


CASE REPORT

The extra-anatomical jump graft reconstruction of the right hepatic artery after resection of a biliary tract malignancy with a common hepatic artery aneurysm: a case report

Yuta Kakizaki , Shigehito Miyagi, Yasuyuki Hara, Atsushi Fujio, Koji Miyazawa, Kai Maida, Toshiaki Kashiwadate, Kazuaki Tokodai, Chikashi Nakanishi, Takashi Kamei & Michiaki Unno

Department of Surgery, Tohoku University, Sendai, Japan

Correspondence

Yuta Kakizaki, 1-1 Seiryō-machi, Aoba-ku, Sendai 980-8574, Japan.
Tel: +81 22 717 7214;
Fax: +81 22 717 7217;
E-mail: ykakizaki@med.tohoku.ac.jp

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Introduction

Increasing the number of surgeries for hepatocellular carcinoma (HCC), we sometimes encounter the cases with some arterial troubles. This is because most HCC cases have undergone repeated interventional treatment such as transarterial embolization (TAE), transarterial chemoembolization (TACE), and hepatic artery infusion chemotherapy (HAIC) through the implanted reservoir. Biliary tract malignancies with a hepatic artery aneurysm are one of the most difficult cases in which surgeons perform resection. If original hepatic arteries cannot be used as reconstructive arteries, it is very difficult to reconstruct the artery.

Extra-anatomical jump graft reconstruction using free grafts is reportedly high risk and associated with high-reocclusion rates [1]. Furthermore, hepatic artery

Key Clinical Message

Performing resection of a biliary tract malignancy with a hepatic artery aneurysm is very challenging. Resection of the extrahepatic bile duct and extra-anatomical reconstruction can be successfully performed using free radial artery autografts from the aorta to the right hepatic artery. Hepatic artery thrombosis can be prevented with intimal preservation.

Keywords

Extra-anatomical reconstruction, hepatic artery reconstruction, hepatocellular carcinoma, radial artery autograft.

thrombosis (HAT) can be a lethal complication. Despite this, where there is no other option, it is necessary to use extra-anatomical jump grafts. We present a case in which we successfully performed resection of a biliary tract malignancy with a common hepatic artery (CHA) aneurysm, followed by reconstruction of the right hepatic artery (RHA) using an extra-anatomical jump graft.

Case Presentation

A 66-year-old man with chronic hepatitis C was diagnosed with HCC and portal vein tumor thrombus (PVTT) in the medial segment. He initially underwent HAIC. After HAIC, contrast-enhanced computed tomography (CT) revealed a decrease in the size of the tumor and PVTT, but simultaneously detected a dissected CHA aneurysm (Fig. 1). We performed extended left

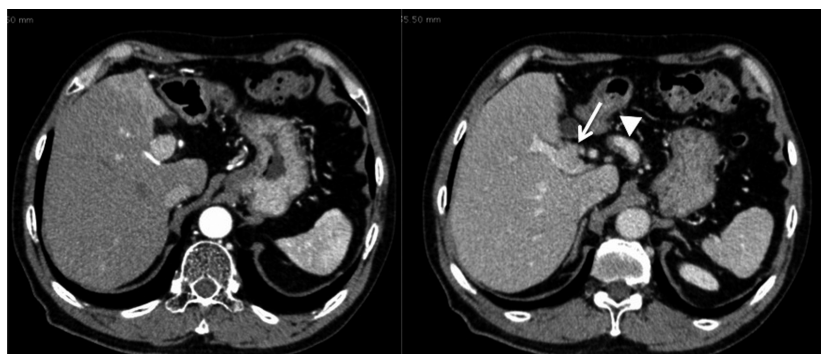


Figure 1. Computed tomography findings before extended left hepatectomy and portal vein tumor thrombectomy. There were a 30-mm mass in the medial segment and a portal vein tumor thrombus in the left portal trunk (arrows). And the common hepatic artery aneurysm (18 mm, maximum short diameter) was also observed (triangle).

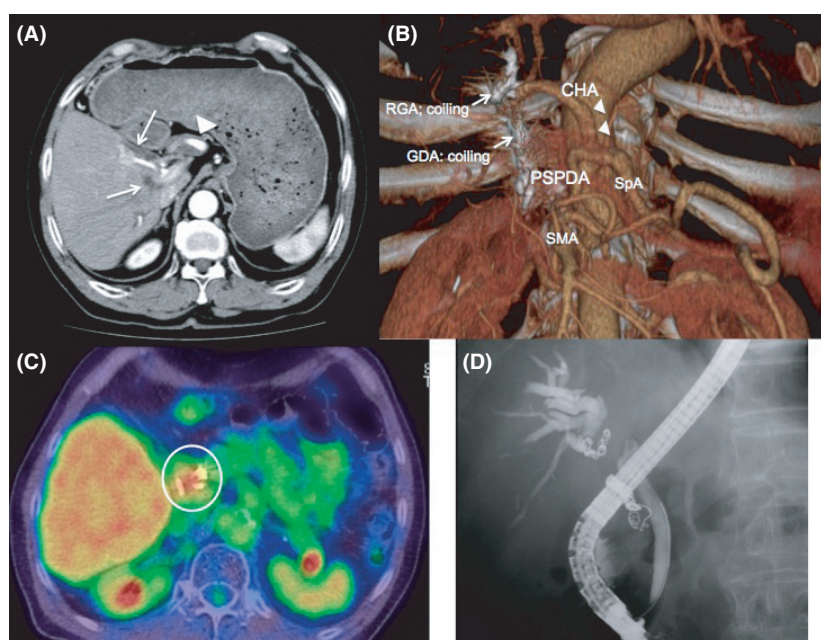


Figure 2. Preoperative findings. (A) Contrast-enhanced computed tomography showed intrahepatic bile duct dilation of the anterior and posterior branches (arrows). There was also observed 18-mm common hepatic aneurysm, which had been no change since the first operation (triangle). (B) Computed tomography (CT) angiography showed common hepatic artery aneurysm (triangles). There were no communicating branches from superior mesenteric artery or celiac axis. (C) Fluorodeoxyglucose positron emission tomography demonstrated solitary uptake in the middle of common bile duct, and there was no other uptake lesion. (D) Endoscopic retrograde cholangiography showed a space-occupying lesion in the middle of the common bile duct. CHA, common hepatic artery; GDA, gastroduodenal artery; PSPDA, posterior superior pancreaticoduodenal artery; RGA, right gastric artery; SMA, superior mesenteric artery; SpA, splenic artery.

hepatectomy and portal vein tumor thrombectomy, with close attention to gently treat of CHA and proper hepatic artery during surgery. Histological examination found moderately differentiated HCC. His postoperative course was uneventful, and his alpha-fetoprotein (AFP) and des-gamma-carboxy prothrombin (DCP) levels were normal. He was followed up every 6 months, and CT imaging was performed. Fifty months later, he presented with sudden obstructive jaundice.

Investigations and Treatment

The physical examination was unremarkable. Laboratory examinations showed peak elevation of total bilirubin (17.0 mg/dL) and direct bilirubin (12.4 mg/dL). DCP was slightly elevated (85 mAU/mL), and AFP was within normal limits. The CT detected intrahepatic bile duct dilation (Fig. 2A). There had been no change in the arterial

aneurysm of the CHA since the first operation. The size of aneurysm was 18 mm of maximum short diameter (Fig. 2A). CT angiography showed CHA aneurysm with no communicating branches from superior mesenteric artery (SMA) and celiac axis (Fig. 2B). Fluorodeoxyglucose positron emission tomography demonstrated solitary uptake in the middle of the common bile duct, and there was no other uptake lesion (Fig. 2C). Endoscopic retrograde cholangiography showed a space-occupying lesion in the middle of the common bile duct, and he underwent a tumor biopsy and endoscopic nasobiliary drainage (Fig. 2D). The biopsy specimen was suggestive of cholangiocarcinoma rather than HCC, but definitive diagnosis was not unclear.

Therefore, we performed resection of the extrahepatic bile duct, and choledochojejunostomy with lymph node dissection (Fig. 3). We decided not to perform pancreaticoduodenectomy based on the pathologically negative surgical margin. During surgery, we noticed no pulse in the RHA before detaching the common bile duct and proper hepatic artery. On ultrasonography, we confirmed no arterial flow to the liver. We cut RHA and observed

the lumen, and assumed that the dissection of the CHA aneurysm had progressed to the RHA (Fig. 4). There was no other means of reconstructing the arteries, so we performed extra-anatomical reconstruction using a left free radial artery autograft (length: 15 cm) as a jump graft from the aorta to the RHA (Fig. 3C,D) [2]. Before grafting the radial artery, clinical assessment of the patient's nondominant (left) arm was performed using Allen's test. Digestive reconstruction was performed according to the Roux-en-Y procedure with an end-to-side choledochojejunostomy. The operation time was 672 min, and intraoperative blood loss was 1330 mL.

Outcome and Follow-Up

The postoperative recovery was uneventful, and the blood flow of the intrahepatic arteries appeared very good on ultrasonography examination by the time of discharge on postoperative day 16. Liver function recovered slowly with time. In addition, the patient experienced no complications in his left arm following surgery.

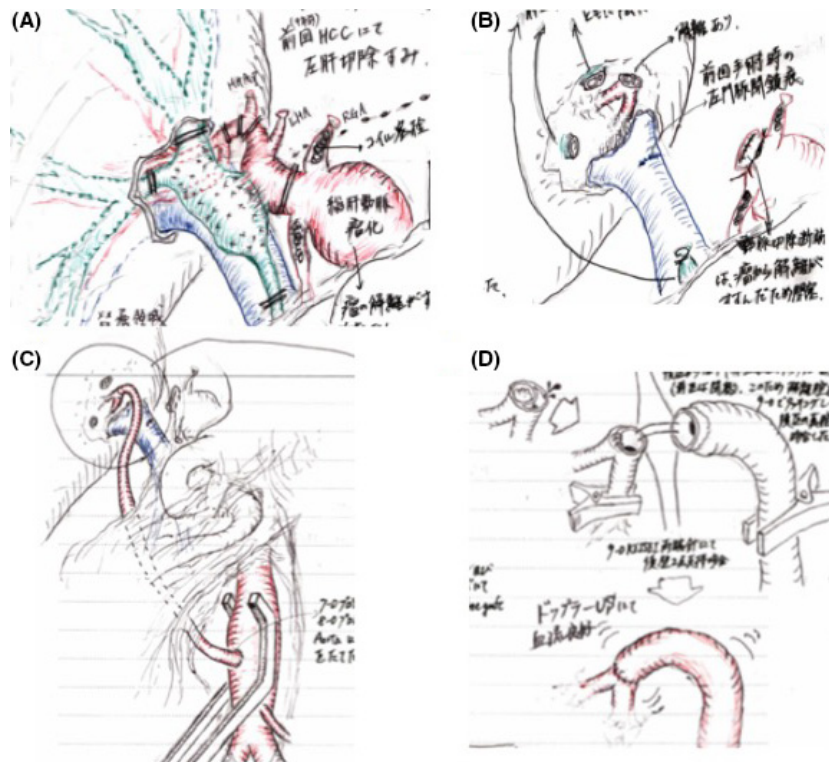


Figure 3. Operative findings. (A) The lesion was present in the middle of the common bile duct and the common hepatic artery aneurysm. A lack of pulse was noticed at the right hepatic artery before detachment of the common bile duct and proper hepatic artery. (B) After resection of the extrahepatic bile duct, we cut the right hepatic artery and recognized the occlusion due to the dissection. We assumed that the dissection of the common hepatic artery aneurysm had progressed to the right hepatic artery. The dissected proper hepatic artery was resected and closed with running sutures. (C, D) Extra-anatomical jump graft reconstruction was performed using a radial artery autograft from the abdominal aorta to the right hepatic artery. The anastomoses were performed with the back wall support suture technique with double needles for intimal preservation.

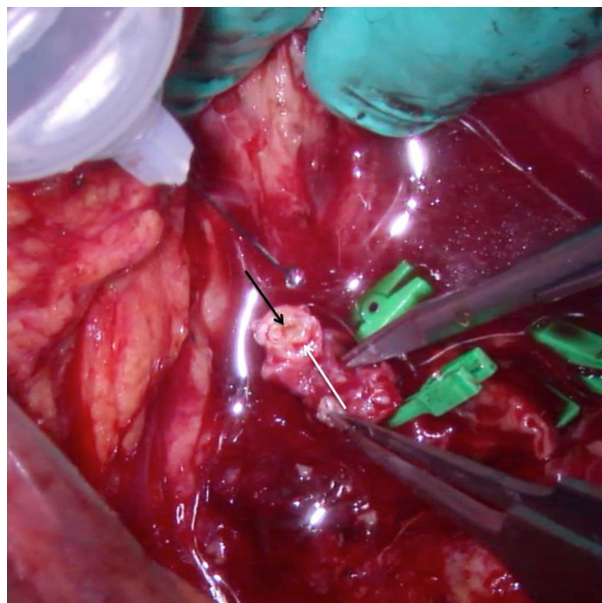


Figure 4. Intraoperative findings. During surgery, after right hepatic artery occlusion was occurred, we cut the right hepatic artery and recognized the dissection (black arrow was false lumen, and white arrow was true lumen).

Macroscopically, the bile duct mass was a polypoid lesion ($10 \times 7 \times 6$ mm). Pathologically, the nodule in the bile duct wall and polypoid lesion was moderately differentiated HCC, which was diagnosed as hematogenous metastasis of the HCC. No metastasis was observed in the dissected lymph nodes. We have previously reported the pathological findings in detail [3].

Seven months later, magnetic resonance imaging detected multiple intrahepatic HCC recurrences. Arteriography showed that the jump graft had good patency (Fig. 5). He underwent TACE through the jump graft repeatedly. TACE has controlled the HCC recurrences well, and he remains alive for 2 years after the operation.

Discussion

We experienced an extremely rare case of biliary tract malignancy with a CHA aneurysm, which caused accidental occlusion of the hepatic artery. We were able to perform successful reconstruction of the RHA using a radial autograft as a jump graft. To the best of our knowledge, such reconstructions have only been reported in living donor liver transplantation (LDLT) cases [2, 4].

When the occlusion occurs on the distal side of the hepatic artery and it is impossible to reconstruct the artery, the only method to supply the liver with oxygenated blood is portal vein arterialization (PVA) [5]. This method has some complications, such as liver

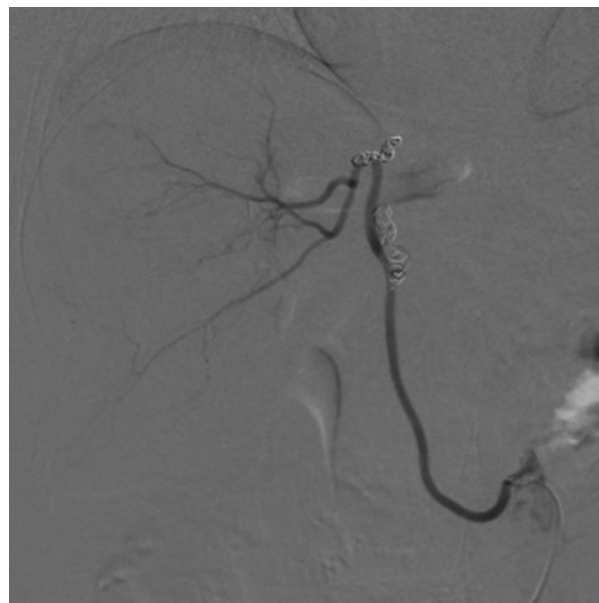


Figure 5. Postoperative findings. The arteriography for multiple hepatocellular carcinoma recurrences showed good patency of the jump graft. Transarterial chemoembolization was performed through the jump graft and controlled recurrences of hepatocellular carcinomas.

abscess and portal hypertension. In this case, fortunately we were able to successfully reconstruct the hepatic artery, and PVA was not necessary. Furthermore, when we would make PVA, portal hypertension might be happened for already resected liver. We think that arterial reconstruction is essential in the case of proximal arterial trouble because we can resolve by an arterial bypass. PVA is the optimal option when distal arterial trouble occurs [5].

Extra-anatomical reconstructions are often performed during LDLT, and involve the anastomoses of the graft's hepatic artery and the recipient's other arteries such as the gastroduodenal artery (GDA), the right gastroepiploic artery (RGEA), or the right gastric artery (RGA). There have been reports of other arteries being used in LDLT, such as the splenic artery, the sigmoid artery, and the mesenteric artery [6–9]. In this case, we could not use the GDA, RGEA, or RGA because of coiling for HAIC. Iida et al. [10] reported that the outcomes of extra-anatomical anastomosis, not including extra-anatomical jump graft reconstruction, were unsatisfactory due to the high-complication rate. We also believe that using local damaged arteries is worse for the critical reconstruction because of the high-occlusion rate. So, we selected an extra-anatomical jump graft for reconstruction using healthy autografts in this case.

Occlusion on the proximal side can be reconstructed by an arterial bypass, such as interposition bypass or extra-anatomical jump graft bypass. We have previously

performed extra-anatomical jump graft reconstructions with a radial artery autograft as a jump graft from the abdominal aorta to the RHA during LDLT [2]. The jump graft reconstruction needs two anastomoses, which increase the risk of HAT. Despite this risk, we did not encounter HAT in seven cases of extra-anatomical jump graft reconstruction, including this case. We believe that the incidence of HAT can be decreased by intimal preservation. So, we used healthy free arterial grafts and performed the back wall support suture technique with double needles for intimal preservation [11–13].

We think that the main advantage of jump graft reconstruction from the aorta is the bloodstream force. The blood inflow of the jump graft is obviously superior to that of the RGEA and RGA, which are third-order branches of the abdominal aorta. Actually, in the field of coronary artery bypass grafting, there have been reports that the blood inflow of the RGEA is lower than that of the internal thoracic artery and saphenous vein bypassed from the aorta [14, 15]. This factor is helpful in reducing the incidence of HAT. In addition, extra-anatomical reconstruction using the GDA, RGEA, and RGA is less flexible than that of jump graft reconstruction, which can lead to kinks and bends at anastomotic sites. The jump graft through the retroperitoneal route is not affected by the position of other organs.

In conclusion, we report a case of reconstructed RHA using a radial autograft. Surgery for arterial aneurysms should be performed carefully, and extra-anatomical jump graft reconstruction of the hepatic artery is an effective option that should be considered in cases of arterial occlusion. Intimal preservation is essential for success.

Acknowledgments

None.

Authorship

YK, SM, and YH: designed the study. SM, YH, AF, KMi, KMa, TK, KT, and CN: were the principal surgeons. YK and SM: reviewed the literature and provided quality assurance of the manuscript. TK and MU: revised the manuscript.

Conflict of Interest

The authors have no conflict of interests to declare.

Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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