Percecutaneous transhepatic techniques for retrieving fractured and intrahepatically dislodged percutaneous transhepatic biliary drainage catheters

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ABSTRACT
Dislodged intrabiliary drainage devices, including catheters, endoprostheses, and stents, may further impair drainage and cause various local reactions, vascular and gastrointestinal tract complications. Endoscopic approaches for management of plastic biliary endoprostheses have been extensively discussed. However, in rare cases of fracture of percutaneous transhepatic biliary drainage (PTBD) catheters, only a percutaneous transhepatic technique for retrieving should be applied to avoid further damage by its rigid fragment. We present the adjusted techniques using either a goose neck snare, over-the-wire balloon catheter, or biopsy forceps with image demonstration and reviews. We encountered two patients with PTBD tube fracture and intrahepatic dislodgment. In both patients, percutaneous approaches were used for successfully retrieving and removing the fractured catheter through transhepatic tract: one with the use of a biopsy forceps, another with an inflatable balloon catheter.

Intrabiliary devices, including percutaneous transhepatic biliary drainage (PTBD) catheter, plastic biliary endoprostheses (PBE), and metallic stents are widely used for relieving biliary occlusion in patients with inoperable tumors and benign, postinflammatory, or iatrogenic strictures. These devices are placed at the stricture site using minimally invasive procedures via endoscopic retrograde cholangiopancreatography (ERCP) or ultrasounds-and fluoroscopy-guided percutaneous transhepatic route.

Dysfunction of the implanted devices from occlusion, migration, or malposition is occasionally encountered, and various complications can occur if the dysfunctional device is not retrieved. These include impaired biliary drainage, local inflammation and stricture, recurrent cholangitis, perforation of hepatic capsule causing biloma or abscess formation, erosion of the adjacent vasculature causing bleeding or pseudoaneurysm, and bowel obstruction or perforation if the fragment freely migrates through gastrointestinal tract (1).

Intervention with minimally invasive ERCP or percutaneous approach are the initial options, while open surgery is performed only when these procedures fail. Compared with plastic PTBD drainage catheters, PBEs have a soft tip and a flexible body. Therefore, variable forms of either ERCP or percutaneous techniques are suitable options, with the reported success rate of 80%–90% (1, 2). However, in extremely rare cases of fracture of rigid PTBD catheters, the percutaneous method may be the optimal solution for retrieving the fragment and avoiding further complications.

Technique
In our institute, PTBD is performed routinely under combined ultrasound and fluoroscopic guidance. A plastic ring biliary drainage catheter (Cook Medical) with the appropriate length and number of side holes is placed through stricture site. The rigid ring catheter is retained for at least 14 days and subsequently replaced with a more flexible silicon (Cliny) or pigtail (Cook Medical) catheter.

The patient database was retrospectively reviewed from 2012 to 2014, and two cases of catheter fracture and intrahepatic dislodgment out of 689 procedures of PTBD were found during this time period, the incidence being 0.3%. Informed consent for image-guided inva-
Managing Fracture of Rigid PTBD Catheters With Biliary Involvement

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Percutaneous retrieval should be performed in a one-step manner and inflated (the partially inflated balloon catheter indicated by white arrow) inserted through the angiosheath, to grab the end of the catheter fragment. The dislodged catheters in both cases were successfully removed through the percutaneous tract under fluoroscopic guidance, and new catheters were placed. Bile was drained smoothly without visible hemobilia, indicating that there is no immediate bile duct or vessel injury during the retrieval procedure by using an angiosheath as protection. Moreover, hemolologic examination of both patients revealed stable levels of bilirubin, hemoglobin, white cells, and liver enzymes. Follow-up X-ray and cholangiogram confirmed the appropriate position and function of catheters.

Discussion

PTBD is a highly efficient procedure for external and internal drainage in biliary obstruction and provides access for placement of metallic stents or plastic endoprostheses. But its clinical applications are slowly declining because of considerably high incidence of procedural and drainage-related complications. The onset of proce-

Main points

- Fracture of rigid percutaneous transhepatic biliary drainage (PTBD) catheters requires immediate management. Percutaneous approach should be preferred for retrieval, while the endoscopic retrograde cholangiopancreatography approach for dislodging plastic biliary endoprostheses should not be used for rigid PTBD catheters.
- Percutaneous retrieval should be performed within a mature percutaneous tract and with use of a large-bore angiosheath for protection of the bile duct and liver parenchyma.
- Devices such as goose neck snare, an over-the-wire balloon catheter, or biopsy forceps, may be employed in techniques for catheter retrieval.

Case 1

A 71-year-old man with history of hepatitis B-related hepatocellular carcinoma underwent deceased donor liver transplant after local control of tumor. The procedure was complicated with choledocho-jejunostomy stenosis and recurrent biliary tract infection, resulting in right lobe atrophy. Therefore, PTBD was performed through the left lobe.

The catheter size was gradually increased over a period of one year, and a 14 and 8.5 French (F) dual pigtail catheters were used for sufficient dilation of the stricture site. During a routine catheter change, an accidental intrahepatic withdrawal of the dual catheter occurred after cutting the external end.

For catheter retrieval, we threaded a 0.035-inch hydrophilic stiff guidewire (Merit Medical Systems) through the tract and along-side the catheter, then a 14 F angiosheath (Merit Medical Systems) was used to further secure the tract. A 7 F biopsy forceps (Cordis Corporation) was inserted through the angiosheath, to grab the end of the fractured catheter and successfully retrieve it (Fig. 1).

Case 2

An 88-year-old man with cholangiocarcinoma invading the caudate lobe and segments 7 and 8 of liver presented with elevated liver enzymes and jaundice. Abdominal computed tomography showed obstruction of the first-order bile ducts, and dilation of bilateral intrahepatic ducts. Palliative PTBD was performed, and 8.3 F ring catheters, with tips proximal to the stenotic segment, were placed in both lobes.

Drainage from ring catheter in the right lobe reduced 13 days after the initial placement. Fracture and intrahepatic withdrawal of catheter was found under fluoroscopy. After removing the extrabiliary fragment, we introduced a 0.035-inch hydrophilic stiff guidewire into the percutaneous tract and successfully threaded the end-hole of the fractured catheter. An 8 F angiosheath was used according to the diameter of the transhepatic tract. Finally, because the working space was relatively small for biopsy forceps manipulation, a balloon dilatation catheter (Wanda; Boston scientific) was partially introduced within the catheter and inflated. The entire unit (fractured catheter, guidewire, angiosheath, and balloon) was retrieved, and the guidewire was successfully reintroduced into the mature intrahepatic tract (Fig. 2).

The dislodged catheters in both cases were successfully removed through the percutaneous tract under fluoroscopic guidance, and new catheters were placed. Bile was drained smoothly without visible hemobilia, indicating that there is no immediate bile duct or vessel injury during the retrieval procedure by using an angiosheath as protection. Moreover, hemolologic examination of both patients revealed stable levels of bilirubin, hemoglobin, white cells, and liver enzymes. Follow-up X-ray and cholangiogram confirmed the appropriate position and function of catheters.

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- Devices such as goose neck snare, an over-the-wire balloon catheter, or biopsy forceps, may be employed in techniques for catheter retrieval.
Fracture and intrahepatic migration of plastic percutaneous biliary catheters are rare. In cases where a catheter fragment remains within the lumen of the biliary tract, percutaneous retrieval techniques are often used to remove the fragment. During percutaneous retrieval, an angiosheath is required for introducing a guidewire alongside the catheter fragment, allowing for its removal. Devices such as a balloon catheter can be used to secure the fracture end to the catheter. Given that the balloon moves relative to the catheter, the fragment can then be moved through friction or the balloon can be used when threading the catheter. ERCP techniques using the biopsy forceps are also applicable because fragments of PTBD catheter are rigid, bulky, and with sharp edges.

The management of fractured catheters, emphasizing on percutaneous retrieval techniques.

In conclusion, fracture and intrahepatic migration of plastic percutaneous biliary catheters are rare. It occurs with rigid catheters, short purchase within the biliary tract, and exaggerated respiratory motion caus-
ing shearing forces between the liver surface and thoracic cage (8). Because the fractured catheter is rigid and generally located upstream to the stricture site, endoscopic approaches used for PBEs are inapplicable. Although no consensus exists on a single method appropriate in all clinical situations, an understanding of the different percutaneous options is helpful. These include using a goose-neck snare, an over-the-wire balloon catheter, or biopsy forceps manipulation within a large-bore angiosheath in mature transhepatic tract.

**Conflict of interest disclosure**

The authors declared no conflicts of interest.