

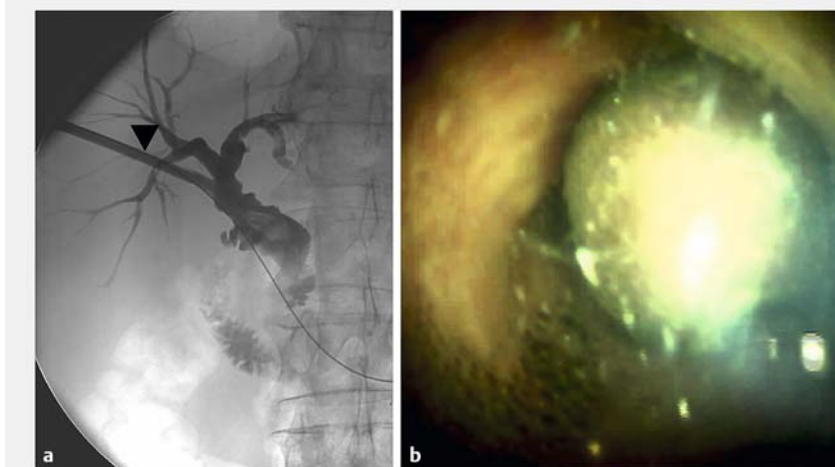
## Cholangioscopy-guided electrohydraulic lithotripsy of large bile duct stones through a percutaneous access device



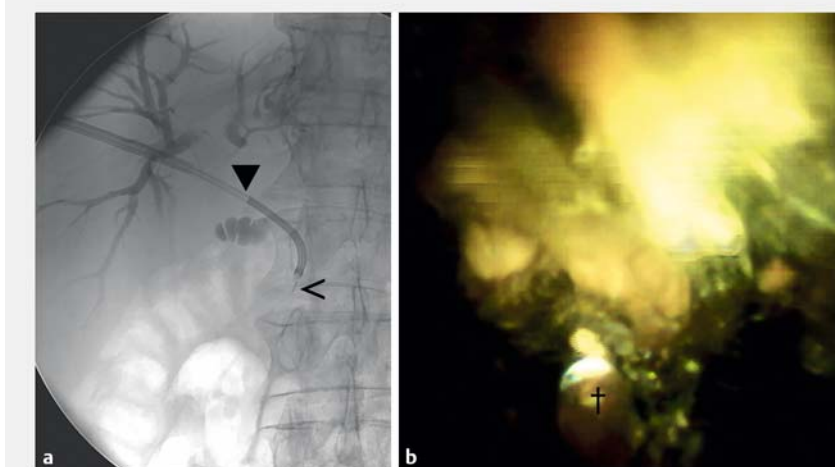
► **Fig. 1** Percutaneous transhepatic cholangiography (PTC) showing large stones (▼) in the main bile duct.

We report a clinical case series of five patients with choledocholithiasis and anatomic abnormalities that made biliary access by endoscopic retrograde cholangiography (ERCP) impossible. In three patients, we were unsuccessful in accessing the biliary tract by single-balloon enteroscopy because of surgically altered anatomy with biliodigestive anastomosis. In two patients, a large diverticulum prevented intubation of the common bile duct. All of the patients presented with signs of cholestasis including elevated bilirubin levels. Magnetic resonance imaging (MRI) scans revealed one to three large stones in the main or intrahepatic bile duct. Different approaches for such patients have been described [1–3].

We primarily used a percutaneous approach (► **Fig. 1**); however, the stones were too hard and/or too large to be fragmented, retrieved, or transpositioned via percutaneous transhepatic cholangiography. An 8.5-Fr drain was inserted and was subsequently replaced by a 12-Fr percutaneous transbiliary drain to enlarge the insertion site. The drain was changed to a 12-Fr sheath, which was placed in the upper main bile duct or in an intrahepatic bile duct ► **Fig. 2**). The bile duct was di-



► **Fig. 2** Cholangioscopy via the percutaneous inlet. **a** The inlet is created by replacing the initial drain with a 12-Fr sheath (▼) to reach the main bile duct. **b** The biliary stone is visualized within the main duct via a cholangioscope passed through the inlet.



► **Fig. 3** Electrohydraulic lithotripsy (EHL) via the percutaneous inlet. **a** The cholangioscope is inserted into the main bile duct (▼), along with the previously inserted lithotripsy probe (◄). **b** Cholangioscopic view showing the tip of the EHL probe (†) pointing to the already fragmented stone.

rectly entered via this inlet with a cholangioscope (SpyGlass Direct Visualization System; Boston Scientific, Natick, Massachusetts, USA). Endoscopic biliary access was possible at a mean of 4 days after the initial percutaneous drainage.

The stones were directly fragmented under optic visualization using an electrohydraulic lithotripsy device (P2,4/3000/f probe; Walz Elektronik GmbH, Rohrdorf, Germany) [4] (► **Fig. 3**). All fragments were completely removed by flushing



► **Fig. 4** Radiographic image after electrohydraulic lithotripsy showing that the biliary stones have been completely removed.

and suction. Complete stone removal was achieved in all patients (► **Fig. 4**). An exemplary case is shown in ► **Video 1**. None of the patients required percutaneous papillotomy or balloon dilation.

A protective 14-Fr drain was placed after the procedure. Follow-up cholangiography showed no signs of remnant bile duct stones or fragments and all patients recovered from their obstructive jaundice. Prophylactic antibiotic therapy was given to all patients. There were no major complications, such as peri-interventional cholangitis or bleeding.

This case series demonstrates the possibility of a fast percutaneous cholangioscopic management for patients with large bile duct stones and altered anatomy. Overall, in our small study, percutaneous access to the biliary tract with a cholangioscope appears to be a very safe and controlled procedure with minimal risk for the patient. Clinicians should be aware of this option to manage stones in the bile duct, even those that are hard and large, when classical procedures such as ERCP, or single- or double-balloon ERCP are not possible.

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### Competing interests

None



► **Video 1** A cholangioscope is passed via the percutaneous inlet. After entering the bile duct, the stone is visualized and fragmented with the electrohydraulic lithotripsy probe, which is inserted through the cholangioscope. After the procedure, the cholangioscope is inserted again and is pushed all the way into the small bowel. On withdrawal, no further stones are visualized but the bile duct is seen to be inflamed because of the stones.

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