Right Versus Left Lobe for Living Liver Donors

John P. Roberts, MD

Background - Living Donors

- Persistent organ shortage
- Advantages of living donors
  - Increase donor pool
  - Shorter time-to-transplant for recipient
  - Improved wait-list and post-transplant mortality
- <10% of transplanted livers are from living donors

Disclosure

Past Consultant for Medsleuth

Benefit of LDLT in the United States A2ALL Study

- The risk of death for a recipient of LDLT is less than half (56%) of the risk of a patient who doesn't have a living donor.

- Berg Hepatology 2011
Background - UCSF Living Donor Liver Transplantation

- 1993: First adult-to-child
- 2000: First adult-to-adult
- Average 25-30 adult-to-adult living donor transplants/year

Donor Risk

- Risk of death estimated between 1/100-1/1000
- Risk of morbidity 40%
  - Infection (wound urine) 13%
  - Bile leak 7%
  - Pleural effusion 17%
  - Hernia 16%
  - Other 20%
- A2ALL Study Group

Equipoise

- Clinical definition of equipoise
  - a state of equilibrium of risk
- For living donor transplant it is the balance of recipient benefit and donor risk.

Double Equipoise

- Donor takes risk to provide recipient benefit.
- Donor wants to have successful recipient outcome
- Donor wants successful donation
- Recipient wants to minimize donor risk.
- Recipient wants successful donor outcome
- Recipient wants successful transplant
- Siegler M Liver Transpl 2006
Minimizing Donor Risk

- The amount of liver removed from the donor increases from left lateral segment to left lobe to right lobe.

Donor Risk of Death

- Does risk of death depend on which lobe is donated?

Left Lobe vs. Right Lobe

- Lateral Segment 25%
- Left lobe 33%
- Right lobe is about 66% of liver

Worldwide Deaths Left vs. Right

- Total deaths for LDLT =34
  - 30 Right
  - 4 Lefts
  - Left lobe deaths =4 (1 suicide)
  - United States Definitely Related
    - Right 4 deaths
    - Left(lateral segment) 1 death

Pomposelli JJ, Pomfret EA. The incidence of death and potentially life threatening “near miss” events in living donor hepatectomy: A world wide survey. Liver Transplantation
Risk of Death

- Liver donation 1-2/1000
- Kidney donation 1/3000
- Bone marrow donation 1/10,000

Acceptable Risk of Donor Death

- Providers maximum risk ~ 1% mortality
- Higher risk accepted by public

Donors requiring liver transplantation?

- In the worldwide survey of “near miss events” in liver donors, 4 right lobe liver donors have required liver transplantation after donation;
- None reported for left lobe donation

Donor Morbidity

- Lateral Segment
- Left Lobe
- Right Lobe
Left Lobe vs. Right Lobe
- Lateral Segment 25%
- Left lobe 33%
- Right lobe is about 66% of liver

Comparison of Donor Outcomes by Graft
- 7 studies comparing outcomes by graft type.
- Lateral segment safest
- Complications of left lobe grafts 50% of rate of right lobe grafts.
- Higher rate of biliary complications in RL donation
- Risk is proportional to the size of the liver remnant in the donor.

If Left Lobes Are Safer for Donor
- If outcome is the same in the recipient there would be no reason to choose right lobe over left lobe
Left Lobe Vs. Right Lobe

• If left lobe donation is safer than right but recipient outcome is worse, left lobe transplantation shifts risk from the donor to the recipient.

Right vs. Left Lobe Grafts

• What is the relative benefit of a left lobe vs. right lobe graft to the recipient?
• What role does graft size play in outcome?

Small Graft Outcome

• 33 patients received grafts <35% of GW/SLV vs 87 patients with GW/SLV of >35%
  – No difference in 1,3 or 5 year survival
  – No difference in INR, bilirubin or ascites production
  – Ikegami Liver Transpl 2009
• GW/RW not predictor of outcome.
  – Selzner Liver Transpl 2009
• GW/RW not predictor of outcome.
  – Hill Liver Transpl 2009

Other Risks for Recipients

• Small grafts may be problematic for recipients with significant ascites as recipients of LDLT produce ascites for 2-3 weeks after transplant.
• Arterial system of left lobe frequently has two small arteries rather than the single artery of right lobe.
• Left bile duct usually single while right is frequently multiple.
UCSF Adult to Adult LDLT

- Total Experience 137
- Started left lobe emphasis 2006

Methods- Study Design

- Retrospective Chart Review
  LDLT 2003-2013

Demographics obtained for all patients

Donors
- Graft size
- Length of stay
- Return to OR
- Readmission

Recipients
- Survival
- Biliary complications
- Length of stay

Results- Overall Demographics

- 107 living donor transplants
- 62 right lobe (58%)
- 45 left lobe (42%)
- 75% related
- 36% for HCV

UCSF Adult to Adult Living Donor Liver Transplantation

Demographics obtained for all patients

Donors
- Graft size
- Length of stay
- Return to OR
- Readmission

Recipients
- Survival
- Biliary complications
- Length of stay

Results- Overall Demographics

- 107 living donor transplants
- 62 right lobe (58%)
- 45 left lobe (42%)
- 75% related
- 36% for HCV
### Results - Recipients Right Versus Left

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Right</th>
<th>Left</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age @ transplant*</td>
<td>55 (45-62)</td>
<td>57 (50-5)</td>
<td>53 (44-60)</td>
<td>0.04</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>54%</td>
<td>45%</td>
<td>67%</td>
<td>0.03</td>
</tr>
<tr>
<td>Graft volume (cc)*</td>
<td>700 (450-800)</td>
<td>800 (700-955)</td>
<td>450 (400-500)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Length of stay (days)*</td>
<td>11 (8-16)</td>
<td>10 (8-14)</td>
<td>13 (9-16)</td>
<td>0.004</td>
</tr>
<tr>
<td>Portal inflow</td>
<td>26%</td>
<td>5%</td>
<td>56%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>modification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biliary complications (post-2006)</td>
<td>20%</td>
<td>29%</td>
<td>23%</td>
<td>0.61</td>
</tr>
<tr>
<td>MELD @ transplant*</td>
<td>20 (17-24)</td>
<td>20 (17-23)</td>
<td>20 (17-24)</td>
<td>0.88</td>
</tr>
<tr>
<td>HCV (%)</td>
<td>36%</td>
<td>39%</td>
<td>31%</td>
<td>0.42</td>
</tr>
</tbody>
</table>

### Results - Donors Right Versus Left

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Right</th>
<th>Left</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age*</td>
<td>33 (27-42)</td>
<td>37</td>
<td>30</td>
<td>0.001</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>50%</td>
<td>47%</td>
<td>53%</td>
<td>0.70</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>79</td>
<td>80.4</td>
<td>76.6</td>
<td>0.20</td>
</tr>
<tr>
<td>Graft size (cc)*</td>
<td>700 (450-800)</td>
<td>800 (700-955)</td>
<td>450 (400-500)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Residual liver volume per SLV*</td>
<td>0.51 (0.38-0.74)</td>
<td>0.39 (0.33-0.47)</td>
<td>0.7 (0.65-0.91)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Length of stay (days)*</td>
<td>7 (6-8)</td>
<td>7 (7-8)</td>
<td>7 (6-7)</td>
<td>0.005</td>
</tr>
<tr>
<td>Hospital complication</td>
<td>14%</td>
<td>18%</td>
<td>9%</td>
<td>0.36</td>
</tr>
<tr>
<td>Readmission</td>
<td>20%</td>
<td>27%</td>
<td>11%</td>
<td>0.05</td>
</tr>
</tbody>
</table>

### Results - Patient Survival

- **Overall Survival**
  - L: 88%
  - R: 85%
  - L: 90%
  - R: 83%
  - p = 0.63

### Results - Recipient Graft Survival

- **Overall Survival**
  - L: 88%
  - R: 82%
  - p = 0.74

- **Number at risk**
  - L: 62, 53, 51, 47, 46, 44, 42, 40, 38, 36, 34, 32, 30, 28, 26, 24, 22, 20, 18, 16, 14, 12, 10, 8, 6, 4, 2, 1, 0
  - R: 62, 54, 51, 47, 46, 44, 42, 40, 38, 36, 34, 32, 30, 28, 26, 24, 22, 20, 18, 16, 14, 12, 10, 8, 6, 4, 2, 1, 0
Tension

- Balance of donor risk and recipient benefit
- If left lobe is safer for donor but more hazardous for recipient where should the balance of risk lie?
Left Lobes

- Left lobes shift risk from donor to recipient
- If no clear increased recipient risk
  - Should be used in preference to right lobes
- If increased recipient risk
  - Left lobe should be considered with inflow modification
- Exclusions for left lobes
  - Recipient with significant ascites
  - Left lobes with two arteries.

Thanks

- Hilary Braun
- Jen Dodge
- Will Parker
- Mark Siegler
- Nancy Ascher
- Jean Botha
- Chris Freise
- Ana Maria Torres
- UCSF Team