

ORIGINAL ARTICLE

Is there any difference between right hepatectomy and left lateral sectionectomy for living donors? As much you cut, as much you hurt?

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Abstract

Background: The worldwide rising demand for cadaveric donors in liver transplantation is an important incentive for the development of alternative transplantation options, such as living donors. A precise evaluation of surgical complications is, therefore, considered to be an important issue in this setting.

Aim: Present a retrospective analysis of 126 living donors hepatectomies undertaken at our centre.

Methods: From December 2002 to August 2009, 126 living donors were submitted to hepatectomy. Donors' complications were stratified according to Clavien's scoring system to compare the morbidity of right hepatectomy (RH) (Group 1) and left lateral sectionectomy (LLS) (Group 2).

Results: Thirty-nine complications were observed in 35 patients. Sixty LLS, 3 left (LH) and 63 RH were performed. The complications were classified as: Clavien grade 1–11 (28.2%), grade 2–12 (30.7%), grade 3A–13 (33.3%), grade 3B–2 (5.1%) and grade 4A–1 (2.5%). When Group 1 (63 patients) and Group 2 (60 patients) were compared, there was no significant difference between the number of complications: 20 (31%) and 14 (23%), respectively ($P > 0.3$).

Conclusions: Hepatectomy for living donor liver transplantation (LDLT) was a safe procedure, regardless of the type of liver resection undertaken. We found no difference in morbidity between RH and LLS, which suggests that complications may occur despite the amount of liver retrieved.

Keywords

liver transplant, living donor, outcomes

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Introduction

Living donor liver transplantation (LDLT) was first undertaken in the pediatric population, in 1989.¹ The first adult-to-adult LDLT was introduced almost a decade after, in Japan.² More than 20 years later, LDLT is an established treatment modality for end-stage liver diseases and an important source for liver grafts in countries where there is a shortage of cadaveric donors, as a result of social, cultural and historical reasons. Although potentially life-

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saving for the recipient, LDLT is a complex surgical procedure which subjects a healthy donor to major surgery without direct therapeutic benefit. A precise evaluation of donors' surgical complications is therefore considered to be an important issue in this setting. Initial data donor post-operative complications are reported from 9%–67%, with most occurring in right liver donors.^{3–5} Recent data show similar morbidity for right and left liver donation, especially for centres with cumulative experience.⁶

A retrospective analysis is presented of 126 living donor hepatectomies operated in our centre, comparing the morbidity of right hepatectomy (RH) and left lateral sectionectomy (LLS).

Patients and methods

From December 2002 to August 2009, 126 liver living donors were submitted to hepatectomy in our centre. The patients' charts were analysed to stratify post-operative complications according to Clavien's scoring system (Table 1).⁷

All patients presented voluntarily for surgery. Details of the pre-operative donor evaluation, as well as surgical technique have been described previously.^{8,9} Right and left liver donors were submitted to prior computed tomography (CT) volumetry to assure a remnant liver with, at least, 30% of the total liver volume. Left lateral sector donors did not undergo CT volumetry prior to surgery. Hepatectomies were performed using an ultrasonic dissector without inflow occlusion, to prevent liver ischemia. Preservation of the middle hepatic vein was performed for all right liver donors. Routine intra-operative cholangiography was carried out before bile duct splitting. To avoid biliary complications, saline with methylene blue was injected via the cholangiography catheter to test for leakage.

Post-operative epidural analgesia was given on a regular basis for all donors. Subcutaneous low-molecular-weight heparin was initiated on the first post-operative day and maintained until hospital discharge.

The χ^2 -square test was used to assess the number of complicated patients in both groups. Post-operative complications were compared using Fisher's exact test. For statistical significance, $P < 0.05$ was considered significant.

Results

Of the 126 donors, 69 were male (55%) and 57 were female (45%). Overall mean age was 31.8 years (range: 18–49 years). One

Table 1 Classification of complications according to the Clavien System

Grade 1	Any deviation from the normal post-operative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions. Allowed therapeutic regimens are drugs as antiemetics, antipyretics, analgesics, diuretics, electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside.
Grade 2	Complications requiring pharmacological treatment with drugs other than such allowed for grade 1 complications. Blood transfusions and total parenteral nutrition are also included.
Grade 3	Complications requiring surgical, endoscopic or radiological intervention.
Grade 3A	Intervention not under general anaesthesia.
Grade 3B	Intervention under general anaesthesia.
Grade 4	Life-threatening complications (including central nervous system complications) requiring intensive care unit stay.
Grade 4A	Single organ dysfunction (including dialysis).
Grade 4B	Multiorgan dysfunction.
Grade 5	Death of the patient.

hundred and seven donors (85%) were related up to the fourth degree (cousin or uncle) and 19 donors were not related to the recipient.

Sixty-seven hepatectomies (53%) were performed for adult and 59 (47%) for pediatric transplantation. According to the Brisbane nomenclature system,¹⁰ we performed 60 (48%) LLS, 3 (2%) left hepatectomies (LH) and 63 (50%) RH. The average operative time was 7.3 h (range: 4–10.5 h). The mean hospital length of stay was 6.4 days (range: 4–14 days).

Thirty-five patients (28%) experienced 39 complications (Table 2). Ten patients (8%) developed biliary tract complications (leak and biloma). Three subjects presented with gastric volvulus, which was corrected endoscopically. Three patients needed to be re-operated for a complication: one because of an electrical burn on the leg, caused by malfunction of the electric coagulator neutral plate, one to treat an incisional hernia and one remaining patient owing to a hemoperitoneum, which was the only life-threatening complication in our series. Other important complications included pneumonia, gastrointestinal haemorrhage, inferior vena cava thrombosis and transitory hepatic insufficiency. After a median follow-up time of 41 months (range: 6–98 months), all donors are alive, except one, who was murdered after an urban street confrontation, 6 months after surgery.

The complications were classified as: Clavien grade 1–11 (28.2%), grade 2–12 (30.7%), grade 3A–13 (33.3%), grade 3B–2 (5.1%) and grade 4A–1 (2.5%). There were no grade 5 complications related to surgery. The majority of complications (59%) were classified as minor grades (1 and 2), whereas major grades (3 and 4) accounted for 41%.

Comparing Group 1 (RH: 63 patients) and Group 2 (LLS: 60 patients) there was no significant difference in the number of patients experiencing complications: 20 (31%) and 14 (23%), respectively ($P > 0.3$). Patients from Group 1 had a total of 23 complications, 16 classified as minor grade and 7 as major grade. Patients from Group 2 experienced 14 complications, 7 minor and 7 major.

Discussion

For the transplant recipient, LDLT has important advantages over deceased donor transplantation, such as: reduced waiting time for transplant, a better quality liver graft and a markedly shorter cold ischaemia time.¹¹ However, for the donor, this procedure brings no direct therapeutic benefit. Thus, the donor operation safety and post-operative recovery are the main concerns in these cases. Despite careful donor selection, death after LDLT has occurred in centres in Europe, the United States and Asia. The estimated worldwide rate of donor death related to donor surgery is 0.15%.¹² In our series, we had no deaths related to donor operatory procedure.

Similar to other series¹³, the most common complication observed in our centre was associated to biliary tract injury: 10 patients (8%) presented with biliary leakage or biloma, nine of

Table 2 Number of complications according to the type of resection and Clavien System

Complications	RH (group 1)	LH	LLS (group 2)	Clavien system classification
Biloma	6	–	1	3A
Gastric volvulus	–	–	3	3A
Biliary leak	3	–	–	2
Alopecia	2	–	1	1
Wound granuloma	1	–	1	3A
Pneumonia	–	–	2	2
Vena cava thrombosis	2	–	–	2
Transitory hepatic insufficiency	2	–	–	2
Cholestasis	2	–	–	1
Hemoperitoneum	–	1	–	4A
Burn	–	–	1	3B
Incisional hernia	–	1	–	3B
Digestive haemorrhage	–	–	1	3A
Blood transfusion	–	–	1	2
Ascitis	1	–	–	2
Urinary lithiasis	–	–	1	2
Wound infection	1	–	–	1
Liquor fistula	1	–	–	1
Hipophosphatemia	1	–	–	1
Fever	1	–	–	1
Left hand paresthesia	–	–	1	1
Wound pain	–	–	1	1

RH, right hepatectomy; LH, left hepatectomy; LLS, left lateral sectionectomy.

them from in Group 1, which suggests that a greater liver cut surface after RH is more likely to be associated with biliary complications ($P = 0.01$). All patients were treated by percutaneous drainage or, conservatively, by post-operative peritoneal drain placement.

Complications related to liver dysfunction, such as transitory hepatic insufficiency, cholestasis and ascites were detected in five (4%) patients, all of them from Group 1, which indicates that right liver donors, even though left with an adequate remnant hepatic volume, are more prone to suffer from liver parenchymal failure ($P > 0.05$).

Three donors, submitted to LLS, developed gastric volvulus within 10 days of surgery ($P > 0.1$). All were diagnosed and treated by upper gastrointestinal endoscopy but no recurrence was observed. In another report of 115 LDLT, 13 donors (11.3%) developed gastric volvulus within 7 days after surgery, 12 of whom underwent LH or LLS.¹⁴ The loss of the gastrohepatic ligament and the dead space created after left lobe resection are believed to be causes for gastric abnormal rotation in these cases.¹⁴

Two patients, from Group 1, presented with inferior vena cava thrombosis, probably because of surgical manipulation of the retrohepatic vena cava and right hepatic vein. They were asymptomatic and received anticoagulation therapy for 6 months. Post-operative alopecia was observed in three donors, in the occipital

region of the head. This complication has already been reported¹⁵ and is caused by localized-induced ischaemia to the scalp as a result of head immobilization during the per-operative and the initial post-operative period. One patient developed a liquor fistula after accidental dural puncture, for peridural catheter insertion. One patient had left-hand paresthesia, caused by compression of the radial nerve by a median arterial pressure catheter. No treatment was needed and he became asymptomatic a few days after surgery.

In our series, we had one life-threatening complication of hemoperitoneum, caused by bleeding from a lesser curvature vein, in a patient submitted to left hepatectomy. This patient presented with signs of hypovolemic shock, 1 h after surgery. Bedside abdominal ultrasonography revealed a moderate volume of free fluid between the intestinal loops, which lead to reoperation. The patient developed acute renal failure after reoperation, but haemodialysis was not necessary. The patient recovered well, without sequelae.

No significant difference was observed in the relative rate of complication according to the type of donor surgery which suggests that complications may occur irrespective of the amount of liver resected. In a Medline search, we found many reports of complications in RH for adult-to-adult LDLT, but few reports that compare RH and LH or RH and LLS complications for LDLT,

especially with a large number of patients and long-term outcomes. From these papers, we observed that initial data identified a higher complication rate for right liver donors when compared with left liver or left lateral section donors, as reported by Lo in a 1508 cases survey.¹⁶ Furthermore, early series of right liver donors demonstrated a high morbidity rate for these patients.¹⁷ However, two analysis divided by period, one carried out by Hwang *et al.*¹⁸ and other by Broering *et al.*¹⁹ showed that accumulated experience with living donors hepatectomies, at liver transplantation centres, was able to reduce the overall complication rate, particularly for RH. Indeed, more recent reports of right liver donors complications demonstrated low risks²⁰ and excellent long-term outcomes, as shown by the University of Toronto Group.²¹ In the same way, a recent report from the Japanese Liver Transplantation Society on 3565 LDLT carried out in Japanese centres, showed similar morbidity for left and right liver donors (8.7% and 9.4%, respectively).⁶

In conclusion, for this reported series of LDLT, donor's surgery was shown to be a secure procedure with morbidity rates in accordance to contemporary data. The number of patients experience complications was similar, regardless of the type of liver resection (RH or LLS). Right liver donors have a higher risk for biliary complications and are more prone to develop hepatic insufficiency-related problems.

Conflicts of interest

None declared.

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