

# Cap-assisted retrograde single-balloon enteroscopy results in high terminal ileal intubation rate

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## Bibliography

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**Background and study aims:** Retrograde single-balloon enteroscopy (RSBE) facilitates evaluation of the distal small bowel and provision of appropriate therapy when necessary. Intubation of the terminal ileum (TI) is a major rate-limiting step, with failure rates as high as 30%. Cap-assisted endoscopy has proven beneficial in other aspects of endoscopy. We have noticed that it similarly aids in TI intubation during RSBE by facilitating opening of the ileocecal valve (ICV). The primary aim of this study was to measure the TI intubation rate using cap-assisted RSBE. Other procedural details and outcomes were also measured.

**Patients and methods:** A total of 36 consecutive RSBEs performed between July 2011 and May 2014 at the Medical University of South Carolina were retrospectively reviewed. All procedures were performed or supervised by our center's

small bowel endoscopist (ASB). Outcomes measured included TI intubation rate, procedure time, depth of maximal insertion (DMI), diagnostic yield (DY), therapeutic yield (TY), and complications.

**Results:** The TI intubation rate was 97% (35/36). The one failure was due to stool completely obscuring the cecum. Median procedure time was 54 minutes, with a mean DMI of 68 cm beyond the ICV. The technical success rate was 86%, whereas DY and TY were 61% and 25%, respectively. There were no complications. The study was limited in that it involved a single endoscopist at a single center.

**Conclusions:** Cap-assisted RSBE results in a high TI intubation rate, without compromise to safety or procedural yield.

## Introduction

Retrograde single-balloon enteroscopy (RSBE) is an established modality for diagnosis and treatment of distal small bowel lesions that are beyond the reach of standard ileocolonoscopy. However, it is a challenging and complicated procedure requiring significant time and skill beyond standard endoscopy. A major barrier to retrograde enteroscopy is intubation of the terminal ileum (TI), with failure rates documented as high as 30% [1]. This is due to the lack of stiffness in the relatively small-caliber enteroscope, which often results in looping of the instrument when trying to intubate the TI. Cap-assisted endoscopy has previously proven beneficial for several aspects of endoscopy, including cecal intubation, adenoma detection, and visualization of the ampulla of Vater by peeling away mucosal folds [2–4]. Similarly, we have found that a distal cap aids in many aspects of retrograde balloon enteroscopy, including intubation of the TI, by facilitating opening of the ileocecal valve (ICV). Therefore, we set out to deter-

mine the terminal ileal intubation rate during RSBE while utilizing a distal cap, as well as procedural outcome variables.

## Patients and methods

We reviewed all RSBEs performed at our institution between July 2011 and May 2014. All RSBEs were performed or supervised by our center's adult small bowel endoscopist (ASB) under general or monitored anesthesia care (MAC) with the exception of one performed with moderate sedation. All procedures were performed with an enteroscope (SIF-Q180; Olympus USA, Center Valley, Pennsylvania, USA) with the single-balloon over-tube. All procedures utilized a distal cap. Patient demographics, procedural indication, procedure time, depth of insertion beyond the ICV, exam findings, treatments performed, and complications were reviewed. We then calculated TI intubation rate, median procedure time, mean depth of maximal insertion beyond the ICV, technical

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success, diagnostic yield, therapeutic yield, and complication rate. The TI intubation rate was defined as the proportion of procedures in which we were able to intubate the TI at least 5 cm. Technical success was defined as previously by the proportion of procedures in which we were able to evaluate at least 20 cm beyond the ICV [5]. Diagnostic yield was defined as previously by the proportion of technically successful procedures in which a diagnosis was determined. Therapeutic yield was defined as previously by the proportion of technically successful procedures in which a therapy was applied. This study was approved by the Medical University of South Carolina's Institutional Review Board for Human Research.

## Results

A total of 36 RSBEs were reviewed. The mean age was 59 (50% female). Indications included bleeding, anemia, mass or polyp seen on capsule endoscopy or imaging, ulcers seen on capsule endoscopy, stricture, and other. Demographics and indications are shown in **Table 1**. TI intubation was successful in 35 of 36 procedures (97%). Median procedure time was 54 minutes, and the mean depth of maximal insertion was 68 cm beyond the ICV. Technical success was achieved in 31 of 36 procedures (86%). A diagnosis was identified in 22 of 36 cases, giving a diagnostic yield of 61%. Therapy was provided in 9 of 36 cases, giving a therapeutic yield of 25%. **Table 2** demonstrates all diagnoses and applicable therapies. There were no complications.

## Discussion

RSBE has proven to be an effective method for evaluating the distal small bowel. One limiting step in the ability to perform RSBE is intubation of the TI. To our knowledge, this is the first study to demonstrate the utility of a distal cap in RSBE. Our results suggest that use of a distal attachment seems to aid in the success of RSBE by facilitating TI intubation. The single failure we experienced was due to stool completely obscuring the cecum. In addition, the technical success rate was 86%, due to two failures noted to have poor prep, including the aforementioned complete obstruction of the cecum with stool, and three noted to have looping due to floppy colons. The diagnostic yield was 61%, with findings typical of RSBE, including primarily arteriovenous malformations, as also polyps, nodules, and ulcers. Although many biopsies were performed, they are not considered therapy. As such, therapeutic yield was calculated to be 25%, consisting only of argon plasma coagulation (APC) for hemostasis of bleeding lesions, and polypectomy.

One limitation of this case series is that it reflects the experience of a single endoscopist at a single center. Further, we had no comparison group as very few RSBEs have been performed without a distal attachment at our institution. However, our procedure time, depth of maximal insertion, diagnostic and therapeutic yields, and rates of technical success and complications are comparable to published values [6–8].

We believe that this case series shows that the use of a distal cap is likely to aid in the success of RSBE by facilitating intubation of the TI. Although RSBE will certainly remain challenging, the attachment of a distal cap is one tool that other small-bowel endoscopists may find beneficial, without obvious compromise to efficacy or safety.

**Table 1** Demographics and Indications.

Demographics	n (%)
Mean Age	59 (range 15–88)
Females	18 (50)
Indication	
Bleeding/anemia	21 (58)
Mass or polyp	7 (19)
Ulcers on capsule	3 (8)
Stricture	2 (6)
Other	3 (8)

**Table 2** Findings and therapies

Findings	Therapy
Nodular lymphoid hyperplasia 75 cm proximal to ICV	
Angioectasia 30 cm proximal to the ICV	APC
Diverticulosis	
Distal ileal ulcerated strictures	
Diminutive ileal angioectasia, 2 ascending colon angioectasia	APC
Oozing colonic angioectasia; non-bleeding mid-ileum angioectasia	APC
Two nodules in distal ileum	
Moderately severe stenosis in the distal ileum	
Moderately severe stenosis in the terminal ileum	
Colon angioectasia	APC
Moderately erythematous mucosa in the ileum	
Angioectasia in distal and mid-ileum	APC
Angioectasia in ileum	APC
Erythema and erosions near AO	
Ileal angioectasia	APC
Normal ileum, moderate diverticulosis	
Submucosal nodule in the distal ileum (lipoma)	
Aphthous ulcers in the mid-ileum and terminal ileum	
Meckel's diverticula 65 cm proximal to the ICV	
Benign Ulcer 80 cm proximal to the ICV	
Polyp in the distal ileum	Polypectomy
12-mm ulcerated pedunculated fibroid polyp 50 cm proximal to the ICV	Polypectomy

ICV, ileocecal valve; APC, argon plasma coagulation; AO, appendiceal orifice

**Competing interests:** None

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