Technical feasibility and safety of transluminal antegrade dilation for hepaticojejunostomy stricture using a novel fine-gauge electrocautery dilator (with video)

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ABSTRACT

Background and study aims A novel fine-gauge electrocautery dilator (ED) has recently become available in Japan. The current study evaluated the safety and feasibility of transluminal antegrade dilation for hepaticojejunal stricture (HJS) using this novel ED.

Patients and methods Patients who with complicated HJS were retrospectively enrolled. The primary and secondary endpoints of this study were rates of technical success defined as functional antegrade HJS dilation using the novel ED and types of adverse events, respectively. A total of 22 patients were enrolled. Among them, six were treated using an enteroscopic approach due to the absence of bile duct dilation or patient refusal to undergo EUS-HGS. Therefore, 16 patients underwent EUS-HGS.

Results The procedure was successful in 15 of 16 patients (93.8 %). The contrast medium flowed from the intrahepatic bile duct to the intestine of 14 of 15 patients (93.3 %). The resolution rate of HJS was 13 of 14 (92.9 %) at 6 months.

Conclusion Our technique might offer a new option with which to treat HJS, although a prospective study with long-term follow-up is needed.

Introduction

Hepaticojejunal stricture (HJS) is usually treated under percutaneous transhepatic or enteroscopic guidance [1, 2]. Percutaneous transhepatic biliary drainage (PTBD) confers several disadvantages such as external drainage and cosmetic issues. Although enteroscopy is an established procedure for patients with surgically altered anatomy, rates of technical success are not very high [3]. Endoscopic ultrasound-guided biliary drainage (EUS-BD) [4–7] has been traditionally indicated for failed endoscopic retrograde cholangiopancreatography (ERCP) in patients with unresectable malignant biliary obstruction. Expanding indications for EUS-BD have recently been reported such as EUS-guided antegrade stone removal [8–11]. However, the appropriate dilation technique for HJS remains controversial. Conversely, results from electrocautery dilation for stricture sites under ERCP guidance have been favorable [12], but conventional devices are associated with risk of bleeding due to burning [10]. A novel fine-gauge electrocautery dilator (ED) has recently become available in Japan [13]. The current study evaluated the safety and feasibility of transluminal antegrade dilation for HJS using this novel ED.

Patients and methods

The Institutional Review Board at Osaka Medical College approved this retrospective study. Written informed consent was obtained from patients with HJS retrospectively enrolled between April 2018 and April 2019. Inclusion criteria comprised HJS with clinical symptoms such as obstructive jaundice or cholangitis.

Technical tips for transluminal antegrade dilation using novel ED

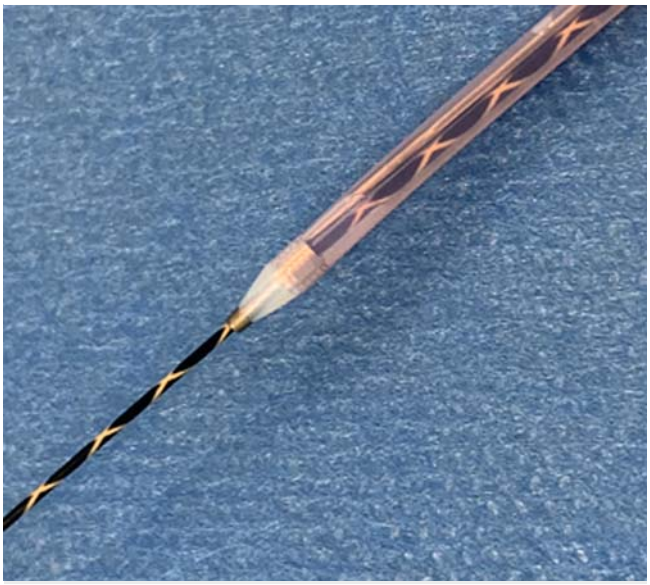
▶ **Fig. 1** shows the novel Fine 025 fine-gauge ED (Medico's Hirata, Osaka, Japan). The distal end of the outer dilator contains a metal tip, and the top of this metal tip is only 3 Fr. Shaft diameter for this electrocautery dilator is 7 Fr, and the shaft is strong and rigid to improve pushability. The electrocautery dilator is also wire-guided, coaxial with a 0.025-inch guidewire.

Technical tips for two-step transluminal antegrade dilation are as follows (▶ **Video 1**). A GF-UCT260 echoendoscope (Olympus Optical, Tokyo, Japan) is inserted into the stomach, then the intrahepatic bile duct is identified and punctured using a Sono Tip Pro Control 19G needle (Medi-Globe GmbH, Rohrdorf, Germany). Bile juice is aspirated and contrast medium is injected (▶ **Fig. 2a**) until an image of the HJS site is acquired. A stiff 0.025-inch VisiGlide guidewire (Olympus Medical Systems) is inserted into the biliary tract (▶ **Fig. 2b**), then the intrahepatic bile duct wall and stomach wall are dilated using a 4-mm biliary dilation balloon catheter (REN, Kaneka Corp., Osaka, Japan) (▶ **Fig. 2c**). If insertion of the stent delivery system remains challenging, additional dilation using a 6-mm balloon catheter or ED can be attempted. Finally, a fully-covered self-expandable metal stent (FCSEMS) (10 or 12 cm length, 10-mm diameter, Niti-S Biliary Covered Stent; TaeWoong Medical, Seoul, South Korea) is deployed from the intrahepatic bile duct to the stomach (▶ **Fig. 2d**).

The second step proceeds after 7 days, during which a fistula is created between the hepatic parenchyma and stomach wall. ▶ **Fig. 3** shows technical tips for antegrade dilation. The guidewire is passed beside the FCSEMS into the intrahepatic bile duct, then the FCSEMS is removed using biopsy forceps under duodenoscopic guidance (JF260V; Olympus Optical, Tokyo, Japan). A digital, single-operator SPY-DS cholangioscope (Boston Scientific Co., Marlborough, Massachusetts, United States) is inserted into the biliary tract through the fistula to evaluate the HJS site (▶ **Fig. 3a**). If cholangioscopic findings are confirmed as benign [14] (▶ **Fig. 3b**), antegrade dilation proceeds using the novel ED (▶ **Fig. 3c**). A SPY-DS is also inserted into the HJS site to evaluate resolution of stricture and adverse events such as bleeding (▶ **Fig. 4a**). These are also evaluated by cholangiography (▶ **Fig. 4b**). A plastic Type IT stent (Gadelius Medical Co., Tokyo, Japan) is then deployed from the intrahepatic bile duct to the stomach (▶ **Fig. 4c**).

Clinical follow-up and definition

Laboratory findings and symptoms such as tarry or bloody stools are evaluated at 1, 3, and 7 days after transluminal antegrade dilation to determine late bleeding from the HJS site. If no adverse events (AEs) are identified, the patient is discharged. Three months later, EUS-guided hepaticogastrostomy (HGS) stent exchange is attempted as follows. An ERCP catheter is inserted into the biliary tract upstream of the HJS site, and contrast medium is injected. If the medium flows from the biliary tract to the intestine across the HJS site, we consider that the HJS has been resolved, and an HGS stent is not deployed.



▶ **Fig. 1** Novel fine-gauge electrocautery dilator. The electrocautery dilator is a wire-guided, coaxial type with 0.025-inch guidewire and a 3-Fr metal tip at the distal end of the outer dilator.

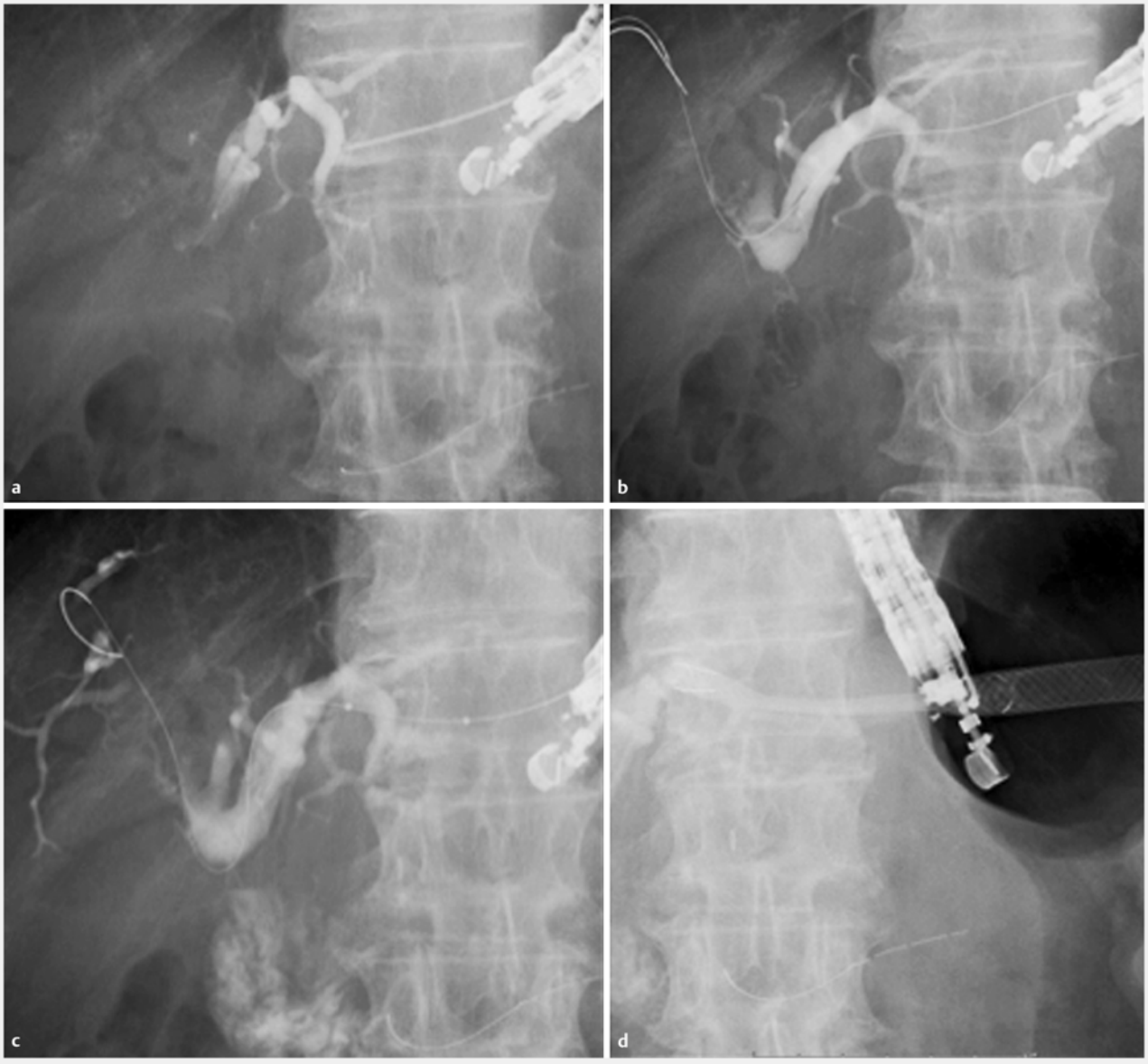
Additional intervention for HJS is considered if the flow of contrast medium is blocked.

The primary and secondary endpoints of this study were rates of technical success defined as functional antegrade HJS dilation using the novel ED and types of AEs, respectively. The follow-up period was from the time of antegrade HJS dilation using the novel ED to final clinical follow-up. Recurrent HJS was considered if clinical symptoms such as cholangitis or obstructive jaundice and bile duct dilatation were evident on images. AEs were graded according to the criteria of the American Society for Gastrointestinal Endoscopy.

Results

During the study period, 22 patients showed HJS. Among them, six patients were treated using an enteroscopic approach due to absence of bile duct dilation or patient refusal to undergo EUS-HGS. Sixteen patients underwent EUS-HGS, and the procedure was successful in 15 patients (93.8 %), indicating excellent technical outcomes. The reason for EUS-HGS failure was associated with guidewire manipulation, and the patient was treated via an enteroscopic approach. ▶ **Table 1** shows characteristics of the 15 patients (median age, 68 years; range, 60–78 years; male, n = 9). The primary surgery of HJS was cholangiocarcinoma (n = 5), intraductal papillary neoplasm (n = 7), or common bile duct stones (n = 3). The most prevalent clinical symptom was frequent cholangitis.

Cholangioscopy showed that the strictures were benign in all patients. Transluminal antegrade dilation using the novel ED was successful for all patients. In addition, no bleeding or perforation arose after HJS dilation in any patients according to cholangioscopic findings. The HJS site was evaluated again after about 90 days (median, 88 days; range, 82–101) days).

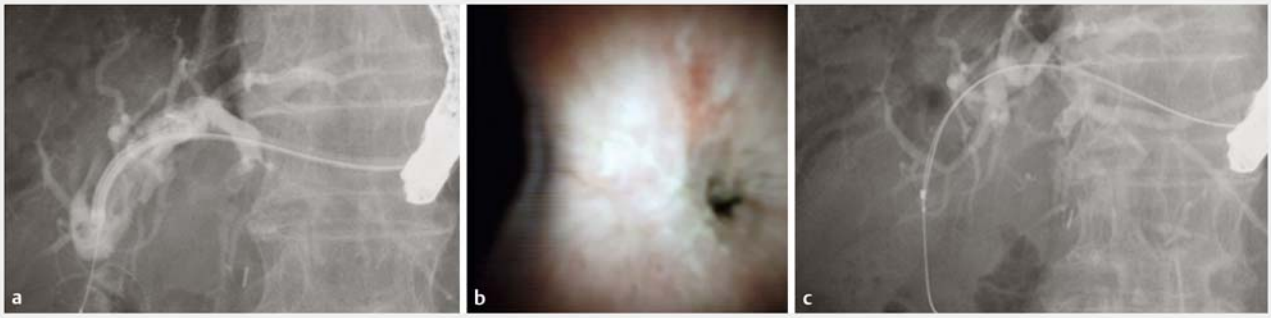


▶ **Fig. 2** Procedures from bile duct puncture to stent deployment. **a** The Intrahepatic bile duct is punctured using a 19-G needle and contrast medium is injected. **b** Attempt to insert the guidewire into the biliary tract. **c** The bile duct and stomach wall are dilated using a balloon catheter. **d** A covered self-expandable metal stent is deployed from the intrahepatic bile duct to the stomach.

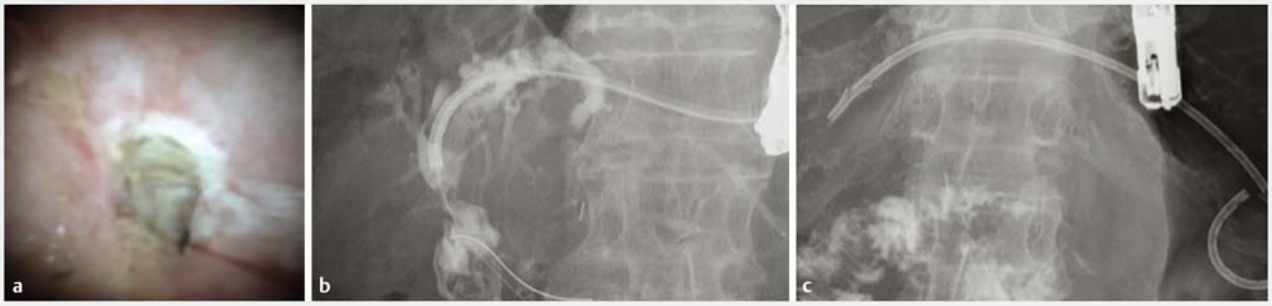
The contrast medium flowed from the intrahepatic bile duct to the intestine of in 14 of 15 patients (93.3 %). The resolution rate of HJS was 92.9 % (13 of 14 patients) at 6 months. Two patients with recurrent HJS underwent repeat EUS-HGS. The AE of mild cholangitis that developed in 1 patient was successfully treated by conservative management.

Discussion

Normally, HJS is treated by balloon dilation or plastic stent deployment under PTBD or enteroscopic guidance. Sato et al. evaluated clinical outcomes of double-balloon (DB) enteroscopy-assisted ERCP for HJS in 102 patients and identified predictors of long-term treatment success [14]. The technical success rate for treatment via DB-ERCP was 89.2 % (91 of 102 patients) in that study, and the overall resolution rate of HJS was 76.9 % (70 of 91 patients) during a median follow-up of 2.7 years. However, 22 of 53 patients (41.5 %) who underwent initially successful balloon dilation for HJS experienced recurrence after a median of 3.4 months (range, 1–36.2) months). On the other hand, the rate of HJS recurrence was 10 % (2 of 20 patients) with treatment by plastic stent deployment. According to that study, balloon dilation alone might be insufficient to treat HJS. Our resolution rate for HJS was 93.3 % at 3 months. Although long-term results should be evaluated, the current findings in-



▶ **Fig. 3** Procedures from cholangioscope insertion to transluminal antegrade electrocautery dilation. **a** The cholangioscope is inserted into the biliary tract via the EUS-HGS route. **b** The hepaticojejunostomy site is evaluated, and cholangioscopic findings confirm the stricture is benign. **c** Transluminal antegrade electrocautery dilation is attempted.

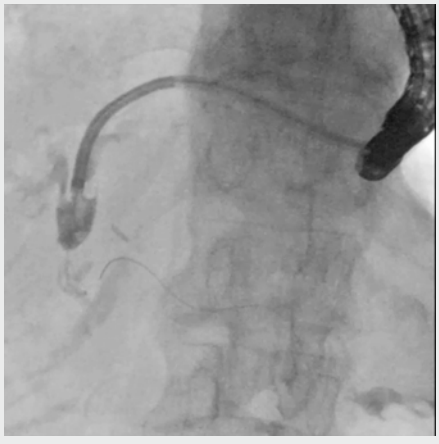


▶ **Fig. 4** From stricture resolution to stent deployment. **a** Hepaticojejunostomy stricture is resolved without bleeding or perforation. **b** Cholangiographic imaging confirms resolution of the hepaticojejunostomy stricture. **c** A plastic stent is deployed from the intrahepatic bile duct to the stomach.

dicate that our technique might be more effective than balloon dilation or plastic stent deployment.

Tomoda et al compared balloon dilation alone with endoscopic stenting for treating HJS under enteroscopic guidance in 103 and 34 patients, respectively [15]. In this study, multivariate analysis selected only balloon dilation as an independent risk factor (hazard ratio, 2.86; 95 % confidence interval, 1.44–6.55; $P = 0.002$). Plastic stent deployment might thus be useful for treating HJS. However, although EUS-BD confers several advantages, such as a short procedural duration and a higher technical success rate than an enteroscopic approach, a plastic stent deployed at an HJS site might be difficult to remove via the EUS-HGS route. Various techniques through the HGS route, such as HJS stent removal and deployment, might thus sometimes prove challenging, and our technique applied to transluminal antegrade ED might offer a novel option for treating HJS.

Reported results for the ED technique are quite favorable [11, 12]. Gao et al. found that strictures in nine of 10 patients with refractory biliary and pancreatic duct stricture were successfully treated by ERCP using wire-guided needle-knife electrocautery [11]. Still, AEs of self-limited bleeds and biliary perforation developed. On the other hand, transpapillary dilation



Video 1 The covered metal stent is removed, and the cholangioscope is inserted into the biliary tract. Cholangioscopic findings reveal obvious hepaticojejunostomy stricture. The stricture is dilated using the novel electrocautery dilator because the ERCP catheter cannot be advanced into the intestine. Cholangioscopic findings confirm dilated hepaticojejunostomy stricture without adverse events.

▶ **Table 1** Patient and lesion characteristics

Number of patients (n)	15
Age (median, yo)	68 (60–78)
Gender (male : female)	9 : 6
Primary disease (n)	
▪ Cholangiocarcinoma	5
▪ Intraductal papillary neoplasm	7
▪ Common bile duct stone	3
Clinical symptom	
▪ Frequent cholangitis	14
▪ Obstructive jaundice	1
Technical success of antegrade ED (n)	93.8 (15/16)
Period of HGS stent exchange (median, days)	88 (82–101)
Resolution rate at 3 months	93.3 (14/15)
Resolution rate at 6 months	92.9 (13/14)
Adverse event (n)	
▪ Cholangitis	1
Median follow-up period (days, range)	350 (176–518)

of refractory severe biliary or main pancreatic duct strictures using a wire-guided coaxial diathermic dilator was successful in all 22 patients [12], with no severe AEs. However, we used the novel fine-gauge ED to reduce risk of bleeding that is still associated with ED due to burning. Cholangioscopic findings confirmed that AEs such as bleeding or perforation did not arise in any of our patients.

Our technique used a 10-mm-diameter FCSEMS. We believe that successful performance of EUS-HGS itself without stent migration or dislocation or bile leakage is extremely important in clinical practice. To prevent stent dislocation, a 10-mm-diameter FCSEMS was selected to resist the strong radial forces that may be encountered. In addition, this FCSEMS is removed after 1 week, so AEs associated with FCSEMS such as stent-induced ductal change may be avoided. Also, our technique may be a relatively complex procedure due to its two-step nature. However, after creation of the fistula between the intrahepatic bile duct and stomach, reintervention is easily and safely performed with a short procedure time compared with the enteroscopic approach.

Our study and technique have several limitations such as the small number of patients, high cost, short duration of follow-up, and retrospective nature of the study.

Conclusion

We concluded that transluminal antegrade ED is safe and feasible. Our technique might offer a new option with which to treat HJS, although a prospective study with long-term follow-up is needed.

Competing interests

The authors declare that they have no conflict of interest.

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