Extracorporeal Hepatic Resection for Unresectable Giant Hepatic Hemangiomas

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In order to perform surgical treatment for tumors unresectable for anatomical reasons, there are two approaches: one is liver transplantation, and the other is extracorporeal hepatic resection (ECHR).1-7 The benefit of liver transplantation is its simple surgical concept, and the benefits of ECHR are that it is immunosuppression-free and that organ donors are unnecessary.1-6

The patient was a 39-year-old female referred to our hospital for possible living donor liver transplantation for her huge and multiple unresectable hemangiomas of the liver. Although she had undergone transcatheter arterial embolization 6 months previously, they showed an increase in size. At the time of referral, she demonstrated abdominal distention with shortness of breath. Her laboratory testing showed normal liver function tests, including a total bilirubin level of 1.3 mg/dL, an albumin level of 4.3 g/dL, and a prothrombin time of 13.6 seconds. A computed tomography scan of the abdomen showed 4 huge tumors (Fig. 1). This location of the tumors and their benign origin led us to choose ECHR rather than living donor liver transplantation after detailed informed consent was obtained. As is well known, the chance of receiving a liver graft from a deceased donor is almost zero in Japan.7-9 The estimated autograft volume after ECHR was 590 g, representing a graft volume/standard liver volume ratio of 49.6% (Fig. 2).

The patient was taken to the operating room, and laparotomy was performed (Fig. 3). The liver was severely enlarged, but the nontumor portion looked like normal hepatic parenchyma. After the dissection of the hilar structures at the mid-hilum, the portosystemic venovenous bypass, using reinforced venous cannulas (Edwards Life Sciences, Inc., Irvine, CA), was established from the inferior mesenteric vein with 16Fr and from the left saphenous vein with 15Fr to the left axillary vein with 14Fr. The patient was started on the bypass at the rate of 4 L/min with a stable circulatory condition. After the division of the proper hepatic artery, the total liver was mobilized from the diaphragm. The common hepatic duct was divided, the vascular clamps were applied and followed by division on the portal vein and suprahepatic and infrahepatic vena cava, and then the total hepatectomy was performed. The explanted liver was flushed with 3 L of normal saline followed by 3 L of University of Wisconsin solution. Intraoperative ultrasound was done on the backtable for the determination of the exact cutting line. After dissection of the vena cava from the dorsal liver with ligation of the short hepatic veins, the huge hemangiomas in segment 1, segment 2 to 3, caudal segment 4, and segment 6 to 7 were resected with a Cavitron ultrasonic surgical aspirator (Valleylab, Inc., Boulder, CO; Fig. 2). After resection, vascular and biliary leakage tests using an injection of University of Wisconsin solution were performed, and the leakage points were repaired with fine sutures. The actual weight of the whole explanted liver was 4770 g, and the auto liver graft after extracorporeal resection was 510 g, representing a graft volume/standard liver volume ratio of 42.3%. The liver graft was placed in an orthotopic position, and then vascular reconstruction was done in the following order: the suprahepatic and infrahepatic vena cava, the portal vein, and the hepatic artery. Reperfusion of the graft was done slowly for thermoregulation and hemodynamic stability. Multiple bleeding

Abbreviations: CHD, common hepatic duct; ECHR, extracorporeal hepatic resection; IVC, inferior vena cava; LHV, left hepatic vein; LPV, left portal vein; MHV, middle hepatic vein; PHA, proper hepatic vein; PV, portal vein; RHV, right hepatic vein; S, segment.

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points were found from the cut surfaces with significant blood loss, and those were controlled with an argon beam coagulator, fine sutures, and Tacho Comb (ZLB Behring, Tokyo, Japan). The hepatic artery flow was 305 mL/min, and the portal vein flow was 1200 mL/min after reperfusion. The duct-to-duct biliary reconstruction over a 3.0-mm internal external stent (retrograde transhepatic biliary drainage tube, Sumitomo Bakelite, Akita, Japan) was carried out between the common bile duct. A cholangiogram was negative for stenosis. The anhepatic time was 6 hours 41 minutes, the cold ischemic time was 6 hours 5 minutes, and the warm ischemic time was 46 minutes. The operative time was 15 hours 59 minutes, and the blood loss was 32,455 g. Although the graft recovery was smooth in the early postoperative days, she underwent relaparotomy on postoperative day 20 for closure of the bile leak from the cut surface on segment 8 and bile duct revision using Roux-en-Y hepaticojejunostomy for bile duct stricture. Afterward, she showed good postoperative course, and she was discharged from the hospital on postoperative day 32 (Fig. 4). Presently, at 8 months after surgery, the patient has a normal liver function with a regenerated autotransplanted liver graft.

Ex situ/in vivo resection of a liver tumor was first reported by Hannoun et al. in 1991. They mobilized...
the liver from the body after the division of the hepatic veins, retaining the connection of the hepatic pedicle, and resected 3 huge liver tumors, including a diffuse hemangioma. Complete ex situ ECHR was reported by Pichlmayr et al.2 in 1990 with a success rate of 4/9 (44.4%), and this was followed by Yanaga et al.3 from our center in 1993 and Lodge et al.4 in 2000. Although not in the English literature, Brekke et al.5 and Severtsev6 both reported ECHR and autotransplantation similar to the current case.

Because of the anatomical locations of the tumors in the current case, we thought the central part of this liver could be preserved after the tumor resections. However, giant hemangiomas are usually hyperemic soft tumors with a thin, fragile wall, and it is almost impossible to perform hemostasis once they start to bleed. The multiple resection planes in this case were anticipated to be huge and nonanatomical, all causing massive bleeding. We were also afraid of uncontrolled bleeding during hepatic resection and of accidental injuries to major hepatic structures including major Glissonian branches or hepatic veins under a bloody surgical field. Because the remnant liver would be a reduced one, such injuries might jeopardize the patient’s life. We were more confident in bench surgery and transplantation because of our experience in liver transplantation than in a challenging and extremely complicated hepatic resection. The bypass draining from the inferior mesenteric vein was established before the mobilization of the liver in order to clamp the liver hilum with stable circulatory status just in case there was accidental bleeding from the tumor during the mobilization.

On the other hand, we still need two technical refinements for this method. One is to reduce the massive postreperfusion bleeding; the cut line needs to be as anatomical as possible, with a more meticulous resection process with fine repairs. The other is biliary reconstruction, which needs to be a hepaticojejunostomy. The bile duct stenosis even with stenting and negative intraoperative cholangiogram seemed due to the ischemic nature of the bile duct after the hilar dissection during the explantation. We herein have described ECHR for multiple giant hemangiomas of the liver that were otherwise untreatable. Although this technique still has various points that need improvement, it may be an attractive option in the future for treating liver tumors.

REFERENCES