

# Retrograde colon imaging through colonic transendoscopic enteral tubing helps to confirm the cause of difficult colonoscopy: a case report

Xiaomeng Jiang<sup>ID</sup>, Runqing Wang, Haibo Sun and Faming Zhang<sup>ID</sup>

**Abstract:** Numerous factors can contribute to a difficult colonoscopy, potentially leading to an incomplete procedure and overlooked lesions. Alternative strategies for handling difficult and incomplete colonoscopies should be considered. We present the case of an 85-year-old male who underwent a difficult colonoscopy, during which two expert endoscopists spent 1.5 h attempting various techniques but failed to intubate the cecum. Subsequently, colonic transendoscopic enteral tubing (TET) was performed. Abdominal plain film revealed tortuosity of the TET tube in the left abdomen corresponding to the distribution of the descending colon. Retrograde colon imaging was conducted by injecting a mixture of contrast medium and air into the colon via the TET tube. X-ray demonstrated well-developed visualization of the entire colon and terminal ileum. And evident elongation and tortuosity of the descending colon resembled an N-type folding pattern. The final diagnosis was determined as descending colon redundancy. Colonic TET combined with retrograde colon imaging through the TET tube may serve as an effective supplementary approach for identifying causes of difficult colonoscopy and improving diagnostic accuracy for bowel diseases when complete visualization is not achieved.

**Keywords:** case report, descending colon redundancy, difficult colonoscopy, retrograde colon imaging, transendoscopic enteral tube

Received: 4 January 2024; revised manuscript accepted: 20 June 2024.

## Introduction

Colonoscopy is a crucial diagnostic tool for colorectal diseases. In comparison to gastroscopy, the procedure of colonoscopy presents greater challenges. Numerous factors have been documented as being associated with difficulties encountered during colonoscopy, including inadequate bowel preparation, severe diverticulosis, redundant colon, looping, adhesions, young and female patients, patient discomfort, and the expertise of the endoscopist.<sup>1</sup> Difficult colonoscopy may frequently occur in clinical practice. In such circumstances, an incomplete colonoscopy procedure may ensue, leading to potential missed diagnoses of colonic diseases.<sup>2</sup>

Therefore, alternative approaches to difficult and incomplete colonoscopies must be considered.

Colonic transendoscopic enteral tubing (TET), a novel colon-specific drug delivery method for multiple fecal microbiota transplantations or frequent colonic medication administration, is a technique in which a specially designed tube is inserted through the colonic biopsy channel and maintained in the colon.<sup>3</sup> In addition to the fecal microbiotic solution that can be injected into the colon through the colonic TET tube, other liquids such as contrast agents can also be injected into the colon through the tube, which may help to achieve retrograde imaging of the colon.

*Ther Adv Gastrointest Endosc*

2024, Vol. 17: 1–7

DOI: 10.1177/

26317745241270568

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Correspondence to:

**Faming Zhang**  
Department of Microbiota  
Medicine, The Second  
Affiliated Hospital  
of Nanjing Medical  
University, 121 Jiang Jia  
Yuan, Nanjing 210011,  
China

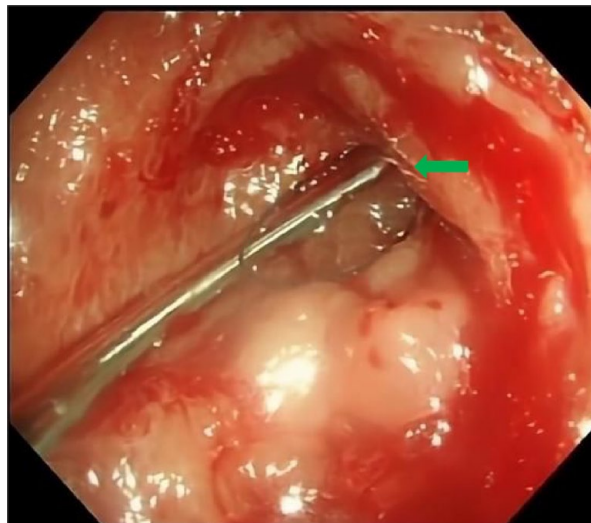
Department of Microbiota  
Medicine, Sir Run Run  
Hospital, Nanjing Medical  
University, Nanjing, China  
[fzhang@njmu.edu.cn](mailto:fzhang@njmu.edu.cn)

**Haibo Sun**  
Endoscopy Center, Xuzhou  
Ruibo Hospital, 18 Xiadian  
Road, Xuzhou 221001,  
China  
[645759907@qq.com](mailto:645759907@qq.com)

**Xiaomeng Jiang**  
Department of  
Gastroenterology, Sir Run  
Run Hospital, Nanjing  
Medical University,  
Nanjing, China

Department of Microbiota  
Medicine & Medical Center  
for Digestive Diseases, The  
Second Affiliated Hospital  
of Nanjing Medical  
University, Nanjing, China

**Runqing Wang**  
Department of Clinical  
Medicine, First Clinical  
Medical College, Nanjing  
Medical University,  
Nanjing, China



**Figure 1.** Blood seeped because of long-time friction and attraction by the colonoscope. The tip of the TET tube was inserted passing through the colonic angulation (green arrow). TET, transendoscopic enteral tubing.

In this study, we attempted to perform colonic TET for a challenging colonoscopy case in which two experienced endoscopists were unable to intubate the cecum. Subsequently, retrograde colon imaging was conducted through the TET tube, revealing a well-developed colon and ultimately aiding in identifying the cause of the difficult colonoscopy.

### Case presentation

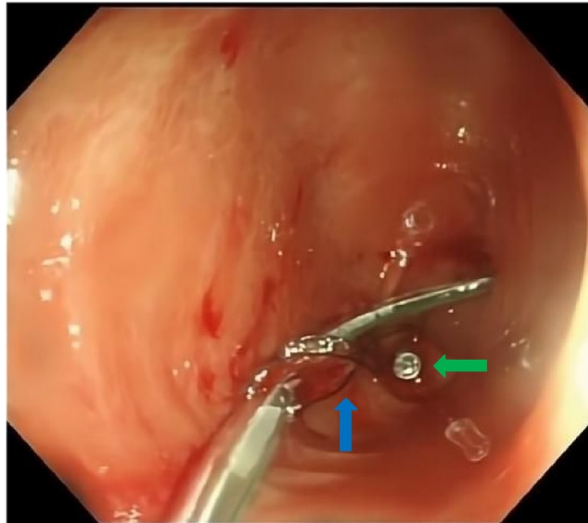
An 85-year-old male was admitted with complaints of chronic constipation. He had a history of femoral head replacement surgery but denied any abdominal surgeries. His BMI was recorded as 16.6 kg/m<sup>2</sup>. To investigate the cause of his constipation, a colonoscopy was scheduled for him. Prior to the procedure, he underwent bowel preparation using 1 L of PEG-4000 fluid on the day before and an additional 2 L 6 h prior to the colonoscopy. Adequate bowel preparation was confirmed when he passed clear and watery stool.

The sedated colonoscopy was performed by an expert endoscopist with over 8 years of experience in endoscopy. A pronounced angulation was observed in the colonic lumen approximately 45 cm from the anus, posing significant challenges for further insertion of the colonoscope. Despite several attempts, the operator reluctantly managed to navigate past the angulation, however, encountered difficulties again due to loop formation within the abdomen during

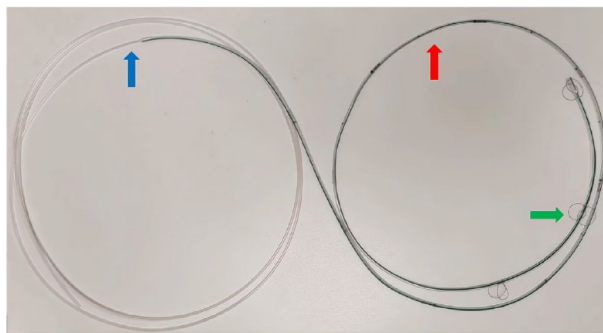
deeper intubation. Another highly experienced endoscopist took over but faced similar obstacles despite employing techniques such as abdominal pressure, body repositioning, adding a transparent cap, and immersing the colonic lumen with water. The procedure lasted approximately 1.5 h for both endoscopists involved. Due to repeated friction and traction caused by colonoscopy, localized mucosal bleeding occurred in the intestine. Concerns regarding complications associated with colonoscopy and anesthesia led to discontinuation of routine colonoscopy.

After obtaining consent from the patient's family, colonic TET was performed. A TET tube (FMT-DT-F-27/1350; FMT Medical, Nanjing, China) was inserted into the intestinal lumen through the biopsy channel of the colonoscopy under direct endoscopic visualization. The distal end of the tube was advanced through the colonic angulation approximately 45 cm from the anus (Figure 1). The colonoscope was then withdrawn while leaving the TET tube in place within the colon. Subsequently, second colonoscopy intubation was performed arriving at the target angulation. The second loop of the TET tube was secured to the colonic mucosa near the colonic angulation using an endoclip (ROCC-D-26-230-C, Micro-Tech, Nanjing, China) (Figure 2). The structure of the TET tube is depicted in Figure 3.

Abdominal plain film revealed tortuosity of the TET tube in the left abdomen corresponding to



**Figure 2.** An endoclip (green arrow) was utilized to secure the second loop (blue arrow) of the TET tube to the colonic mucosa near the angulation. TET, transendoscopic enteral tubing.



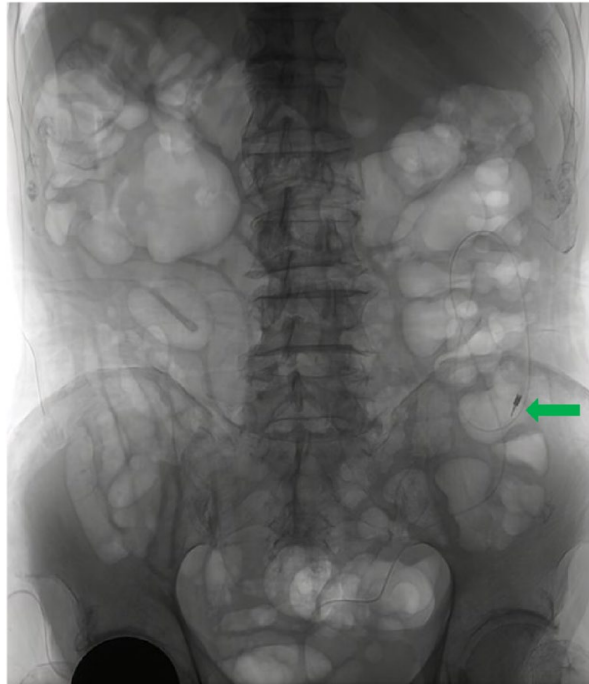
**Figure 3.** The structure of the colonic TET tube consists of two parts. The main part of the tube is indicated by the red arrow, measuring 1350 mm in length with a diameter of 2.7 mm, and featuring three loops at its terminal end (green arrow), which can be fixed to the colonic mucosa using endoclips. The temporarily connected extended part of the tube is shown by blue arrow, providing convenience for exchange. TET, transendoscopic enteral tubing.

the distribution of descending colon. The visualized endoclip in the film indicated the location of sharp flexure impeding passage during colonoscopy evaluation (Figure 4). Furthermore, retrograde colon imaging was performed by injecting a mixture consisting of 600 mL normal saline, 200 mL iohexol, and 100 mL air via the colonic TET tube. X-ray imaging demonstrated well-developed entire colon and terminal ileum without evidence of mass lesions, stenosis, or ulcers. Descending colon exhibited obvious tortuosity and elongation resembling an N-type folding pattern (Figures 5 and 6).

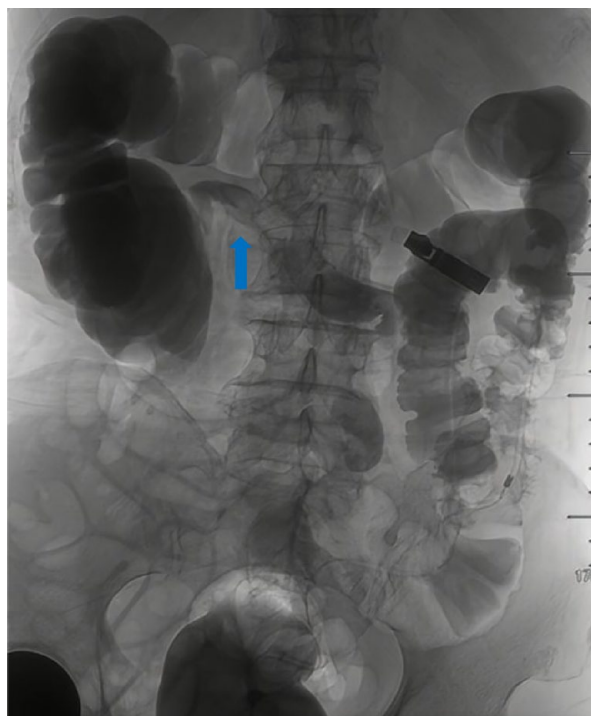
Based on retrograde colon imaging findings, final diagnosis for this patient is descending colon redundancy which may be associated with constipation symptoms and difficulty encountered during previous attempted colonoscopy.

Four hours after retrograde colon imaging, the colonic TET tube was removed. The patient complained of no particular discomfort. Oral medications for constipation were given to him.

The reporting of this study conforms to the CARE checklist (Gagnier JJ, Kienle G, Altman DG,



**Figure 4.** X-ray imaging revealed tortuosity of the TET tube in left abdomen region. The location where an endoclip was placed indicates a sharp flexure where colonoscopy could not pass through (green arrow). TET, transendoscopic enteral tubing.



**Figure 5.** Retrograde colon imaging via the colonic TET tube demonstrated well-developed entire colon and terminal ileum (blue arrow). TET, transendoscopic enteral tubing.



**Figure 6.** The descending colon exhibited obvious tortuosity and elongation, resembling an N-type fold.

Moher D, Sox H, Riley D; the CARE Group. The CARE Guidelines: Consensus-based Clinical Case Reporting Guideline Development).

### Discussion

A successful cecal intubation, defined as the insertion of the colonoscope to the terminal ileum proximal to the ileocecal valve and/or the cecum,<sup>4</sup> is essential for a thorough and complete colonoscopy. It is important to avoid incomplete colonoscopies as they may result in missed lesions.<sup>2</sup> The most commonly used indicators for assessing competency in colonoscopy are cecal intubation time (CIT) and cecal intubation rate (CIR).<sup>5,6</sup> Difficult colonoscopy is typically characterized by a CIT exceeding 10 min or an incomplete examination using a standard scope.<sup>7</sup>

According to recommendations from the American Society for Gastrointestinal Endoscopy, competent endoscopists should achieve a CIR >95% for screening healthy adults and >90% for all cases.<sup>8</sup> However, it has been estimated that up to 10%–20% of real-world colonoscopies may encounter difficulties with cecal intubation.<sup>9</sup> A recent study involving 1281 unsedated colonoscopies reported a proportion of difficult cecal intubations at 27.2%.<sup>10</sup> In cases where difficult colonoscopy is anticipated, CIR ranged from

90% to 96%, while CIT varied between 21.00 and 23.42 min.<sup>11</sup> Increasing CIR and reducing CIT remain crucial objectives for difficult colonoscopy.

Predicting the difficulty level of an upcoming examination before performing a colonoscopy can be challenging. However, several factors have been identified that might influence its difficulties, including age, gender, BMI, bowel preparation status, prior abdominal or pelvic surgery history, bowel anatomy variations, and endoscopist experience.<sup>10,12</sup> Among these factors, the impact of bowel anatomy on difficulty levels during both pre-examination prediction and actual performance remains uncertain due to colonoscopy limitations in observing bowel distribution or redundancy compared with visualizing lesions within the bowel lumen.

Colonic TET is an interventional therapeutic procedure for the intestine.<sup>13</sup> Since 2015, it has been demonstrated that colonic TET is a novel, safe, and convenient technique for transplanting washed fecal microbiota and administering medication into the colon.<sup>14,15</sup> Recent studies have shown that colonic TET can be used to rescue endoscopy-related perforations and manage intestinal obstruction by draining colonic air and fluid through the TET tube.<sup>16,17</sup> Based on its

two-way fluid exchange function, the colonic TET tube may be attempted to inject contrast agents for retrograde colon imaging. The TET Study Group in China in 2023 published the experts' recommendation that retrograde administration of contrast agent via the colonic TET tube may improve clinical diagnosis by imaging stenosis, ulceration, masses, and fistulas using fluoroscopy or computed tomography (CT), compensating for deficiencies in diagnostic efficiency compared to CT scans with or without contrast.<sup>13</sup> As we know, colonic TET has never been used for patients with difficult colonoscopy previously.

For this difficult colonoscopy case, a variety of methods were attempted to aid insertion including changing experts, applying abdominal pressure, adjusting body position, adding a transparent cap, and water immersion. However, further advancement was hindered due to constant flexure formation and looping. During colonoscopy it was unclear what caused these difficulties, perhaps there was excessive angulation within the bowel lumen or localized luminal strictures. To determine the cause of difficulty during colonoscopy as well as any potential lesions in proximal lumen areas, the colonic TET tube placement followed by retrograde colon imaging was performed.

The abdominal plain film clearly showed the bent shape of the radiopaque material comprising the colonic TET tube which corresponded with distribution of the descending colon. The endoclip was visualized on the plain film, indicating the site of colonic flexure beyond which colonoscopy could not proceed. Retrograde colon imaging via the colonic TET tube provided excellent visualization of the entire colon and terminal ileum, facilitating exclusion of colorectal cancer and other lesions in this patient. The overall distribution pattern of the colon was also clearly demonstrated, particularly with a distinct N-shaped appearance observed in the descending colon. Therefore, based on findings obtained using the colonic TET tube, a diagnosis of descending colon redundancy was established as the underlying cause for difficult passage during colonoscopy.

### Conclusion

The utilization of colonic TET and retrograde colon imaging through this technique may serve as an effective approach to identify causes contributing to difficult colonoscopies and enhance

diagnostic accuracy for bowel diseases when a complete examination of the entire colon is unattainable. However, it should be noted that this is only a case report, and further studies with larger sample sizes are required to confirm the effectiveness of colonic TET in difficult colonoscopy.

### Declarations

#### *Ethics approval and consent to participate*

Not applicable (there is no identification material in our images and/or in the whole manuscript. Furthermore, written informed consent to treatment was obtained from the participants included in the study. At last, this was a single case report, not a large-scale clinical study, so the ethics committee of Sir Run Run Hospital Nanjing Medical University thought that ethics approval was not required, as long as informed consent was obtained from the participants).

#### *Consent for publication*

The patient involved in this study gave written informed consent for the publication of his medical data and images. The patient's personal information was removed from text, images, and figures.

#### *Author contributions*

**Xiaomeng Jiang:** Investigation; Writing – original draft; Writing – review & editing.

**Runqing Wang:** Investigation; Writing – original draft; Writing – review & editing.

**Haibo Sun:** Supervision; Writing – review & editing.

**Faming Zhang:** Conceptualization; Supervision; Writing – review & editing.

#### *Acknowledgements*

We appreciate the patient from Sir Run Run Hospital, Nanjing Medical University for giving us the opportunity to share the case report with all of you.

#### *Funding*

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work is supported by the Nanjing Medical University Fan Daiming Research Funds for Holistic Integrative Medicine.

### Competing interests

The authors declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Faming Zhang conceived the concept of transendoscopic enteral tubing and related devices. The others declare no conflict of interest.

### Availability of data and materials

All data used in this research were submitted.

### ORCID iD

Xiaomeng Jiang  <https://orcid.org/0009-0001-3740-3351>

Faming Zhang  <https://orcid.org/0000-0003-4157-1144>

### Supplemental material

Supplemental material for this article is available online.

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