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CASE REPORT

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Adult living donor liver transplantation using right posterior segment

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Abstract Varying circumstances call for various types of donor hepatectomy. We report here on an unusual type of donor hepatectomy, right posterior segmentectomy. A 46-year-old sister of the recipient was the donor. Her preoperative CT showed that the right anterior portal vein originated from the umbilical portion of the left portal vein. Intraoperative cholangiography revealed that the right posterior hepatic duct joined the common hepatic duct in the extrahepatic area. Right posterior segmentectomy was performed without transfusion in the donor. The postoperative course proceeded favorably in both donor and recipient until postoperative day 41, when the recipient unexpectedly expired as a result of cerebral hemorrhage. The donor was discharged with good liver function. We can conclude that the right posterior segment of the donor can be used as a graft, when the volume of left liver is not enough for both donor and recipient, or the vascular structures favor right posterior segmentectomy.

Keywords Living donor liver transplantation · Right posterior segmentectomy

Introduction

Living donor liver transplantation (LDLT) was initially introduced to overcome organ shortage for pediatric patients [2]. Due to the recent success of LDLT in the pediatric age group, this procedure has been extended to adult patients. However, LDLT for adult recipients is limited by the critical mass of liver required to sustain life. For donor safety, a minimal volume of liver should be resected, but sufficient volume should be obtained to sustain the metabolic demands of the recipient. Obviously, a volumetric imaging study, either by computed tomographic (CT) scanning, or magnetic resonance imaging, becomes an essential part of the donor work-up. The type of donor hepatectomy for LDLT should be selected on the basis of both the segmental liver volume of the donor and the recipients's body size to prevent liver failure in recipients and ensure donor safety. Right lobectomy or extended left lobectomy is commonly used in most cases. However, variations of vascular and biliary structures sometimes make it difficult to perform formal hepatic resection. Here we report on a case involving an unusual type of donor hepatectomy, right posterior segmentectomy, which was performed at our hospital.

Case report

A living donor liver transplantation using the right posterior segment of the donor was performed in November 29, 1999. The recipient was a 45-year-old woman who had suffered hepatitis B-associated liver cirrhosis; the donor was her 46-year-old elder sister. The donor was screened by laboratory tests, including complete blood cell count, liver and renal biochemistry values, and viral serologic studies. All the laboratory results were within normal limits, and an O^+ blood type donor/patient match was obtained. CT and Doppler ultra-sonography showed that a right anterior portal branch originated from the umbilical portion of the left portal vein (Fig. 1). The estimated total liver volume was

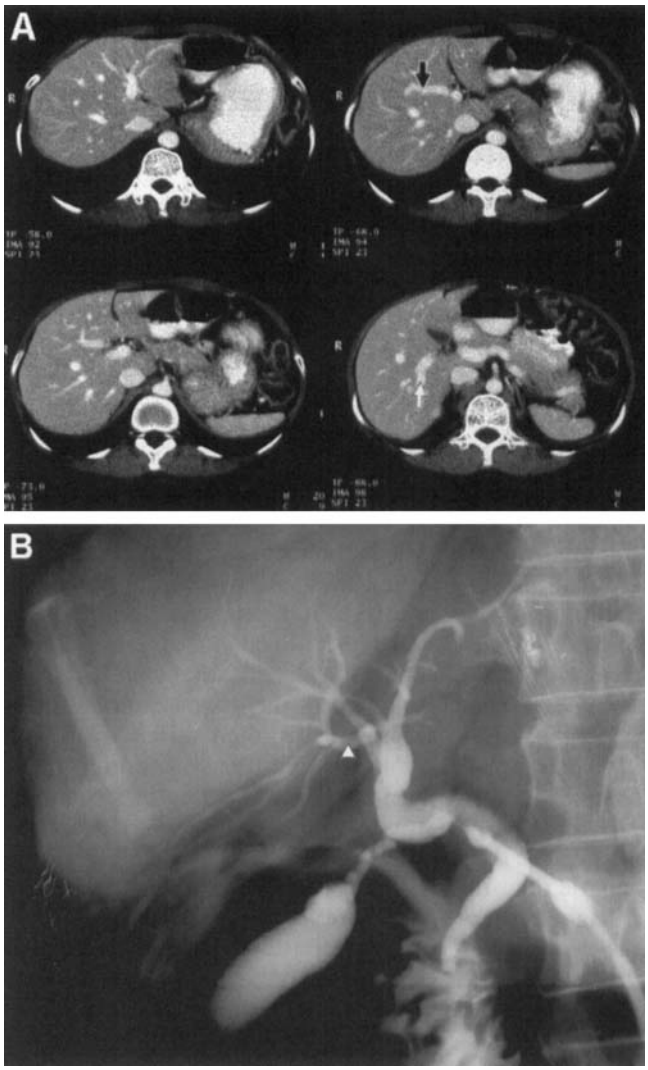

Fig. 1 Preoperative computerized tomography (**A**) and intraoperative cholangiography (**B**) of donor. The *black arrow* indicates the right anterior portal vein that originates from the umbilical portion of the left portal vein, and the *white arrow* indicates the right posterior portal vein. The *arrowhead* shows the right posterior hepatic duct, which was separated in the extra-hepatic area

912.6 ml. The volume of left lobe, right anterior segment and posterior segment were 287.5 ml, 285.0 ml, and 340.1 ml, respectively. Taking into account the anomalous anatomy of the portal vein, we planned a right posterior segmentectomy. The ratio of the remnant liver volume to the total volume of the liver of the donor was 62.7%, measured by CT volumetry. As the standard liver volume (SV) of the recipient was 1082.8 ml and the graft volume (GV) was 340.1 ml, the GV/SV was 31.4%.

In the donor, the laparotomy was performed via a bilateral subcostal incision with an upward midline extension. After preliminary hilar dissection and cholecystectomy, operative cholangiography via cystic duct cannulation was performed to study the bile duct anatomy (Fig. 1). The cholangiogram revealed an early-branching pattern of the right hepatic duct, which allowed the right posterior hepatic duct to be separated in the extrahepatic area. Further hilar dissection was then performed to isolate the right hepatic artery that branched early into the right anterior and posterior branches, and the posterior branch of the right hepatic artery was also isolated at the hilum. Finally, the right posterior portal branch, which joined the left portal vein, could easily be isolated. Artery, portal vein, and bile duct to the right posterior segment were all isolated outside the liver. The right lobe of the liver was then rotated towards the left side in order to divide the right triangular ligament and the tiny venous branches between the anterior surface of the inferior vena cava and the posterior surface of paracaval portion of the caudate lobe. The rotation was performed intermittently to avoid protracted twisting of the inflow and outflow vascular pedicles. The right hepatic vein and the right inferior hepatic vein larger than 1 cm were preserved until the time of harvesting. The liver was transected in a plane which was demarcated on the liver surface, temporarily occluding the right posterior portal branch and the right hepatic artery. Inflow vascular occlusion was not used during liver transection. When the transection of the liver approached the liver hilum, the right posterior hepatic duct together with the surrounding Glissonian sheath was encircled. After identifying the confluence of the right anterior and posterior hepatic duct, the right posterior hepatic duct was divided near the confluence. The divided end at the confluence was closed transversely using a continuous 6-0 nonabsorbable suture. The liver transection was continued immediately anterior to the right hepatic vein. After heparinization, the right posterior portal branch was cannulated, and the right posterior segment was harvested and perfused with UW solution. The weight of right posterior segment was 350 g; the graft to the recipient body weight ratio (GRWR) was 0.64%. A drain was inserted into the right subphrenic cavity before wound closure. The operation time was 285 min. No transfusion was done and no specific problem occurred during the operation. In the recipient, the diseased liver was resected with the inferior vena cava preserved, and a portocaval shunt was performed. The right hepatic vein and the right inferior hepatic vein were anastomosed sequentially to the inferior vena cava. After rinsing with cold lactated Ringers's solution, the right

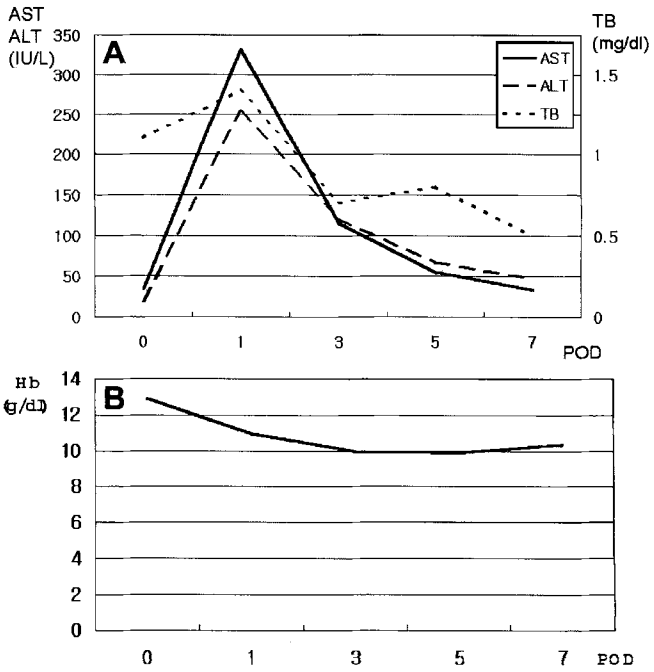

Fig. 2 Serum AST, ALT, TB levels (**A**) and blood Hb (**B**) levels during the first postoperative week. *AST* aspartate transaminase, *ALT* alanine transaminase, *TB* total bilirubin, Hb hemoglobin

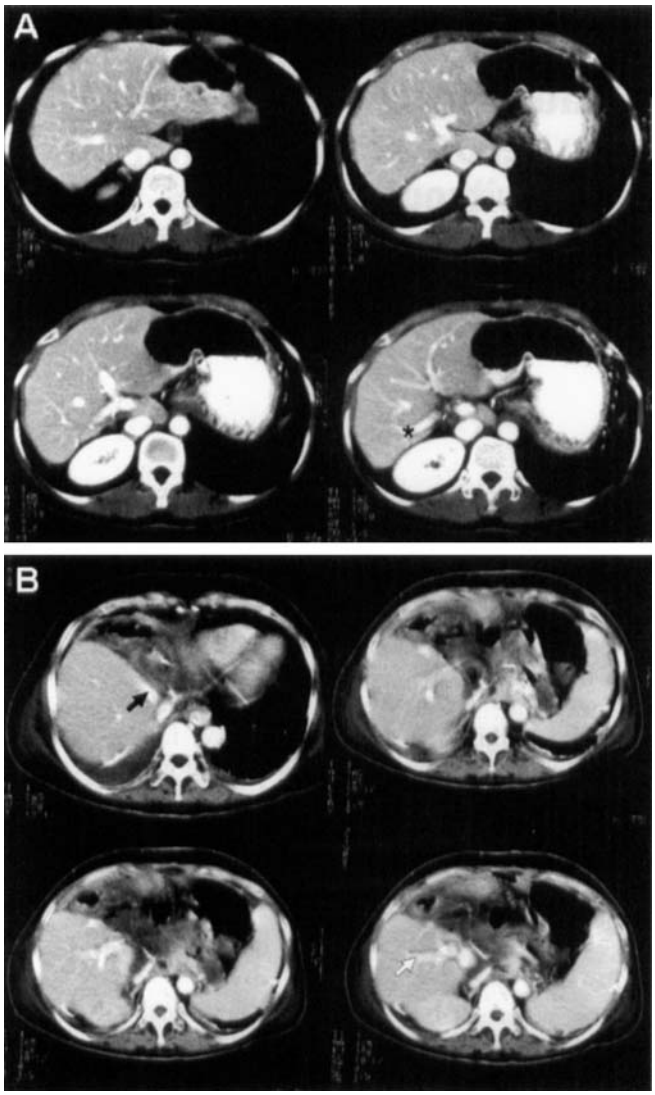

Fig. 3 Postoperative computerized tomography of donor (**A**) and recipient (**B**). The *asterisk* indicates the right anterior portal vein of the donor, the *black arrow* marks the right hepatic vein of the graft, and the *white arrow* marks the right posterior portal vein of the graft

posterior portal vein of the graft was anastomosed to the right portal vein of the recipient. The right posterior hepatic artery of the graft was anastomosed to the right hepatic artery of the recipient. The biliary reconstruction was made with an Roux en-Y hepaticojejunostomy. The pre & postoperative serum total bilirubin (TB), alanine transaminase (ALT), aspartate transaminase (AST), and hemoglobin (Hb) levels of the donor are shown in Fig. 2. The donor was discharged with good liver function on the postoperative day 9. No complication developed thereafter. The donor has returned to her previous occupation and remains healthy. The recipient followed a postoperative course similar to other recipients of LDLT, with normalized liver functions on postoperative day 25, when AST/ALT was 19/15 IU/L, and her TB was 1.0 mg/dl. The biliary fistula was detected on postoperative day 34, and a revision of the hepaticojejunostomy was done. Unfortunately she expired unexpectedly as a result of a cerebral hemorrhage on postoperative day 41. Figure 3 shows the postoperative follow-up CT of the donor and of the recipient.

Discussion

Since our LDLT program was started in January 1999 until June 2001, 79 LDLTs have been carried out in our hospital . Right lobectomy, left lobectomy, and left lateral segmentectomy are the main types of donor hepatectomy performed. LDLT using the left lateral segment is widely accepted as a means of meeting the demand for organs in the pediatric population [3], in which an ischemic change can be seen in the left medial segment in the remnant donor liver. However, right lobectomy is being increasingly performed safely in healthy adult living donors [1], where the right anterior segment can be congested, as it drains into the middle hepatic vein. In contrast, the graft of a right posterior segment has no congestion or ischemic change. In this case, the ratio of the graft volume to the whole liver volume in the donor was 37.3% to ensure donor safety, and the GRWR was 0.64%, which was relatively small but sufficient to sustain the recipient. Therefore, the right posterior segment could safely be used as a graft for LDLT. In spite of the anatomy of the portal vein, the hepatic artery and the bile duct permitted right posterior segmentectomy. Optimal resection, however, required careful planning of the operative strategy.

This is the first report of LDLT using the right posterior segment. Although the recipient expired due to cerebral hemorhhage occurring incidentally, we conclude that the right posterior segment can be used as a suitable graft.

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