Choledocholithiasis – Sphincterotomy and Stone Extraction with a Basket

J Pohl, Dr.-Horst-Schmidt-Klinik, Wiesbaden, Germany

© 2013 Elsevier GmbH. Open access under CC BY-NC-ND license.

Received 18 January 2012; Revision submitted 18 January 2012; Accepted 1 April 2012

Abstract

Endoscopic sphincterotomy is a basic technique that enables extraction of biliary stones by enlarging the papillary opening. However, it is also the most invasive procedure routinely performed by endoscopists and is associated with a considerable complication risk, especially when not properly performed. Here the author presents a case with jaundice and suspected biliary stones. Step-by-step explanation of the sphincterotomy and stone extraction technique with a basket is provided. Moreover, options for cannulating a floppy papilla are demonstrated. This article is part of an expert video encyclopedia.

Keywords

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

Video Related to this Article

Video available to view or download at doi:10.1016/S2212-0971(13)70198-5

Technique

Endoscopic retrograde cholangiopancreatography (ERCP).

Materials

- Endoscope: Fuji ED450XT8; Fujinon Inc., Saitama, Japan.
- Generator: ERBE VIO generator; ERBE, Tübingen, Germany.
- Balloon catheter: Extraction balloon, Escort II, 15 mm diameter; Cook Medical, Winston-Salem, NC, USA.
- ERCP cannula: Fluoro Tip; Boston Scientific Corporation, Natick, MA, USA.
- Tapered ERCP cannula: Contour ERCP Cannula (5 Fr); Boston Scientific Corporation, Natick, MA, USA.
- Sphincterotome: PreCurved Triple Lumen Sphincterotome; Cook Medical, Winston-Salem, NC, USA.
- Guidewire: Cook Medical, Winston-Salem, NC, USA.
- Stone extraction basket: BAS 1 half-twisted wire-guided 15-mm basket; Medwork, Höchstadt, Germany.

Background and Endoscopic Procedure

A 51-year-old woman presented with jaundice and abdominal pain. Sonography showed cholecystolithiasis and choledocholithiasis with a dilation of the common bile duct. At ERCP, the papilla revealed a rather long papillary roof and a floppy appearance. In these situations, a tapered-tip ERCP is helpful. It eases cannulation in cases with a floppy or narrow papilla and very tiny orifices of the pancreatic or biliary duct. Compared to the standard diagnostic cannula, the tip caliber is smaller and allows selective cannulation of fine orifices. However, keep in mind that the finely tapered-tip cannula does only accept 0.008 wires and that care must be taken to avoid mucosal damage causing submucosal injection of contrast. After cannulation, fluoroscopy identified a singular 8 mm stone in the distal portion of the duct. There are several important issues to be considered before stone extraction: First, it is important to assess the bile duct anatomy and to adjust the procedure to the stone and clinical situation. The critical size of a stone above which removal may be difficult is approximately 15 mm in diameter. These stones have to be disintegrated before their extraction, for example, by mechanical lithotripsy. However, in the present case, this is obviously not necessary. Next, an adequate exit for the stone should be made. To this end, a sphincterotomy with a sphincterotome is engaged. The triple-lumen sphincterotome is a precurved device that accepts a 0.035 guidewire in one lumen and allows simultaneous injection of contrast through another lumen. It contains a thin 20 mm steel wire at the tip of the catheter. Tension of this wire produces a bowing effect, with the wire forming the bowstring. When the instrument is correctly positioned in the papilla, the exposed wire functions as a cautery knife. Besides sphincterotomy, the sphincterotome is often used to initiate cannulation of the bile duct, because compared with a catheter, the sphincterotome orientation to the distal biliary tree is favorable and adjustable.

The sphincterotome is introduced into the bile duct and the roof of the papilla is elevated by exerting tension on the cutting wire. The cut should be directed toward 11 o’clock to avoid vascular injury. Common errors are applying too much tension and introducing the wire too deeply. These approaches may result in an uncontrolled rapid and large incision with increased risk of bleeding and perforation. Usually a combination of cutting and coagulation current is applied in short
Choledocholithiasis – Sphincterotomy and Stone Extraction with a Basket

Key Learning Points/Tips and Tricks

- A tapered ERCP cannula is helpful in cases with very tiny orifices of the pancreatic or biliary duct and in cases with a floppy papilla.
- Before stone extraction, evaluate the relative diameters of the stones and bile duct especially distal to the stone to be removed. To this end, the initial endoscopic cholangiogram is the most accurate way to make this assessment.
- For 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 extend to the transverse fold.
- Do not feel compelled to complete the treatment in one session when there are multiple or large stones.

Complications and Risk Factors

The overall complication rate for endoscopic sphincterotomy (EST) is determined in large surveys ranges between 4% and 10%.1,2 Pancreatitis is the most common complication of EST.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, either by cutting the biliary sphincter with an endoscopic sphincterotomy or by endoscopic papillary balloon dilation. Dilation has the advantage of sphincter preservation and a lower risk of hemorrhage, but carries an increased risk of post-ERCP pancreatitis (up to 15%).4 Few centers use it routinely, but it can be the optimal technique in specific situations such as altered surgical anatomy like a Billroth II partial gastrectomy or conditions where there is a risk of bleeding such as portal hypertension, renal failure, and uncorrectable coagulopathy.

Scripted Voiceover

A 51-year-old lady presented with choledocholithiasis. At ERCP the papilla reveals a rather long papillary roof and a floppy appearance. Surprisingly, despite the jaundice there is still considerable bile flow. Because sphincterotomy prior to stone extraction is envisioned a sphincterotome is favoured to cannulate the naı̈ve papilla. However, as you see here the pancreatic duct is repeatedly instrumented without selective biliary access being achieved. This is probably due to angulation and obstruction of the intrapapillary bile duct as soon as the rather rigid tip of the sphincterotome is pushed in the papillary orifice. In situations with a floppy or narrow papilla a finely tapered-tip ERCP cannula might be helpful. Look: In comparison to the standard diagnostic cannula the tip caliber is smaller and allows selective cannulation of fine orifices. Here we have the cannula with the tapered tip already in place. First the axis of the catheter has to be aligned with the axis of the bile duct, then the papillary orifice is cannulated. Alright: we are in the right place and the common bile duct is contrasting upon gentle injection of contrast but the angle needs to be optimized. To this end we apply a simple shortenting maneuver and slowly withdraw the endoscope with a slight torque to the right. The acute angulation within the intrapapillary bile duct is now straightened out and the position allows successful cannulation. The catheter is first advanced to the confluence and than slowly withdrawn while the assistant gently injects contrast. Make sure that you do not inject too much since this might mask small stones. Here: there is the trouble maker. A 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. For this purpose we use a precurved triple lumen sphincterotome. This device accepts a guide wire in one lumen and allows simultaneously injection of contrast through another lumen. It contains a thin 20 mm steel wire that ends 3 mm from the nose. Tension of the wire produces a bowing effect, with the wire forming the bowstring. When the instrument is correctly positioned in the papilla, the exposed wire functions as a cautery-knife. The sphincterotome is now advanced over the guide wire and introduced into the bile duct. Now the orientation of the catheter is optimized. The cut should be directed toward 11 o’clock to avoid vascular injury. At least one-third of the cutting-wire should be visible outside the papilla. The roof of the papilla is elevated when tension is exerted on the cutting wire. This allows the endoscopist to ascertain the correct direction of the cut during the procedure. For the cut a combination of cutting and coagulation current is applied. Here we use the ERBE endocut mode. There is dark bile spilling out of the enlarged opening. However, for appropriate access to the bile duct we have to continue the cut a little bit. The correct length of the incision should be about
10–15 mm and extents to the transverse fold for a normal papilla. Now its perfect. In a next step we need to remove the stone. To this end we apply the basket technique. The catheter with the basket is pretty stiff, but with our nice sphincterotomy the closed basket can be maneuvered through the papilla without problems. If difficulties are encountered we could also advance the basket over a guide wire. Under fluoroscopic control we advance the closed basket proximal to the stone. Then the basket is opened and we try to engage the stone by pushing and pulling the basket on to the stone. Traction is then applied while the basket wires are closed and the stone is removed. If resistance is felt at the sphincterotomy site, the endoscope extraction maneuver is performed with downward deflection of the tip and rotation of the control body to the right. It is important to apply traction in line with the long axis of the biliary duct. In a last step, to ensure complete clearance of the duct, an occlusion cholangiogram with a balloon catheter is performed. Fluoroscopy confirms complete extraction of the stone.

References