Case Report

Percutaneous-transhepatic creation of a bilioenteric neoanastomosis in a patient with bile duct injury using cone-beam computed tomography

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ABSTRACT

We describe the creation of a percutaneous transhepatic bilioenteric neoanastomosis with the aid of cone-beam computed tomography (CBCT) in a patient suffering from a complicated bile leak after extensive hepatobiliary surgery. Access to the afferent bowel limb was safely performed in a single-stick manner via transhepatic approach with the aid of real-time navigation fluoroscopic imaging generated by CBCT arteriography. CBCT confirmed access of the afferent limb and absence of peri-anastomotic vessel damage, allowing the successful creation of a bilioenteric neoanastomosis, resolving the patient’s biliary leak. The patient is alive and asymptomatic at 12-month follow-up, demonstrating patency of the percutaneous bilioenteric neoanastomosis.

Keywords: Biliary intervention; Bilioenteric neoanastomosis; Cone-beam computed tomography; Fusion imaging; Percutaneous intervention

Introduction

Herein, we describe the creation of a percutaneous transhepatic bilioenteric neoanastomosis adjacent to the native surgical hepaticojejunostomy with the aid of cone-beam computed tomography (CBCT) for procedure planning and real-time imaging guidance on a patient with an aberrant isolated right posterior bile duct injury following extensive hepatobiliary surgery.

Case Report

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was waived by our Institutional Review Board.

Patient

This case report was compliant with the Health Insurance Portability and Accountability Act and approved by our institutional review board with a waiver of informed consent. A 19-year-old female patient with Von Hippel–Lindau syndrome, pancreatic neuroendocrine tumor metastatic to the liver and skip metastasis to the bile ducts underwent a left hepatectomy, pylorus-preserving pancreaticoduodenectomy, duodenojejunostomy, and hepaticojejunostomy. Immediate postoperative course was remarkable for biloma formation arising from the excluded right posterior bile ducts (Fig. 1), which was addressed with percutaneous abscess drain placement within the biloma and placement of a percutaneous transhepatic external biliary drain. After multidisciplinary discussion, the decision was made to attempt creation of a percutaneous bilioenteric neoanastomosis between the aberrant posterior bile duct and the afferent bowel limb.

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Percutaneous hepaticoloojejunostomy technique

Under general anesthesia, two 0.035-inch guidewires were placed within the afferent bowel limb by endoscopy via the duo-
denojejunostomy and were subsequently exchanged for a 5-Fr
100-cm long catheter (TEGT Torcon NB Advantage Beacon tip
catheter; Cook Medical, Bloomington, IN, USA) and a 25-mm bal-
loon catheter (Impact PTA balloon dilatation catheter; B. Braun,
Bethlehem, PA, USA), which was inflated with a saline/contrast
solution. The existing percutaneous external biliary drain was
exchanged for a 6-Fr 23-cm-long sheath, and a 5-Fr Kumpe cath-
eter (Cook Medical) was advanced through the sheath and placed
with its tip adjacent to the external wall of the afferent bowel
limb at the level of the balloon catheter. A 5-Fr catheter (SOS
Omni Selective Catheter; Angiodynamics, Latham, NY, USA) was
used to select the celiac artery. In order to evaluate the relation-
ship between the hepatic artery, the afferent bowel limb, and the
tip of the 5-Fr Kumpe catheter, a single-phase CBCT arteriography
(CBCTA) was performed with an injection rate of 1.5 mL/second
of 100% contrast medium (Ominipaque 300; GE Healthcare, Little
Chalfont, UK) with a 5 seconds delay imaging acquisition (Fig. 2).

Using an image guidance software package (syngo iGuide-
Toolbox; Siemens AG, Forchheim, Germany), a virtual path be-
tween the 5-Fr Kumpe and the balloon catheter was drawn on the
soft-tissue reconstructed multiplanar CBCTA images on a separate
workstation (Leonardo; Siemens AG) with the intent of avoiding
the anteriorly and cranially located hepatic artery. The virtual
path was overlaid on the fluoroscopic images using a Cartesian
coordinate system for real-time navigation (Fig. 2). The back tip
of a 0.018-inch guide wire (V-18 control wire; Boston Scientific,
Marlborough, MA, USA) was placed through the 5-Fr Kumpe
catheter and used to penetrate the afferent bowel limb. A non-
contrast CBCT was then performed demonstrating successful ac-
cess to the afferent bowel limb (Fig. 3).

The existing 5-Fr catheter located within the afferent bowel
limb was exchanged for a 25-mm snare kit (Amplatz GooseNeck
Snare Kit; Covidien, Plymouth, MN, USA), which was used to
capture the tip of the 0.018-inch percutaneous guide wire (Fig.
4). The 5-Fr Kumpe catheter was then advanced over the wire
within the afferent limb lumen. The catheter was exchanged over
a 0.035-inch guide wire for a 20 mm × 4 mm balloon catheter
(Mustang PTA balloon dilatation catheter; Boston Scientific),
which was used to dilate the afferent bowel limb wall. Finally, a
10.2-Fr external/internal drainage biliary catheter (Cook Medical)
was advanced over the guide wire, revealing adequate drainage of the bile ducts within the afferent bowel limb and no evidence of contrast extravasation into the abdominal cavity (Fig. 5). The biliary catheter was capped 48 hours after the procedure. The patient had immediate decreased output from the percutaneous abscess drains, which were removed 3 days after the procedure. Routine cholangiography at 3 months showed a mature bilioenteric neoanastomosis tract with no signs of stenosis or contrast leaking (Fig. 6). The patient is alive and remains asymptomatic with the percutaneous biliary catheter capped at 12-month follow-up.

Discussion

Bile leakage is considered a major complication occurring in 0.4% to 12% of patients undergoing hepatobiliary resection and in 3% to 8% of pancreatic resection. The associated complications, such as hydroelectrolytic imbalance and sepsis, prolong hospitalization, increase the level of care, and are considered a major cause of postoperative morbidity and mortality. Surgery has traditionally been proposed as the treatment of choice for bile leakage, especially for cases with complete dehiscence of the bilioenteric anastomosis. More recently, minimally invasive methods such as endoscopic and percutaneous image-guided intervention have been used as an alternative strategy for the creation of hepaticoenteric drainage pathways with encouraging results. CBCT image fusion and navigation have been recently described to facilitate planning of technically challenging procedures where information provided by the combination of fluoroscopic and cross-sectional imaging is required. Wallace et al suggested that CBCT cholangiography could be especially useful in delineating variant biliary anatomy when surgical intervention is considered. Likewise, Nanashima et al postulated that the use of CBCT three-dimensional cholangiography provides better spatial resolution than two-dimensional cholangiography. In our

Fig. 3. Cone-beam computed tomography showing successful guide wire access (arrow) to the afferent bowel limb.

Fig. 4. Successful capture of the percutaneous microwire (arrow) by the snare kit (arrowhead).

Fig. 5. Successful external/internal percutaneous biliary drain (arrows) placement demonstrating opacification of the afferent limb (asterisk).

Fig. 6. Three-month digital subtraction cholangiogram showing patent bilioenteric neoanastomosis (arrow) with no signs of contrast extravasation.
In conclusion, CBCT facilitated the creation of a bilioenteric neoanastomosis by providing information useful for diagnosis, procedure planning, real-time navigation, and confirmation of technical success after obtaining percutaneous-transhepatic afferent bowel limb access, while avoiding peri-anastomotic complications and obviating the need for a percutaneous transjejunal approach.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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