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Case Report

Reconstruction of graft hepatic artery and portal vein with donor iliac vessel interposition in liver transplantation: one case report and review of the literature

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Abstract: A patient with friable hepatic artery and poor hepatic arterial inflow, portal vein thrombosis and serious gastroesophageal varices underwent modified piggyback liver transplantation. The hepatic artery was reconstructed by interposing donor's iliac arterial conduit anastomosed to the infrarenal aorta, while the portal vein flow was ensured by the interposition of donor's iliac venous graft. The graft function and blood flow through the anastomosis remains excellent more than 8 years postoperatively. We consider the interposition of iliac vessels is a viable alternative for arterial and portal reconstruction in adult liver transplantation when direct arterial or portal anastomosis cannot be routinely performed.

Keywords: Liver transplantation, hepatic artery, portal vein, iliac vessel interposition

Case report

The patient, a 73-year-old man with liver cirrhosis and portal hypertension, underwent periesophagogastric devascularization and splenectomy 51 years ago. He was admitted to our hospital again for liver transplantation with melena and hematemesis 8 years ago, and the confirmed diagnosis was upper gastrointestinal bleeding, liver cirrhosis, portal hypertension and hepatic decompensation. There was no positive sign except for physiognomy of chronic disease. The results of laboratory tests were listed as follows: routine blood test: WBC-3.2×10^9/L, Hb106 g/L, PLT167×10^9/L; chemical analysis of hepatitis: HBsAg(-), HBeAg(-), HBcAb(-), HCV(-); liver function test: ALT68 U/L, ALP143 U/L, ALB28 g/L, TP56 g/L, TBIL33.1 μmol/L, DBIL7.8 μmol/L; time of blood clotting: PT15.4 S, APTT47.60 S. The irregular-nodular liver surface and the disproportionate right and left lobe were presented in the three-dimensional computed tomography (CT). The gastroesophageal varices and calcification of thrombus in the portal vein were also visible in the CT (**Figure 1A**). A modified piggyback liver transplantation was performed when a graft from donor after cardiac death was provided.

Intraoperatively, we found that the portal vein became occlusive owing to a hard thrombus, which extended from the hepatic hilum to the junction of superior mesenteric vein and splenic vein, and the hepatic artery was friable and showed poor hepatic arterial inflow, as a consequence, the recipient portal vein and hepatic artery could not be used for anastomosis. After the diseased liver was resected, the donor's liver was transplanted without veno-venous bypass. The graft suprahepatic inferior vena cava (IVC) was anastomosed to the recipient's hepatic vein joint, and the graft infrahepatic inferior vena cava was closed. The arterial reconstruction was obtained using a donor iliac artery interposition graft between the recipient infrarenal aorta and the bifurcation of donor common hepatic artery and splenic artery. The portal vein reconstruction was performed in a similar way. The donor iliac vein graft was inter-

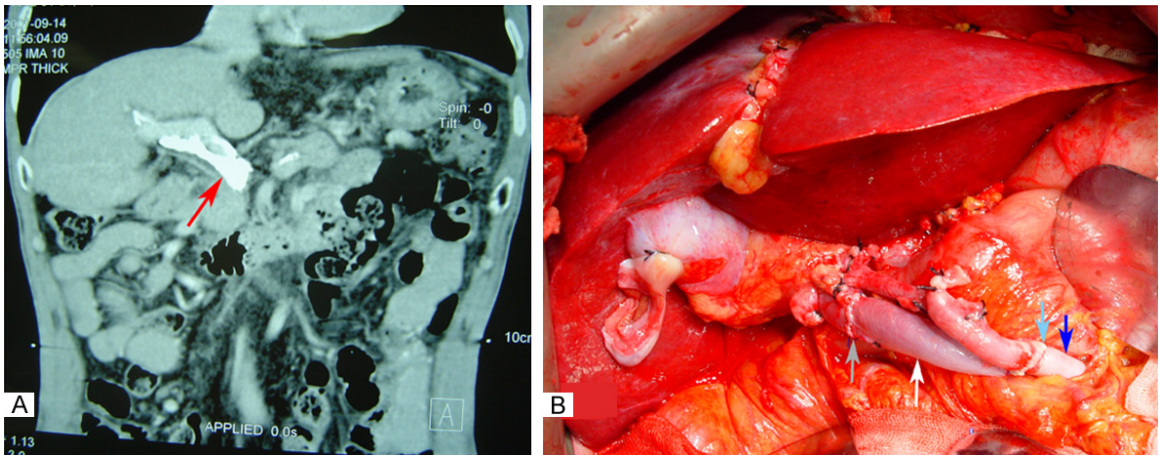

Figure 1. A: Preoperative three-dimensional CT. The red arrow shows calcification of thrombus in the portal vein. B: Intraoperative photography. The white arrow indicates the interposed iliac vein conduit, whereas the dark blue arrow indicates the interposed iliac artery conduit. The grey and light blue arrow respectively indicates the anastomosis with donor's portal vein and hepatic artery.

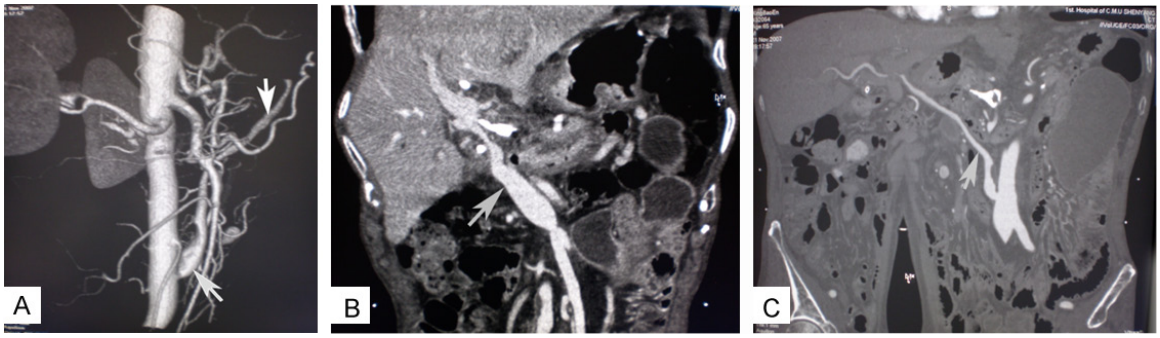

Figure 2. (A-C) At one month post transplantation, a three-dimensional CT shows the patent interposed iliac arterial conduit (white arrow in A), and the patent interposed iliac vein (grey arrow in B and C). The grey arrow in (A) indicates the proximal interposed arterial anastomosis with infrarenal aorta.

posed between the graft portal vein and the confluence of the recipient superior mesenteric vein and splenic vein (**Figure 1B**). The donor iliac vessels were brought to the hepatic hilum behind the stomach through the transverse mesocolon, as the method reported by the Muiesan P [1]. The biliary duct construction was accomplished by an end-to-end anastomosis of the common bile duct without T-tube. The patient was administrated triple immunosuppressive regimen combined with tacrolimus, mycophenolate mofetil and prednisolone. Low molecular heparin calcium was used routinely to prevent arterial or portal vein thrombosis. The patient discharged from the hospital one month after operation, and the newer prophylactic anticoagulant treatment regimen consisting of aspirin (100 mg/day) and plavix (75 mg/day) was administrated to the patient. CT taken at the end of the first postoperative month revealed that both the hepatic artery and the portal vein with donor iliac vessel interposition were patent (**Figure 2A-C**). The patient was followed up regularly after discharge and presented with a good liver graft function. Prednisolone was slowly discontinued at approximately 10 months after operation. However, an abnormal liver graft function was presented at 6 years and ten months after transplantation with an elevation in the enzymes and bilirubin (ALT112 U/L, TBIL21.3 μmol/L, DBIL9.0 μmol/L). The concentration of tacrolimus maintained 3.5-4.5 ng/ml. The ultrasound did not show any positive sign, then we performed the chemical analysis of hepatitis: HBsAg>250 IU/ml, HBeAg1328 IU/ml, HCV(-), HBV DNA $1.95^{*}10^{7}$ IU/ml. Entecavir (ETV) was administrated to the patient as 0.5 mg p.o once daily. Subsequent

liver function tests showed significant improvement (ALT23 U/L, TBIL17.6 μmol/L, DBIL8.3 μmol/L), and the hepatitis B virus load decreased to $2.5^{*}10^{3}$ IU/ml. So far, the graft function and blood flow through the anastomosis remains excellent more than 8 years postoperatively.

Discussion

The successful construction of hepatic artery and portal vein is critical for liver transplantation. The recipient hepatic artery (HA) and portal vein (PV) are usually suitable for revascularization of the transplanted liver. However, standard construction of the hepatic artery and portal vein may be restricted in some conditions, such as atherosclerosis, anatomic variance, friability or other damaged condition of the recipient vessel (e.g., The patient had been treated by TACE or portosystemic shunt before liver transplantation), poor hepatic arterial or portal vein inflow, mismatch of size between the recipient and donor vessel, portal vein thrombosis and retransplantation. In these conditions, alternative reconstruction of HA and PV have to be considered. A direct anastomosis between the graft vessel and infrarenal aorta may be chosen, however, this idea cannot be achieved in most of the cases because of the limited length of the donor vessel. Thus, a vessel conduit between the donor HA/portal vein and the recipient infrarenal aorta/portal vein become to be the most common alternative. Many types of vessels for interposition can be used, such as iliac artery/vein, splenic artery [2, 3], and saphenous vein [1]. Generally speaking, iliac vessels obtained by the donor are the most commonly used as the conduit [4]. On rare occasions, cold preserved or cryopreserved vessel and artificial vessel can be considered.

In this case, when we found the hepatic artery was friable and showed poor hepatic arterial inflow, we tried to anastomose the donor hepatic artery to the branch of celiac trunk, however, the length of donor hepatic artery is not enough. When we obtained the donor liver, the iliac vessels were procured simultaneously. Therefore, we chose the reconstruction of hepatic artery by the interposition of donor iliac artery. The donor iliac artery has been traditionally regarded as the most suitable interposition material for hepatic artery reconstruction. Although the cryopreservation technique allowed us to use the vessels at anytime, some literatures have reported that the use of cryopreserved vascular grafts was associated with the vascular complications including stenosis, thrombosis and aneurysmal dilatation [5]. Moreover, the 5-year primary patency rate of cryopreserved veins as PV substitutes has been reported to be only 58% [6]. Therefore, the use of cryopreserved vessels was limited. Hwang S thought that a cold-stored iliac vein homograft without freezing promised a favorable outcome [7]. Nevertheless, the time of cold-stored iliac vein was restricted to 14 to 30 days [8]. The defect also limited its use. Autologous vein grafts may overcome this; however, procurement of autologous vein grafts prolongs time in surgery and may increase the extra trauma to patients. Artificial vessels, such as polytetrafluoroethylene (PTFE), may resolve the problem of relative shortages of vessel allografts. However, the concerns about infection, the early thrombosis and progressive narrowing of the internal lumen may limit the application of the artificial vessels [9, 10].

The reconstruction of both the hepatic artery and portal vein were performed in our case, and there is nearly no such report in adult liver transplantation except one article [11]. Although many literature have reported that the incidence of HAT in cases using arterial conduit is more frequent than that using native hepatic artery, respectively 21.8% VS 3.8, 16.7% VS 3.8% and 5.3% VS 3.2%, as reported by three articles [4, 12, 13], one article have reached a different conclusion [14]. In our article the graft function and blood flow through the anastomosis remains excellent more than 8 years postoperatively. Also there are few reports about the long-term patency of interposition arterial conduits [1, 12, 15]. We consider that the skilled anastomosis technique, the suitable size and short storage of iliac vessels are important for less complication and longer patency. In addition, the infrarenal site for arterial conduit anastomosis is easy to access and sufficient hepatic inflow can be assured. Although the new-onset hepatitis B was diagnosed at 6 years and ten months after transplantation, the damaged liver graft function restored to normal rapidly through antiviral treatment. We consider the interposition of iliac vessels is a viable alternative for arterial and portal reconstruction in adult liver transplanta-

tion when direct arterial or portal anastomosis cannot be routinely performed.

Disclosure of conflict of interest

None.

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