

EUS-guided Hepaticogastrostomy: how should it be handled?

Hepaticogastrostomia eco-guiada: qual é sua aplicabilidade?

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SUMMARY

The EUS guided hepaticogastrostomy and choledochoduodenostomy are very advanced procedures in the pancreatic biliary area and intend to have an effective biliary drainage. The hepaticogastrostomy is indicated in those cases with hilum obstruction, on the other hand the choledochoduodenostomy is an option in distal biliary cancer. The correct indication depends on multidisciplinary approach and it includes the informed consent to patient. The EUS biliary drainage should be performed by very experienced endosonographers and on protocols approved at Institutional IRB.

Keywords: Hepaticogastrostomy, Echoguided, Cancer.

RESUMO

A hepaticogastrostomia e coledocoduodenostomia eco-guiadas são procedimentos avançados na endoscopia biliopancreática e compõem em conjunto a drenagem biliar eco-guiada. A hepaticogastrostomia é indicada nos casos de obstrução hilar, enquanto a coledocoduodenostomia é procedimento de escolha nas lesões distais. Convém lembrar que a drenagem biliar eco-guiada deve ser a segunda opção depois da falha da colangiografia endoscópica retrógrada. A indicação destes procedimentos deve ter alcance multidisciplinar e compartilhar a informação com o paciente ou responsável legal. A hepaticogastrostomia é método factível quando realizada por endoscopistas com proficiência em endoscopia biliopancreática e eco-endoscopia avançadas. A drenagem biliar eco-guiada deve ser realizada, atualmente, em condições rigorosas de protocolo em instituições de ensino.

Unitermos: Hepaticogastrostomia, Eco-guiada, Câncer.

INTRODUCTION

Novel approaches to biliary drainage using EUS (EUSBD) guided puncture of the bile duct – the common bile duct (CBD) or the left hepatic duct are now possible in cases where ERCP fails¹. After EUS access to the bile duct, drainage can be accomplished by either the transpapillary route (rendezvous and antegrade techniques²) or the transmural route. Transmural bile duct drainage under EUS effectively creates a bilio-digestive anastomosis, since the stent is placed across the GI tract wall and the bile duct. Whereas transmural extrahepatic bile duct drainage under EUS (i.e. EUS-guided choledochoduodenostomy) has been covered in the literature, we will focus in this chapter on transmural intrahepatic bile duct drainage, commonly referred to as EUS-guided hepaticogastrostomy (EUS-HG).

General patient, equipment and operator requirements for EUSBD are listed in further. We will further describe here the equipment and devices required for EUS-HG, common to most other EUSBD approaches. A step-by-step description of EUS-HG will be presented next. Finally, the specific place of EUS-HG within the context of other EUSBD approaches will be discussed and the published literature on it briefly reviewed.

EQUIPMENT AND DEVICES

A - Interventional Echoendoscopes

Around 1990, the Pentax-Corporation developed an electronic convex curved linear array echoendoscope (FG32UA) with an imaging plane in the long axis of the endoscope and aligned with the instrumentation plane. This

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echoendoscope, equipped with a 2.0mm working channel, enabled fine-needle aspiration biopsy under EUS guidance (EUS-FNA). However, the relatively small working channel of the FG32UA was a drawback for therapeutic intervention. As an example, drainage of a non-bulging pseudocyst using this early instrument was soon reported, but it required exchanging the echoendoscope for a therapeutic duodenoscope in order to insert a stent³. To enable stent placement using an echoendoscope, interventional echoendoscopes (FG 38X, EG 38UT and EG 3870UTK) were developed by Pentax-Hitachi. The FG 38X has a working channel of 3.2mm, which allows the insertion of a 8.5 French stent or nasocystic drain. The EG38UT and EG3870UTK have larger working channels of 3.8mm and are equipped with an elevator, thereby allowing the placement of a 10 French stent^{4,5}.

The Olympus Corporation has also developed convex linear array echoendoscopes. The GFUC 30P has a biopsy channel of 2.8mm, which enables the placement of 7 French stents or nasocystic catheters. This echoendoscope is also equipped with an elevator. A new prototype, the GFUCT 30, has a larger working-channel of 3.7mm allowing the placement of a 10 French stent. The main drawback of convex linear array echoendoscopes is the more limited imaging field (120° using the Pentax and 180° using the Olympus) produced by an electronic transducer. The Olympus instruments are coupled with the Aloka processor or with a smaller processor (Suzie).

B- Needles And Accessories For Drainage

As already described, needles used for bile duct access under EUS can be categorized into flexible, cautery needles (needle-knives or fistulotomes) and stiff, cutting needles (EUS-FNA needles). Needle knives can be difficult to visualize endosonographically. The “Zimmon” needle-knife (Wilson-Cook Corporation, Winston Salem, North Carolina, USA) has a large gauge needle that is relatively easy to visualize compared to other needle-knives. Cautery is usually required to penetrate through the intervening structures into the bile duct when a needle-knife is used¹. A cystotome is a more stable diathermic sheath and has a round cutting tip instead of a needle. Cystotomes are commonly used during pancreatic pseudocyst drainage⁴. The calibre used for pseudocyst drainage is usually 8.5 to 10 French. A modified small calibre cystotome (6 French), also referred to as “fistulotome” (Endoflex, Voerde, Germany) is more convenient for EUSBD.

Standard EUS-FNA needles are well visualized endosonographically and can be used for non-cautery access to the bile duct. The drawback of the most commonly used EUS-FNA needles is their small caliber (22 or 23 G) allowing only 0.018

inch guidewires. Using a larger 19G FNA needle (Wilson-Cook Corporation), a 0.0035 inch guidewire can be inserted through the needle into the dilated bile duct. As explained in Chapters 13-14 and 16-17, one of the main problems with EUS-FNA needle access to the duct is the difficulty in manipulating the guidewire through the needle. The main trouble is the “stripping” of the wire coating, which in turn risks leaving part of it into the patient. Furthermore, a strip-off or cut-off wire usually prevents stent insertion over it, which results in procedural failure unless a repeat puncture is attempted. As the intrahepatic bile duct rapidly collapses upon initial puncture, and the subsequent contrast or bile extravasation may substantially impair the endosonographic view, repeat puncture is not always feasible when EUS-HG is the approach to EUSBD pursued.

To solve the problem of guidewire damage with standard EUS-FNA needles, we worked with Cook Medical to design a new special needle called the EchoTip® Access Needle. This needle is original because it has a sharp stylet that makes it relatively easy to insert the needle into the bile duct, the pancreatic duct or a pseudocyst. When the stylet is withdrawn, the outer needle sheath is left in place with a blunt, non cutting tip. Manipulation of the guidewire without incurring the risk of damaging the guidewire is easy with this blunt tipped needle sheath.

TECHNIQUE OF EUS-GUIDED HEPATICO-GASTROSTOMY (EUS-HG)

As in the alternative extrahepatic access EUSBD technique for transmural drainage (i.e., choledochoduodenostomy), EUS-HG is closely related to EUS-guided drainage of pancreatic pseudocysts⁴. In all these cases, the target is imaged under EUS and punctured with a needle. The puncture tract is then dilated (using cautery, mechanical devices, or both), and a stent is placed across the puncture tract to drain the duct or the pseudocyst into the GI tract lumen.

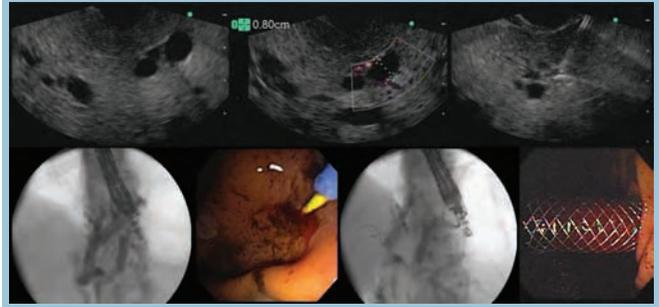
EUS-guided hepaticogastrostomy was first reported in 2003. Burmester and coworkers used EUS-HG in a Billroth II patient with unresectable pancreatic cancer and failed ERCP because of tumor infiltration of the papilla. In the same series, another patient with recurrent gastric cancer and total gastrectomy had a transmural stent placed across the jejunal wall below the gastrojejunostomy, i.e. EUS-guided hepaticogastrostomy⁶. We also reported in 2003 EUS-HG in a patient with subtotal gastrectomy and recurrent malignancy. The left biliary system was inaccessible, because a metal stent had been previously placed percutaneously in the right hepatic duct across the confluence⁷.

The procedural steps of EUS-HG are as follows. Using an interventional echoendoscope, the dilated left hepatic duct (usually segment III) is well visualized. EUS-HG is then performed under combined fluoroscopic and ultrasound guidance, with the tip of the echoendoscope positioned such that the ultrasound transducer is either in the middle part of the small curvature of the stomach or slightly upwards, closer to the cardia. A needle (19 G, EchoTip® Access Needle, Cook Ireland Ltd., Limerick, Ireland) is inserted transgastrially into a peripheral branch of the left hepatic duct, and contrast medium is injected. Before contrast is injected, bile can be aspirated through the needle in order to confirm the intraductal position of the needle tip. Opacification delineates fluoroscopically the dilated biliary tree down to the point of obstruction. The needle is exchanged over a guidewire (0.02 inch diameter, Terumo Europe, Leuven, Belgium) for a 6.0 French diathermic sheath (Cysto-Gastro set, Endo-Flex, Voerde, Germany), which is then used to enlarge the channel between the stomach (or jejunum in patients with total gastrectomy) and the left hepatic duct. The diathermic sheath is advanced across the intervening liver parenchyma by using cutting current. After removing over a guidewire (TFE-coated 0.035 inch diameter, Cook Europe, Bjaeverskov, Denmark) the diathermic sheath, an 8.5 French, 8 cm – long hepatico-gastric stent) or an 8 cm long covered self-expandable metal stent (SEMS) (partially covered Wallstent or fully covered Wallflex, Boston-Scientific, Natick, Massachusetts, USA) is placed transmurally. Fluoroscopy confirms adequate stent placement and function by showing contrast drainage through the stent into the stomach.

Bile leakage into the peritoneum is the major risk of EUS-HG. Several strategies are used by different authors to minimize this risk. A 6 or 7 French naso-biliary drain with mild aspiration or gravity drainage can be left in place through the metal stent during 48 hours, even if this is somewhat inconvenient to the patient. More recently we have developed a more patient-friendly approach to minimize the risk of leakage, by combining an uncovered metal stent with a covered metal stent inside. The uncovered stent is deployed initially, so as to provide anchorage and prevent migration, and then the covered stent is inserted coaxially and deployed within the first stent. Finally, in cases where the guidewire crosses the downstream stricture antegradely, hepaticogastrostomy can be combined with antegrade placement of an additional metal stent bridging the distal stricture, which further decreases the pressure gradient across the transmural stent by providing additional downstream decompression of the bile duct⁸. Alternative strategies used by other authors to prevent migration include the use of fully covered SEMS with both ends flared⁹ or forceful balloon expansion upon stent deployment (as opposed to gradual spontaneous self-expansion over several

hours) -to monitor foreshortening- plus insertion of a double pig-tail stent through the expanded SEMS-to provide additional anchorage¹⁰.

Figure 1 - The sequence of images show, on clockwise way, the step – by step technique of EUS guided hepaticogastrostomy as described in the text with details



EUS-HG IN COMPARISON WITH OTHER EUSBD APPROACHES

As discussed, the rationale for all variant EUSBD approaches as a second-line option in select difficult cases where ERCP is not feasible is threefold. EUSBD may be potentially more convenient (performed in the same session), more physiologic (allowing immediate internal biliary drainage) and less invasive (affording more accurate control as well as more access sites to the bile duct) than the classic alternatives of percutaneous biliary drainage (PTBD) or surgery.

The specific anatomic features of patients that may make EUS-HG preferable to other EUSBD are based on the intrahepatic access route and the transmural drainage route. Intrahepatic access is the only choice in patients with proximal (hilar) biliary obstruction and is usually more convenient in patients with distal gastrectomy, since imaging the CBD under EUS is not always possible in the setting of postoperative altered anatomy¹¹. One advantage of transmural drainage after intrahepatic bile duct access over transpapillary drainage is that the challenging step of antegrade guidewire passage (required for both rendezvous and antegrade stenting) is avoided. In addition to guidewire passage, rendezvous requires an accessible papilla, which is usually not the case in patients with surgically altered anatomy or tight duodenal stenoses. Antegrade stent insertion does not require an accessible papilla, but involves dilation of the puncture tract, just as EUS-HG. In patients with postoperative anatomy, antegrade transpapillary stenting without combined hepaticogastrostomy is less convenient for stent revisions, since HG provides easy repeat access to the bile duct without the need for a repeat puncture. Stent revisions are not uncommonly required during follow-up. The advantages of EUS-HG

over rendezvous or antegrade stent insertion are particularly relevant in patients with prior duodenal or biliary SEMs who experience recurrent biliary obstruction¹².

These variant EUSBD approaches must, however, be viewed as complementary rather than mutually exclusive. For example, as mentioned when discussing strategies to minimize the risk of bile leakage in EUS-HG, antegrade transpapillary stents can be combined with transmural stenting⁸. Puspok et al performed antegrade transpapillary SEMs insertion in a patient with recurrent gastric cancer after Roux-en-Y gastrectomy. They then left a transmural plastic stent across the puncture tract both to minimize the risk of leakage and to preserve access¹³. Dual drainage (antegrade and transmural) has also been used serially. Fujita et al performed transesophageal EUSBD by inserting a 7 French plastic stent into a peripheral left bile duct branch in a patient with advanced gastric cancer¹⁴. Ten days later, the plastic stent was cannulated with a guidewire and removed over it with a snare¹⁵. Then, using flexible devices through the mature fistula, the guidewire was manipulated under fluoroscopy across the malignant distal bile duct stricture, and a SEMs passed antegradely over the wire was subsequently deployed across the stricture above the papilla.

Patients with distal bile duct obstruction without prior gastrectomy who have both intra and extrahepatic bile duct dilation (and no gross ascites) are the only ones in whom there is an issue about which access site for EUSBD might be preferable, intrahepatic or extrahepatic. If the selection criteria for EUSBD versus PTBD are broad (i.e. EUSBD is favoured as the initial second-line approach after failed ERCP), this type of patients may represent just 20% of the candidate population¹⁶. Operator preference plays a part in this small patient subset. As highlighted in Chapter 14, the CBD offers a more obvious target for EUS puncture, the echoendoscope is in a more anchored position, and probably access to the CBD makes rendezvous easier than it is with intrahepatic access. On the other hand, intrahepatic EUSBD is performed with the echoendoscope in a more straight position, which favors transmission of the pushing force during stent insertion. It is also probably easier to penetrate a small intrahepatic bile duct surrounded by liver parenchyma than the fibrotic, hard wall of the CBD.

LITERATURE REVIEW

To date, transmural intrahepatic EUSBD has been reported in 51 patients, EUS-HG in 42 and other closely related variant approaches through a transjejunal or a transesophageal

route in 9. In five patients with total gastrectomy, the left bile duct was similarly accessed under EUS from below the cardia and transmural stents were placed across the jejunal wall. In the remaining four patients a cephalad peripheral left bile duct branch was selected for puncture, so that eventually the stent pierced the wall of the intra-abdominal esophagus slightly above the cardia. Approximately half of these patients come from three small series specifically dealing with transmural intrahepatic EUSBD^{8,12,17}, whereas the other half comes from either mixed series in which EUS-HG is reported along extrahepatic EUSBD^{6,9,13,18-20} or individual case reports^{7,14,21-24} (Table 1).

EUS-HG (or its variants) was technically successful in 49 out of these 51 patients, with clinical resolution of biliary obstruction in 46 cases. Therefore EUS-HG had a 94% per-protocol success rate and a 90.2% success rate on an intention-to-treat basis. These success rates are very high, considering the difficult patient population in which EUS-HG was attempted. However, three facts deserve consideration. First, these results come from highly experienced operators at referrals centers. Secondly, there is definitely a significant publication bias, i.e. since positive studies are more likely to be published, and this patient cohort is derived from small series and individual case reports, in real practice outcomes are probably somewhat less favorable. Finally, success was achieved at the expense of an overall 20% complication rate, twice as high as that of ERCP. Most complications were accounted for by inadequate biliary drainage, resulting in either peritoneal bile leakage or cholangitis (Table 1). Plastic stents caused cholangitis due to early migration²⁰ or early clogging⁸. Foreshortening of transmural SEMs led to bile peritonitis or biloma, requiring percutaneous drainage and repeat EUSBD⁹, and caused the only reported death to date²⁴. Half of the complications were nonetheless mild, manifested by transient abdominal pain with or without pneumoperitoneum that settled on conservative measures.

There is great consistency across all reports on EUS-HG regarding technical details. FNA needle access was used initially in all but two cases, in which cautery access using a prototype fistulotome was used instead⁶. Bougie or balloon dilation was performed before stent insertion in all but four cases, the two just mentioned in which a fistulotome was used, a case in which the tract was dilated after FNA-needle guidewire placement with the tapered tip of a wallstent²¹, and finally another case in which apparently just cautery was used for access, since no mention of dilation is made²⁴. The one technical aspect in which there is less uniformity is the use of cautery, be it kneedle-knives or fistulotomes. Overall, any diathermy use was reported in just 39.5% of

Table 1. Summary of the published literature on EUS-HG and related transmural intrahepatic EUSBD techniques

Author/Ref/Year	n Total EUSBD	n IH-Transmural		Success		Complications		Initial Stent	
		EUSHG	non-HG	Technical	Clinical	n	Type	Plastic	SEMS
Burmester ⁶ 2003	4	1	1	2	2	0	-	2	0
Puspok ¹³ 2005	6	0	1	1	1	0	-	1	0
Artifon ²¹ 2007	1	1	0	1	1	0	-	0	1
Bories ⁸ 2007	11	11	0	10	10	4	2 cholangitis, 1 ileus, 1 biloma	7	3
Will ¹⁷ 2007	8	4	4	7	6	2	1 cholangitis, 1 pain	2	5
Chopin-Laly ²² 2008	1	1	0	1	1	0	-	0	1
Iglesias-Garcia ²³ 2008	1	1	0	1	1	0	-	NS	NS
Horaguchi ²⁰ 2009	16	5	2	7	6	1	Cholangitis	7	0
Maranki ¹⁸ 2009	49	3	0	3	3	0	-	3	0
Park ⁹ 2009	14	8	1	9	9	2	Pneumo	0	9
Park ¹² 2010	5	5	0	5	5	0	-	0	5
Martins ²⁴ 2010	1	1	0	1	0	1	Peritonitis&death	0	1
Eum ¹⁹ 2010	3	1	0	1	1	0	-	0	1
Total	120	42	9	49	46	10	5 mild/ 5 severe	22	26

EUSBD: EUS-guided biliary drainage, HG: hepatico-gastrostomy; SEMS: Self-expandable metal stent; Pneumo: pneumoperitoneum. Case reports from Giovannini et al⁷ and Fujita et al¹⁴ not tallied because already included in case series by Bories et al⁸ and Horaguchi et al²⁰, respectively. why EUS-HG may be considered the most simple and effective approach to complex biliary drainage in some select patients based on their specific anatomic features.

cases. Whereas some authors use it routinely⁸, others resort to it selectively⁹ (only after failure to advance a mechanical dilator over the guidewire) or do not use it at all.¹⁷

From a clinical standpoint, however, the most relevant technical choice appears to be the type of stent. As detailed in Table 1, 7 to 8.5 plastic stents were placed in 46% of cases, whereas uncovered, partially covered or fully covered SEMS were placed initially in 54%. It is difficult to draw significant conclusions from the published reports, since no formal comparisons have been made between the two types of stents. SEMS are appealing for three reasons. Firstly, upon full expansion SEMS effectively seal the puncture/dilation tract, which would in theory prevent leakage more effectively. Secondly, their larger diameter provides better long-term patency, which would decrease the need for stent revisions. Finally, if dysfunction by ingrowth or clogging occurs, management is somewhat less challenging than with plastic stents, since a new stent (plastic or SEMS) can easily be inserted through the occluded SEMS in place. In contrast, exchanging a clogged plastic transmural stent usually requires over-the-wire replacement, because free-hand removal involves the risk of track disruption with subsequent guidewire passage into the peritoneum, hence requiring repeat EUSBD (or PTBD) to re-establish drainage¹⁵. These presumed advan-

tages of SEMS must be balanced against the fact that transmural SEMS insertion and deployment are somewhat more demanding than they are at ERCP. In particular, the serious risk of foreshortening and bile peritonitis should be prevented with careful attention to detail²⁴.

We had recently reported our experience in 38 patients (11 with benign disease and 27 with malignancy) using trans-gastric EUSBD with transmural, transpapillary (antegrade) or combined stent insertion. The technical success rate was 97%, and all successfully stented patients improved clinically. However, the complication rate was 25% (5 bile peritonitis, 3 stent migration, 1 liver abscess). There was one death caused by bile peritonitis, and the rest resolved under conservative management²⁵.

CONCLUSIONS

EUS-HG is a very useful EUSBD approach for patients with hilar strictures or prior gastrectomy. In the setting of altered surgical anatomy EUS-HG (or its variations) can be used alternatively or complementary to antegrade EUSBD, since it facilitates stent revision without significant additional risks. As with other EUSBD, EUS-HG carries a relatively high

morbidity rate. These techniques require experienced operators backed by a multidisciplinary team. Further technical improvements are likely to reduce number of adverse events and will probably contribute to the more widespread adoption of these procedures as a second-line approach to biliary drainage after failed ERCP.

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