Current status of endosonography-guided biliary drainage

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ABSTRACT

An obstructed biliary system is usually drained by endoscopic retrograde cholangiopancreatography, and when this is unsuccessful, the standard alternative technique is percutaneous transhepatic biliary drainage. Surgical biliary bypass may also be required. In recent years, endosonography has transformed from a solely diagnostic procedure to one with therapeutic capabilities. Endosonography-guided biliary drainage is now being performed as an alternative to percutaneous transhepatic biliary drainage. This is an evolving field, with challenges that must be addressed before it can become a routine clinical practice. This review summarises the current status of endosonography-guided biliary drainage.

Keywords: biliary obstruction, endosonography, therapeutic drainage

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INTRODUCTION

Biliary obstruction may be caused by benign diseases such as common bile duct stones, benign biliary strictures and chronic pancreatitis, or malignancies such as cholangiocarcinoma and pancreatic adenocarcinoma. Endoscopic retrograde cholangiopancreatography (ERCP) is the standard first-line technique for biliary drainage. In benign diseases such as bile duct stones, definitive treatment may be achieved by ERCP, papillotomy and stone extraction. Biliary stent insertion is used to drain both benign and malignant strictures.[1] Nonetheless, there are situations where ERCP may not be necessary or possible. Localised periampullary cancer presenting with obstructive jaundice may be resected without prior ERCP and drainage. If endoscopic access to the papilla is not possible due to duodenal obstruction or altered anatomy, percutaneous transhepatic biliary drainage (PTBD) or surgery would be the first-line options. For terminally ill patients whose prognosis remains unchanged by interventions, best supportive care alone would suffice. If ERCP is indeed indicated but unsuccessful, PTBD is used as a salvage procedure. In recent years, endosonography (EUS) has transformed from a diagnostic procedure to one with therapeutic capabilities. In particular, EUS-guided biliary drainage (EUSBD) is now being performed as an alternative to salvage PTBD after failed ERCP. This review summarises the current status of EUSBD (Fig. 1).

CURRENT OPTIONS FOLLOWING UNSUCCESSFUL ERCP

When ERCP is unsuccessful, the standard options include referral to a more experienced endoscopist; precut for biliary access; PTBD; and surgical drainage. Most endoscopists have successful ERCP cannulation rates of greater than 85%. Expert endoscopists consistently achieve success rates that are above 95%.[2] Referral to another more experienced colleague or centre should always be considered, taking into account one's level of expertise. In a case series of 562 patients with initial unsuccessful ERCP, repeat ERCP at a referral centre was successful in 96.4%.[3]

Precut is an advanced ERCP technique used when standard cannulation techniques are unsuccessful. It involves the use of an endoscopic accessory, such as a needle knife, to deroof the papilla in order to expose the biliary opening and thus facilitate cannulation. It has inherently higher risks of complications such as pancreatitis, bleeding and perforation,[4] and is usually performed only by advanced practitioners. However, it has also been shown that in experienced hands, the complication rates may not significantly differ from the baseline ERCP risks.[5,6]

PTBD is usually performed as the first-line salvage procedure after failed ERCP. After initial drainage is achieved, subsequent definitive treatment may involve: (1) long-term external biliary drainage; (2) PTBD-ERCP rendezvous, during which a guidewire is inserted across the percutaneous drainage catheter into the bile duct and duodenum, caught by a snare, pulled into the working channel of the duodenoscope and then used to guide catheter insertion during ERCP; and (3) elective definitive surgery. PTBD is associated with major complication rates of 4%–25% and procedure related mortality rates of up to 5.6%.[7] Specific

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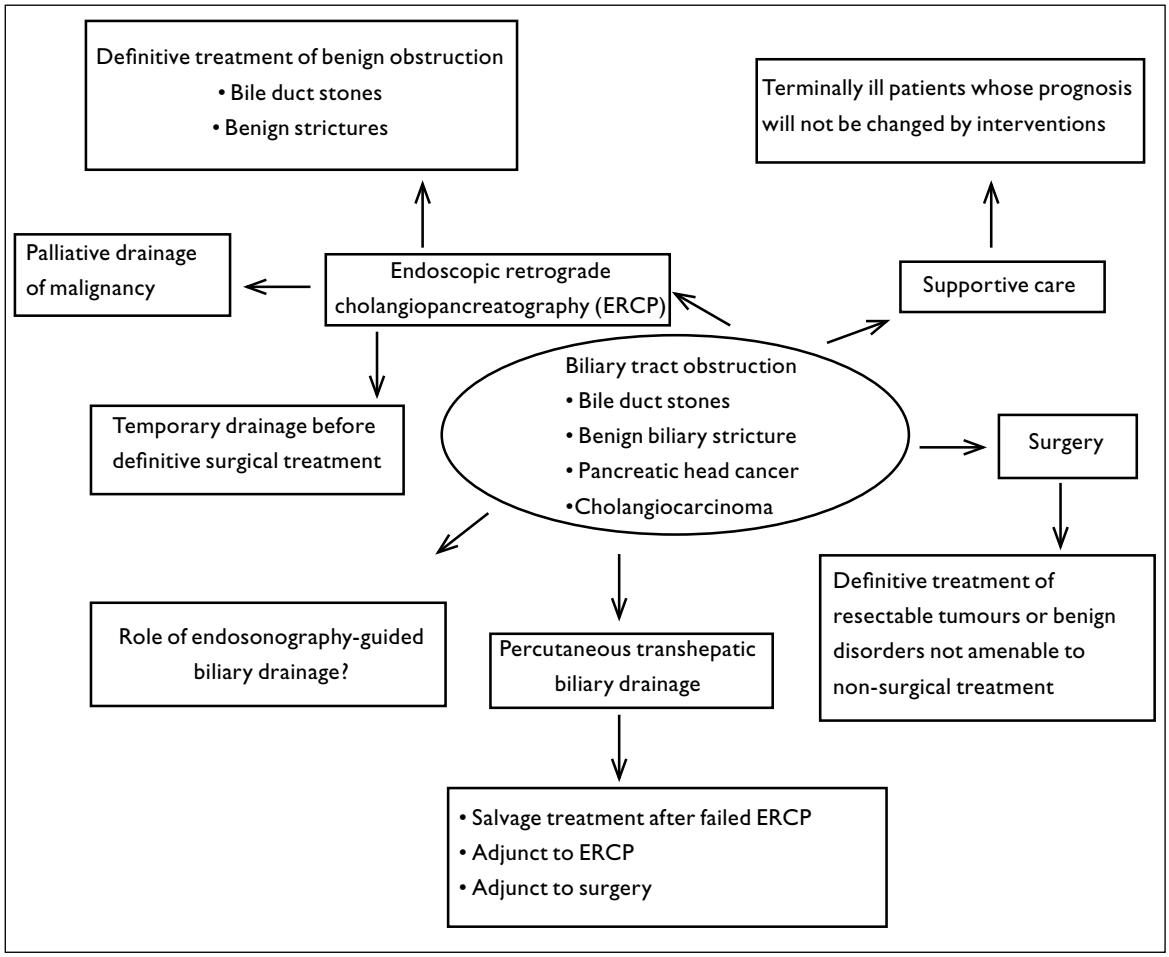

Fig. 1 Chart shows the management options in biliary obstruction.

complications that may arise include bleeding, bile duct injury, cholangitis and sepsis, fistula formation, perforation, pneumothorax, pancreatitis, and catheter blockage or migration. The presence of an external drainage catheter would also have an adverse impact on patients' comfort and quality of life. The success rates of PTBD are lower and the complication rates are higher, in the context of non-dilated compared to dilated intrahepatic ducts.[7]

Surgery is more invasive with greater risks for morbidity and mortality compared to ERCP and PTBD. In selected situations, surgery may be performed directly to provide definitive treatment. However, some patients may not be surgical candidates, and even if surgery were necessary, it may still be essential to first establish biliary drainage in order to optimise the patient's condition. Additionally, in the context of metastatic malignant biliary obstruction, endoscopic drainage has been shown to be cheaper and to provide better quality of life than surgical bypass,[8] and as such, performing PTBD followed by PTBD-ERCP rendezvous would be preferred to performing palliative surgical drainage. It is under this premise that the potential benefit of EUSBD is conceived.

ANATOMICAL FEASIBILITY OF EUSBD

An echoendoscope has an ultrasonic transducer at its tip, which enables the visualisation of retroperitoneal structures outside the gastrointestinal tract. When the scope tip is inserted into the duodenum, the adjacent extrahepatic bile duct can be clearly visualised by EUS. The intrahepatic bile ducts are visualised by EUS when the scope tip lies in the stomach. When EUS was initially introduced in the 1980s, it was purely a diagnostic modality, with radial ultrasonic scanning that permitted the reconstruction of cross-sectional images similar to those of computed tomography. Linear echoendoscopes were introduced in the 1990s. These endoscopes enabled linear ultrasonic scanning, which facilitated the tracking of needles inserted out of the working channel of the scope tip. EUS-guided fine needle aspiration (FNA) became possible because the path of the needle tip during the puncture process could

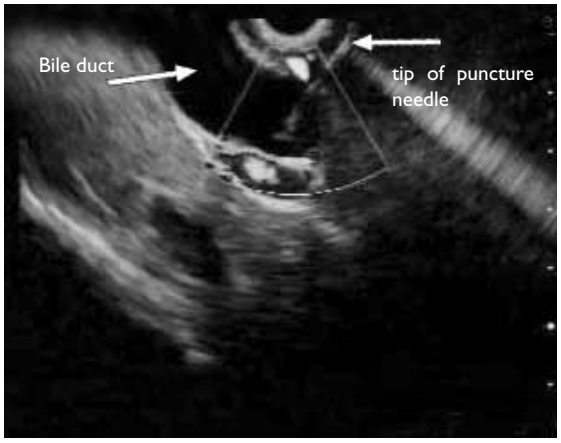

Fig. 2 A dilated bile duct due to pancreatic head cancer is punctured under endosonography guidance.

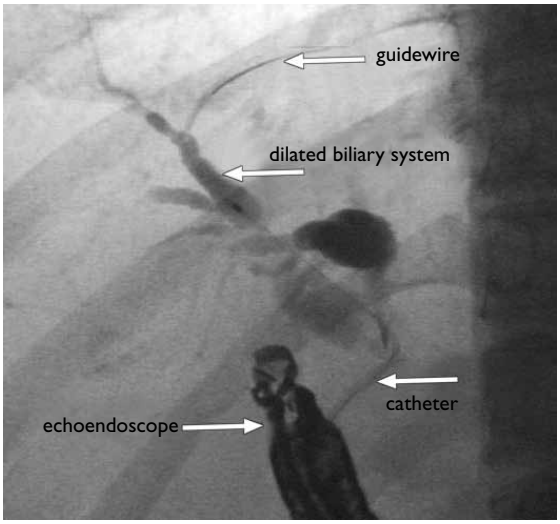

Fig. 3 Cholangiogram is performed after the biliary system is accessed by endosonography-guided puncture.

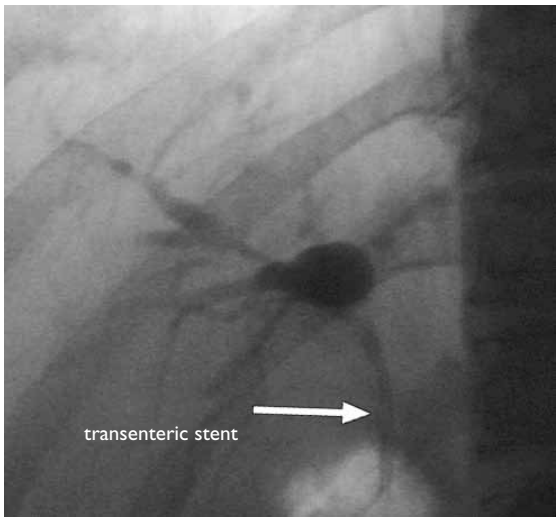

Fig. 4 A transenteric stent is inserted for biliary drainage.

then be traced. More importantly, it paved the way for the era of therapeutic EUS. EUS-guided puncture of the obstructed biliary systems could be performed, and this facilitated the passage of guidewire and stent for EUSBD.[9]

POTENTIAL BENEFITS OF EUSBD

The potential benefits of EUSBD include avoiding local complications associated with PTBD and long-term external drainage in cases where external PTBD drainage catheters cannot be internalised, thus significantly improving the quality of life of terminally ill patients, and possibly lower morbidity than PTBD and surgery. It must be qualified that published data on EUSBD is limited and that no randomised controlled trials comparing the different treatment modalities are available. EUSBD is also not an alternative for a poorly performed ERCP.

TECHNIQUE OF EUSBD

The patient should be haemodynamically stable and be able to undergo conscious sedation. In certain cases, general anaesthesia may be required. There should be no coagulopathy. Blood should be grouped and matched in case of post procedural bleeding requiring transfusion. Before EUSBD, prophylactic antibiotics are administered. A therapeutic linear echoendoscope with a larger working channel of 3.7 mm, thus allowing stent placement, is utilised. Either a transduodenal or a transgastric approach can be used. With the transduodenal approach, the extrahepatic bile duct is visualised by EUS and punctured under Doppler ultrasonography guidance using a 19-gauge FNA needle (Fig. 2), after which a 0.025- or 0.035-inch guidewire is introduced into the biliary system. With the transgastric approach, the intrahepatic bile duct is visualised by EUS and accessed. The latter has the advantage of allowing biliary drainage even in the context of pyloric or duodenal obstruction. Once biliary access is achieved and a guidewire is inserted, contrast is injected to perform a cholangiogram (Fig. 3), and subsequent biliary drainage can be performed with one of the following techniques: transenteric stent insertion; antegrade biliary drainage; or transpapillary drainage via a rendezvous technique.

Transenteric stent placement is the simplest technique. Once guidewire access of the biliary tract is achieved, a 7-French dilator or a 4–6 mm dilating balloon is inserted over the guidewire to create a transenteric fistula, followed by stent insertion (Fig. 4). For the antegrade drainage and rendezvous techniques, the guidewire must be manoeuvred across the major papilla into the duodenum. In the antegrade drainage

Table I. Published data on endosonography-guided biliary drainage.

Study	Year	No. of patients	No. of clinical success (%)	Complication: no. of patients
Burmester et al[11]	2000	4	3 (75)	Bile leak: 1
Giovannini et al[12]	2001	1	1 (100)	Nil
Mallery et al[13]	2004	2	2 (100)	Nil
Kahaleh et al[14]	2004	5	4 (80)	Biliary peritonitis: 1
Püspök et al[15]	2005	6	5 (83.3)	Nil
Ang et al[16]	2007	2	2 (100)	Pneumoperitoneum: 1
Bories et al[17]	2007	11 (3 SEMS)	10 (90.9)	Ileus: 1; bilioma: 1; cholangitis: 1
Will et al[18]	2007	8	7 (87.5)	Pain: 2; cholangitis: 1
Tarantino et al[19]	2008	8	8 (100)	Nil (1 unrelated mortality due to underlying liver cirrhosis)
Yamao et al[20]	2008	5	5 (100)	Pneumoperitoneum: 1
Itoi et al[21]	2008	4	3 (75)	Bleeding/perforation requiring surgery: 1
Pelaez-Luna et al[22]	2008	1	1 (100)	Nil
Hanada et al[23]	2009	4	4 (100)	Nil
Maranki et al[24]	2009	49	41 (83.7)	Pneumoperitoneum: 4; bleeding: 1 biliary peritonitis: 1; pain: 1; aspiration pneumonia: 1
Park et al[25]	2009	14 (SEMS)	14 (100)	Pneumoperitoneum: 2
Nguyen-Tang et al[26]	2010	5 (SEMS)	5 (100)	Nil

SEMS: self expandable metallic stents

technique, the puncture tract is first dilated to facilitate stent insertion into the biliary system. The stent is then pushed down from the intrahepatic to the extrahepatic bile duct in an antegrade manner. With the rendezvous technique, the echoendoscope is carefully removed while leaving the guidewire in place. This is followed by duodenoscope insertion into the duodenum, upon which the guidewire coming out of the major papilla is grasped with a snare and withdrawn through the working channel of the duodenoscope. The procedure is then completed using standard ERCP techniques.

RESULTS OF PUBLISHED DATA

Wiersema et al first reported the use of EUS-guided cholangiography in seven patients to guide repeat ERCP.[10] Subsequently, EUSBD was reported. To date, published data remains sparse and the number of centres performing this procedure limited. Only case reports and case series have been published. Given the high success rates of ERCP in expert hands, it is understandable that only a limited number of cases actually required EUSBD. In the vast majority of reported cases, plastic biliary stents were used,[11–24] although the use of biliary self-expandable metallic stents has also been reported.[25,26] The results of published data are summarised in Table I. The overall success rate was 89% (range 75%–100%). Major complications such as free perforation, biliary leak with peritonitis and bleeding requiring salvage surgery are uncommon. Post procedural pneumoperitoneum, pain and peritonism may rarely occur but can be managed conservatively.

CURRENT ROLE OF EUSBD AS AN ALTERNATIVE TO PTBD

In current clinical settings, most patients would still undergo PTBD as the primary salvage procedure after unsuccessful ERCP, after which a PTBD-ERCP rendezvous procedure can be performed to achieve the more physiological transpapillary drainage. The data for EUSBD is limited, but the results are extremely promising. EUSBD should be performed by experienced endoscopists with expertise in both interventional EUS and ERCP in the setting of a tertiary level centre, where experienced pancreatobiliary surgeons and interventional radiologists are available in the event of complications. EUSBD has been used for achieving biliary access in both benign disorders such as bile duct stones, as well as in malignant biliary obstruction. In the case of benign diseases such as bile duct stone, PTBD followed by PTBD-ERCP rendezvous may still be preferable given the fact that the expertise is more readily available. With regard to malignant

biliary obstruction, EUSBD has a distinct advantage over PTBD in that in the event of unsuccessful transpapillary drainage, it is still possible to relieve the biliary obstruction via transenteric stenting, obviating the need for an external drainage catheter, thus improving the quality of life of terminally ill patients. Before exploring alternative biliary drainage techniques, one should always consider referral to a more experienced ERCP endoscopist, who may be able to achieve successful biliary drainage using either standard cannulation techniques or precut for biliary access.

CONCLUSION

EUSBD is a very promising therapeutic alternative to PTBD in the event of unsuccessful ERCP. There is a need for greater ease in the acquisition of technical skills and more long-term clinical outcome data. Its greatest clinical value may be in the context of palliating unresectable malignant biliary obstruction.

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