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Endoscopic Ultrasonography-Guided Biliary Drainage: Evaluation of a Choledochoduodenostomy Technique

Takamitsu Komaki Masayuki Kitano Hiroki Sakamoto Masatoshi Kudo

Department of Gastroenterology and Hepatology, Kinki University School of Medicine, Osakasayama, Japan

Key Words

Choledochoduodenostomy · Endoscopic ultrasonography · Endoscopic retrograde biliary drainage · Percutaneous transhepatic biliary drainage

Abstract

Background: Endoscopic ultrasonography (EUS)-guided choledochoduodenostomy (CDS) is as an alternative to percutaneous transhepatic biliary drainage (PTBD) in patients with biliary obstruction when endoscopic retrograde biliary drainage (ERBD) is unsuccessful. ***Purpose:*** We reviewed our experience and technique in patients undergoing EUS-CDS. ***Patients:*** Over a 2-year period to December 2008, 15 patients with unsuccessful ERBD underwent EUS-CDS. ***Methods:*** EUS-guided needle puncture was performed to access the bile duct from the duodenal bulb. After cholangiography, a guidewire was inserted through the needle and directed to the hepatic hilum. The punctured fistula was then dilated with a biliary dilator and a plastic stent was inserted. ***Results:*** The technical success rate of EUS-CDS was 93% (14/15 patients); 1 patient underwent an EUS-guided rendezvous approach because the choledochoduodenal fistula could not be dilated. Decompression of the bile duct was achieved in all patients. Complications included cholangitis in 4 patients, self-limiting local peritonitis in 2 and distal stent migration in 1 patient. The median follow-up time was 125 days and the median duration of stent patency was 99 days. ***Conclusion:*** EUS-CDS may be effective for patients following unsuccessful ERBD and offers an attractive alternative to PTBD.

Introduction

Endoscopic retrograde biliary drainage (ERBD) is the first choice for biliary decompression, and the success rate of this technique ranges from 90 to 95% [1]. However, ERBD may fail in patients with anatomic variations due to prior surgery, periampullary diverticula, tortuous ducts, impacted stones, or tumor infiltration. For patients with unsuccessful ERBD, next-step options include repeated ERBD [2], percutaneous transhepatic biliary drainage (PTBD) [3, 4], and surgical intervention [5].

Recent technical advancements have broadened the clinical applications of endoscopic ultrasonography (EUS)-guided fine needle aspiration in gastrointestinal diseases. Interventional EUS procedures, including ethanol injection for celiac plexus neurolysis [6], gene therapy,

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Masatoshi Kudo, MD, PhD
Department of Gastroenterology and Hepatology
Kinki University School of Medicine
377-2 Ohnohigashi, Osakasayama, Osaka 589-8511 (Japan)
Tel. +81 72 366 0221, ext. 3525, Fax +81 72367 2880, E-Mail m-kudo@med.kindai.ac.jp

Table 1. Characteristics of the study patients undergoing EUS-CDS

Patient No.	Age years	Sex	Diagnosis	Device used for puncture	Access method	First plastic stent	Complication	Re-intervention	Follow-up period, days	End point
1	64	F	lymph node metastasis	NK	direct	pigtail	self-limiting peritonitis	–	248	dead
2	61	M	pancreatic carcinoma	NK	direct	straight	–	–	12	dead
3	83	M	pancreatic carcinoma	NK	direct	straight	cholangitis	+	142	dead
4	36	F	malignant lymphoma	NK	direct	straight	distal migration	–	619	alive
5	67	F	pancreatic carcinoma	NK	direct	straight	self-limiting peritonitis	–	125	dead
6	63	F	pancreatic carcinoma	NK	direct	straight	cholangitis	+	119	dead
7	55	F	pancreatic carcinoma	NK	direct	straight	–	–	66	dead
8	76	M	pancreatic carcinoma	FN	rendezvous	straight	–	–	201	dead
9	73	F	lymph node metastasis	NK	direct	straight	cholangitis	+	106	dead
10	87	F	pancreatic carcinoma	NK	direct	straight	–	–	142	dead
11	72	F	pancreatic metastasis	FN	direct	straight	–	–	28	dead
12	59	M	lymph node metastasis	FN	direct	straight	–	–	29	dead
13	73	M	pancreatic metastasis	FN	direct	straight	cholangitis	+	235	alive
14	62	F	pancreatic carcinoma	FN	direct	straight	–	–	125	dead
15	70	M	pancreatic carcinoma	FN	direct	straight	–	–	60	dead

NK = Needle knife; FN = fine needle.

and immunotherapy for pancreatic cancer [7], pancreatic pseudocyst drainage [8], and pancreaticogastrostomy [9], have already been reported. EUS-guided drainage of an obstructed biliary system has also been described [10]. Therefore, in this study, we state our experience with 15 patients who underwent EUS-guided choledochoduodenostomy (CDS) at our institution and review the past reports on this technique.

Patients and Methods

Patients

Between June 2006 and December 2008, 15 patients (6 males and 9 females; median age 67 years) with unsuccessful ERBD underwent EUS-CDS and were included in this study. The major papilla was not reached because of duodenal infiltration in 6 patients, and biliary cannulation was aborted in 9 patients (table 1). Two of the 15 patients showed minimal or moderate perihepatic ascites, a relative contraindication to PTBD.

Informed consent was obtained from all patients. Our institutional review board waived formal review and approved the procedure, deeming the technique to be an extension of existing procedures. All procedures were performed by three dedicated pancreatobiliary endoscopists.

Technique

ERBD was initially attempted in all patients using conventional techniques with either a JF260V or a TJF260V duodenoscope (Olympus Medical Systems, Tokyo, Japan). When ERBD was unsuccessful, EUS was performed with a GF-UCT240 or a GF-UC240P linear-array echoendoscope (Olympus Medical Systems). When dilation of the extrahepatic bile duct was visualized at the duodenal bulb, color Doppler ultrasound (US) was used to confirm the absence of the regional vasculature. EUS-guided puncture of the extrahepatic bile duct was carried out with a 19-gauge fine needle (Echo-Tip; Cook, Winston-Salem, N.C., USA) or a needle knife (Zimmon; Cook; fig. 1a). To confirm successful biliary access, a contrast medium was injected under fluoroscopy for cholangiography (fig. 1b). A 0.035-inch guidewire (Revowave; Olympus Medical Systems) was introduced through the EUS needle and orientated vertically toward the hepatic hilum (fig. 1c). Next, 6-, 7- and 9-french tapered biliary dilator catheters (Sohendra; Cook) were inserted and removed (in this order) over the guidewire to dilate the tract. Finally, a 7-french straight stent (Flexima; Boston Scientific, Natick, Mass., USA) was advanced through the CDS incision to the extrahepatic bile duct (fig. 1d, e).

Follow-Up

Biochemical parameters and a simple abdominal X-ray were performed after 2 days, 1 week, and monthly for 3 months after the procedure, and thereafter every 3 months. Abdominal US or computed tomography was performed every 3 months.

Results

The technical success rate of EUS-CDS was 93% (14/15 patients), and all 15 patients had successful EUS-assisted cholangiography. In 14 patients, the stents could be placed through the choledochoduodenal fistula. In 1 patient, we could not dilate the choledochoduodenal fistula because of sclerosing cholangitis. Therefore, in this patient, we placed stents across the major papilla with the rendezvous technique. Fine needles were required in 6 of 14 patients for biliary access. The median duration of the procedure was 37 min (range 25–43 min).

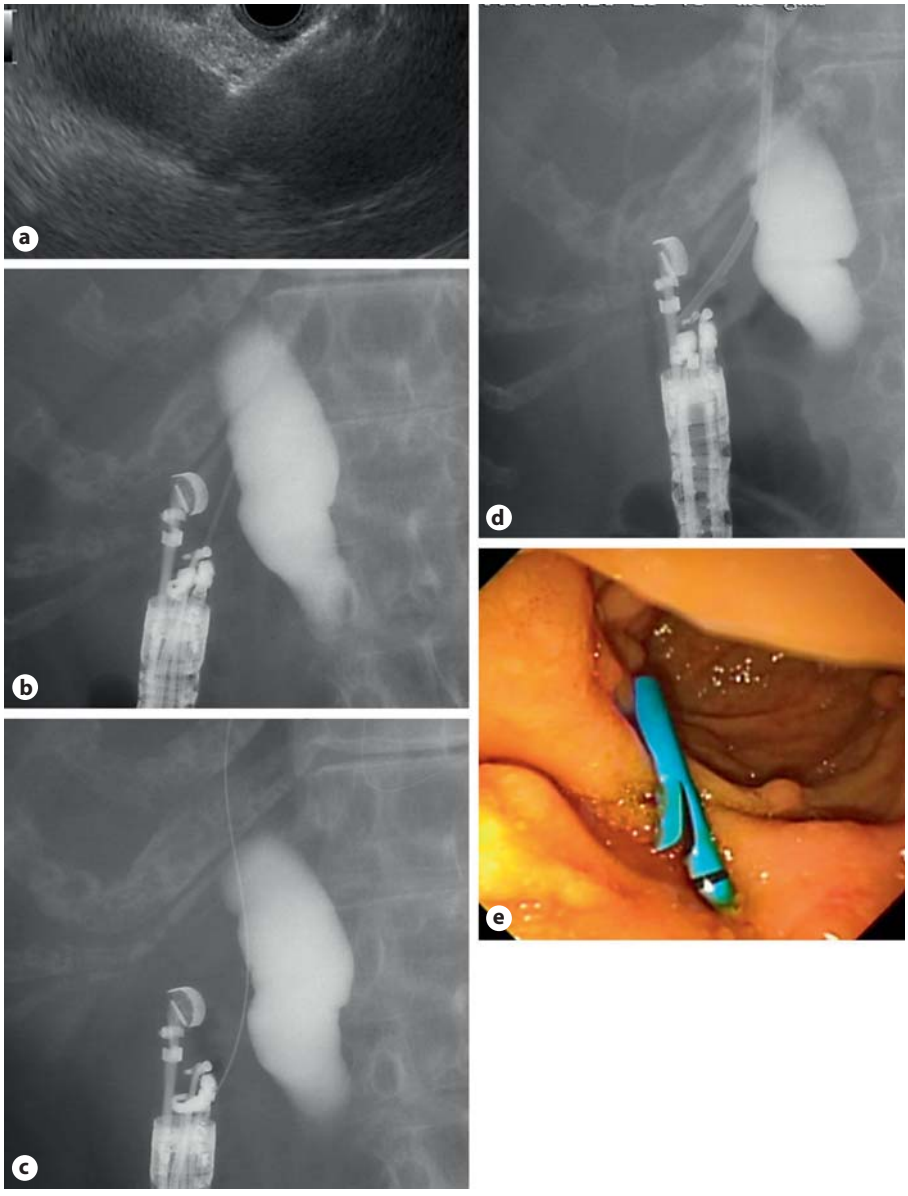

Fig. 1. Technique of EUS-CDS. **a** Endoscopic US image of the fine needle inserted into the common hepatic duct. **b** Fluoroscopic image obtained by endoscopic US during cholangiography through the fine needle. **c** Fluoroscopic image during insertion of the guidewire through the puncture. **d** Fluoroscopic image during insertion of a stent through the puncture. **e** Endoscopic view of the plastic stent inserted from the duodenal bulb into the common hepatic duct.

Decompression of the bile duct was achieved in all patients with a success rate of 100% (14/14). After stent placement under EUS guidance, the median bilirubin level decreased significantly from 6.6 to 1.6 IU/ml ($p = 0.0004$).

The median follow-up time was 125 days (range 12–619 days); 13 patients died because of primary cancer growth. Two patients (14%) showed self-limiting peritonitis with mild abdominal discomfort and were managed conservatively, with spontaneous recovery within 1 week in both patients.

The median duration of stent patency was 99 days (12–248 days). All 4 patients with retrograde cholangitis underwent stent exchange via duodenoscopy. One patient who was treated with chemotherapy for malignant lymphoma showed distal stent migration, although this stent passed spontaneously without becoming trapped into the bowel. In this patient, the abdominal lymphoma decreased following chemotherapy in the absence of jaundice.

Table 2. Summary of published reports on EUS-CDS

Study	n	Device used for puncture n	Device used for dilation	Treatment success %	Initial stent n	Complications n
Giovannini et al. [10]	1	NK	dilator	100	10-F PS	none
Burmester et al. [17]	2	NK	not performed	100	8.5-F PS	bile peritonitis (1)
Puspok et al. [18]	5	NK	balloon/not performed	100	7–10-F PS	none
Kahaleh et al. [19]	1	FN	not described	100	10-mm SEMS	pneumoperitoneum (1)
Ang et al. [20]	2	NK	dilator	100	7-F PS	pneumoperitoneum (1)
Yamao et al. [21, 22]	5	NK	dilator	100	7–8.5-F PS	pneumoperitoneum (1)
Fujita et al. [24]	1	NK	dilator	100	7-F PS	none
Tarantino et al. [23]	4	FN	balloon	100	PS	none
Itoi et al. [25]	4	NK (2)/FN (2)	dilator	100	7-F PS (in 3 patients), NBD (1)	bile peritonitis (1)
Park et al. [27]	5	FN	dilator	100	10-mm CSEMS	none
Hanada et al. [26]	4	FN	dilator	100	6–7-F PS	none

n = Number of patients; NK = needle knife; FN = fine needle; PS = plastic stent; SEMS = self-expanding metallic stent; CSEMS = covered self-expanding metallic stent; NBD = nasobiliary drainage.

Discussion

Biliary obstruction is preferentially managed by ERBD [11]. However, ERBD may be unsuccessful because of tumor extension [12] or prior surgery [13]. Alternatives to unsuccessful ERBD include PTBD and surgery. PTBD has a complication rate of up to 32%, including fistula formation, cholangitis, peritonitis, empyema, hematoma, and liver abscesses [14, 15]. Surgery offers long-term patency but is also associated with increased morbidity and mortality [16]. EUS-CDS is a relatively new technique, permitting therapeutic biliary procedures when ERBD is unsuccessful.

To date, 11 studies have assessed the role of EUS-CDS (table 2) [10, 17–27]. According to these studies, EUS-CDS has been performed in 34 cases, including 33 patients with abdominal malignancies (22 pancreatic cancers, 6 papilla of Vater cancers, 2 bile duct cancers, 1 pancreatic lymphoma, 1 hepatoma, and 1 gastric cancer) and in 1 patient with bile duct stones. Overall, 18 needle knives and 15 fine needles were used for puncture. Except for 6 patients with a self-expanding metallic stent and 1 with nasobiliary drainage, 7- to 10-french plastic stents were used for placement. Once the stents were placed, all patients showed biliary decompression. The complication rate was 14% (5/34). Two patients developed focal bile peritonitis and 3 patients developed pneumoperitoneum, but none of the adverse events were fatal. A needle knife was used in 4 of these 5 patients, but there was no significant difference between the use of a needle knife or a fine needle in terms of adverse events.

In this study, we reviewed our experience with EUS-CDS. Biliary decompression was accomplished in all patients after prior failure of ERBD. However, self-limiting peritonitis occurred in 2 patients and cholangitis in 4 patients, although neither fatal adverse events nor major complications occurred.

The advantage of EUS-CDS over PTBD is the ability to puncture the biliary tree with minimal vascular injury using real-time color Doppler US imaging without external drainage. A limitation of EUS is more restricted access to the right hepatic biliary system, but in our opinion, EUS-CDS is a more useful treatment approach than ERBD. Currently, the procedure entails a high degree of complexity and its use should be limited to facilities with extensive experience in EUS and ERBD.

EUS-CDS may replace PTBD at tertiary care centers. Multicenter studies comparing EUS-CDS with PTBD are necessary to demonstrate the utility and indications of both techniques and better evaluate the risks of complications with both techniques.

Disclosure Statement

All authors report that they have no disclosures relevant to this publication.

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