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Precaution against postoperative venous complications after major hepatectomy using the pedicled omental transposition flap: Report of two cases

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ABSTRACT

INTRODUCTION: Vascular complications following hepato-pancreatic biliary surgery can be devastating, and therefore precaution of them must be critical. We report two cases in which the pedicled omental transposition flap might be effective to avoid postoperative venous complications following major hepatectomy.

PRESENTATION OF CASE: Case 1 is a 80-year-old male who required to perform re-laparotomy at postoperative day 1 following major hepatectomy due to acute portal venous thrombosis (PVT). In the second surgery, the main trunk of PV was occluded by thrombus resulted from its redundancy and kinking. PV was resected with an adequate length and reconstructed. The omental flap was placed between PV and inferior vena cava (IVC) to fill in the dead space, resulting in favorable intrahepatic portal blood flow. Case 2 is a 64-year-old male who underwent left trisectionectomy because of giant hepatocellular carcinoma located close to the trunk of right hepatic vein (RHV) and IVC. After removal of the specimens, the dead space developed between the RHV and IVC. In order to prevent outflow block caused by kinking of the RHV, the omental flap was placed between the RHV and IVC, and the right triangle ligament of the liver was fixed to the diaphragm. RHV patency was confirmed by postoperative imaging.

DISCUSSION: The omental flap is a simple procedure and useful to fill the dead space developed in the area surrounding major vessels.

CONCLUSIONS: We experienced two cases in which vascular complications might be avoided by filling the dead space surrounding major vessels using the omental flap.

1. Introduction

Recently, aggressive surgical resection including major hepatectomy with or without vascular reconstruction has been recognized as a therapeutic option for hepatic malignancy to achieve histologically negative margin (R0) resection.[1] However, postoperative complications following major hepatectomy occur with a certain probability and result in prolongation of hospital stay and aggravation of quality of life of patients.[2] The incidence of postoperative venous complications including portal venous thrombosis (PVT) and the interruption of venous outflow of the liver, referring to "outflow block", is rare, while it would lead to devastating consequences. Therefore, it would be important to make every effort during operation to prevent from the occurrence of postoperative venous complications. Herein, we report two cases in which the pedicled omental transposition flap might be able to avoid the occurrence of postoperative venous complications following major hepatectomy. The clinical courses of these patients were reviewed and factors associated with postoperative venous complications were discussed from the current literatures.

2. Case presentation: case 1

A 80-year-old male presented with mass forming and periductal infiltrating type of intrahepatic cholangiocarcinoma accompanied by gallbladder carcinoma was referred to our hospital. Preoperative contrast-enhanced computed tomography (CT) showed the low-density tumor within right hemiliver located mainly in the anterior segment and extended to anterior branch of PV (Fig. 1A and B), and the well-enhanced tumor in the cystic duct (Fig. 1C). Three-dimensional reconstruction of CT imaging (3D-CT) showed that an

Abbreviations: PVT, portal venous thrombosis; CT, computed tomography; 3D-CT, Three-dimensional reconstruction of CT imaging; US, ultrasonography; HV, hepatic vein; IVC, inferior vena cava.

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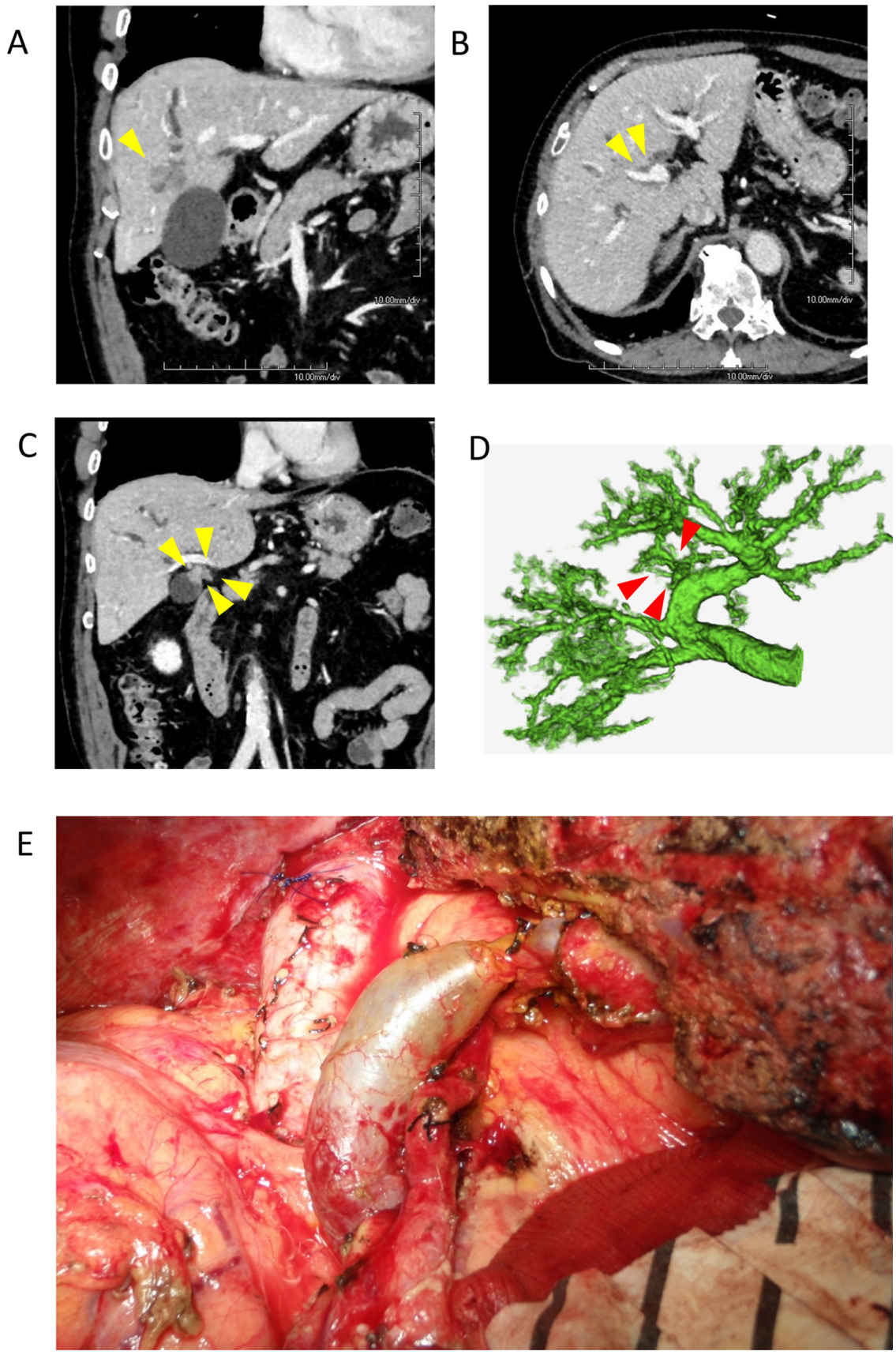

Fig. 1. Preoperative CT imaging studies and the intraoperative photography at the first operation in the case 1. (A) Arrow head shows the tumor located mainly in the anterior segment. (B) Arrow heads indicate the tumor extended to anterior branch of portal vein. (C) Arrow heads indicate the well-enhanced tumor occupied within the cystic duct. (D) Portal vein reconstruction using three-dimension CT scan shows anatomic variation of right posterior sectorial portal venous branch. Arrow heads indicate large caudate lobe branches. (E) intraoperative photography representing the main trunk of portal vein following hepatectomy.

independent right posterior sectorial PV was branched from main trunk and the large caudate lobe branches presented (Fig. 1D).

Right hepatectomy with caudate lobe resection and extrahepatic bile duct resection was performed. After dissection of regional lymphnode, the right hepatic artery and right posterior sectorial branch of PV was ligated. The right anterior sectorial branch of PV was invaded by the tumor as shown in preoperative 3D-CT. Liver parenchymal transection was performed and the root of anterior branch of PV was exposed. The anterior branch of PV was clamped across the trunk of PV vertically and then it was excised and sutured using 6-0 Prolene continuous stitches. All branches from the transverse portion of the left PV to caudate lobe were ligated and excised. After complete transection of liver parenchyma, the middle hepatic artery originated from the proper hepatic artery was preserved and the left hepatic duct was resected. Negative margin of distal hepatic duct was confirmed pathologically by frozen-section analysis. Fig. 1E shows the intraoperative photography representing the main portal trunk following hepatectomy. A Roux-en-Y hepaticojejunostomy was used for the biliary reconstruction. The falciform ligament was fixed to ventral peritoneal wall to prevent the hepatic venous outflow block. Intra-operative Doppler ultrasonography (US) before the closure of abdominal wall showed no evidence of either stenosis or obstruction of the PV and left hepatic vein (HV). The duration of operation was 739 min and the amount of blood loss was 1745 g requiring 6 units of blood transfusion within 24 h after operation.

Laboratory examination at POD 1 revealed severe liver dysfunction: serum total bilirubin level; 6.9 mg/dl, AST; 600 U/L, ALT 636 U/L, prothronbin time (INR); 1.88, and Doppler US showed severe decrease of portal blood flow velocity (1.4 cm/s; Fig. 2A). Acute PVT was strongly suspected, and then the emergent relaparotomy was performed immediately. The biliary reconstruction was uncoupled and PV was exposed. The main trunk of PV was redundant and kinked with the angle of 270° and completely occluded by thrombus. PV was resected with an adequate length and reconstructed after complete removal of PVT. However, PV was kinked again due to a rotation of the remnant liver to the right side resulting in a diminishment of intrahepatic portal flow. The pedicled omental transposition flap was made and placed between the PV and inferior vena cava (IVC) to fill in the dead space (Fig. 2B). Intraoperative Doppler US showed favorable intrahepatic portal blood flow (Fig. 2C), and then Roux-en-Y hepaticojejunostomy was reconstructed. Postoperative course was favorable and the patency of portal blood flow was well-preserved (Fig. 2D). However, this patient was died of acute respiratory distress syndrome due to aspiration pneumonia at POD 54.

3. Case presentation: case2

A 64-year-old male presenting with Hepatitis C virus-related giant HCC was referred to our hospital. Preoperative imaging studies showed that the tumor located mainly in the Couinaud's segment 1, 4 and 8. The tumor extended to left and right anterior Glissonian sheaths and compressed the trunk of the right HV (Fig. 3A and B). Left trisectionectomy with or without reconstruction of right HV was planned to achieve R0 resection. Intraoperative appearance showed that the tumor occupied close to the trunk of right HV and IVC and compressed them without vascular invasion. R0 resection was achieved by left trisectionectomy without resection of the right HV. As a result, the dead space developed between the right HV and IVC (Fig. 3C), which might result in hepatic venous outflow block due to kinking of the right HV brought about by a lean of the remnant liver lobe to cranial side. In order to prevent outflow block, the omental flap was placed between the right HV and IVC to fill in the dead space (Fig. 3D) and the right triangle ligament of the liver was fixed to diaphragm using 4-0 absorbable sutures. Doppler US performed at POD 1 showed normal waveform of the right HV (Fig. 3E) and patency was confirmed by CT scan at POD 7 (Fig. 3F). He was alive without disease recurrence at 15 months after surgery.

4. Discussion

The occurrence of vascular complications including acute PVT and hepatic venous outflow block following hepato-pancreatic biliary surgery is not frequent. Once these complications occur, however, they can be associated with a very high mortality. The study from Japan reported that perioperative venous complications occurred in 20 of 1078 patients (1.9%) undergoing liver resection and the mortality rate in these patients was 70%.[3] PVT is rare but is a dismal complication in pancreatic surgery as well as liver surgery. Bachellier et al. reported that the incidence rate of PVT following pancreaticoduodenectomy was 3.2% in patients requiring portal vein reconstruction, while the mortality rate was 100%.[4] In the field of liver transplantation, one of the largest retrospective series reported that PVT occurred in 84 cases (2%) of 4234 orthotopic liver transplantation cases, and more than half of these patients died.[5] The series of pediatric living donor liver transplantation in Kyoto, Japan, reported that early PVT occurred in 9 of 521 cases (1.7%) with the mortality rate of 67%.[6] Therefore, avoidance of these venous complications must be critical to improve early postoperative outcome in HPB surgery.

Technical factors that predispose to PVT include kinking, torsion, and stenosis of the PV.[7] In case 1, PVT developed in the main trunk of PV because of kinking. This phenomenon might be brought about by three factors; (1) redundancy of PV resulted from anatomic variation of portal venous branching, (2) the caudate lobe branches of PV were considerably large shown as Fig. 1D, and ligation of these vessels resulted in the narrowing of left main trunk of PV, (3) as a result of caudate lobe resection, lacking the space occupied properties behind and below the left main trunk of PV. Redundancy and stenosis of PV and lack of space occupied properties may result in the kinking of PV and occurrence of PVT. During relaparotomy, the length of PV was adjusted adequately by means of resection of PV, and dead space behind PV was filled by the omental flap. These procedures might be useful to preserve the patency of PV.

Doppler US of PV is the most effective to detect PV stenosis and PVT. A previous study reported that decreased flow velocity in the portal vein (<15 cm/s) was significantly associated with the development of PVT.[8] If PVT is detected by Doppler US, CT scan would be necessary to confirm the diagnosis. In case 1, relaparotomy was immediately performed to treat acute PVT diagnosed by means of only Doppler US, which indicated severe decrease of portal blood flow velocity (1.4 cm/s). In addition the results of blood test showed seriously poor liver function. These findings let us to perform relaparotomy immediately without further evaluation to confirm PVT using other modality. Doppler US has been performed daily following every major hepatectomy in our department, which might provide the success of the emergent surgery in this case.

Hepatic venous outflow block is the major concern following liver transplantation, occurring in 1–2% and 2–4% of patients undergoing orthotopic and living donor liver transplantation, respectively.[9,10] The difference of incident rate of the outflow block between orthotopic and living donor liver transplantation suggests that the factors leading to the outflow block would not be only technical reasons including narrowing and stenosis of the venocaval anastomosis but also kinking of a redundant HV and dislocation of the graft liver.[7,11] Hepatic venous outflow block was reported in patients undergoing the right trisectionectomy in whom the

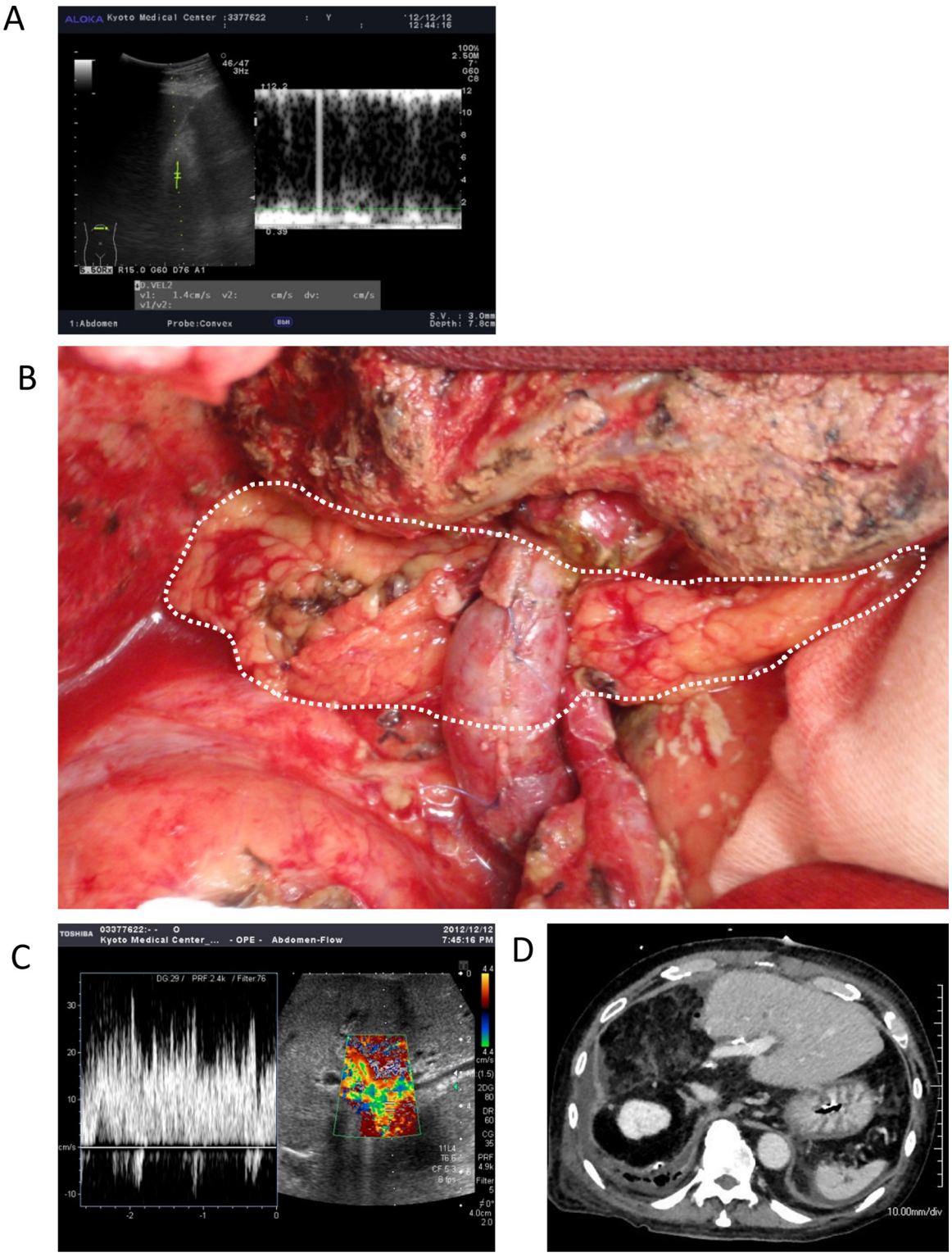

Fig. 2. Doppler US and CT imaging study and intraoperative photography at the relaparotomy in the case 1. (A) Doppler US at postoperative day (POD) 1 shows significant decrease of portal flow velocity. (B) Intraoperative photography represents the main trunk of portal vein following removal of portal venous thrombosis and vascular reconstruction. Dotted line indicates the pedicled omental transposition flap placed between portal vein and inferior vena cava to fill in the dead space. (C) Intraoperative Doppler US shows favorable intrahepatic portal blood flow. (D) CT scan at POD 7 shows the patency of portal vein.

dislocation of the remnant liver due to an inadequate fixation to the abdominal wall occurred.[3] On the other hand, it will be rare in patients undergoing left trisectionectomy basically because the remnant liver is fixed in the right subphrenic space. In case 2, the tumor occupied between the IVC and trunk of the right HV and dead space developed among them following liver resection. Consequently, the length of HV unsupported with liver parenchyma became excessive, which might result in kinking due to a lean of the remnant liver lobe to the cranial side. Therefore, omental flap was placed between right HV and IVC to fill in the

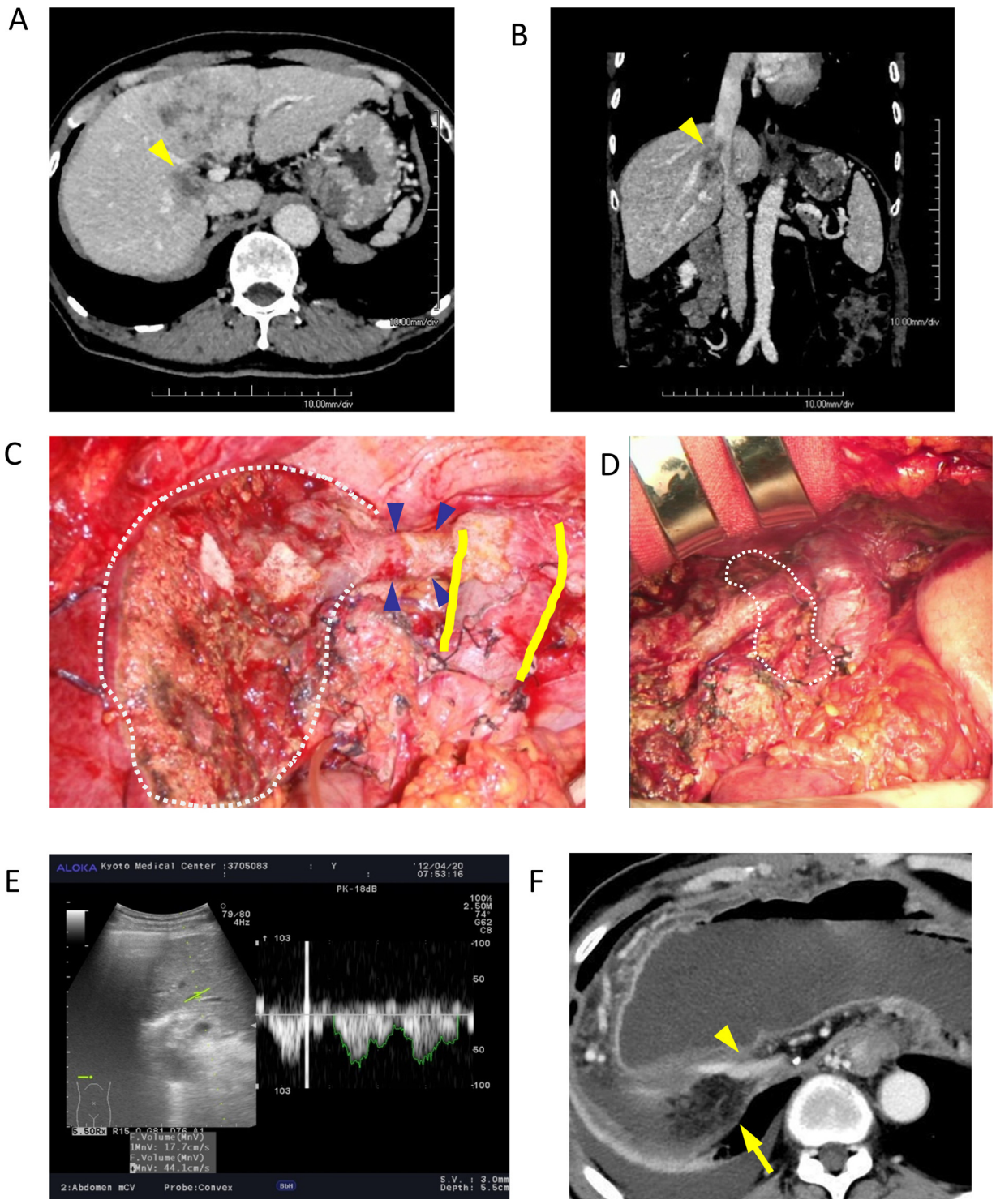

Fig. 3. Preoperative CT and Doppler US imaging studies and the intraoperative photography at the surgery in the case 2. (A) Arrow head shows the tumor located mainly in the Couinaud's segment 1, 4 and 8 and extended to left and right anterior glissonian sheaths. (B) The tumor compressed the trunk of the right hepatic vein (arrowhead). (C) Intraoperative photography represents that dead space develops behind right hepatic vein after the complete removal of the tumor (arrowheads). The area encircled by while dotted line is the cut surface of liver parenchyma. Yellow line indicates the IVC. (D) Dotted line indicates the pedicled omental transposition flap placed between right HV and IVC to fill in dead space. (E) Doppler US shows normal hepatic venous flow direction. (G) CT scan at POD 7 shows the patency of right hepatic vein (arrowhead). Arrow indicates the omental flap represented low-density mass. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

dead space. The greater omentum has been widely used in various surgical fields because of it is unique properties including a mass effect, filling the dead space remaining after curettage and debridement of infected tissue, the enhancement of neovascularization, and the ability to absorb exudates.[12–15] The omental flap is feasible to fill the dead space and is a simple procedure without any fixation.

In conclusions, PVT and hepatic venous outflow block are serious complications following HPB surgery. Every effort should be made during surgery to avoid the occurrence of these fatal complications.

Using the pedicled omental transposition flap may be useful for the case in which the dead space develops the surrounding area of PV or HV.

Conflict of interest

Narita and other co-authors have no conflict of interest.

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Ethical approval

Written informed consent was obtained from the patient for publication of this Case report and any accompanying images. A copy of the written consent is available for review by the Editor of this journal.

Author's contributions

Narita, Ikai: Study conception and design.

Narita, Ikai, Matsusue, Hata, Yamaguchi, Otani: Drafting manuscript or critical revision of the manuscript.

Narita, Matsusue, Hata, Yamaguchi, Otani, Ikai: Final approval of the manuscript.

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