Endoscopic ultrasound guided biliary drainage

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Received: October 18, 2011 Revised: April 30, 2012
Accepted: July 1, 2012
Published online: July 16, 2012

Abstract

Endoscopic retrograde cholangio-pancreatography is the most appropriate technique for treating common bile duct and pancreatic duct stenosis secondary to benign and malignant diseases. Even if the procedure is performed by skillful endoscopist, there are patients in whom endoscopic stent placement is not possible. Common causes of failure include complex peri-papillary diverticula, prior surgery procedures, tumor involvement of the papilla, biliary sphincter stenosis, and impacted stones. Percutaneous trans-hepatic biliary drainage (PTBD) and surgical intervention carry morbidity and mortality. Recently endoscopic ultrasonography-guided biliary drainage has been reported as an alternative technique. Endoscopic ultrasonography-guided biliary drainage using either direct access or a rendezvous technique has attracted attention as an alternative procedure to PTBD, with a technical success between 75%-100% and with low complication rate. We have reviewed published data on EUS guided biliary drainage procedures with the aim of summarizing the efficacy and safety of this promising method.

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Key words: Interventional endoscopic ultrasonography; Endoscopic ultrasonography drainage; Biliary drainage; Endoscopic retrograde cholangio-pancreatography

INTRODUCTION

Endoscopic retrograde cholangio-pancreatography (ERCP) is the most appropriate technique for treating common bile duct and pancreatic duct stenosis secondary to benign and malignant diseases. Biliary and/or pancreatic duct cannulation and visualization are successful with ERCP in a high percentage of cases managed by experienced hands. The ERCP with stent insertion in patients with malignant pancreatic-biliary strictures has a success rates between 70% to 95%.[1-3] However, even if the procedure is performed by skillful endoscopist, there are patients in whom endoscopic stent placement is not possible. Common causes of failure include complex peri-papillary diverticula, prior surgery procedures (such as gastrectomy with Billroth II anastomosis), tumor involvement of the papilla, biliary sphincter stenosis, and impacted stones.[4]

In these cases percutaneous trans-hepatic biliary drainage (PTBD) or surgical intervention is required, although both these methods carry morbidity and mortality.
Some disadvantages with the percutaneous approach include the need to traverse the liver, a decreased quality of life due to the presence of external drainages and a significant morbidity and mortality, 7% and 5% respectively\cite{4,5}. Endoscopic ultrasonography (EUS) is a widely accepted modality for the diagnosis of gastrointestinal and pancreato-biliary diseases. In 1992, Vilmann et al.\cite{6} published the first case report of EUS-guided fine needle aspiration (EUS-FNA) of a lesion in the pancreas head using a curved linear array echoendoscope. Since then, many researchers have expanded the indications for EUS-FNA to include various kinds of lesions, and also for therapeutic purposes. EUS-guided cholangiography was first described by Wiersema et al.\cite{7} in 1996. Recently endoscopic ultrasonography-guided biliary drainage has been reported as an alternative technique by many researchers.\cite{8-27} Endoscopic ultrasonography-guided biliary drainage (EUS-BD) using either direct access or a rendezvous technique has attracted attention as an alternative procedure to PTBD, with a technical success between 75%-100% and with low complication rate.\cite{8-27}

Indeed another important advantage of EUS-BD compared with external PTBD is better quality of life due to the internal placement of the stent: this is undoubtedly a desirable goal; moreover, if allowed by local facilities, EUS-BD performed in the same session of the failed ERCP, in the same room and under the same sedation, could have many advantages for the patient and could be a rational approach also from the cost standpoint.

On the other hand, the EUS guided biliary drainage, has major limitation due to fewer cases reported till date and lack of long term data. Because of, the technical difficulty encountered during re-intervention and problem of stent migration, the expertise needed for such procedure is a major limitation of the techniques. Furthermore, comparative studies of EUS-BD vs PTBD are required to select the optimal candidates and to best evaluate the technical and treatment outcomes also in terms of quality of life and costs.

**TECHNIQUE**

EUS-guided biliary drainage includes two methods: a rendezvous technique and a direct access technique, and two approach routes: trans-gastric approach and trans-duodenal approach.

**Rendezvous**

Once the echoendoscope is positioned in the stomach or duodenum, and the bile duct is visualized by endosonography, the bile ducts are punctured with a 19- or 22-gauge needle, bile is aspirated and iodine contrast is injected through the EUS needle to display the intra-hepatic and extra-hepatic bile ducts. Because of a standard needle has been inserted, a 2.6 mm working channel echo endoscope can be used for this procedure. After confirmation of bile duct puncture, a guide wire is advanced distally through any stricture and across the papilla using fluoroscopic guidance. When the guide wire has passed through the papilla into the duodenum, the endoscope exchange is performed: the EUS scope is removed leaving the guide wire in place and a duodenoscope is passed by the side of the EUS-placed guide wire up to the papilla. Finally, the guide wire is grasped with a snare or forceps and pulled back out the working channel of the duodenoscope for subsequent over-the-wire cannulation, the access to the common bile duct is achieved and a standard endoscopic retrograde cholangiography with stent placement can be performed.

**EUS-guided choledocho-duodenostomy**

The technique is basically similar to EUS-guided drainage of pancreatic pseudocyst. A EUS endoscope with large working channel is introduced, and the tip is placed in the duodenal bulb. The common bile duct is displayed from the duodenal bulb. The position is chosen based on EUS evaluation of the distance between the gastrointestinal wall and the bile duct over the stricture. A 22 G or 19 G needle is advanced and a puncture, under real time and under color Doppler assistance, is performed. After puncture, bile is aspirated and iodine contrast is injected to obtain a cholangiogram (Figure 1); a guide wire is positioned in the bile duct and a new papilla is created by precut or dilatation with catheter balloon; when a thin wire was initially used, the wire is replaced with a 0.035 inch wire. Finally, when indicated, a plastic stent is placed. The absence of intra-abdominal leakage of

![Figure 1 Cholangiogram obtained with iodine contrast injection through the endoscopic ultrasound-needle.](image-url)
contrast medium is confirmed on X-ray fluoroscopy. In recent reports, a covered self-expandable metallic stent (SEMS) instead of plastic stent is placed through the choledocho-duodenostomy site into the extra-hepatic bile duct (Figure 2). In case of stent occlusion, a guide wire is inserted into the bile duct through an occluded stent using an ERCP catheter, the stent is then removed using a snare, keeping the guide wire in place. Finally, a new stent is inserted over the guide wire.

**REVIEW OF LITERATURE**

**Rendezvous**

In six reports on EUS-guided rendezvous technique describing a total of 45 patients, the overall success rate was 80% (36/45). The complication rate was 4% (2/45), including pneumoperitoneum and bile leakage. In a recent largest case series reported by Maranki et al., of the 49 patients who underwent the intra-hepatic and extrahepatic approach only using EUS-guided rendezvous technique, the overall success rate of trans-papillary stenting was 65% (32/49). A rendezvous technique is feasible only when the endoscope can be advanced to the papillary orifice for retrieval of the guide wire. The EUS-rendezvous is used solely to puncture the obstructed bile duct and pass a guide wire through the native papilla to allow subsequent ERCP. Potential advantages of EUS-rendezvous access include achievement of biliary drainage at a single session by using conventional ERCP techniques. Though the stent patency and late complications at long term follow-up of patients treated with this technique have not yet been reported in detail,
those result seem to be basically the same as those of endoscopic trans-papillary biliary stent placement.

**EUS-guided choledocho-duodenostomy**

EUS guided choledocho-duodenostomy was first reported by Giovannini in 2001. Several studies have evaluated the role of EUS-CDS[8,14,16,19,23-25,27-30]. In these studies there are many differences in terms of type of devices used to create the fistula: needle knife or sphincterotomy, 19 G or 22 G needles or needles followed by a needle knife. In 94% of cases the transduodenal stents were successfully inserted. The rate of treatment success was 100% among the patients with successful bile duct access. Theoretically one-step method with direct puncture of the extra-hepatic bile duct may reduce the risk of guide wire dislocation while the instruments are exchanged. The rate of complications reported was 15%, including bile peritonitis and pneumoperitoneum. Park et al[20] reported 5 cases of EUS-BD puncture with one-step placement of a fully covered SEMS. Although the follow-up periods were short (median, 6 mo; range, 2-7 mo), there was only one re-intervention necessitated by stent migration. So a longer stent patency using a fully covered metal stent can be expected. After that, sev-

### Table 1  Reports with self-expandable metallic stent placement

| Authors                 | Cases | Technical success | Clinical success | Method | Stent used | Early complications | Late complications |
|-------------------------|-------|-------------------|------------------|--------|------------|--------------------|-------------------|
| Giovannini et al[8]     | 2     | 100%              | 100%             | CDS    | 10 F PS    | ---                | ---               |
| Burmester et al[8]      | 4     | 75% (1 failure)   | 100%             | HGS    | 10 F PS and PCSEMS 1 | ---                | ---               |
| Mallery et al[8]        | 2     | 100%              | 100%             | HGS    | 8.5 F PS   | ---                | ---               |
| Puspok et al[8]         | 6     | 83% (1 failure)   | 80% (1 failure)  | RPST   | USEMS      | ---                | ---               |
| Ang et al[9]            | 2     | 100%              | 100%             | CDS    | 7 F PS     | ---                | ---               |
| Fujita et al[9]         | 1     | 100%              | 100%             | CDS    | 7 F PS     | ---                | ---               |
| Bories et al[20]        | 11    | 91% (1 failure)   | 80%              | HGS    | 7-10 F PS  7 PCSEMS 3 | PS: 1 ileus and 2 occlusion | SEMS: 1 migration and 2 occlusion due to tissue ingrowth |
| Will et al[7]           | 8     | 90% (1 failure)   | 88.9% (1 failure)| HES    | 8.5 F PS 3 | ---                | ---               |
| Itoi et al[25]          | 4     | 100%              | 100%             | CDS    | 7 F PS 3   | ---                | ---               |
| Tarantino et al[20]     | 8     | 100%              | 100%             | CDS    | 5 F NBD 1  | ---                | ---               |
| Yamao et al[9]          | 5     | 100%              | 100%             | CDS    | 10 F PS    | ---                | ---               |
| Kabaleh and Maranski et al[31,32,25] | 49 | 84% (8 failure)   | 98%              | TPSA   | 10 F PS    | ---                | ---               |
| Hanada et al[27]        | 4     | 100%              | 100%             | CDS    | 6-7 F PS   | ---                | ---               |
| Brauer et al[30]        | 12    | 92% (1 failure)   | 72%              | CDS    | 10 F PS 5  | ---                | ---               |
| Park et al[9]           | 14    | 100%              | 100%             | CDS    | 10 F PS    | ---                | ---               |
| Lai et al[24]           | 1     | 100%              | 100%             | CDS    | 10 F PS 1  | ---                | ---               |
| Martins et al[20]       | 1     | 100%              | 100%             | HGS    | PCSEMS     | ---                | ---               |
| Nguyen-Tang et al[24]   | 5     | 100%              | 100%             | TPSA   | USEMS      | ---                | ---               |
| Kim et al[20]           | 15    | 80% (3 failure)   | 100%             | RPST   | USEMS 8    | ---                | ---               |
| Bellettrutti et al[24]  | 1     | 100%              | 100%             | CDS    | FCSEMS     | ---                | ---               |
| Iwamuro et al[30]       | 7     | 100%              | 100%             | CDS    | 10 F PS 7  | ---                | ---               |
| Eum et al[19]           | 3     | 100%              | 100%             | CDS    | FCSEMS     | ---                | ---               |
| Artifon et al[19]       | 3     | 100%              | 100%             | CDS    | FCSEMS     | ---                | ---               |
| Artifon et al[19]       | 1     | 100%              | 100%             | CA     | PCSEMS     | ---                | ---               |
| Siddiqui et al[24]      | 8     | 100%              | 88%              | CDS    | FCSEMS     | ---                | ---               |
| Fabbri et al[20]        | 16    | 75% (4 failure)   | 100%             | CDS    | PCSEMS     | ---                | ---               |

**SEMS:** Self-expandable metallic stent.
eral reports on choledocho-duodenostomy with SEMS placement were published, even if with a small number and with a short follow up\(^7\). More recently Fabbri et al.\(^8\) reported a series of 16 patients treated with SEMS (9 choledocho-duodenostomies with SEMS placement and 3 biliary rendezvous procedures with papillary SEMS placement). No major complications and no procedure-related deaths occurred. There was one case of pneumoperitoneum which was managed conservatively. The median follow-up was 170 d. None of the patients required endoscopic re-intervention. This series demonstrated that EUS-BD with a partially covered SEMS has a high rate of clinical success and low complication rates, and could represent an alternative choice for biliary decompression.

**EUS-guided hepatico-gastrostomy**

EUS-guided hepatogastrostomy was first reported by Burmester et al.\(^9\) in 2003. A dilated peripheral branch of the left intra-hepatic system that is closest to the EUS transducer is accessed trans-gastrically using a 19- or 22-gauge needle or a needle knife. In the same way of choledocho-duodenostomy, after removal of the needle stylet, bile is aspirated and contrast is injected to visualize the ducts under fluoroscopy (Figures 3 and 4). A guide wire is then passed through the FNA needle into the left intra-hepatic system. The wire should be positioned deep into the peripheral intra hepatic bile ducts, or should pass into the duodenum across the biliary stricture. The trans-mural tract between the stomach and the left intra-hepatic system can be dilated using either an ERCP cannula, cystotome, bougie or dilating balloon, if necessary. Finally a plastic or metallic stent is inserted though the hepatico-gastrostomy site into intrahepatic bile ducts

**Review literature**

Six reports are available on EUS-guided hepatico-gastrostomy\(^10-14\). The procedure was successful in 96% of cases (all but one case). Various types of stents, including plastic stents, uncovered metal stents, and covered metal stents were used. Once the stents were placed, all but one patient (96%) had clinical success (resolution of obstructive jaundice). The rate of complications was 14% without mortality: 1 case of ileus probably due to the use of morphine during anesthesia, 1 case of biloma, and 2 cases of cholangitis. Stent migration has been reported as a late complication in one case.

**CONCLUSION**

EUS continues to evolve with a new emphasis on image guided intervention rather than image analysis. The development of the large channel linear array echoendoscope allows more therapeutic procedures. Placing guide wires with EUS shows great promise in fostering endoscopy based therapy, and internal drainage of obstructed bile ducts using the EUS method is becoming accepted where ERCP fails (e.g., intra-diverticular papilla, Roux-en-Y gastrojejunostomy or other previous surgery procedure, papilla stenosis, impacted stones, etc.). This procedure should be limited to facilities with extensive experience in therapeutic EUS and should be used only when attempts at decompression via ERCP are unsuccessful. The use of this technique has already been endorsed by several studies confirming the feasibility and safety of EUS-guided procedures, including many reports with SEMS placements (Table 1). Comparative trials between EUS-guided biliary drainage versus PTBD are lacking as well as rendezvous technique versus direct access technique. Finally, as more experience is gained, we have to determine which of the following are more effective than their alternatives: transduodenal, transgastric approach, rendezvous or direct access, plastic stent or SEMS. EUS biliary drainage is not be considered as a routine procedure. Additional studies to define risks and long-term outcomes are necessary before introducing these techniques in clinical practice.

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S- Editor Yang XC  L- Editor A  E- Editor Yang XC