Overtube-balloon–assisted direct peroral cholangioscopy by using an ultra-slim upper endoscope (with videos)

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Background: The ''mother–baby'' endoscope system currently used for peroral cholangioscopy (POC) has several limitations. Endoscopic direct cholangioscopy when using an ultra-slim upper endoscope with a guidewire to maintain access has been reported, but appropriate accessories are required to increase the success rate. Herein, we describe a novel method, overtube-balloon–assisted endoscopy, for direct POC.

Objective: To evaluate the feasibility and usefulness of direct POC when using an ultra-slim upper endoscope with an overtube balloon to maintain access.

Setting: A single center.

Design: Case series.

Patients: Twelve patients with biliary disease.

Interventions: Direct POC by using an ultra-slim upper endoscope and diagnostic and/or therapeutic procedures.

Main Outcome Measurements: Success rate of this technique, diagnostic or therapeutic feasibility, and complications.

Results: Overtube-balloon–assisted direct POC was performed successfully in 10 of 12 patients (83.3%). The procedure revealed 4 common bile duct (CBD) stones, 4 benign biliary strictures, 1 polypoid tumor, and 1 cholangiocarcinoma. Five patients underwent forceps biopsy under direct visualization of the intraductal lesion. Laser lithotripsy was successfully performed in 1 patient. No procedure-related complication occurred.

Limitations: A small number of patients and no comparison with conventional cholangioscopy.

Conclusions: The overtube balloon appears to be a useful accessory in direct POC when using an ultra-slim upper endoscope. However, further development of a slim overtube or other accessories is necessary to improve the success rate of direct POC.

Cholangioscopy permits direct visualization of the bile duct and the performance of diagnostic and/or therapeutic procedures.[1–5] Nonsurgical cholangioscopy has been established for both the peroral and percutaneous approaches, although the percutaneous approach is invasive and requires time for route formation.[2] The peroral approach is usually performed by using a ''mother–baby'' endoscope system, but it remains expensive, time consuming, cumbersome, and requires 2 experienced endoscopists. In addition to these disadvantages, the small caliber of the working channel and the fragility of the baby endoscope must be considered.[6–8] Given these problems, the clinical use of direct peroral cholangioscopy (POC) is limited to relatively few medical centers.

Previous studies examined the feasibility of direct POC by using an ultra-slim upper endoscope for intraductal diagnosis, with a guidewire to maintain access.[8] However, until now, additional trials that use this method have not been reported, and several limitations have been noted.[9] Herein, we report the use of an overtube balloon, which was originally designed for double-balloon enteroscopy,

Abbreviations: CBD, common bile duct; POC, peroral cholangioscopy.

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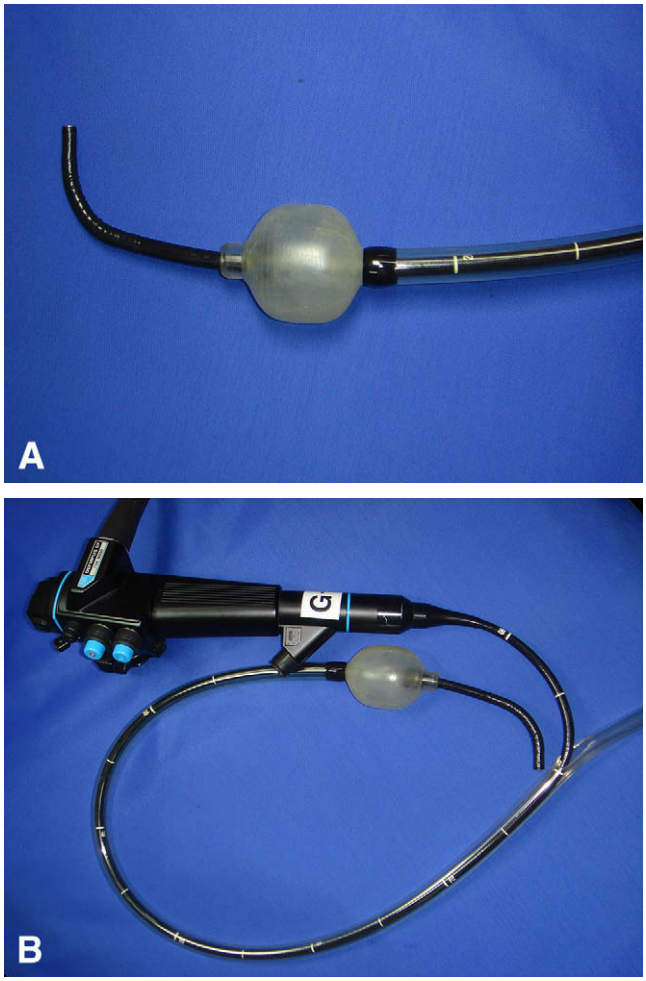

Figure 1. A, Ultra-slim upper endoscope with overtube. **B,** The endoscope was inserted through a hole cut 70 cm from the distal end of the overtube.

to facilitate the introduction of an ultra-slim endoscope into the bile duct.

PATIENTS AND METHODS

Patients

From August 2006 to September 2007, 12 patients (4 men and 8 women; mean age 69.1 years, range 63–83 years) with biliary disease (11 with common bile duct [CBD] stones, with or without biliary strictures, and one with cholangiocarcinoma) underwent endoscopic direct POC. Inclusion criteria were the presence of biliary disease, a dilated CBD (>10 mm), and previous endoscopic major sphincterotomy or papillary balloon dilation to advance the endoscope into the CBD. Direct POC was used to evaluate the bile duct after stone removal, assess intermediate strictures, and inspect and biopsy intraductal lesions. POC was used to remove intractable CBD stones.

Capsule Summary

What is already known on this topic

- The clinical use of direct peroral cholangioscopy is limited, because it is expensive, time consuming, cumbersome, and requires 2 experienced endoscopists.

What this study adds to our knowledge

- Overtube-balloon–assisted direct peroral cholangioscopy was successfully performed in 10 of 12 patients without procedure-related complication.

Instruments

Ultra-slim upper endoscopes (GIF-N230 or GIF-N260; Olympus Optical Co, Ltd, Tokyo, Japan), with a 2-mm working channel and a 5.2-mm to 6-mm outer diameter, were used. A 13.2-mm outer-diameter, 10.8-mm inner-diameter overtube (TS-13140; total length 1450 mm; Fujinon Corp, Omiya, Japan), which was originally designed for double-balloon enteroscopy, was punctured 65 to 75 cm from its distal end, and an ultra-slim endoscope was inserted. Biopsy specimens were taken by using a forceps (FB-19K-1; Olympus).

Procedures

All patients were sedated by intravenous administration of meperidine and midazolam. Before the procedure, an ultra-slim upper endoscope was inserted through a hole at 65 to 75 cm from the distal end of the overtube (Fig. 1). The overtube that contained the endoscope was advanced into the duodenal bulb, followed by retraction after inflation of the overtube balloon. In cases in which it was difficult to introduce the overtube into the duodenum, the overtube was passed through the pylorus by using the 9.0-mm outer-diameter endoscope (GIF-XQ260; Olympus), and then the endoscope was replaced with an ultra-slim endoscope. The overtube was anchored by the inflated balloon, and the endoscope was supported by the overtube. Then, the endoscope was advanced directly into the major papilla, upstream of the bile duct, with endoscopic and fluoroscopic guidance (Fig. 2, Video 1, available online at www.giejournal.org). We then performed a cholangioscopic examination of the bile duct. The procedure was considered successful if the examiners managed to advance the endoscope into the bifurcation or strictured segment. Forceps biopsies were performed as required to confirm histopathologic diagnoses. Laser lithotripsy was performed to eliminate large CBD stones. The average length of time for reaching the bifurcation or strictured segment was 12.6 minutes (range 7–23 minutes) in successful cases.

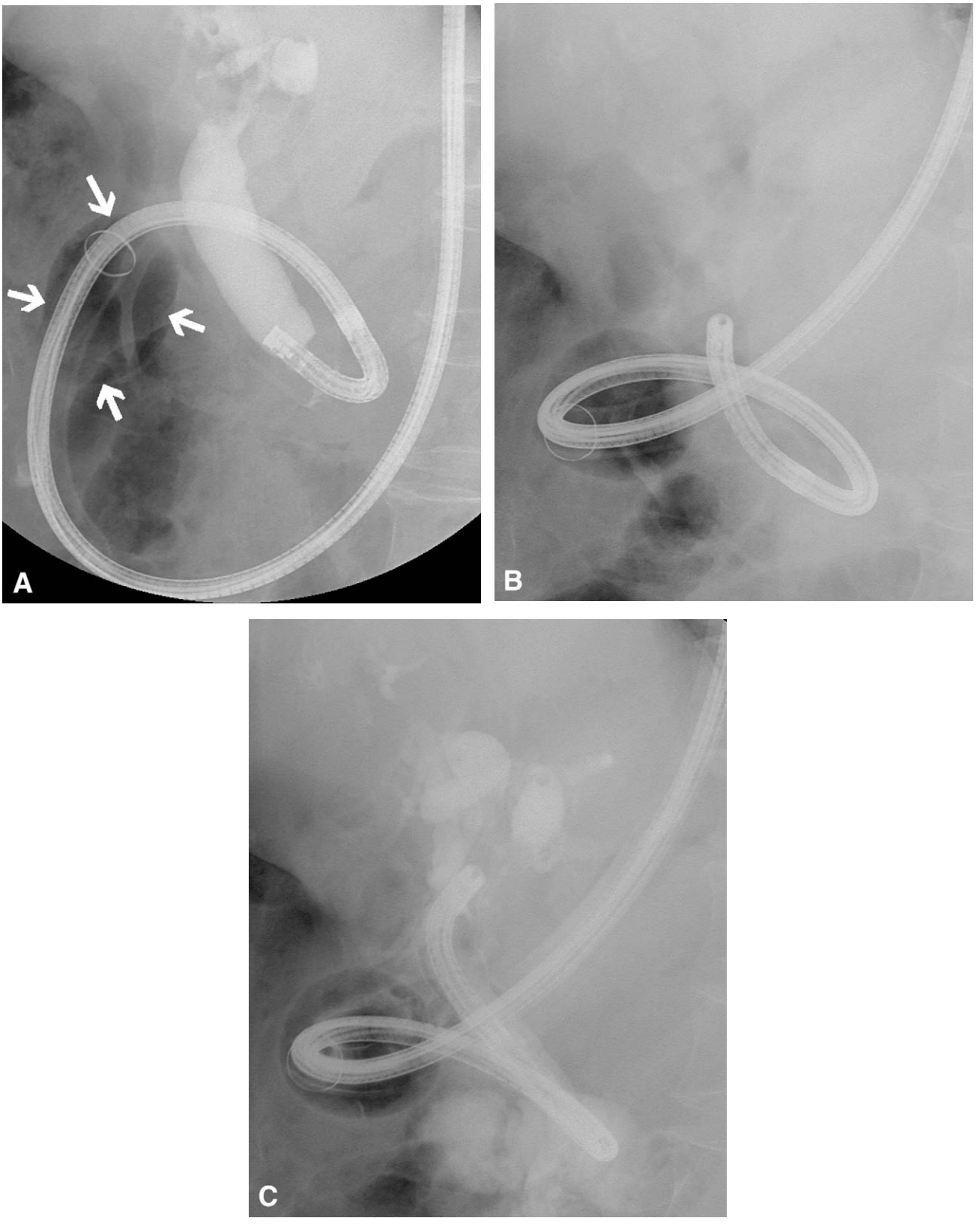

Figure 2. Radiographs, showing an ultra-slim upper endoscope advancing into the bile duct through the overtube (*arrow* indicates the balloon of the overtube). **A,** The endoscope was advanced into the ampullary portion. **B,** The endoscope was advanced into the distal CBD. **C,** The endoscope was advanced into the bifurcation.

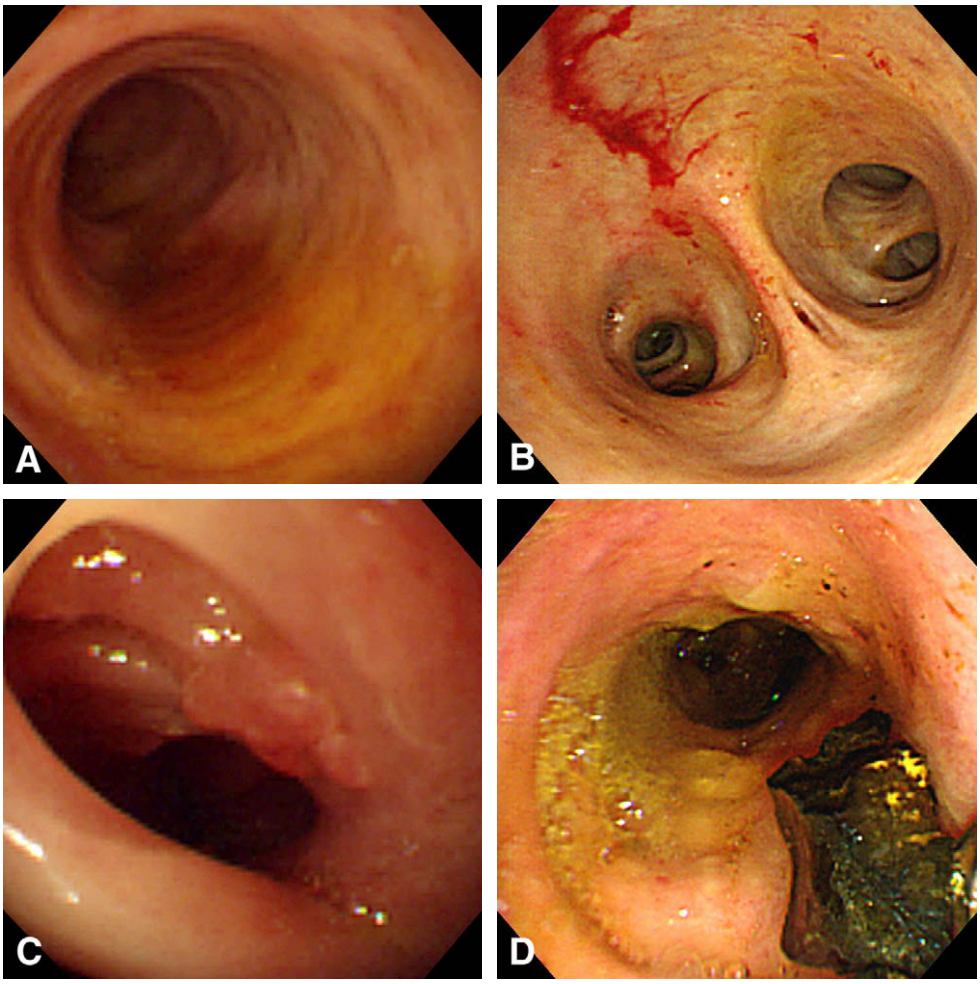

Figure 3. A, Cholangioscopic view, showing a normal CBD. **B,** Cholangioscopic view, showing bifurcation. **C,** Cholangioscopic view, showing an intraductal polypoid lesion at the bifurcation. **D,** Cholangioscopic view, showing a remnant stone in the CBD.

RESULTS

Overtube balloon-assisted direct POC by using an ultraslim upper endoscope was successfully performed in 10 of 12 patients (83.3%). This procedure allowed direct visualization of the bile duct and access to the bifurcation or strictured segment of the duct in most cases (Fig. 3, Video 2, available online at www.giejournal.org). Endoscopic biopsies under direct visualization were performed for 3 stricture lesions, 1 polypoid tumor, and 1 mucin-producing cholangiocarcinoma. These biopsy specimens revealed the presence of 1 cholangiocarcinoma, 1 hyperplastic polyp, and 3 nonspecific chronic inflammations. Three remnant bile-duct stones were detected. Laser lithotripsy was performed under direct visualization for 1 case of intractable CBD stones. The fragmented stones were removed via conventional endoscopic retrograde cholangiography by using a basket and balloon catheter after direct POC. Advancement into the bile duct failed in 2 patients because of looping of the endoscope in the third portion of the duodenum, even when using an overtube. Major procedure-related complications, such as perforation, pancreatitis, and bleeding, were not observed. The overall results of direct POC are summarized in Table 1.

DISCUSSION

Direct visual examination of the bile duct is useful in both diagnostic and therapeutic clinical practice. However, the conventional ''mother–baby'' endoscopic system has several limitations, including economic and technical issues, which limit its clinical use. Continuous technical developments and trials have improved the POC system, which resulted in the recent development of a single-operator POC system (SpyGlass System; Microvasive Endoscopy, Boston Scientific, Natick, Mass), which is currently undergoing clinical trials.[10,11]

The ultra-slim upper endoscope is typically used in pediatric patients or in transnasal applications. Very few case reports are available regarding the use of these slim

TABLE 1. Outcomes of direct POC

Patient no.	Diagnosis	Direct POC	Findings of direct POC	Diagnostic or therapeutic procedures
1	CBD stone	Success	Normal bile duct	
2	CBD stone	Success	Remnant stone	
3	CBD stone/stricture	Success	Remnant stone	
			Benign stricture	Biopsy
4	CBD stone	Success	Remnant stone	
5	CBD stone	Success	Large CBD stone	Laser lithotripsy
6	CBD stone and stricture	Success	Benign stricture	Biopsy
7	CBD stone and stricture	Success	Benign stricture	Biopsy
8	CBD stone and stricture	Success	Polypoid lesion	Biopsy
9	CBD stone and stricture	Success	Benign stricture	
10	CBD stone and stricture	Failure		
11	CBD stone	Failure		
12	Cholangiocarcinoma	Success	Papillary mucinous neoplasm	Biopsy

endoscopes in the diagnosis and treatment of intraductal biliary disease. Larghi and Waxman[8] reported successful direct POC when using a 5.9-mm-diameter pediatric upper endoscope (GIF-XP160; Olympus) in 3 patients. They used a super-stiff Jagwire (Boston Scientific) to maintain access and successfully advanced the endoscope into the bile duct. Park et al[9] advanced an ultra-slim (5.0-mm diameter) upper endoscope (GIF-XP260; Olympus) directly into the bile duct, without a guidewire, and performed argon plasma coagulation for recurrent hepatoma with intraductal growth. To ease the passage of the endoscope into the hilar area, the investigators compressed the patient's abdomen. Brauer et al[12] also described a successful case of direct POC by using a slim (9.8-mm diameter) endoscope (GIF-H180; Olympus), without guidewire assistance, in which they advanced the instrument through an ampullary orifice that had been widely opened by extrusion of mucus. They then performed narrow–band imaging, chromoendoscopy, and argon plasma coagulation for an intraductal papillary mucinous neoplasm of the bile duct. However, the clinical utility of direct POC by using a slim endoscope is limited because of a somewhat inconstant success rate for deep biliary cannulation.

In previous cases, we attempted to perform direct POC with guidewire assistance. However, although approximately half of the procedures were successful, the remaining procedures failed, because the guidewire dislodged from the bile duct. These results indicate that an accessory to secure the endoscope is required for successful cholangioscopy. The overtube used in double-balloon enteroscopy is useful in bowel shortening and allows the endoscope to be advanced deep into the small bowel[13]; therefore, we thought that an overtube might be useful in securing the endoscope, by preventing loop formation during advancement and by providing a more accessible angle to the papilla.

Although our report is an observational study of a small number of patients, our results demonstrate the applicability of this new direct POC method. Overtube-balloon–assisted direct POC can be performed by a single endoscopist and provides superior endoscopic images and a larger working channel than the conventional ''mother–baby'' endoscope system. This method also improved the success rate of direct POC. There was no specific problem with mucosal trapping or stripping during the procedure because of the marked differences in diameter between the overtube and the endoscope.

Our method, however, has several limitations. The overtube with an inner diameter of 10.8 mm was too large in diameter for an ultra-slim endoscope with a diameter of 5.2 mm to 6 mm, which made it difficult to manipulate both the overtube and the endoscope, which then resulted in patient discomfort, similar to that experienced during enteroscopy. Therefore, the development of a suitable slim overtube is required. In 2 cases, we failed to advance the endoscope into the bile duct, even when using an overtube. We were unable to reach the proximal bile duct because of looping in the third portion of the duodenum. Therefore, modification or redesign of the overtube is required to

improve the success of direct POC. In addition to proper accessories, the recently developed 4-directional ultra-slim upper endoscope (GIF-XP260N; Olympus) may be more appropriate for reaching the bile duct.

In conclusion, direct POC by using an ultra-slim upper endoscope with an overtube balloon is a useful diagnostic and therapeutic modality for selected biliary diseases.

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