



ORIGINAL ARTICLE / *Pediatric imaging*

## Percutaneous management of benign biliary disorders in children

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### KEYWORDS

Interventional radiology;  
Cholelithiasis;  
Biliary intervention;  
Bile duct diseases;  
Pediatric

### Abstract

**Purpose:** The goal of this study was to analyze the outcomes of percutaneous transhepatic management of benign biliary disorders in pediatric patients.

**Materials and methods:** This study included 11 pediatric patients who underwent percutaneous transhepatic biliary interventional procedures between September 2007 and December 2016. There were 3 males and 8 females with a mean age of  $9.6 \pm 5.4$  (SD) years (range: 2–17 years). Technical details, complications and outcome of the procedures were evaluated.

**Results:** The underlying pathologies were bile duct stones ( $n=2$ ), bile leakage ( $n=4$ ), choledochal cyst ( $n=3$ ) and benign biliary stricture ( $n=2$ ). The therapeutic interventional procedures were as follows; percutaneous stone removal in patients with bile duct stones, external biliary drainage in patients with choledochal cyst, bile diversion by internal-external percutaneous biliary drainage (IE-PBD) in patients with bile leakage, plastic stent placement, IE-PBD with balloon dilatation in patients with benign biliary stricture. The procedures were successful in all patients technically and clinically. One patient experienced intermittent fever.

**Conclusion:** Percutaneous transhepatic biliary interventional procedure is an effective and safe approach for the treatment of pediatric patients with bile duct stones, bile leakage, symptomatic choledochal cyst and benign biliary stricture when endoscopic procedure is unavailable or fails.

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## Introduction

Percutaneous biliary interventions are performed for the management of liver transplant complications and malignant or benign source of biliary disorders in native liver, such as common bile duct (CBD) stones, benign biliary strictures, choledochal cysts, and rhabdomyosarcoma in pediatric patients [1–10]. Endoscopic retrograde cholangiopancreatography (ERCP) is the first choice for evaluation and management of pancreaticobiliary diseases, such as acute and chronic pancreatitis, choledochal cysts, bile leaks and biliary obstruction due to stricture and stones [4–5]. The success rates and complication rates of endoscopic procedures are 95–98% and 2.3–9.7%, respectively [4–5]. ERCP may be unavailable or may result in failure due to some limitations, such as anatomic problems or age and size limitation of the patient. Percutaneous methods are alternative non-surgical techniques in such cases [1,2,9,10].

The goal of this study was to analyze the outcomes of percutaneous transhepatic management of benign biliary disorders in pediatric patients.

## Materials and methods

### Patients

Approval for the study was given by our institutional research ethics committee. Our medical and imaging record of the interventional suite were reviewed, for the period of September 2007 and December 2016 to identify the pediatric patients who had undergone percutaneous transhepatic biliary interventional procedure, due to obstructive or non-obstructive benign biliary disorders. Demographic data, presenting symptoms of the patients, laboratory findings, diagnostic and interventional imaging findings, indication for the intervention, technical details, technical and medical success and complications of the procedures and length of follow-up was extracted and recorded for each patient. Finally, we evaluated the efficacy of the percutaneous interventional procedures in these cases.

This study included 11 pediatric patients, who underwent percutaneous transhepatic biliary interventional procedures between September 2007 and December 2016. There were 3 males and 8 females with a mean age of  $9.6 \pm 5.4$  (SD) years (range: 2–17 years). Twelve patients with CBD stones who were managed percutaneously and reported previously were not included in this group [9]. The underlying pathologies were bile duct stones and sludge formation ( $n=2$ ), bile leakage ( $n=4$ ; including two patients with cysto-biliary fistula, one with trauma-related bile leak and one with laparoscopic cholecystectomy (LC)-related bile duct injury [BDI] and bile leakage), choledochal cyst ( $n=3$ ) and benign biliary stricture ( $n=2$ ). Demographic data of the patients, indications for interventions, type of interventional procedures and their outcomes are listed in the Table 1.

The diagnosis of biliary disorders was made based on clinical examination, laboratory findings, ultrasound and magnetic resonance images (MRI) examination. Presenting symptoms were obstructive jaundice with elevated liver function tests (LFTs) with or without serum bilirubin level in patients with CBD stones and obstructive benign biliary

strictures, cholangitis signs in patients with choledochal cysts. The cysto-biliary fistula was diagnosed by cystography via the surgically inserted catheter into the cyst cavity. LC-induced BDI and leakage presented with bile leakage from surgically-inserted drain catheter with signs of peritonitis. In a patient with trauma, there was suspicion of BDI during explorative laparotomy.

### Technique

Complete blood count, prothrombin time, partial thromboplastin time and international normalized ratio, LFTs and serum bilirubin levels were reviewed before the procedure. Routine abdominal ultrasound examination was performed and MRI was carefully checked to evaluate the biliary system before the intervention.

The parents of all patients gave the informed consent before the procedure. All procedures were performed under intravenous sedation and continuous monitoring was performed for all patients during the procedure. Prophylactic intravenous broad-spectrum antibiotic (cephalosporin) was administered to patients who did not receive antibiotic therapy. The procedures were performed with fluoroscopy guidance, under standard sterile conditions. Low pulse rate fluoroscopy and optimal collimation were used with gonad protection to reduce radiation exposure.

First, percutaneous transhepatic cholangiography (PTC) was performed in patients without drain catheter to evaluate the biliary tree and pathology using a right intercostal approach. In two patients with cysto-biliary fistula, cystography was performed via the surgically inserted drain catheter to demonstrate the cysto-biliary fistula and biliary tree. For the PTC, a 21-gauge (G) Chiba needle (Cook Medical, Bloomington, IN, USA) was entered into the liver parenchyma. The stylet was removed, then the needle was withdrawn slowly during injection of non-ionic contrast media (Iopromide, Ultravist® 370, Schering, Berlin, Germany) until a biliary duct was demonstrated. Repeated maneuver was performed in different directions until the procedure was successful. In the case of a central duct was punctured, a more peripheral duct was punctured using a second needle to avoid the risk of hemorrhagic complications. After satisfying opacification of the biliary tree, a 0.018-inch microguide was advanced into the hepatic duct through the needle. A coaxial introducer system (Accustick™ II Introducer System, Boston Scientific, Natick, MA) was placed into the bile duct over the microguide. After entrancing to the bile duct, the stiffener and 4-French (F) dilator were removed and full opacification of the biliary tree was achieved by administering the more contrast material. Then, tract dilatation was performed using a 7-F dilator over a 0.035-inch floppy-tipped stiff guidewire (Backup Meier™ steerable wire guide, Boston Scientific, Natick, MA), and a 7/8-F vascular introducer sheath was placed into the common hepatic duct (CHD). After this stage, following interventional procedures were performed according to the type of biliary pathology.

In two patients with bile duct stones, which was a sludge formation in one, causing biliary obstruction, the guidewire was advanced into the duodenum through the sphincter of Oddi, via the vascular sheath. Then, an angiographic

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