Practical considerations of right lobe living donor liver transplantation in adults

William J Wall MD, Edward Solano MD

The practice of living donor liver transplantation in adults has developed rapidly over the past five years and brings with it a set of unique technical and ethical challenges. The evaluation of potential donors focuses on their health and motives, and the results of noninvasive imaging, with the objective of ensuring the best outcomes for both donors and recipients. Graft volume is critical to success, and venous outflow reconstruction is paramount, although there is no consensus on the preferred method. Biliary tract complications occur in 30% of recipients. Complications that may interfere with recovery or delay the return to well-being occur in one of every four or five donors. The precise risk of donor death cannot be stated with certainty because comprehensive data on all cases are not available. It is clear, however, that donation of the right lobe of the liver carries with it a much greater risk of mortality than kidney donation. The paucity of details reported on donors who have died makes it impossible to determine to what extent the deaths were preventable. The option of living donation is an invitation to expand the criteria for recipient selection to the extent that the deaths were preventable.

The option of living donation is an invitation to expand the criteria for recipient selection to the extent that the deaths were preventable. The option of living donation is an invitation to expand the criteria for recipient selection to the extent that the deaths were preventable.

Key Words: Donor issues; Liver transplantation; Living donor; Recipient operation

Liver transplantation using living donors began 12 years ago in response to the critical shortage of donor organs for pediatric recipients (1-4). The concept was an extension of the use of reduced size grafts from deceased donors. Although controversial at the time of its inception (5,6), it gained wide acceptance in a relatively brief period of time. Today, donation of the right lobe of the liver from a living adult donor to a child is firmly established in pediatric practice (7). It has helped to significantly reduce the waiting times and mortality for children requiring transplantation.

Living donor liver transplantation (LDLT) in adults has been undertaken during the past five years and, as for children, it was introduced to address the increasing disparity between the supply of donor organs and the number of adult patients awaiting transplantation (8-10). Unlike the pediatric experience, however, controversies surrounding LDLT in adults have continued to escalate since its introduction (11-16). The procedure has ignited much more debate because of the frequency and magnitude of the donor risks associated with removing the right lobe of the liver and its rapid application without comprehensive and detailed donor outcome data. A recent donor death has been widely publicized (17). The present review will consider some practical aspects of LDLT in adults and discuss issues that, in our view, have not been adequately addressed by transplant specialists.

THE LIVING DONOR

Donor safety is the most important consideration in LDLT. Transplant specialists are obligated to ensure that all circumstances are suitable for the operation to go forward. There is no universally accepted protocol for donor evaluation, but the assessment of potential donors has three objectives: assurance that the donor is physically and mentally healthy; assurance that the motives of the donor are appropriate; and assurance that the donor anatomy and graft size are satisfactory (18,19).

The process should preferably begin with potential donors coming forward spontaneously to express an interest in donation. Information about LDLT can be provided to potential recipients and those close to them at the time of referral for transplantation, but potential donors should not be solicited.
Donation should be a purely altruistic act, and there should be a demonstrable, significant relationship between the donor and recipient. The initial screening interview, to address the donor's medical history and relationship with the recipient, need not be performed by a physician, nor does it have to be performed at the transplant centre. In many instances, the interview yields information that precludes any further assessment, such as significant health issues or incompatible body size (20).

When screening uncovers no obvious contraindications, a more detailed medical history and physical examination, together with appropriate tests, are undertaken to rule out any unexpected liver disorder or other significant disease (18,21). Any physical condition that could contribute to morbidity after major hepatic resection must be identified. Medical contraindications include morbid obesity, significant cardiovascular disease, respiratory disease, diabetes mellitus or any other major organ dysfunction. Age by itself is not a contraindication. Individuals in their sixth decade have donated (22), but a more intensive investigation should be done to evaluate their surgical risk. Potential donors are advised at the onset of the process that they may halt the assessment at any time. A physician independent of the transplant program is in the best position to provide an impartial assessment and elucidate the motives driving donation. Coercion from family or other sources must be ruled out. If any concerns arise about the donor’s motivation or personal relationships, formal psychological or psychiatric evaluation may be required. Potential donors must understand the nature of the operation, the likelihood and nature of adverse events, and what to expect during the recovery period.

Graft size is the most important technical consideration in selecting donors for LDLT. The small-for-size syndrome may result from the implantation of grafts that are too small. Size matching is expressed as either the percentage graft weight to recipient body weight or the percentage of graft volume to standard liver volume (23). A percentage graft weight to recipient body weight between 0.8% and 1.0% or a percentage of graft volume to standard liver volume of 40% or more is considered to be adequate (20,24). The lower limits are not absolute, as shown by documented successes with grafts below the commonly accepted ratios (25-27). Nevertheless, caution should be exercised with the use of small grafts, and they should be avoided for recipients with severe hepatic decompensation or severe portal hypertension (19,28). The sickest recipients need large grafts, not small ones.

If steatosis is present, donor graft size needs to be corrected for fat content. It has been suggested that every 1% of steatosis decreases functional graft mass by 1% (19). Thus, the percent fat content should be subtracted to calculate true graft size. The acceptable limit of steatosis has not been determined for fat content. It has been suggested that every 1% of steatosis decreases functional graft mass by 1% (19). Thus, the percent fat content should be subtracted to calculate true graft size. The acceptable limit of steatosis has not been determined for fat content. It has been suggested that every 1% of steatosis decreases functional graft mass by 1% (19). Thus, the percent fat content should be subtracted to calculate true graft size. The acceptable limit of steatosis has not been determined for fat content. It has been suggested that every 1% of steatosis decreases functional graft mass by 1% (19). Thus, the percent fat content should be subtracted to calculate true graft size. The acceptable limit of steatosis has not been determined for fat content. It has been suggested that every 1% of steatosis decreases functional graft mass by 1% (19). Thus, the percent fat content should be subtracted to calculate true graft size. The acceptable limit of steatosis has not been determined for fat content. It has been suggested that every 1% of steatosis decreases functional graft mass by 1% (19). Thus, the percent fat content should be subtracted to calculate true graft size. The acceptable limit of steatosis has not been determined for fat content.

The incidence of steatosis in the donor liver has some correlation with the body mass index (BMI). In the study by Rinella et al (29), no patient with a BMI of 25 kg/m² or lower had steatosis, a BMI of 25 kg/m² to 28 kg/m² was associated with a 33% incidence of steatosis, and a BMI greater than 28 kg/m² was associated with a 76% incidence of steatosis. Computed tomography (CT) and magnetic resonance imaging (MRI) are useful in detecting steatosis, but may not accurately quantify the percentage of fat. Most centres use percutaneous liver biopsy selectively; for example, in potential donors whose imaging suggests the presence of steatosis or for those with a BMI over a certain value. A different view has been put forward by Ryan et al (30), who suggested that all donors should undergo biopsy. In their series of liver biopsies in 100 consecutive living donors, BMI correlated very weakly with histological estimates of fat content. The majority (73%) of those with a BMI greater than 25 kg/m² had no histological evidence of steatosis, while 9% of those with a BMI below 25 kg/m² had at least 10% steatosis. In addition, the biopsies detected occult liver disease in three potential donors. The risk associated with a liver biopsy is very small, but it is not negligible, and must be balanced against the chance of finding occult disease and potentially sparing the donor an unnecessary operation.

The radiological expertise and equipment at any given centre will influence what preoperative imaging is used to define the hepatobiliary anatomy (31-33). With the accuracy of high resolution CT angiography, MR angiography and Doppler ultrasonography, the trend is to use minimally invasive imaging, which improves donor convenience and safety. Venous and arterial anatomy can usually be visualized noninvasively (34,35), although angiography is used routinely in some centres (9). CT with three-dimensional reconstruction has been shown to be highly accurate in defining venous anatomy and moderately helpful in defining arterial anatomy (32). Abnormal anatomy does not necessarily preclude donation, but documentation is valuable for planning surgery. Unfavourable biliary anatomy, such as a left or right lobe duct draining into the opposite side, can be documented preoperatively by endoscopic retrograde cholangiopancreatography, multidetector CT cholangiography or MR cholangiopancreatography. Assessment of the biliary tree with MR cholangiopancreatography (36) or multidetector CT cholangiography (37) correlates well with intraoperative cholangiography. Given the accuracy of MRI in assessing the hepatic parenchyma, vascular anatomy and the biliary system, it can provide a comprehensive preoperative assessment (38).

**RECIPIENT SELECTION**

When LDLT was introduced, it was intended to provide transplants for candidates waiting for grafts from deceased donors. Initially, good-risk recipients were selected, which reserved livers from deceased donors for sicker, more urgent recipients and made it easier to justify donor risks for recipients who would have the very best survival after transplantation. It also allowed ample time for donor assessment and thoughtful discussion before obtaining consent. There is tremendous logic in this approach. It is also sensible to specifically apply LDLT to patients on the list for a deceased donor graft who are disadvantaged by the fact that they are assigned a relatively low priority despite being in need of transplantation. They include patients with cholestatic and metabolic liver diseases, and those with a deteriorating quality of life due, for example, to disabling fatigue, pruritus or encephalopathy. LDLT can provide transplantation for them at the most opportune stage of their illnesses. The same considerations apply to patients with early hepatocellular carcinoma. The provision of LDLT to these recipients at the ideal time should reduce their attrition rate due to tumour progression (39).

The view that LDLT should be restricted to only the best-risk recipients is probably too narrow. Lo et al (8) have argued that donor risk is best justified when a very sick patient needs
an urgent transplant. Certainly, LDLT can save the lives of patients with fulminant hepatic failure (40-42) and critically ill patients with decompensated liver disease (43). Although they are prioritized on the waiting list, they deteriorate quickly, and organs from deceased donors may not become available in a timely fashion. Living donor assessment can be accomplished in a matter of hours in specific situations, and the timing of transplantation can be optimized if a living donor comes forward early enough. Whether LDLT would result in higher patient and graft survival after transplantation in patients with fulminant hepatic failure than with cadaveric grafting is not yet known. When LDLT is used for desperately ill patients with chronic liver disease, recipient survival rates of 43% have been reported (43). Because the one-year mortality rate of 57% after LDLT far exceeds the 18% rate after cadaveric transplantation for United Network for Organ Sharing status 2A recipients, the appropriateness of using living donors in these circumstances has been questioned (44).

There has been spirited discussion at transplant meetings concerning the use of living donors to provide transplants for patients who would not otherwise qualify for the procedure, especially those with malignancies that are advanced beyond currently accepted guidelines. Historical reports show that some of these patients can enjoy extended survival and occasionally be cured (45,46), but the shortage of organs from deceased donors currently denies these patients access to transplantation. In some centres, LDLT is seen as a solution for cancer victims who would not otherwise receive transplants. Gondonesi et al (47) reported that more than one-half of the cancers treated with LDLT were greater than 8 cm in diameter. Donors will sometimes come forward for these patients, even if they understand that the chance of curing the recipient is slim. The question is how low of a recipient cure rate is acceptable to risk the life of a healthy living donor. Under the urging of family members, LDLT is also contemplated for other patients with severe alcoholic liver disease who do not satisfy abstinence criteria or for those with recurrent hepatitis C. These scenarios are becoming more frequent occurrences, and ethical debates about recipient rights to treatment and donor autonomy can be expected to dominate the discussions.

TECHNICAL ASPECTS OF DONOR AND RECIPIENT OPERATIONS

The many technical varieties of LDLT in adults reflect the evolving nature of these unique donor and recipient operations. Right lobe grafts are preferred in most centres, having the advantages of size and easier anatomical reconstruction. Left lobe grafts are still popular in East Asia, but extended right lobe grafts (segments 4 to 8) are widely regarded as too extensive for the donor.

The donor operation

It is useful to mark the intended site of division of the bile duct to the right lobe with a radiopaque clip and correlate it with the operative cholangiogram. Dissection of the right branch of the hepatic artery is undertaken to the right of the common bile duct, with minimal disruption to the hepatic parenchyma surrounding the biliary branches to the right lobe to reduce the risk of ductal ischemia (48). Occasionally, the portal vein trifurcates into right anterior, right posterior and left branches. Dual branches to the right lobe are taken separately, leaving the afferent venous supply to the donor left lobe intact.

When the right lobe is separated from the inferior vena cava (IVC), sizable (greater than 5 mm) venous branches and true accessory right hepatic veins are preserved. In most cases, the right hepatic vein is large and is the only draining vein required for a right lobe graft. In up to 24% of individuals, however, the right hepatic vein is relatively small and an inferior or accessory right hepatic vein, or a tributary from the middle hepatic vein, also provides significant drainage of the right lobe (49). Accessory veins should be preserved and reimplemented into the recipient liver to avoid venous congestion of the graft or even graft failure (31,49). The plane of hepatic transection is determined primarily by the course of the middle hepatic vein, which should be identified by intraoperative ultrasonography (31,33,49,50). The middle hepatic vein drains segment 4, but it may also drain significant parts of segments 5 and 8, as well as variable areas of segments 2 and 3. Some surgeons recommend division of the liver to the left of the middle hepatic vein, thereby including it with the graft to ensure adequate venous drainage (8,30-32). Others recommend that the division be performed to the right of the middle hepatic vein, arguing that the drainage of the middle hepatic vein is not always significant and that taking it risks injury to the left hepatic vein and, potentially, leaves an inadequate mass of liver in the donor (49,53,54). Obviously, either approach can be used (55). If division to the right of the middle hepatic vein is selected, significant tributaries draining segments 5 and 8 should be preserved for reimplantation, using vein grafts if necessary (31,33,49,53-55).

The bile duct is transected after enough hepatic parenchyma has been divided to permit good visualization. Sharp dissection is used and tissue is purposely left around the bile duct orifice. In nearly 40% of cases, there is more than one duct draining the right lobe, but a ductoplasty may allow the creation of a single orifice for anastomosis in the recipient (33). The use of tissue sealants on the cut edge of the liver should not replace meticulous efforts to secure each vascular and biliary tributary with hemoclips or ligatures.

The recipient operation

Marcos et al (59) have detailed the critical inter-relationships between graft volume, venous outflow and inflow, and their importance to optimize graft function and avoid venous congestion. Right lobe grafts are immediately subjected to substantial increases in portal perfusion after engraftment. Thus, it is imperative that the venous outflow of the graft is technically perfect. When the venous outflow is constructed, total occlusion of the IVC allows maximal caval manipulation to facilitate the creation of a wide anastomosis. We prefer to construct an anastomosis that uses the orifice of the recipient right hepatic vein, often enlarging it vertically on the IVC, as has been described by several authorities (53,59). Significant accessory hepatic veins are separately anastomosed to the IVC directly, or with vein grafts or remnants of the recipient middle hepatic vein (54). The donor right portal vein is anastomosed to either the left hepatic vein and, potentially, leaves an inadequate posterior or accessory right hepatic vein, or a tributary from the middle hepatic vein, also providing significant drainage of the right lobe (50). When the right lobe is separated from the inferior vena cava, sizable (greater than 5 mm) venous branches and true accessory right hepatic veins are preserved. In most cases, the right hepatic vein is large and is the only draining vein required for a right lobe graft. In up to 24% of individuals, however, the right hepatic vein is relatively small and an inferior or accessory right hepatic vein, or a tributary from the middle hepatic vein, also provides significant drainage of the right lobe (49). Accessory veins should be preserved and reimplemented into the recipient liver to avoid venous congestion of the graft or even graft failure (31,49). The plane of hepatic transection is determined primarily by the course of the middle hepatic vein, which should be identified by intraoperative ultrasonography (31,33,49,50). The middle hepatic vein drains segment 4, but it may also drain significant parts of segments 5 and 8, as well as variable areas of segments 2 and 3. Some surgeons recommend division of the liver to the left of the middle hepatic vein, thereby including it with the graft to ensure adequate venous drainage (8,30-32). Others recommend that the division be performed to the right of the middle hepatic vein, arguing that the drainage of the middle hepatic vein is not always significant and that taking it risks injury to the left hepatic vein and, potentially, leaves an inadequate mass of liver in the donor (49,53,54). Obviously, either approach can be used (55). If division to the right of the middle hepatic vein is selected, significant tributaries draining segments 5 and 8 should be preserved for reimplantation, using vein grafts if necessary (31,33,49,53-55).

The bile duct is transected after enough hepatic parenchyma has been divided to permit good visualization. Sharp dissection is used and tissue is purposely left around the bile duct orifice. In nearly 40% of cases, there is more than one duct draining the right lobe, but a ductoplasty may allow the creation of a single orifice for anastomosis in the recipient (33). The use of tissue sealants on the cut edge of the liver should not replace meticulous efforts to secure each vascular and biliary tributary with hemoclips or ligatures.

The recipient operation

Marcos et al (59) have detailed the critical inter-relationships between graft volume, venous outflow and inflow, and their importance to optimize graft function and avoid venous congestion. Right lobe grafts are immediately subjected to substantial increases in portal perfusion after engraftment. Thus, it is imperative that the venous outflow of the graft is technically perfect. When the venous outflow is constructed, total occlusion of the IVC allows maximal caval manipulation to facilitate the creation of a wide anastomosis. We prefer to construct an anastomosis that uses the orifice of the recipient right hepatic vein, often enlarging it vertically on the IVC, as has been described by several authorities (53,59). Significant accessory hepatic veins are separately anastomosed to the IVC directly, or with vein grafts or remnants of the recipient middle hepatic vein (54). The donor right portal vein is anastomosed to either the left hepatic vein and, potentially, leaves an inadequate posterior or accessory right hepatic vein, or a tributary from the middle hepatic vein, also providing significant drainage of the right lobe (50). When the right lobe is separated from the inferior vena cava, sizable (greater than 5 mm) venous branches and true accessory right hepatic veins are preserved. In most cases, the right hepatic vein is large and is the only draining vein required for a right lobe graft. In up to 24% of individuals, however, the right hepatic vein is relatively small and an inferior or accessory right hepatic vein, or a tributary from the middle hepatic vein, also provides significant drainage of the right lobe (49). Accessory veins should be preserved and reimplemented into the recipient liver to avoid venous congestion of the graft or even graft failure (31,49). The plane of hepatic transection is determined primarily by the course of the middle hepatic vein, which should be identified by intraoperative ultrasonography (31,33,49,50). The middle hepatic vein drains segment 4, but it may also drain significant parts of segments 5 and 8, as well as variable areas of segments 2 and 3. Some surgeons recommend division of the liver to the left of the middle hepatic vein, thereby including it with the graft to ensure adequate venous drainage (8,30-32). Others recommend that the division be performed to the right of the middle hepatic vein, arguing that the drainage of the middle hepatic vein is not always significant and that taking it risks injury to the left hepatic vein and, potentially, leaves an inadequate mass of liver in the donor (49,53,54). Obviously, either approach can be used (55). If division to the right of the middle hepatic vein is selected, significant tributaries draining segments 5 and 8 should be preserved for reimplantation, using vein grafts if necessary (31,33,49,53-55).

The bile duct is transected after enough hepatic parenchyma has been divided to permit good visualization. Sharp dissection is used and tissue is purposely left around the bile duct orifice. In nearly 40% of cases, there is more than one duct draining the right lobe, but a ductoplasty may allow the creation of a single orifice for anastomosis in the recipient (33). The use of tissue sealants on the cut edge of the liver should not replace meticulous efforts to secure each vascular and biliary tributary with hemoclips or ligatures.
portal vein, either in situ or using backtable reconstruction with a Y-graft of the recipient portal vein bifurcation (60). Venous flow can be assessed intraoperatively after reperfusion using Doppler ultrasound (58,61).

Hepatic arterial reconstruction is usually end-to-end to the recipient hepatic artery proper or its right branch. A jump graft using the saphenous vein overcomes inadequate length. Micovascular techniques may be used, but are not always necessary (31). Occasionally, two hepatic arteries supply the right lobe graft. A suggested technique to deal with this anomaly is backtable reconstruction with a Y-graft consisting of the bifurcation of the recipient’s right and left hepatic arteries taken to the level of the gastroduodenal artery takeoff (60).

A single biliary anastomosis is associated with a lower biliary complication rate (62). Fan et al (63) have recently emphasized the importance of proper technique to avoid biliary problems. By precise location of the division of the right hepatic duct, they have obtained a single orifice in most of their cases. Also, they made an effort to create one orifice by ductoplasty and stressed the importance of creating a jejunal opening equal in size to the right hepatic duct. The application of these principles reduced their biliary complication rate from 43% to 8%. A Roux-en-Y hepaticojejunostomy is still our preference, but duct-to-duct reconstructions are often used (53,63,64). A role has been suggested for biliary stents (31,33,63), but, as with whole organ transplants, there are no firm data to show that they reduce the incidence of biliary complications.

**POSTOPERATIVE COMPLICATIONS**

**Donor outcome**

Few analyses have been published that provide comprehensive details about donor outcomes after right hepatic lobectomy. Many reports (65,66) include major, but not minor, complications, and few include pertinent information on the length of stay, readmission rates (and reasons), time before returning to work, quality of life after donation and long-term health. From the available information, however, it is clear that the risks of a right hepatic lobectomy in a healthy donor are significant and that there is considerable postoperative morbidity (22,54,65,67-70). Approximately 20% to 25% of donors experience an adverse event or symptom that may or may not interfere with their recovery. A survey of 42 transplant centres in the United States obtained data on 433 adult LDLT procedures (66). Thirteen centres accounted for 80% of the transplants. Biliary complications requiring intervention occurred in 16% of the donors, and 5% required reoperation. The overall complication rate was 21%, and 10% of donors had to be readmitted to hospital (71). Complication rates tended to be lower in high volume centres, but the differences were not statistically significant.

Beavers et al (69) analyzed complications involving 409 right lobe donors from 12 series in the literature (six North American, four Asian and two European) and estimated that the crude morbidity rate was 31%. The most frequent complications were bile leaks, prolonged ileus and minor wound problems, followed by pleural effusions, atelectasis and neurapraxia. Readmission rates were infrequently reported but some were as high as 22%. Time to recovery, in the two series that reported it, averaged three to four months, similar to that recently reported in a Berlin study (22). A survey of 1508 living liver donors in five Asian centres showed that right lobe donors had the highest complication rate (28%), and their complications were more serious than left lobe or left lateral segment donors (70).

There are significant quality-of-life issues affecting donors. In an analysis by Trotter et al (72), 71% of right lobe donors reported ongoing symptoms, including 42% with a change in body image, and almost one-third had sought medical attention. When donors are carefully followed, it is evident that they feel unwell for a long time afterwards. Nevertheless, donors generally indicate that they were happy that they donated and would make the same decision again (72).

Although donor mortality cannot be accurately quantified because of incomplete data, it is certain that more deaths have occurred than have been reported in medical journals. A total of seven donor deaths have been mentioned in reports from transplant centres. The first was a parental donor for a child in Germany, a 29-year-old mother who died of a pulmonary embolus two days after surgery (73). She was overweight, smoked and was taking contraceptives (74). There have been six more deaths reported in right or extended right lobe donors (66,69,75-78), and it is claimed that there have been others (11,16). It is relevant to compare the risk of right lobe donor mortality with living kidney donation, which is approximately three per 10,000 donors (79,80). At the time of writing the present review, there had been approximately 1500 right lobe donors. Thus, the mortality rate for living right lobe donation is obviously much greater than it is for kidney donation.

**Recipient outcome**

The survival of LDLT recipients is good, but technical complications are greater than with whole-size grafts. The incidence of biliary complications ranges from 15% to 64% (10,54,62), which is significantly higher than the 10% to 15% rate after whole-sized transplantation (81,82). Leakage of bile from the anastomosis or from the cut edge is common. Although most leaks can be managed nonoperatively, they prolong hospital stay and consume resources. Biliary strictures can result from very small bile ducts, the sequelae of bile leaks or ischemic injury. Occasionally, stenting may be all that is required, but operative intervention is often needed. Because of the greater concern for vascular patency and adequacy of blood flow with LDLT than with whole organ grafts, postoperative monitoring with Doppler ultrasound has become routine. Lower doses of tacrolimus are required after LDLT to achieve therapeutic blood levels (83,84).

Concerns have been raised about the vulnerability of living donor grafts to reinfection with hepatitis C. A few reports (85,86) have suggested that partial grafts from living donors are more prone to aggressive, recurrent hepatitis C than are whole grafts from deceased donors. It has been postulated that hepatic regeneration enhances hepatocyte infection with the virus, although other mechanisms may also be operative, such as genetic homology of donor-recipient pairs (87). Russo et al (88) recently analyzed United Network for Organ Sharing data on 279 LDLT hepatitis C-positive recipients and found that one- and two-year patient and graft survival were not significantly different from 3995 hepatitis C-positive recipients who received deceased donor grafts. As pointed out by the authors, and emphasized in a slightly different way in an accompanying editorial (89), differences in the severity of illness pretransplant need to be considered when interpreting survival after transplantation. Recipients of living donor grafts are, as a group, less sick. In addition, other variables that may impact the development of recurrent hepatitis C (e.g., viral load, genotype, type of
immunosuppression and treated rejection) need to be taken into account. Longer follow-up and more comprehensive data are needed before this issue can be clarified.

**UNRESOLVED ISSUES**

The major issue facing LDLT today is the lack of information on donor mortality and, to a lesser extent, morbidity. Hepatologists and surgeons have an obligation to provide potential donors and recipients with accurate information about risks and outcomes, otherwise, informed consent is impossible. The fact that donors are prepared to accept very high risks does not lessen that obligation. The lack of agreement on the real risk of mortality was revealed in a survey (66) of 42 adult-to-adult living donor programs in the United States. When asked what death rate was quoted to potential donors, the answers varied from less than one in 1000 to more than one in 100 (66). Surely, the estimate of mortality given to potential liver donors should not vary in logarithmic proportions. This is a pressing issue, especially when expanded criteria for recipient selection are currently being put forward and donor risks are being balanced against recipient survival rates that may be much lower than the 80% to 85% success rate we have come to expect.

The picture that is emerging of the morbidity of right lobe donation is not comforting. Donors need to understand that complications and persistent symptoms frequently occur, and that recovery is prolonged. Data sets on donor morbidity are still far from complete. Publications that address donor complications should report all complications and their impact on ultimate recovery, including hospitalization, readmission and time to return to work. Moreover, the reasons for persistent symptoms are poorly understood. Some donor operations have been aborted, but only one centre has provided any information on this issue (54). Unless these unfortunate cases are detailed in the literature, the transplant community will not learn from the experience of others. Some donors have had to be rescued by liver transplants themselves, but details of these cases have not been reported in any manner that would be instructive to others (66).

**REFERENCES**

Wall and Solano

Submit your manuscripts at http://www.hindawi.com