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Pictorial Review

Percutaneous biliary interventions through the gallbladder and the cystic duct: What radiologists need to know

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Percutaneous cholecystostomy is an established drainage procedure for the management of high-risk patients with acute cholecystitis. However, percutaneous image-guided access to the gallbladder may not be limited to the simple placement of a drain, but may also be used as an alternative approach to the biliary tree through the catheterization of the cystic duct, for a variety of other more complicated conditions. Percutaneous transcholecystic interventions may be performed in both malignant and benign disease. In the case of malignant jaundice, the transcholecystic route may be used when the liver parenchyma is occupied by metastatic lesions and transhepatic access is not possible. In benign conditions, access through the gallbladder may offer a solution if the biliary tree is not dilated. The transcholecystic access may then be route of insertion of large sheaths, internal drainage catheters, lithotripsy devices, stone retrieval baskets, and stents. The purpose of this review is to illustrate the techniques and to discuss the indications, complications, and technical difficulties of this alternative access to the biliary tree.

Introduction

Image-guided percutaneous gallbladder drainage was introduced into clinical practice in the early 1980s,[1–3] however, it was not until the 1990s that the majority of radiologists became more familiar with the technique and the first case reports were published.[4–10] Since then, the method has been widely used and offers a valid solution in selected patients with an acutely inflamed and obstructed gallbladder.[11–17]

Percutaneous transcholecystic access to the biliary tree may be performed after image-guided puncture of the gallbladder and subsequent catheterization of the cystic duct and the common bile duct (CBD), with a guide wire.[12,17–19] The procedure may be used in a variety of malignant and benign conditions.[20–22] The purpose of this review is to illustrate the main percutaneous transcholecystic access techniques and to discuss the indications, complications, and technical difficulties of this alternative access to the biliary tree.

Indications

Indications for percutaneous transcholecystic access to the biliary tree are mainly conditions of obstruction of the

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CBD (benign or malignant) that are either not associated with dilated ducts or where the transhepatic approach is not feasible due to diffuse liver disease (cysts or metastases). Further indications may be the necessity of stent placement in the cystic duct and failed endoscopic sphincterotomy or stone removal in patients with acute pancreatitis.[4,5,11,12,22] Several reports have been published describing catheterization through the cystic duct and the placement of an external biliary drain or alternatively catheterization of the obstruction of the CBD and the placement an internal drain.[16,17,23–25] Yasumoto et al.[18] described lack of intrahepatic duct dilatation and history of gastrectomy as the main indications for transcholecystic access and stent deployment in the CBD. The indications for interventions through the gallbladder and the cystic duct are listed in Table 1.[12,16,17,21–25]

Techniques

Two access routes are described for percutaneous cholecystostomy: the transhepatic and the transperitoneal.[26] No significant difference in complication rates is reported between the two access routes.[14,15] The main reported benefits of the transhepatic route are reduction in the risk of bile leakage, greater catheter support, and quicker maturation of the tract.[15,19,27] Disadvantages, such as higher rate of bleeding, pneumothorax, and fistula formation, have also been reported.[28] The transperitoneal route is preferred for patients with bleeding disorders or those with diffuse liver disease.

Premedication and sedation may be used. Most of the authors use 1–2 mg midazolam and 50–100 μg fentanyl intravenously. Fasting for 6 h is required if sedation is administered.

Ultrasound-guided puncture and the Seldinger technique are used by the majority of operators. There might be a risk of minor bile leakage with the Seldinger technique during the needle–dilator–catheter exchange manoeuvres.[11,19,27] The kit that is most commonly used has a 22 G access needle, through which a 0.018″ wire is introduced. When the wire is within the gallbladder the system is upsized to 0.035″ with the use of a coaxial introducer (Fig 1). Another approach may be with the use of CT guidance, which reduces the risk of pneumothorax, and with a CT cholangiogram the precise anatomy of the cystic duct may be delineated. Once access to the gallbladder is obtained, an 8.5 F drainage locking pigtail catheter is advanced over the 0.035″ wire and left *in situ* for a few days. In this way, the gallbladder is decompressed and wire manipulation and catheterization of the cystic duct is more feasible. In the series of Yasumoto et al.,[18] stent deployment in the CBD was performed after a mean time of 10.4 days (range 5–21 days). Tract maturation is also important to avoid bile leak. If the transhepatic route is used, the tract is matured within 2 weeks of the initial access. For access via the transperitoneal route, at least 3 weeks are required; tract fistulography may be performed prior to any manoeuvres to confirm the presence of a mature and stable fistula.[15]

To access the cystic duct, fluoroscopy and real-time fluoroscopic imaging are required. A cholangiogram is initially performed preferably with diluted contrast medium, in order to confirm the CT findings. The drainage catheter is then exchanged over a stiff wire to a 6 or 7 F sheath, preferably with a Britetip. The use of a second safety guide wire as a "buddy wire" outside the sheath is recommended in case access is lost due to the lack of support from the gallbladder, which may occur even with a mature tract. The "buddy-wire" technique requires that two wires are inserted through the sheath and the sheath is then retracted and re-inserted over one of the two wires so that the second wire remains within the gallbladder as a separate access. The sheath may also be secured with a stitch to the skin to increase support during catheter–wire manipulations.

A short 4 or 5 F angled catheter (Fig 1) may be introduced through the sheath, and a stiff hydrophilic wire may be used to navigate the tortuous cystic duct. After crossing the cystic duct, the catheter is advanced to the CBD. Depending on the underlying disease, the CBD may also be crossed with the

Table 1
Indications for interventions through the gallbladder and the cystic duct.[11,15–20]

1. Benign or malignant CBD disease in a patient with an already existing cholecystostomy
2. Benign or malignant CBD disease in a patient with contraindication for transhepatic puncture
3. Benign or malignant CBD disease in a patient after failed or contraindicated endoscopic retrograde cholangiopancreatography/ percutaneous transhepatic cholangiography, including acute pancreatitis
4. Malignant jaundice due to obstruction of the distal CBD, presenting as acute cholecystitis
5. Acute cholecystitis due to cystic duct malignant infiltration, for decompression and cystic duct stenting
6. Acute cholecystitis due to cystic duct obstruction, caused by an occluded metallic stent of the CBD, for decompression and cystic duct stenting

CBD, common bile duct.

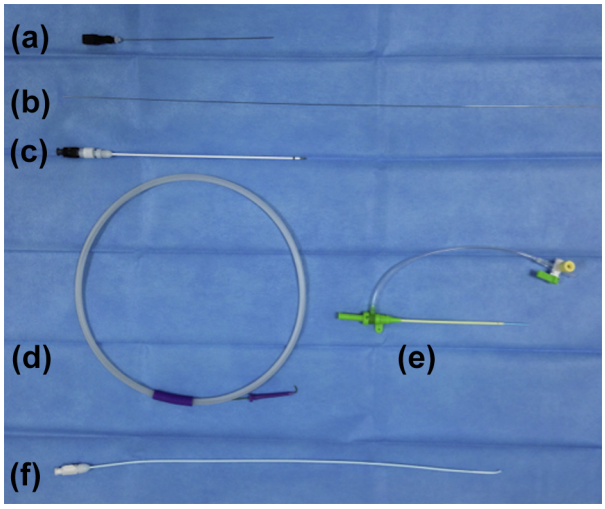

Figure 1 Access kit for transcholecystic interventions: (a) 22 G needle, (b) 0.018″ wire, (c) coaxial access system, (d) 0.035″ stiff wire, (e) 6 F brite tip sheath, (f) 4 F biliary manipulation catheter.