



A spiraling journey into the small bowel: a case series of novel motorized power spiral enteroscopies

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Background and aims: The small bowel has, to date, remained a difficult area to access via endoscopy. The novel motorized power spiral enteroscopy, recently introduced, has more depth of insertion and is of shorter duration. Presented here is a case series of motorized spiral enteroscopies.

Methods: Motorized spiral enteroscopy is indicated for patients requiring deep enteroscopy (eg, for a diagnosis of obscure GI bleeding, suspected inflammatory bowel disorder) and for therapeutic interventions, such as polypectomy, hemostasis, or stricture dilatation. It is contraindicated in patients who are not eligible for general anesthesia, with perforation, or with coagulopathy and in the pediatric population. The contraindications for the anterograde route are gastroesophageal varices, foregut stenosis, eosinophilic esophagitis, and so on. The retrograde approach is contraindicated in active colitis, anal stenosis, or colonic stricture. Informed consent was sought from all the patients.

Results: The procedure was successful in 13 of 14 (92.8%) in that the target site was reached or panenteroscopy was confirmed. The diagnoses were stricture and ulcers of the jejunum or ileum. The procedures performed were argon plasma coagulation and stricture dilation. The average duration of anterograde enteroscopy was 61.1 minutes and retrograde enteroscopy was 90 minutes. The major adverse events were hypothermia (3 of 14) and pancreatitis (1 of 14), from which the patients recovered fully.

Conclusions: Novel motorized power spiral enteroscopy is a great tool in small-bowel diagnostics and therapeutics. Speed and ease add to the attractiveness of the procedure. (VideoGIE 2020;5:591-6.)

The small bowel has until now been a difficult area to access via endoscopy. For many decades, push enteroscopy remained the only way to visualize the small bowel.¹ Video capsule endoscopy, introduced in 2000, created a revolutionary change in that the entire small bowel could be visualized.² The double-balloon enteroscope (Fujifilm, Tokyo, Japan) was introduced by Yamamoto et al in 2001.³ The double-balloon enteroscope was a lengthy procedure, involved substantial radiation exposure because of constant fluoroscopy, and did not have much stability during endoscopic procedures. Single-balloon enteroscopy (2007, Olympus corp, Tokyo, Japan) had similar drawbacks.⁴ Total enteroscopy rates and depth of maximum insertion with device-assisted techniques were still low.⁵ Laparoscopy-assisted enteroscopy was used whenever panenteroscopy was desired.⁶ The spiral enteroscope (Spirus Medical, Stoughton, Mass, USA) was introduced in 2008. This enteroscope required manual spiral rotation. It needed 2 operators and proved tedious. The novel

motorized power spiral enteroscope (Olympus corp) has done away with the shortcomings of the predecessors.⁷ It is a single-operator technique.

MATERIALS AND METHODS

The motorized spiral enteroscope is 168 cm long (Fig. 1A and 1B) and 12.8 mm in diameter with a 3.2-mm working channel. It is compatible with standard colonoscopic accessories. It has an inbuilt motor operated by a foot pedal (Fig. 1C), which drives the rotation of the spiral segment. The forward pedal causes clockwise movement of the spiral segment. This causes pleating of the bowel and forward movement of the endoscope. The backward pedal causes the bowel to unpleat. The single-use disposable spiral overtube is 24 cm in length (Fig. 1A and 1B) and fits 16 cm from the tip of the enteroscope (behind the bending section) by a double-lock

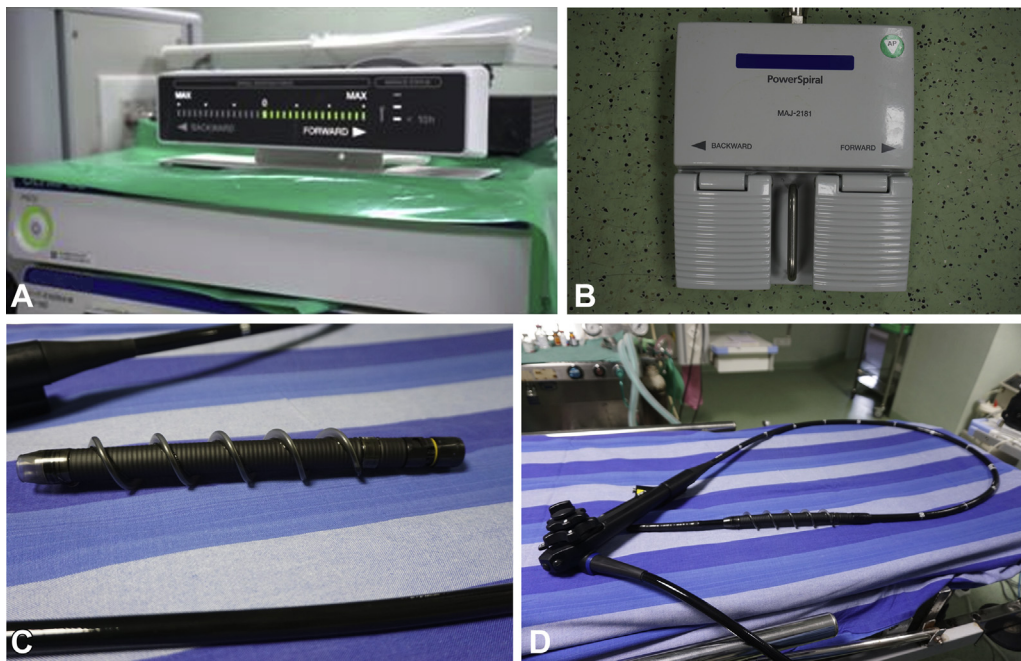


Figure 1. **A**, Novel motorized power spiral enteroscope. **B**, Disposable spiral overtube. **C**, Foot pedal, which drives the motor. **D**, Force gauge.

mechanism. It has a rubber spiraling fin with a total diameter of 31 mm. Although not recommended, before antegrade approach, serial bougie dilation is done up to 18 mm to ensure easy passage of the spiral segment. The neck of the patient is extended, and the endotracheal tube cuff is deflated to facilitate passage across the cricopharynx.

The spiral rotation is started right at the cricopharyngeal region and continued intermittently throughout the procedure. Standard enteroscopy maneuvers are used to move forward, in addition to operation of the motorized spiral. The safety features include a force gauge that helps to prevent injury due to excessive force. The force gauge stops the spiral rotation when there is excess pressure because of undue looping or distal obstruction (Fig. 1D). This acts as a safeguard against perforation, which was reported to have a 0.27% rate with conventional spiral enteroscopy.⁸ Carbon dioxide and water irrigation is used during insertion. Limited water irrigation is done at sharp turns and bends; excess water irrigation hinders the pleating action. Fluoroscopy is not necessary but may be used rarely for better localization. During withdrawal, the endoscope has to be maintained at the 80-cm mark until the endoscope exits from the pylorus.

Indications and contraindications

Motorized spiral enteroscopy is indicated for patients requiring deep enteroscopy (eg, for a diagnosis of obscure GI bleeding, suspected inflammatory bowel disorder) and for therapeutic interventions, such as polypectomy, hemostasis, or stricture dilatation. The endoscope is stable while

sampling tissue and while performing therapies such as argon plasma coagulation, hemoclipping, polypectomy, and stricture dilatation.

Motorized spiral enteroscopy is contraindicated in patients who are not eligible for general anesthesia or prolonged deep sedation. Other contraindications include patients with suspected perforation, uncontrolled coagulopathy, or recently placed feeding jejunostomy and the pediatric population. For the antegrade approach, additional contraindications include esophageal or gastric varices, foregut stenosis, deep mucosal laceration, suspected eosinophilic esophagitis, and inability to accept the mouthpiece. Relative contraindications are cervical disc prolapse or inability to extend the neck. Contraindications for the retrograde approach include severe active inflammation of the colon, anal stenosis, or colonic stricture. A cautious approach is advised for stricturing diseases, previous abdominal or pelvic surgery, altered anatomy, or pregnancy.

Preparation

For the antegrade approach, overnight fasting before the procedure was sufficient. For the retrograde approach, bowel preparation similar to colonoscopy was done. Antegrade enteroscopy was done with the patient under general anesthesia. Nasotracheal intubation was used. For the solely retrograde approach, deep sedation was given. Informed consent was sought from all patients before the procedure.

Here, we present a case series of 14 patients who underwent novel motorized spiral enteroscopy at a gastroenterology referral center.

TABLE 1. Case series of novel motorized spiral enteroscopy

No.	Age/sex	Indication for enteroscopy	Route of enteroscopy	Successful (target reached)	Time taken	Findings	Histopathology findings	Procedures performed	Adverse effects
1	28/M	Distal jejunal and proximal ileal strictures on CT enterography	Anterograde and retrograde	Yes	30 min 40 min	Distal jejunal stricture, proximal ileal stricture with nodularity and ulceration	Crohn's enteritis	Biopsy	–
2	60/M	Short-segment wall thickening in distal jejunum and proximal ileum on CT enterography	Anterograde	Yes	15 min	Mid-jejunal stricture with ulcers	Crohn's enteritis	Biopsy	–
3	64/M	Long-segment thickening in proximal ileum; multiple large mesenteric nodes on CT enterography	Retrograde and push enteroscopy anterograde	Yes	75 min	Proximal ileal stricture	Crohn's enteritis	Balloon dilatation and biopsy	–
4	44/M	Thickening with mucosal enhancement of proximal jejunal loops on CECT abdomen	Anterograde	Yes	30 min	Tight stricture in distal jejunum with preceding clean-based ulcer	Crohn's jejunitis	Biopsy	–
5	36/M	End-stage renal disease; retrieval of retained capsule endoscope due to proximal ileal stricture	Retrograde; patient did not consent to anterograde	Yes	180 min	Proximal ileal stricture noted	Nonspecific ileitis	Balloon dilation; procedure abandoned because patient could not tolerate the prolonged anesthesia. Plan to repeat later.	Hypothermia
6	25/M	Skip areas of circumferentially enhancing wall thickening in mid- and distal ileum	Anterograde and retrograde (panenteroscopy confirmed by tattooing)	Yes	60 min 90 min	Normal study	–	Panenteroscopy	–
7	44/F	Subacute intestinal obstruction, with history of appendectomy and cesarean section; high CRP and fecal calprotectin	Anterograde could not be done because the spiral segment could not pass beyond the cricopharynx. Retrograde approach was difficult, probably because of adhesions—150 cm of ileum reached.	Yes	85 min	Distal ileal narrowing with erosions	Crohn's ileitis	Biopsy	–
8	82/F	Recurrent obscure GI bleeding	Anterograde could not be done because of a short neck. Hence retrograde was done. Tattooing and push enteroscopy were done anterograde and panenteroscopy confirmed.	Yes	80 min	Angiectasias in ileum and jejunum	–	APC	–

(continued on the next page)

TABLE 1. Continued

No.	Age/ sex	Indication for enteroscopy	Route of enteroscopy	Successful (target reached)	Time taken	Findings	Histopathology findings	Procedures performed	Adverse effects
9	63/M	Obscure GI bleeding	Anterograde—cecum reached	Yes	105 min	Ileal ulcers with bleeding	Crohn's ileitis	APC	–
10	80/F	Obscure GI bleeding	Anterograde and retrograde	Yes	90 min 110 min	Jejunal and ileal angiectasias	–	APC	Hypothermia
11	50/M	Midjejunal stricture	Anterograde	Yes	30 min	Mid-jejunal stricture	Crohn's jejunitis	Biopsy	–
12	65/M	Short segment of distal jejunal loop adherent to anterior abdominal wall in left iliac fossa region	Anterograde and retrograde	Yes	100 min 60 min	Ileal ulcer	Nonspecific ileitis	Biopsy	–
13	58/F	Long-segment wall thickening in distal jejunum and proximal ileum	Anterograde (not progressing beyond jejunum) and retrograde (nonprogression beyond ileocecal valve)	No	–	Small jejunal ulcers and erosions	Nonspecific jejunitis	Biopsy	Hypothermia and pancreatitis
14	79/M	Obscure occult GI bleeding	Anterograde —panenteroscopy confirmed by reaching cecum	Yes	90 min	Normal	–	–	–

CECT, Contrast-enhanced computerized tomography; APC, argon plasma coagulation; CRP, C-reactive protein.

RESULTS

The demographic characteristics, indication for enteroscopy, route of enteroscopy, procedure duration, findings, therapeutic intervention, and adverse effects are given in Table 1 and summarized in Table 2.

The indications for the enteroscopy in this case series were small-bowel pathology needing histopathology and obscure GI bleeding. All of our patients with abdominal pain had undergone CT enterography with definite findings before enteroscopy. One patient had undergone capsule endoscopy, which showed ulcers in the mid-ileum, and was scheduled for spiral enteroscopy for biopsy. Informed consent was obtained before the procedure. In the previous case reports, the indication for motorized spiral enteroscopy was obscure GI bleeding.^{7,9} In the current case series, 10 of 14 procedures were indicated for suspected thickening/stricture of ileal and jejunal

segments; obscure GI bleeding was the indication in 4 of 14 patients. In the patients with suspected stricture, the site of pathology was reached and biopsy specimens were taken. The biopsy and procedures were performed during insertion because it was possible to miss lesions during withdrawal.

The procedural yield and the route taken are shown in Table 3. The duration of anterograde and retrograde enteroscopy is shown in Table 4. Panenteroscopy was confirmed on entering the cecum in 2 patients (Video 1, available online at www.VideoGIE.org). The duration of panenteroscopy was 90 minutes in 1 patient and 105 minutes in another. In other patients (3 of 14) it was confirmed by tattooing and reaching the tattooed segment via the opposite route. In most patients, panenteroscopy was not attempted because of strictures. Even if the stricture was crossed, care was taken that the spiral segment did not cross the stricture.

TABLE 2. Routes of enteroscopy

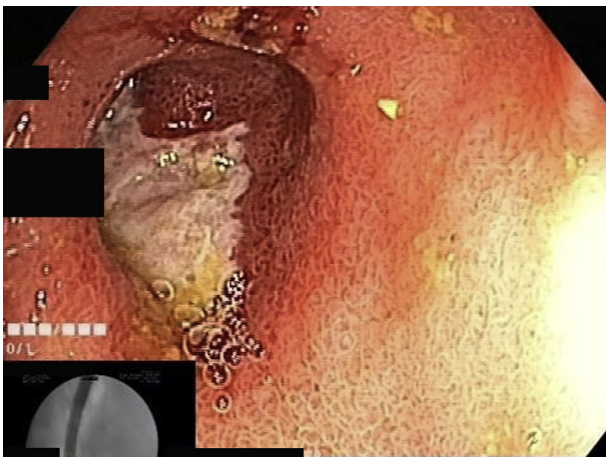
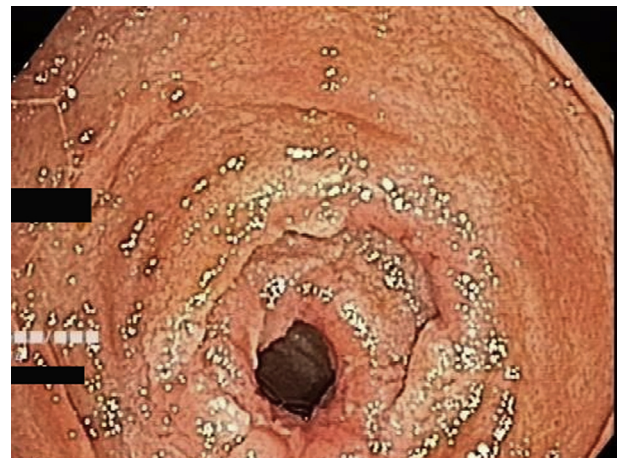
No.	Route of enteroscopy	n/N (%)
1	Anterograde only	5/14 (35.71)
2	Retrograde only	4/14 (28.57)
3	Both anterograde and retrograde	5/14 (35.71)

TABLE 3. Procedural yield

No.	Procedural yield	n/N (%)
1	Target lesion reached or total enteroscopy achieved	13/14 (92.8)
2	Total enteroscopy	5/14 (35.71)
3	Total enteroscopy by anterograde route alone (complete anterograde enteroscopy)	2
4	Total enteroscopy with anterograde and retrograde routes combined	1
5	Total enteroscopy with retrograde route and push enteroscopy anterograde	2

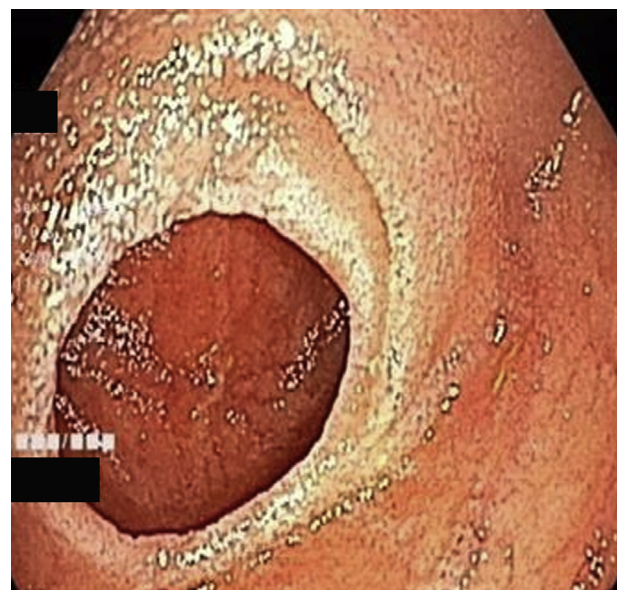
TABLE 4. Time taken for enteroscopy

No.	Route of enteroscopy	Average duration (min)
1	Anterograde enteroscopy	61.1
2	Retrograde enteroscopy	90

**Figure 2.** Distal jejunal stricture.**Figure 3.** Mid-jejunal stricture.

The target lesion was reached or total enteroscopy was achieved in 13 of 14 of cases (92.8%). The most common diagnoses were strictures or ulcers of the jejunum or ileum (Figs. 2-4). In obscure GI bleeding, the diagnoses were small-bowel angiectasias and ileal ulcers with ooze. In the initial learning curve, having a roadmap like a previous capsule endoscopy or CT enterography can be very useful. In most patients with small-bowel strictures and ulcers, the histopathologic diagnosis was Crohn's disease (7 of 10 patients). Therapeutic procedures performed were argon plasma coagulation for angiectasia (Fig. 5A and B), argon plasma coagulation for oozing ulcer, and balloon dilation of the stricture (Fig. 6).

Previous case reports on use of novel motorized spiral enteroscopy report success in reaching the targeted lesion, short duration, and no serious adverse events.^{7,9} The issues faced with motorized spiral enteroscopy in our series were mucosal abrasions to the cricopharyngeal region because of the large spiral tube. However, none of the patients had perforation, and they were all given liquids within 12 hours. Some (3 of 14) had mild odynophagia, which

**Figure 4.** Distal jejunal stricture.

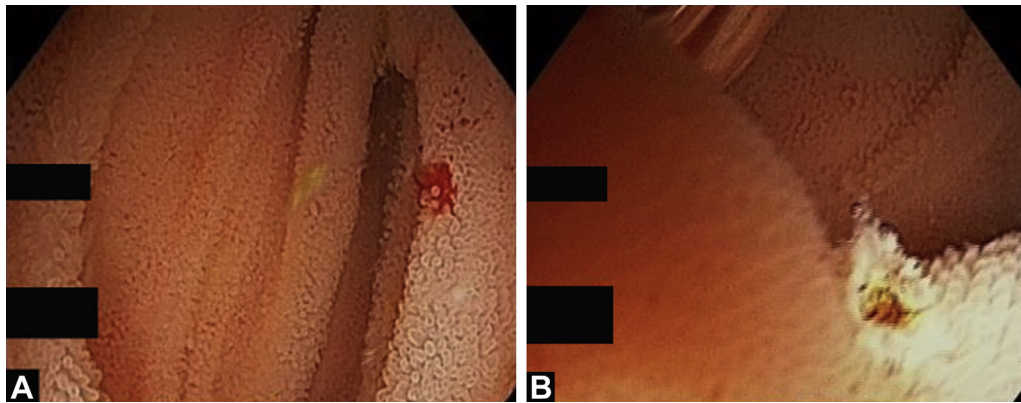


Figure 5. A and B. Argon plasma coagulation of ileal angiectasia.

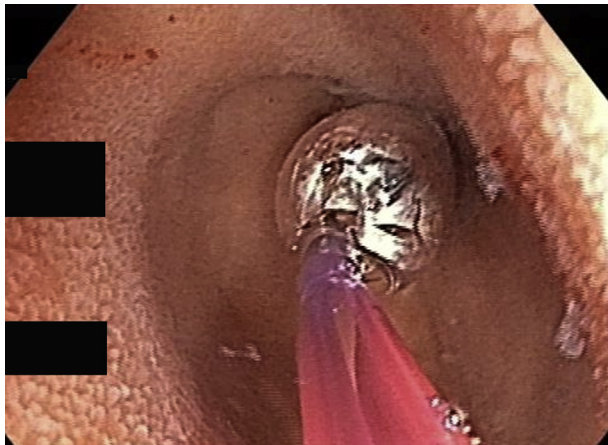


Figure 6. Balloon dilatation of proximal ileal stricture.

resolved with oral sucralfate suspension. In 2 patients, the spiral segment could not be passed across the cricopharynx. Both of the patients were female and had a short neck. The thick ring-like stub that projects from the site where the spiral overtube locks onto the tip of the endoscope is difficult to pass across the cricopharynx. Both of the patients underwent retrograde spiral enteroscopy, and the target lesion was reached successfully. Some patients (3 of 14) had superficial mucosal abrasions in the small intestine. The patients were asymptomatic.

Three patients had hypothermia during the procedure and recovered within 6 hours. Hypothermia was probably due to a large volume of water infusion and prolonged anesthesia. This prompted us to use warm water as a protocol, after which we did not find hypothermia. One patient developed pancreatitis and recovered with conservative management.

CONCLUSION

Novel motorized spiral enteroscopy is a great tool for diagnostic and therapeutic enteroscopy. Panenteroscopy

is easily achieved with this. Speed and ease add to the attractiveness of the procedure.

DISCLOSURES

All authors disclosed no financial relationships.

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<https://doi.org/10.1016/j.vgie.2020.08.001>