Portal vein embolization in the treatment of portal vein bleeding after percutaneous transhepatic biliary drainage: A case report and literature review

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Abstract

Percutaneous transhepatic biliary drainage (PTBD) is an effective treatment for benign and malignant obstructive jaundice. Major bleeding complications occur in approximately 2–3% of patients after PTBD, which can result in death. A case involving a 63-year-old male with malignant obstructive jaundice, who experienced severe bleeding after PTBD, is reported. Emergency digital subtraction angiography, celiac trunk artery and superior mesenteric artery angiography were performed; however, no signs of arterial bleeding were found. To identify etiology, portal venography was performed under ultrasound guidance and portal vein bleeding was diagnosed. Ultimately, selective portal vein embolization successfully stopped the bleeding.

1. Introduction

Percutaneous transhepatic biliary drainage (PTBD) is an effective treatment for both benign and malignant obstructive jaundice. Major bleeding complications occur in approximately 2–3% of patients after PTBD and can result in death.1–3 This report describes a patient who experienced severe bleeding during PTBD and was successfully treated using portal vein embolization (PVE).

2. Case report

In March 2021, a 63-year-old male with hilar cholangiocarcinoma due to obstructive jaundice underwent bilateral PTBD and right biliary metal stent implantation at the authors’ hospital. Six months later, the patient was readmitted for obstructive jaundice. He had underlying diseases, including hypertension, diabetes, gouty arthritis, chronic renal insufficiency, and chronic gastritis. After admission, the patient underwent bilateral PTBD. Intraoperative cholangiography revealed biliary stent stenosis, and the guidewire could not pass through the stenosis. A drainage tube was placed on each side postoperatively. Gallbladder enlargement was observed on intraoperative ultrasonography (US), and gallbladder puncture was performed. Three days later, a small amount of bloody bile was observed in the right PTBD effluent. Under fluoroscopy, drainage tube angiography revealed that the previous right PTBD tube had moved outward, and the head end of the drainage tube was located at the edge of the bile duct. Considering the possibility of drainage tube prolapse, the patient’s jaundice would be further aggravated due to stenosis of the biliary metal stent. In this procedure, biliary ablation, balloon dilatation, and biliary metal stent implantation were performed on the right stent-blocked segment, and an external PTBD drainage tube was placed immediately postoperatively. On postoperative day 3, 2420 ml of bile was drained, with a small amount of blood from the right drainage tube within 24 h. Drainage tube angiography revealed prolapse of the right PTBD tube. During the procedure, the attempt to replace the new PTBD drainage tube failed, and the tip of the guide wire fell into the abdominal cavity. Therefore, a 6 Fr drainage tube was placed in the abdominal cavity, and a small amount of dark red blood was observed flowing from the drainage tube during the procedure. The patient was hemodynamically stable during the procedure. After returning to the ward, the patient experienced hemorrhagic shock, with a nadir blood pressure of 60/30 mmHg. Rapid fluid replacement was performed immediately, vital signs assessment and routine blood tests were performed, and blood pressure increased to 110/50 mmHg.

US performed in the ward revealed a large amount of fluid in the right thoracic and abdominal cavities. Thoracentesis was performed to drain the dark-blooded fluid, and the patient was immediately transferred to...
the radiation intervention operating room to undergo digital subtraction angiography (DSA) and emergency hemostasis. The patient underwent hepatic arteriography and PVE hemostasis under local anesthesia. The femoral artery was punctured using the Seldinger technique, followed by celiac artery and superior mesenteric arteriography using a 5 Fr Yashiro catheter (Terumo, Tokyo, Japan) (Figs. 1 and 2), with no signs of arterial hemorrhage observed. To identify etiology, under US guidance, a branch of the portal vein was punctured using an EV needle (Hakko, Nagano, Japan). A 0.035-inch guidewire was inserted in the portal vein without a vascular sheath, and a standard polyethylene 5 Fr angiography catheter (Hanaco Medical, Tianjin, China) was placed at the main portal vein for angiography, which revealed bleeding in the right portal vein branch. There was obvious contrast medium extravasation in the puncture channel of the right liver (Fig. 3). During the procedure, it was found that the puncture angle was too large and the bleeding site was embolized along the original portal vein puncture route, which was very difficult to perform. Another portal vein puncture was performed, and the right portal vein branch was selectively embolized (Fig. 4). The embolic agent was a mixture of n-butyl-cyanoacrylate (NBCA; Compont, Beijing, China) and lipiodol (Guerbet, Roissy, France) in a 1:3 ratio. Re-examination using portal vein angiography revealed that embolization was effective and the bleeding was successfully stopped (Fig. 5). Finally, the puncture tract of the trans-hepatic PVE was treated using the delayed catheter removal technique, which is commonly used in our mini-invasive intervention center.4

3. Discussion

The portal vein, hepatic artery, and hepatic bile ducts are enclosed in a connective tissue sheath (Glisson's sheath) and run parallel to the liver or near the hepatic hilum. As such, the portal vein and hepatic artery are the vessels most likely to be injured during PTBD, whereas the hepatic vein is rarely injured. When the hepatic vein is injured, it is often part of a significant injury that also involves the portal vein and/or the hepatic artery.5,6 Studies have reported that the following factors increase the risk for bleeding after PTBD: coagulation disorders and antiplatelet use; biliary tract is not dilated7; central puncture8; 18-gauge (G) needle has been supplanted in modern practice by the 21- or 22-G Chiba needle1,9; multiple punctures; and other risk factors including advanced age, cirrhosis, and chronic renal insufficiency.10 Bleeding in the patient described in this report was considered to be due to injury of the hepatic vessels caused by the puncture needle, which was related to the patient's chronic renal insufficiency, abnormal coagulation function, and the use of an 18-G EV needle during the procedure.

The clinical signs of portal vein and hepatic artery hemorrhage overlap to some extent. However, severe hemorrhage with shock may occur if there is major injury to the central large-caliber portal vein branches.11 Multiphase computed tomography (CT) or CT angiography

Fig. 1. Celiac artery angiography revealing no signs of bleeding. Abdominal drainage tube (arrowhead), gallbladder drainage tube (white arrow).

Fig. 2. Superior mesenteric artery angiography revealing no signs of bleeding.

Fig. 3. Portal venography revealing contrast extravasation at the right portal vein branch (white arrow).
may also be performed initially as part of the workup. However, if an arterial bleed is suspected and the patient is hemodynamically unstable, DSA can be performed directly to determine the cause. Treatment options for hepatic artery injury include stent-graft placement and embolization. Embolization is more common, and transcatheter arterial embolization (TAE) has been confirmed to be the preferred treatment for arterial bleeding, most often using coils. The success rate of TAE is reported to be as high as 80–100%.\textsuperscript{12,13} Embolization should be performed as selectively as possible to reduce the incidence of postoperative complications. All the above minimally invasive treatments are highly effective in stopping bleeding when post-PTBD bleeding occurs. The most common reason for portal venous bleeding is traversing the catheter through a branch of the peripheral portal vein. Sometimes, the PTBD catheter is displaced such that the side holes communicate with the venous channel.\textsuperscript{14} Pull-back cholangiography under DSA was performed to confirm the diagnosis and assess the size and location of the injured portal vein branch. Subsequently, according to the size/location of the portal vein injury, a drainage tube was placed at the injury site to achieve hemostasis or temporary balloon inflation until more definitive therapy could be performed. If portal vein access can be obtained, options include placing a stent graft across the injury site\textsuperscript{15} or coiling the affected portal vein\textsuperscript{16}. Other options include placing coils via percutaneous drain access to straddle the site where the portal vein is traversed.\textsuperscript{17} If hemostasis is unsuccessful, surgical intervention, such as vessel ligation or partial hepatic resection, can be considered. However, these surgical procedures carry significant risks.\textsuperscript{14} Intercostal hemorrhage can also cause hemodynamic instability; however, intercostal hemorrhage due to PTBD is less common, and damage to this artery presents as a chest wall hematoma or hemothorax, which was not consistent with the clinical presentation of the patient described herein. NBCA glue has been widely established as a transcatheter or direct injection embolic agent. As an embolization method, NBCA has the advantages of short procedure time and low material costs.\textsuperscript{18,19} Successful treatment of portal vein hemorrhage by injecting NBCA directly into the peripheral portal vein branches through a needle and performing targeted glue embolization along the liver surface has been reported.\textsuperscript{20} The patient experienced massive abdominal and thoracic hemorrhages. Thoracic hemorrhage may be associated with the PTBD puncture route passing through the costophrenic angle. Based on clinical manifestations, it may be difficult to accurately locate the hepatic artery and/or portal vein hemorrhage. The patient was in hemorrhagic shock and was not suitable for diagnostic imaging, such as CT angiography. In this patient, the PTBD drainage tube prolapsed, and pull-back cholangiography could not be used to diagnose portal vein injury. Therefore, emergency visceral arteriography was performed, which revealed no signs of active bleeding. To save the patient’s life, the bleeding site was accurately located using portal venography, and elective NBCA-PVE was performed to stop the bleeding.

4. Conclusion

These results demonstrated that PVE can be minimally invasive, safe, and effective, and combined with diagnosis and treatment and used as a supplement to selective hepatic arteriography. In the future, PVE may play an important role in emergency hemostasis of the liver, especially in the treatment of iatrogenic biliary tract hemorrhages. NBCA may be the preferred embolic agent for PVE to achieve hemostasis.

Patient consent

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

Ethical approval

Institutional Review Board approval was not required because this is a retrospective study.

Declaration of competing interest

We declare that we do not have any commercial or associative interests that represent a conflict of interest in connection with the submitted work.

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