

Living Donor Liver Transplantation Overview

**Prepared for the
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by:**

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Living donor liver transplantation (LDLT) began slightly more than 16 years ago (1-3). Its first application was in response to the critical shortage of donor organs for small children. The left lateral segment of an adult liver (approximately 25% of the liver volume) was transplanted into children with biliary atresia. It became quickly established in major transplant centers. That approach, in addition to the use of reduced-sized grafts from deceased donors, was a major benefit to children. It had a large impact on reducing the mortality of small children on the waiting list and it significantly reduced their waiting time. The bond between a parent and child and the desire of a parent to save the life of an infant justified the operation and its rapid acceptance, in spite of the risk for the donor.

Living liver donation between adults using the right lobe developed 8 years ago as an extension of the adult-to-child experience (4-6). As for children, it was introduced to address the increasing disparity between the inadequate supply of donated livers from deceased donors and the increasing number of adult patients awaiting transplantation. Greater controversy has surrounded LDLT between adults because of the magnitude of the surgery and the greater risks for the donor, including death (7-11). The expected outcome for the recipient should justify the donor risk, and the recipient should meet the same criteria for receiving a graft from a living donor as he or she would to receive a transplant from a deceased donor.

There is no universally accepted protocol for donor evaluation but there is consensus that the assessment should ensure the physical and mental health of the donor, that the motives of the donor are appropriate, and that the donor liver is healthy and favorable in terms of size and anatomy (12-14). Most programs require that there should be a demonstrable, significant relationship between the donor and recipient although Good Samaritan donors have been used. To ensure lack of coercion and appropriate motivation, donors are usually independently assessed by an individual who is not a member of the transplant team. Psychosocial evaluation requires the involvement of a social worker, psychologist, or psychiatrist as deemed necessary. It is imperative that the potential donor understands the nature and risks of the operation and the possibility and nature of adverse events, as well as the recovery period.

Non-invasive imaging can usually determine graft size accurately and provide adequate detail of vascular anatomy (15-16). In the adult-to-adult situation, the lower limit of graft size (to avoid the "too small-for-size" syndrome) is 0.8% of the recipient body weight, although it is not an absolute cut-off (17-21). In adult-to-child transplantation, it is more common to have the opposite problem i.e. the liver segment is larger than ideal. Steatosis (fatty infiltration of the liver) adversely affects graft function. Imaging and donor body mass index usually detect it, but correlations are not uniform (22). The acceptable limit of graft steatosis has not been determined. Donor liver biopsy may be required to determine its extent, or to rule out other underlying disease. Both the donor and recipient operations are technically complex, and that complexity is reflected in the higher rates of vascular and biliary complications seen in recipients of segmental grafts compared to recipients of whole-sized livers from deceased donors (23-28).

Postoperative complications are common and occur in one of every four or five right lobe donors, the commonest ones being fluid collections, bile leaks, bleeding, wound and chest complications (29-33). More life-threatening complications include injury to the bile ducts of the

donor, portal vein thrombosis, and pulmonary embolism. In a survey of LDLTs between adults at 42 transplant centers in the United States, biliary complications requiring intervention occurred in 6% of the donors and 5% required re-operation (30). The overall complication rate was 21% and 8% of donors required repeat hospitalization (33). In an analysis of 12 reported series in the literature, the estimated crude morbidity rate for donors was 31% and the time to recovery averaged 3-4 months (29). The rate of complications is higher in right lobe donors than in donors of the left lateral segment and the complications are more serious (32).

There are few in-depth analyses of quality of life after donation and most centers have not reported substantial information on long-term health after donation. What has been reported however, shows that significant issues are present for many donors. In one center's experience, nearly three-quarters of right lobe donors reported ongoing symptoms following discharge, one-third sought medical attention for ongoing symptoms and 42% had a change in body image (34). In another survey of liver donors, 40% reported what they perceived to be a complication and the mean time to recovery was 4 months (35). Ninety-two percent returned to their pre-donation occupation. In spite of persistent symptoms, donors generally indicated that they were happy that they donated and they would make the same decision again.

The risk of death cannot be definitively stated because no registry exists that includes data on all living donors. It is estimated there have been 6-7,000 liver transplants with living donors, approximately half of those being adults who donated to children i.e. donated the left lateral segment of the liver. Nine donor deaths have been mentioned in various case series in the literature, but at a recent meeting on living donors it was stated that there have been more, as many as 14. It has been suggested that the risk of donor death in adult-to-child LDLT is about one in one thousand, and that it is closer to one in two hundred in adult-to-adult LDLT with use of the right lobe. Therefore, it is much greater than the risk of mortality with living kidney donation.

The reported deaths are incompletely detailed in the literature, leaving no insight into how preventable the deaths may have been (30,35-42). There have been misadventures in the donor surgery and some donors have had to undergo emergency life-saving liver transplants as a result. There have been situations when donors operations have been aborted because of unexpected findings or untoward events in the operating room. The National Institutes of Health and the American Society of Transplant Surgeons announced two years ago the initiation of a prospective study of adult-to-adult LDLT at nine centers in the United States. The purpose is to gather accurate data on all donors and recipients, to determine the risk/benefit ratio, and record complications and outcomes.

The personal financial implications for liver donors have not been well studied. They include loss of income (for several months or more), and travel and lodging expenses (43). In one American analysis, out-of-pocket expenses incurred by the donor averaged \$3,600 US (34). Clearly, the financial impact on the donor may be a significant disincentive to donate.

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