

# 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

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## ABSTRACT

**Background and Objective:** EUS-guided biliary drainage is now comparable to percutaneous drainage. This technique can be used in cases of complex drainage of the hilum, mainly for salvage therapy to drain the left liver. In cases of inaccessible papilla or altered anatomy, EUS-guided biliary drainage for hilar stenosis of the liver could be used as the first approach. However, this technique has limited applicability for the right liver. In this feasibility study, we reported drainage of the right liver using the bridge technique and hepaticogastrostomy. **Patients and Methods:** This retrospective study was based on a prospective registry from January 2013 to February 2017. Patients with inaccessible papilla due to altered anatomy or duodenal invasion and drainage under EUS guidance and bridge technique without previous biliary drainage were included in the study. The bridge technique was used to place an uncovered biliary stent between the right and left liver. The left liver was drained with a hepaticogastrostomy. **Results:** Twelve patients were included in the study. Stenosis was Type II for nine, IIIA for two, and Type IV for one patient. Technical and clinical success was 100% and 83%, respectively. Morbidity was 33% (four patients), including three with abdominal pain managed conservatively and one with a percutaneous salvage drainage. Postoperative mortality was 8% (uncontrolled sepsis). The mean survival was 6 months. Chemotherapy could be administered in 70% (seven) patients in cases of clinical success. **Conclusion:** The bridge technique under EUS guidance could be a first alternative for draining malignant hilar stenosis in cases of the inaccessible papilla.

**Key words:** Bridge technique, EUS drainage, hepaticogastrostomy, hilar drainage

## INTRODUCTION

EUS-guided drainage of the biliary duct was described in the 2000s to drain the liver in cases of failure of classical ERCP or altered anatomy

as an alternative to percutaneous drainage.<sup>[1]</sup> The technique is now well evaluated, and this alternative

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to percutaneous drainage has become a standard drainage technique.<sup>[2]</sup>

EUS-guided biliary drainage is therefore now comparable to percutaneous drainage and likely has lower adverse effects, as demonstrated in studies comparing it with the percutaneous route.<sup>[3,4]</sup> More recently, EUS-guided drainage was described as an alternative in cases of hilar stenosis. Ogura *et al.* described it as a rescue reintervention<sup>[5]</sup> after classical ERCP. Applying the conclusions of these papers, EUS-guided biliary drainage for hilar stenosis of the liver could be used as a first approach in cases of inaccessible papilla or altered anatomy. Ogura *et al.* described a clinical case wherein hepaticogastrostomy was used, allowing drainage of the right liver through the left liver into the stomach.<sup>[6]</sup> However, few data are available regarding this technique; only ten cases have been published in two papers,<sup>[7,8]</sup> excluding the previous clinical case.<sup>[5]</sup>

We therefore retrospectively reviewed all cases of biliary drainage of hilar tumors using this technique in our unit to evaluate the feasibility of this bridge technique.

## PATIENTS AND METHODS

Our work is a single-center retrospective study based on prospectively collected data and was performed according to our Institutional Review Board agreement.

The retrospective analysis was performed in September 2017 by an independent operator Citizen's Band using the hospital's computerized patient file or by contacting general practitioners or referring gastroenterologists.

Inclusion criteria were malignant hilar stenosis of the bile duct, inaccessible papilla due to duodenal stenosis or altered anatomy, and an attempt of the bridge technique.

Patients who refused to participate in the study and/or patients with previous biliary drainage were excluded from the study.

### *Endoscopic procedure*

The procedure was performed with patients intubated and sedated and in the supine position. The liver segment II or III was punctured with a 19 G access needle (EchoTip® Ultra 19-A, Cook Medical, USA) or a standard 19 G needle (EchoTip® Ultra 19, Cook Medical)

with a therapeutic echoendoscope (EG38UTK [Pentax, Tokyo, Japan]). In case of hepaticojejunostomy, the site of puncture was 5 cm below the esophagojejunal anastomosis. After opacification, a guide wire (Jagwire 0.35 inch, Boston Scientific®) was introduced into the left bile duct. A fistula was then created with a 6-Fr cystotome (Endo-Flex company, Voerde, Germany). By pushing the cystotome against the hilum stenosis, the guide wire could be inserted into the right liver, usually in the posterior portion. To cross the stenosis, the cystotome was initially used without current. If this was unsuccessful, an ENDOCUT® was used; however, in most cases, ENDOCUT® was not efficient and a direct current had to be used. Direct current was also used to avoid damaging the guide wire with coagulation. The hilum stenosis between the left and right liver was then enlarged with a 4 mm dilation balloon (Hurricane Balloon Dilation Catheter 4 mm × 4 cm, Boston Scientific). Then, a 6 cm long stent was inserted between the right and left liver, creating a bridge between the two (Silver Self-expanding stent, Cook medical® or WallFlex biliary stent from Boston scientific®). Another stent was finally placed between the liver and stomach or jejunum to create a hepaticogastrostomy or a hepaticojejunostomy (Giobor stent, Taewoong Medical®, Korea). A 6-Fr nasobiliary drain was used at the discretion of the operators [Figures 1 and 2].

### *Definition*

Technical success was defined as correct placement of the stents. Correct placement of the bridge stent was defined according to its position between the right and left liver when it crossed the liver. Correct placement of the hepatic or jejunostomy was determined according to the uncovered part in the liver, the covered part of the stent between the area of puncture, and the lumen of the stomach or the jejunum. At the end of the procedure, emptying of the contrast was checked from the right to the left liver and from the left liver to the lumen of the stomach or jejunum. Clinical success was determined according to a decrease by 50% in the bilirubin level 1 month after the procedure.

Follow-up started on the date of the endoscopic drainage and ended in September 2017 or at death, whichever was earlier.

Complications occurring in the first month following the biliary drainage procedure were defined according to the Clavien-Dindo classification.<sup>[9]</sup>

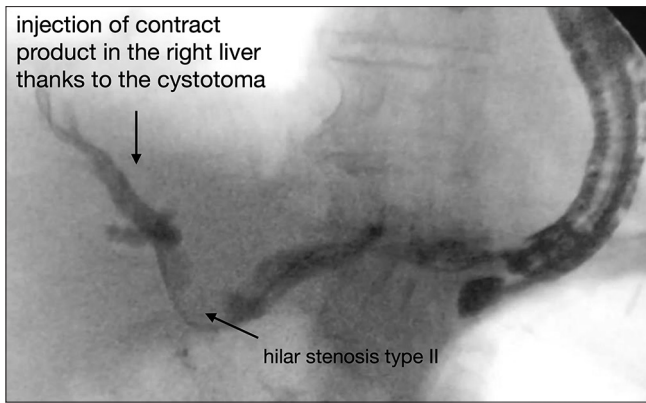


Figure 1. Visualization of the stenosis

**End points**

The primary end point was the feasibility determined based on technical and clinical success and the rate of complications.

The secondary end points were the possibility for patients to receive chemotherapy and survival after drainage.

**RESULTS**

Twelve patients (five men, seven women, mean age 59.5 years) admitted from January 2013 to February 2017 were included in the study. Inaccessible papilla was due to duodenal invasion in six patients and altered anatomy for the remaining patients (Whipple surgery in five patients, gastrectomy in one). The stenosis was Type II (Bismuth classification) in nine, Type IIIA in two, and Type IV in one patient. The stenosis pathology was pancreatic adenocarcinoma in six patients, gallbladder carcinoma in two, endocrine pancreatic carcinoma in two, gastric cancer in one, and cholangiocarcinoma in one patient [Tables 1 and 2].

Endoscopic drainage was performed as described in the methods: eleven patients underwent hepaticogastrostomy and one underwent hepaticojejunostomy. The type of stents, all of which were metallic, are described in Table 1. A nasobiliary drain was placed in each patient to decrease bile leakage. One patient had a percutaneous drainage in the same session (Type IIIA) to drain the lateral segment of the liver.

The technical and clinical success rate was 100% and 83% (10/12), respectively. One patient underwent a salvage percutaneous drainage because of fever and

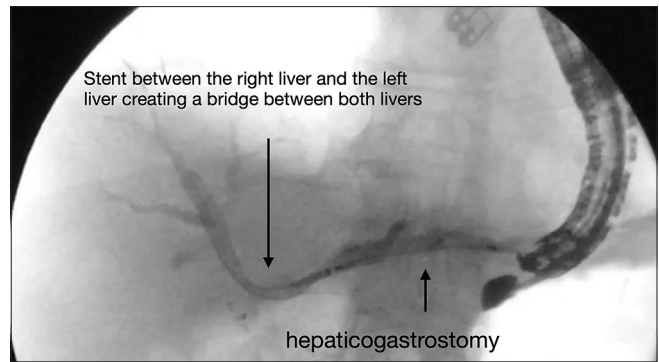


Figure 2. Bridge technique and hepaticogastrostomy

**Table 1. Characteristics of population studied**

Men, n (%)	5 (42%)
Age (median)	59.5 years (48-73)
Histology (%)	
Pancreatic adenocarcinoma	6 (50)
Gallbladder carcinoma	2 (17)
Pancreatic endocrine carcinoma	2 (17)
Cholangiocarcinoma	1 (8)
Gastric cancer	1 (8)
Bismuth classification (%)	
Type II	9 (75)
Type IIIA	2 (17)
Type IV	1 (8)
Etiology of inaccessibility of the papilla (%)	
Duodenal invasion	6 (50)
Altered anatomy	6 (50)
Whipple surgery: 5 (83%)	
Gastrectomy: 1 (17%)	
Stent type (%)	
Uncovered 6 cm stent + Giobor 8 cm	4 (33)
Uncovered stent 6 cm + Giobor 10 cm	5 (42)
Uncovered 8 cm stent + Giobor 8 cm	2 (17)
Uncovered 8 cm stent + Giobor 10 cm	1 (8)

no decrease in bilirubin (Type IIIA), and one patient presented with cholangitis after drainage (Type IV) with a multidisciplinary decision to provide only supportive care (death on day 7).

Postoperative morbidity was 33% (four patients). Three patients had postoperative pain, requiring the administration of analgesia with morphine (Grade I of Clavien-Dindo classification). One patient presented cholangitis, thus needing a new endoscopy with salvage percutaneous drainage (Grade IIIA).

Postoperative mortality (Grade V of Clavien-Dindo classification) was 8%, due to cholangitis not controlled with antibiotics in a patient who had opted for only palliative care.

**Table 2. Patients and characteristics**

Primary tumor	Bismuth classification	Cause of inaccessibility of the papilla	Mechanism of hilar obstruction	Stent type	Drainage type
Pancreatic NET	Type II				
Pancreatic adenocarcinoma	Type II	Whipple surgery	Local relapse	Uncovered 8 cm stent + Giobor 8 cm	Hepaticogastrostomy
Pancreatic adenocarcinoma	Type II	Duodenal invasion	Local advanced disease	Uncovered 6 cm stent + Giobor 10 cm	Hepaticogastrostomy
Cholangiocarcinoma	Type IIIB	Whipple surgery	Local relapse	Uncovered 6 cm stent + Giobor 8 cm	Hepaticogastrostomy
Pancreatic adenocarcinoma	Type IV	Duodenal invasion	Local advanced disease	Uncovered 6 cm stent + Giobor 8 cm	Hepaticogastrostomy
Gallbladder cancer	Type II	Duodenal invasion	Local advanced disease	Uncovered 6 cm stent + Giobor 10 cm	Hepaticogastrostomy
Pancreatic adenocarcinoma	Type II	Duodenal invasion	Local advanced disease	Uncovered 8 cm stent + Giobor 10 cm	Hepaticogastrostomy
Gallbladder cancer	Type II	Duodenal invasion	Local advanced disease	Uncovered 6 cm stent + Giobor 10 cm	Hepaticogastrostomy
Pancreatic NET	Type II	Whipple surgery	Local relapse	Uncovered 8 cm stent + Giobor 8 cm	Hepaticogastrostomy
Pancreatic adenocarcinoma	Type II	Duodenal invasion	Local advanced disease	Uncovered 6 cm stent + Giobor 10 cm	Hepaticogastrostomy
Pancreatic adenocarcinoma	Type IIIB	Whipple surgery	Local relapse	Uncovered 6 cm stent + Giobor 8 cm + PCT	Hepaticogastrostomy
Gastric cancer	Type II	Gastrectomy	Local relapse	Uncovered 6 cm stent + Giobor 8 cm	Hepaticojejunostomy

PCT: Per-Cutaneous Transhepatic drainage, NET: Neuroendocrine tumor

The mean duration of hospitalization was 5 days. All patients were dead at the date of the last report. The mean survival was 6 months (range, 7 days–13 months). One patient was lost to follow-up. In addition, during the follow-up period, one patient needed a duodenal stent because of occlusion and one patient needed two endoscopies for biliary obstruction. Chemotherapy could be administered in seven (70%) patients with clinical success.

## DISCUSSION

In 2012, the European Society of Gastrointestinal Endoscopy stated that more than 50% of the liver had to be drained to increase patient survival in cases of hilar stenoses. Therefore, draining only the left liver is not sufficient to obtain this percentage.<sup>[10]</sup> Draining the right liver using EUS is challenging because the anatomy makes it difficult to visualize the right liver through the stomach or the bulbus duodeni. EUS-guided drainage has been described for salvage therapy in cases of failure of hilar stenosis after classical ERCP<sup>[11,12]</sup> although few studies have specifically described the drainage of the right liver under EUS guidance. Ogura *et al.* described EUS-guided drainage of the right liver, puncturing the right liver directly through the bulbus duodeni in two and four patients in two studies,<sup>[5,7]</sup> while two clinical cases have described

EUS-guided drainage of the right liver through the transduodenal route.<sup>[13,14]</sup>

In our study, the drainage of the right liver was performed through the left liver, allowing drainage of the right liver even in cases of altered anatomy or duodenal invasion for hilar stenosis.

After a clinical case,<sup>[6]</sup> Ogura *et al.* published a first case series with seven patients describing this bridge technique,<sup>[7]</sup> which was already described in an abstract by our team.<sup>[15]</sup> More recently, a French team described this kind of drainage being used in three patients<sup>[8]</sup> in a series of 18 patients with hilar strictures and failure of ERCP.

To the best of our knowledge, our study, with 12 patients, is the largest study reporting EUS drainage of the right liver through the left liver in cases of hilar stenosis and is the first series with enough patients to evaluate the feasibility, complications, and possibility of administering chemotherapy after the bridge technique. Unlike other studies about EUS drainage for hilar stenosis, and similar to the study by Ogura *et al.*, EUS-guided drainage was performed as the first-line therapy.

Our rate of complications was low although it is moderately higher than in the case series by



Ogura *et al.* However, we took into consideration abdominal pain that was likely due to moderate bile leakage and was managed conservatively, and re-endoscopy due to cholangitis because of a longer follow-up (6 months *vs.* 4.1 months for our study *vs.* that by Ogura *et al.*, respectively). Considering the Clavien-Dindo classification, we had a morbidity >Grade I, meaning reintervention was needed in 8% of patients. We have to keep in mind that the concern was hilar stenosis; compared to that seen in our study, the morbidity and mortality is higher in some well-known studies, with a maximum rate of 14% mortality seen in the study by Deviere *et al.*<sup>[16]</sup>

A limitation of this study is its retrospective design without the intention to treat; as a result, the technical success is 100% by definition. Moryoussef *et al.*<sup>[8]</sup> tried to answer the question regarding the technical success rate, finding a success rate of 50%, but with only three patients. Case description was limited because of this retrospective design, especially if the pejorative evolution of Type III (salvage PCT) and IV (death on day 7) is due to nondrainage of the opacified segments. Another limitation is that stent patency could not be evaluated because of the low survival due to disease progression, the low rate of stent obstruction (only one patient), and the low number of patients.

EUS-guided drainage for hilar tumors is likely one technique that could be performed in cases of ERCP failure or inaccessible papilla.<sup>[17]</sup> The bridge technique with EUS-guided drainage for hilar stenosis requires a high level of technical skills; nevertheless, it is a feasible alternative to drain patients with hilar tumors with inaccessible papilla. Further studies will be required to define its place in the management of malignant hilar stenosis.

## CONCLUSION

Our study is a feasibility study showing that the bridge technique can be performed under EUS guidance for malignant hilar stenosis. This palliative treatment with an acceptably low rate of complications allows a majority of patients to receive chemotherapy after drainage. The application of this drainage technique in the management of hilar stenosis needs to be better defined with additional studies.

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## Conflicts of interest

There are no conflicts of interest.

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