

Choledocholithiasis – Sphincterotomy and Stone Removal With an Extraction Balloon



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Abstract

At choledocholithiasis, enlarging the papillary opening with a sphincterotomy is a prerequisite for endoscopic stone extraction. After sphincterotomy, more than 90% of common bile duct (CBD) stones can be removed with a Dormia basket or balloon catheter. Here we present a case with endoscopic management of choledocholithiasis providing step-by-step explanation of the sphincterotomy and stone extraction with a balloon catheter. This article is part of an expert video encyclopedia.

Keywords

Balloon catheter; Biliary stone; Endoscopic retrograde cholangiopancreatography; Papillotomy; Video.

Video Related to this Article

Video available to view or download at doi:10.1016/S2212-0971(13)70199-7

Technique

Endoscopic retrograde cholangiopancreatography (ERCP).

Materials

- Endoscope: 13882 PKS; Karl Storz, Tuttlingen, Germany.
- Generator: ERBE VIO generator; ERBE Elektromedizin GmbH, Tübingen, Germany.
- Balloon catheter: Extraction balloon, Escort II, 15 mm diameter; Cook Medical, Winston-Salem, NC, USA.
- Sphincterotome: PreCurved Triple Lumen Sphincterotome; Cook Medical, Winston-Salem, NC, USA.
- Guide wire: Cook Medical, Winston-Salem, NC, USA.

Background and Endoscopic Procedure

A 72-year old man presented with cholestatic liver function tests and some abdominal tenderness in the right upper quadrant. Abdominal ultrasound showed choledocholithiasis and the patient was referred for ERCP.

Given that this procedure is therapeutic, we initiated cannulation of the naïve papilla with a sphincterotome. Compared with a catheter, the sphincterotome orientation to the distal biliary tree is favorable and allows movement of the tip in the desired direction by controlled bowing of the distal end. After successful insertion of the wire, the sphincterotome was guided into the bile duct. Fluoroscopy identified a singular 8 mm stone in the distal portion of the duct. In a next step, biliary sphincterotomy was performed to provide a sufficient

exit path for the stone and access for any manipulation that may be required.

Sphincterotomy entails the incision of the papilla and sphincter muscles to open the terminal portion of the common bile duct (CBD). There are three simple but important steps for successful and safe sphincterotomy:

1. After deep bile duct cannulation of the sphincterotome (Precurved Triple Lumen Sphincterotome; Cook Medical), retract the sphincterotome until at least one-third of the wire length is exposed outside of the papilla.^{1,2} Cutting during deeper cannulation dramatically increases the risk of vascular injury and severe bleeding, as well as perforation.
2. The cutting wire is then bowed until the roof of the papilla is elevated.
3. During the cut, direct the incision toward 11 o'clock to follow the direction of the bile duct.

How long is the optimal cut size? The optimal length of incision should be 10–15 mm with the maximum extent being limited by the length of the intraduodenal portion of the CBD. The cut should be generous enough to allow passage of the stone across the papilla. As a measure of adequate cut size, the bowed sphincterotome can be carefully drawn across the cut papilla.

After enlarging the papillary opening, the endoscopist must decide on an extraction method appropriate for both the anatomy and the stone. The basket provides better traction than the balloon catheter and therefore, is preferable for the extraction of large stones (> 1 cm).³ The balloon extraction technique does not require capture of the stone as the inflated balloon occludes the complete lumen and therefore, this approach is preferable for the removal of small stones and gravel. A further advantage of the balloon catheter is that it can be inserted over a guide wire, which can be helpful when extracting an intrahepatic stone.³ The balloon extraction technique involves placement of an appropriate extraction balloon (Escort II, 15 mm diameter, Cook Medical) proximal to the stone and then inflation of the balloon just sufficient to occlude the bile duct before traction is applied. In cases with

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multiple stones, it is important to extract each stone individually, beginning with the distal-most one. Pulling out several stones in a row might cause significant trauma to the bile duct. It is important to apply traction in line with the long axis of the bile duct. When there is little or no resistance at the sphincterotomy site, stones can easily be pulled into the duodenum. If there is too much resistance be careful; well-controlled extraction is mandatory to minimize the trauma of the papillary opening. Withdraw the balloon to a point closest to the endoscope and then perform the extraction maneuver by downward deflection of the endoscope tip and rotation to the right away from the papilla.

Key Learning Points/Tips and Tricks

- In cases with a naïve papilla and high probability of a therapeutic procedure, initial cannulation of the bile duct with a sphincterotome is helpful and economic.
- During cannulation attempts, repeated inadvertent filling of the pancreatic duct should be avoided; think about using the guide-wire based cannulation techniques.
- At sphincterotomy, at least one-third of the cutting wire should be visible outside the papilla.
- The correct length of the incision should be approximately 10–15 mm and may extend to the transverse fold.
- In cases with multiple stones, it is important to extract each stone individually, beginning with the distal-most one. Pulling out several stones in a row might cause significant trauma to the bile duct.

Complications and Risk Factors

The overall complication rate for endoscopic sphincterotomy determined in large surveys ranges between 4% and 10%^{1,2} with pancreatitis being the most common complication.¹ However, the course is mild in most cases. The rates of bleeding reported in the literature are difficult to compare, as the definition may vary. The Freeman Study found significant hemorrhage in 2% of cases, with 1.4% defined as severe with the need of blood transfusion.

Alternatives

Removing bile duct stones by ERCP requires enlarging the papillary opening. Endoscopic sphincterotomy is now well established as the first-line treatment for bile duct stones worldwide. However, endoscopic papillary balloon dilation is also considered as an alternative in Japan. In other countries, this technique is no longer performed because of concerns regarding postprocedure pancreatitis.⁴ Still, in specific situations such as altered surgical anatomy like a Billroth 2 partial gastrectomy or conditions where there is a risk of bleeding such as portal hypertension, renal failure and uncorrectable coagulopathy balloon dilation might be considered.

Scripted Voiceover

This is an ERCP in a 72-year old man with symptomatic choledocholithiasis. Since this procedure is therapeutic, we

initiate cannulation of the naïve papilla with a sphincterotome. The precurved sphincterotome has a specific advantage compared to standard catheter: it allows movement of the tip in the desired direction by controlled bowing of the distal end and therefore facilitates cannulation of the bile duct in most cases. Here we insert the sphincterotome into the top-left hand corner in the 11 o'clock direction. We feel that the catheter pops deeper inside the papilla. Now we gently advance and withdraw the guide wire: However, insertion of the duct is not achieved immediately. To define the anatomy a small pulse of contrast is injected and we see some contrasting of the pancreatic duct. The sphincterotome is now tightened further and very slowly withdrawn from the papilla. Then we advance the tip slightly beyond the papilla in the biliary orientation and again gently advance the wire. Now we've got it: the wire is successfully guided in the bile duct. Guided by the wire the sphincterotome is now easily advanced and the CBD is contrasted upon gentle mask small stones. Here we see the small singular 8 mm biliary stone in the distal portion of the duct. In a next step we have to perform sphincterotomy to prepare an adequate exit for this stone. The cutting-wire is bowed until the roof of the papilla is elevated. Now cutting is performed with the "Erbe" Endocut mode. This is still not wide enough. We have to repeat cutting to achieve an optimal incision length of 10–15 mm. The direction of the sphincterotomy is always directed toward 11 o'clock, the direction of the bile duct. During the whole procedure it is of utmost importance that at least one-third of the cutting-wire is visible outside the papilla. Be aware: Cutting during deeper insertion dramatically increases the risk of bleeding and perforation. In a next step we need to remove the stone. In this case we apply the balloon extraction technique as it offers some advantages over the basket technique when removing small stones and gravel. The extraction balloon is inserted over a guide wire. The balloon has a maximum diameter of 15 mm when fully inflated. Under fluoroscopic control the balloon is placed proximal to the stone. Then the balloon is inflated to an extent just sufficient to occlude the bile duct before traction is applied. Now we apply traction in line with the long axis of the bile duct. Downward deflection of the endoscope tip and rotation to the right away from the papilla help to increase traction. Here we go: we extracted that pale stone that has the classical appearance of a berry, the so called morula shape. In patients in a prone position extracted stones are mostly collect in the 6 o'clock position. So when you are looking for extracted stones: this is the place to look first! In a last step a final cholangiogram is performed. It confirms complete clearance of the duct with spontaneous drainage of the contrast media.

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