

## **How far can we go on donor selection: age & volume?**

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Living donor liver transplantation (LDLT) is being performed worldwide to solve the problem of a great and ongoing shortage of organ donors which ends up with increased waitlist mortality for patients who require liver transplants. Living donor right hepatectomy (LDRH) is currently the most common form of living donor surgery in adult-to adult LDLT despite concerns about donor safety, an uncompromisable issue. The potential surgery-related morbidity of living donors reportedly ranged from 16% to 78.3%.<sup>[1]</sup>

But, as surgical technique and management for living donor surgery get improved with time and experience, several steps to get closer to the cliff edge have been taken as the means to expand living donor pools for LDLT in patients who have no other alternatives, which include the use of ABO incompatible grafts <sup>[2]</sup>, selection of living donors with liver remnants < 30% <sup>[3]</sup>, obese donors <sup>[4]</sup>, elderly donors <sup>[5, 6]</sup>, and donors with intra-abdominal adhesion <sup>[7]</sup> or previous abdominal surgery <sup>[8]</sup>.

The two most common unfavorable factors in selecting living donor candidates are age and volume, which can affect postoperative outcomes including liver failure in donors and recipients.

Here is the opinion that takes the pro in this debate, based on the 12-year experience of the

author's institution and literature reviews.

## **Age**

There were only a few reports using elderly living donors  $\geq 60$  years old, which focused mostly on graft and recipient survival rather than donor outcomes and showed a similar postoperative course compared with younger donors.<sup>[9, 10]</sup>

We investigated the outcomes of living donors aged  $\geq 60$  years and their recipients in right lobe LDLT. Perioperative and long-term outcomes with at least 1 year follow-up of both living donors aged  $\geq 60$  years and their recipients in right lobe LDLT between March 2008 and August 2013 were analyzed retrospectively on prospectively collected data base. Ten donors were enrolled in this study. The median age of donors was 62.5 years (range; 60-76). In all donors, liver function tests were normalized within 1 month. At a median postoperative follow-up of 31.4 months (range; 12.1-71.9), wound infection in a living donor was the one and only complication. All donors recovered completely and returned to their previous activities. All 10 recipients showed good initial function with 1-year graft and recipient survival both at 100%. This study showed that living donors aged  $\geq 60$  years may deserve consideration for right hepatectomy under the strict selection criteria: preservation of middle hepatic vein (MHV), remnant-to-total liver volume ratio (RTVR)  $\geq 30\%$ , and no or mild fatty change in healthy condition.

We also experienced a case of a 76-year-old female who underwent LDRH for her 75-year-old

husband with recurrent hepatocellular carcinoma on April 30, 2012. With her voluntary decision, full medical and psychiatric assessment was performed. The operative time was 130 minutes in the donor and 399 minutes in the recipient. Both the donor and recipient had an uneventful recovery and were discharged on day 7 and 10, respectively with normal liver function. The couple has had no complication so far and is currently doing well in good health 59 months after LDLT.

### **Remnant liver volume**

The safe limits for partial hepatectomy are still unresolved in the literature. The minimal volume of remnant liver depends on factors related to liver function and the presence of underlining liver disease. So, considering normal liver function in living donors, preoperative evaluation for safety of donor hepatectomy is based on the volume of future liver remnant. The minimum safe limit for liver resection with normal liver (RTVR > 20%) was published in 2006 in the consensus statement following consensus conference on the resectability of liver metastases.<sup>[11]</sup>

However, insufficient is the evidence defining the safe minimal remnant volume after living donor hepatectomy. Donor safety is of utmost importance in living donor liver transplantation. So, the use of donors with RTVR < 30% is highly debatable. Here is our center's experience. The outcomes of living donors with a RTVR < 30% after right hepatectomy were evaluated by the selection criteria: preservation of MHV, age < 50 years, and no or mild fatty change in healthy

adults. All living donors who underwent right hepatectomy saving MHV at the authors' institution between January 2005 and September 2011 were divided into 2 groups: group A (n=28) with an RTVR < 30% and group B (n=260) with an RTVR  $\geq$  30%. Perioperative data, complications by the Clavien classification, and the outcomes with at least 15 months follow-up were compared. Twenty-eight donors were enrolled in group A and 260 in group B. The estimated liver volume was strongly correlated with the actual graft weight ( $R^2=0.608$ ,  $p<0.001$ ). The calculated donation liver volume and RTVR made significant differences between the two groups ( $p=0.034$  and  $p<0.001$ , respectively). The peak postoperative AST, ALT, and INR levels made no difference between the two groups. The peak total bilirubin level was higher in group A than in group B ( $p=0.039$ ). The hospital stay was longer in group A than in group B ( $p<0.001$ ). All donors recovered completely with no significant difference in overall complications between the two groups. Right hepatectomy saving MHV with an RTVR less than 30% could be safely indicated in carefully selected living donors under 50 years old with no or mild fatty change.

## **Comments**

Considering the premier issue of donor safety, it was very tough decisions to accept the donor candidates with old age or small remnant liver volume. Actually, exploring the untrodden path with the aim of using those unfavorable or marginal living donors is difficult and even considered reckless enough to endanger donor safety. In addition, very few reports in the literature have

dealt with living donor using these unfavorable factors. Therefore, the lowest limit of the RTVR and upper limit of age in living liver donors cannot be defined currently. However, the outcome after LDRH is not only dependent on the remnant liver volume or donor age but also on other donor factors at the time of surgery such as, fatty changes, and undetected underlying illness. Surgical experience is another variable that must be considered in deciding whether to accept the selection criteria for donor with RTVR<30% or old age. Any complication, including near-miss events such as bleeding, infections, biliary leakage, and strictures, may tip the balance against donor safety in addition to potential burdens of small RTVR or old age, which can possibly lead to a vicious cycle of fatal morbidity.

What is accepted as low medical risk may differ from one transplant center to another, depending on surgical expertise and team judgment. Safe and speedy surgery is one of the key success factors to improve the outcomes of LDRH. Various modifications in surgical technique and management <sup>[12-16, 1, 17]</sup> resulted in the recent morbidity less than 2% without any major complications, reoperation or blood transfusions for more than 400 LDRHs since 2010. The majority of LDRHs were completed less than 3 h with the shortest at 106 min.

Generally, living donors, a highly select healthy cohort, pass full medical and psychiatric assessment by health-care professionals, and so are expected to tolerate smaller remnant liver volumes than patients with diseased livers. Our results showed that the intrinsically higher

perioperative risk for individuals of old age or low RTVR could be kept at acceptably low levels by using sound selection criteria and by adopting advanced surgical technique and management. Therefore, the selection criteria for LDRH will be able to be extended with advanced surgical technique and improved management without compromising donor safety.

Donor safety, a matter of utmost importance, is ensured by three factors: preoperative evaluation of the donor, intraoperative surgical technique, and postoperative care. Surgical technique is a priority for determining the outcome of donors. As such, donor surgeons should be prepared to be fully informed regarding the case; in addition, they should recognize their strengths and weaknesses. Care and vigilance should be exercised to limit the possibility of serious morbidity during routine LDRH. The three areas could be continuously refined, with the ultimate goal of zero morbidity. Getting closer to cliff edge is dangerous, but the precipice can be accessed with safety equipment.

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