
Right Hepatic Lobectomy as a Liver Graft-Saving Procedure

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Retransplantation is common after liver transplantation (LT). However, in the present era of organ shortages, every attempt to save the liver graft should be performed before considering retransplantation. We report our experience with right hepatic lobectomy (RHL) for liver graft salvage. In a retrospective series of 180 adult LTs, 4 patients underwent RHL (Couinaud's segments V, VI, VII, VIII) in the post-LT period. In all cases, the procedure was performed without Pringle's maneuver or mobilization of the left liver lobe to preserve its vascularization. Three liver graft recipients developed intrahepatic biliary strictures, mainly localized to the right lobe of the graft, and RHL was performed 14, 75, and 78 months after LT. These patients were alive at last follow-up without further episodes of cholangitis or retransplantation (mean follow-up, 38 months). The fourth patient developed early post-LT right liver necrosis with a functioning hepatic artery and underwent right lobectomy 48 hours after LT. He later developed cholangitis secondary to late hepatic artery thrombosis, requiring retransplantation after 18 months. We conclude that RHL can be considered a graft-saving option in selected liver transplant recipients with localized biliary strictures, with excellent patient and graft survival. (*Liver Transpl* 2001;7:269-273.)

Liver transplantation (LT) has become the standard of care for many end-stage liver diseases. LT surgery and immunosuppressive protocols improved with experience, leading to excellent results in terms of patient survival and quality of life after LT. The main limitation to LT has been the cadaveric organ donor shortage. In the United Network for Organ Sharing (UNOS) area, the median waiting time for a liver transplant was 515 days in 1998, and even longer for status 3 liver transplant candidates.¹ This year, 1,317 liver transplant candidates died on the UNOS waiting list.¹ This shortage and, in particular, the increasing death toll in adult candidates has forced the transplant community to find alternative sources of grafts, such as living or non-heart-beating donors.

Retransplantation is common after LT, accounting for 9% of all LTs in 1998.¹ Because it requires a second graft, it increases the organ shortage. Moreover, retransplantation is associated with greater morbidity and mortality.^{2,3} Therefore, every attempt to save the graft should be made before listing liver transplant recipients for retransplantation.

The aim of this report is to present our experience

with right hepatic lobectomy (RHL; Couinaud's segments V, VI, VII, VIII) in liver transplant recipients as a graft-saving procedure.

Patients and Methods

In a consecutive series of 180 adult LTs performed between 1987 and 1999, we retrospectively reviewed the files of 4 men who underwent RHL (Couinaud's segments V, VI, VII, VIII) in the post-LT period (Table 1).

In all cases, classic RHL was performed without Pringle's maneuver or mobilization of the left liver and the surrounding adhesions to preserve its collateral vascularization. Parenchymal transection was performed with an ultrasonic dissector using hemoclip sutures (Ligaclip; Ethicon, Somerville, NJ) and fibrin glue for hemostasis and prevention of bile leaks from the transected liver surface. A cell saver was used in all procedures. None of the patients experienced liver insufficiency in the post-LT period, whereas regeneration of the remnant left part of the liver graft occurred in all patients.

Case Presentations

Patient 1. Patient 1 was born in 1967. In 1987, he underwent LT for decompensated cirrhosis secondary to Wilson's disease. He developed intrahepatic bile duct strictures secondary to hepatic artery thrombosis and underwent retransplantation in 1989. This second LT was complicated by hepatic artery thrombosis causing extrahepatic and intrahepatic liver strictures. In 1991, he underwent bile duct reconstruction with a Roux-en-Y choledochojejunostomy and hepatic artery revascularization using in situ fibrinolysis and end-to-end anastomosis between the right gastroepiploic artery and the donor hepatic artery. The left hepatic artery was successfully

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Presented as a poster at the First Joint Meeting of the American Society of Transplantation and American Society of Transplant Surgeons, Transplant 2000, May 14, 2000, Chicago, IL.

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1527-6465/01/0703-0112\$35.00/0

doi:10.1053/jlts.2001.21318

Table 1. Patient Characteristics

Patient No.	Cause of Liver Failure	Reason for RHL	Delay Between LT and RHL	RHL Hospital Stay (d)	Complications	Follow-Up (mo)	Outcome
1	Wilson's disease	Biliary strictures	78 mo	13	None	53	Uncomplicated
2	HCV	Biliary strictures	75 mo	14	None	43	Uncomplicated
3	HCV	Biliary strictures	14 mo	40	Biliary fistula	19	Uncomplicated
4	HCV	Ischemic necrosis	2 d	20	None	18	Re-LT

desobstructed, but the right hepatic artery remained lost. The patient underwent recurrent episodes of cholangitis. Because the biliary strictures were mainly in the right biliary tree, the patient underwent RHL in 1996.

Patient 2. Patient 2 was born in 1935. He underwent LT in 1990 for decompensated cirrhosis secondary to hepatitis C virus (HCV). In 1996, he underwent endoscopic retrograde cholangiography for recurrent cholangitis that showed a right bile duct stricture. The hepatic artery was open, assessed by Doppler ultrasonography. Endoscopic treatment with stents was not successful, and the right bile duct was considered occluded (Fig. 1). In 1996, he required hemodialysis for chronic renal insufficiency, in part related to cyclosporine therapy. In September 1996, he was hospitalized for recurrent sepsis, and abdominal computed tomography (CT) showed abscesses in the right liver (Fig. 2). He underwent RHL in October 1996 without complications and kidney transplantation in January 1997.

Patient 3. Patient 3, a man born in 1947, underwent uncomplicated LT in August 1997 for decompensated HCV cirrhosis. In October 1997, he was readmitted for cholangitis. The hepatic artery was open. Retrograde cholangiography showed strictures, mainly in the intrahepatic right bile duct (Fig. 3). These strictures were treated with a temporary stent. In a few months, the patient developed 5 recurrences of cholangitis requiring hospitalizations and underwent cholangiography several times for intrahepatic biliary strictures localized in the right liver. Endoscopic treatments with stents and balloons were unsuccessful, and in September 1998, CT of the liver showed hypoperfused regions of the right liver, suggesting abscesses (Fig. 4). In October 1998, the patient underwent RHL, during which abscesses of the right liver were confirmed. The postoperative period was complicated by a biliary fistula, which was treated conservatively. Abdominal CT, performed to evaluate abdominal pain in May 1999, showed compensatory hypertrophy of the left remnant liver (Fig. 5).

Patient 4. Patient 4 was born in 1945. He developed HCV cirrhosis complicated by a 6-cm hepatocarcinoma treated by chemoembolization in December 1996 and segment VII resection in January 1997. In November 1998, he underwent LT for decompensated cirrhosis, with a Roux-en-Y choledochojejunostomy. Postoperative day 2, the patient developed major cytotoxicity, and abdominal CT showed necrosis of the right liver (Fig. 6). At laparotomy, necrosis of

the right liver was confirmed, and RHL was performed. The hepatic artery was found to be patent. The patient left the hospital postoperative day 22 without further complications. At the 3-month follow-up hepatic Doppler examination, the hepatic artery could not be seen and thrombosis was confirmed by selective arteriography. The patient developed progressive jaundice and pruritus secondary to ischemic cholangitis and successfully underwent retransplantation in May 2000.



Figure 1. Endoscopic retrograde cholangiography of patient 2 showing obstruction of the right branch of the intrahepatic bile duct and preserved left bile ducts.



Figure 2. Abdominal CT of patient 2 showing abscesses in the right liver graft lobe.



Figure 3. Endoscopic retrograde cholangiography of patient 3 showing strictures mainly localized in the right intrahepatic bile ducts.

Results

The mean postoperative stay was 21 days (range, 13 to 40 days). The postoperative clinical course was not different from that of RHL in non-transplant patients because none of the patients developed transient liver failure or significant hyperbilirubinemia postoperatively. Patient 3 developed a biliary fistula treated conservatively with prolonged percutaneous drainage.

All patients were alive at last follow-up in May 2000. Patients 1, 2, and 3 did not experience further episodes of cholangitis and did not require hospitalization or retransplantation (mean follow-up, 38 months). Doppler ultrasonography showed arterial flow in the left hepatic artery and compensatory hypertrophy of the left liver remnant. Patient 4 needed retransplantation 18 months after LT for intractable cholangitis and jaundice related to late hepatic artery thrombosis.

Discussion

LT has transformed the prognosis of most patients with end-stage liver diseases. However, LT has become the victim of its success because currently, many patients who could be saved by LT die on waiting lists because of the donor organ shortage. Facing this drama, the transplant community has been seeking alternative sources of organ donors, such as non-heart-beating donors, marginal cadaveric donors, or living donors for adult liver transplant recipients. In addition, retransplantation uses a second donor liver, increasing the organ

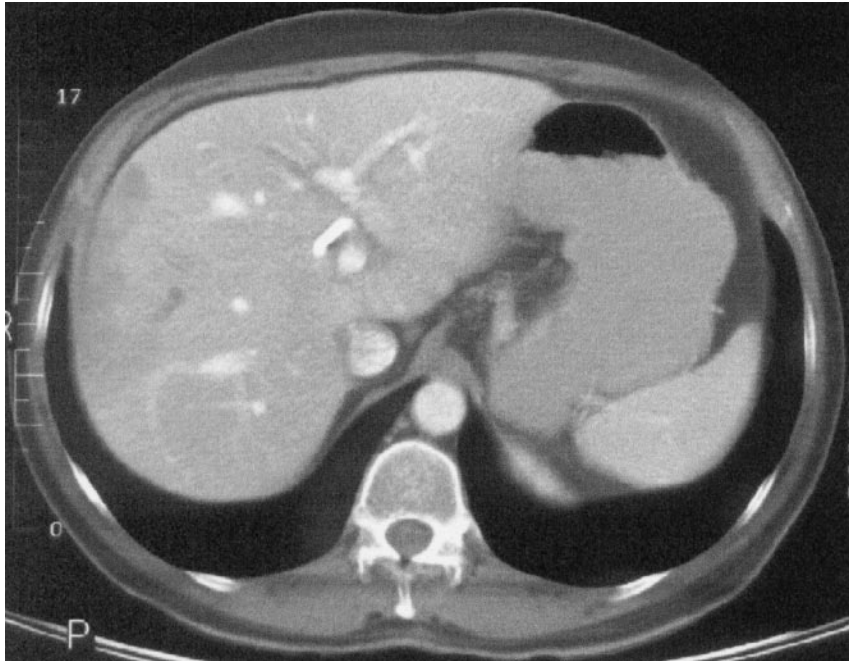


Figure 4. Abdominal CT of patient 3 showing infectious lesions in the right liver graft lobe.

shortage. Moreover, in comparison with primary LT, retransplantation faces a greater rate of morbidity and mortality^{2,3} and therefore should be avoided when possible. Graft rescue procedures have been described and are regularly performed to treat vascular or extrahepatic biliary complications after LT.⁴⁻⁶

This report presents our experience with RHL in 4 liver transplant recipients. Three patients developed intrahepatic biliary strictures, mainly localized in the right liver lobe, for which RHL was performed 14, 75, and 78 months after LT, resulting in rescue of the graft. In the fourth patient, the right part of the liver became

necrotic 48 hours after LT, possibly related to thrombosis of the right hepatic artery. RHL was successfully performed, and the patient was discharged postoperative day 20. However, this patient underwent late hepatic artery thrombosis that induced progressive ischemic cholangitis that led to graft failure and retransplantation. To our knowledge, 2 other cases of RHL after LT have been reported to date in the literature, allowing rescue of the grafts.^{7,8} Regeneration of the remnant of the donor liver occurred, and no liver insufficiency was observed. It is now clear that a liver graft can regenerate after living donation or use of a small-

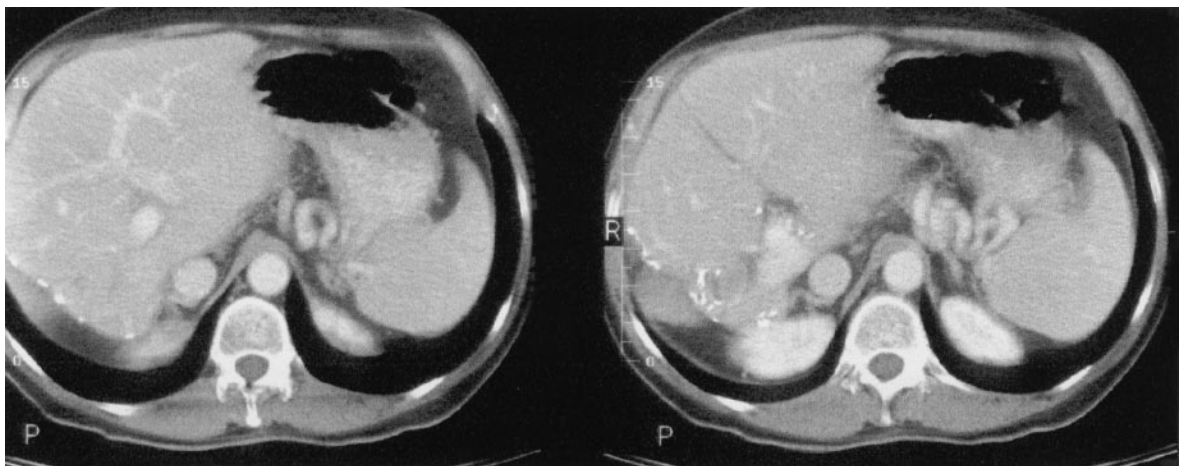


Figure 5. Abdominal CT of patient 3 showing compensatory hypertrophy of the left liver graft lobe 6 months after RHL.

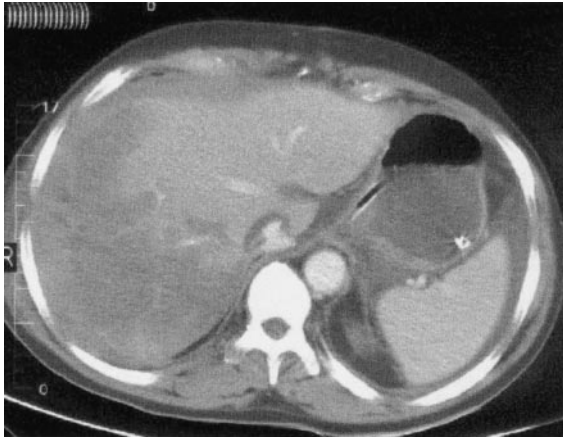


Figure 6. Abdominal CT of patient 4 showing ischemic necrosis of the right liver graft lobe 48 hours after LT.

for-size whole-liver graft, which was considered unproved 10 years ago.^{9,10} Using animal models¹¹ for liver graft regeneration, it has been suggested that calcineurin inhibitors may even promote liver regeneration.^{12,13} In all published cases of RHL after LT, the arterial blood supply to the left part of the liver was preserved. However, it is uncertain whether liver regeneration is possible in a donor liver with long-standing thrombosis of the hepatic artery or portal vein.

In conclusion, these 4 cases show that RHL can be performed after LT with an outcome not different from that in normal livers. This approach may avoid retransplantation in rare cases of biliary strictures localized to the right part of the liver graft.

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