantly decreased after cotreatment with FUC. HO-1, SOD-2, and Bcl-2 significantly increased in LLC-PK1 cells treated with FK506 after cotreatment with FUC. Moreover, flow cytometry assay showed that apoptotic cell death was increased by FK506 treatment, whereas it was decreased after cotreatment with FUC.

Conclusions: These results collectively provide therapeutic evidence that FUC ameliorates the FK506-induced renal damage via antioxidant effect and inhibiting apoptosis and inflammation.

Corresponding author: Hyuk Jai Jang
E-mail: d990081@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Toll-like receptor 4 blockade protects kidneys against ischemia-reperfusion injury

Won-Hee Cho, Jung-Woo Seo, Seon Hwa Park, Yang Gyun Kim, Ju-Young Moon, Sang-Ho Lee

Department of Internal Medicine-Nephrology, Kyung Hee University Hospital at Gangdong, Korea

Background: Renal ischemia-reperfusion injury (IRI) is involved in the majority of clinical conditions manifested as deteriorated kidney function, however, specific treatment for this type of injury is still far from clinical use. Although animal studies have demonstrated that toll-like receptor 4 (TLR4) is a key mediator of IRI, few evaluation of pharmacological TLR4 inhibition in renal IRI has been carried out.

Methods: We subjected C57BL/6 mice to 23 minutes of renal pedicle clamping preceded by an intraperitoneal injection with vehicle or a TLR4 inhibitor, TLR-inhibitory peptide 1 (TIP1). Sham control mice underwent only a flank incision. The kidneys were harvested after 24 hours of reperfusion for histology, western blot analysis, RT-PCR, and flow cytometry.

Results: Pretreatment with TIP1 lowered the magnitude of elevated serum creatinine levels and attenuated tubular injury. In addition, TIP1 administration led to the reduced mRNA expression of inflammatory cytokines and decreased apoptotic cells as well as lower oxidative stress in postischemic kidneys. In the kidneys pretreated with TIP1, macrophage and T helper 17 cell infiltrations were less abundant compared with IRI only group.

Conclusions: Our data demonstrated that inhibition of TLR4 with TIP1 reduced tubular injury and the inflammatory and immune response in the mouse model of renal IRI.

Corresponding author: Sang-Ho Lee
E-mail: minime12@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Discard of organs is the Achilles heel of deceased donor organ transplantation program: a study of ethology and predictors of organ discard from South India

Banigallapati Vijay Kiran

Department of Nephrology, Nizam's Institute of Medical Sciences, Hyderabad, India

Background: With the significant growth of the deceased donor organ transplantation programs world-wide, the discard of organs also increased. Our objective was to assess the etiology and predictors of organ discard in Jeevandan—the deceased donor organ transplantation program from South India.

Methods: This was a retrospective chart analysis. Univariate and multivariate logistic regression analysis was used to predict the indicators of organ discard.

Results: The kidney discard rate and liver discard rate was 19.27% and 7.68%, respectively. The main reason for kidney discard was marginal donor kidney (61.23%) followed by chronic kidney disease in the donor (15.94%). For liver discard, the main reason was cirrhosis of the liver (34.54%) followed by non-alcoholic fatty liver disease (20%). The risk factors for kidney discards were higher age, male gender, intracerebral hemorrhage as a cause of brain death, long-standing diabetes, hypertension, and elevated terminal creatinine. Protective factors against kidney discard were higher serum proteins and higher sodium. Risk factors for liver discards were history of alcohol abuse, higher bilirubin, higher alanine aminotransferase, and acute kidney injury. Higher platelet count is a novel protective factor identified.

Conclusions: We assessed the etiology for discard of kidneys and livers in a deceased donor organ transplant program. The factors that predict the discard and protective factors against discard were identified.

Corresponding author: Banigallapati Vijay Kiran
E-mail: bharadwaj16@yahoo.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Safety and efficacy of enhanced recovery after surgery (ERAS) program after donor hepatectomy: a propensity-matched analysis

Sung Eun Park, Ho Joong Choi

Division of Hepatobiliary, Department of Surgery, The Catholic University of Korea, Seoul St. Mary’s Hospital, Seoul, Korea

Background: Enhanced recovery after surgery (ERAS) programs have been shown to have benefits for various surgery, and recently, several studies have reported the advantages of the ERAS program in liver surgery. These achievements could be expected to improve the safety of donor hepatectomy, where the safety of donor is the most important, but studies are still lacking. The aim of this study was to assess the outcomes and benefits after implementation of an ERAS program on donor hepatectomy in living donor liver transplantation.

Methods: We analyzed perioperative outcomes on consecutive patients between January 2016 and October 2020 who underwent donor hepatectomy. Patients were divided into ERAS group and conventional surgery (CS) group. Propensity score matching (PSM) was used to define the independent effect of ERAS program on donor hepatectomy and 42 patients of ERAS group and 42 patients of CS group were enrolled.

Results: There were no significant differences in demographics characteristics between the two groups. The ERAS group was significantly lower in the rate of postoperative morbidity (11.9% vs. 31%, P=0.033) and 90-day readmission (2.4% vs. 14.3%, P=0.048). The postoperative hospital days and the length of intensive care unit stay were significantly shorter for the ERAS group (10.2 vs. 11.4 days, P=0.039). Duration till first flatus and postoperative nausea and vomiting were significantly reduced in ERAS group. Pain control was better in ERAS (visual analogue scale: postoperative day 1, 1 3.5 vs. 2.7, P<0.001).

Conclusions: This study evaluated the impact of ERAS program approach on donor hepatectomy in living donor liver transplantation. ERAS programs applied to patients undergoing donor hepatectomy can safely and effectively reduce the incidence of complications, improve postoperative pain and bowel movement, accelerate patient recovery.

Corresponding author: Ho Joong Choi
E-mail: carin337@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Usefulness of preoperative magnetic resonance spectroscopy in improving the safety of a living liver donor

Jae Ryong Shim, Hyo Jung Ko, Tae Beom Lee, Byung Hyun Choi, Kwangho Yang, Je Ho Ryu

Department of Surgery, Pusan National University Yangsan Hospital, Yangsan, Korea

**Background:** The steatosis of graft liver is an important factor in liver transplantation that determines the graft function in the recipient and the recovery of the remnant liver in the living donor. We analyzed the data of living donor from our center to evaluate whether magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS) can replace liver biopsy.

**Methods:** From May 2010 to May 2019, total 239 living donor data was collected. Eighty-four patients who had no MRI or MRS data were excluded. The result of preoperative liver biopsy was compared to preoperative MRI and MRS data. The steatosis was defined by the degree of macrosteatosis.

**Results:** The MRI fat fraction was a good parameter in predicting fatty changes between normal and fatty liver groups (3.09%±3.38%, 7.48%±4.07%; P<0.001). The MRS was also a good parameter for predicting fatty changes between normal and fatty liver groups (2.09%±1.43%, 6.89%±2.68%; P<0.001). Linear regression showed that pathological results were significantly correlated with MRS (P<0.001, R^2=0.604), but not with MRI (P<0.001, R^2=0.227).

**Conclusions:** MRS has several benefits for quantifying hepatic steatosis during a living donor liver transplantation evaluation, including no radiation exposure, and a noninvasive procedure. Moreover, preoperative MRS can determine an anatomical variation of the bile duct, which helps improve the safety of the living donor. However, more clinical data and further studies are needed to ensure that preoperative MRI is essential.

**Corresponding author:** Jae Ryong Shim
E-mail: zombiepr@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Single-institution analysis of willingness of waitlist patients to undergo kidney transplantation with expanded criteria brain-dead donors

Jung Ja Hong¹, Sae Rom Lee¹, Ah Young Lee¹, Ji Won Woo¹, Seon Bin Park¹, Shin Hwang², Young Hoon Kim³

¹Organ Transplantation Center, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea
²Department of Liver Transplantation and Hepatobiliary Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea
³Department of Kidney and Pancreas Transplantation Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: The waitlist period for kidney transplantation (KT) has been increasing due to intractable shortage of brain-dead donors in Korea. To solve this organ shortage issue, KT cases with expanded criteria brain-dead donor (ECD) organs have been increasing. This study intended to analyze the willingness of waitlist patients to undergo KT with ECD in a single institution in order to use as the basic data for selecting and managing patients waiting for deceased donor KT (DDKT).

Methods: We carried out a survey with 1,069 patients who were enrolled at the waitlist for DDKT from 2015 to 2019 at a single institution. They were asked whether they were willing to undergo KT with ECD of type 1 and 2. The answers were analyzed through descriptive statistics. ECD type 1: age over 60 years, but serum creatinine is normal (<1.5 mg/dL) without hypertension or diabetes and type 2: serum creatinine is higher than 3.0 mg/dL due to acute kidney injury, under continuous renal replacement therapy to improve acute renal failure, or serum creatinine is normal (<1.5 mg/dL) but over 60 years of age with hypertension or diabetes.

Results: Of them, 390 patients (36.0%) refused ECD type 1. In contrast, other 345 patients (32.0%) answered to undergo KT with deceased donors over 60 years, but they did not want KT with donors over 70 years; 231 (22.0%) patients did not have a limit in the donor age; and 103 (10%) patients hesitated or avoided answers. As a result, 576 (52.6%) of 1,096 patients were willing to undergo KT with ECD type 1. The proportions of such affirmative-answer group according to the patient age were 196 (34.1%) in their 50s, 171 (29.7%) in their 60s, 115 (19.9%) in their 40s, 57 (9.9%) in their 30s, 21 (3.7%) in their 70s, 14 (2.4%) in their 20s and three (0.30%) in their teens. Meanwhile, 538 patients (50.3%) refused ECD type 2. Other 345 patients (32.0%) answered to undergo KT with deceased donors over 60 years, but they did not want KT with donors over 70 years; 231 (22.0%) patients did not have a limit in the donor age; and 103 (10%) patients hesitated or avoided answers. As a result, 576 (52.6%) of 1,096 patients were willing to undergo KT with ECD type 2, the waitlist periods were ≥1 year in 135 patients, ≥2 years in 110, ≥3 years in 83, ≥4 years in 58, and ≥5 years in 33. Their distributions by age were 148 patients over 50s, 116 patients over 60s and 70s, 93 patients over 40s, 52 patients over 30s, and 10 patients over 20s. Among the 576 patients who expressed their willingness to undergo KT with ECD type 1, 322 (55.9%) answered to undergo any type of ECD DDKT.

Conclusions: We believe that the results of this study are helpful to select and manage the DDKT candidates quickly and efficiently when occurrence of ECD is notified. It is necessary to establish practical protocols and to improve awareness toward KT with ECD.

Corresponding author: Jung Ja Hong
E-mail: hj25009@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
A narrative study on the life of organ procurement coordinator

Ha Young Song¹, Han Ik Cho², Wonhyun Cho¹, Chunhee Bok¹

¹Department of Yeongnam Management, Korea Organ Donation Agency, Seoul, Korea
²Department of Education, Gyeongsang National University, Jinju, Korea

Background: Organ procurement coordinators (OPC) are the first person to approach the family when a potential brain death patient is referred and play a key role in attracting the donation of organs and the family's consent. Thus, it is necessary to listen to their real stories and to understand their experience.

Methods: This study used a narrative inquiry method developed by Clandinin and Connelly (2000) as a method to inquire the lives of OPC and to understand the meaning of such an experience. Three coordinators who have been worked at Korea Organ Donation Agency as a coordinator for more than 3 years and are working in Youngnam region. Data collection was done for 3 months from May 2019 to August 2019.

Results: The meaning of their relationship with organ families were that in their first encounter with donor family, they are trying their best to sympathize with their pain, to support them emotionally, and to relieve their pain. However, there was a conflict over what seemed to be trying to persuade organ donation by coordinator and a negative perception about organ donation. About relationship with the hospital include the confusion about working place where they have to move to a different hospital every day and the conflict with the hospital staff.

Conclusions: This study was conducted to understand the experience of OPC through narrative inquiry. We tried to understand the work of OPC by approaching the whole course of their life comprehensively, not as a part of task and to understand the vivid experience of the OPC. The result of this study can be used as a basic data for the direction and design of future studies.

Corresponding author: Ha Young Song
E-mail: sgloomy@naver.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Withdraw life sustaining treatment and organ donation

Seungyre Jeong, Younghwan Hwang, Minyoung Chu, Ohhyuk Yun, Youngsoon Jeong, Jeongrim Lee, Won-Hyun Cho

1Department of Coordinator, Korea Organ Donation Agency, Seoul, Korea
2Korea Organ Donation Agency, Seoul, Korea

Background: According to the statistics of the National Agency for Management of Life-Sustaining Treatment, 85,000 end of life care patients have been withdrawn life sustaining treatment over two years since the implementation of law in February 2018. However, according to annual report of Korea Organ Donation Agency (KODA), there were a considerable number of patients who requested to withdraw life sustaining treatment among the referred potential brain death to the call center of KODA. Their family consent rate was lower than the group that didn’t mentioned about interrupting the end of life care.

Methods: The study was designed using the referred cases of potential brain death to KODA during 2018 and 2019. Demographic findings of requesting withdrawn life sustaining treatment among the referred cases and their result of donation progress in each step were evaluated.

Results: Within the research period, there were a total of 4,910 cases (2,426 in 2018, 2,484 in 2019) of brain death, and among them, 569 (193 in 2018 and 376 in 2019) cases requested to withdraw life sustaining treatment. This means a 94.8% increase in requesting family compared to the previous year. In terms of gender, 63% of the cases were male, and the most common age group was the fifties (23.4%). Among 569 requested donors, 475 (83.5%) were appropriate for organ donation, out of which, 394 (82.9%) families were interviewed about organ donation, and accepted organ donation in 45 cases (9.5%). Only 29 cases (6.1%) were succeeded in organ procurement.

Conclusions: It is estimated that there will be more families who wish to withdraw life sustaining treatment among potential brain death referred to KODA for organ donation in the future. Therefore, in order to activate organ donations, we need a system revision about end of life care process, first to the donor coordinator and then explain all the options by that coordinator.

Corresponding author: Seungyre Jeong
E-mail: sr.jung@koda1458.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Causes of lowered family consent rate for organ donation

Eunsuk Yu¹, Yukyoung Son², Kyeonghee Han¹, Myoungwha Lee¹, Yuri Chong¹, Youngsoon Jeong¹, Jeongrim Lee¹, Wonhyun Cho²

¹Donation Information Division, Korea Organ Donation Agency, Seoul, Korea
²Korea Organ Donation Agency, Seoul, Korea

Background: The number of deceased donors that have increased annually until 2016 has started to decline in the last three years. This study therefore intends to analyze the trend of potential brain death reported to Korea Organ Donation Agency (KODA) and use the analysis results as a basic data for the activation of organ donation.

Methods: A comparative analysis was performed for the first period (P1: 2014 to 2016) where the number of donations continued to increase and the second period (P2: 2017 to 2019) that showed decline in donations compared to 2016.

Results: The cases of potential brain death reported to KODA was 5,548 in P1 and 7,126 in P2, a 28.4% increase from the previous period. Among these, the cases of medically suitable for organ donation increased by 36.5%, from 4,053 in P1 to 5,534 in P2. Decreased the consent rate from 52.9% in P1 to 37.2% in P2. The discontinuation of donation process even after family consent increased by 17.6% (from 74 cases in P1 to 87 cases in P2), mostly due to legal issues and death before the judgment of brain death.

Conclusions: The decrease in families’ consent for organ donation turned out to be the biggest cause of declining donation. The major reasons for refusal to donation such as can be attributed to the lack of understanding of the medical state of brain death, a negative image of sharing and donation that is pervasive in Korean society, and the distrust between community members. Therefore, there is a need for education and promotion at a national level to enhance the awareness of the value of life and to encourage the public to practice the value of sharing.

Corresponding author: Eunsuk Yu
E-mail: es.ryw@koda1458.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Cellular immune monitoring for prediction of cytomegalovirus and BK viral reactivation after kidney transplantation

Kyung-Hwa Shin¹, Jin Hyeon Lee¹, Sang Heon Song², Eun Young Seong², Miyeun Han², Hyung-Hoi Kim¹

¹Department of Laboratory Medicine, Pusan National University Hospital, Busan, Korea
²Division of Nephrology, Department of Internal Medicine, Pusan National University Hospital, Busan, Korea

**Background:** The reactivation of cytomegalovirus (CMV) and BK virus after kidney transplantation is a critical factor that affects donor and graft survival. However, accurate methods for viral reactivation prediction and overall immune status assessment after transplantation remain unavailable. This study aimed to evaluate cellular immunity assays based on the potential for predicting CMV and BK viral reactivation in kidney transplant patients.

**Methods:** Fourteen male and twelve female patients who underwent kidney transplant were enrolled in the study between November 2019 and June 2020 (median age: 58 years [range, 38–68 years]). Whole blood samples were collected before transplantation. QuantiFERON-CMV (Qiagen, Germantown, MD, USA), QuantiFERON-Monitor assay (Qiagen), and lymphocyte subsets (CD3, CD4, CD8, CD19, CD56) were used to quantify the cellular immune response.

**Results:** There were no differences between the lymphocyte subsets from patients with and without CMV viremia. However, the levels of T lymphocytes in patients without BK viremia (median CD3+ 71.2%) was higher than those in patients with BK viremia (median CD3+ 62.5%). The interferon gamma (IFN-γ) levels (measured using the QuantiFERON-Monitor) in patients with CMV viremia (median, 160.9 IU/mL) and in those without CMV viremia (median, 324 IU/mL) did not differ. Also, the IFN-γ levels in patients with BK viremia (median, 256.5 IU/mL) and in those without BK viremia (median, 231.3 IU/mL) did not differ. The patients with CMV viremia (n=8) exhibited reactivity in the QuantiFERON-CMV assay. The patients with non-reactive QuantiFERON-CMV profile (n=7) results did not show viremia.

**Conclusions:** Immune monitoring and the prediction of reactivation risk after kidney transplantation are critical factors in kidney transplant. The combination of these methods is useful for predicting CMV and BK viral reactivation after solid organ transplantation.

**Corresponding author:** Kyung-Hwa Shin
**E-mail:** skh2009pnuh@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Development and validation of an algorithm to estimate eplet mismatch by substituting imputation of HLA antigens for high-resolution HLA typing based on Korean HLA frequencies

Soo-Kyung Kim1, Borae G. Park2, Hyung Eun Son3, Jong Cheol Jeong3, Yun Ji Hong4, Dong Wan Chae5

1Department of Laboratory Medicine, Ewha Womans University Mokdong Hospital, Seoul, Korea
2Department of Laboratory Medicine, Korea University Guro Hospital, Seoul, Korea
3Department of Internal Medicine, Seoul National University Bundang Hospital, Seongnam, Korea
4Department of Laboratory Medicine, Seoul National University Bundang Hospital, Seongnam, Korea
5Department of Internal Medicine, Seoul National University Hospital, Seoul, Korea

Background: Assessment of eplet mismatches in transplantation requires high-resolution (HR) molecular human leukocyte antigen (HLA) typing. However, HR typing is rarely applied to solid organ transplantation. We developed an algorithm to derive an HR genotype from a low-resolution (LR) one and evaluated its performance in a Korean population.

Methods: Our multistep imputation process is based on an HLA haplotype and allelic frequency dataset for the Korean population. To evaluate the performance of the algorithm, the HR typing results of 127 Korean patients who underwent sequence-based typing (SBT) were converted to LR HLA-A, -B, and DR genotypes. HR genotypes were then derived from the LR genotypes using the algorithm. We compared the HR genotypes derived using the algorithm with those determined by SBT.

Results: A total of 94.4% (120/127) of the LR genotypes could be converted into HR genotypes using the algorithm. Also, 59 (46.5%) could be assigned an HR genotype based on haplotype frequencies for the Korean population. There were 28 errors (23.7%) in A, 12 (10.2%) in B, and 23 (19.5%) in DR. Additionally, for the 61 HR genotypes (48.0%) assigned using our algorithm, and there were 11 errors (9.0%) in A, 10 (8.2%) in B, and 28 (23.0%) in DR. Overall, the HR genotype was inaccurate for 16.3% (39/240) of HLA-A, 9.2% (22/240) of HLA-B, and 21.3% (51/240) of HLA-DR. In particular, A2 (n=30) and A26 (n=6) of HLA-A, B62 (n=8) and B61 (n=7) of HLA-B, and DR4 (n=23), DR14 (n=8), and DR15 (n=6) of HLA-DR showed high error rates. According to the differences in HR genotypes, the eplet differences were up to four in A, three in B, and seven in DR.

Conclusions: The error rate of our algorithm was lower than that previously applied to non-Caucasian populations. However, it should be used cautiously because it can yield erroneous results.

Corresponding author: Borae G. Park
E-mail: boraepark@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Outcome of ABO-incompatible kidney transplantation depending on the ABO type of transfused plasma: comparative analysis between the universal AB plasma and donor type plasma

Han Joo Kim¹, Jin Seok Kim¹, John Jeongseok Yang¹, Yousun Chung², Hyungsuk Kim³, Sung Shin⁴, Young Hoon Kim⁴, Sang-Hyun Hwang¹, Heung-Bum Oh¹, Dae-Hyun Ko¹

¹Department of Laboratory Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea
²Department of Laboratory Medicine, Kangdong Sacred Heart Hospital, Seoul, Korea
³Department of Laboratory Medicine, Seoul National University Hospital, Seoul, Korea
⁴Division of Transplantation, Department of Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Since the remarkable development of various desensitization methods and immunosuppressive agents, the outcome of ABO-incompatible solid organ transplantation has greatly improved. However, there is no evidence-based consensus about how to determine the blood type of blood products for transfusion to recipients of ABO-incompatible solid organ transplantation, and each institution has its own principles.

Methods: We retrospectively analyzed the data of 60 ABO-incompatible kidney transplantation recipients between August 2009 and June 2013. All recipients had blood type O, and their donors’ blood type was A or B. Patients’ demographics and clinical status were compared between the two recipient groups; one group received AB plasma despite the donor’s blood type (n=30), and the other group received plasma that matched the donor’s blood type (n=30).

Results: The demographics of the two groups did not show statistically significant differences. Both rejection-free survival and rejection rate graphs seemed favorable in the group that received donor type plasma, but no statistically significant difference was observed. Other parameters did not show significant differences.

Conclusions: We suggest a strategy for transfusion in ABO-incompatible solid organ transplantation. This strategy can improve transfusion safety and the efficient use of blood products.

Corresponding author: Dae-Hyun Ko
E-mail: daehyun1118@amc.seoul.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
How we achieved 0% of thrombotic graft loss: the initial 60 cases of pancreas transplant

Byung Hyun Choi

Department of Surgery, Pusan National University Yangsan Hospital, Yangsan, Korea

Background: One of the major surgical complications after pancreas transplant is early graft failure due to thrombosis. Unfortunately, the early graft loss rate has not improved over the last 30 years. Even in recent reports, the technical failure rate due to thrombosis was 5%–10%. The low flow portal venous system must have the tendency of thrombosis, thus the graft pancreas in inherently thrombogenic. Therefore, wider and shorter anastomosis of the portal vein is better for maintaining blood flow. The size of the opening is more important than the length according to the equation above.

Methods: We performed 60 cases of pancreas transplant (11 simultaneous pancreas-kidney, or simultaneous pancreas living-donor kidney, 14 pancreas after kidney, 34 pancreas transplant alone, and one pancreas after liver transplant) in Pusan National University Yangsan Hospital, Korea, since 2015. There is no thrombotic graft loss in our cases.

Results: Most of our cases were performed with venous drainage to vena cava and duodenal exocrine drainage. The venous anastomotic technique was evolved from the direct anastomosis (n=8). Then we did a diamond-shaped patch anastomosis (n=13). After that, the fence angioplasty with using vena cava graft was applied to 31 cases. And finally, we have been performing the venous anastomosis with aortic interpositional graft (n=8). The conventional or low molecular heparin was used for the prevention of thrombosis in the first 40 cases of transplant. However, we do not use any heparin anymore neither in the intraoperative nor postoperative periods. There was some partial thrombosis in graft splenic vein or superior mesenteric vein on computed tomography scans. However, these partial thromboses did have any effect on graft loss.

Conclusions: In conclusion, we need to understand the mechanism of thrombus in graft pancreas and should do the best effort to make the wide venous anastomosis and maintain the venous flow. We would like to share our know-how with members of transplant society.

Corresponding author: Byung Hyun Choi
E-mail: gmoolpop@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Serial postoperative donor-derived cell-free DNA in recipients undergoing pancreas transplantation

Hyun-Ji Lee¹, Byung Hyun Choi², Kyoung-Hwa Shin³, In-Suk Kim¹, Hyoung-Hoi Kim³

¹Department of Laboratory Medicine, Pusan National University Yangsan Hospital, Yangsan, Korea
²Department of Surgery, Pusan National University Yangsan Hospital, Yangsan, Korea
³Department of Laboratory Medicine, Pusan National University Hospital, Busan, Korea

Background: Early detection of rejection after organ transplantation is important as it can prevent deterioration of the transplanted organ. With the development of molecular genetic technology, a digital PCR method that can detect with a small amount of DNA has been developed. In this study, donor derived cell-free DNA (ddcfDNA) was measured in pancreatic transplant patients to investigate the correlation with prognosis after organ transplantation.

Methods: We tested DNA of patients from December 2016 to August 2018, comprising seven donors and seven recipients of pancreas transplantation. Single nucleotide polymorphism (SNP) markers were selected to differentiate donor DNA from recipient DNA. Plasma cell-free DNA (cfDNA) is extracted from whole blood and subjected to the parallel quantification of recipient and ddcfDNA, by the use of digital PCR for SNPs different between those two genomes. The donor DNA percentage was calculated as the corrected donor DNA counts divided by the total positive DNA counts, multiplied by 100. Repeated ddcfDNA determinations were scheduled to be performed in the study on postoperative day (POD) 1, 4, 7, 10, and 14 days after transplantation.

Results: All seven patients were insulin-dependent diabetes mellitus, two males and five females. The age of the recipient was median 34 years (range, 26–58 years). The preoperative body mass index was median 23.15 kg/m² (range, 15.94–25.61 kg/m²). The preoperative HbA1c was median 8.2 (range, 5.5–12.10). The ddcfDNA (%) measured serially is median 0.54 (range, 0.24–66.53) for POD 1, median 3.8 (range, 1.72–50) for POD 4, median 1.69 (range, 0–52.94) for POD 7, median 1.22 (range, 0.16–53.84) for POD 10, and median 2.75 (range, 0.38–71.42) for POD 14. During the same period, the values of amylase are median 55 (range, 22–71) for POD1, median 52 (range, 27–77) for POD 4, median 85 (range, 61–139) for POD 7, median 82 (range, 60–147) for POD 10, and median 80 (range, 66–145) for POD 14.

Conclusions: In this study, ddcfDNA was measured for 2 weeks after transplantation in pancreatic transplant recipients.

Corresponding author: Hyun-Ji Lee
E-mail: hilhj1120@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Pancreas transplant in a young patient: an option

Muhammad Zakria

Department of Surgery Hepatobiliary, Liver Transplant, Wapda Medical Complex Lahore, Masood Hospital, Lahore, Pakistan

Background: Pancreas transplant is mainly offered to treat the insulin-dependent diabetes mellitus. In some cases, if there is loss of parenchyma due to trauma or chronic pancreatitis, total pancreatectomy is advised to save the life and for better quality of life. Chronic pancreatitis is an inflammatory condition pancreas transplant is important after pancreatectomy. This is required to overcome the exocrine and endocrine deficiency. We have a patient who falls in this category and she requires pancreas transplant. We have to find the solution for the chronic pancreatitis which requires total pancreatectomy followed by the pancreas transplant.

Methods: A 24-year-old female had severe complaints of pain abdomen. Initially she was managed as acute pancreatitis. Due to repeated attacks of pancreatitis, she went into the stage of chronic pancreatitis. Her radiological investigations were showing as if there was loss of parenchyma of pancreas and dilated pancreatic duct. She underwent pancreaticojejunostomy but even after that she could not find the relief. She still has recurrent attacks of pain, indigestion, vomiting, diarrhea, high blood sugar levels and weakness. Pain radiating to back is more challenging. Coeliac axis block is an option for pain but to control other issues by enzymatic preparations and insulin have failed. Probably we have to think about the transplant of pancreas in such patients.

Results: In patients of chronic pancreatitis, if pain persists despite all the maneuvers and quality of life is badly damaged than we have to remove the pancreas followed by the pancreas transplant.

Conclusions: Pancreas transplant is very important in patients of chronic pancreatitis to improve the quality of life. This is not the first option in these patients but if all the other methods for relieving have failed then we accept it as the last choice.

Corresponding author: Muhammad Zakria
E-mail: zakriastar@yahoo.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
High success rate of liver and kidney transplant during seven months COVID-19 period

Emre Karakaya¹, Aydincan Akdur¹, Ebru Ayvazoglu Soy¹, Feza Yarbug Karakayali¹, Sedat Yildirim¹, Adnan Torgay², Cihat Burak Sayin³, Gokhan Moray¹, Mehmet Haberal¹

¹Department of General Surgery, Baskent University Hospital, Turkey
²Department of Anaesthesia and Reanimation, Baskent University Hospital, Turkey
³Department of Nephrology, Baskent University Hospital, Turkey

Background: During the pandemic, so many centers have postponed transplant surgery. In the present study, we aimed to evaluate our liver and kidney transplant during the pandemic period.

Methods: During 7 months in the pandemic period, we performed 49 kidneys and 14 liver transplant. Before the transplant procedure, all candidates were screened for coronavirus 2019 (COVID-19). Also, we recorded transplantation age, sex, graft type, post-transplant laboratory values complications, and length of stay.

Results: In this period we performed 49 kidney and 14 liver transplants. In the kidney group, five recipients were a child. Thirty-two patients (65%) were male. Adult kidney recipients’ mean age was 39.5 years and children were 4, 6, 14, 15, and 16 years. Recipients were treated in transplant service after surgery. All patients were discharged with normal laboratory values. In the liver transplant group, ten patients were a child and four patients were adults. All liver transplants were living donor liver transplants. The mean age of child patients was 24.2 months. One liver recipient died due to oxalosis induced heart failure and one liver recipient died due to intracranial bleeding. Other patients were discharged with normal liver functions. Both kidney and liver donors were discharged without any problem.

Conclusions: Our results showed that transplant surgery can be performed during a pandemic safely with the exclusion of COVID.

Corresponding author: Emre Karakaya
E-mail: rectorate@baskent.edu.tr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Correlation of brain-dead organ donors’ age and time period between admission and the first brain death examination: 5 years data of Korea

Eun-sil Jeong1, A. S. M. Tanim Anwar2, Jae-myeong Lee1

1Transplantation Center, Korea University Anam Hospital, Seoul, Korea
2Department of Nephrology, Dhaka Medical College Hospital, Dhaka, Bangladesh

Background: Deceased organ donation can be performed only with the consent of the donor or their family members. We tried to identify whether donor age is related to decision making for the families to give consent for organ donation.

Methods: In this study, we reviewed data of 2,451 brain-dead organ donors (male, 1,645; female, 806; mean age, 46.5±16.2 years) from Korean Network for Organ Sharing (KONOS) registry pertaining to the period between December 2012 and December 2017. We assessed the time period between the admission of the patient and the first brain death assessment.

Results: We found that the mean duration from the admission to the first brain death examination was significantly longer in the age group of 0–30 years (16.2±6.01 days), compared to age group 31–83 years (6.7±1.07 days; P=0.001). There was a strong negative correlation (r=0.795, P=0.010) between age and the mean duration from the admission to the first brain death examination.

Conclusions: As the family members of the younger brain-dead donors needed more time to consent for organ donation compared to those of older donors, the first brain death examination and donation process delayed in case of young donors.

Corresponding author: Jae-myeong Lee
E-mail: ljm3225@hanmail.net

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Nine years experiences of solid organ xenotransplantation

Hye Sun Shin¹, Ik Jin Yun¹, Hyun Keun Chee², Jun Seok Kim², Jung Hwan Park³, Hyun Suk Yang⁴, Wan Seop Kim⁵, Ki Cheul Shin⁶, Kyoung Sik Park¹, Keon Bong Oh⁷

¹Department of Surgery, Konkuk University Medical Center, Seoul, Korea
²Department of Thoracic and Cardiovascular Surgery, Konkuk University Medical Center, Seoul, Korea
³Division of Nephrology, Department of Internal Medicine, Konkuk University Medical Center, Seoul, Korea
⁴Division of Cardiology, Department of Internal Medicine, Konkuk University Medical Center, Seoul, Korea
⁵Department of Pathology, Konkuk University Medical Center, Seoul, Korea
⁶Department of Ophthalmology, Konkuk University Medical Center, Seoul, Korea
⁷Animal Biotechnology Division, National Institute of Animal Science, Wanju, Korea

Background: There are far more patients awaiting transplantation than there are organ donors, the problem of organ scarcity has become more profound. One promising alternative could be xenograft using pig organ. There are very few teams in Korea that actively work on xenotransplantation studies, although our team has been conducting xenotransplantation research since 2011.

Methods: Since 2011, with state research funding, our team has been performing solid organ transplantation and partial corneal transplantation preclinical studies using transgenic pigs and non-human primates (NHP). From 2011 to 2020, 24 cases of heart transplantations, 13 cases of kidney transplantations and 10 cases of corneal transplantations were conducted. The transgenic pigs (GTKO) have been used to prevent hyperacute rejection. And we are using genetically engineered pigs with different genetic backgrounds such as CD46, CD73, CD39, and CD55. Immunosuppressive therapy is based on anti-CD154 and appropriately mixed with anti-thymocyte globulin, rituximab, tacrolimus, mycophenolate mofetil rapamycin, and steroid. In the case of corneal transplantation, minimal immunosuppression was applied for partial lamellar corneal transplantation.

Results: Long-term survival records are 60 days for the heart and 84 days for the kidney. The partial lamellar corneal transplantation has the longest record for survival which is more than 3 years that is currently continuing without rejection. And the average survival record for the heart is 17 days, 19.5 days for the kidney and 260 days for the cornea. Since GTKO pigs were used, no hyper-acute rejection has been observed.

Conclusions: Overall, our achievements and experience will be able to help solve the problem of organ shortage. Although the findings are not yet adequate for clinical trials and are relatively poor, further research practices and studies are thought to be achieve better outcomes. Donor genetic backgrounds and combination of immune suppressants increased the graft survival and partial lamellar corneal transplantation could be able to achieve better results.

Corresponding author: Ik Jin Yun
E-mail: ijyun@kuh.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Enhanced HLA typing performance of Korea Biobank Array with large scale reference panel

Sung Min Kim¹, Jong Cheol Jeong², Dong Jin Joo³, Jaeseok Yang⁴, Myoung Soo Kim³, Hye-Mi Jang¹, Hyun-Young Park⁵, Bong-Jo Kim¹, Young Jin Kim¹

¹Division of Genome Science, National Institute of Health, Cheongju, Korea
²Department of Internal Medicine, Seoul National University Bundang Hospital, Seongnam, Korea
³Department of Surgery, Yonsei University College of Medicine, Seoul, Korea
⁴Department of Surgery, Seoul National University Hospital, Seoul, Korea
⁵Department of Precision Medicine, National Institute of Health, Osong, Korea

Background: In clinical transplantation, increased human leucocyte antigen (HLA) mismatch between donor and recipient were well-known risk factor for graft survival. However, HLA typing in a large scale genome study is not feasible due to high cost. Alternatively, HLA alleles can be statistically inferred via HLA imputation from single nucleotide polymorphism (SNP) microarray data. Previously, Korea National Institute of Health (KNIH) designed Korea Biobank Array (KBA), a fully customized SNP microarray for Koreans with 10K HLA regional SNPs as optimal set for imputing HLA alleles.

Methods: We assessed HLA typing accuracy of KBA comparing HLA imputed alleles from KBA and HLA typing via high-throughput sequencing. Among Korean Organ Transplantation Registry participants, 254 samples were genotyped using KBA and also HLA typed by HLAaccuTest kit (NGeneBio). For HLA imputation, IMPUTE v4 was used with reference panels of Pan-Asian & Korean (PanREF, n=854) or Han Chinese MHC (HanREF, n=10,689). Accuracy was assessed by comparing four-digit HLA alleles of the imputed and the NGS based typing among HLA-A, HLA-B, HLA-C, HLA-DRB1, HLA-DPA1, HPA-DPB1, HLA-DQA1, and HLA-DQB1 loci.

Results: Imputed HLA alleles were compared its true HLA alleles from NGS typing. For four-digit HLA alleles, accuracy was 88.9% and 93.6% for PanREF and HanREF, respectively. While accuracy for HLA-DPA1 and HLA-DPB1 was comparable (95%–96%), HLA-C and HLA-DQA1 showed large difference in accuracy (51.7%–91.5% for PanREF, 82.2%–99.1% for HanREF). However, both panels showed comparable accuracy (about 95%) for HLA-A, HLA-B, and HLA-DRB1, which are the most important three loci for transplantation. Overall, imputed HLA alleles from KBA using HanREF showed enhanced accuracy over PanREF.

Conclusions: Taken together, accuracy for HLA typing of KBA was increased using large reference panel (HanREF). The result showed that KBA is an efficient platform to comprehensively obtain four-digit level imputed HLA alleles with accuracy of about 94%.

Corresponding author: Young Jin Kim
E-mail: anwtlarkr@gmail.com

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
First experience of $\alpha_{1,3}$-galactosyltransferase gene-knockout (GTKO) transgenic pig to nonhuman primate lamellar corneal xenotransplantation

Ik Jin Yun$^1$, Ki Cheul Shin$^2$, Hye Sun Shin$^1$, Wan Seop Kim$^3$, Madhuri Saindane$^1$, Keon Bong Oh$^4$, Hee Jung Kang$^5$, Yu Rim Ahn$^1$

$^1$Department of Surgery, Konkuk University Medical Center, Seoul, Korea
$^2$Department of Ophthalmology, Konkuk University Medical Center, Seoul, Korea
$^3$Department of Pathology, Konkuk University Medical Center, Seoul, Korea
$^4$Division of Animal Biotechnology, National Institute of Animal Science, Wanju, Korea
$^5$Department of Laboratory Medicine, Hallym University College of Medicine, Chuncheon, Korea

**Background:** Corneal allotransplantation is a well-known technique to treat corneal blindness. However, the problem of organ scarcity in transplantology has become profound. One promising alternative could be xenograft using pig as an organ donor. Full thickness corneal xenotransplantation needs total immunosuppression. This study is an investigation of the efficacy of $\alpha_{1,3}$-galactosyltransferase gene-knockout (GTKO) transgenic pig-to-nonhuman primate lamellar corneal transplantation with minimal immunosuppression.

**Methods:** We conducted 10 lamellae corneal xenotransplantation between 2016 and 2019. Clinically acceptable graft size (diameter 7.5 mm, thickness 500 um). The dexamethasone subconjunctival injection (1.5 mg/0.3 mL) was administered for minimal immunosuppression immediately after surgery and eye drops of 0.5% levofloxacin and 1% prednisolone acetate were applied four times a day for 1 week, gradually tapered. No eye drops were added after two months. Three cases are alive without graft rejection. We examined the remaining seven cases for the histopathological features and Immunologic profiles.

**Results:** As a result, three of the ten xenografts survival is significantly longer 1,239, 589, and 316 days. Corneal opacity resulted in graft failure, and terminated in seven cases. Rejected grafts showed extensive polymorphic cellular infiltration, different degrees of epithelial layer irregular attenuation, stromal neovascularization, and inflammatory cell infiltrations including lymphocytes, plasma cells, eosinophils, neutrophils. Stromal irregularity, fibrosis and edema are observed in two of seven cases resulting in a single case of sub epithelial detachment. Immunologic profiles of the recipients with rejected grafts shows minimal increase in anti-Gal antibody IgG and IgM but increase in anti-Gal IgG is seen in one case. Four cases have different systemic inflammatory conditions with regards to plasma C3a and D-dimer levels. The anterior stromal surface of the graft showed epithelial nests and fibrous proliferation.

**Conclusions:** The GTKO transgenic pig to NHP lamella xeno corneal transplantation could be a promising substitute for human corneal allograft. Lamella xeno corneal transplantation may be a feasible option with minimal immunosuppression.

**Corresponding author:** Ik Jin Yun
**E-mail:** ijyun@kuh.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Activation of transforming growth factor-β and epithelial-mesenchymal transition enhance regulatory T cells-mediated metastasis

Arum Yoon, JinWoo Hong, Chae-Ok Yun

Department of Bioengineering, Hanyang University, Seoul, Korea

Background: Even though substantial portion of patients with melanoma diagnosis are present with distant metastases, the underlying oncogenic process remains unclear.

Methods: We have hypothesized that regulatory T cells (Tregs) play a critical role in invasion and metastasis of melanoma cells. Thus, we evaluated whether the administration of exogenous Tregs into melanoma tumor-bearing mice promotes lung metastasis.

Results: Our results demonstrated that cell-to-cell contact between melanoma cells and Tregs increase the invasive and metastatic phenotype of melanoma. Further, interaction of cancer cell and Treg significantly elevated the expression level of transforming growth factor-β (TGF-β) and the subsequent induction of the epithelial-to-mesenchymal transition. B16-BL6 melanoma tumors co-cultured with Tregs showed a larger population of migrating cells compared to B16-BL6 tumors cultured without Tregs. Additionally, the injection of exogenous Tregs into B16-BL6 melanoma tumors led to the recruitment and infiltration of endogenous Tregs into tumor tissues, thus increasing the overall Treg percentage in the tumor infiltrating lymphocyte population.

Conclusions: Collectively, our findings suggest novel mechanisms in which exogenous Treg-dependent upregulation of TGF-β and mesenchymal markers is crucial for augmenting the migration capacity and invasiveness, thereby contributing to the metastasis of melanoma.

Corresponding author: Chae-Ok Yun
E-mail: chaeok@hanyang.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Mesenchymal stem cells enable delivery of an oncolytic adenovirus specifically to the tumor without posing any risk associated with systemic administration of naked virions to the host

Arum Yoon, JinWoo Hong, Chae-Ok Yun

Department of Bioengineering, Hanyang University, Seoul, Korea

Background: Systemic delivery oncolytic virus to tumors remains a major challenge due to its poor tumor tropism and immunogenicity.

Methods: In this regard, we hypothesize that mesenchymal stem cells (MSCs) with low immunogenicity and tumor-homing property could serve as a promising systemic delivery tool for oncolytic viruses.

Results: We showed that MSCs could be effectively infected by oncolytic adenovirus (oAd) and the virus replicated efficiently in the MSC carrier. Importantly, systemically administered oAd loaded in MSCs (oAd/MSC), which were initially infected with a low viral dose, led to significantly and preferentially elevated viral accumulation in tumor tissues, while attenuating virus detection in normal organs in respect to systemically administered naked oAd. Efficient retargeting of oAd to tumor tissues prevented the induction of oAd-associated hepatotoxicity that arise due to native hepatic tropism of systemically administered oAd. Further, pharmacokinetic profiling of oAd/MSC revealed that cell carrier improved and prolonged oAd retention in blood circulation compared with naked Ad. Importantly, these attributes enabled oAd/MSC to elicit potent antitumor effect, while attenuating systemic toxicity.

Conclusions: Collectively, these results demonstrate that MSC-mediated systemic delivery of oAd is a promising strategy for achieving synergistic antitumor efficacy with improved safety profiles.

Corresponding author: Chae-Ok Yun
E-mail: chaeok@hanyang.ac.kr

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
The influence of healthcare provider’s autonomy support, autonomous motivation and competence on self-care behaviors in kidney transplant patients based on self-determination theory

Sunyoung Son¹, Man ki Ju¹, Mi Kyung Sim²

¹Division of Transplantation, Department of Surgery, Gangnam Severance Hospital, Seoul, Korea
²Department of Nursing, Shinsung University, Dangjin, Korea

Background: It is important for transplant patients to perform continuous self-care behavior after transplantation. The self-determination theory is that explains the persistence factors of health behavior of chronically ill patients. This study was conducted to identify the factors of the self-determination theory of kidney transplant patients and to prepare basic data to improve self-care behavior of them.

Methods: The subjects of this study were 79 transplant patients who underwent follow-up care in an outpatient clinic after receiving a kidney transplant at one G university hospital in Seoul. Survey research was done using the “Health care climate questionnaire,” “autonomous motivation,” “Perceived competence scale” tools, and “self-management” tools. The data collected from April 20, 2020 to August 20, and the collected data were analyzed using SPSS ver. 21.0 for windows.

Results: The average age of the subjects was 54.1 years (27–78 years), and male patients were 46 (58.2%). The duration after transplantation was 5.25 years. The factors a significant correlation was confirmed were Healthcare provider’s autonomy support and autonomous motivation (r=0.39, P<0.001), healthcare provider’s autonomy and competence (r=0.29, P<0.05), health-care), Healthcare provider’s autonomy and self-care behavior (r=0.34, P<0.01), autonomous motivation and competence (r=0.39, P<0.001), autonomous motivation and self-care behavior (r=0.47, P<0.001), competence and self-care behavior (r=0.44, P<0.001). As a result of multiple regression analysis, the factors that have the greatest influence on self-care behavior were identified in the order of competence (β=0.377, P<0.01), and autonomous motivation (β=0.293, P<0.01). The total explanatory power was 30.1%.

Conclusions: As a result of this study, it was consistent with the results of previous studies that autonomous motivation increased competence and continuation self-care behavior. This could contribute to the development of an intervention program for improving the self-care behavior of patients.

Corresponding author: Sunyoung Son
E-mail: otc@yuhs.ac

© The Korean Society for Transplantation
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
Journal of Transplantation (KJT; pISSN: 2671-8790, eISSN: 2671-8804, launched in 1987) is the official journal of the Korean Society for Transplantation. KJT is an international, peer-reviewed, open access journal. The manuscript submitted for the journal should include the information and knowledge regarding transplantation, which are scientific, creative, novel, and ethical. KJT covers research topics related to clinical investigation of transplantation, basic research of transplantation immunology and translational approaches. It is published quarterly on the last day of March, June, September, and December.

Manuscripts submitted to KJT should be prepared according to the following instructions. KJT follows the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals (http://www.icmje.org/icmje-recommendations.pdf) from the International Committee of Medical Journal Editors (ICMJE).

RESEARCH AND PUBLICATION ETHICS

The journal adheres to the guidelines and best practices published by professional organizations, including ICMJE Recommendations and the Principles of Transparency and Best Practice in Scholarly Publishing (joint statement by the Committee on Publication Ethics, COPE; the Directory of Open Access Journals; the World Association of Medical Editors; and Open Access Scholarly Publishers Association; http://doaj.org/bestpractice). Furthermore, the full process of handling research and publication misconduct should follow the COPE flowchart (https://publicationethics.org/resources/flowcharts).

Authorship and Author’s Responsibility

Authors are responsible for the whole content of each article. Co-authorship should be based on the following 4 criteria: (1) substantial contributions to the conception or designing of the work; or the acquisition, analysis, or interpretation of data for the work; (2) drafting or revising of the work critically for important intellectual content; (3) final approval of the version to be published; and (4) agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Any persons who do not meet the 4 criteria above should be placed as contributors in Acknowledgments section.

The contributions of all authors must be described. KJT has adopted the CRediT Taxonomy (https://casrai.org/credit/) to describe each author’s individual contributions to the work. The role of each author and ORCID number should be addressed in the title page.

• Role of corresponding author: The corresponding author takes primary responsibility for communication with the journal during the manuscript submission, peer review, and publication process, and typically ensures that all the journal’s administrative requirements, such as providing details of authorship, ethics committee approval, clinical trial registration documentation, and gathering conflict of interest forms and statements, are properly completed, although these duties may be delegated to 1 or more coauthors. The corresponding author should be available throughout the submission and peer-review process to respond to editorial queries in a timely manner, and after publication, should be available to respond to critiques of the work and cooperate with any requests from the journal for data or additional information or questions about the article.

• Correction of authorship: Any requests for such changes in authorship (adding author(s), removing author(s), or rearranging the order of authors) after the initial manuscript submission and before publication should be explained in writing to the editor in a letter or email from all authors. This letter must be signed by all authors of the paper. A copyright assignment must be completed by every author.

• Contributors: Any researcher who does not meet all 4 ICMJE criteria for authorship discussed above but contributes substantively to the study in terms of idea development,
manuscript writing, conducting research, data analysis, and financial support should have their contributions listed in the Acknowledgments section of the article.

**Originality and Duplicate Publication**

All submitted manuscripts should be original and should not be under consideration by other scientific journals for publication at the same time. No part of the accepted manuscript should be duplicated in any other scientific journal without the permission of the editorial board. If a duplicate publication related to the papers of this journal is detected, the violation will be announced in the journal, their institutes will be informed, and the authors will be penalized.

- Secondary publication: It is possible to republish manuscripts if the manuscripts satisfy the conditions of secondary publication of the ICMJE Recommendations (http://www.icmje.org/icmje-recommendations.pdf).

**Conflict-of-Interest Statement**

The author is responsible for disclosing any financial support or benefit that might affect the content of the manuscript or might cause a conflict of interest. Examples of potential conflicts of interest are financial support from or connections to pharmaceutical companies, political pressure from interest groups, and academically related issues. In particular, all sources of funding applicable to the study should be explicitly stated.

**Statement of Human and Animal Rights**

Clinical research should be conducted in accordance with the World Medical Association Declaration of Helsinki: Medical Research Involving Human Subjects (https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/). Clinical studies that do not meet the Helsinki Declaration will not be considered for publication. Human subjects should not be identifiable, such that patients’ names, initials, hospital numbers, dates of birth, or other protected healthcare information should not be disclosed. For all clinical transplant investigation, authors should state their adherence to the Declaration of Istanbul. For animal subjects, research should be performed based on the National or Institutional Guide for the Care and Use of Laboratory Animals, and the ethical treatment of all experimental animals should be maintained.

**Statement of Informed Consent and IRB/IACUC Approval**

Copies of written informed consent and Institutional Review Board (IRB)/Institutional Animal Care and Use Committee (IACUC) approval for clinical research should be kept. If necessary, the editor or reviewers may request copies of these documents to resolve questions about IRB/IACUC approval and study conduct.

**Management Procedures for the Research and Publication Misconduct**

When the journal faces suspected cases of research and publication misconduct such as duplicate publication, plagiarism, fraudulent or fabricated data, changes in authorship, undisclosed conflict of interest, ethical problem with a submitted manuscript, a reviewer who has appropriated an author’s idea or data, complaints against editors, and etc., the resolving process will follow the flow-chart provided by the COPE (https://publicationethics.org/resources/flowcharts). The discussion and decision on the suspected cases are done by the editorial board.

**Editorial Responsibilities**

The editorial board will continuously work for monitoring/safeguarding publication ethics: guidelines for retracting articles; maintenance of the integrity of the academic record; preclusion of business needs from compromising intellectual and ethical standard; publishing corrections, clarifications, rejections and apologies when needed; no plagiarism, no fraudulent data. The editorial board checks manuscripts to confirm the originality of the text through Similarity Check. If the value of similarity index is unexpectedly high, it will be screened more precisely on plagiarism or duplicate publication. Editors are always keeping the following responsibilities: responsibility and authority to reject/accept article; no conflict of interest with respect to articles they reject/accept; acceptance of a paper only when reasonably certain; promotion of correction or retraction publication when errors are found; preservation of anonymity of the reviewers.

---

**EDITORIAL POLICY**

**Copyrights**

Copyrights of all published materials are owned by the Korean Society for Transplantation. All authors must sign the Transfer of Copyright Agreement when they submit their manuscript. Materials appearing in the journal are covered by copyright. The authors are responsible for obtaining permission from the copyright holder to reprint any previously published materials in KJT.

**Open Access Policy**

KJT is an open access journal distributed under the terms of the Creative Commons Attribution Non-Commercial License (https://creativecommons.org/licenses/by-nc/4.0/) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided that the original work is properly cited. Author(s) do not
need to be permitted for use of tables or figures published in KJT in other journals, books, or media for scholarly and educational purposes. This is in accordance with the Budapest Open Access Initiative definition of open access.

Registration of Clinical Trial Research
Any research that deals with a clinical trial should be registered with a primary national clinical trial registration site such as the Clinical Research Information Service (https://cris.nih.go.kr), other primary national registry sites accredited by World Health Organization (https://www.who.int/ictrp/network/primary/en/) or ClinicalTrial.gov (https://clinicaltrials.gov/), a service of the US National Institutes of Health.

Data Sharing
KJT encourages data sharing wherever possible, unless this is prevented by ethical, privacy, or confidentiality matters. Authors wishing to do so may deposit their data in a publicly accessible repository and include a link to the DOI within the text of the manuscript.


Archiving Policy
KJT provides the electronic backup and preservation of access to the journal content in the event the journal is no longer published by archiving in National Library of Korea (https://www.nl.go.kr/). According to the deposit policy (self-archiving policy) of Sherpa/Romeo (http://www.sherpa.ac.uk/), authors cannot archive pre-print (i.e., pre-refereeing), but they can archive post-print (i.e., final draft post-refereeing). Authors can archive publisher's version/PDF.

MANUSCRIPT PREPARATION

General Requirements
• The entire manuscript should be written in English.
• The main document with the manuscript text and tables should be prepared in an MS Word (docx) or RTF file format.
• The manuscript should be double spaced on 21.6×27.9 cm (letter size) or 21.0×29.7 cm (A4) paper with 3.0 cm margins at the top, bottom, right, and left.
• All manuscript pages are to be numbered at the bottom consecutively, beginning with the abstract as page 1.

Neither the author’s names nor their affiliations should appear on the manuscript pages.
• The authors should express all measurements according to International System (SI) units with some exceptions such as seconds, mmHg, or °C.
• Only standard abbreviations should be used. Abbreviations should be avoided in the title of the manuscript. Abbreviations should be spelled out when first used in the text and the use of abbreviations should be kept to a minimum.
• Name for microorganism is fully stated at the first appearance (e.g., Escherichia coli), then abbreviation for genus is used (e.g., E. coli). Scientific name of species is written in italic. Do not use italic if the calling of a species is not a scientific name (e.g., E. Coli, Papovaviridae, Hepadnavirus, streptococci, coagulase negative staphylococci, Epstein-Barr virus, hepatitis B virus, herpes simplex virus). Gene nomenclature is written in italics, whereas protein product of certain genes is not written in italics (e.g., BCR-ABL mutations, HER2 gene, BCR-ABL kinase domain, HER2-positive).
• P-value from statistical testing is expressed as capital P.
• The names and locations (city, state, and country only) of manufacturers should be given.
• When quoting from other sources, a reference number should be cited after the author's name or at the end of the quotation.

Manuscript preparation is different according to the publication type, including the original/special article, review, case report, study protocol, correspondence, and editorial. Other types are also negotiable with the editorial board.

Manuscript Type
• Original Articles are full-length manuscripts, which are expected to contain original scientific discovery. Section headings should include Abstract, Introduction, Methods, Results, Discussion, Acknowledgments, References, Tables, and Figure legends. Manuscript limitations are 3,500 words, 6 tables/figures, and 30 references. References, Tables, and Figure legends, are not counted as the manuscript word count.
• Special Articles highlight a topic of special relevance to the field of transplantation—for example, practice guidelines or national policy for transplantation. There is no limit to the length of each manuscript; however, if unnecessarily long, the author may be suggested to modify the length during the review process.
• Reviews give summarized overview of the existing literature on topics related to KJT readership. Both solicited or unsolicited reviews are considered for the publication. Section headings should include Abstract, Introduction, Subheadings, Conclusions, Acknowledgments, References, Tables, and Figure legends. Manuscript limitations are 6,000 words and 200 references.
• Case Reports are expected to have clinical importance and novelty. Section heading should include Abstract, Introduction, Case Report(s), Discussion, Acknowledgments and References, Tables, and Figure legends. Manuscript limitations are 1,500 words, 6 tables/figures, and 15 references.

• Study Protocols should report planned or ongoing research studies. If data collection is complete, we will not consider the manuscript. We encourage the submission of protocol manuscripts at an early stage of the study. When reporting protocols, we recommend following standard formats such as the SPIRT and PRISMA-P. For more detailed information, visit EQUATOR Network (https://www.equator-network.org/).

• Correspondence (Letters to the Editor) may be in response to a published article, or a short, free-standing piece expressing an opinion. If the Correspondence is in response to a published article, the Editor-in-Chief may choose to invite the article’s authors to write a Correspondence Reply. Manuscript limitations are 500 words, 2 tables/figures, and 5 references. The number of authors should not exceed 4.

• Editorials are an invited comment on a recently published manuscript. Editorial offers broader view of raised issues, balanced interpretation, and a link to further questions. Manuscript limitations are 800 words and 10 references.

• Symposium presentations are reports of the presentation from the annual meeting.

Table 1 shows the recommended maximums of manuscripts according to publication type; however, these requirements are negotiable with the editor.

### Title Page

<table>
<thead>
<tr>
<th>Type of article</th>
<th>Abstract (word)</th>
<th>Text (word)(a)</th>
<th>References</th>
<th>Tables &amp; Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original article</td>
<td>Structured, 250</td>
<td>3,500</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>Special article</td>
<td>200</td>
<td>NL</td>
<td>NL</td>
<td>NL</td>
</tr>
<tr>
<td>Review</td>
<td>200</td>
<td>6,000</td>
<td>200</td>
<td>NL</td>
</tr>
<tr>
<td>Case report</td>
<td>200</td>
<td>1,500</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Study protocols</td>
<td>200</td>
<td>3,500</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>Editorial</td>
<td>-</td>
<td>800</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Correspondence</td>
<td>-</td>
<td>500</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Letter to the editor</td>
<td>-</td>
<td>500</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>In reply</td>
<td>-</td>
<td>500</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

KJT, Journal of the Korean Society for Transplantation; NL, no limited.

(a)Maximum number of words is exclusive of the abstract, references, tables, and figure legends.

Table page should have article title (200 characters limit including spaces), authors’ name (include ORCID*), affiliation of authors, running title (50 characters limit including spaces), corresponding author’s information (name, affiliation, address, phone, and e-mail address). All manuscripts, including Editorials, Reviews, and Letters to the Editors, should have a title page.

**ORCID (Open Researcher and Contributor ID)**

All authors are recommended to provide an ORCID. To obtain an ORCID, authors should register at the ORCID website: https://orcid.org. Registration is free for all researchers.

**Authors’ Contributions**

The work authors have conducted for the study should be described in this section. To qualify for authorship, all contributors must meet at least one of the 7 core contributions by CRediT (conceptualization, methodology, software, validation, formal analysis, investigation, data curation), as well as at least one of the writing contributions (original draft preparation, review, and editing). Authors may also satisfy the other contributions; however, these alone will not qualify them for authorship. Contributions will be published with the final article and they should accurately reflect contributions to the work. The submitting author is responsible for completing this information at submission, and it is expected that all authors will have reviewed, discussed, and agreed to their individual contributions ahead of this time. The information concerning sources of author contributions should be included in this section at the submission of the final version of the manuscript (at the first submission, this information should be included in the title page).

Examples of authors’ contributions are as follows: Conceptualization: THK. Data curation: JHA. Formal analysis: TA, JHA. Funding acquisition: JMP. Methodology: JMP, JHA. Project administration: SL. Visualization: MHC, JH. Writing--original draft: IJY, THK, YIA. Writing--review & editing: all authors.

**Highlights**

All papers must include 3-5 short highlights presenting short summary or important findings in the next of title page. Each highlight includes less than 90 characters including space.

**Abstract & Keywords**

Abstracts for original articles are limited to 250 words and should be structured as followings: Background, Methods, Results, and Conclusions. Three to 6 keywords are listed below the abstract. MeSH (Medical Subject Headings of Index Medicus) terminology is preferred for the keywords selection. Special article, review, case report, and study protocol have abstracts in a single paragraph whose structure is up to author’s discretion.
Main Text

Sections of original articles are divided as followings: Introduction, Methods, Results, and Discussion. The Introduction is a concise explanation of hypothesis or study aims. Introduction does not hold subheadings. The Methods section should thoroughly cover the methodological details. In the Results and Discussion, subheadings may be used to organize contents. For a case report, sections consist of introduction, case report(s), and discussion.

- Studies performed using clinical samples or data, and those involving animals, must include information on the IRB approval or waiver and informed consent. An example is shown below. “We conducted this study in compliance with the principles of the Declaration of Helsinki. The study's protocol was reviewed and approved by the Institutional Review Board of OO (IRB No. 00). Written informed consent was obtained / Informed consent was waived.”

- Description of participants: Ensure correct use of the terms sex (when reporting biological factors) and gender (identity, psychosocial or cultural factors), and, unless inappropriate, report the sex and/or gender of study participants, the sex of animals or cells, and describe the methods used to determine sex and gender. If the study was done involving an exclusive population, for example in only 1 sex, authors should justify why, except in obvious cases (e.g., prostate cancer). Authors should define how they determined race or ethnicity and justify their relevance.

References

In the text, references should be cited with Arabic numerals in brackets (e.g., [1], [2,3], [4-6]), numbered in the order cited. In the references section, the references should be numbered and listed in order of appearance in the text. List all authors if there are less than or equal to 6 authors. List the first 6 authors followed by “et al.” if there are more than 6 authors. If an article has been published online, but has not yet been given an issue or pages, the digital object identifier (DOI) should be supplied. References to unpublished material, such as personal communications and unpublished data, should be noted within the text and not cited in the References. Personal communications and unpublished data must include the individual’s name, location, and date of communication. Journal titles should be abbreviated in the style used in Medline. Other types of references not described below should follow Citing Medicine: The NLM Style Guide for Authors, Editors, and Publishers (http://www.nlm.nih.gov/citingmedicine).

- Journal Articles

- Books

- Conference Proceeding

- Dissertation

- Website

Acknowledgments and Financial Disclosures

General acknowledgments and conflict of interest are stated in this section. All financial funding and material support should be stated explicitly. Grant or Contract should be stated with the grant or contract number. Authors should disclose any relationship with pharmaceutical companies or other entities. Employment contracts, consultancy, advisory boards, membership on boards of directors, stock ownerships are examples of relationships. Please refer to the
COPE guidelines (http://www.publicationethics.org/). The corresponding author is responsible for collecting financial relationship information from all authors. If there are no conflict of interest among authors, please state "No potential conflict of interest relevant to this article was reported". in the acknowledgments section.

Tables
Tables should be cited in the text and are numbered using Arabic numbers in the order of their citation. Each table should be typed on separate pages. Location of table begins at the next page after references. For each table, table number and title should be included at the top of the table. Table titles should be concise and descriptive (e.g., Table 1. Values of water quality variables for 16 samples from Han River, Seoul, taken in May 2018). Abbreviation and additional information for any clarification should be described in notes below each table. Abbreviations should be explained in formats as shown here: (DDKT, deceased donor kidney transplant; LDKT, living donor kidney transplant). Additional information for any clarification is designated for citation using superscripts. Alphabetical superscripts should be used. Explanation for superscript citation should be done as following examples: a) Not tested; b) P<0.05.

Figures and Figure Legends
Figures should be cited in the text and are numbered using Arabic numbers in the order of their citation. Figures are not embedded within the text. Each figure should be submitted as an individual file. Location of figure legends begins at the next page after the last table. Every figure has its own legend. Abbreviation and additional information for any clarification should be described within each figure legend. Figure files are submitted in EPS or TIFF formats. Requirement for minimum resolutions are dependent on figure types. For line drawings, 1,200 dpi are required. For grey color works (i.e., picture of gel or blots), 600 dpi are required. For color or half-tone artworks, 300 dpi are required. The files are named by the figure number.

Adherence to Reporting Guidelines
For specific study designs, such as randomized control studies, studies of diagnostic accuracy, meta-analyses, observational studies, and nonrandomized studies, authors are encouraged to also consult the reporting guidelines relevant to their specific research design. A good source of reporting guidelines is the EQUATOR Network (https://www.equator-network.org/) and the NLM (https://www.nlm.nih.gov/services/research_report_guide.html).

SUBMISSION AND PEER-REVIEW PROCESS

Online Submission
All manuscripts are submitted online. At the web page of the KJT (http://www.ekjt.org), click on e-Submission button, which will open a separate electronic submission system. Login the system by typing your existing ID (registered e-mail address) and password. If you aren’t registered at the electronic submission system, make your ID by clicking the JOIN button. In case of any trouble, contact the office of the Korean Society for Transplantation (Tel: +82-2-484-8052, Fax: +82-2-485-8052, e-mail: journal@mykst.org).

Peer-Review Process
All papers, including those invited by the Editor, are subject to peer review. Manuscripts are reviewed by at least 2 external experts and editors. KJT’s average turnaround time from submission to decision is 3 weeks. The editor is responsible for the final decision whether the manuscript is accepted or rejected.

- The journal uses a double-blind peer-review process: the reviewers do not know the identity of the authors, and vice versa.
- Decision letter will be sent to corresponding author via registered e-mail. Reviewers can request authors to revise the content. The corresponding author must indicate the modifications made in their item-by-item response to the reviewers’ comments. Failure to resubmit the revised manuscript within 8 weeks of the editorial decision is regarded as a withdrawal.
- The editorial committee has the right to revise the manuscript without the authors’ consent, unless the revision substantially affects the original content.
- After review, the editorial board determines whether the manuscript is accepted for publication or not. Once rejected, the manuscript does not undergo another round of review.

Appeals of Decisions
Any appeal against an editorial decision must be made within 2 weeks of the date of the decision letter. Authors who wish to appeal against a decision should contact the editor-in-chief, explaining in detail the reasons for the appeal. All appeals will be discussed with at least 1 other associate editor. If consensus cannot be reached thereby, an appeal will be discussed at a full editorial meeting. The process of handling complaints and appeals follows the guidelines of COPE available from (https://publicationethics.org/appeals). KJT does not consider second appeals.
Final Version
After the paper has been accepted for publication, the author(s) should submit the final version of the manuscript. The names and affiliations of the authors should be double-checked, and if the originally submitted image files were of poor resolution, higher resolution image files should be submitted at this time. Symbols (e.g., circles, triangles, squares), letters (e.g., words, abbreviations), and numbers should be large enough to be legible on reduction to the journal's column widths. All symbols must be defined in the figure caption. If references, tables, or figures are moved, added, or deleted during the revision process, renumber them to reflect such changes so that all tables, references, and figures are cited in numeric order.

Manuscript Corrections
Before publication, the manuscript editor will correct the manuscript such that it meets the standard publication format. The author(s) must respond within 48 hours when the manuscript editor contacts the corresponding author for revisions. If the response is delayed, the manuscript's publication may be postponed to the next issue.

Proofs and Reprints
The author(s) will receive the final version of the manuscript as a PDF file. Upon receipt, the author(s) must notify the editorial office (or printing office) of any errors found in the file within 48 hours. Any errors found after this time are the responsibility of the author(s) and will have to be corrected as an erratum.

Errata and Corrigenda
To correct errors in published articles, the corresponding author should contact the journal's editorial office with a detailed description of the proposed correction. Corrections that profoundly affect the interpretation or conclusions of the article will be reviewed by the editors. Corrections will be published as corrigenda (corrections of the author's errors) or errata (corrections of the publisher's errors) in a later issue of the journal.

ARTICLE PROCESSING CHARGES
There is no author's submission fee or other publication-related fees as all publication costs are shouldered by the publisher.

CONTACT US
Editor-in-Chief:
Ik Jin Yun, MD, PhD
Department of Surgery, Konkuk University School of Medicine, Seoul, Korea
E-mail: ijyun@kuh.ac.kr

Editorial Office:
The Korean Society for Transplantation
#327, 202 Baekbeom-ro, Mapo-gu, Seoul 04196, Korea
Tel: +82-2-484-8052, Fax: +82-2-485-8052
E-mail: journal@ekjt.org
Manuscript Submission Checklist

General Requirements
☐ The corresponding author (or the representative author of the co-corresponding authors) is the submitter of this manuscript.
☐ All manuscripts should be written in English.
☐ The main document with manuscript text and tables should be prepared in an MS Word (docx) or RTF file format.
☐ Manuscripts should be double-spaced in A4-size pages.
☐ Manuscripts should include line numbers.
☐ All pages should be numbered consecutively, starting with the abstract.

Title Page
☐ The title page and the rest of the manuscript text are prepared separately in two files (not combined together).
☐ The title page is arranged in the following order: article title, authors’ full name(s), affiliation(s), ORCID, authors’ contributions, corresponding author’s information, running title (less than 40 characters), and acknowledgments, if any.
☐ The acknowledgements section including financial support, conflicts of interest, and author contributions is in title page, not in the manuscript.

Abstract
☐ The abstract does not exceed 250 words (Background, Methods, Results, Conclusions) for original articles and 200 words for special articles, reviews, case reports, and study protocols. Up to 3-6 keywords are listed at the bottom of the abstract.

Main Text
☐ The manuscript is organized according to following sequence: Title page, Abstract and keywords, Main text, References, Tables, Figure legends, and Figures.

Tables and Figures
☐ All tables and figures are numbered in the order of their appearance in a main text.
☐ Tables are included at the end of the manuscript as editable text and not as images.
☐ Figures are as separate files, in EPS or TIFF format.

References
☐ References are listed in proper format. All references listed in the reference section are cited in the text and vice versa.
☐ The number of references is limited to 30 (for original articles, study protocols), 200 (for reviews), 15 (for case reports), 10 (for editorials), or 5 (correspondence).
Copyright Transfer Agreement

Manuscript ID

Manuscript title

Corresponding author name

Tel: __________________ Fax: __________________ E-mail: __________________

This manuscript contains original material. Neither the article nor any part of its essential substance, tables or figures have been or will be published elsewhere prior to appearing in the Korean Journal of Transplantation. The authors of the article hereby prove the statements above and agree that the Korean Society for Transplantation holds the copyright on all submitted materials and the right to publish, transmit, sell, and distribute them in the journal or other media.

<table>
<thead>
<tr>
<th>Corresponding author</th>
<th>Print name</th>
<th>Date</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-authors</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conflict of Interest Statement

As the corresponding author, I declare the following information regarding the specific conflicts of interest of authors of our aforementioned manuscript.

Examples of conflicts of interest include the following: source of funding, paid consultant to sponsor, study investigator funded by sponsor, employee of sponsor, board membership with sponsor, stockholder for mentioned product, any financial relationship to competitors of mentioned product, and others (please specify).

<table>
<thead>
<tr>
<th>Author</th>
<th>No conflict involved</th>
<th>Conflict (specify)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I accept the responsibility for the completion of this document and attest to its validity on behalf of all co-authors.

Corresponding author (name/signature) ____________________________________________

Date __________________________