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Outcomes of Endoscopic Biliary Drainage in Postsurgical Anatomy Using Endoscopic Ultrasound and Enteroscopy: A Comparative Study

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Abstract

Objectives Biliary obstruction is a common problem encountered in postsurgical anatomy, which may lead to serious complications if not treated promptly. Endoscopic drainage is a minimally invasive and effective treatment option for such patients. However, the optimal route of endoscopic drainage, either SBE-ERCP (single-balloon enteroscopy with endoscopic retrograde cholangiopancreatography) or EUS-BD (endoscopic ultrasound-guided bile duct drainage), remains controversial. In this study, we aim to evaluate the feasibility and outcomes of endoscopic drainage using these two techniques in postsurgical biliary obstruction over a period of 7 years.

Materials and Methods We conducted a retrospective study of patients who underwent endoscopic drainage for postsurgical biliary obstruction using SBE-ERCP or EUS-BD techniques between 2015 and 2022. The demographic details, clinical presentation, procedure duration, number of sessions required, technical success, complications, and change of procedure from SBE-ERCP to EUS-BD or vice versa were recorded.

Results Seventy-five patients, predominantly females with a mean age of 48 years, underwent endoscopic drainage. Forty-eight patients underwent SBE drainage and 27 patients underwent EUS-HG (EUS-guided hepaticogastrostomy). The mean duration of procedure (44 vs. 77 minutes), number of complications (4 vs. 5), technical success rate (93.5 vs. 85%), change of procedure (0 vs. 3), and number of sessions (1.1 vs. 1.8) were significantly less in the EUS-HG as compared to SBE-ERCP.

Conclusions Endoscopic biliary drainage is feasible, safe, and effective in postsurgical biliary anatomy but requires high technical expertise. The study proposes an algorithm that can be applied in such group of patients to determine the route for choosing the drainage procedure. This requires further validation with a large prospective cohort.

Keywords
- cholangitis
- pneumobilia
- hepaticojejunostomy
- ERCP
- biliary drainage

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Introduction

Endoscopic biliary drainage in patients with postsurgical anatomy presents a significant clinical challenge, particularly in developing countries. Several factors contribute to this challenge, including delayed presentation, complications associated with percutaneous transhepatic biliary drainage (PTBD), the requirement for specialized technical expertise, limited availability of skilled practitioners, and the complex ductal anatomy observed in special situations such as post-liver transplant or after a redo surgery. Additionally, the availability of appropriate instruments (such as short balloon enteroscopes, single-balloon enteroscopy [SBE], double-balloon enteroscopy [DBE], and pediatric colonoscopes) may be limited. While revising the anatomy is an option for patients with benign strictures, repeat surgery is associated with drawbacks such as prolonged hospitalization, increased morbidity, stricture recurrence, and financial burdens on both the patient and the health care system.[1–5]

However, advancements in technology have improved the success and outcomes of endoscopic procedures. With the introduction of short enteroscopes like SBE and DBE, therapeutic success has increased tremendously. Endoscopic ultrasound-guided hepaticogastrostomy (EUS-HG) has emerged as a safe and effective technique in patients with altered anatomy. Nonetheless, certain anatomical factors, such as nondilated intrahepatic bile ducts, presence of pneumobilia, and specific ductal anatomy (single duct, double duct, or multiple ducts) may pose challenges to EUS-guided drainage. In comparison, enteroscopy-guided drainage typically requires more time during the procedure due to the long intestinal loops and also due to proximity of the left intrahepatic ductal system to the intestinal loops. In contrast, EUS-HG takes less time during the procedure but has a long learning curve and is associated with a higher incidence of complications compared to enteral drainage methods.

Enteroscopy-guided drainage can be an alternative method for patients with benign strictures, but its success relies on patient-related and anatomical factors. Patient-related factors include comorbidities (increasing the risk of anesthesia) and the patient's clinical condition at the time of the procedure (e.g., unstable condition in the presence of cholangitis, where PTBD may be a safer option). Anatomy-related factors encompass the length of the afferent limb and the specific type of anatomy (single duct, double, or multiple ducts), as well as the presence of a hepaticojejunostomy (HJ) or gastric access loop.[6–10]

In this study, we try to compare two methods of biliary drainage: SBE with endoscopic retrograde cholangiopancreatography (SBE-ERCP) and endoscopic ultrasound-guided bile duct drainage (EUS-BD). The aim of this study is to evaluate the efficacy and safety of the two approaches. We also propose an algorithm that may guide further management in such cases.

Methods

A retrospective study was conducted involving 75 patients to analyze factors and outcomes. The inclusion criteria consisted of adult patients (18–80 years) with altered anatomy such as post-HJ, post-Roux-en-Y, post-HJ with gastric access loop, and postliver transplantation. Patients included had to be fit for anesthesia, not experiencing severe cholangitis (Tokyo type 4 or less), symptomatic for stricture (pain, jaundice, deranged liver function tests suggestive of obstruction), and with anatomical strictures that had failed PTBD. The study also included additional conditions such as post-HJ anatomy after liver transplantation (single duct, double duct, or more) and revision of HJ stricture with multiple duct anatomy.

The exclusion criteria were the following: failure to provide a valid consent, hemodynamic instability, contraindication for anesthesia, and the presence of a large mass or metastasis in the left lobe of the liver (for EUS-HG).

Patient characteristics, including age, symptoms, previous management, indications for surgical and endoscopic drainage, imaging studies, and details of the endoscopic procedure, were recorded. Drainage of the biliary system was performed using either an SBE with an overtube for SBE-ERCP or a linear array echoendoscope for EUS-HG.

The success of the procedures was evaluated based on technical success (reaching the anastomotic site, biliary cannulation, stricture dilation, and stent placement) and clinical success (resolution of jaundice, abdominal pain, and other symptoms). Postprocedure complications, including perforation, bleeding, pain, infection, or cholangitis, were monitored and recorded.

Endoscopy Technique

The endoscopic drainage procedures described in the study involved two techniques: SBE-ERCP and EUS-BD.

For SBE-ERCP, an SBE with an overtube and a distal balloon (SIF-Q180, Olympus, Japan) was used. The enteroscope was advanced into the small bowel until the jejunojejunal anastomosis site. From there, the afferent limb was entered, and the scope was advanced over an overtube to the anastomotic site with intermittent guidance using fluoroscopy for monitoring. In the absence of specific SBE-ERCP accessories at the time of study, alternative equipment was used, including an argon plasma coagulation (APC) probe (ERBE, Germany) and special long bile cannulas (Olympus, Japan) for cannulation of the anastomotic site. Different accessories were employed based on the type of anatomy and the number and type of anastomosis. For instance, a 0.035-inch wire was used for single duct strictures, while a 0.025-inch wire was used for double or multiple duct anatomy. After successful wire negotiation, a cholangiogram was obtained, and the stricture was dilated using a CRE balloon catheter (6, 8, 10, and 12 mm in size) depending on the stricture size and the session number. Initially, an 8- or 10-mm balloon was used, and subsequent sessions employed larger balloon sizes. Plastic double pigtail stents of various lengths and a fixed stent size of 7-Fr diameter were used due to the scope channel size. The aim was to drain all systems, if possible, in a single session and assess the progress during subsequent follow-ups (►**Figs. 1**, **2** and **3**).

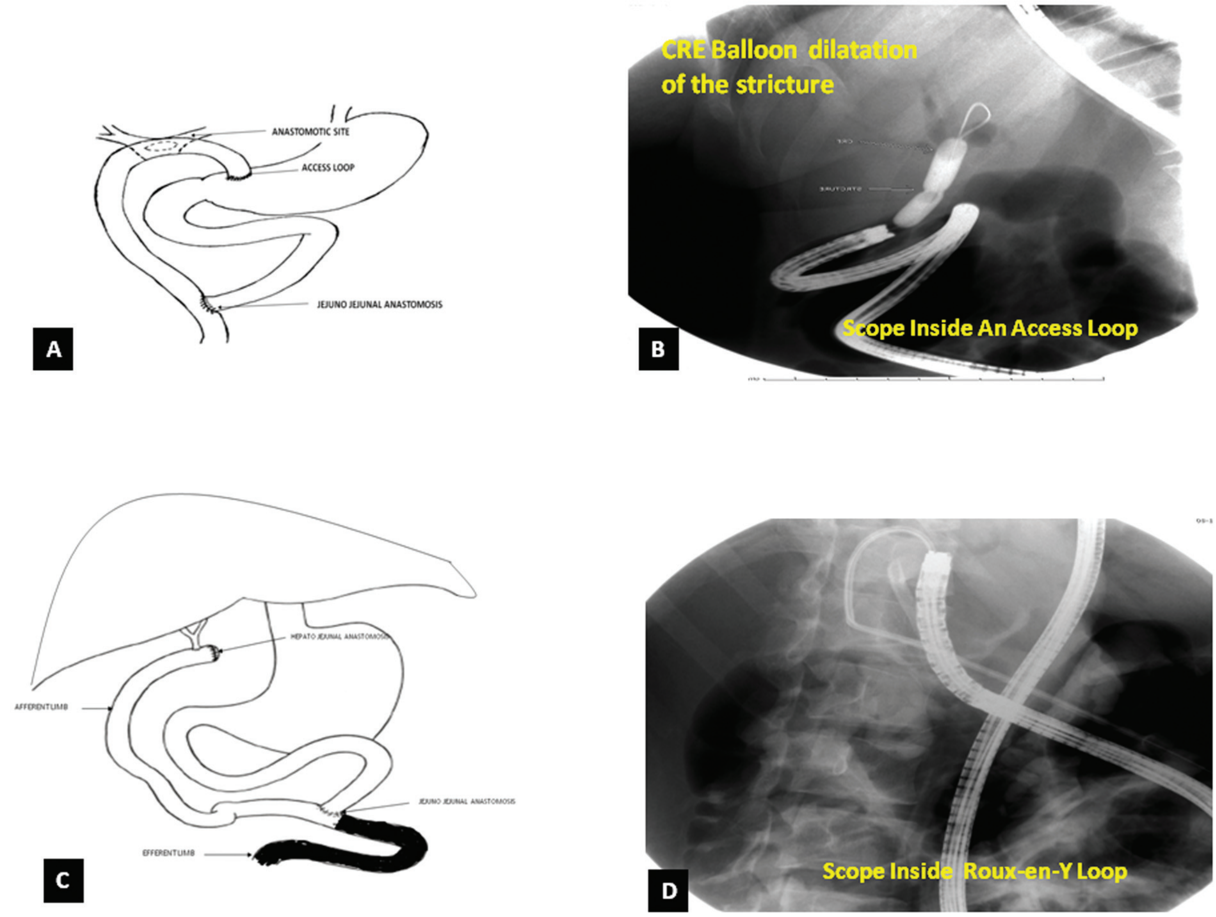

Fig. 1 SBE-guided biliary drainage in altered GI anatomy. (**A,B**) Post-HJ with gastric access loop with a CRE balloon across the stricture. (**C,D**) Post-HJ anatomy with no access loop and a plastic stent being deployed across the stricture. GI, gastrointestinal; HJ, hepaticojejunostomy; SBE, single-balloon enteroscopy.

In EUS-HG, a linear echoendoscope (GF- UCT 180, Olympus, Japan) was utilized to access the biliary system. The left lobe of the liver was imaged from the lesser curvature of the stomach, and segment 2 or 3 ducts were targeted for puncture and access. After confirming the desired duct through bile aspiration and contrast instillation for cholangiogram and ductal anatomy, an exchange wire (0.035 inch, 450 cm; Olympus, Japan) was passed into the left biliary system, deep into the left ductal system or the right intrahepatic duct. The tract was dilated using a Soehendra biliary dilator (size $\geq$6 mm, in a graded fashion) and or a 6-Fr Cystotome, followed by placement of a partially covered biliary SEMS (self-expandable metallic stent) specially designed for EUS-HG (Giobor, Taewoong, Korea; Biliary NC, MI Tech, Korea) or an Fc-SEMS (Boston Scientific, United States) if partially covered stents were not available. Both SBE-ERCP and EUS-HG were performed in a semi-prone position by experienced hepatobiliary endoscopists under monitored anesthesia provided by an experienced anesthetist (►**Fig. 4**).

Procedure success was defined as technical success, which involved reaching the anastomotic site, biliary cannulation, stricture dilation, and stent placement. Clinical success was defined as the resolution of jaundice, abdominal pain, clinical symptoms, and intrahepatic biliary radicle dilatation (IHBRD).

Postprocedure complications, including perforation, bleeding, pain, infection, and cholangitis, were assessed and monitored immediately after the procedure and for 6 hours postprocedure or until discharge. Patients were then reviewed at 1 week after discharge and followed up monthly for 2 months, and subsequently every 6 months. Perforation was defined as the presence of free air under the diaphragm with signs of peritonitis. Bleeding was defined as a drop in hemoglobin (>2 g) after the procedure, requiring blood transfusions.

Statistical Methods

Patient and altered anatomy characteristics, procedure details (surgery type and duration), and procedural outcomes were summarized as frequencies and proportions for categorical variables and means with standard deviation and medians with interquartile ranges for continuous variables. Categorical variables were then compared between the SBE-ERCP and EUS-BD using either Fisher's exact test or chi-squared test as

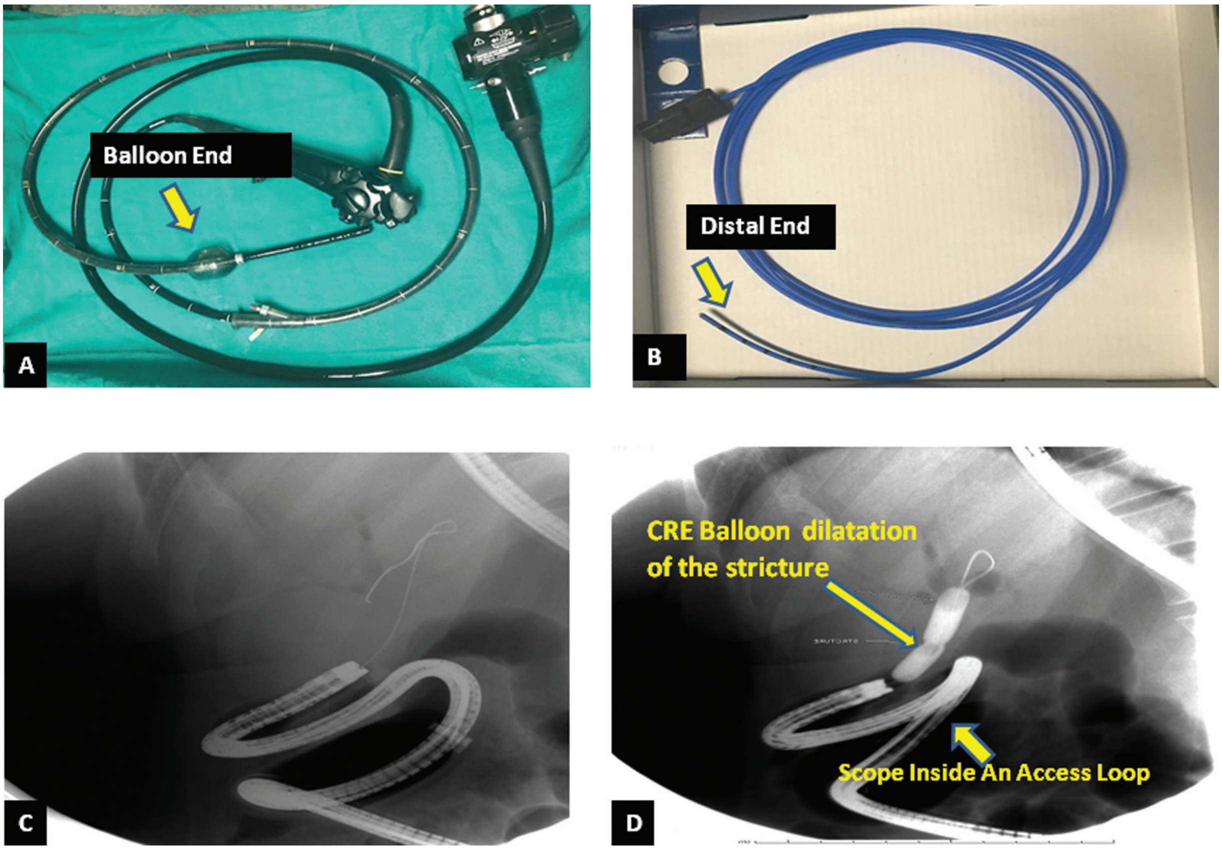

Fig. 2 (**A**) SBE with an overtube and a balloon inflated at the distal end of the overtube. (**B**) APC catheter used for biliary canulation. (**C**) Fluoroscopy of wire inside the bile duct. (**D**) Fluoroscopy image of dilatation of the stricture over a guidewire with a waist at the anastomotic site. APC, argon plasma coagulation; SBE, small bowel enteroscopy.

indicated and continuous variables were compared using the Wilcoxon rank-sum test. Statistical significance was established as $p < 0.05$. All the data were compiled using Microsoft Excel and analyzed using SPSS 22.

Results

A retrospective study was done from 2015 to 2022 in patients who presented with obstructive jaundice to tertiary referral centers. In the study, a total of 75 patients, comprising mainly female participants, were included; their mean age was 48 years. The most common presentation was pain followed by jaundice or both. The mean bilirubin at presentation was 3.8 mg/dL (3.5 in SBE-ERCP and 4.2 in EUS-HG). The mean procedure duration was 59 minutes (65 minutes in SBE-ERCP and 23 minutes in EUS-HG), and the overall technical and clinical success was 86.7 and 88%, respectively.

Over the study period, 4,134 patients presented with obstructive jaundice and 144 presented with obstructive jaundice with postsurgical anatomy; 39 patients were excluded and 30 patients did not complete the follow-up and hence were excluded. The type of surgical anatomy was post-HJ for bile duct injury, post-Whipple surgery for malignant as well as benign diseases, post-HJ with gastric access loop (HJ + AL), and after living donor liver transplant with HJ (LDLT + HJ) for posttransplant bile duct injury or abnormal ducts. The etiology of biliary obstruction was benign in the majority of patients (48/75).

Forty-eight patients underwent SBE-ERCP drainage and 27 patients underwent EUS-HG. When comparing the routes of drainage (SBE-ERCP vs. EUS-HG), the procedure duration was 23 minutes in the EUS-HG group versus 65 minutes in the SBE-ERCP group, with a p value of 0.03. The mean number of sessions was 1.1 (29/27) in the EUS-HG and 1.8 (82/48) in the SBE-ERCP group. EUS-HG was mostly done in malignant patients (22/27) and SBE-ERCP was done in benign patients (43/48). Postprocedure complications were noted in nine patients (12%; 5 in the SBE-ERCP group and 4 in the EUS-HG group) with five patients complaining of pain (4 in the SBE-ERCP group and 1 in the EUS-HG group), two patients having minor bleeding (0 in the SBE-ERCP group and 2 in the EUS-HG group), who were managed conservatively, and one patient developing bile leak (0 in the SBE-ERCP group and 1 in the EUS-HG group) who was successfully managed conservatively. No further interventions such as PTBD or surgical intervention were required in the postprocedure period. The overall success rate (technical and clinical) was 85% in SBE-ERCP and 93.5% in EUS-HG.

In three patients, an initial attempt at performing SBE-ERCP was unsuccessful in reaching the anastomotic site. Subsequently, an EUS-guided rendezvous technique was

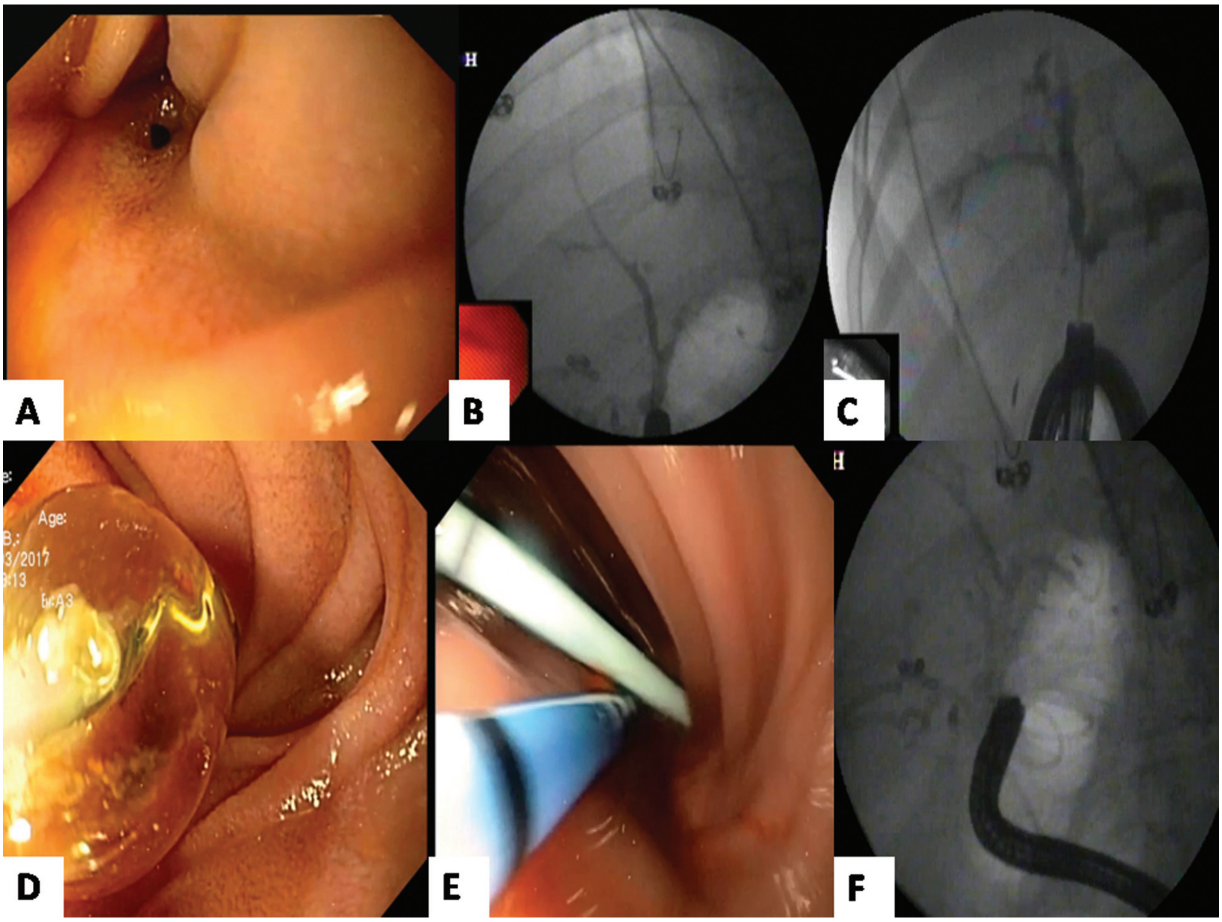

Fig. 3 Post-HJ anatomy. (**A**) Endoscopy image with narrowed anastomotic opening. (**B**) Partial cholangiogram showing intrahepatic dilatation. (**C**) Comple cholangiogram with scope showing anastomotic site stricture. (**D**) Balloon dilatation of the stricture. (**E**) Plastic stents being deployed across the anastomotic site. (**F**) Fluoroscopy showing multiple plastic stents after deployment. HJ, hepaticojejunostomy.

employed, successfully passing a guidewire deep into the jejunum. Following this step, the SBE-ERCP procedure was completed successfully.

Discussion

With the advancement of minimally invasive surgery in the biliary tract, laparoscopic cholecystectomy for gallstones has become the standard of care. However, despite its safety, bile duct injuries still occur. Bile duct injury is the most common complication noted in 0.2 to 0.5% cases, and is attributed to surgical and anatomical factors. In cases of injury, endoscopic therapy, such as ERCP and biliary stenting, serves as the rescue treatment for mild cases, while severe cases require surgical interventions like HJ or choledochojejunostomy. However, surgical treatment itself is associated with postprocedure morbidity and redevelopment of anastomotic stricture. The standard treatment options for postsurgical anastomotic strictures are PTBD and surgical revision. However, both modalities have shortcomings, such as catheter migration, bile leaks, bleeding, cholangitis, and prolonged morbidity. For instance, a study on HJ stricture revision in pancreatic resection patients reported surgical morbidity rates of up to 10% and recurrent cholangitis in 22% of cases, leading to an extended hospital stay.[11–14]

With improved diagnostic modalities, there is earlier detection of pancreatobiliary malignancies, leading to increased biliary-enteric anastomosis procedures, such as Whipple's procedure, Roux-en-Y, and HJ. However, these procedures are not without complications, including anastomotic strictures and tumor recurrence at the anastomotic site, which in turn will require biliary drainage.

Over the past decade, endoscopic procedures have gained popularity with the introduction of enteroscopes and pediatric colonoscopies in clinical practice. SBE and DBE have enabled biliary drainage endoscopically, depending on instrument availability. A study comparing outcomes of DBE-guided ERCP versus SBE-guided ERCP demonstrated higher success rates and fewer complications with SBE, although the difference was not statistically significant. In our study, SBE was used. Another study using SBE for drainage reported a success rate of over 85% (12 of 14 cases). The use of a dedicated short balloon enteroscope, which has a large therapeutic channel, has added benefits, such as a large working channel and additional water jet flushing without complications. In our study, we observed a comparable success rate of 85% within the SBE-ERCP group as in previous

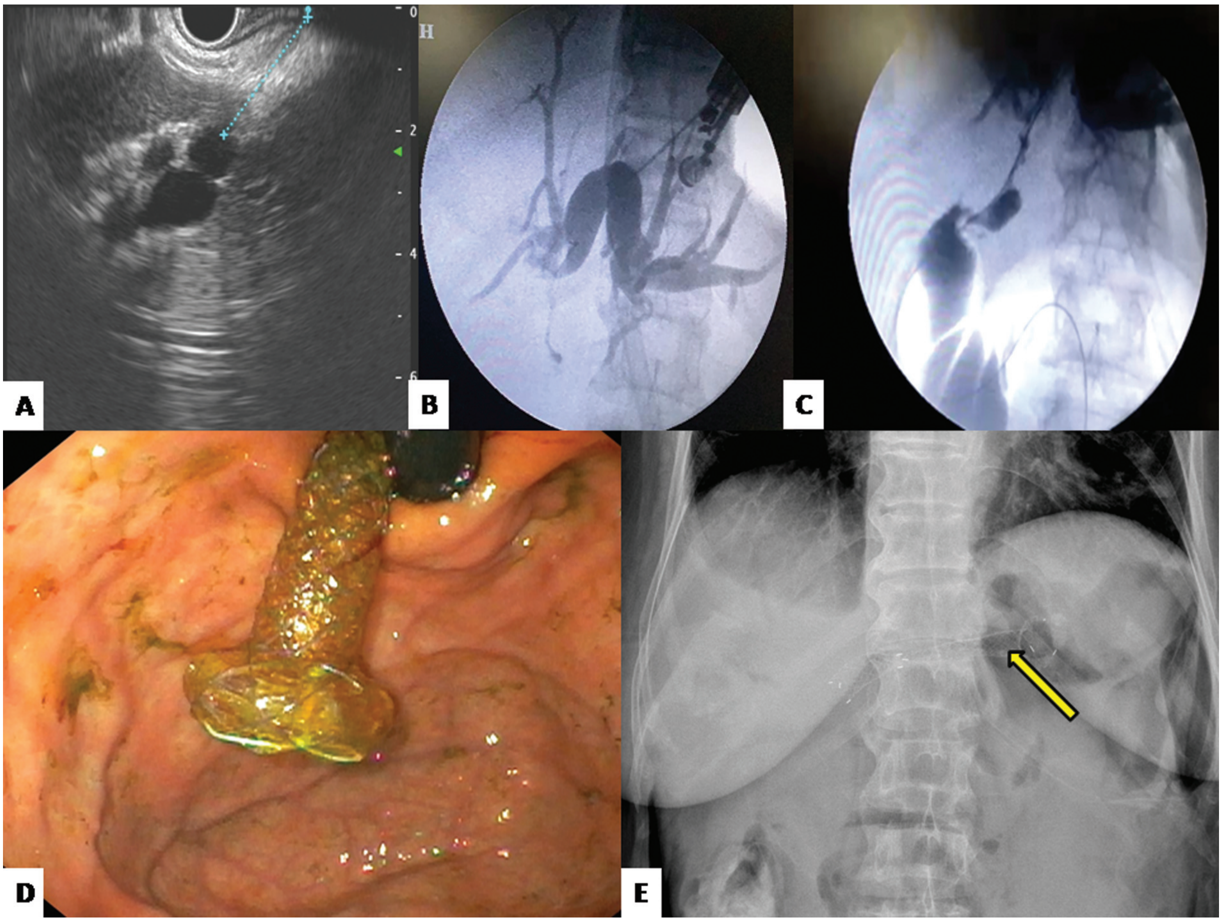

Fig. 4 EUS-guided hepaticogastrostomy. (**A**) Dilated left lobe intrahepatic biliary radical (IHBR). (**B**) EUS-guided puncture followed by contrast instilled into the left IHBR. (**C**) EUS-guided puncture followed by contrast instilled into the left IHBR and passage of wire beyond the stricture into the jejunum for a rendezvous procedure. (**D**) Endoscopic image of the gastric end of the hepaticogastrostomy stent. (**E**) Abdominal radiograph showing the SEMS (EUS-HG) with yellow marker showing the SEMS. EUS, endoscopic ultrasound-guided; SEMS, self-expandable metallic stent; HG, hepaticogastrostomy.

studies. However, this achievement rate was lower when compared with EUS-HG, which could potentially be attributed to the following factors:

- Insufficient stricture dilation (possibly due to fibrosis at the anastomotic site).
- Challenging anatomical conditions requiring frequent reintervention, such as the length of the afferent loop and the age of the patient. It is important to note that our study did not include a comparative analysis of outcomes based on different surgical anatomy.
- Availability of accessories for SBE-ERCP was limited. In the EUS group, clinical and technical success rates were higher, likely due a large-caliber stent placement (mostly SEMS). Additionally, biliary obstruction was mostly complete, with fewer features of cholangitis compared to the SBE-ERCP group. In the SBE-ERCP group, stents were mostly plastic and of smaller caliber, and the obstructions were often incomplete, potentially leading to cholangitis.[15–18]

A meta-analysis comparing endoscopic drainage with PTBD showed that although PTBD had a higher success rate, it was associated with more stent migrations, repeated interventions, and recurrent cholangitis. Another randomized controlled study comparing EUS-guided biliary drainage and PTBD in malignant biliary obstruction with failed ERCP revealed fewer complications, reinterventions, and adverse events in the EUS group compared to PTBD. However, the study was conducted in a tertiary referral center with expert endoscopists and radiologists. In our study, EUS-HG was performed without major complications or the need for conversion to radiological or surgical interventions.[19–27]

Endoscopic drainage was also performed in liver transplant patients, especially those undergoing LDLT, who had HJ anatomy due to recipient conditions prior to transplant or revision surgery for anastomotic strictures. Challenges in these cases included limited intrahepatic bile duct dilation and multiduct anastomosis, making PTBD or EUS-BD difficult. SBE-ERCP or DBE-ERCP proved to be the ideal choices for drainage in nondilated ducts and multiple-site anastomosis.[27–33]

Based on the findings in our study, we propose an algorithm for managing patients with obstructive jaundice and postsurgical anatomy. The algorithm takes into account the availability of technical expertise and ductal assessment, including the size of the intrahepatic ducts, presence of pneumobilia, and etiology of the stricture (benign or malignant) using relevant imaging modalities such as abdomen computed tomography (CT) or magnetic resonance cholangiopancreatography (MRCP; ►**Supplementary Material Figs. 1** and **2**, available in the online version only).

In conclusion, endoscopic interventions in patients with altered gastrointestinal anatomy pose challenges but are successful and effective when performed with specialized instruments, accessories, and high technical skills. The algorithm-based approach suggested in this study allows for early decision-making regarding biliary drainage (SBE-ERCP or EUS-HG), leading to decreased complications, increased success rates, and reduced procedure times. However, further validation through large prospective cohorts is necessary.

Funding
None.

Conflict of Interest
None declared.

References

1 Novikov A, Kumta NA, Samstein B, Kahaleh M. Endoscopic ultrasound-guided transhepatic biliary drainage in altered anatomy: a two-step approach. Endoscopy 2016;48(Suppl 1):E287
2 Chowdhury SD, Kurien RT, Bharath AK, et al. Endoscopic ultrasound-guided gastrojejunostomy with a Nagi stent for relief of jejunal loop obstruction following hepaticojejunostomy. Endoscopy 2016;48(Suppl 1):E263–E264
3 Jirapinyo P, Lee LS. Endoscopic ultrasound-guided pancreatobiliary endoscopy in surgically altered anatomy. Clin Endosc 2016;49 (06):515–529
4 Enestvedt BK, Kothari S, Pannala R, et al; ASGE Technology Committee. Devices and techniques for ERCP in the surgically altered GI tract. Gastrointest Endosc 2016;83(06): 1061–1075
5 Tyberg A, Desai AP, Kumta NA, et al. EUS-guided biliary drainage after failed ERCP: a novel algorithm individualized based on patient anatomy. Gastrointest Endosc 2016;84(06): 941–946
6 Gupta K, Mallery S, Hunter D, Freeman ML. Endoscopic ultrasound and percutaneous access for endoscopic biliary and pancreatic drainage after initially failed ERCP. Rev Gastroenterol Disord 2007;7(01):22–37
7 Baniya R, Upadhaya S, Madala S, Subedi SC, Shaik Mohammed T, Bachuwa G. Endoscopic ultrasound-guided biliary drainage versus percutaneous transhepatic biliary drainage after failed endoscopic retrograde cholangiopancreatography: a meta-analysis. Clin Exp Gastroenterol 2017;10:67–74
8 Matsushita M, Shimatani M, Takaoka M, Okazaki K. “Short” double-balloon enteroscope for ERCP with conventional accessories in patients with altered GI anatomy. Gastrointest Endosc 2009;69(04):981–982, author reply 982
9 Kawamura T, Uno K, Suzuki A, et al. Clinical usefulness of a short-type, prototype single-balloon enteroscope for endoscopic retrograde cholangiopancreatography in patients with altered gastrointestinal anatomy: preliminary experiences. Dig Endosc 2015;27 (01):82–86
10 Jamwal K, Sharma MK, Sharma BC, Sarin SK. Endoscopic drainage of obstructed biliary system in altered gastrointestinal anatomy: an experience from a tertiary center in India. Indian J Gastroenterol 2018;37(04):299–306
11 Kiriyama S, Kozaka K, Takada T, et al. Tokyo Guidelines 2018: diagnostic criteria and severity grading of acute cholangitis (with videos). J Hepatobiliary Pancreat Sci 2018;25(01):17–30
12 Halbert C, Altieri MS, Yang J, et al. Long-term outcomes of patients with common bile duct injury following laparoscopic cholecystectomy. Surg Endosc 2016;30(10):4294–4299
13 Fong ZV, Pitt HA, Strasberg SM, et al; California Cholecystectomy Group. Diminished survival in patients with bile leak and ductal injury: management strategy and outcomes. J Am Coll Surg 2018; 226(04):568–576.e1
14 MacFadyen BV Jr, Vecchio R, Ricardo AE, Mathis CR. Bile duct injury after laparoscopic cholecystectomy. The United States experience. Surg Endosc 1998;12(04):315–321
15 Prawdzik C, Belyaev O, Chromik AM, Uhl W, Herzog T. Surgical revision of hepaticojejunostomy strictures after pancreatectomy. Langenbecks Arch Surg 2015;400(01):67–75
16 Pitt HA, Sherman S, Johnson MS, et al. Improved outcomes of bile duct injuries in the 21st century. Ann Surg 2013;258(03): 490–499
17 Cuendis-Velázquez A, Morales-Chávez C, Aguirre-Olmedo I, et al. Laparoscopic hepaticojejunostomy after bile duct injury. Surg Endosc 2016;30(03):876–882
18 Pal P, Kulkarni S, Chaudhary H, et al. Single-balloon enteroscopy–guided ERCP in surgically altered anatomy is safe and highly effective: results from a prospective study. J Dig Endosc 2019;10 (04):221–227
19 Zielsdorf SM, Klein JJ, Fleetwood VA, Hertl M, Chan EY. Hepaticojejunostomy for benign disease: long-term stricture rate and management. Am Surg 2019;85(12):1350–1353
20 Yamamoto H, Sekine Y, Sato Y, et al. Total enteroscopy with a nonsurgical steerable double-balloon method. Gastrointest Endosc 2001;53(02):216–220
21 De Koning M, Moreels TG. Comparison of double-balloon and single-balloon enteroscope for therapeutic endoscopic retrograde cholangiography after Roux-en-Y small bowel surgery. BMC Gastroenterol 2016;16(01):98
22 Tomizawa Y, Sullivan CT, Gelrud A. Single balloon enteroscopy (SBE) assisted therapeutic endoscopic retrograde cholangiopancreatography (ERCP) in patients with Roux-en-Y anastomosis. Dig Dis Sci 2014;59(02):465–470
23 Duan F, Cui L, Bai Y, Li X, Yan J, Liu X. Comparison of efficacy and complications of endoscopic and percutaneous biliary drainage in malignant obstructive jaundice: a systematic review and meta-analysis. Cancer Imaging 2017;17(01):27
24 Itoi T, Ishii K, Sofuni A, et al. Single-balloon enteroscopy-assisted ERCP in patients with Billroth II gastrectomy or Roux-en-Y anastomosis (with video). Am J Gastroenterol 2010;105(01): 93–99
25 Zhao XQ, Dong JH, Jiang K, Huang XQ, Zhang WZ. Comparison of percutaneous transhepatic biliary drainage and endoscopic biliary drainage in the management of malignant biliary tract obstruction: a meta-analysis. Dig Endosc 2015;27(01):137–145
26 Lee TH, Choi JH, Park H, et al. Similar efficacies of endoscopic ultrasound-guided transmural and percutaneous drainage for malignant distal biliary obstruction. Clin Gastroenterol Hepatol 2016;14(07):1011–1019.e3
27 Shami VM, Kahaleh M. Endoscopic ultrasonography (EUS)-guided access and therapy of pancreatico-biliary disorders: EUS-guided cholangio and pancreatic drainage. Gastrointest Endosc Clin N Am 2007;17(03):581–593, vii–viii
28 Kamei H, Imai H, Onishi Y, et al. Considerable risk of restenosis after endoscopic treatment for hepaticojejunostomy stricture after living-donor liver transplantation. Transplant Proc 2015; 47(08):2493–2498
29 Tomoda T, Tsutsumi K, Kato H, et al. Outcomes of management for biliary stricture after living donor liver transplantation with hepaticojejunostomy using short-type double-balloon enteroscopy. Surg Endosc 2016;30(12):5338–5344

30 Jamwal KD, Padhan RK, Sharma A, et al. Endoscopic management of biliary obstruction in patients with post-surgical anastomosis and special situations: a concise review. Gastroenterol Hepatol Lett 2012;2(02):18–22
31 Jamwal K, Sharma A, Padhan RK, et al. EUS or enteroscopy guided drainage in altered GI anatomy: an algorithm based individualized approach in obstructive jaundice. J Gastroenterol Hepatol 2019;34(S3):170
32 Rai P, Udawat P, Chowdhary SD, et al. Society of Gastrointestinal Endoscopy of India consensus guidelines on endoscopic ultrasound-guided biliary drainage: part I (indications, outcomes, comparative evaluations, training). J Dig Endosc 2023;14(01):30–40
33 Samanta J, Udawat P, Chowdhary SD, et al. Society of Gastrointestinal Endoscopy of India Consensus guidelines on endoscopic ultrasound-guided biliary drainage: part ii (technical aspects). J Dig Endosc 2023;14(02):74–87