Achieving cecal intubation in the difficult colon (with videos)

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Introduction

The term "difficult colon" implies colon anatomy that makes cecal intubation difficult, despite good basic technique, abdominal pressure, and position change. My approach to achieving cecal intubation in difficult colons is based on over 930 referrals in which colonoscopy was not completed by a gastroenterologist or surgeon. In this series, my success rate for intubating the cecum, defined as passing the ileocecal valve and visualizing the entire cecal caput, is 98%[1]. Below is a listing of the key elements I rely on for success.

Tip 1. Classify the anatomy problem

In order of descending frequency as encountered in a referral practice, the anatomic causes of incomplete colonoscopy are (1) redundant colon, (2) angulated and narrowed sigmoid, and (3) hernias.

Classifying the anatomic problem allows selection of the best colonoscope (adult scopes for redundant colons and skinny scopes for difficult sigmoids) and defines the possible need for overtubes (occasionally in redundant colons and never in angulated sigmoids).

Hernias that have prevented colonoscope passage must be reduced before starting the procedure. Left inguinal hernias are usually easily reduced. After reduction, an assistant should hold a hand

This is the author's manuscript of the article published in final edited form as:

Rex, D. K. (2021). Achieving cecal intubation in the difficult colon (with videos). Gastrointestinal Endoscopy. https://doi.org/10.1016/j.gie.2021.11.026

over the hernia opening until the colonoscope tip has passed the sigmoid, at which point the hand pressure can be released. Large transverse colon hernias are more difficult to reduce, and if the hernia persists when the colonoscope tip reaches the transverse colon, the scope will typically enter the hernia but exiting on the cecal side seems impossible. If there is fixed resistance the procedure should be aborted, as use of a smaller, longer, or more flexible scope will usually produce the same result. Cecal intubation with a large transverse colon hernia may be achieved only after surgical hernia repair.

Tip 2. Choose the right colonoscope

For a redundant colon with or without lumenal dilation, the adult instrument is superior to the flexible instrument because it is stiffer and resists looping better. For the narrowed and angulated sigmoid, skinnier scopes are better. Thus, the pediatric colonoscope may succeed when the adult colonoscope does not, and the ultrathin may succeed when the pediatric does not. The other key feature is the length of the bending section, which is shorter on upper endoscopes and push enteroscopes compared with colonoscopes (Videos 1, 2). The shorter the bending section, the tighter the turning radius and the more capable the instrument of passing a sharp angulation (Figure 1). Thus, an upper endoscope and a push enteroscope may pass a sigmoid angle that cannot be passed with any colonoscope. I usually use a push enteroscope when the ultrathin colonoscope fails. The disadvantage of push enteroscopes is their length, which when combined with relatively narrow working channels can make instrument passage difficult. The problem is usually worse with snares than with biopsy forceps. Upper endoscopes and colonoscopes are both easier to use in the colon than enteroscopes, because of their shorter length and/or larger

working channels. The upper endoscope has enough length to reach the cecum in about two-thirds of cases. In patients with known angulated sigmoids as the cause of failed scope passage, I try a pediatric colonoscope, followed by an ultrathin, followed by either the push enteroscope or an upper endoscope. If the referring doctor failed with a pediatric colonoscope and I'm confident in their skills, I go directly to the ultrathin colonoscope.

There is extensive literature on balloon enteroscopes in previously incomplete colonoscopies, but the published success rate in cecal intubation is no greater than using the instruments outlined above, and balloon enteroscopes are often not available outside of referral centers.

Tip 3. Insert underwater

In the context of difficult colons, underwater means insertion proceeds with identification of lumenal direction underwater with the gas turned off. No gas insufflation is permitted, and pockets of gas in the colon are removed as they are encountered. However, true water exchange is not needed to get the insertion advantages of water (Figure 2).

Excellent preparation facilitates underwater insertion, especially in a dilated colon. Patients with dilated and redundant colons may require 2 or more days of ingesting preparation to achieve a preparation that allows underwater colonoscopy all the way to the cecum.

In the redundant and dilated colon, water insertion makes the colon shorter and less dilated compared with gas insufflation, so less instrument is used, and the endoscopist is less likely to

“run out of scope” in the proximal colon (Video 3). In my experience, underwater insertion reduced the need for overtubes and/or long scopes in patients referred with redundant colons to 7% compared to 37% in historical controls using gas insertion[2]. Underwater insertion is the most important technical change that can be made when a colonoscopy fails because of redundancy and colonoscopy is reattempted at a later date. If you’re struggling with redundancy, withdrawing while removing all gas and starting over underwater in the same procedure is reasonable.

Water filling is also recommended in angulated sigmoids. Water filling straightens sigmoid angles, and importantly prevents barotrauma in the proximal colon, which occurs only in the setting of angulated sigmoids (Figure 2). Occasionally, if the lumen direction is not clear underwater, I’ll convert to carbon dioxide insufflation. When carbon dioxide is used, abdominal distention should be monitored by palpation.

Tip 4. Use right-left control more for steering

In angulated sigmoids, use both the up-down and right-left controls simultaneously for better steering. Torque on the insertion tube is also useful and generally rotation that puts the next turn in the up direction is best. Once in the turn, simultaneous manipulation of the up-down control and the right-left control provides the exquisite tip control needed for extremely angulated sigmoids. Slide by maneuver is appropriate, and frequent pull back on the insertion tube will help accordion the colon over the insertion tube and straighten the colon ahead of the instrument. If caution is applied to avoid diverticula and avoid pushing against fixed resistance, the risk of

perforation is negligible[1] (in our experience zero). The endoscopist should apply forward pressure that keeps the instrument tip in the turn with exquisite control of tip direction. I prefer the left-hand insertion tube grip to achieve this combination (Figure 3; Videos 1, 2), but some experts choose to have a second operator advance the insertion tube during passage of an extreme angle.

Tip 5. Get the loops out early

This rule applies to all colonoscopy, but in a difficult colon it is especially important. Particularly during and immediately after passage of the sigmoid, make sure there is good one to one transmission of forward movement of the insertion tube to scope advancement, and an appropriately short length of scope (no more than 40-70 cm of instrument) before proceeding. Once the loops are out, application of abdominal pressure to *prevent* development of new loops is very useful

Tip 6. Abdominal pressure: lots of it in the right place

Experienced colonoscopists understand that excellent abdominal pressure is sort of an art form. In the United States, we tend to rely on abdominal pressure more than position change for difficult insertions, primarily because patients are sedated with propofol, and there is often the impression they are more likely to aspirate if they are turned supine or into the right lateral decubitus position. Thus, the tendency is to rely more on abdominal pressure, and less on position change. As noted above, pressure should be applied to *prevent* loop formation when

possible. Thus, if the insertion tube is straight, and a loop begins to form, withdraw the loop, apply pressure, and reinsert with the goal of preventing the loop from re-forming.

Figure 4 shows good locations and directions for pressure. A common error is to push on the abdominal wall in a straight posterior direction. Pressure is often more effective when additional direction is added, such as medial from the left in the splenic flexure area, superior from the lower abdomen to counter transverse colon loops, and medial from the right to move the endoscope down the ascending colon. If pressure is ineffective but a loop in the colonoscope is felt through the abdominal wall, the loop should be withdrawn and pressure attempted on the location where the loop was felt. For any location of abdominal pressure, only one attempt at advancing the scope is needed to judge whether that location is effective. On a large patient, which is common in redundant colons, having 2 and even 3 people push on the abdomen can be effective. Massage of the abdomen, with a goal of catching a loop in the bending section or the insertion tube and pushing it forward sometimes works. Sometimes pressure prevents endoscope advancement, so during periods of no advancement, check this by removing the pressure. Persistence and determination by both the endoscopist and those applying pressure pays off.

Tip 7. Have an overtube available

In redundant colons, if all other measures fail, an overtube may help if the loop formation is occurring primarily in the distal colon (Figure 5). Overtubes are backloaded onto the endoscope and advanced into the colon. The insertion tube should be as straight as possible before activation and stiffening of a single use overtube, or before advancement of one of the older

reusable overtubes (if one is available). Once the overtube has been placed, if the instrument is not long enough it can be withdrawn for advancement of a push enteroscope through the overtube. A randomized trial of using the above measures versus placement of an overtube from the outset is warranted for failed colons due to redundancy.

Tip 8.

After success, note methods used in the procedure report. When the patient returns for follow-up, the same anatomic difficulties will still be present, and methods that failed the first time will fail again. Go straight to the method that had documented success.

References

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Figure legend

Figure 1. A, The tips of the 4 instruments relied on by the author to pass angulated sigmoids. From the left, the pediatric colonoscope (PCF-H190L) with tip diameter of 11.5 mm. Next, the ultra slim PCF-PH190L with 9.5 mm diameter tip. Next, the GIF-H190 upper endoscope with tip diameter 9.2 mm. Finally, the SIF-Q180 push enteroscope with tip diameter 9.2 mm and length 190 cm. B, The same instruments seen in maximum up and right-left hairpin. From the left, the pediatric colonoscope (PCF-H190L), the ultra slim colonoscope (PCF-PH190L), the upper

endoscope (GIF-H190), and the push enteroscope (SIF-Q180). Note that the upper endoscope and the SIF-Q180 enteroscope have shorter bending sections with a tighter turning radius. This enables them to pass turns that neither colonoscope may pass, though each has disadvantages with regard to length (GIF-H190) or challenges in instrument passage through the working channel (SIF-Q180).

Figure 2. A, With gas insertion the redundant colon elongates and dilates, making cecal intubation more difficult. B, Water insertion in the redundant colon keeps the colon shorter and narrower, preserving instrument length for cecal insertion. C, In the narrow and angulated sigmoid, gas insertion makes the angles more acute and creates the potential for barotrauma (see dilated right colon and red serosal tears). D, Water insertion in the angulated colon straightens the sigmoid, and eliminates barotrauma risk.

Figure 3. The left-hand insertion grip. The insertion tube is held between the fourth and fifth fingers, with or without torque on the insertion tube as appropriate for the next turn. Forward pressure into the turn is maintained by forward pressure of the hands and forearms. The left hand operates the up-down control, and the right hand provides simultaneous full right-left control. (See Videos 1, 2).

Figure 4. Useful hand placements and pressure direction for abdominal pressure. A, To counter sigmoid looping. B, To assist transverse passage. C, To counter transverse looping. D, To assist passage through the ascending colon

Figure 5. Overtubes for use in extremely difficult redundant colons. The black tube is a 60 cm reusable Olympus (Olympus Corporation, Center Valley, Pa, USA) overtube that is no longer commercially available. The white tube is the Pathfinder (Neptune Medical, Burlingame, Calif, USA) overtube, which has the advantage of being available in two lengths for both adult and pediatric colonoscopes, and easy conversion between the flexible to rigid modes.

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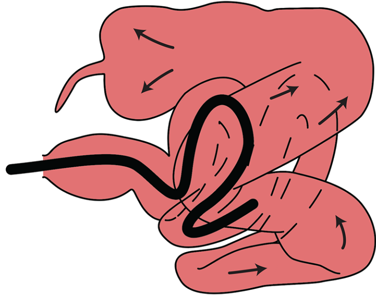
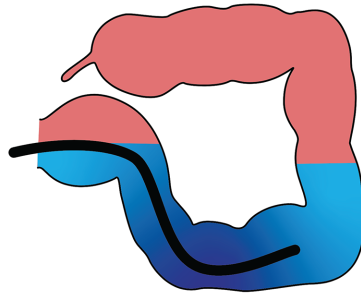
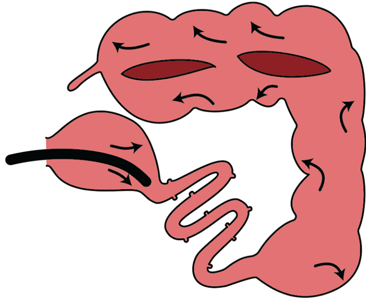
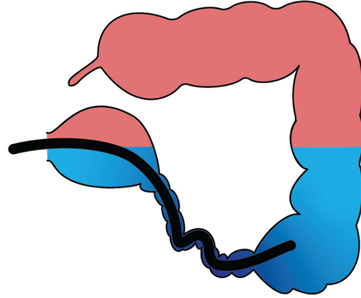
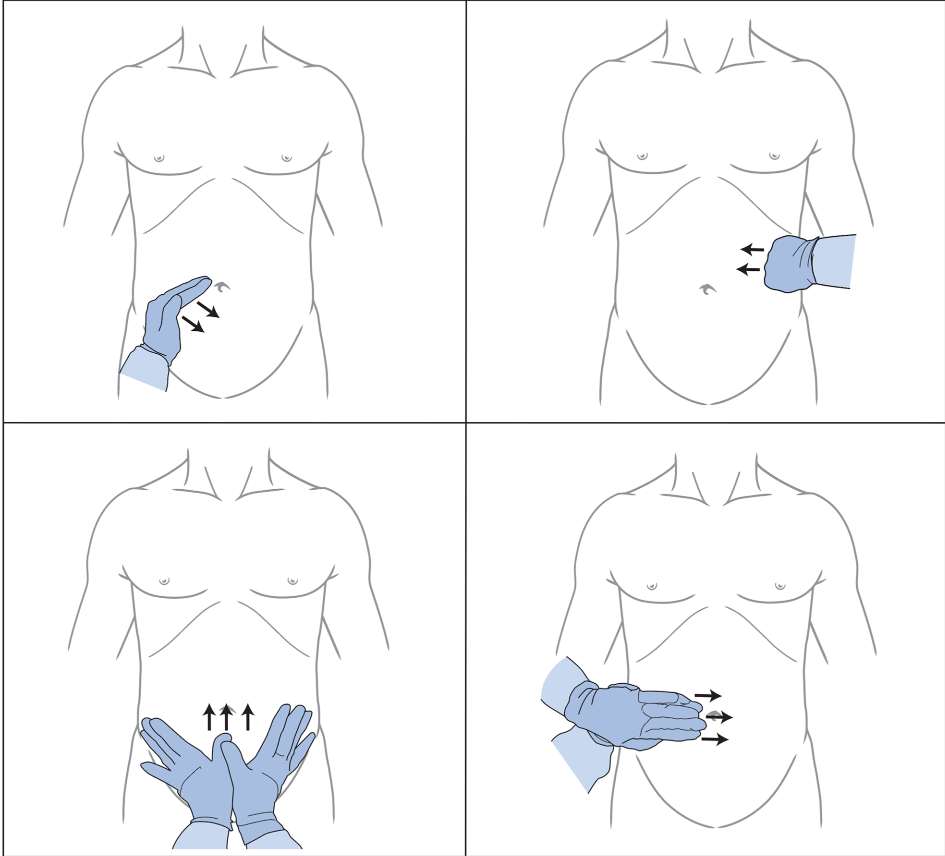
Pathfinder

	Gas Insertion	Water Insertion
Redundant Colon		
Angulated Sigmoid		



How can one safely and effectively reach the cecum in a long, redundant, and loopy colon? This is a question that several of us ask ourselves during colonoscopy. In this edition of Top Tips from Master Endoscopists, Dr Doug Rex, President of the ASGE, provides us with clear and precise insights for this important topic. Starting from endoscope selection and patient positioning to loop reduction, Doug, as always, does a masterful job in walking us through the steps on how to approach a patient during a difficult colonoscopy. HIs simple yet elegant ways on providing guidance on this and other topics related to colonoscopy are a testament to his skills as an educator and endoscopist.

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