—Original Article—

Feasibility of EUS-guided hepaticogastrostomy for inoperable malignant hilar biliary strictures

Jérôme Winkler[1], Fabrice Caillol[1], Jean-Philippe Ratone[1], Erwan Bories[1], Christian Pesenti[1], Marc Giovannini[1]
[1]Department of Endoscopy, Institut Paoli-Calmette, Marseille, France

ABSTRACT

Background and Objectives: EUS-guided biliary drainage (EUS-BD) has emerged as a complementary technique for primary drainage or as a rescue technique after failed endoscopic retrograde cholangiography. The objective of this study was to demonstrate the feasibility of EUS-BD for malignant hilar stenosis (MHS), both as an initial and rescue procedure. **Patients and Methods:** This study was a retrospective work based on a prospective registry of patients with malignant drainage stenosis of the hilum. For this analysis, only patients who underwent EUS-BD drainage were included. The drainage procedure could be performed by EUS-BD alone or in combination with another technique, for initial drainage or reintervention. **Results:** Between January 2015 and September 2018, 20 patients were included. The mean patient age was 68 years. Seven patients had primary liver tumors and 13 had obstructions caused by metastasis. Four patients had Type II stenosis, 7 had Type IIIA, 2 had Type IIIb, and 7 had Type IV stenosis. Sixteen patients underwent EUS-guided hepaticogastrostomy (EUS-HGS) for initial drainage and four as reintervention. For initial drainage, 2 patients underwent EUS-HGS alone and 14 underwent EUS-HGS in combination with another technique: 11 combined with endoscopic retrograde cholangiopancreatography (ERCP), 2 with percutaneous transhepatic drainage, and 1 with ERCP and percutaneous transhepatic drainage. The technical success rate for EUS-HGS in the drainage of MHS was 100%, and the clinical success rate was 95%. The mean percentage of liver drained was 84%, with an average 1.7 endoscopic sessions and an average 2.7 protheses. The early complication rate was 35% and the mortality rate was 5%. Five EUS-HGS/ERCP combination drainage procedures were performed in one session and six were performed in two sessions with similar complication rates and percentages of liver segments drained. **Conclusion:** EUS-BD is a feasible and safe technique for initial drainage and for reintervention procedures. The EUS-HGS/ERCP combination seemed to be useful in cases of complex stenosis and could be performed during the same session or in two sessions.

Key words: EUS-guided biliary drainage, feasibility, hilar malignant strictures

INTRODUCTION

Since being first described in 2001,[1] EUS-guided biliary drainage (EUS-BD) has demonstrated its usefulness when ERCP fails and thus in the drainage of unresectable malignant hilar stenosis (MHS). In this case, biliary drainage is the main palliative therapeutic measure. Currently, the European Society of Gastrointestinal Endoscopy (ESGE) guidelines

Access this article online

Quick Response Code:

Website: www.eusjournal.com

DOI: 10.4103/eus.eus_68_20

How to cite this article: Winkler J, Caillol F, Ratone JP, Bories E, Pesenti C, Giovannini M. Feasibility of EUS-guided hepaticogastrostomy for inoperable malignant hilar biliary strictures. Endosc Ultrasound 2021;10:51-6.

Address for correspondence
Dr. Jérôme Winkler, Department of Endoscopy, Institut Paoli-Calmettes, Marseille, France. E-mail: jerome.winkler@hotmail.fr
Received: 2020-01-31; **Accepted:** 2020-09-28; **Published online:** 2021-01-05

and an Asia-Pacific group recommend draining more than 50% of the total liver volume.[2,3] A recent study showed that the survival of patients with MHS was highly correlated with the percentage of liver segments drained regardless of the drainage technique.[4] However, combined techniques are often required, especially for complex stenosis.[5] Therefore, EUS-BD is a therapeutic option that can be applied as initial drainage or for reintervention.[6-14] The alternative to EUS-BD drainage is percutaneous transhepatic drainage. Studies have shown a similar success rate, but EUS-BD drainage seems to have more advantages with lower rates of intervention.[15-19] The aim of this study was to evaluate the feasibility of applying EUS-BD for non-operable malignant hilar strictures.

PATIENTS AND METHODS

This is a retrospective analysis of a prospectively managed and monocentric registry of patients included between January 2015 and September 2018 for biliary drainage of an inoperable malignant hilar lesion (Hilarium data). In the first part of the analysis, we included all patients with primary or secondary histologically confirmed nonoperable MHS or those who were highly suspected to have stenosis and underwent echoendoscopic-guided drainage (EUS-HGS) alone or in combination with another technique. Second, we evaluated all patients with an initially undrained left liver due to atrophy or ERCP failure. These patients were followed up and underwent drainage by EUS-HGS, if necessary. Malignant stenosis was defined by histology, and obvious malignant stenoses were follow-up until death or for at least 1 year.

The exclusion criteria were as follows: no malignant stenosis, benign stenosis, presurgical endoscopic drainage, or blood coagulation disorders. This study was performed with approval from the institutional review board under the authority of the CNIL (Hilarium study). Written informed consent was obtained from each patient included in the study. The study protocol conforms to the Declaration of Helsinki.

Definitions and outcomes

The primary outcome was a technical success, defined as the correct placement of the stents by EUS-BD.

The secondary outcomes were clinical success (defined as a 50% decrease in serum bilirubin levels 1 month later), postoperative complications (within 30 days after drainage) based on the Clavien–Dindo classification,[20] treatment after drainage (chemotherapy or radiotherapy), length of hospital stay, reintervention rate, overall survival, and drainage quality (percentage of liver segments drained).

Endoscopic drainage could be performed in two or more sessions, when planned, to treat complex stenosis. The intersession time period was required to be fewer than 7 days (including nonworking days). Endoscopic reintervention was defined as the performance of a new endoscopic procedure seven or more days after the end of the drainage.

Follow-up started on the date of the first endoscopic drainage procedure and ended in September 2018 or on the date of patient death.

Drainage techniques

EUS-guided hepaticogastrostomy

The EUS procedure was performed with a therapeutic echoendoscope (EG38UTK [Pentax, Tokyo, Japan]) with large working channels of 3.8 mm under triple guidance with ultrasound, endoscopy, and fluoroscopy. The echoendoscope was positioned in the stomach. Liver segment II, or sometimes segment III, was punctured with an access needle 19G (EchoTip® Ultra 19-A, Cook Medical) or with a standard 19G needle (EchoTipÕ Ultra 19, Cook Medical). After opacification, a guidewire (Jagwire 0.35“ from Boston Scientific) was introduced in the left bile duct. A fistula was created with a 6F cystotomy (Endo-Flex Company). A stent was then placed. A 6F nasobiliary drain was placed at the operator's discretion. The stents inserted included a Giobor™ stent (10 × 80 mm and 10 × 100 mm Niti-S Biliary Covered Stents, Giobor, Taewoong Medical) and a Poincloux stent (HanarostentÕ partially covered biliary stent, 10 × 100 mm, MI Tech).

Percutaneous transhepatic drainage and ERCP were performed, as described in our previous paper.[4]

All procedures were performed while the patient was intubated and in the supine position under general anesthesia. Five operators could perform the three techniques and could choose the technique at his or her discretion. The policy of the unit is to try to drain the majority of the liver segments.

RESULTS

Among the 139 patients in the registry, 20 patients (14.3%) underwent EUS-BD drainage:

16 patients underwent initial drainage and 4 patients underwent reintervention. The characteristics of the patients are summarized in Table 1.

The technical success rate was 100% and the clinical success rate was 95%. The global postoperative complication rate was 35% (n = 7) and 15% (n = 3) was Grade III or more, according to the Clavien–Dindo classification. Four complications were treated medically (Grade II): one biliary leakage, one cholangitis, one fecaloma, and one pulmonary embolism. Two complications were Grade IIIb (two cholangitis requiring endoscopic reintervention). The postoperative mortality rate (Grade V) was 5% due to one case of pancreatitis associated with cholangitis treated by a rescue EUS-HGS procedure.

The average percentage of liver segments drained was 84% (37.50%–100%) for patients with a median 2.7 protheses (1–5). The mean hospitalization length was 7.5 days (2–18). Nine patients needed an endoscopic reintervention in the follow-up period, mainly due to obstruction (n = 3) and cholangitis (n = 5), with an average stent patency time of 133 days. Eight patients were treated with radiotherapy or chemotherapy after the drainage procedure. The median overall survival was 136 days (9–540).

Table 1. Patient characteristics

	Patients (n=20)
Age (median)	68 years (33-83)
Male	10
Karnofsky performance scale (%)	82
Diagnosis (%)	
Cholangiocarcinoma	7 (35)
Metastasis	13 (65)
Colon	5 (25)
Ovarian	2 (10)
Pancreas	2 (10)
Others	4 (20)
Type of stenosis (%) (bismuth classification)	
Type II	4 (20)
Type IIIa/Type IIIb	7/2 (35/10)
Type IV	7 (35)
Mean hepatic invasion rate (%)	24 (0-60)
Type of drainage (%)	
Initial drainage	16 (80)
ERCP + EUS-HGS	11
EUS-HGS + percutaneous transhepatic drainage	2
EUS-HGS Alone	2
ERCP + EUS-HGS + percutaneous transhepatic drainage	1
Reintervention EUS-HGS	4 (20)
Duodenal stenosis (n)	0
Ascites (n)	0

EUS-HGS: EUS-guided hepaticogastrostomy

Initial drainage with EUS-guided biliary drainage

Sixteen patients underwent initial drainage with EUS-BD: 11 patients underwent drainage combined with ERCP + EUS-HGS and 5 were treated with other combinations of techniques (2 percutaneous transhepatic drainage + EUS-HGS, 2 EUS-HGS alone, and 1 ERCP + EUS-HGS + percutaneous transhepatic drainage). The early complication rate was 33% and 6 patients required endoscopic reintervention in the follow-up period. The average percentage of liver drained was 86%.

Combined ERCP and EUS-hepaticogastrostomy

In total, 11 patients underwent combined ERCP and EUS-HGS [Figure 1]. Five stenoses were Type IIIa, 5 were Type IV, and 1 was Type II. The complication rate was 18% (n = 2), the liver drainage rate was 96%, and the mean hospitalization length was 7.3 days. Five drainage procedures were performed during the same session and six procedures were performed in two sessions (within 7 days). The average length of hospital stay was 7.4 days for one-step procedures compared to 8.3 days for procedures performed in two steps. The complication rate for the combined ERCP-EUS-HGS drainage of MHS was 18%, including two cases of cholangitis.

Alternative drainage combinations

Two patients underwent EUS-HGS alone due to a fully invaded right liver associated with Type IIIA and IV strictures. There were no complications or endoscopic reinterventions. Two patients underwent combined drainage procedures of EUS-HGS and percutaneous transhepatic drainage due to modified anatomy (Whipple procedure). The first patient had right–left drainage by hepaticogastrostomy, and a complementary percutaneous transhepatic drainage procedure was performed to achieve a 100% liver drainage rate without complications or endoscopic resumption [Figure 2]. Finally, only one patient underwent drainage by three techniques in two sessions, with a combination of ERCP and EUS followed by percutaneous transhepatic drainage for Type IV cholangiocarcinoma.

Reintervention endoscopy with EUS-hepaticogastrostomy

Four patients underwent EUS-HGS as reintervention. One patient underwent a rescue drainage procedure by

Figure 1. Combined ERCP and EUS-hepaticogastrostomy drainage

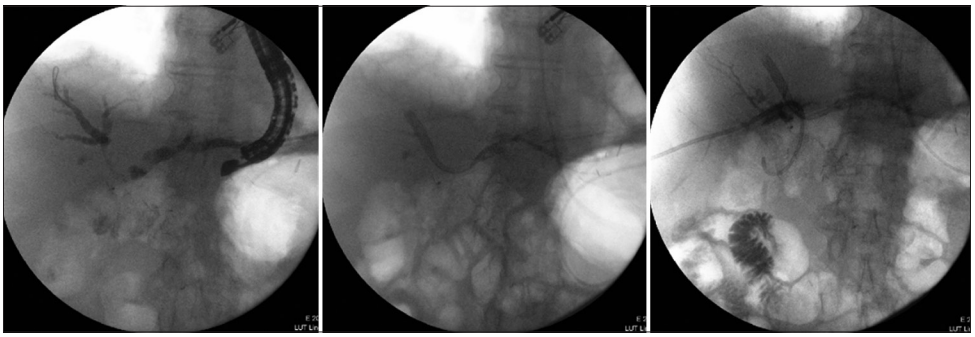

Figure 2. Example of combined technique: Bridging technique with percutaneous drainage

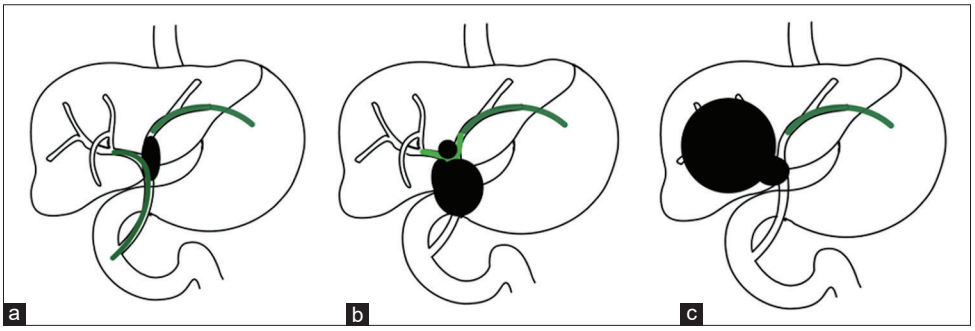

Figure 3. Examples of strategy using EUS-hepaticogastrostomy. (a) ERCP + EUS-hepaticogastrostomy. (b) Bridge technique in case of altered anatomy or inaccessible papilla. (c) EUS-hepaticogastrostomy alone when the right liver is invaded

EUS-HGS 9 days after ERCP because of pancreatitis associated with cholangitis. However, the patient died after the drainage procedure. Two patients underwent EUS-HGS during the long-term follow-up because of disease progression (day 183 and day 303), and one patient needed EUS-HGS to drain the left liver, which was not initially drained.

In this cohort of 139 patients, 11 had undrained left livers, which were due to poor conditions in four cases, atrophy in two cases, and cannulation failure without opacification in seven cases. The strictures were mainly Type IV (n = 8), Type IIIA (n = 2), and Type IIIB (n = 1). The postprocedure biliary drainage rate was 47% and the postoperative complication rate was 45%. In the follow-up period, only one patient required additional drainage of the left liver, which was performed by EUS-HGS.

DISCUSSION

Our study showed that EUS-BD is a feasible and safe approach in the management of MHS as an initial or secondary drainage procedure.

For primary drainage, the ERCP approach remains the reference technique for MHS. However, several techniques are often necessary, especially for high-grade strictures.[5] In our study, only EUS-HGS was used, and most of the procedures combined EUS-BD with another technique. In 2015, Park proposed the combination of EUS-HGS and ERCP for hilar malignant stenosis.[21] In our study, we demonstrated that this combination could be performed in one or two sessions with an acceptable complication rate. Interestingly, these cases mainly involved Type IIIA strictures. This observation is likely because adding a stent on the left intrahepatic

bile duct is technically more difficult when the right liver drainage procedure is performed with two or more stents.[22] The preliminary results of the CERES study demonstrated that this approach is effective and safe.[23] The combination of EUS-HGS and ERCP seems to be a promising approach for complex strictures that achieves a high rate of biliary drainage.

EUS-HGS alone as a primary drainage technique appears to be useful when the papilla is inaccessible due to altered anatomy. In this situation, several studies have demonstrated the feasibility of the bridge technique.[24,25] Another indication for EUS-HGS alone as the initial drainage method is complex hilar strictures associated with significant invasion of the hilum and right liver since this situation is associated with a high risk of ERCP failure. The advantage of EUS-HGS is that this method can be applied as a rescue technique after ERCP failure,[8,9] early in the case of cholangitis or at a distance when there is disease progression [Figure 3].

This combined technique raises the question of whether the left liver needs to be drained. The unilateral and bilateral drainage approaches have been evaluated in some studies, and bilateral drainage seemed to have fewer reinterventions and better stent patency than unilateral drainage.[26,27] In addition, bilateral drainage potentially increases the volume of hepatic drainage, which is correlated with survival.[4] A maximalist attitude is therefore relevant. EUS-BD must be considered when drainage of the left liver by ERCP fails. In our registry, few patients had an undrained left liver due to this maximalist policy. However, in most cases, no drainage was required in the follow-up, probably because of poor prognoses or contraindications to anesthesia.

Therefore, several factors must be considered before an additional drainage procedure is performed in the left liver: performance status, liver parenchyma atrophy, risks for complication, and estimated overall survival and the clinical and paraclinical course after the first drainage procedure. At this time, further data are needed to evaluate the different approaches. In our study, the complication rate was comparable to that of other studies on the drainage of MHS and the majority only require medical treatment. For the combined ERCP-EUS-HGS technique, the postoperative complication rate was acceptable, and the biliary drainage rate was high. The main limitations of this study are the retrospective nature and the small number of patients.

However, the decision to perform EUS-BD depends on several parameters, including ERCP failure, and is made on a case-by-case basis depending on the patient and team; thus, a randomized prospective strategy comparison study would be limited. The main challenge is to find reliable tools to define the best strategy for each patient in advance.

CONCLUSION

In our study, EUS-BD is a feasible technique for MHS and has an acceptable complication rate. This method can be used in combination with other techniques, such as ERCP, during the initial drainage or for reintervention. EUS-BD is a safe technique to optimize the percentage of hepatic volume drained in cases of MHS.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Giovannini M, Moutardier V, Pesenti C, *et al*. Endoscopic ultrasound-guided bilioduodenal anastomosis: A new technique for biliary drainage. *Endoscopy* 2001;33:898-900.
2. Rerknimitr R, Angsuwatcharakon P, Ratanachu-ek T, *et al*. Asia-Pacific consensus recommendations for endoscopic and interventional management of hilar cholangiocarcinoma. *J Gastroenterol Hepatol* 2013;28:593-607.
3. Dumonceau JM, Tringali A, Papanikolaou IS, *et al*. Endoscopic biliary stenting: Indications, choice of stents, and results: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline – Updated October 2017. *Endoscopy* 2018;50:910-30.
4. Caillol F, Bories E, Zemmour C, *et al*. Palliative endoscopic drainage of malignant stenosis of biliary confluence: Efficiency of multiple drainage approach to drain a maximum of liver segments. *United European Gastroenterol J* 2019;7(1):52-9.
5. Miura S, Kanno A, Masamune A, *et al*. Bismuth classification is associated with the requirement for multiple biliary drainage in preoperative patients with malignant perihilar biliary stricture. *Surg Endosc* 2015;29:1862-70.
6. Ogura T, Masuda D, Imoto A, *et al*. EUS-guided hepaticogastrostomy for hepatic hilar obstruction. *Endoscopy* 2014;46 Suppl 1 UCTN: E32-3.
7. Prachayakul V, Aswakul P. Endoscopic ultrasound-guided biliary drainage: Bilateral systems drainage via left duct approach. *World J Gastroenterol* 2015;21:10045-8.
8. Minaga K, Takenaka M, Kitano M, *et al*. Rescue EUS-guided intrahepatic biliary drainage for malignant hilar biliary stricture after failed transpapillary re-intervention. *Surg Endosc* 2017;31:4764-72.
9. Ogura T, Onda S, Takagi W, *et al*. Clinical utility of endoscopic ultrasound-guided biliary drainage as a rescue of re-intervention procedure for high-grade hilar stricture. *J Gastroenterol Hepatol* 2017;32:163-8.
10. Park SJ, Choi JH, Park DH, *et al*. Expanding indication: EUS-guided hepaticoduodenostomy for isolated right intrahepatic duct obstruction (with video). *Gastrointest Endosc* 2013;78:374-80.
11. Kawakubo K, Isayama H, Kato H, *et al*. Multicenter retrospective study

of endoscopic ultrasound-guided biliary drainage for malignant biliary obstruction in Japan. *J Hepatobiliary Pancreat Sci* 2014;21:328-34.
12. Makmun D, Fauzi A, Abdullah M, *et al*. The role of EUS-BD in the management of malignant biliary obstruction: The Indonesian perspective. *Diagn Ther Endosc* 2017;2017:4856276.
13. Nakai Y, Kogure H, Isayama H, *et al*. Endoscopic ultrasound-guided biliary drainage for unresectable hilar malignant biliary obstruction. *Clin Endosc* 2019;52:220-5.
14. Moryoussef F, Sportes A, Leblanc S, *et al*. Is EUS-guided drainage a suitable alternative technique in case of proximal biliary obstruction? *Therap Adv Gastroenterol* 2017;10:537-44.
15. Sportes A, Camus M, Greget M, *et al*. Endoscopic ultrasound-guided hepaticogastrostomy versus percutaneous transhepatic drainage for malignant biliary obstruction after failed endoscopic retrograde cholangiopancreatography: A retrospective expertise-based study from two centers. *Therap Adv Gastroenterol* 2017;10:483-93.
16. Khashab MA, Valeshabad AK, Afghani E, *et al*. A comparative evaluation of EUS-guided biliary drainage and percutaneous drainage in patients with distal malignant biliary obstruction and failed ERCP. *Dig Dis Sci* 2015;60:557-65.
17. Paik WH, Park YS, Hwang JH, *et al*. Palliative treatment with self-expandable metallic stents in patients with advanced type III or IV hilar cholangiocarcinoma: A percutaneous versus endoscopic approach. *Gastrointest Endosc* 2009;69:55-62.
18. Sharaiha RZ, Khan MA, Kamal F, *et al*. Efficacy and safety of EUS-guided biliary drainage in comparison with percutaneous biliary drainage when ERCP fails: A systematic review and meta-analysis. *Gastrointest Endosc* 2017;85:904-14.
19. Bapaye A, Dubale N, Aher A. Comparison of endosonography-guided vs. percutaneous biliary stenting when papilla is inaccessible for ERCP. *United European Gastroenterol J* 2013;1:285-93.
20. Clavien PA, Barkun J, de Oliveira ML, *et al*. The Clavien-Dindo classification of surgical complications: Five-year experience. *Ann Surg* 2009;250:187-96.
21. Park DH. Endoscopic ultrasound-guided biliary drainage of hilar biliary obstruction. *J Hepatobiliary Pancreat Sci* 2015;22:664-8.
22. Wiggers JK, Groot Koerkamp B, Coelen RJ, *et al*. Preoperative biliary drainage in perihilar cholangiocarcinoma: Identifying patients who require percutaneous drainage after failed endoscopic drainage. *Endoscopy* 2015;47:1124-31.
23. Romano R, Kongkam P, Boonmee C, *et al*. Su1414 combination of ERCP and EUS-guided biliary drainage in high-grade malignant hilar biliary obstruction (the ceres study): Preliminary results of a multicenter cohort study. *Gastrointest Endosc* 2018;87:AB346-7.
24. Caillol F, Bosshardt C, Reimao S, *et al*. Drainage of the right liver under EUS guidance: A bridge technique allowing drainage of the right liver through the left liver into the stomach or jejunum. *Endosc Ultrasound* 2019;8:199-203.
25. Ogura T, Sano T, Onda S, *et al*. Endoscopic ultrasound-guided biliary drainage for right hepatic bile duct obstruction: Novel technical tips. *Endoscopy* 2015;47:72-5.
26. Iwano H, Ryozawa S, Ishigaki N, *et al*. Unilateral versus bilateral drainage using self-expandable metallic stent for unresectable hilar biliary obstruction. *Dig Endosc* 2011;23:43-8.
27. Lee TH, Kim TH, Moon JH, *et al*. Bilateral versus unilateral placement of metal stents for inoperable high-grade malignant hilar biliary strictures: A multicenter, prospective, randomized study (with video). *Gastrointest Endosc* 2017;86:817-27.