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No-Touch En Bloc Right Lobe Living-Donor Liver Transplantation with Inferior Vena Cava Replacement for Hepatocellular Carcinoma Close to Retrohepatic Inferior Vena Cava: Case Report

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ABSTRACT

Current studies have shown that living-donor liver transplantation (LDLT) for hepatocelluar carcinoma (HCC) satisfying the Milan criteria does not compromise patient survival or increase HCC recurrence compared with deceased-donor liver transplantation (DDLT). For patients with HCC beyond the Milan criteria, however, worse outcomes are expected after LDLT than after DDLT, despite insufficient data to reach a conclusion. Regarding operative technique, LDLT might be a less optimal cancer operation for HCC located at the hepatic vein confluence and/or paracaval portion. The closeness to the wall of the retrohepatic inferior vena cava (IVC) is greater than in conventional DDLT, rendering it difficult to perform a no-touch en bloc total hepatectomy. An LDLT, which must preserve the native IVC for the piggyback technique during engraftment, may lead to tumor remnants. To reduce recurrences after LDLT, we successfully performed a no-touch en bloc total hepatectomy including the retrohepatic IVC and all 3 hepatic veins. IVC replacement with an artificial vascular graft together with a modified right-lobe LDLT was performed for a patient having advanced HCC close to the hepatic vein confluence and paracaval portion. There was no artificial vascular graft-related complication, such as thrombosis or infection. Despite the limitations of LDLT, requiring the piggyback technique for graft implantation, IVC replacement using an artificial graft led us to perform a no-touch en bloc total hepatectomy as with a conventional DDLT.

THE PIGGYBACK hepatectomy technique in liver transplantation is avoided in patients with hepatocellular carcinoma (HCC) because of the theoretical increased risk of a positive vena caval margin with the potential for metastatic spread of tumor via the native vena cava or through the hepatic veins (HVs). There is increased operative manipulation of a liver bearing HCC during a piggyback hepatectomy, which also may lead to an increased risk of HCC spread.[1] Current studies, however, have shown that living-donor liver transplantation (LDLT) for HCC meeting the Milan criteria[2] does not compromise patient survival or increase HCC recurrence compared with deceased-donor liver transplantation (DDLT).[3–6] Among subjects with HCC beyond the Milan criteria, however, LDLT may lead to worse outcomes than DDLT, although the data are insufficient to establish this conclusion.[4,7] Particularly for patients with advanced HCC close to the retrohepatic inferior vena cava (IVC) and/or HV confluence, conventional DDLT with an en bloc total hepatectomy might be a better cancer operation than LDLT with a piggyback total hepatectomy.

We experienced a case of HCC recurrence in the transplanted liver and IVC wall after LDLT for an advanced HCC close to the IVC wall and the HV confluence (Fig 1). Similar to the report of Matsuda et al, residual microscopic cancer cells in the short HV and the IVC wall were considered to be the cause of the recurrence. We performed a no-touch

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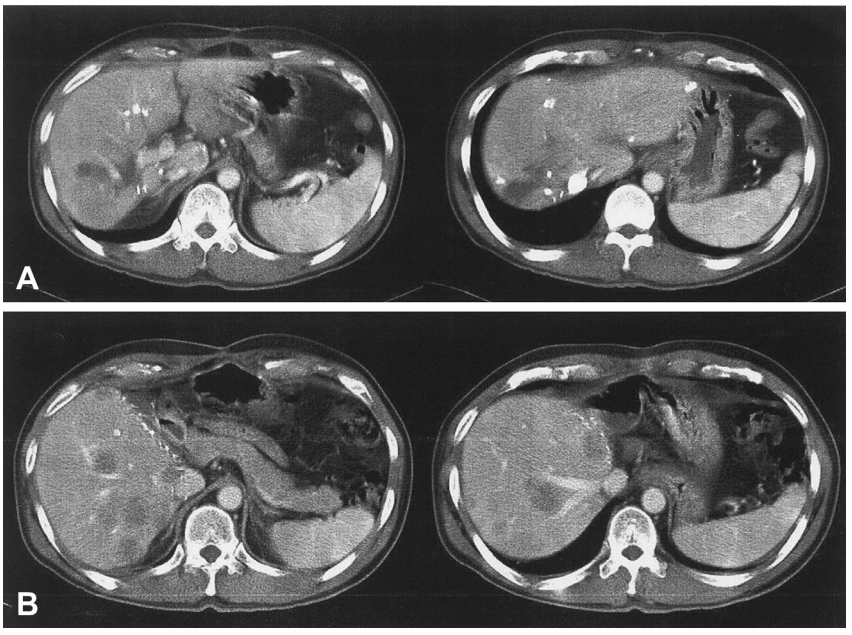

Fig 1. Critical case of hepatocellular carcinoma (HCC) recurrence after living-donor liver transplantation for advanced HCC close to the inferior vena cava (IVC) wall and the hepatic vein (HV) confluence. (A) Preoperative computerized tomography (CT) scan showing multiple hepatocellular carcinomas close to the IVC wall and HV confluence. (B) Follow-up CT scan 12 months after transplantation revealed recurrence in the transplanted liver and IVC wall.

en bloc total hepatectomy including the retrohepatic IVC and all 3 HVs, ie, the same method as a conventional DDLT, followed by reconstruction of the IVC with the use of a 32-mm-diameter Dacron artificial vascular graft followed by an LDLT, a modified right-lobe graft.

CASE PRESENTATION

A 61-year-old man was referred to our hospital for LDLT. His diagnosis was hepatitis B liver cirrhosis of Child-Pugh B score 7 points, and a Model for End-Stage Liver Disease score of 13 points. Initial dynamic computerized tomography (CT) scan showed a maximum of 8.1 cm among 3 HCCs in both liver lobes without gross vascular invasion, but closely abutting the trunks of the 3 major HVs and the IVC wall. There was no evidence of distant metastasis on preoperative imaging, including chest CT bone and positron-emission tomography using ^{18}F-fluorodeoxyglucose. The lesions were but beyond the Asan criteria, namely, a single lesion <5 cm and up to 6 nodules without gross vascular invasion.[8]

The alpha-fetoprotein and protein induced by vitamin K antagonist II values were 2.3 ng/mL and 32 mAU/mL, respectively. Preoperatively transarterial chemoembolization (TACE) for the HCCs was performed not only to suppress tumor progression but also to down-stage the tumors. Preoperative follow-up CT scan revealed the tumors to show good lipiodol uptake with the size reduced to 6.0 cm but still with a partially viable portion (Fig 2).

The donor was his daughter, a 33-year-old woman. Her body weight and height were 52 kg and 166 cm, respectively; her body mass index was 19 kg/m^2. She donated a modified right lobe (MRL) graft that weighed 750 gm with minimal fatty change; the graft-to-recipient weight ratio was 1.01%.

Surgical Technique

Via an inverted-T incision, we dissected the hepatic hilum to reduce tumor cell spread from manipulation of the HCC before mobilizing the liver. The dissected hepatic artery was divided after obtaining adequate length and diameter to anastomose it to the donor hepatic artery. The bile duct was transected just above the bifurcation of right and left hepatic ducts, followed by dissection of the bilateral portal branches. Subsequently, the infrahepatic IVC was dissected to the renal veins and encircled. The suprahepatic IVC was also encircled through minimizing the liver mobilization and dissecting the bilateral triangular, coronary, and gastrohepatic ligaments. Then, the left groin was dissected to isolate the femoral vein and prepare for a venovenous bypass (VVB). We obtainere autogenous great saphenous vein (GSV) for HV plasty to ensure good outflow between the liver graft and the replaced IVC bearing an artificial vascular graft.

The first step of the no-touch en bloc total hepatectomy, established a femoral-to-jugular VVB, seeking to maintain stable vital signs during the procedure. After division of the bilateral portal vein, a bypass catheter was inserted diverting the splanchnic blood flow through the VVB to prevent mesenteric congestion. After cross-clamping the supra- and infrahepatic IVC, we divided the infrahepatic IVC just above the renal vein insertion site. All retroperitoneal attachments of the right lobe, including the right adrenal gland, were mobilize before the recipient liver was resected en bloc together with the retrohepatic IVC, which was replaced with a 32-mm Dacron vascular graft. After