Evolution of LDLT and How to Expand Responsibly

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Disclosures

- No relevant financial conflicts
Learning Objectives

1. To learn the history of solid organ transplantation and living donation
2. To learn the history of living donor liver transplantation
3. To understand current approaches to expand living donor liver transplantation responsibly
   1. Nondirected donors
   2. Paired exchange
### Early attempts at solid organ transplantation

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Surgeon</th>
<th>Donor</th>
<th>Human Recipient</th>
<th>Surgery</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1905</td>
<td>France</td>
<td>Princetau</td>
<td>Rabbit</td>
<td>16yo female</td>
<td>Pieces of rabbit kidney placed into her kidney</td>
<td>Patient survived two weeks</td>
</tr>
<tr>
<td>1906</td>
<td>France</td>
<td>Jaboulay</td>
<td>Pig</td>
<td>Female</td>
<td>Transplanted to arm</td>
<td>Patient died after one hour</td>
</tr>
<tr>
<td>1909</td>
<td>Germany</td>
<td>Unger</td>
<td>Primate</td>
<td>Male</td>
<td>Two Rhesus kidneys transplanted into groin</td>
<td>Patient died after 32 hours</td>
</tr>
</tbody>
</table>
| 1933  | Ukraine  | Voronoy       | 60yo prisoner | 23yo F with renal failure due to toxic ingestion | -ABO mismatch  
-6h warm ischemic time  
-Transplanted into thigh | Graft functioned for 21hr, patient died at 48hr (patent vessels on autopsy) |

Unger: Primate to Human Kidney Transplant
Solid organ transplant research: Joseph Murray

- Harvard trained plastic surgeon
- Served in World War II, also involved in treatment of burn patients
- Returned to the Brigham Hospital after the war in 1947
- Clinical plastic surgeon and director of Harvard Surgical Research Labs
- Experimental kidney transplantation in dogs (>100 dogs in the first two years)
- Close research relationship with Medawar’s group

http://collections.countway.harvard.edu/
Clinical Solid Organ Transplantation: Early 1950s

- Paris group reported 16 cases of clinical renal allotransplantation in 1950
- Chicago group published a single case in 1951
- 9 patients transplanted at the Brigham between March 1951-February 1953
Clinical Solid Organ Transplantation: Brigham Experience

• It was our aim in this investigation to study the subject of homotransplantation of the human kidney—not to offer a therapeutic procedure. We agree with Dempster that “it is quite out of the question that kidneys should be homotransplanted in man just in case a permanent survival might be obtained.”

• Goals:
  • Determine if underlying renal disease affected transplanted kidney
  • Determine if human allografts behaved similarly to animal models
Clinical Solid Organ Transplantation: Kolff-Brigham artificial kidney

- Developed by Dutch physician, Willem Kolff, during World War II
- First functional machine in 1943
- First life-saving treatment in 1946
- Only useful as a short-term therapy
- Cumbersome drum-like design
- First units in US in 1948-1950
  - Cleveland Clinic
  - Mt Sinai
  - Brigham Hospital
Clinical Solid Organ Transplantation: Brigham Experience

- **Donors:**
  - 6 cadaveric donors
  - 2 ‘healthy’ donors
  - Average 3.5 hr of warm ischemic time

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Fig. 1. The Method of Placing the Renal Transplant in the Right Thigh

Clinical Solid Organ Transplantation: Brigham Experience

Fig. 13. B. B., Case No. 4—The 83rd Day
A retrograde pyelogram of the transplanted kidney shows no evidence of obstruction or distortion of the calyces, pelvis, or ureter.
Brigham Experience: Results

• Four of the nine transplants developed measureable function. The kidneys secreted urine for 37 to 180 days.

• Of the four that worked, all had delayed graft function (8-19 days).

• The general pathologic picture which accompanies homograft failure in the human is qualitatively similar to that seen in experimental animals, but appears much more slowly.
Brigham Experience: Intention to treat

- Fall of 1953:
  - 22y.o. Richard Herrick developed renal failure while working in the Coast Guard
  - Rapidly progressing uremia
  - Noted to have an identical twin brother
Brigham Experience: First successful kidney transplant

- Extensive internal ethics review, primarily related to using healthy living donor
- Confirmation of being monozygotic twins:
  - Fingerprinting
  - Skin grafts with biopsy
- Operation was rehearsed on cadavers on December 21, 1954
- December 23, 1954: Simultaneous OR for donor and recipient
The donor artery was severed, the kidney was allowed to empty itself of blood and then the renal vein was clamped and divided. No attempt was made to cool or perfuse the kidney.

The ureter had previously been separated. A polythene catheter was left in the ureter going to the renal pelvis and emerging with a cystostomy tube.
Brigham Experience: First successful kidney transplant

Richard died of a heart attack 8 years later, with a functioning graft

Ronald lived to be 82
Timeline of Organ Transplantation

- 1954: First successful kidney transplant in Boston
- 1967: First successful liver transplant at Univ. Colorado
- 1979: First successful heart transplant in South Africa
- 1983: Introduction of Cyclosporine A
- 1989: FK-506 (Tacrolimus) introduced in solid organ transplantation

14th Annual Living Donation Conference
Presented by the American Foundation for Donation and Transplantation
Learning Objectives

1. To learn the history of solid organ transplantation
2. To understand current practice for adult liver transplantation
Father of Liver Transplantation: Tom Starzl
(March 11, 1926 – March 4, 2017)
History of Liver Transplantation

- First attempted liver transplant in 1963 was in a child
  - Dr. Starzl in Denver, CO
  - 3yo with biliary atresia
- First successful series in 1968
  - 8 total children
- Better outcomes with introduction of Cyclosporine in 1980 lead to worldwide expansion of both pediatric and adult liver transplantation

http://www.starzl.pitt.edu/people/groth.html
Worldwide Distribution of Liver Transplantation, 2018

~32,000 LT in 2017
Indications for Liver Transplantation

Chronic Liver Disease:
- EtOH
- Hepatitis C
- Hepatitis B
- NASH
- Autoimmune
- PSC
- PBC
- Cryptogenic

Acute Liver Disease:
- Acetaminophen
- Viral Hepatitis
- Autoimmune Hepatitis
- HELLP Syndrome
- EtOH

Neoplastic Liver Disease:
- Hepatocellular Carcinoma
- Cholangiocarcinoma
- Hepatoblastoma
- Epithelioid Hemangioendothelioma

14th Annual Living Donation Conference
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Living Donor Liver Transplantation

- First developed for children (left lateral segment)
- Introduced in late 1990s
- Most growth in regions without access to deceased donors
Pediatric liver disease:

Application of liver transplantation:
Limits and logistics

- Children with liver disease
- Referred for transplantation
- Waiting list
- Received OLT
- Survived OLT
Letters to the Editor

LIVER TRANSPLANTATION FROM LIVE DONORS

Sir,—A liver transplant programme in Brazil began in September, 1985, but by November, 1988, only 15 adults and 4 children had been transplanted due to shortage of cadaveric organ donors, a problem faced in many other countries. By the end of the 3rd year of our programme the probability that a potential recipient would die while on the waiting list was 50% for adults and 73% for children.

A technique for liver transplantation from live donors has been developed at our laboratory. Hepatic segments II and III (left lateral) are resected and transplanted to the recipient, whose liver has already been removed with preservation of the entire inferior vena cava. The graft is placed in the hepatic fossa in an obverse position, which favours perfect alignment of the vascular stumps. The risk of haemorrhage in the donor is reduced by a simple device, described elsewhere.1

HLA-DQβ NON-ASP-57 ALLELE AND INCIDENCE OF DIABETES IN CHINA AND THE USA

Sir,—Children in the United States are about twenty times more likely to acquire insulin-dependent diabetes mellitus (IDDM) than children in China, incidence rates for white children in Allegheny County, Pennsylvania,1 and for children in Tianjin2 being 15·8 and 0·7 per 100 000 per year, respectively. This huge variation in incidence is unexpected but may be due, in part, to genetic differences across populations and specifically associated with the polymorphism in position 57 of the HLA-DQβ chain.

Genetic susceptibility (or resistance) to IDDM in whites is strongly related to variation in a short segment of the HLA-DQβ chain gene.3 The presence of at least one allele leading to aspartic acid in position 57 (Asp-57 or A) of this chain seems to protect against IDDM, while a non-charged aminoacid in the same position (non-Asp-57 or N/A) is associated with increased susceptibility. Among probands in the IDDM registries in Allegheny County, 96% were NA/NA, 4% were heterozygous, and none was A/A (table). NA homozygosity was significantly associated with IDDM, with an estimated relative risk of 10·7.2

The contribution of the non-Asp-57 genetic marker to IDDM in non-US populations has not been well studied. To see if variations...
Successful Liver Transplantation from a Living Donor to Her Son


14th Annual Living Donation Conference
Presented by the American Foundation for Donation and Transplantation
Liver Transplantation in Children
From Living Related Donors

Surgical Techniques and Results

CHRISTOPH E. BROELSCH, M.D., PH.D., PETER F. WHITTINGTON, M.D., JEAN C. EMOND, M.D., THOMAS G. HEFFRON, M.D., J. RICHARD THISTLETHWAITE, M.D., PH.D., LARRY STEVENS, M.D., JAMES PIPER, M.D., SUSAN H. WHITTINGTON, and J. LANCE LICHTOR, M.D.

Pediatric liver transplantation with reduced size donor organs (RLT) has evolved into a standard clinical procedure increasing the choices of recipients for their treatment. Nevertheless organ availability remains a major problem. The authors therefore have proposed to study the use of hepatic segments from living related
Ethical foundation for LDLT

• Ethical imperative to address donor shortage
• Clinical foundation to assure safety and efficacy
• Informed consent and multidisciplinary protection of donor
Segmental Liver Transplantation from a Living Donor

By BLANCA SMITH

SEGMENTAL LIVER TRANSPLANTATION FROM LIVING DONOR

Fig. 1.—Left lateral segment of the liver showing portal and hepatic veins.
Reduced-sized orthotopic liver graft in hepatic transplantation in children

H. Bismuth, M.D., and D. Housset, M.D., Villejuif, France

Because of the rarity of child donors, in cases of adult donors room requirement for the liver graft is a major technical obstacle to liver transplantation in children. To overcome this difficulty in a child, the authors performed an orthotopic transplantation with an adult liver that had been reduced to the left lobe. The absence of technically-related complications suggests that this procedure might facilitate the performance of liver transplantation in children.

From the Unité de chirurgie hépatique et Groupe de Recherche de chirurgie hépatique, INSERM U70, Hôpital Paul Brousse, Villejuif, France

The liver is the largest organ in humans. In some cases, the large size of the liver graft renders transplantation technically difficult or impossible. This is particularly the case for heterotopic liver transplantation when there is not enough room in the abdomen for a normal-sized liver graft or for orthotopic liver transplantation in children when the liver graft comes from an older donor.

was normal. Histologic examination of the liver revealed a severe cholestasis with normal interlobular bile ducts. Biliary channels appeared to be dilated under the electron microscope. The following evolution was marked by progressively increased jaundice and pruritus and progression worsening the growth. In September 1981 physical examination revealed an underdeveloped child (26 kg per 1.21 m) with intractable
Different types of LDLT grafts

RH
LH
LL
Transplantation of Two Patients with One Liver

Analysis of a Preliminary Experience with ‘Split-liver’ Grafting

Surgical reduction of donor livers to treat small children has been performed successfully in several centers. While this procedure improves the allocation of livers, it does not increase the organ supply. We have extended reduced-size orthotopic liver transplantation (OLT) to treat 18 patients with 9 livers, accounting for 26% of our transplants during a 10-month period and have evaluated the results. In 18 split liver OLTs, patient survival was 67% and graft survival was 50%. In comparison, for 34 patients treated with full-size OLT during the same period, patient survival was 84% \((p = 0.298)\) and graft survival was 76% \((p = 0.126)\). Biliary complications were significantly more frequent.
The surgical laboratory: anatomic preparation
SEGMENTAL LIVER TRANSPLANTATION FROM LIVING DONORS Report of the Technique and Preliminary Results in Dogs

DANIEL CHERQUI*, JEAN C. EMOND, ANDREA PIETRABISSA,
“Informed consent for a living donor is impossible in a Judeo-Christian society”
Living related liver transplantation

K Tanaka, S Uemoto, Y Tokunaga, S Fujita, K Sano, E Yamamoto, H Kato, Y Yamaoka, K Ozawa

Koichi Tanaka

Professor, Department of Transplantation and Immunology
Liver Transplantation in Children From Living Related Donors

*Surgical Techniques and Results*

CHRISTOPH E. BROELSCH, M.D., PH.D., PETER F. WHITINGTON, M.D., JEAN C. EMOND, M.D.,
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Pediatric liver transplantation with reduced size donor organs (RLT) has evolved into a standard clinical procedure increasing the choices of recipients for their treatment. Nevertheless organ availability remains a major problem. The authors therefore have proposed to study the use of hepatic segments from living related donors.
Improved results of living-related liver transplantation with routine application in a pediatric program.

Emond JC, Heffron TG, Kortz EO, Gonzalez-Vallina R, Contis JC, Black DD, Whittington PF.

45 LTX in children 4/91-4/92

- Graft source
  - 18 LDLT
  - 27 from deceased donors (60%)
    - 12/27 reduction (44%)
- Patient survival
  - 17/18 LDLT (94%)
  - 21/24 DDLT (88%)
Laparoscopic living donor hepatectomy for liver transplantation in children

Prof Daniel Cherqui MD a, b, Prof Olivier Soubrane MD b, Emmanuel Husson MD a, Eric Barshasz MD, Olivier Vignaud MD a, Mourad Chojnow MD a, Sophie Brachot MD, Christophe Chardot MD a, Prof Frédéric
Adult to adult living donor liver transplantation:

Larger hepatectomy for donor and smaller graft for recipient
## LDLT in USA: 1989-2014

<table>
<thead>
<tr>
<th></th>
<th>Pediatric era</th>
<th>1997-2001</th>
<th>Total LDLT</th>
<th>Total OLT</th>
<th>Percent LDLT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peds</td>
<td>213</td>
<td>490</td>
<td>1512</td>
<td>14324</td>
<td>10.5%</td>
</tr>
<tr>
<td>Adults</td>
<td>5</td>
<td>886</td>
<td>3601</td>
<td>113992</td>
<td>3.1%</td>
</tr>
</tbody>
</table>
Graft Type 5 Yr Survival

<table>
<thead>
<tr>
<th>Graft Type</th>
<th>5 Yr Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole</td>
<td>70.6%</td>
</tr>
<tr>
<td>Split</td>
<td>72.4%</td>
</tr>
<tr>
<td>Live</td>
<td>77.5%</td>
</tr>
</tbody>
</table>

Patient Survival – Adult

Post Transplant Survival
Laparoscopic Nephrectomy

OPTN/UNOS 1995-2002

Living Donors

Laparoscopic Nephrectomies

Year

Number

70%
Cumulative Adoption Curve

- Typically expected
- Typically experienced

Cumulative Adopters

Time

100%
Factors affecting shape of adoption curve

• Difficulty of the proposed innovation
• Real and perceived risk
• Existence of alternatives
Donor dies after live liver transplant at CU Hospital

From left to right. Shannon Arnold, Ryan Arnold, Chad Arnold. (July 29, 2010)

LAHEY

Lahey cleared in death of liver donor

Posted by Gideon Gil August 5, 2010 05:36 PM

By Liz Kowalczyk, Globe Staff

State and federal health officials who investigated the death of a liver donor at Lahey Clinic said that they have not uncovered any problems with the quality of care at the hospital or other deficiencies that may have led to the tragedy.

The state Department of Public Health has completed its review of the May 24 fatality, as has the US Centers for Medicare and Medicaid Services, Roseanne Pawelec, a spokeswoman
Greffe du foie : mort d'un donneur

ERIC FAVEREAU 20 MARS 2007 À 06:44  (MIS À JOUR : 20 MARS 2007 À 06:44)

En France, c'est le second décès suite à un prélèvement depuis 1994.

Le professeur Jacques Belghiti est effondré. Chef de service de chirurgie digestive à l'hôpital Beaujon près de Paris, l'homme est chaleureux, attachant, à mille lieux des clichés sur les chirurgiens maladroits. Qui plus est, c'est l'un des meilleurs spécialistes français des greffes de foie. Et en particulier, des greffes à partir d'un donneur vivant. Il en a effectué près de 150. Là où il ne sait quoi dire. Le 15 mars, un
# Living donor risk: USA*

<table>
<thead>
<tr>
<th></th>
<th>Total cases</th>
<th>Deaths</th>
<th>Transplants</th>
<th>Total risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pediatric</strong></td>
<td>1337</td>
<td>1 (.07%)</td>
<td>0</td>
<td>1 (.07%)</td>
</tr>
<tr>
<td><strong>Adults</strong></td>
<td>2915</td>
<td>4 (.13%)</td>
<td>4 (.13%)</td>
<td>8 (.26%)</td>
</tr>
</tbody>
</table>

*Deaths and transplants immediately related to surgery*
Kidney donor mortality is 0.03%

**Perioperative Mortality and Long-term Survival Following Live Kidney Donation**

**Context** More than 6000 healthy US individuals every year undergo nephrectomy for the purposes of live donation; however, safety remains in question because longitudinal outcome studies have occurred at single centers with limited generalizability.

**Objectives** To study national trends in live kidney donor selection and outcome, to estimate short-term operative risk in various strata of live donors, and to compare long-term death rates with a matched cohort of nondonors who are as similar to the donor cohort as possible and as free as possible from contraindications to live donation.

**Design, Setting, and Participants** Live donors were drawn from a mandated national registry of 80,347 live kidney donors in the United States between April 1, 1994, and March 31, 2009. Median (interquartile range) follow-up was 6.3 (3.2-9.8) years. A matched cohort was drawn from 9364 participants of the third National Health and Nutrition Examination Survey (NHANES III) after excluding those with contraindications to kidney donation.

**Main Outcome Measures** Surgical mortality and long-term survival.

**Results** There were 25 deaths within 90 days of live kidney donation during the study period. Surgical mortality from live kidney donation was 3.1 per 10,000 donors (95% confidence interval [CI], 2.0-4.8) and did not change during the last 15 years.
LDLT in Asia

• High burden of liver disease
• Superior tradition of advanced liver surgery
• Advanced technology
• Religious and cultural obstacles to DDLT
LD utilization and access type (5-year experience at Columbia)

<table>
<thead>
<tr>
<th></th>
<th>Transplants</th>
<th>Adults</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>539</td>
<td>414</td>
<td>125</td>
</tr>
<tr>
<td>Living donor</td>
<td>107</td>
<td>64</td>
<td>43</td>
</tr>
<tr>
<td>%Living donor</td>
<td>19.85%</td>
<td>15.46%</td>
<td>34.40%</td>
</tr>
<tr>
<td>Laparoscopy</td>
<td>65</td>
<td>22</td>
<td>43</td>
</tr>
<tr>
<td>%Laparoscopy</td>
<td>60.75%</td>
<td>34.38%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>
This is a study of if we took MHV. We will not do this.
The LDLT Advantage…

LDLT should **offer an overall advantage to the recipient when compared to waiting** for an acceptable DD organ to become available for transplantation. The decision to proceed with a LDLT should be made after a careful analysis of the recipient risk to benefit ratio.
LDLT Per Million Population

US #18

68 countries with reported LDLT cases
US Adult LDLT Procedure Volume Over Time

USA
- Based on OPTN data as of 7/31/2022
- Adult - age 18+ at the time of listing

Percentage of Adult LT
- 2008-2013: 3.3%
- 2014-2019: 4.3% (pre-pandemic)
- 2020: 5.5%
- 2021: 6.1% (567 total)
Long-term Survival LDLT vs DDLT

Better long-term survival with LDLT compared to DDLT

Table:

<table>
<thead>
<tr>
<th></th>
<th>DDLT</th>
<th>LDLT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>80,315</td>
<td>3,781</td>
</tr>
<tr>
<td>2</td>
<td>51,599</td>
<td>2,493</td>
</tr>
<tr>
<td>4</td>
<td>37,916</td>
<td>1,879</td>
</tr>
<tr>
<td>6</td>
<td>27,184</td>
<td>1,433</td>
</tr>
<tr>
<td>8</td>
<td>18,342</td>
<td>1,045</td>
</tr>
<tr>
<td>10</td>
<td>11,504</td>
<td>728</td>
</tr>
</tbody>
</table>
Excellent outcomes observed in Adult LDLT, regardless of geography

A. 1 Year Patient Survival

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>LDLT</th>
<th>DDLT</th>
<th>O-E Variance</th>
<th>Weight</th>
<th>Hazard Ratio Exp(O-E) / VI</th>
<th>Fixed, 95% CI</th>
<th>Hazard Ratio Exp(O-E) / VI</th>
<th>Fixed, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al Sekeyle, 2015</td>
<td>14</td>
<td>222</td>
<td>16 269</td>
<td>0</td>
<td>7.46</td>
<td>1.4%</td>
<td>1.00 [0.49, 2.05]</td>
<td></td>
</tr>
<tr>
<td>Iborbea, 2017</td>
<td>4</td>
<td>48</td>
<td>12 128</td>
<td>-0.139</td>
<td>3</td>
<td>0.6%</td>
<td>0.95 [0.31, 2.99]</td>
<td></td>
</tr>
<tr>
<td>Brangiu, 2011</td>
<td>5</td>
<td>36</td>
<td>12 120</td>
<td>1.73</td>
<td>3.53</td>
<td>0.7%</td>
<td>1.63 [0.58, 4.63]</td>
<td></td>
</tr>
<tr>
<td>Chen, 2014</td>
<td>0</td>
<td>0</td>
<td>0 0</td>
<td>0</td>
<td></td>
<td>Not estimable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chen, 2016</td>
<td>4</td>
<td>34</td>
<td>8 72</td>
<td>0.049</td>
<td>2.67</td>
<td>0.5%</td>
<td>1.02 [0.31, 3.38]</td>
<td></td>
</tr>
<tr>
<td>Chok, 2017</td>
<td>6</td>
<td>54</td>
<td>2 40</td>
<td>0.68</td>
<td>1.5</td>
<td>0.3%</td>
<td>1.57 [0.32, 7.60]</td>
<td></td>
</tr>
<tr>
<td>E. Kim, 2017</td>
<td>12</td>
<td>109</td>
<td>21 76</td>
<td>7.94</td>
<td>7.54</td>
<td>1.4%</td>
<td>0.35 [0.17, 0.72]</td>
<td></td>
</tr>
<tr>
<td>Hu, 2016</td>
<td>51</td>
<td>389</td>
<td>107 647</td>
<td>-23</td>
<td>49.49</td>
<td>9.2%</td>
<td>0.43 [0.18, 1.03]</td>
<td></td>
</tr>
<tr>
<td>Jang, 2013</td>
<td>0</td>
<td>0</td>
<td>0 0</td>
<td>0</td>
<td></td>
<td>Not estimable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim, 2017</td>
<td>20</td>
<td>146</td>
<td>12 35</td>
<td>-0.18</td>
<td>7.5</td>
<td>1.4%</td>
<td>0.44 [0.21, 0.90]</td>
<td></td>
</tr>
<tr>
<td>Kim, 2014</td>
<td>1</td>
<td>21</td>
<td>2 29</td>
<td>-0.989</td>
<td>0.67</td>
<td>0.1%</td>
<td>0.42 [0.04, 4.55]</td>
<td></td>
</tr>
<tr>
<td>Lee, 2012</td>
<td>6</td>
<td>48</td>
<td>9 23</td>
<td>-4.42</td>
<td>3.6</td>
<td>0.7%</td>
<td>0.29 [0.10, 0.82]</td>
<td></td>
</tr>
<tr>
<td>Lee, 2013</td>
<td>3</td>
<td>31</td>
<td>5 52</td>
<td>-0.397</td>
<td>1.875</td>
<td>0.3%</td>
<td>1.24 [0.30, 5.17]</td>
<td></td>
</tr>
<tr>
<td>Li, 2011</td>
<td>20</td>
<td>128</td>
<td>29 221</td>
<td>2.92</td>
<td>11.84</td>
<td>2.2%</td>
<td>1.26 [0.72, 2.26]</td>
<td></td>
</tr>
<tr>
<td>Lu, 2006</td>
<td>4</td>
<td>124</td>
<td>5 56</td>
<td>-2.22</td>
<td>2.22</td>
<td>0.4%</td>
<td>0.37 [0.10, 1.37]</td>
<td></td>
</tr>
<tr>
<td>Reichman, 2013</td>
<td>10</td>
<td>145</td>
<td>7 145</td>
<td>3.17</td>
<td>4.11</td>
<td>0.8%</td>
<td>2.16 [0.82, 5.57]</td>
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<tr>
<td>Schmieding, 2007</td>
<td>4</td>
<td>17</td>
<td>38 269</td>
<td>3.73</td>
<td>3.02</td>
<td>0.7%</td>
<td>2.80 [1.00, 7.60]</td>
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<tr>
<td>SPTIR 2005-2017</td>
<td>440</td>
<td>2750</td>
<td>13368 58120</td>
<td>67.49</td>
<td>426</td>
<td>78.9%</td>
<td>0.85 [0.78, 0.94]</td>
<td></td>
</tr>
<tr>
<td>Wan, 2014</td>
<td>4</td>
<td>40</td>
<td>12 80</td>
<td>1.52</td>
<td>3</td>
<td>0.5%</td>
<td>0.60 [0.19, 1.87]</td>
<td></td>
</tr>
</tbody>
</table>

Total (95% CI) 4342 66205 100.0% 0.83 [0.76, 0.89]

Total events 608 11228

Heterogeneity: Chi² = 33.11, df = 16 (P = 0.007); I² = 52%
Test for overall effect: Z = 4.34 (P = 0.001)

Meta-analysis and meta-regression of outcomes for adult living donor liver transplantation versus deceased donor liver transplantation

Arianna Barbeta1,2 | Mayada Aljahani2 | Michelle Kim1,2 | Christine Tien2 | Aaron Ahearn1,2 | Hannah Schlipperood | Linda Sher1,2 | Juliet Emamuallee1,2

14th Annual Living Donation Conference
Presented by the American Foundation for Donation and Transplantation

4/20/2023
Current State in the US: Overall benefit of LDLT

- SRTR database 2012-2021
- 119,275 candidates and recipients – 2820 received LDLT

Significant survival benefit gained by living donor transplantation even at very low MELD scores
Learning Objectives

1. To learn the history of solid organ transplantation and living donation
2. To learn the history of living donor liver transplantation
3. To understand current approaches to expand living donor liver transplantation responsibly
   1. Nondirected donors
   2. Paired exchange
In a GMA3 Interview, a Mom Meets the Altruistic Liver Donor Who Saved Her Son’s Life

What inspired a young paramedic from Massachusetts to become a living organ donor and save the life of a 2-year-old boy from North Carolina.
Global experience and perspective on anonymous nondirected live donation in living donor liver transplantation

Muhammad H. Raza¹ | Hassan Aziz² | Navpreet Kaur¹,² | Mary Lo³ | Linda Sher¹,² | Yuri Genyk¹,² | Juliet Emamaullee¹,² ID
Nondirected living liver donor activity in the U.S.

- 105 cases from 2000-2019
- First case was right lobe to adult recipient, USC, 5/2000
- 40 cases in 2019
Nondirected living liver donors: Demographics

- 44% allocated to pediatric recipients
- 29 patients previously living kidney donors
  - 83% at different center
- All but one patient >1 year post-kidney donation
- One patient donated a kidney 9 months after LLS
## Nondirected living liver donor: Publications

<table>
<thead>
<tr>
<th>First author and year of publication</th>
<th>Country</th>
<th>Center</th>
<th>Year</th>
<th>N</th>
<th>Age Range</th>
<th>Surgery (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. Jendrisak, 2006 (22)</td>
<td>U.S.</td>
<td>Washington University, Washington University Medical Center</td>
<td>*</td>
<td>1</td>
<td>35</td>
<td>LLS</td>
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<td>L. Wright, 2007 (13)</td>
<td>Canada</td>
<td>University of Toronto, Toronto General Hospital</td>
<td>*</td>
<td>1</td>
<td>46</td>
<td>LLS</td>
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<tr>
<td>J.-B. Otte, 2009 (14)</td>
<td>Belgium</td>
<td>Université Catholique de Louvain, Cliniques Saint-Luc</td>
<td>2004</td>
<td>1</td>
<td>50</td>
<td>LLS</td>
</tr>
<tr>
<td>T.W. Reichman, 2010 (15)</td>
<td>Canada</td>
<td>University of Toronto, Toronto General Hospital</td>
<td>2005-2009</td>
<td>12</td>
<td>20-54</td>
<td>RTH (7), LLS (5)</td>
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<tr>
<td>N. Goldaracena, 2019 (16)</td>
<td>Canada</td>
<td>University of Toronto, Toronto General Hospital</td>
<td>2005-2017</td>
<td>50</td>
<td>20-59</td>
<td>RTH (21), LLS (24), LL (5)</td>
</tr>
</tbody>
</table>
LDLT Paired Exchange?

- ABO incompatible
- Age incompatible (donor much older than recipient)
- Size incompatible
- Immunologic concerns
Current NALLDIG membership

- 30 Programs
- >95% of LDLT activity in North America
Conclusions

- Solid organ transplantation has existed for nearly 70 years and began with living donation
- LDLT can mitigate waitlist mortality and allow patients to get transplanted when they are less sick
- LDLT offers excellent overall patient, rejection-free, and graft survival for transplant recipients
- Living liver donation is safe in carefully selected patients
- LDLT is expanding in the US
  - Nondirected anonymous donation
  - Initiation of paired exchange pilot program
Acknowledgements

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• @DrEmamaullee on Twitter

• Dr. Jean Emond (Columbia)
• Dr. Kim Olthoff (UPenn)

• Referrals for USC LDLT Program: 323-442-5908
Session Survey

Juliet Emamaullee, MD, PhD FRCSC FACS | April 18th 9:15 AM-10:15 AM