**Advances in Endoscopic Ultrasound-Guided Biliary Drainage: A Comprehensive Review**

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Endoscopic retrograde cholangiopancreatography (ERCP) has become the first-line therapy for bile duct drainage. In the hands of experienced endoscopists, conventional ERCP results in a failed cannulation rate of 3% to 5%. This failure can occur more commonly in the setting of altered anatomy or technically difficult cases due to either duodenal or biliary obstruction. In cases of ERCP failure, patients have traditionally been referred for either percutaneous transhepatic biliary drainage (PTBD) or surgery. However, both PTBD and surgery have higher than desirable complication rates. Within the last decade, endoscopic ultrasound-guided biliary drainage (EUS-BD) has become an attractive alternative to PTBD after failed ERCP. Many groups have reported on the feasibility, efficacy and safety of this technique. This article reviews the indications for ERCP and the currently practiced EUS-BD techniques, including EUS-guided rendezvous, EUS-guided choledochoduodenostomy and EUS-guided hepaticogastrosotomy. (Gut Liver 2013;7:129-136)

**Key Words:** Endoscopic retrograde cholangiopancreatography; Endoscopic ultrasound; Self expanding metal stent

**INTRODUCTION**

Endoscopic retrograde cholangiopancreatography (ERCP) is considered first line therapy for drainage of the biliary tree. When ERCP is unsuccessful, the next step is referral to a more experienced endoscopist. Repeat ERCP at a referral center is successful in 85% to 98% of cases when initial ERCP was unsuccessful. Failed biliary cannulation in the hands of an experienced endoscopist is usually due to either anatomical variation after surgery or from tumor infiltration. Traditionally those patients have been managed with percutaneous transhepatic biliary drainage (PTBD) or surgery. The potential complications associated with these procedures, along with the patient dissatisfaction associated with external drainage make these options less desirable.

In recent years, endoscopic ultrasound (EUS) has evolved from a purely diagnostic procedure to a therapeutic one. Wiersema et al. first reported EUS-guided cholangiopancreatography in 1996. Subsequently, EUS-guided cholangiopancreatography followed by biliary drainage (BD) has been performed with many case reports and series confirming both the success and safety of this technique.

EUS-BD offers several advantages over both PTBD and surgery. First, EUS-BD can be performed at the time of the initial ERCP, without a need for further delay or additional procedures. In addition, EUS-BD provides internal drainage as opposed to the external biliary drain that accompanies PTBD and has been associated with significant patient dissatisfaction.

Surgery to provide BD can also have considerable negative consequences on a patient’s health and recovery. Indeed, surgery requires a longer recovery time. In patients with malignant biliary obstruction who already have a poor prognosis and short life expectancy, the invasive nature, longer recovery and delay in chemotherapy make surgery a less attractive option.

**INDICATION**

While many investigators have reported that EUS-BD can be utilized when standard ERCP is unsuccessful, indications for EUS-BD have not been established. Consideration for EUS-BD should be given any time successful cannulation of the bile duct cannot be achieved. In the hands of a skilled endoscopist, the most frequent causes of unsuccessful cannulation of the bile duct are surgically altered anatomy or obstruction of the
Common reasons for surgically altered anatomy can be encountered in patients after bariatric surgery or after intestinal diversion for pancreatic cancer or other diseases and include Billroth II, Roux-en-Y, and biliopancreatic diversions.

Obstruction of the gastrointestinal (GI) tract is most often due to malignant causes. Tumor infiltration can preclude successful cannulation of the bile duct either at the level of the duodenum, such as is seen in a patient with gastric outlet obstruction, or at the level of the ampulla or bile duct itself.

Another situation where EUS-BD may prove to be useful is with an unusually difficult cannulation associated with a periampullary diverticulum. In this case, a EUS-guided “rendezvous” can be performed resulting in passage of a transpapillary guidewire and then conversion to and completion of ERCP by the conventional route. Briefly, the following are the indications for EUS-BD: 1) failed conventional ERCP; 2) altered anatomy; 3) tumor preventing access into the biliary tree; 4) contraindication to percutaneous access (i.e., ascites, etc.).

**MATERIALS AND INSTRUMENTS**

It is important to ensure that all required equipment is in the room prior to puncture of the bile duct. Once the bile duct has been accessed via EUS, it is crucial to proceed in an expeditious manner without any additional or unnecessary manipulation of the guidewire or needle to decrease the chances of losing of access and complications.

1) Fluoroscopy: This should be set up prior to start of procedure. Fluoroscopy can be used to facilitate angle of bile duct puncture, which should be as much in the direction of cephalic to caudad as possible to facilitate transpapillary passage of guidewire. The fluoroscopy image should be centered with the tip of the scope, bile ducts, and duodenum all in view.
2) Contrast for cholangiography
3) Plenty of water to flush catheters and hydrophilic wires
4) Echoendoscopes with a 3.8-mm working channel to avoid being limited in catheters and stents diameter. In addition, duodenoscope if possibility of rendezvous technique and conversion to retrograde procedure.
5) Fine needle aspiration (FNA) needles: 19 gauge (G) FNA needles are preferred over 22 G since they allow manipulation of 0.035-inch guidewires.
6) Hydrophilic 0.035-inch guidewires are preferred due to their ease of manipulation and ability to support a variety of catheters and stents. In addition, it is important to use uncoated wires when possible due to the “shearing” effect that the FNA needle can have on the coating of the guidewire.
7) Bougie catheters and dilating balloons: Either a 4 to 6 mm wire-guided hydrostatic dilating balloon catheter or a 6 to 7 Fr dilating bougie.
8) A rotatable sphincterotome or bending catheter with ability to bend and change direction should be available in the event that the wire needs to be redirected to facilitate transpapillary passage of wire.
9) Stents (refer to discussion below regarding placement of plastic versus metal stents)

**TECHNIQUES**

1. EUS-guided rendezvous

EUS-BD is typically performed utilizing either the EUS-guided rendezvous technique or by creating a tract from either the stomach or the duodenum into the bile ducts. When the duodenoscope can be advanced to the level of the ampulla it is preferable to attempt an EUS-guided rendezvous. In this procedure, under EUS and Doppler guidance, a needle is inserted into either a left intrahepatic duct or common bile duct. We find it most helpful to have the scope in the duodenal bulb and then under