Initial experience with retrograde overtube-assisted enteroscopy using a spiral tip overtube

Luis F. Lara, MD, Shailender Singh, MD, and Jayaprakash Sreenarasimhaiah, MD

Overtube-assisted enteroscopy has expanded therapeutic options for the small bowel, but the effectiveness of spiral tip overtube-assisted endoscopy for retrograde small bowel evaluation is not known. This retrospective study reviewed the results of retrograde enteroscopy procedures among six consecutive patients. In these patients, cecal retroflexion was necessary to enter the terminal ileum when using an enteroscope, and 40 to 130 cm of the distal small bowel was intubated. The average procedure time was 52 minutes. The procedure was diagnostic in four patients, and successful endoscopic therapy was performed in three patients, including completion of a polypectomy at the ileocecal valve, resolution of a distal intestinal obstruction in a patient with cystic fibrosis, and a small bowel anastomotic stricture release. There were no procedure-related complications. Overtube-assisted enteroscopy with the spiral tip overtube allows for antegrade or retrograde evaluation of the small bowel. Pan-enteroscopy may become possible as the technique and equipment improve. The advantages of the different forms of overtube-assisted enteroscopy (spiral, single, and double balloon) need to be determined.

Endoscopic evaluation of the small bowel improved significantly with video capsule endoscopy, but limitations include the inability to manipulate it and lack of therapy (1–3). Push enteroscopy also has limitations due to gastric looping, which limits the ability to transmit axial force onto the endoscope (1, 2). Older overtubes that attempted to reduce loop formation did little to improve depth of insertion, and mucosal trauma and perforations were not uncommon (4–6).

Overtube-assisted enteroscopy (OAE) is a dynamic procedure that complements the endoscope, beyond just straightening the gastric loop. It has improved the diagnostic and therapeutic endoscopic abilities for small bowel disease, and antegrade, or per-oral, and retrograde, or trans-anal, approaches have been described (1, 2, 7). The double-balloon overtube has been more widely studied, and depths of insertion of 200 cm from the ligament of Treitz and 130 cm from the ileocecal valve in the retrograde approach have been reported (8, 9). Data for the single-balloon overtube for OAE are more limited, but pan-enteroscopy has also been reported (10, 11). Complete small bowel enteroscopy has been more frequently reported outside the United States (12–15). Therapeutic enteroscopy, including hemostasis, stricture dilatation, foreign body removal, and

polypectomy, has been reported for both double-balloon and single-balloon OAE (16–23).

The OAE using a spiral tip overtube (OAE spiral), also called spiral enteroscopy (Spirus Medical Inc., Stoughton, MA), is a newer method that relies on pleating the small bowel by clockwise rotation of an overtube that has a raised helix at the tip (1, 24). The spiral tip overtube was first developed as a sigmoid straightening device before becoming an antegrade enteroscopy assist device; it has undergone modifications to its current presentation (1, 24, 25). Little data are available on the success of retrograde enteroscopy using the spiral tip overtube. The spiral tip overtube became available at our institution in May 2008. We report our first cases of diagnostic and therapeutic retrograde enteroscopy using OAE spiral.

METHODS

All enteroscopies performed at the University of Texas Southwestern Medical Center are prospectively collected in a database. Search of this database revealed six consecutive cases of retrograde OAE spiral. The study was approved by the institutional review board.

One Advantage overtube (tube length, 70 cm; tube inner diameter, 1.31 cm; tube outer diameter, 1.85 cm; outer diameter including spirals, 3.33 cm) and 5 Vista overtubes (tube length, 100 cm; tube inner diameter, 1.31 cm; tube outer diameter, 1.85 cm; outer diameter including spirals, 3.06 cm) were used, according to what was available at the time of the procedure.

The overtube was preloaded onto an Olympus PCF Q160 or PCF H180AL pediatric colonoscope or an SIF Q140 enteroscope and secured at the distal part of the endoscope (near the controls). The endoscope was then introduced in the usual fashion through the anus and advanced to where the colon lumen straightened out, usually in the descending or transverse colon. The overtube was disengaged and advanced over the endoscope using clockwise rotation; thus, the colonoscope served

From the Division of Gastroenterology, Department of Internal Medicine, Baylor University Medical Center (Lara); and Division of Digestive and Liver Diseases, Department of Internal Medicine, The University of Texas Southwestern Medical Center (Singh, Sreenarasimhaiah).

Corresponding author: Luis F. Lara, MD, Pancreas Care Specialists, 3900 Junius Street, Suite 605, Dallas, Texas 75246 (e-mail: LuisF.Lara@BaylorHealth.edu).

Table. Retrograde enteroscopy using the spiral tip overtube

No.	Age (yrs)	Sex	Indication	Procedure time (min)	Type of endoscope	Diagnosis	Therapy	Depth of insertion (cm)*
1	51	F	Polyps	43	PCF Q160	IC valve polyp	Snare polypectomy	40
2	28	F	CF-DIOS	50	SIF Q140	Succus obstruction	PEG and NAC infusion	70
3	67	F	Recurrent small bowel obstruction	68	PCF Q160 and SIF Q140	Ileal anastomotic stricture	Balloon dilation	130
4	40	F	Occult GI bleeding	65	SIF Q160	None	None	100
5	27	F	Abnormal CT scan	28	PCF Q160	None	Ileal biopsies	40
6	85	M†	Occult GI bleeding	61	SIF Q140	None	None	70

*From ileocecal valve.

†Pan-endoscopy achieved.

CT indicates computed tomography; GI, gastrointestinal; IC, ileocecal; CF-DIOS, cystic fibrosis–distal intestinal obstruction syndrome; PEG, polyethylene glycol; NAC, N-acetylcysteine.

as a “guidewire” for the overtube. Since this maneuver usually resulted in simultaneous advancement of the tip of the colonoscope, it was important to always maintain good visibility of the lumen. When visualization of the lumen was not possible, overtube insertion was stopped, and water irrigation was performed to expose the lumen. Insufflation was kept to a minimum, and carbon dioxide was used. If this failed, the scope was gently pulled back while holding the overtube, and rarely spinning the overtube counter-clockwise, until the lumen was seen. The tip of the endoscope was usually advanced to the transverse colon or distal ascending colon in this fashion, where maximal overtube insertion usually occurred. The cecum was reached by disengaging the overtube and, while holding the handle at the anus, pushing the endoscope through the overtube.

Applying the principles of antegrade OAE spiral, once maximal overtube insertion had occurred, the Cantero maneuver was performed to attempt to reduce or pleat more of the colon over the overtube. This was achieved by first disengaging the overtube and then applying suction on the endoscope while rotating the overtube clockwise at the same time that the endoscope was slowly pulled back (1). Ileocecal valve intubation sometimes required cecal retroflexion.

RESULTS

The six consecutive retrograde enteroscopies, including type of endoscope used, procedure time, and depth of insertion, are described in the *Table*. The tip of the overtube was advanced into the ascending colon in three patients (patients 3, 5, and 6) and to the ileocecal valve in two patients (patients 2 and 4). The tip of the single Advantage overtube could not be advanced beyond the midtransverse colon in patient 1. The procedure was performed with a pediatric colonoscope alone in two patients

(patients 1 and 5), with an enteroscope alone in three patients (patients 2, 4, and 6), and with a pediatric colonoscope followed by an enteroscope in one patient (patient 3). Cecal retroflexion was needed for ileal intubation when using the enteroscope in all patients. Once the ileum was intubated, the endoscope was exclusively advanced by pushing. At this stage the Cantero maneuver was not successful at improving insertion. External abdominal compression also appeared to add little to procedure success.

Patient 1

A 51-year-old woman was referred after a double-contrast barium enema study showed a large polyp in the cecum. A 3-cm sessile polyp in the cecum extending to the ileocecal valve

was removed by saline lift and piecemeal snare polypectomy during routine colonoscopy. Histology showed tubulovillous adenoma without dysplasia. Because of a concern of possible ileal involvement, a retrograde enteroscopy was performed, and to make it easier to retrieve tissue, an overtube was used. Forty centimeters of ileum was intubated. The only Advantage overtube was used on this patient. Remnant tubular adenoma was removed from the ileocecal valve, and the terminal ileum appeared normal.

Patient 2

A 28-year-old woman with cystic fibrosis, who had received bilateral lung transplantation 2 years earlier, had a small bowel obstruction (SBO) believed to be due to distal intestinal obstruction syndrome with mucus plugging. She failed to respond to bowel rest, nasogastric tube decompression, and polyethylene glycol and N-acetylcysteine infusions into the small bowel through a nasogastric tube. A previous colonoscopy and ileoscopy were nondiagnostic. On retrograde OAE, adherent mucus and debris clumps occupying most of the lumen were identified 70 cm from the ileocecal valve. A total of 3.8 L of polyethylene glycol and 1 L of N-acetylcysteine were instilled into the lumen through the enteroscope. The SBO resolved within 6 hours.

Patient 3

A 67-year-old woman had recurrent SBO, bowel resections, and adhesiolysis as a complication of diverticular abscess and peritonitis 25 years earlier. A transition point was identified by computed tomography scan in the ileum. Previous colonoscopy and ileoscopy had been unremarkable. Anticipating that endoscopic therapy could be applied, the procedure was first performed with the overtube and a colonoscope (Olympus PCF

Q160), which was advanced 40 cm into the ileum, where an anastomotic stricture was identified and dilated with a CRE 18- to 20-mm balloon (Boston Scientific Corp., Natick, MA) and tattooed with India ink. The colonoscope was removed while leaving the overtube in place, and a 250-cm-long enteroscope (Olympus SIF Q140) was advanced through the overtube and 130 cm into the small bowel. No other strictures were noted. The patient has remained free of SBO for the past 9 months.

Patient 4

A 40-year-old woman who had had a Whipple resection due to annular pancreas and obscure overt gastrointestinal bleeding required iron supplementation and blood transfusions. She had at least two negative colonoscopies and esophagogastroduodenoscopies, a negative enteroscopy with a pediatric colonoscope, a negative antegrade spiral tip overtube enteroscopy to the duodenum only, a negative double-balloon retrograde enteroscopy that was advanced about 220 cm in the small bowel, and a negative capsule endoscopy, all at another institution. A red blood cell nuclear scan suggested distal small bowel bleeding. The enteroscope was advanced 100 cm from the ileocecal valve. No bleeding or lesions were found. Bleeding has not recurred in over 12 months.

Patient 5

A 27-year-old woman with abdominal pain and diarrhea had a small bowel follow-through test that showed nodularity in the terminal ileum. A computed tomography scan at our institution showed mural hyperenhancement in the mid to distal ileum, so to ensure that deep ileoscopy was achieved, a retrograde OAE was performed. The colonoscope was advanced 40 cm from the ileocecal valve, where mucosal nodularity was noted. Biopsy results were normal.

Patient 6

An 85-year-old man with obscure overt gastrointestinal bleeding had negative colonoscopy and esophagogastroduodenoscopy results, but capsule endoscopy performed at another institution showed "red spots" in the distal small bowel. An antegrade OAE spiral was unremarkable. The maximal depth of insertion was tattooed. A retrograde OAE spiral was subsequently performed, and the tattoos were seen at 70 cm from the ileocecal valve. No mucosal abnormalities were noted.

DISCUSSION

OAE has improved the diagnostic and therapeutic potential for the small bowel. While the antegrade overtubes accept only enteroscopes with a maximal outer diameter of 9.4 mm, the colon overtube allows insertion of more varied endoscopes, improving therapeutic capabilities. This was illustrated in patient 3, where a colonoscope was first used to treat a known distal small bowel stricture, and an enteroscope was then used to complete the small bowel exam.

The ileum was successfully intubated in all patients, in contrast to what has been reported for double-balloon endoscopy (8, 9). We feel that the overtube makes the ileocecal valve less

pliable as the ascending colon is straightened out, which together with the inherent flexibility of the enteroscope as compared to a colonoscope makes it more difficult to intubate the terminal ileum using the usual antegrade approach, thus requiring retroflexion for small bowel intubation. This procedure took no more than 5 minutes and was achieved without any mucosal damage. Caution should be exercised when attempting this maneuver, however (17, 30).

The small number of patients in our report makes it difficult to report on success yields, but retrograde OAE spiral established a diagnosis or ruled out disease in four of six patients (patients 1, 2, 3, and 5), and successful endoscopic therapy was possible in three of six patients (patients 1, 2, 3)—success rates similar to those reported for double-balloon endoscopy (8, 9, 12–15). No lesions or active hemorrhage was noted in the two patients with occult gastrointestinal bleeding, and in one patient (patient 4) no further bleeding has occurred in more than 12 months following OAE spiral. The second patient (patient 6) was lost to follow-up. More importantly, the overtube allowed access to areas not previously reached by retrograde colonoscopy, where endoscopic therapy ultimately proved therapeutic. In patient 5, the colonoscope was not exchanged for an enteroscope, as the mucosal abnormality described on imaging was reached. We were able to perform pan-enteroscopy in one patient (patient 6, who had a previous per-oral OAE spiral), but no lesion was found. As technique and equipment improve, pan-enteroscopy may become more common in the West (12–15).

The potential advantage of one type of OAE compared to the others necessitates further study. The single-balloon overtube was first available at our institution, but in our experience the spiral tip overtube is simpler to use and has decreased procedure time. OAE spiral provides a more stable platform to perform endoscopic therapy, as it tends to stay in position better than the single-balloon overtube (2). This was evident in patient 1, where we used the Advantage spiral overtube that is no longer available. Tissue from the remnant polyp was removed by snare and recovered by pulling the colonoscope while leaving the overtube inserted, thus allowing for rapid colonoscope reinsertion. The Vista overtubes were used in the other five cases. These longer overtubes were advanced more proximally into the colon, which could have had an impact on maximal small bowel insertion distance. Actually, in this report, depth of small bowel retrograde insertion using the 250-cm enteroscope compared favorably to that reported for retrograde double-balloon endoscopy (8, 9). To compare OAE outcomes data, we recommend that reporting of the maximal depth of endoscope insertion adhere to consensus statements (28, 29).

A low incidence of mucosal trauma or perforations has been described for OAE spiral, and the number of cases needed to achieve proficiency appears to also be low (2, 24). The retrograde OAE spiral and single-balloon endoscopy do not need two operators, unlike double-balloon endoscopy.

OAE spiral is an exciting new technique for investigating the small bowel. The therapeutic advantages of OAE over capsule endoscopy are obvious, but studies to determine appropriate

application of this emerging technology, and how it compares to single-balloon and double-balloon OAE, are needed.

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