



Living-Donor Liver Transplantation with the Left Lobe

13

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13.1 Donor Operation

An inverted, T-shaped incision is made, and the abdominal cavity is opened. After the exploration, cholecystectomy and intraoperative cholangiography are performed. The cholangiogram will guide the division of the bile duct in the latter stages of the operation.

The hepatoduodenal ligament is completely encircled with a sling to ensure vascular control. The left triangular ligament is divided, and the junction of the left and middle hepatic veins with the suprahepatic cava is defined. The mobilization is undertaken from the left side, dissecting the caudate lobe from the vena cava and ligating the small, short hepatic veins (Fig. 13.1). If a large draining vein is encountered, it should be preserved, dissected, and placed on a sling.

The hilar dissection is then approached from the left side of the hepatoduodenal ligament. The left hepatic artery is dissected, isolated, and encircled with a vascular sling. The middle hepatic artery should be identified and preserved, and the left branch of the portal vein is also dissected and encircled (Fig. 13.2). This is facilitated by the gentle retraction of the left hepatic artery. The bile duct is not dissected at this stage to avoid compromising the blood supply.

The parenchymal transection plane is identified with temporary occlusion of the vascular inflow (Fig. 13.3). Transection is then performed 5 mm to the right of the border of the Rex-Cantlie line. To assist the deeper parenchymal

transection, a liver-hanging maneuver can be used. A tape is passed between the middle and left hepatic veins and the right hepatic vein on the anterior surface of the cava, behind the caudate. At the hilar end, the tape is brought anterior to the left portal vein and hepatic artery. Using gentle traction on the tape, the parenchyma is transected using the method of choice, such as the Cavitron ultrasonic surgical aspirator (CUSA), water-jet dissector, or Harmonic scalpel.

Once parenchymal transection is completed, the left bile duct will be sharply cut, guided by the intraoperative cholangiography. The remnant stump is sutured closed with absorbable sutures (Fig. 13.4). This will leave the hilar structures isolated on slings and the hepatic vein encircled by the tape used for the hanging maneuver.

Once the inflow vessels are divided, the warm ischemia time starts, so this step should be performed rapidly but cautiously to avoid vascular damage. The left hepatic artery (with or without the middle artery) is ligated as proximally as possible and is divided. The left portal vein is then divided, with care not to injure the donor's portal vein trunk (Fig. 13.5). Finally, the left and middle hepatic veins, as well as any preserved short hepatic veins, are clamped and divided. The stumps of the hepatic veins are oversewn continuously with monofilament sutures.

The graft is removed and handed over to the surgical team performing the bench surgery. Hemostasis is secured, and a drain is placed on the cut surface of the liver.

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Figure 13.1

Dissection of short hepatic veins

Figure 13.2

Dissection of the hepatic arteries and portal vein

Figure 13.1

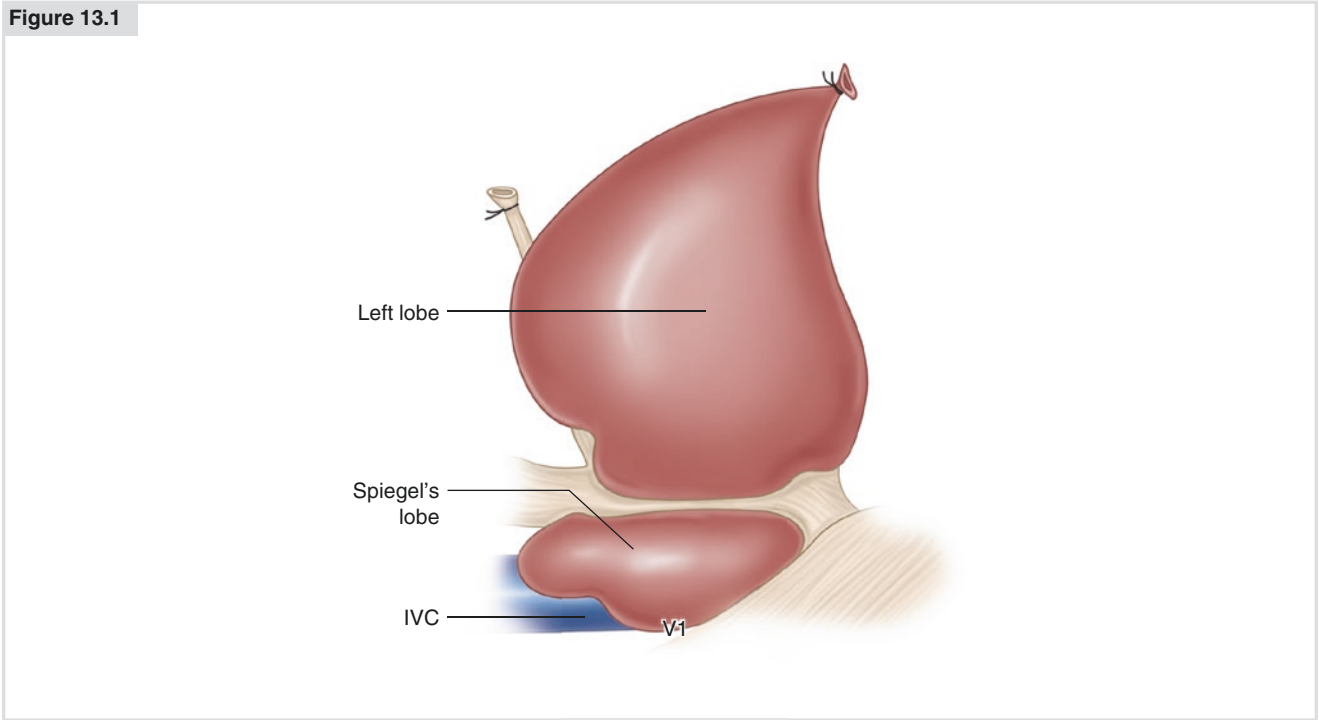


Figure 13.2

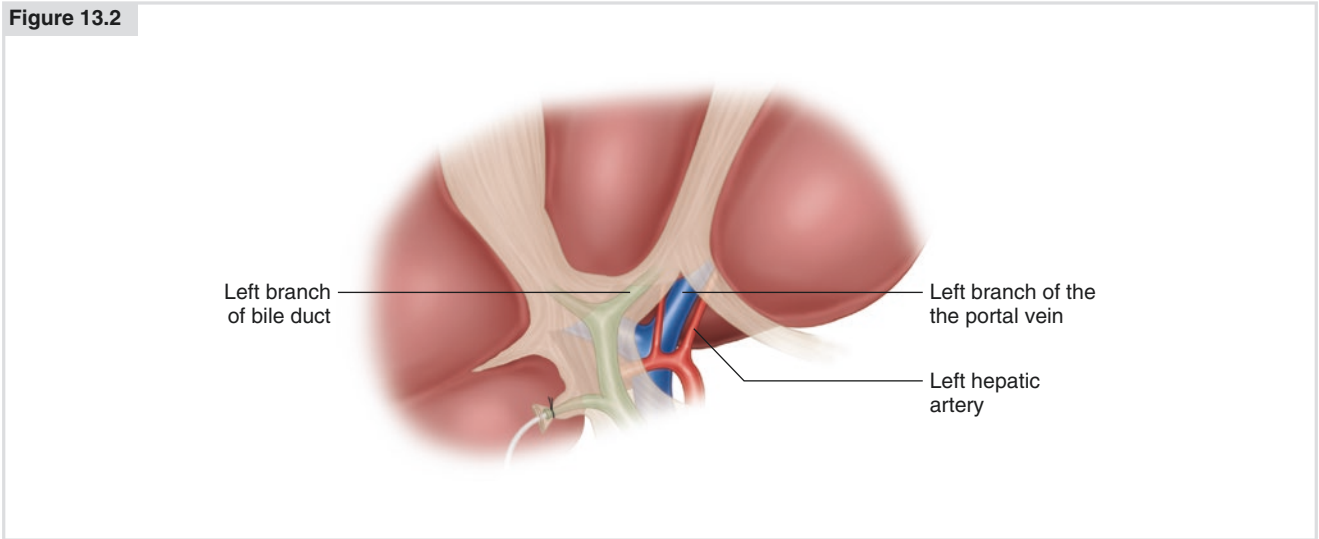


Figure 13.3

Demarcation line for parenchymal transection

Figure 13.4

Parenchyma dissection and cutting of the bile duct

Figure 13.3

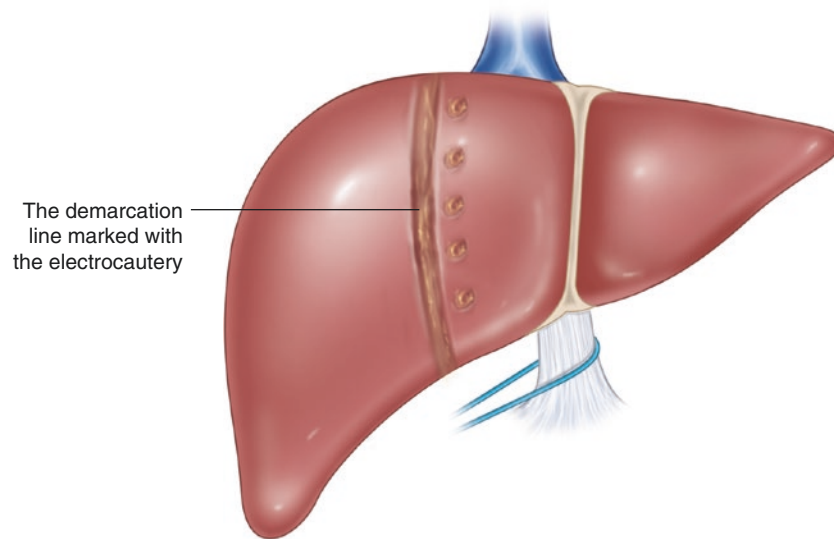


Figure 13.4

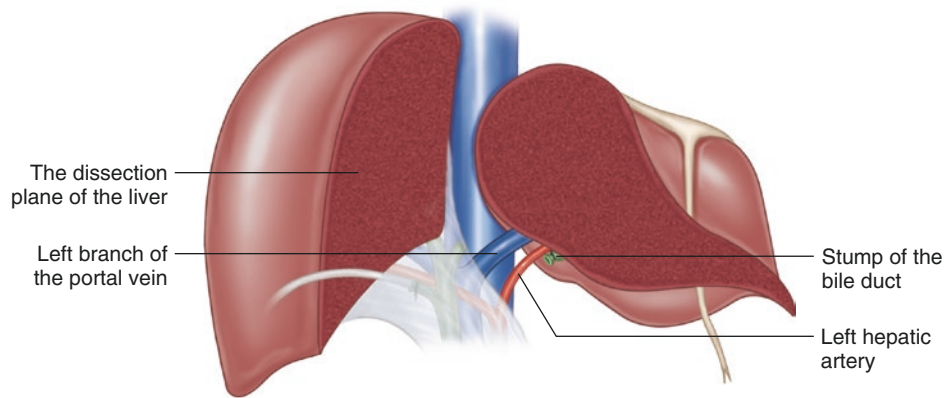
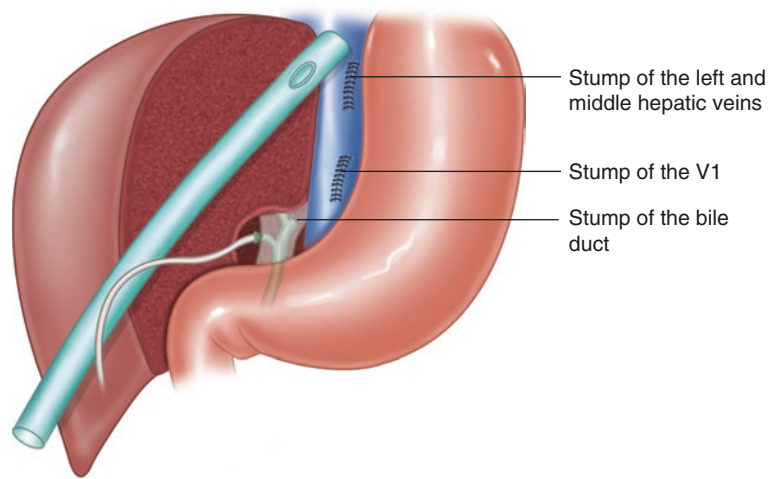


Figure 13.5

The artery and vein were closed and the drain is placed

Figure 13.5



13.2 Bench Surgery

Before the graft is removed, another surgical team prepares the back table with appropriate-size cannulas, instruments, solutions, ice, etc. When the graft is removed, it will be immediately brought to the back table and immersed in chilled normal saline solution. An appropriate-sized cannula is carefully inserted into the orifice of the portal vein, and

cold normal saline solution is flushed through the vein (Fig. 13.6). The flushing is continued until the effluent from the hepatic veins is clear. The preservation solution is replaced with cold normal saline solution. The artery and the bile duct are not flushed.

The most important aspect of the bench surgery is venous outflow reconstruction. The right side of the middle hepatic vein, the left side of the left hepatic vein, or both are cut longi-

Figure 13.6

The liver graft was flushed at the bench

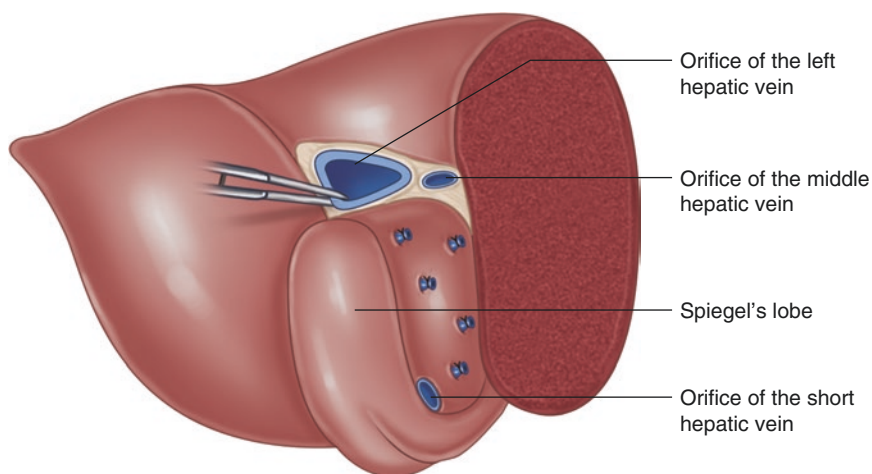
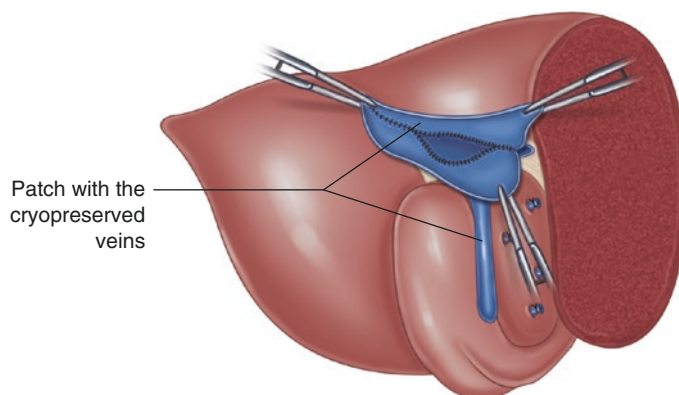
Figure 13.7

Venous outflow reconstruction at the bench with attachment of a vein patch. The extension graft is spatulated at one end and anastomosed to the orifice of the short hepatic vein, and the other end is sutured to the posterior cuff of the left and middle hepatic veins

tionally, and a rectangular-shaped vein patch is attached. This is usually a cryopreserved iliac vein, which is opened longitudinally to widen the diameter of the cuff. If a short hepatic vein has been preserved, this can be anastomosed to the recipient cava, or venoplasty of the short hepatic vein onto the left and middle hepatic vein orifice can be performed during the back table management. The extension graft is spatulated at one end

and anastomosed to the orifice of the short hepatic vein. The other end of the conduit graft is sutured to the posterior cuff of the left and middle hepatic veins providing a wide lumen that cannot be narrowed (Fig. 13.7).

After the bench reconstruction is completed, the graft is weighed, submerged in preservation solution, and carefully brought to the recipient operating room.

Figure 13.6**Figure 13.7**

13.3 Recipient Operation

The main technical principle when explanting the liver is to maintain the length and integrity of all hilar structures to maximize the implantation options. The left and right hepatic arteries should be dissected long. When accessory and replaced hepatic arteries are present, they should also be preserved long. The left and right portal veins should be dissected into the liver and isolated separately, maximizing the length as much as possible. The whole left portal vein (including the umbilical portion) can be resected, and a part of it can be used as a venous patch for the outflow reconstruction in the bench

procedure. This will also facilitate dissection of the left bile duct as peripherally as possible. Left and right bile ducts should be preserved. Preservation of the entire hilar plate is useful for maximizing the options for the bile duct reconstruction (Fig. 13.8). Caval preservation is imperative, and all short hepatic veins are identified, ligated, and divided. The three hepatic veins should be preserved as long as possible. All the ligaments between the liver and abdominal cavity are carefully divided. Dissection of all the phrenic veins is mandatory to allow clamping of the suprahepatic vena cava for outflow reconstruction. The right hepatic vein and the middle and left hepatic veins are clamped, and the liver is removed (Fig. 13.9).

Figure 13.8

Explantation of the liver after clamping of the hepatic veins. The right and middle/left hepatic veins are clamped. The portal vein is also clamped and small bulldog clamps are applied on the right and left hepatic arteries

Figure 13.9

Creation of the hepatic arterial anastomosis. The artery and portal vein are reconstructed and the graft is reperfused

The right hepatic vein stump is oversewn. After the left and middle hepatic veins are joined into a single orifice, the inferior vena cava is cross-clamped above and below the hepatic veins. The right side of the middle hepatic vein is then cut toward the closed right hepatic vein, making a horizontal cavotomy to match the venous patch on the graft side. The donor liver is brought out of ice, and the venous patch graft is sutured to the cavotomy site. Left-liver cases almost always require a single-portal anastomosis between the graft left portal vein and the recipient left portal branch or portal vein trunk. Alignment is critical, and the anterior walls of the graft and recipient left portal branches are marked with 6-0

Prolene®. The hepatic arterial anastomosis is generally performed in an interrupted fashion with 8-0, 9-0, and 10-0 nylon sutures under an operating microscope. We prefer a duct-to-duct anastomosis for the bile duct reconstruction. The possible advantages of the duct-to-duct anastomosis include the absence of an enteric anastomosis, a functional sphincter of Oddi, and possible endoscopic approach to the anastomotic sites. Biliary tree anastomosis should be free of tension; upon completion, cholangiography through the external stent tube is used to check for leakage and stricture. The benefit of the stent tube across the anastomotic site remains controversial.

Figure 13.8

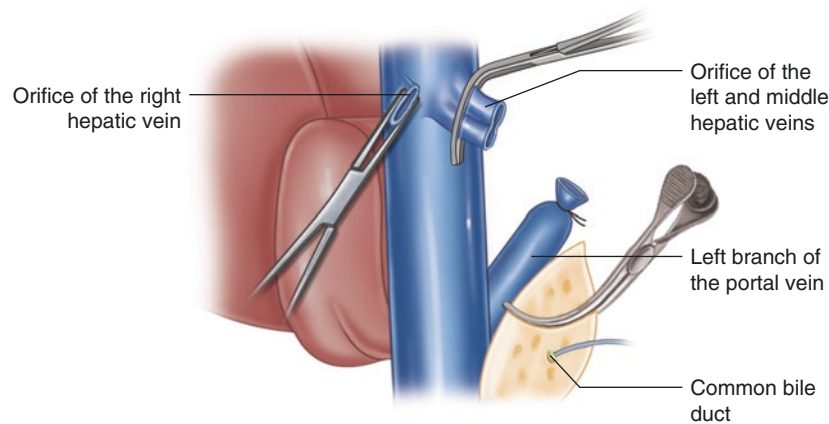
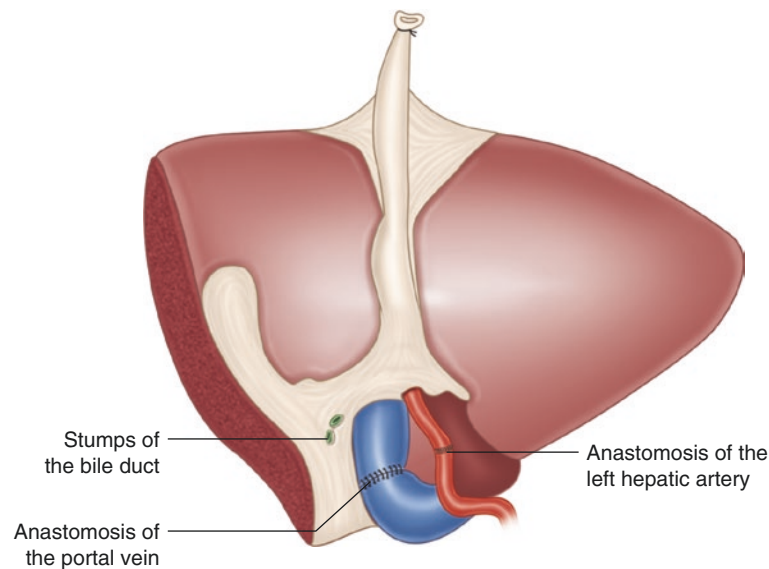


Figure 13.9



13.4 Results

13.4.1 Donor

Donors will be monitored closely during the immediate postoperative course. Frequent laboratory evaluations, including liver function tests, creatinine, and prothrombin time, should be carried out. The nasogastric tube should remain in place until bowel function returns. Acid-blocking agents are administered until hepatic function is recovered and oral diet is started. Prophylactic antibiotics are administered preoperatively and are continued for 1–2 days after the operation. Incentive spirometry is recommended to prevent atelectasis. Lower extremity sequential compression devices should remain in place until patients are ambulatory.

Bile juice leakage from the dissection of the liver or the stump of the bile duct is the most common complications (5%).

13.4.2 Recipient

Postoperative management of a living donor recipient is similar to that for deceased donor liver transplantation. In the immediate postoperative period, close invasive cardiac monitoring is necessary to avoid excessive central venous pressure. Necessitated tacrolimus doses are usually smaller for partial liver graft than that of whole liver graft, which should be adjusted according to the size of the graft [1].

When the amount of bleeding is much and the low blood pressure status is seen during the transplant procedure, we have to expect the postoperative renal failure. The patient body weight and in-out balance will be checked regularly every 12 h to maintain the patients' general condition and prevent acute renal failure. Within 3–4 postoperative days, the diuretic stage will come.

Complications of the recipients include hepatic arterial thrombosis (3%), portal vein stenosis (2%), hepatic vein stenosis (1%), bile duct leakage (5%), and bile duct stenosis (20%).

13.5 Conclusions

Successful transplantation using a left liver graft is dependent on careful donor selection for a specific recipient which includes an accurate assessment of graft size using computed tomography. In donor procedure, the left and the middle hepatic arteries and left and main portal trunk are exposed. The caudate portal veins branch to the Spiegel lobe has to be preserved. Bile duct transection including hilar plate dissection is then carried out. In implantation, one of the most important technical aspects is caval drainage, which is followed by portal vein, hepatic artery, and biliary anastomosis.

Reference

1. Sugawara Y, Makuuchi M, Kaneko J, et al. Correlation between optimal tacrolimus doses and the graft weight in living donor liver transplantation. *Clin Transplant*. 2002;16:102–6.