MHV RECONSTRUCTION IN ADULT RIGHT LIVER GRAFT : CMPRL METHOD

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Since Dec 2011
In the era of ALDLT using right liver graft

RECIPIENT SAFETY

Intention, Age, Weight, Metabolic demand, Disease, GRWR, CV, Anatomical variation...

DONOR SAFETY

Intention, Age, BMI, Laboratory finding, Steatosis, RLV, CV, Anatomical variation...
Successful living-related partial liver transplantation to an adult patient

Sir—Living-related liver transplantation (LRLT) has been accepted as an alternative approach to cadaveric liver transplantation in view of the paucity of paediatric cadaveric donors. Although in most cases of LRLT the recipients are children, this procedure could also be considered for adult patients in a critical condition in countries where cadaveric organ procurement is prohibited. Here we describe the clinical course of an adult patient who had LRLT.

A 53-year-old woman had been diagnosed as having primary biliary cirrhosis at the age of 44. At the age of 52 her total bilirubin rose rapidly from 17.1 µmol/L to above 342 µmol/L. Despite conservative treatment, her liver function deteriorated, and was complicated by ascites and grade III hepatic coma. According to the Mayo model for the prediction of survival of patients with primary biliary cirrhosis, the calculated R value was high (9.6). The patient and her family were informed that LRLT might be possible, and they indicated their willingness to consider this option with the patient's 25-year-old son acting as the donor. The standard liver volume for the patient was calculated to be 970 mL on the basis of body surface area. Volumetric analysis with computed tomography revealed that the left lobe volume of the donor's liver was 434 mL, corresponding to 45% of the recipient's standard liver volume. In our experience, a patient who received a graft weighing 46% of the standard liver volume recovered uneventfully after transplantation. Therefore we decided that LRLT was indicated for this patient. This proposal was submitted to the ethical committee of Shinshu University School of Medicine and was accepted.

In November, 1993, the patient underwent LRLT with the donor's left lobe as the graft. We have described the procedure used for LRLT elsewhere. The recipient regained consciousness 10 h after the operation. Volumetric analysis showed rapid enlargement of the graft to 1141 mL as early as 2 weeks after the operation. Both the patient and donor were discharged from the hospital and are now leading normal lives.

In Japan, because of the legal difficulties associated with cadaveric donation, LRLT is the only type of liver transplantation permissible. Accordingly, the application of LRLT for adult recipients is now being discussed. We have carried out 16 LRLT operations for children with end-stage liver disease, and 14 of them are alive. Among the recipients, the oldest and heaviest was a 15-year-old boy with subacute fulminant hepatic failure, who successfully received his father's left hepatic lobe.

LRLT for adult recipients is not the established procedure it is for children, and decisions regarding its use should be made carefully. However, due to the limited supply of donor livers and the difficulties associated with cadaveric donation, LRLT may become an option for adult patients for whom urgent transplantation is indicated.

Yasuhiro Hashikura, Masatoshi Makuuchi, Seiji Kawasaki, Hidetoshi Matsumani, Toshihiko Ikekami, Yuichi Nakazawa, Kento Kyosawa, Takafumi Ichida
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complicated with severe congestion of the AS immediately after operation, followed by prolonged massive ascites and severe hepatic dysfunction. One recipient died of sepsis with progressive deterioration of graft function 20 days after LT.
1996-2005
Donor morbidity 20.5% (41/200)
Donor mortality 0.5% (1/200)
d/t duodeno-caval fistula

Ann Surg 2007;245:110

3000 donors Up to 2012
CD IIIa 6.7% → 1.3%
no donor death

Transplantation Proceedings 2013;45:1937
Living donor liver transplantation in Japan and Kyoto University: what can we learn?

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Forum on Liver Transplantation

(A) Right hepatic vein dominant graft; (B) middle hepatic vein dominant graft.

MHV dominant: > 40% of the right lobe graft drains into the MHV

RHV dominant: < 40% of the right lobe graft drains into the MHV

25 September 2019
Makassar Hepatopancreaticobiliary Surgery Forum
Graft selection algorithm for right lobe graft based on multidetector computed tomography

If the remnant liver volume is <30%, a donor is rejected

*: Acceptance of graft depends on other factors such as age and steatosis.
Topics: Recent advances in liver transplantation

Donor evaluation and heptectomy for living-donor liver transplantation

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Algorithm for graft type selection.

The basic principles are as follows:
1. The graft size should be over 40% (35% for low-risk recipients) of the recipient’s (SLV).
2. The parenchymal resection percentage should be under 70% (under 65% for cases of extended right liver [RL]) of the donor’s total liver volume (TLV).
**Schematic drawing of retrohepatic dissection**

*Line A* indicates recommended dissection course. When a resistance-free space cannot be found in the upper third of this course (*dashed ellipse*), there is a risk of injuring accessory hepatic veins.

*Line B* dissecting course heading for a typical proper hepatic vein for the caudate lobe (*PrCV*).

*Line C* dissecting course heading for a nontypical PrCV (*N-PrCV*)
Fig. 4. Gradual repositioning of the tape behind the major tributaries of the middle hepatic vein (MHV) during right hepatectomy without the MHV. The major tributaries of the MHV (i.e., the main drainage veins from segments 5 and 8 [V5 and V8]) are encircled and preserved until graft harvest. The cranial part of the caudate lobe is divided, and the upper between V8 and V5 is suspended and divided (b). The upper tip of the tape is then passed behind V5 (c), and the remaining liver parenchyma between V5 and the hilar plate is divided (d). The tape is removed, and the anterior surface of the hepatic inferior vena cava (IVC) is completely exposed (e). (From reference 109, with permission)
Recipient venoplasty of triple hepatic veins
Anastomosis between stump of MHV tributaries and vein grafts on the bench when the orifice of the graft right hepatic vein was smaller than that of the recipient.
Hepatic vein reconstruction when the orifice of the graft MHV was comparable with that of the recipient.
(b1). Double vena cava technique using cryopreserved deceased donor IVC by Tokyo University

(b2). Quilt unification venoplasty using autogenous GSV patch with circumferential GSV fence by Asan Medical Center
Review article

Right posterior segment graft for living donor liver transplantation: A systematic review

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b Department of Gastroenterological Surgery, Okayama University Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences, 2-5-1 Shikatacho, Kita-ku, Okayama, Japan
c Department of General and Transplantation Surgery, The Medical University of Warsaw, Nowogrodzka 59 St., 02-066 Warsaw, Poland
Donor Selection for RPS Graft

- **Tokyo**: 2\(^{nd}\) choice, if Left Graft <35-40\% SLV
  
  CI: separate A6 & A7; **Supra-portal RPHA**

- **ASAN**: If LL <30\% whole liver volume; **PV type 3**

- **Ajou**: If LL<35\% total LV, GRWR >0.7-0.8

- **Osaka**: 3\(^{rd}\) choice (remnant>35\% Donor LV and Graft< 40\% SLV)

- **Kyushu**: 3\(^{rd}\) choice: LL/SLV <35\% and donor LL<35\%
  
  CI: **PV type 1**, **Post. HD running dorsal Post.PV**

- **Kyoto**: 2\(^{nd}\) choice if GRWR Left Graft <0.6
Classification of portal vein systems
A, Type 1 (bifurcation). B, Type 2 (trifurcation).
C, Type 3 (separate posterior portal vein from the main portal vein).
Running patterns of the posterior hepatic duct and portal vein systems
A, The posterior hepatic duct (HD) running through the ventral side of the right portal vein (PV) would be the most suitable for the right posterior segment (RPS) grafts. B, The posterior HD running through the dorsal side of the posterior PV would not be favorable.
Portal Vein

Type 1  n=83 (86.4%)
Type 2  n=6 (6.3%)
Type 3  n=7 (7.3%)
MHV in RL-LDLT

HARVEST

ADVANTAGES:
- Large graft volume
- V5 & V8 adequate
- Recovery is good
- Avoids outflow obs. (twist)

DISADVANTAGES:
- Strong technical skill
- Excessive operation time
- Venous outflow obs. Possibility
- Donor risk

Selection criteria:
- Less adipose donor
- LL ≥ 30%
- V4 outstanding
- GRWR < 0.8
- Dominant MHV

RETAINED

ADVANTAGES:
- Shorter donor op time
- Remnant liver larger
- Safer donor

DISADVANTAGES:
- V5/v8 may damages
- Graft recovery time: delay
- Excessive operation time
- Tortuosity, angulation
- Venous outflow obstruction

Selection criteria:
- Less adipose donor
- V5/V8 ≥ 5mm
- GRWR ≥ 0.8
- IRHV outstanding

Resection and Procurement of the Right Hemiliver in Adult-to-Adult Living-Donor Liver Transplantation (LDLT)
Operative Techniques in Liver Resection, 2016
Wentao Wang, Jianyong Lei, and Jiulin Song

25 September 2019
Makassar Hepatopancreaticobiliary Surgery Forum
Various Types of The Right Liver Graft

- ERL (Extended Right Liver) - Queen Mary
  → ERL with preserving V4b
- MRL (Modified Right Liver) - AMC
- MERL (Modified Extended Right Liver)
  MERL with excavating MHV - SNUH (n=18)
  MERL with tailoring transaction of V5 - AMC (n=3)
- VPRL (V5 Preserving Right Liver) - Kyushu (n=15)
- CMPRL (Caudal MHV Preserving Right Liver) - PNUYH (n=84)
Middle Hepatic Vein
RHV and MHV
preparing RL Graft preserved MHV
Indications for MRL (Gyu Lee, 2002)

1. MELD Score > 20 (seriously ill)
2. GRWR < 1
3. Donor age > 50 yo
4. MHV dominant
5. Anterior sector > posterior sector
CMPRL
Caudal MHV  Preserving RL
<table>
<thead>
<tr>
<th>Variable</th>
<th>All patients</th>
<th>MRL group (n=30)</th>
<th>CMPRL group (n=65)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation time (min)</td>
<td>382.58±55.97</td>
<td>422.67±42.64</td>
<td>364.08±51.74</td>
<td>0.000</td>
</tr>
<tr>
<td>ICU stay (day)</td>
<td>1.02±0.144</td>
<td>1.00±0.000</td>
<td>1.03±0.174</td>
<td>0.337</td>
</tr>
<tr>
<td>Hospital stay (day)</td>
<td>15.21±2.629</td>
<td>15.63±3.189</td>
<td>15.02±2.328</td>
<td>0.289</td>
</tr>
<tr>
<td>Remnant liver volume (%)</td>
<td>37.10±3.369</td>
<td>36.00±4.197</td>
<td>36.84±3.439</td>
<td>0.304</td>
</tr>
<tr>
<td>Graft weight (g)</td>
<td>715.97±128.48</td>
<td>742.67±112.63</td>
<td>703.64±134.19</td>
<td>0.170</td>
</tr>
<tr>
<td>GRWR</td>
<td>1.090±0.243</td>
<td>1.108±0.256</td>
<td>1.082±0.238</td>
<td>0.628</td>
</tr>
<tr>
<td>Complications*</td>
<td>8 (8.4%)</td>
<td>2 (6.7%)</td>
<td>6 (9.2%)</td>
<td>0.676</td>
</tr>
<tr>
<td>V5 number</td>
<td>1.11±0.341</td>
<td>1.33±0.547</td>
<td>1.00±0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>V5 diameter (mm)</td>
<td>14.16±4.206</td>
<td>11.13±2.886</td>
<td>15.55±3.992</td>
<td>0.000</td>
</tr>
<tr>
<td>V5 patency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 month after operation</td>
<td>82 (86.3%)</td>
<td>21 (70.0%)</td>
<td>61 (93.8%)</td>
<td>0.002</td>
</tr>
<tr>
<td>3 months after operation</td>
<td>62 (65.3%)</td>
<td>8 (26.7%)</td>
<td>54 (83.1%)</td>
<td>0.000</td>
</tr>
<tr>
<td>6 months after operation</td>
<td>48 (50.5%)</td>
<td>4 (13.3%)</td>
<td>44 (67.7%)</td>
<td>0.000</td>
</tr>
</tbody>
</table>
CASE REPORT

LIVING DONOR LIVER TRANSPLANTATION
M./Laki2/62 Tahun

- Diagnosa: Cirrhosis Hepatis + HCC (S 2, 4b, 6, 7) Hepatitis B + DM Tipe II +
- MELD Score: 9
- CP Score: 6
- SLV: 1224 ml (Urata’s score)
- 35% SLV: 428 ml

<table>
<thead>
<tr>
<th>Standard Liver Volume (706,2xBSA+2,4ml)</th>
<th>1224.126 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>25% SLV</td>
<td>306.0315 ml</td>
</tr>
<tr>
<td>30% SLV</td>
<td>367.2378 ml</td>
</tr>
<tr>
<td>35% SLV</td>
<td>428.4441 ml</td>
</tr>
<tr>
<td>40% SLV</td>
<td>489.6504 ml</td>
</tr>
</tbody>
</table>
Box 1 | Formulas for SLV estimation

Urata\(^2\): 2.4 + 706.2 \times BSA

Hashimoto\(^3\): \(-404.8 + 961.3 \times BSA\)

Heinemann\(^5\): \(-345.7 + 1072.8 \times BSA\)

Vauthey\(^6\): \(-179.4 + 1267.2 \times BSA\)

Yu\(^7\): 21.585 \times BW^{0.732} \times BH^{0.225}

Yoshizumi\(^8\): 772 \times BSA
Tahap 1

1. Interview oleh Koordinator transplant
   i. Konfirmasi keinginan menjadi donor
2. Hubungan famili 3 tingkat atau suami/istri
   i. Mengenal resipient dalam waktu yg lama

Tahap 2

1. Tes Laboratorium
   i. Darah lengkap
   ii. Gol Darah
   iii. Serologi Hepatitis
   iv. Test fungsi hati

2. Skrining oleh transplant surgeon
   i. Tidak ada riwayat medis yg signifikans
   ii. Hepatitis Negatif
   iii. ABO Kompatibel atau identik
   iv. Evaluasi psikiatri jika diperlukan

Tahap 3

1. Biopsi hati (jika BMI > 25 dan/ blue liver pada USG)
2. Endoskopi (> 40 thn)
3. Colonoscopy (jika darah samar positif dan atau CeA signifikans)
4. Treadmill (> 40 thn)
   – 3-D CT / CT Angio liver*
1. HLA typing/cross match
   i. ICG R 15 menit
   ii. Konsultasi Anesthesi
   iii. Informed concern final

1. Tes Darah samar tinja (FOBT)
   ii. Rontgen dada, EKG,test fungsi paru
   iii. CT abdomen 3-phase dengan kontras/injektor
<table>
<thead>
<tr>
<th>Donor</th>
<th>Resipient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Donor</td>
</tr>
<tr>
<td></td>
<td>160.8 Cm</td>
</tr>
<tr>
<td>SLV</td>
<td>1087</td>
</tr>
<tr>
<td>TLV</td>
<td>961</td>
</tr>
<tr>
<td>RHV</td>
<td>371</td>
</tr>
<tr>
<td>Caudate</td>
<td>16</td>
</tr>
<tr>
<td>MHV</td>
<td>349</td>
</tr>
<tr>
<td>LHV</td>
<td>93</td>
</tr>
<tr>
<td>V8</td>
<td>121</td>
</tr>
<tr>
<td>V5</td>
<td>96</td>
</tr>
<tr>
<td>V4</td>
<td>71</td>
</tr>
<tr>
<td>L</td>
<td>356</td>
</tr>
<tr>
<td>C</td>
<td>31</td>
</tr>
<tr>
<td>L+C</td>
<td>387</td>
</tr>
<tr>
<td>A</td>
<td>415</td>
</tr>
<tr>
<td>P</td>
<td>159</td>
</tr>
<tr>
<td>A+P</td>
<td>574</td>
</tr>
<tr>
<td>L+C</td>
<td>387</td>
</tr>
<tr>
<td>R(V58 sacrific)</td>
<td>337</td>
</tr>
<tr>
<td>R(V8 Reconst)</td>
<td>457</td>
</tr>
<tr>
<td>R(V5 Reconst)</td>
<td>433</td>
</tr>
<tr>
<td>R(V58 Reconstr)</td>
<td>554</td>
</tr>
<tr>
<td>R (Extended)</td>
<td>574</td>
</tr>
</tbody>
</table>
- **Diagnosa:**
  - Cirrhosis Hepatis
  - + Hepatitis B
  - + Multicentric HCC
    ( S 2, 4b, 6, 7)
- MELD Score: 9
- Child Pugh Score: 6
- SLV: 1224 ml
- 35% SLV: 428 ml
HEPATIC ARTERY RECONSTRUCTION
Hepatic Artery (Mitchelle’s classification)

A57%  B12%  C20%  D6%  E3%  F2%  E2

ra
rp
lh
ra
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TERIMA KASIH