Tips for Better Colonoscopy From Two Experts

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INTRODUCTION

Many American endoscopists may not yet be aware that Australia has become a major force in colonoscopy. The leader of this movement from "down under" has been Michael Bourke of Westmead Hospital in Sydney. Although I consider Michael's greatest contributions to the science of colonoscopy to be in the area of polypectomy, I and many others have been struck by his skill as a teacher of colonoscopy. He has a remarkable ability to articulate how technical aspects of colonoscopy should be performed, and perhaps at no time is this more evident than when he teaches on insertion technique. I have always thought that experienced colonoscopists do many things during insertion that are partly unconscious and seem to elude description, but Michael seems able to find the words.

At Digestive Disease Week 2011, the great colonoscopy teacher Jerry Waye created a session at which Michael and I were each asked to present on the topic "Lessons From a Lifetime of Colonoscopy." After the meeting, the editors of the *American Journal of Gastroenterology* invited us to turn these presentations into a piece for the Red Section. What follows is a distillation of the some of the points made that day.

Michael's piece is entitled "Ten Tips for Better, Safer Insertion," and mine is "Ten Changes I've Made in the Past Decade to My Approach to Routine White-Light Colonoscopy." While hardly a comprehensive discussion of colonoscopy technique, we hope these comments will be useful to some as we all strive to perform safer and more effective colonoscopy.

—Douglas K. Rex

TEN TIPS FOR BETTER, SAFER INSERTION

1. Anticipate altered sigmoid anatomy.

The rectosigmoid angle may be very acute, particularly in (i) elderly patients with stenosing diverticular disease; (ii) patients with a history of previous low abdominal or pelvic surgery, such as previous abdominal hysterectomy; and (iii) young women. Even when this angle is easily overcome, it is best not to push forcefully through, elongating the sigmoid colon on the instrument, but rather to keep a short scope and use torque steering and rotation of the insertion tube (IT) (particularly clockwise) to reach the descending colon.

2. Never push against fixed resistance.

Never try to push through fixed resistance. Force does not work in endoscopy. This is the critical rule in avoiding perforation from scope passage. Use particular care to not stress the colon wall when the colon is abnormal—e.g., in radiation colitis or severe inflammatory bowel disease.

3. Maximize sensory feedback from the IT.

Hold the IT with your fingers as if it were a pencil (not like a tennis racket). This will maximize sensory feedback from the tip of the instrument and inform on the amount of tension within the IT. When the scope is straight, the IT at the level of the anus will feel relatively "floppy," and it seemingly falls onto the bed as it exits the anus. In contrast, when the scope is severely angulated or looped, the IT will feel stiff, and it does not fall on the bed.

4. Master the left colon.

Approximately two-thirds of total insertion time should be spent in the left colon. All loops should be reduced and the scope straight before you move beyond the splenic flexure.

In general, this is the most difficult segment during insertion. The sigmoid colon is more like an accordion than any other portion of colon and can be stretched to as much as 70–80 cm, but it will shorten to about 25–30 cm with a straight scope located in the cecum (at 65–70 cm of insertion). Thus precise anatomical location within the sigmoid by virtue of distance on insertion is very unreliable. It may be useful on withdrawal. If a polyp is not removed on insertion, it is very important to precisely note its position with a straight scope so that it can be readily identified on withdrawal—its clock-face position within the lumen may have completely changed. You may even consider leaving a suction mark on the adjacent mucosa or taking a biopsy to aid localization on withdrawal. The sigmoid mesentery is highly variable in length and mobility, and thus in some patients the sigmoid colon can pass well into the upper abdomen before making a loop back down to the descending colon. In contrast, after hysterectomy, the sigmoid tends to be rather angulated and may be fixed into the area previously occupied by the uterus. This can create difficulties during insertion.

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In general, because of the shape of the pelvis with the curved sacrum, the colonoscope will naturally pass from posterior to anterior, and in more than 80% of cases it will then take a clockwise anteroposterior spiral into the descending colon, sometimes forming a true alpha loop (**Figure 1**). Some degree of upward looping with a convex arc forming toward the diaphragm always occurs as the colonoscope is advanced through the sigmoid. If one advances beyond the rectum into a long straight (often relatively featureless) segment, this often reflects a lengthy or mobile sigmoid mesentery, and a large loop may well be forming. In this situation the colonoscope will often pass relatively easily into the descending colon, forming a relatively open N loop (**Figure 2**). Eventually such a loop will cause pain, and the endoscopist will be aware of its formation because of non-progression up the descending colon, the excessive length of instrument inserted, and the long straight insertion phase beyond the rectum. Such a loop is easily withdrawn by application of clockwise torque of between 90° and 180° and slow withdrawal of the instrument. From this point it is often easy to advance up to the splenic flexure. If clockwise torque doesn't work, always consider counterclockwise torque on the IT, and often in this case the turn may exceed 180 degrees. Applying loop resolution techniques when halfway through a loop will only cause the colonoscope to drop back below the loop without genuine progress being achieved.

Almost all colonoscopy procedures require some degree of sigmoid loop resolution. The scope must be straight at the splenic flexure so that the remainder of the procedure can proceed smoothly, but still a sigmoid loop may tend to re-form, and thus, while moving through the proximal colon, it is important to repeatedly straighten and pull back to keep the sigmoid straight. On occasion, right hypogastric (directed medially and downward) or nonspecific left iliac fossa pressure may assist in maintaining a straight sigmoid.

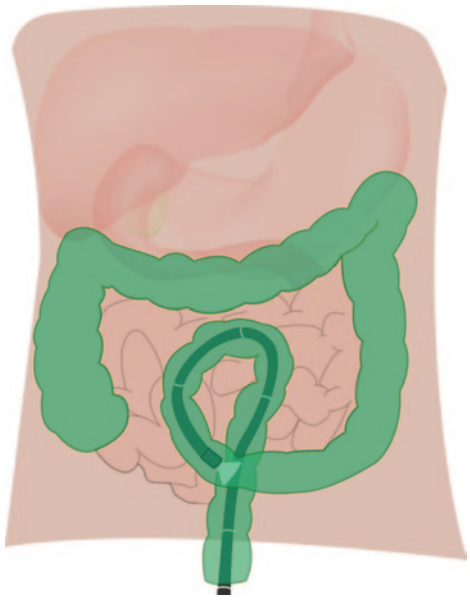

Figure 1. A conventional alpha loop: The colonoscope passes from posterior to anterior from the rectum to the sigmoid and then takes a clockwise anteroposterior spiral into the descending colon.

5. Problem-solve in an algorithmic fashion.

The most common problems that result in failed cecal intubation and their potential solutions are listed in **Table 1**. Knowledge (or a reasonable estimate) of the location of the scope tip and the IT's status is necessary to apply these strategies successfully. If this is not obvious, it can be approximated by assessing the amount of scope inserted and the tension in the IT and applying knowledge of the colonic anatomy to that point. A resistance-free insertion

Table 1. Colonoscopy insertion problem and sequential response strategy

	Sequential response		
Problem	**1**	**2**	**3**
Stenotic or sharply angulated—fixed rectosigmoid junction or sigmoid colon	Right hypogastric pressure directed medially and downward above the pubis (**Figure 4**)	Change position to supine ± pressure as in 1	Right lateral position or change to pediatric colonoscope or gastroscope
Long resistance-free left colon forming an N, alpha, or complex loop	Recognize, advance to the end of the loop, and resolve with clockwise torque	Resolve with slow anticlockwise torque often >180° (for a reverse alpha loop)	Withdraw the scope to the rectum or until it is straight, apply specific pressure, and re-insert slowly
Trouble passing the splenic flexure, high and mobile splenic flexure, may also be looping sigmoid	Apply variable stiffener and aim for 12 o'clock ± left upper quadrant pressure just beneath the left costal margin pushing postero-inferiorly	Supine position ± pressure as in 1 or right hypogastric or left iliac fossa pressure	Right lateral position ± pressure as in 1 and/or 2
Non-progression in mid-/proximal transverse	Apply variable stiffener ± left upper quadrant pressure	Right hypogastric or left iliac fossa pressure	Supine or right lateral position
Scope in the ascending colon but cecum in the distance	Use gentle forward and backward movements while aspirating air and applying anticlockwise torque to pass the scope down the medial wall of the ascending colon, aiming for the ileocecal valve	Adopt a halfway-back position (shoulders rotated back toward the supine position but not the patient's hips) ± left iliac fossa pressure and advance aiming for 12 o'clock	Supine or right lateral position

Assumptions and caveats: The patient is initially in the left lateral position, the scope is straight, and the patient is sedated. On occasion, a change in position may be a preferred strategy before pressure, especially when the patient can be repositioned with relative ease.

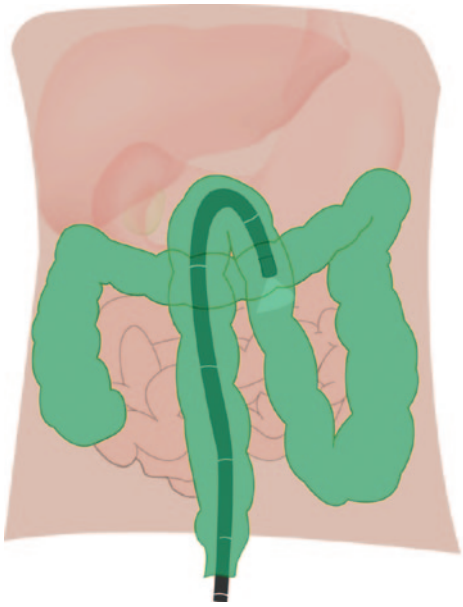

Figure 2. An open N loop, which is encountered with a loose sigmoid mesentery: If, after the rectosigmoid junction is passed, a long straight, resistance-free and often relatively featureless colonic segment is encountered, then this type of loop may be forming.

through featureless colon to 80 cm with few angulations suggests the formation of a large sigmoid loop. This will need to be resolved before you attempt to advance to the right colon. In contrast, a straight 50-cm scope at the splenic flexure with non-progression on insertion suggests a mobile sigmoid or "high" splenic. Use of the stiffener or specific pressure will control the problem.

6. Change solutions quickly.

Attempt each response only once or twice. If a solution does not work after two attempts, then you are unlikely to succeed with this strategy. The next logical step in the hierarchy should be chosen. Expert colonoscopists who quickly and painlessly intubate the cecum are generally not more dexterous than their less experienced colleagues, but make better decisions more quickly without repetition of maneuvers that have failed previously. **Table 1** shows the preferred initial strategies, but this is not an exhaustive list.

7. Change instruments in the difficult sigmoid.

In general, pediatric colonoscopes allow easier passage of the sigmoid, and many use them as the preferred instrument. Sometimes even a gastroscope may be necessary. When compared with an adult colonoscope, the pediatric colonoscope and gastroscope have smaller tip diameters (12.3, 11.3, and 8.8 mm, respectively) and take a more compact arc with complete "up" movement to achieve 180° angulation (6.6 × 5.6 cm for an adult colonoscope compared with 3.8 × 3.4 cm for a gastroscope) (**Figure 3**). Hence narrow, severely angulated corners can be traversed more easily. Even when a gastroscope is used, the cecum can often be easily reached, as the relatively fixed sigmoid colon acts as a splint, tending not to loop, and thus instruments with short insertion lengths will succeed.

8. Be subtle in passing the hepatic flexure.

As the scope has often "buckled up" the splenic flexure, most often one can shorten into the proximal transverse by withdrawal and clockwise torque (beyond the mid-transverse angulation). Try to enter the ascending colon with only 70–90 cm of scope inserted. Often one can rotate clockwise into the ascending with gentle advancement and then, by aspirating and gentle backward and forward movements, proceed to the cecum. Remember that brisk or forceful movements when the scope is in the right colon will result in looping of the relatively unfixed left colon. In ideal insertion conditions, the length of instrument inserted at the anus results in an equal distance of endoscope tip progression in the colon. This is termed one-to-one progress. During insertion, loss of one-to-one progress indicates that the scope is bowing. (Consider the situation in gastroscopy when advancing to the pylorus. The flexible endoscope will bow for a variable distance on the greater curve of the stomach, and then, as it is splinted by the fixed gastric wall, progress toward the pylorus will resume.) This may occur after the mid-transverse angulation (or in the left colon) and is acceptable if, after 5–8 cm of painless insertion, with marginally increased resistance, progress resumes. The endoscopist should always unconsciously note when loss of one-to-one progress occurs, as this redundant length of inserted endoscope requires withdrawal after the next corner. At the hepatic flexure this can be simply completed by clockwise torque, aspiration, and withdrawal into the ascending colon.

If there is difficulty in passing the hepatic flexure, rotate the patient first halfway back to supine (moving only the shoulders) and then, if needed, to full supine (see below). At the hepatic flexure the colon assumes an anteroposterior direction as it passes from the relatively mobile anterior transverse to the posteriorly positioned ascending colon; a simple halfway-back rotation of the patient will open up this flexure and often allow easy scope passage.

9. See the medial wall of the cecum.

All landmarks should be confidently identified in the cecum. The scope should be able to comfortably touch the appendiceal orifice. This indicates that deep cecal intubation has been achieved. The ileocecal valve can be considered as being located on the medial or posteromedial wall, and in consideration of this landmark, generally the anterior and lateral walls of the cecum are easily seen. A frequent blind spot is the region immediately inferior to the ileocecal valve, and between that point and the appendiceal orifice. Difficult-to-detect sessile lesions that may later lead to interval cecal cancers may lurk in this area. If difficulty is encountered, it is crucial that a deliberate effort be made to view this area. This can be done via aspiration of air and application of counterclockwise torque, hugging the medial wall of the ascending colon and working gently backward and forward with 2-cm movements to insert the tip of the colonoscope beyond the ileocecal valve.

10. Be willing to quit.

As a general rule, if the cecum has not been reached within 20 minutes or progress during insertion comes to a halt for more than 10 minutes, then, particularly for trainees, the situation should be reconsidered. Always remember that safety is the primary objective.

Complete colonic examination (non-endoscopic alternatives exist) may not be necessary, and as technical difficulty increases, the balance of procedure-related risk against clinical benefit may reach a tipping point where the benefit does not justify the risk. When difficulty is encountered, trainees should involve their teacher or supervisor early, as at this point he or she may be able to talk them through the resolution of the problem as an educational exercise. The trainees who ultimately complete their training with the most skill and technical insight are those who involve their teachers early. If assistance is delayed, then the consultant may need to take over or, worse, the procedure may need to be aborted.

TEN CHANGES I'VE MADE IN THE PAST DECADE TO MY APPROACH TO ROUTINE WHITE-LIGHT COLONOSCOPY

1. Use split-dose or same-day bowel preparations.

Every bowel preparation can be split so that at least half of it is given on the morning of the examination. I have lots of visitors to my colonoscopy suite, and our fellows rotate through our hospital as well as our Veterans Administration and county hospitals. The most common comment I get from visitors and from our fellows is that they are surprised by how consistently good our bowel preparations are. I believe the basic change that has resulted in this improvement is split dosing of preparations (and, more recently, same-day dosing for afternoon colonoscopies).

There is no remaining excuse for not split-dosing. There is clear evidence that the risk of aspiration is not affected by ingestion of clear liquids up until 2 hours before the time of sedation. Further, the actual increase in patients' having to stop to go to the bathroom on the way to the endoscopy unit is quite small and is a tiny price to pay for the benefits of split dosing.

2. Insufflate with carbon dioxide.

Carbon dioxide insufflation eliminates the problem of prolonged postprocedural discomfort from gas pain. Carbon dioxide must be considered when there is an increased risk of pneumatic injury, including colonoscopic decompression for acute colonic pseudo-obstruction, colonic stricture dilation, stent placement, and colonoscopy in patients with severe colonic diverticular disease. However, we now use it for all colonoscopies. My experience is that the combination of carbon dioxide and modern sedation (propofol) has allowed colonoscopy to become a truly painless procedure for the overwhelming majority of patients.

Figure 3. A comparison of the 180° turning arcs of (from right to left) adult and pediatric colonoscopes and a gastroscope. Sometimes in an acutely angulated or severely stenotic sigmoid colon, whether from diverticular disease or pelvic adhesions, a gastroscope may be preferred.

3. Use water immersion for redundant colons.

Several randomized controlled trials have established the benefit of water immersion during the insertion phase of colonoscopy in patients who are unsedated or receiving minimal sedation. A less well-known benefit of water immersion is facilitating cecal insertion in the patient with the very redundant colon. We have all had the experience of running out of colonoscope in a redundant colon (that may also be dilated), despite our best efforts to prevent loop formation. When you know the colon is redundant, the use of water immersion will keep a dilated colon collapsed and straighter and, in my experience, greatly reduce the difficulty and time for insertion in a very redundant colon. Consider trying this method in examinations that you know will be difficult because of redundancy.

4. The left-hand scope grip.

Videoendoscopy has enabled us to take the control head away from our faces. Some examiners naturally develop the left-hand scope grip, in which the insertion tube (IT) is sometimes placed between the fourth and fifth fingers of the left hand. Torque can be applied to the instrument before it is gripped between the fourth and fifth fingers of the left hand; and if there is enough strength in those fingers, the torque can be maintained. Short-distance in-and-out control of the IT can be achieved in this grip by movement of the left forearm. The advantage of this grip is that it allows simultaneous movement of the up/down control with the left hand and the right/left control with the right hand. In my opinion, this allows a degree of precision in movement that in some circumstances is unachievable with the right hand on the IT. I admit that I have a bias against operating the right/left control with the left thumb, because I believe the movement is not ergonomically sound. In any case, it is extremely difficult to simultaneously operate the up/down and right/left controls with the left thumb.

In addition to performing detailed therapeutic work, the left-hand scope grip can be useful in passing complex turns in the sigmoid colon.

5. Expand complication awareness.

The traditional complications of colonoscopy are perforation and postpolypectomy bleeding. I believe that two substantial complications that are not sufficiently discussed and are surprisingly common are aspiration pneumonia and splenic injury. Both are potentially related to the increasing use of deep sedation. Remember that a deeply sedated patient loses protective reflexes that prevent aspiration. Be extremely careful when a patient receiving propofol begins to hiccup, as often they soon begin refluxing. In addition, be careful when a deeply sedated patient is turned to the supine or the right lateral decubitus position, as these positions

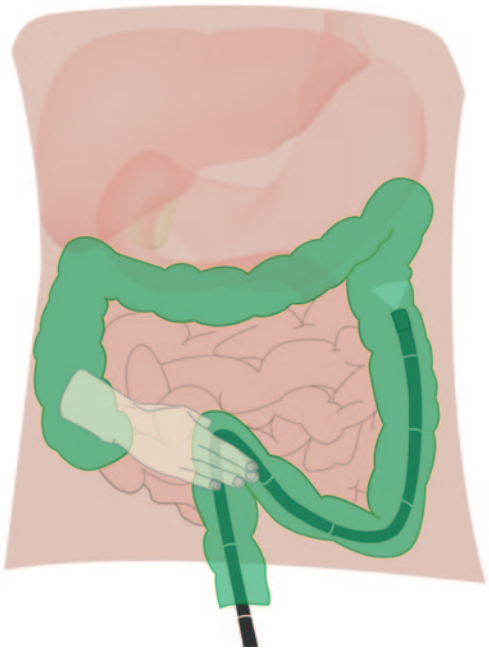

Figure 4. Application of right hypogastric (suprapubic) pressure. This technique will control the sigmoid colon that is bowing to the right or anteriorly and is a useful first step when sustained loss of one-to-one progress occurs (in either the left or the right colon).

can facilitate gastroesophageal reflux. In my experience, some anesthesia specialists are insufficiently aware of this risk. It is critical to be vigilant regarding the risk and immediately ready to turn the patient into a safer position, as well as to have suction available.

In addition, the use of deep sedation might encourage the formation of large or complex bends and loops in the colonoscope. Creation of complex loops, and perhaps their removal (with torque?), is potentially a factor that stresses the splenocolic ligament and could result in splenic avulsion and bleeding. We have seen several splenic injuries in our unit, and a number of the insertions involved trainees. Although the real cause and incidence of these injuries are uncertain, we must always use safe insertion technique, as outlined by Dr Bourke, in the deeply sedated as well as the moderately sedated or unsedated patient.

6. Cold snaring technique.

The prevalence of diminutive polyps detected during colonoscopy is increasing in recent colonoscopic studies. The overwhelming majority of these polyps will never harm the patient. We can avoid harming the patient in the process of removing them by avoiding electrocautery. For 1- and 2-mm lesions and diminutive lesions that are difficult to approach endoscopically (usually in the upper left endoscopic field), the use of a large-capacity or jumbo cold forceps is appropriate. For most diminutive lesions, I prefer the cold snare. Cold snaring technique is quite different from hot snaring. When hot snaring is used for diminutive polyps, typically the polyp and perhaps a tiny amount of normal adjacent mucosa are resected. The polyp is tented into the lumen, and the lumen is deflated to improve protection of the muscularis propria. With cold snaring, it is better to take both the polyp and the strip of normal mucosa 2–5 mm around the polyp. Tenting is unnecessary and can impair retrieval of the polyp. Deflation is also unnecessary. Proper cold snaring technique involves pushing the snare tip into the wall at a point 2–5 mm away from the polyp in order to anchor the tip and ensure that the entire polyp and a strip of adjacent mucosa will be removed.

7. Think flat, depressed, and serrated.

The biggest changes in detection over the past decade involved the recognition that as many as half of the precancerous lesions in the colon are not "polyps" but "flat lesions." These include the very prevalent flat adenomas, the relatively rare depressed adenomas, and proximal colon serrated lesions. A modern colonoscopist must be familiar with the spectrum of white-light appearances of these lesions. Detection rates of flat lesions, and particularly serrated lesions, are dramatically different between endoscopists, even between gastroenterologists. One must develop an eye for these lesions. Good examination technique is partly technical and involves adequate luminal distention; adequate cleanup of stool, mucus, and bubbles; adequate time; and "working the folds." However, I am surprised at how often I am watching a fellow perform colonoscopy and he or she exposes a polyp or serrated lesion and keeps right on withdrawing, not having recognized the lesion on the screen. Right now we do not know a good way to change this except to be aware of the spectrum of appearances of these lesions and to be constantly vigilant. Every subtle alteration in the color, surface shape and contour, and loss of a vascular pattern must be inspected. Endoscopists must know the "mucus cap" and other signs of serrated lesions.

8. Examine the right colon twice.

There is no question that colonoscopy is less effective in preventing colorectal cancer on the right colon compared with the left colon. Flat, depressed, and serrated lesions all predominate in the proximal colon. Because of the subtlety of lesions in the right side of the colon, I now usually examine the right colon twice. I do this most consistently when the initial examination identifies one or more lesions, because that is a predictor that lesions have been missed. The second examination can be performed in either the forward view or the retroflex view. Retroflexion in the right colon is a relatively easy maneuver if the instrument shaft is straight and there is good one-to-one transmission during insertion. Retroflexion in the proximal colon should be mastered in any case, because it can be invaluable in the resection of some polyps located on the proximal sides of haustral folds.

9. Expand your snare options.

Over the past decade, I have seen my referral practice for endoscopic resection of large sessile polyps change. Whereas we used to see lesions that were simply large, we now see polyps that tend more to be flat or very difficult to access. Not unexpectedly, these

lesions have often been partially removed, which makes their endoscopic resection more difficult because the polyp does not lift normally with injection. Everyone encounters these flat lateral spreading tumors. Alternative snares, particularly the spiral snare (Olympus, Center Valley, PA) as well as ultrathin snares, have been a very important tool in improving the ability to resect very flat lesions. The spiral snare has a propensity to grip normal tissue, a factor that must be understood, or the novice can ensnare more tissue than desired. However, it is this same feature that allows the spiral snare to remove very flat lesions.

10. Consider closing high-risk polypectomy sites.

Although we do not have data from randomized controlled trials to support the practice, my own belief is that prophylactic clipping is an effective way to reduce complications associated with large polypectomy defects. At a minimum, I would consider zippering polypectomy defects closed when patients must go on an anticoagulation or antiplatelet agent such as clopidogrel, when a polyp in the ascending colon has been particularly hard to reach, when there is any question about a deeper injury during polypectomy, or when the patient has been referred from a remote area where there is less endoscopic expertise, particularly if you consider that a postpolypectomy bleed or other complication might not be well tolerated. Prospective randomized controlled trials are needed to understand whether this advice is wise.

CONFLICT OF INTEREST

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