Review

EUS-guided choledochoduodenostomy for malignant distal biliary obstruction palliation: an article review

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Abstract:
The EUS-guided biliary drainage is a new tool for the palliation of distal obstructive biliary lesions. The EUS-guided access, which creates a fistulization between the duodenal bulb and distal common biliary duct, is an effective method to relieve jaundice and has low morbidity and mortality, in patients with distal biliary obstruction (pancreatic mass or papillary câncer). This technique is called choledochoduodenostomy and is presented promptly in this article. The EUS-guided biliary drainage should be made within protocol conditions and done by very experienced endosonographers.

Keywords:
biliary drainage; endoscopic ultrasound-guided; choledocho

Introduction

Endoscopic biliary stenting at endoscopic retrogade cholangiopancreatography (ERCP) is a well-established therapy for both benign and malignant biliary obstruction.[1-3] In the last decades, the EUS-guided ductal access techniques paired with standard ERCP drainage techniques have been developed to overcome ERCP failures and improve the outcomes over those afforded by more invasive alternatives, such as percutaneous transhepatic biliary drainage (PTBD) and surgery. This hybrid procedure is given a variety of names, but the more encompassing one is endosonographic cholangiopancreatography (ESCP).[4] Based on the combination of the three possible access routes (intrahepatic bile, extrahepatic bile, and pancreatic ducts) with the three possible drainage routes (transmural, transpapillary antegrade, and transpapillary retrograde), ESCP admits nine variant approaches: six for the bile duct and three for the pancreatic duct.[5,6] The six ESCP variant approaches to the bile duct drainage are referred collectively as EUS-guided biliary drainage (EUSBD). This chapter focuses on the EUSBD technique that provides transmural drainage from an extrahepatic bile duct access route, which is most commonly termed as the EUS-guided choledochoduodenostomy (EUS-CDS). Transmural intrahepatic EUSBD (hepaticogastrostomy) and transpapillary EUSBD (antegrade and rendezvous) will also be discussed in this paper.

Rationale

As stated above, the EUSBD is divided by the access route into the EUS-guided intrahepatic bile duct drainage, where the intrahepatic bile duct is punctured from a transesophageal, transgastric, or transjejunal approach, and the EUS-guided extrahepatic bile duct drainage, where the common bile duct (CBD) is punctured from a transduodenal or transgastric approach (usually from the distal antrum). The overall rationale for EUS-CD is shared by the alternative EUSBD techniques. The threefold advantages are: (1) logistic advantage (can be performed in the same session as the originally failed ERCP without further delay), (2) physiologic advantage (provides immediate internal biliary drainage without the need for external drains), and (3) anatomic advantage (can be tailored to the anatomy of the individual patient, whereby the precise imaging afforded by EUS results in a potentially less invasive procedure than PTBD).

In addition to the underlying common rationale for EUSBD implicit in EUS-CDS, there is a specific rationale

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for it. The CBD is more easily imaged under EUS than the intrahepatic bile ducts, in contrast to what happens under transabdominal ultrasound. This condition means that it can be imaged and accessed under EUS without added risks even in patients with minimal or no bile duct dilation. The CBD in patients with dilated bile ducts is a more obvious target for puncture than the intrahepatic ducts. This procedure results in a faster and cleaner access without repeated puncture attempts, thereby minimizing risks. The retroperitoneal location of the CBD makes it an attractive access site for patients with ascites, in whom fluid around the liver makes transhepatic access (whether percutaneous or transgastric under EUS) more difficult and hazardous.

Aside from the advantages of extrahepatic access over intrahepatic access, the specific rationale for EUS-CDS is also derived from the transmural drainage route, as opposed to transpapillary EUSBD (antegrade or rendezvous). The antegrade stent insertion from an extrahepatic access site is challenging and has only been reported in two exceptional cases.[7,8] The real choice between transmural and transpapillary drainage after extrahepatic bile duct access under EUS therefore lies between EUS-CDS and rendezvous. The proponents of the rendezvous argue that it may be less invasive than EUS-CDS because transmural intervention is usually limited to puncture and guidewire passage, thus, drainage is accomplished retrogradelly via ERCP without the need for puncture tract dilation.[9] However, EUSBD rendezvous carries a 20% failure rate even in expert centers because the guidewire passage across the stricture and the papilla is often unsuccessful. The needle allows virtually no interplay with the guidewire, which cannot be manipulated across the stricture through a needle in the same way as it can be done at ERCP using flexible catheters. The EUSBD needle-rendezvous (i.e., without creating a fistula to allow passage into the bile duct through the puncture tract of flexible devices to help manipulate the guidewire antegradely) may require repeat punctures with different angles or trying different types of guidewires, often resulting in a prolonged and labor-intensive procedure. The second part of the rendezvous following antegrade guidewire passage involves scope exchange and guidewire retrieval, which is also cumbersome and plagued with difficulties. In summary, the advantages of EUS-CDS over transpapillary rendezvous are its higher success rate and relative simplicity, which appear to make it a more reproducible approach despite being more invasive. Nonetheless, both EUSBD variant approaches can be considered complementary in as much as these procedures are used in a heterogeneous patient population. Some indications are better suited for EUS-CDS, whereas in other cases, EUSBD rendezvous is clearly advantageous. Similarly, EUS-CDS can be used as a second line approach to salvage the significant proportion of failed rendezvous cases even if the rendezvous is the intended drainage technique.[10,11] This open-ended approach to EUSBD (i.e., inclusive of both rendezvous and EUS-CDS) results in comparatively higher success rates than that of EUSBD series that limit their approach to just the rendezvous.[9]

Technical data, discussion of possible therapies and recommendation of the prosthesis, and practical recommendations for proposed endoscopic techniques

Indication

Similar to other EUSBD techniques, EUS-CDS should only be considered in patients with confirmed (not just suspected) biliary obstruction after failed ERCP despite maximal attempts by experienced operators. General patient, operator, and equipment requirements are the same as for other EUSBD techniques. However, EUS-CDS has specific anatomic requirements that differ from other EUSBD alternatives. The first anatomic requirement is distal biliary obstruction. This requirement means that EUS-CDS is not suitable for proximal (hilar) biliary obstruction, where intrahepatic EUSBD approaches are clearly required. The second anatomic requirement is the ability to image CBD under EUS. CBD is typically imaged from the distal stomach or the duodenal bulb; thus, this process is difficult or impossible to conduct in patients with prior gastrectomy and gastrojejunostomy (e.g., Roux-en-Y).[12]

Finally, similar to other EUSBD approaches, the EUS-CDS is predominantly used in patients with malignant biliary obstruction. Alternative approaches, such as rendezvous, may rightly be considered after failed cannulation in patients with documented benign causes of biliary obstruction (e.g., CBD stones or papillary stenosis). EUS-CDS is less adequate in these distinct settings, where biliary drainage is usually accomplished through sphincterotomy (with or without stone removal) as opposed to stenting.

Procedure

As stated above, CBD puncture from the duodenum (EUS-CDS) is the most common approach. A similar approach from the stomach (EUS-choledochogastrostomy or EUS-choledochoantrostomy) may also be used in selected instances depending on the anatomy of the patient (see below). CBD is visualized from the duodenal bulb using a curved linear array echoendoscope in a long or a short scope position. The direction of the needle in the long scope position is toward the hilar (proximal) bile duct, whereas it is toward the lower (distal) bile duct in the short scope position. However, the correlation between scope position and needle orientation is not always straightforward. Anatomic distortion may make necessary additional fine adjustments involving the torque of the echoendoscope shaft and/or the control wheels. The orientation of the needle can be checked via fluoroscopy before the puncture is actually carried out. The needle checking is relevant because an upward needle orientation makes the EUS-CDS easier, which tends to decrease the angle for transmural stent advancement over the guidewire into the bile duct. Conversely, a downward needle orientation is sought when rendezvous is intended as the initial drainage choice.

Two types of needle devices are available for access. The conducting flexible needles, commonly used at ERCP for pre-cut and pseudocyst drainage, uses electrocautery (EndoCut ICC200, ERBE ELEKTROMEDIZIN GmbH, Tübingen, Germany). The so called needle-knife (Zimmon papillotome, Cook Endoscopy, Winston-Salem, NC), used for pre-cut, produces axial cutting with a thin wire that extends 2 mm beyond the tip of the catheter. The so called cystotome or fistulatome (Cook Endoscopy, Winston-Salem, NC; Endoflex, Tubingen, Germany), traditionally used for pseudocyst drainage, has a blunt, round cutting piece at the tip that produces circumferential cutting.

Cystotomes are slightly stiffer than needle-knives and produce a larger burn on the duodenal and CBD walls. The cystotome needle is larger and its round cutting reduces the need for dilation before stent insertion. Cystotomes are, therefore, particularly useful in cases where resistance to the advancement of flexible devices over the wire into the duct is met. Thinner caliber cystotomes (6-Fr) are preferable than the larger ones (10-Fr). Needle-knives, on the other hand, being more flexible, can be used free hand as the initial access device under EUS. Non-conducting stiff cutting needles, commonly used for EUS-guided fine needle aspiration ((EUS-FNA)) are also available (EUS-FNA). EUS-FNA needles are available in several calibers, where the two most commonly used are the large 19-gauge needle and the thin 22-gauge needle (EchoTip, Cook Endoscopy). Cook recently developed a specific needle for EUSBD.

Regardless of the choice, the needle is inserted transduodenally into the bile duct under EUS visualization. The stylet is removed and the bile is aspirated to confirm needle ductal access. The contrast medium is injected into the bile duct for cholangiography if a bile return is observed. A 450-cm long, 0.035-inch, 0.021-inch, or 0.018-inch guidewire is then inserted through the outer sheath, and its position is confirmed fluoroscopically.

The needle is removed, flushed with saline inside the gastrointestinal lumen to prevent clogging, and a repeat puncture will be attempted if no return of bile or a bloody aspirate was observed. Nonetheless, the problem of a needle apparently inside the duct under EUS, which is, in fact, on a different plane, usually occurs when accessing very small ducts. This problem is hardly ever the case during EUS-CDS. After the guidewire gain access into the bile duct, some dilation of the puncture track is usually necessary using a dilating biliary catheter (Soehendra biliary dilator, Cook Endoscopy), a papillary balloon dilator (Maxpass, Olympus medical systems, Tokyo, Japan), or both sequentially (axial dilator followed by the balloon dilator). This procedure aims at dilating the duodenocholedochal fistula to facilitate stent insertion. The need for dilation is maximal when no cautery is used for the initial entry under EUS, when a stiffer (metal) or larger caliber plastic (10-Fr) stent is intended, and when the distance to CBD or the resistance felt during the initial advancement of the needle is greater. Finally, a 5- to 10-Fr biliary pigtail, straight plastic stent, or a fully covered self-expandable metal stent (SEMS) [Zeon Medical Co. Ltd. Tokyo, Japan] is inserted through the choledochoduodenostomy site into CBD. Care should be taken by monitoring the intraductal placement of the proximal end of the stent through fluoroscopy and monitoring the intraduodenal (or intragastric) position of the distal (closer to the scope) end of the stent through endoscopy. The latter aspect is of particular relevance when using SEMS. SEMS tend to foreshorten upon full expansion, which takes place a few hours after the procedure. The foreshortening towards CBD beyond the GI wall may cause early SEMS dislodgment. Therefore, an adequate length of SEMS (15 to 20 mm) should be left inside the GI lumen to prevent this serious complication. This process is longer than what is customarily done when the SEMS is placed transpapillary at ERCP. The additional anchorage techniques in preventing dislodgment include forceful balloon dilation of SEMS up to 8 to 10 mm after initial deployment, or using a coaxial double pigtail through SEMS, as reported for pseudocyst drainage using transmural SEMS.[13]

EUS-CDS is an invasive and complex procedure despite the seemingly simple sequence of duct imaging and puncture under EUS, guidewire advancement and track dilation under fluoroscopy, and eventually stent insertion and deployment under combined fluoroscopic and endoscopic monitoring. Knowledge about the full array of needle devices, guidewires, dilators, and stents, as well as about the subtle variations in scope position (gastric or duodenal), scope orientation (upward and downward), and stent anchoring techniques is highly recommended to increase success rates and minimize complications. In addition, operator confidence with specific devices plays a role. Some authors feel that access without cautery is less prone to complications. These authors favored an initial non-conducting needle access and then selectively using cautery only after failed mechanical dilation over the guidewire of the puncture tract.[6,14] Mechanical dilation without cautery requires a stiffer 0.035-inch guidewire for support, which in turn involves the use of a 19-gauge EUS-FNA needle. Other authors found the stiffer 19-gauge EUS-FNA needles cumbersome to use in the relatively long position of the echoendoscope in the duodenum, and resorted to either initial direct needle-knife access under EUS[15] or needle-knife access under a thinner (0.018) guidewire passed into the CBD after puncture with a 22-gauge EUS-FNA needle.[16] Finally, some other authors resorted to both needle-knife and EUS-FNA needle access.[17]

Literature findings based on the perspective of evidence-based medicine[5-27]

Giovannini *et al*.[18] first reported about the EUS-guided choledochoduodenostomy. Some authors exchanged the echoendoscope over a catheter-protected guidewire for a duodenoscope, through which the stent was eventually inserted. As detailed earlier, the puncture needles that are available are conducting and nonconducting. About half the number of each has been used in published reports. This finding contrasts the reports for intrahepatic EUSBD, where nonconducting needle access is clearly preferred. The reason why cautery access (conducting needle) is favored during EUS-CDS is fourfold. First, the echoendoscope for EUS-CDS is in a longer and curved position in the duodenum as compared with the shorter distance to the subcardial region from where intrahepatic access is typically gained. This long position increases friction between the stent delivery system and the endoscope working channel, which impairs the transmission of the pushing force, thereby making the transmural stent insertion more difficult. Second, the thick and fibrous wall of CBD is harder to penetrate mechanically than the relatively soft liver parenchyma (except in cases with underlying cirrhosis) and the wall of smaller bile ducts. Third, the tendency to create a space by pushing until the bile duct wall yields is greater between the duodenal wall and CBD than between the gastric wall and liver. Finally, the CBD is larger and has the nearest vessels at a greater distance than the intrahepatic bile ducts (where vessels run closely in parallel). This condition offers some protection against severe bleeding, which is a feared complication of cautery access.

Most cases report the placement of a plastic stent. However, recent reports show the increasing use of SEMS.[14] The success rate for the 61 cases reported to date is as high as 95%, with excellent results in all successfully drained patients (100% per-protocol clinical response rate). Some cases report that stent insertion was too difficult and a nasobiliary drainage tube was placed instead.[17,24] A few cases illustrate another interesting variation on EUS-CDS, where the extrahepatic bile duct was punctured from the stomach rather than the standard transduodenal approach.[14,20] Although only six cases were reported, all were successful.

Expected complications and treatment options

Complications are either procedure- or stent-related. The definitions of procedural complications are not well standardized. Most of these procedural complications are related to bile (or just air) leakage into the retroperitoneum (with transduodenal access) or the peritoneum (with transgastric access to the CBD), with or without added infection. The severity ranges from a self-limiting condition, which is resolved within 48 to 72 h with conservative measures, to full-blown peritonitis, which requires emergency surgery. However, most reported complications are mild, a thus, the need for emergency surgery is exceedingly rare. Other interventional measures that may be required in the event of complications, such as percutaneous drainage, are however, common.

Peri-procedural leakage of bile into the abdominal cavity is most likely due to poor drainage. Factors, such as too large a fistula, early stent clogging, and inappropriate positioning of the stent (including foreshortening of SEMS), can cause poor drainage.

Late stent-related complications (e, once a mature fistula is formed) are similar to those seen with transpapillary stents placed at ERCP, namely, migration and stent occlusion. The solution to stent migration or occlusion is the same way as stents placed at ERCP or by inserting a new stent. The technique for repeat stent placement differs from what is commonly done at ERCP. If a clogged plastic stent is in place across the fistula, a guidewire will be advanced through the stent. The stent is grasped with a snare passed over the wire and removed over it. This more complex maneuver aims at keeping guidewire access to the duct after stent removal. A SEMS may be placed using a duodenoscope after plastic stent removal. If SEMS clogging occurs, the debris occluding its lumen may be cleaned up. However, merely cleaning is not long lasting in this setting. A new coaxial stent needs to be placed inside the clogged one, either a plastic stent or a SEMS. This procedure is known as the stent-in-stent approach.

Distal stent migration into the GI tract lumen with a mature fistula only involves repeat biliary drainage because migrated stents usually pass out spontaneously. Repeat biliary drainage may be attempted in several ways. The simplest one is placing a new stent through the same fistula, if it is still visible. However, a repeat EUS-CDS through a new puncture site or PTBD are required if the fistula cannot be identified endoscopically. Recovery of the stent as well as emergency surgery should be considered if proximal stent migration to the retroperitoneum or the peritoneum occurs. This serious complication, however, has not yet been reported for EUS-CDS. Finally, bile leakage into the abdomen may occur if less serious distal migration occurs when the fistula is still immature (a fibrous track not yet formed). In the event of stent migration and leakage with an immature fistula, repeat EUS-guided biliary drainage (perhaps using a SEMS) or PTBD need to be considered. Surgery should also be considered depending on the condition of the patient.

Conclusion

Although the current data are still limited, EUS-guided extrahepatic transmural bile duct drainage has a high potential as an alternative biliary decompression procedure in cases of failed ERCP. The procedure is complex and invasive. Moreover, the approach requires careful patient selection and an experienced operator supported by a well-trained team in a multidisciplinary setting. Specific anatomic factors of the patient favor EUS-CDS over complementary EUSBD approaches. Multicenter trials aimed at standardizing the technique in performing EUS-guided extrahepatic transmural bile duct drainage would be desirable; however, the relatively few patient candidates for it and the wide spectrum of technical variations reported make this endeavor difficult to accomplish in the near future. Detailed prospective studies with homogeneous inclusion criteria, careful follow-up, and dedicated hands-on training models will probably be more effective in advancing this burgeoning field of interventional endoscopy.

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