Endoscopic Ultrasonography-Guided Biliary Drainage: Experience of a Moroccan Center
Mohamed Acharki¹, Soumaya Jellal*¹, Mouna Salihoun¹, Nawal Kabbaj¹

¹EFD-Hepatogastroenterology Unit, Ibn Sina Hospital, Mohammed V University, Rabat, Morocco

**Background:** Endoscopic ultrasound-guided biliary drainage (EUS-BD) is a relatively new therapeutic modality in the arsenal of endoscopists for attaining satisfactory biliary drainage when traditional ERC fails. The aim of our study is to describe the first Moroccan experience with EUS-BD in patients with malignant biliary obstruction after a failed or inaccessible ERC. **Methods:** This is a retrospective study conducted at Ibn Sina Hospital, from Mars 2018 to July 2022, which include 27 patients with an inoperable or metastatic malignant biliary obstruction who underwent endoscopic ultrasonography-guided biliary drainage (EUS-BD) in case of endoscopic retrograde cholangiopancreatography (ERCP) failure. **Results:** From a total of 288 patients with malignant biliary obstruction, 27 underwent EUS-BD (9.3%), 15 EUS-guided hepaticogastrostomy (55.5%), and 12 EUS-guided choledocoduodenostomy (44.4%) were performed. The mean age was 62.5 years (age range: 23-74 years), a male predominance of 59% was noted, cholestatic jaundice was present in 100% of patients and associated with pruritus in 92.59% of cases. The mean level of Total Bilirubin was 190 mg/l. The causes of biliary obstruction were: an inoperable pancreatic head mass in 13 patients (48.1%), a cholangiocarcinoma in 7 patients (25.9%), an ampullary mass in 4 patients (14.8%), a gallbladder cancer with hepatic and duodenal invasion in one patient (3.7%), a gastric antropyloric adenocarcinoma with pancreatic head invasion in one patient (3.7%) and Duodenal adenocarcinoma in one patient (3.7%). The leading causes of failed ERCP were secondary to tumor infiltration of the duodenal wall and critical duodenal stenosis in 11 cases (40.7%), in 9 cases due to a difficult cannulation (33.3%) and in 7 cases due to a failure to pass the stricture by ERCP (25.9%). In EUS-HG the technical and the clinical success rates were 86.6% (13/15) and 84.6% (11/13), respectively, the complication rate was 13.3% (2/15) including one case of stent migration complicated with bile leak and one case of cholangitis. In EUS-CD the technical and the clinical success rates were 91.6% (11/12) and 81.8% (9/11), respectively, the complication rate was 16.6% (2/12) including two cases of cholangitis. The technical and the clinical success rates in all EUS-BD were 85.1% (24/27) and 83.3% (20/24), respectively. The complication rate was 14.8% (4/27). Conclusion: EUS-BD appears to be an effective and safe therapeutic option for biliary decompression in cases where ERC fails.

**Keywords:** EUS-BD, EUS-CD, EUS-HG, malignant biliary obstruction.

---

**INTRODUCTION**

Endoscopic retrograde cholangiography (ERC) with stent placement is the procedure of choice for relief of biliary obstruction, the success rate of ERC is 90 % [1-3]. Failure of ERC can be attributed to surgically altered anatomy, duodenal obstruction, gastric outlet obstruction, in situ enteral stents, periampullary diverticula, or periampullary tumor infiltration [4]. Conventionally, such patients undergo percutaneous transhepatic biliary drainage (PTBD) or Surgical biliary bypass. However, PTBD is more commonly preferred to surgery, it is associated with high substantial morbidity rates of up to 23% in the form of catheter dislodgement, recurrent infection, acute cholangitis, pneumothorax, and cosmetic problems (due to external drainage) [5]. This may lead to poor outcomes and decline in quality of life [6, 7].

Endoscopic ultrasound-guided biliary drainage (EUS-BD) is an alternative to failed ERC, first published by Giovannini and colleagues [9] in 2001. Subsequently, several groups described the efficacy of EUS-BD with a pooled technical success rate of 91.5% and a pooled clinical success rate of 87% [12], suggesting it is an effective alternative in place of PTBD or biliary bypass surgery.
The aim of our study is to describe the first Moroccan experience with EUS-BD in patients with malignant biliary obstruction after a failed or inaccessible ERCP.

**PATIENTS AND METHODS**

**Patients:**
This study is a retrospective study conducted at Ibn Sina Hospital, from March 2018 to July 2022, which include 27 patients with an inoperable or metastatic malignant biliary obstruction who underwent endoscopic ultrasonography-guided biliary drainage (EUS-BD) in case of endoscopic retrograde cholangiopancreatography (ERCP) failure.

**Methods:**
All the procedures were performed in the prone position with intubation, EUS was performed using the Pentax linear echoendoscope with an experienced endoscopist, following which, the patients were admitted for at least 2 days and monitored for potential complications such as fever, abdominal pain, pneumoperitoneum, bleeding, and peritonitis.

**EUS-BD techniques**

**EUS-guided hepatogastrostomy**
15 patients underwent EUS-guided hepatogastrostomy (EUS-HG) this approach was typically preferred in cases where the papilla is not endoscopically accessible due to gastric outlet obstruction, to an obstructing duodenal tumor, or in patients with surgically altered anatomy. Dilatation of intrahepatic ducts is necessary to perform this approach.

With the tip of the echoendoscope positioned along the lesser curvature of the stomach, the dilated left hepatic duct (segment III) can be correctly visualized. Transgastric needle (19-gauge) insertion into the left hepatic duct and contrast injection clearly show the biliary tree under fluoroscopy. The next step is to exchange the needle over a guidewire (0.035 inch) for a 6.Fr cystotome used to create the fistula between the CBD and duodenal bulb.6 cm fully covered self-expandable metal stent (FCSEMS)was then positioned over the under fluoroscopic and endoscopic guidance (Figure 1).

**EUS-guided choledocoduodenostomy**
12 patients Underwent EUS-guided choledocoduodenostomy (EUS CD). It is usually performed in case of failure of selective cannulation of the common biliary duct because of ampullary neoplasm, neoplastic infiltration from pancreatic cancer, or when the access to the papilla is prevented by benign (peptic stenosis) or malignant duodenal stenosis. The tip of the echoendoscope is advanced to the duodenal bulb or, when feasible, to the antrum wall where the dilated common biliary duct (CBD) is closer to the wall, the access to the bile duct is achieved with a 19-gauge needle, an aspiration of bile followed by contrast injection clearly show the biliary tree under fluoroscopy. The next step is to exchange the needle over a 0.035 inch guidewire for a 6. Fr cystotome used to create the fistula between the CBD and duodenal bulb.6 cm fully covered self-expansible metal stent (FCSEMS) was then positioned over the under fluoroscopic and endoscopic guidance (Figure 2).

**Outcome Parameters**
The outcome parameters included technical and clinical success.
- Technical success was defined as the successful deployment of the stent into the biliary system.
- Clinical success was defined as greater than 50% reduction in the bilirubin value after 2 weeks from the procedure, when compared with the preprocedural value.

All complications during the procedures and follow-up were recorded. Patients were monitored during and after the procedure for complications such as fever, bleeding, biliary peritonitis, and pneumoperitoneum.

**RESULTS**
From a total of 288 patients with malignant biliary obstruction, 27 underwent EUS-BD (9.3%), 15 EUS-guided hepatogastrostomy (55.5%) and 12 EUS-guided choledocoduodenostomy (44.4%) were performed. The mean age was 62.5 years (age range: 23-74 years), a male predominance of 59% was noted, cholestatic jaundice was present in 100% of patients and associated with pruritus in 92.59% of cases. The mean level of Total Biturbin was 190 mg/l.

The causes of biliary obstruction were: an inoperable pancreatic head mass in 13 patients(48,1%), a cholangiocarcinoma in 7 patients (25.9%), an ampullary mass in 4 patients(14.8%), a gallbladder cancer with hepatic and duodenal invasion in one patient (3,7%), a gastric antropyloric adenocarcinoma with pancreatic head invasion in one patient (3,7%) and Duodenal adenocarcinoma in one patient (3,7%).

The leading causes of failed ERCP were secondary to tumor infiltration of the duodenal wall and critical duodenal stenosis in 11 cases (40,7%), in 9 cases due to a difficult cannulation (33,3%) and in 7 cases due to a failure to pass the strecture by ERCP (25,9%).

In EUS-HG The technical and the clinical success rates were 86.6% (13/15) and 84.6% (11/13), respectively, the complication rate was 13.3% (2/15) including one case of stent migration complicated with bile leak and one case of cholangitis.
In EUS-CD The technical and the clinical success rates were 91.6% (11/12) and 81.8% (9/11), respectively, the complication rate was 16.6% (2/12) including two cases of cholangitis.

The technical and the clinical success rates in all EUS-BD were 85.1% (24/27) and 83.3% (20/24), respectively. The complication rate was 14.8% (4/27).

The summary of all cases is shown in Table 1 and 2.

Figure 1: EUS-guided hepaticogastrostomy

Figure 2: EUS-guided choledocoduodenostomy
Table 1: Summary of cases that underwent EUS-BD

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Diagnosis</th>
<th>Indication of EUS-BD</th>
<th>Procedure</th>
<th>Stent</th>
<th>Technical success</th>
<th>Clinical success</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>M</td>
<td>Cholangiocarcinoma</td>
<td>ERCP failure to pass the stricture</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>M</td>
<td>Inoperable pancreatic head mass</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>74</td>
<td>F</td>
<td>Inoperable pancreatic head mass</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>67</td>
<td>M</td>
<td>Inoperable pancreatic head mass</td>
<td>difficult cannulation</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>69</td>
<td>M</td>
<td>gallbladder cancer with hepatic and duodenal invasion</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>No</td>
<td>cholangitis</td>
</tr>
<tr>
<td>6</td>
<td>72</td>
<td>F</td>
<td>Ampullary Mass</td>
<td>difficult cannulation</td>
<td>EUS-CG</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>7</td>
<td>59</td>
<td>M</td>
<td>Inoperable pancreatic head mass</td>
<td>difficult cannulation</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>No</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>8</td>
<td>63</td>
<td>F</td>
<td>Inoperable pancreatic head mass</td>
<td>ERCP failure to pass the stricture</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
<td>M</td>
<td>Inoperable pancreatic head mass</td>
<td>difficult cannulation</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>10</td>
<td>54</td>
<td>F</td>
<td>Cholangiocarcinoma</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>11</td>
<td>62</td>
<td>M</td>
<td>gastric antro-pyloric adenocarcinoma with pancreatic head invasion</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>No</td>
<td>No</td>
<td>None</td>
</tr>
<tr>
<td>12</td>
<td>M</td>
<td>Cholangiocarcinoma</td>
<td>ERCP failure to pass the stricture</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>No</td>
<td>cholangitis</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>F</td>
<td>Ampullary Mass</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>F</td>
<td>Inoperable pancreatic head mass</td>
<td>difficult cannulation</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>M</td>
<td>Inoperable pancreatic head mass</td>
<td>difficult cannulation</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>M</td>
<td>Cholangiocarcinoma</td>
<td>ERCP failure to pass the stricture</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>No</td>
<td>cholangitis</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>M</td>
<td>Cholangiocarcinoma</td>
<td>difficult cannulation</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>F</td>
<td>Ampullary Mass</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>F</td>
<td>Inoperable pancreatic head mass</td>
<td>ERCP failure to pass the stricture</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>F</td>
<td>Inoperable pancreatic head mass</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>M</td>
<td>Inoperable pancreatic head mass</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>M</td>
<td>Cholangiocarcinoma</td>
<td>ERCP failure to pass the stricture</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>No</td>
<td>No</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>M</td>
<td>Duodenal adenocarcinoma</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>No</td>
<td>Stent migration+Bile leak</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>F</td>
<td>Inoperable pancreatic head mass</td>
<td>difficult cannulation</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>F</td>
<td>Inoperable pancreatic head mass</td>
<td>ERCP failure to pass the stricture</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>M</td>
<td>Cholangiocarcinoma</td>
<td>difficult cannulation</td>
<td>EUS CD</td>
<td>FCSEMS, 6cm</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>M</td>
<td>Ampullary Mass</td>
<td>Duodenal stenosis</td>
<td>EUS-HG</td>
<td>PCSEMS, 8cm</td>
<td>Yes</td>
<td>No</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

Endoscopic retrograde cholangiography (ERCP) with stent placement is the procedure of choice for relief of biliary obstruction. The success rate of ERCP is 90% [1–3]. Failure of ERCP can be attributed to surgically altered anatomy, duodenal obstruction, gastric outlet obstruction, in situ enteral stents, periampullary diverticula, or periampullary tumor infiltration [4]. Conventionally, such patients undergo percutaneous transhepatic biliary drainage (PTBD). However, PTBD is associated with substantial morbidity in the form of catheter dislodgement, recurrent infection, acute cholangitis, pneumothorax, and cosmetic problems (due to external drainage) [5]. This may lead to poor outcomes and decline in quality of life [6, 7].

Endoscopic ultrasound-guided biliary drainage (EUS-BD) is a relatively new therapeutic modality in the arsenal of endoscopists for attaining satisfactory biliary drainage when traditional ERC fails. Wiersma and colleagues [8] described the first EUS-guided cholangiopancreatography in 1996 on patients who had failed ERCP. The world’s first EUS-guided biliary drainage was published by Giovannini and colleagues [9] in 2001. Subsequently, several groups described the efficacy of EUS-BD, suggesting it is an effective alternative in place of PTBD or biliary bypass surgery. EUS-BD can be performed by two major approaches: extrahepatic (EH) and intrahepatic (IH).

In the EH approach, the common bile duct is accessed mainly through the duodenum or through the gastric antrum. Biliary drainage can be achieved by either transluminal stent placement (choledochoduodenostomy) or transpapillary stent placement via the rendezvous technique [10], this approach is usually performed in case of failure of selective cannulation of the common bile duct because of ampullary neoplasm, neoplastic infiltration from pancreatic cancer, or when the access to the papilla is prevented by benign (peptic stenosis) or malignant duodenal stenosis.

On the other hand, when the IH approach is used the left lobe of the liver is accessed from the gastric wall and rarely from the distal esophagus or jejunum. Using this approach, biliary drainage can be attained by either transluminal stent placement (hepaticogastrostomy) or transpapillary stent placement via rendezvous technique or antegrade technique [10]. Such approach is typically preferred in cases where the papilla is not endoscopically accessible due to gastric outlet obstruction, to an obstructing proximal duodenal tumor, or in patients with surgically altered anatomy. Dilatation of intrahepatic ducts is compulsory to perform this approach. Cancer infiltration of the gastric wall within the planned path of approach to the biliary ducts or massive ascites and coagulopathy are contraindications to this type of approach.

The choice of approach is still under debate and is mainly based on anatomical factors, indication of the procedure, and the endoscopist’s experience. Ascites or nondilated intrahepatic left biliary ducts are conditions for an extrahaepatic approach.

Artion et al., [10] compared the outcomes of EUS-HG and EUS-CD in a prospective randomized trial of 49 patients with distal malignant biliary obstruction. The technical success rate was 96% versus 91% with a clinical success rate of 91% versus 77% and similar procedural time. The overall adverse event rates were 16.3% (20% for the HG group and 12.5% for the CD group). These data show no significant differences between the two techniques.

These data have been confirmed by Khashab et al., [27] in an international multicenter comparative trial with 121 patients who underwent EUS-BD (CD: 60, HG: 61). However, CD was found to be associated with shorter hospital stay, improved stent patency, and fewer procedural and stent-related complications [27].

Based on the meta-analysis of EUS-guided biliary drainage done in 1437 patients from 23 studies, a pooled technical success rate of 91.5% was reported, a pooled clinical success rate of 87% [12]. Other studies have shown clinical success in the range of 84%–97% [13, 14, 16-22]. In the majority of studies [13-23] clinical success has been closely related to technical success, indicating the importance of a successful procedure. In our study the technical and the clinical success rates were 86.6% (13/15) and 84.6% (11/13), our results match those of previous studies.

Outcomes and complications in EUS-BD have been well documented in sever large studies, EUS-BD has a similar profile of adverse events to ERCP. In a meta-analysis, an overall pooled rate of adverse events was 17.9%, the commonest being biliary leak and infection. The pooled rate of biliary leaks was 4%, and the pooled rate of infection and stent migration was 3.8%.

Table 2: Technical success, clinical success and complications rates of EUS-BD

<table>
<thead>
<tr>
<th></th>
<th>EUS-HG</th>
<th>EUS CD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>86.6% (13/15)</td>
<td>91.6% (11/12)</td>
<td>85.1%</td>
</tr>
<tr>
<td>Clinical</td>
<td>84.6% (11/13)</td>
<td>81.8% (9/11)</td>
<td>83.3%</td>
</tr>
<tr>
<td>Complications</td>
<td>13.3%</td>
<td>16.6%</td>
<td>14.8%</td>
</tr>
</tbody>
</table>

CD: choledocoduodenostomy; EUS: endoscopic ultrasound; BD: biliary drainage; HG: hepaticogastrostomy.
Comparative studies between EUS-BD and other techniques are primarily available for distal malignant obstruction. In a recent systematic review and meta-analysis of EUS-BD versus ERCP, 9 studies involving 634 patients were included. There were no significant differences between the technical and clinical success of EUS-BD and ERCP-BD. EUS-BD was associated with significantly less reintervention versus ERCP-BD and regarding adverse events, the rates were similar for EUS-BD and ERCP-BD. There were no significant differences in the types of adverse events (stent occlusion, stent migration, stent dysfunction, and duration of stent patency) between the 2 techniques. EUS-BD was associated with lower reintervention rates compared with ERCP-BD, with comparable safety and efficacy outcomes [11].

There are no prospective studies evaluating the role of EUS-BD as a primary drainage technique in comparison to ERCP. The ERCP related complications like pancreatitis in difficult cannulation might suggest the role of EUS-BD as a good primary alternative in these setting or in patients with altered anatomy or malignant obstruction. However, the use of advanced ERCP techniques in a tertiary-care center usually provides high technical success rate so that EUS-BD is required in a very limited number of cases (only 0.6% of native papilla ERCPs according to the authors) [26].

There is level 1 evidence for EUS-BD in the distal biliary malignant block. A recent systematic review and meta-analysis by Sharaiha and colleagues [25] included 9 studies comparing the efficacy and safety of EUS-BD and PTBD: 3 randomized controlled trials (RCTs) and 6 retrospective studies. EUS-BD and PTBD showed equivalent technical success. However, EUS-BD was associated with better clinical success, fewer postprocedure adverse events, and lower reintervention rates. No significant differences were observed for the duration of hospital stay between EUS-BD and PTBD, but EUS-BD was more cost-effective.

Our study’s limitations are the relatively small number of cases and their retrospective assessment.

CONCLUSION

EUS-BD appears to be an effective and safe therapeutic option for biliary decompression in cases where ERCP fails. However, it requires a high level of technical skills and should be performed only in tertiary centers by experienced endoscopists. Randomized controlled trials evaluating the efficacy of this procedure in comparison with other therapeutic modalities are required.

REFERENCES


