Colonoscopy core curriculum

This is one of a series of documents prepared by the American Society for Gastrointestinal Endoscopy (ASGE) Training Committee. This curriculum document contains recommendations for training, intended for use by endoscopy training directors, endoscopists involved in teaching endoscopy, and for trainees in endoscopy. It was developed as an overview of techniques currently favored for the performance and training of colonoscopy and to serve as a guide to published references, videotapes, and other resources available to the trainer. By providing information to endoscopy trainers about the common practices used by experts in performing the technical aspects of the procedure, the ASGE hopes to improve the teaching and performance of colonoscopy.

INTRODUCTION

Identifying the skills required to perform colonoscopy safely, effectively, and comfortably is the aim of this document. Specifics on training and competency assessment of these skills are also covered. Additional information on endoscopy training can be found in the ASGE's "Principles of Training in Gastrointestinal Endoscopy" and the combined professional societies' core curriculum.[1,2] These core documents are pertinent and are recommended to colonoscopy trainers and trainees alike.

GOALS OF TRAINING

Trainees are required to learn how to maximize visualization of the colonic and terminal ileal mucosa, minimize patient discomfort, and ensure the appropriate identification, removal, or ablation of lesions and other therapeutic techniques. These skills come with mastery of the individual core elements of the procedure. The core technical and cognitive skills are listed in Table 1 and are covered in detail. The core skills to be covered can also be classified by the Accreditation Council for Graduate Medical Education competencies listed in Table 2.

Training faculty

This issue is covered in depth in the document "Principles of Training in Gastrointestinal Endoscopy."[1] In general, teaching faculty should not only be expert endoscopists who are committed to the entire training process (teaching and assessment), but facile in the skills involved in instruction. Program directors need to ensure that an adequate number of such individuals are available to ensure quality teaching and that some form of monitoring of faculty teaching occurs to ensure that the standards are maintained.

Facilities

Training programs must maintain an environment that is conducive to quality endoscopy education. This includes not only adequate procedural equipment, staffing, and compliance with work-hour guidelines but also from a departmental and institutional standpoint as well.[3] These issues are addressed succinctly in the joint ASGE American College of Gastroenterology document "Ensuring Competence in Endoscopy," in which they state:

Training in gastrointestinal endoscopy should take place within the context of a global clinical training program in the fields of adult or pediatric gastroenterology or general surgery. These training programs must be recognized by the Accreditation Council for Graduate Medical Education or the American Osteopathic Association and should exist within institutions where they are supported by the presence of accredited training programs in internal medicine, pediatrics, general surgery, radiology, and pathology.[4]

Endoscopic experience

Initial cognitive training. Before fellows beginning hands-on training, some basic cognitive and technical skills are required. Knowledge of GI anatomy, colon preparation, procedure indications/contraindications, sedation, and airway management are essential. These can be taught by using various methods from didactic lectures series, core reading requirements, and even multimedia educational tools.

Preprocedure assessment. Training in the techniques of colonoscopy must go hand-in-hand with the development of good preprocedure assessment habits. Staff should instruct trainees to review pertinent medical information (eg, surgical history, medical history, medications) on each patient.[5] A review of previous sedation issues and previous endoscopic findings should be reviewed. A thorough knowledge of how each of these factors relate to colonoscopy indications, contraindications, complications, informed consent, patient education, and anticoagulation management are essential and should be taught to all trainees.[6-8] Full reviews of these topics are beyond the scope of this document but are covered in

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TABLE 1. List of the core motor and cognitive skills required to be competent in colonoscopy

Motor	Cognitive
Correctly holding the colonoscope	Anatomy
Use of the colonoscope controls	Patient selection
Colonoscope insertion	Preparation
Colonoscope advancement	Colonoscope selection
Tip control	Informed consent
Torque	Sedation management
Lumen identification	Assessment of indication and risks
Withdrawal/mucosal inspection	Pathology identification
Loop reduction	Therapeutic device settings
Angulated turns	Integration of findings into management plans
Terminal ileum intubation	Report generation and communication
Biopsy	Complication management
Snare polypectomy	Quality improvement
	Professionalism

ASGE guidelines referenced and are also available on the ASGE Web site (http://www.asge.org).

Bowel preparation. Trainees should understand the critical importance of proper bowel preparation for optimal visualization, safety, and ease of a colonoscopic examination. Trainees should acquire the knowledge to optimize the bowel preparation on the basis of efficacy, compliance, patient satisfaction, and comorbid conditions. Trainees should become familiar with the variety of preparations available including the standard large-volume polyethylene glycol electrolyte solutions, smaller volume polyethylene glycol electrolyte solutions, and pill formulations. In addition, the trainee should appreciate that the addition of prokinetic agents, by using split-dose regimens and adding flavoring to polyethylene glycol solutions, may help improve patient compliance with the bowel preparation. Trainees should be able to describe the complications associated with bowel preparation. Regardless of the bowel preparation selected, the trainee must understand that attention to proper patient instruction is essential in obtaining good results. Further information on this topic is available in the literature and the ASGE document entitled "Preparation of Patients for Gastrointestinal Endoscopy."[9]

Sedation, patient management, and physician behavior during colonoscopy. Maintenance of patient comfort, dignity, and privacy are of paramount importance during colonoscopy and are skills best taught by example, supplemented with feedback and constructive criticism to the trainee. During the procedure itself, communication and feedback between the colonoscopist, assistant, and patient are essential for patient comfort and safety, but these skills may be underdeveloped by the early trainee focused on the technical aspects of the procedure. In particular, good patient communication is extremely important in relieving patient anxiety and limiting discomfort and should be an important part of colonoscopy training. The art and science of moderate (conscious) sedation must also be mastered by trainees of colonoscopy. Advance cardiac life support or similar training is advisable. In addition, the trainee must be able to assess whether a patient may require the assistance of an anesthesiologist for sedation. ASGE documents and other published guidelines are very helpful in the teaching process.[10-12] Finally, a positive teaching environment must be maintained in the procedure room at all times and interruptions kept to a minimum. Individual teaching styles vary, but the trainer must foster a positive, professional learning environment by offering constructive comments.

Postprocedure management. After a colonoscopy, communication of findings, therapeutic results, and plans for follow-up must be emphasized to the trainee as an extremely important phase of the procedure. This involves both discussions with the patient, family when involved, and effective communication to the referring health professional. The importance of timely and complete procedure reporting cannot be overemphasized, and the need to use accepted nomenclature to describe findings must be imbued in the trainee.[13] Trainer and trainees alike should use the accepted minimum standard terminology in their computerized procedure reporting system or dictated reports to foster standardization of reporting and data collection throughout the endoscopy community.[14]

Initial hands-on training

Initial hands-on experience. In addition to the basic cognitive skills outlined, there are some basic motor skills that one should ideally have before starting patient colonoscopy. These include an understanding of the colonoscope mechanics, use of colonoscope controls, and rudimentary skills at colonoscope advancement and mucosal inspection. These motor skills have traditionally been taught at the bedside, but an increasing emphasis has been placed on teaching these early skills with the use of either mechanical, animal, or computer simulation aids. For decades, trainers have used various mechanical teaching aids such as latex colon models. Recently, the use of computer simulation models has become more widespread, and research has also shown this to be effective in advancing early skills and even reducing patient discom-

TABLE 2. Accreditation Council for Graduate Medical Education competencies*

1. Patient care: assessment of relevant history, imaging, physical examination, recommendations for diagnostic and/or therapeutic endoscopic options, development of management plan, and performance of essential procedures with special attention to assessment of competent performance of diagnostic/therapeutic endoscopy
2. Medical knowledge: assessment of clinically applicable cognitive skills that underlie the practice of GI endoscopy and the ability to apply this knowledge in clinical decision making regarding endoscopic procedures
3. Interpersonal and communication skills: assessment of skills required for effective interactions with other health care providers and patients and their families
4. Professionalism: assessment of sensitivity and responsiveness to patients, staff, and colleagues while performing endoscopy
5. Practice-based learning and improvement: assessment of fellow's ability to analyze and evaluate their endoscopic experiences and implement strategies to continually improve their quality of endoscopic practice, the ability to apply knowledge of study design and statistical methods to the appraisal of endoscopic studies
6. System-based practice: timely and accurate reporting of procedure results, use of standard terminology and assessment of the ability to understand, access, and use resources and providers such as surgeons, oncologists, pathologists, and radiologists to provide optimal endoscopic care, the ability to apply evidence-based, cost-conscious strategies to prevention, diagnosis, and management of GI diseases

*Each of the skills described in this document can be classified within the competency framework put forth by the Accreditation Council for Graduate Medical Education.

fort in the early stages of training.[15-17] Appropriate posture, body positioning, and hand/limb mechanics by the endoscopists are also critical habits to correctly establish from the onset of training to minimize the risk for long-term overuse injuries in the future endoscopist.

Rectal examination. Before the introduction of the colonoscope, trainee should understand the importance of a careful perianal examination. A digital rectal examination is also essential to lubricate the anal canal, assess the rectal vault for palpable lesions or other abnormalities, examine the prostate gland in men, and palpate adjacent structures in women.

Colonoscope advancement techniques. The earliest skills that the fellow must master are appropriate colonoscope navigation skills. It is especially important to teach good habits early to prevent poor techniques from becoming ingrained in the trainee. Ideally, teaching the 1-handed steering technique is generally recommended. In this method, the right hand remains on the colonoscope shaft, and steering is accomplished primarily with the use of the up-down knob alone accompanied with right-left torque of the colonoscope shaft. This allows for continuous control of the colonoscope and, with proper torque technique, helps prevent the formation of loops. A 2-handed technique, in which the right hand is intermittently removed from the colonoscope shaft and used to adjust the right-left knob, can be effective, especially in particularly angulated turns but in general is not recommended as the main navigation technique for efficiency purposes. More on these issues can be found in endoscopy texts.[18-21]

Prevention of looping. A difficult challenge in colonoscopy is the prevention and reduction of looping of the colonoscope. The endoscopist in training should be taught the principles of loop formation and the rationale for loop reduction techniques before performing his or her first colonoscopy. All trainees should understand the need for frequent withdrawal of the colonoscope with appropriate use of torque. The previously referenced general textbook chapters address this issue, and excellent demonstrations of these techniques exist in the ASGE instructional videos "Colonoscopy and Polypectomy" and "Colonoscopy Insertion to the Cecum" (Appendix 1).

Transabdominal pressure. The importance of external transabdominal pressure to assist advancement of the colonoscope should not be underestimated. The techniques of applying pressure should be included in the training of both colonoscopists and colonoscopy assistants. Abdominal pressure as an aid for colonoscopy has been well described but is often not applied in any standardized fashion.[22,23] An colonoscopist can determine fairly quickly whether an application of transabdominal pressure is helping to advance a colonoscope. If not helpful, other locations should be tried in a timely manner.

Change in body position. Trainees should understand the importance of using changes in patient position to aid in colonoscope advancement. Repositioning the patient from the left lateral decubitus position to his or her back may be useful when looping occurs, particularly when advancing from the hepatic flexure to the cecum. This may also allow for easier and more precise application of external abdominal pressure. Some colonoscopists find the right lateral decubitus position or even the prone position also to be potentially helpful when having difficulties achieving cecal intubation, although these positions are not commonly required.[24]

Mucosal visualization. Although many early trainees focus on the goal of reaching the cecum, they must be reminded that the entire purpose of the examination is the careful inspection of the mucosa during colonoscope withdrawal. It is critical to teach fellows good mucosal visualization habits that include a slow methodical withdrawal with circumferential inspection of the mucosa. The importance of suctioning retained luminal contents and intermittently readvancing the colonoscope to look be-

hind folds is also critical. Although tedious for instructions at times, especially early on in training, scanning patterns will improve and become more efficient as their interpretive skills grow.

Retroflexion. The inclusion of a retroflexed view of the rectum is an essential element of colonoscopy. Trainees must be aware that acquired anatomic changes such as scarring from radiation or proctitis may preclude this maneuver, but in selected cases, insertion of a smaller-caliber colonoscope can be used to complete the examination. Careful observation of the anal canal during colonoscope withdrawal is important in these cases as well to identify causes of rectal outlet bleeding.

Intermediate cognitive and hands-on training

Once hands-on training is under way, it is expected that fellows' cognitive skills in pathology recognition and management will grow.

Pathology recognition. As mucosal inspection skills develop, the efficiency of mucosal visualization and the independent identification of mucosal pathology such as polyps or other mucosal lesions will improve. A trainee must also understand what management is indicated or contraindicated. These cognitive skills grow primarily with repetition of seeing similar findings presenting themselves in different ways. This requires adequate training volumes to ensure fellows experience a broad spectrum of disease and with sufficient repetition. However, the patient-based repetition can be augmented with the use of teaching aids such as atlases of endoscopic images, self-education resources such as the ASGE's Gastrointestinal Endoscopy Self-Assessment Program and the Online Learning Center at https://www.extendmed.com/asge/. Formal assessment of these interpretive skills by training programs via examinations based on endoscopic images are an important part of training because they can help identify trainees that need further education but also serve as a strong motivating factor for trainees to use the multiple learning resources describe previously.

Terminal ileum intubation. The techniques for entering the ileum are well demonstrated in the ASGE teaching video "Colonoscopy and Polypectomy" (Appendix 1). If attempted routinely, visualization of the terminal ileum can be achieved in as many as 95% of cases without complications.[25] Attempts to intubate the terminal ileum by the trainee should be encouraged during routine colonoscopy regardless of the procedure's indication. This will ensure that the trainee attains proficiency in the technique for situations when ileoscopy is essential.

Estimating polyp size. According to surveillance guidelines, the size of the polyp influences the timing of subsequent evaluations.[26] Trainees need to understand that there are various methods to estimate the size of a polyp. In addition to estimating entirely by eye, trainees can judge size by placing open biopsy forceps with a known jaw span alongside the polyp.

Basic forceps biopsy. Once pathology is identified, it is often necessary to obtain biopsy specimens for histologic confirmation. The technique of forceps biopsy during colonoscopy is straightforward and similar to that in upper GI endoscopy. Specific biopsy recommendations for all disease states are beyond the scope of this document.

Trainees should become proficient in cold biopsy (noncautery) for sampling of the mucosa to investigate for histologic abnormalities and for therapeutic removal of diminutive polyps of roughly 3 mm or less. Trainees should understand when "hot" biopsy (monopolar cautery forceps) might be useful and the risks and complications of this technique, which has been largely replaced by the use of a small snare without cautery.

For colonic masses suspicious for carcinoma, trainees should be instructed that 6 careful biopsy specimens appear to be adequate for diagnosis, with further biopsy specimens unlikely to increase the diagnostic yield.[27] In addition, some mass lesions may be removed by snare resection to obtain deeper tissue. Biopsy as part of periodic surveillance for dysplasia in inflammatory bowel disease and colitis is a recognized standard of care. Because professional recommendations on screening methods and frequency periodically change, trainees need to ensure that they stay current of the most recent guidelines.

Basic polypectomy. Removal and obliteration of adenomas is central to the role of colonoscopy screening programs to reduce the incidence of adenocarcinoma of the colon. Small polyps can be adequately removed with either cold or hot biopsy, but snare removal is often recommended for polyps larger than 5 mm. A wide variety of polypectomy instruments and techniques are available to the instructor and trainee with the decision for one or the other based on a number of factors, but predominantly polyp size and location.

Before performing polypectomy, a thorough understanding of the principles of electrosurgical cautery is essential. A number of excellent texts and other reference sources are available.[18,20,21] Trainees should be introduced to the wide variety of snare designs (eg, standard, mini-snare, rotatable, spiral, barbed, snare/basket combinations). Trainers should also provide detailed hands-on instruction for the basic operation, troubleshooting, and safety checking of their particular model of generator.

Monopolar snare polypectomy is well established as a relatively safe and effective modality for the removal of colon polyps and is recommended alone or in combination with other techniques for most polyps. All aspects of the basic technique should be introduced to the trainee before polypectomy is attempted. The trainee should be taught the vital importance of teamwork and communication with the endoscopy assistant during polypectomy and have direct experience in the assistant role themselves before performing polypectomy. Elements of the basic technique that should be emphasized include snare selection, testing, positioning of the polyp during colonoscopy, cautery settings, and snare

closure technique. The ASGE videos on polypectomy are also highly recommended (Appendix 1).

In addition to biopsy forceps, the use of snares for cold snare excisions is now a generally accepted technique for resection of polyps smaller than 6 mm. The colonoscopy instructor should teach the trainee proper technique for snare and forceps use and favor use of one over the other depending on polyp size, location, and other variables. To avoid time-consuming and occasionally unsuccessful searches for diminutive polyps on colonoscope withdrawal, trainees should be taught to remove most tiny polyps on first visualization ("on the way in"), a practice shown to be both safe and efficient. Large, easily seen polyps (generally those >1 cm) may be left in place and resected on colonoscope withdrawal to facilitate efficient polyp retrieval.

Advanced techniques for the difficult colon

Cecal intubation is possible in as many as 97% of patients in expert hands.[28-31] However, technical difficulties are encountered in some cases that may impede or prevent completion of the examination despite basic measures such as patient repositioning or external pressure. These difficulties are often caused by excessive looping of the instrument, redundancy of the colon, fixation of colonic segments, and the presence of strictures or simply the inability to adequately sedate the patient with traditional conscious sedation methods. As trainees grow in experience, they need to learn techniques that can help them overcome some of these obstacles.

Use of alternative endoscopes. There are several alternative instruments that can be used in an attempt to complete a difficult colonoscopy. Trainees should be familiar with the various endoscopes available, and the differences between these colonoscopes with regard to flexibility, outer diameter, length of the insertion tube, and degree of tip deflection. As fellows advance in their training, they need to become familiar with each colonoscope's strengths and weaknesses and how to use them to optimize the chances of achieving the individual procedure's goals.

Fluoroscopy and nonradiographic imaging. Although the use of fluoroscopy during routine colonoscopy was once a widely accepted practice, there is little need for this with the currently available colonoscopes. The ASGE does not consider it prudent to teach trainees to perform colonoscopy with the routine use of fluoroscopy. However, in rare cases, judicious use of fluoroscopy may be helpful in preventing and reducing loops in the difficult colon. A nonradiographic magnetic positioning system has been developed for use in training and as an aid for loop reduction, although it is generally not available (see "Initial hands-on experience" section).

Advanced (large polyp) resection

Large polyps, especially those larger than 2 cm in diameter, may be challenging for the colonoscopy instructor and trainee alike. Sound clinical judgment, skill, and expertise allow safe and effective polypectomy of most large polyps, but sensible limits apply. Trainees should be able to identify polyps that are likely not amenable to colonoscopic removal (obviously malignant sessile polyps, polyps spanning >1 haustral fold, those greater than one third to one half of the luminal circumference, and extremely large polyps with broad bases expected to require multiple colonoscopies for removal).

Large pedunculated polyps. Snare polypectomy of large pedunculated polyps requires careful assessment and technique. Polyps with wide stalks may contain large vessels. Trainees should be made aware that polyps with broad stalks (≥1.5 cm) in diameter are often best avoided, whereas those with stalks 1 cm or less can usually be resected by using standard cautery technique. Instructors should consider teaching presnare epinephrine injection (1:10,000) below the desired snare site and/or the use of endoscopically placed detachable nylon loops or endoclips for large-stalked polyps thought to have a higher risk of bleeding because of the stalk size or patient characteristics.[32,33] For some large pedunculated polyps, negotiation of the snare loop around the head may be extremely difficult. Piecemeal head resection to "whittle down" the polyp until the stalk is easily snarable should be used in these situations. Finally, trainees should be instructed never to remove a polyp if unsure about safety or their ability to perform the polypectomy successfully (ie, "don't start what you can't finish"). Instead, these patients should be referred to a more experienced endoscopist or surgical intervention should be considered.

Large sessile polyps. Resection of large sessile polyps often requires piecemeal resection because polyps larger than 1.5 cm snared in the standard fashion may cause tenting of the full colonic wall into the snare, imparting a high risk of perforation or deep thermal injury. Piecemeal resection alone was the traditional preferred method, but more recently, virtually all authorities advocate submucosal saline solution injection techniques via a sclerotherapy needle to form a safe plane for mucosal resection. Trainees should be taught both resection techniques. Trainees should be familiar with the various injectates, including saline solution with or without epinephrine, hypertonic saline solution (2 N), dextrose and sodium hyaluronate, and the use of dilute contrasting dye. Trainees should appreciate the importance of the nonlifting sign for carcinoma when using these injection techniques.[34,35] ASGE videotapes demonstrating these techniques are extremely helpful for instruction and are listed in the References.

Tissue retrieval techniques. Failure to retrieve a polyp is often considered a minor complication of colonoscopy. Trainees must become proficient in all techniques of polyp tissue removal. Diminutive polyps are removed with biopsy forceps, and snared polyps as large as 7 to 8 mm may be aspirated through the biopsy channel after polypectomy. Full tissue retrieval collection is facilitated by commercially available filtered suction traps, allowing for capture and separation of multiple polyps. For larger

polyps, the trainee should gain experience in the use of the snare itself for retrieval, but it is difficult and tedious to retrieve multiple polyps with the standard snare. The technique of maintaining the captured polyp at a distance on colonoscope withdrawal (to allow for visualization of the mucosa on the way out) should be taught to all trainees. Baskets or retrieval nets are useful for retrieval of multiple polyps, but at added expense. For multiple large polyps, multiple passes through the colon may be facilitated through use of a colonic overtube, a technique used infrequently today. Retrieval techniques are demonstrated on the ASGE videos on polypectomy.

Techniques for hemostasis

Postpolypectomy bleeding. Delayed or immediate hemorrhage should occur in less than 1% of polypectomies; therefore, many trainees will have only a very limited direct experience with its treatment.[36-40] The endoscopy trainer is urged to review the proper approach to postpolypectomy bleeding with the trainee before an actual occurrence. Given the brisk rate of some postpolypectomy bleeding and the concern of the attending endoscopist to promptly control active (brisk) bleeding before access to the polypectomy site is obscured, the trainees may find themselves with limited colonoscope time during these rare events early in their training. However, the techniques used are similar to those used in other types of GI bleeding, and trainees must ultimately feel confident of these in the postpolypectomy bleeding situation. Oozing from polypectomy sites may require no treatment or simple epinephrine injection. For brisk arterial stalk hemorrhage, immediate resnaring of the remnant stalk, with a 10- to 15-minute period of strangulation is an expedient and effective initial therapy. If not possible, a 5- to 10-mL 1:10,000 epinephrine injection into the stalk is recommended next. Placing a self-retaining detachable nylon loop, metallic clipping, rubber band ligation, and cautery using thermal probes are all useful in select cases of stalk hemorrhage. Performance of these techniques on colonoscopic models in a sham bleeding situation or use of some of these techniques prophylactically during large polyp removal (such as loop placement and epinephrine injection) will allow the trainee some experience with these techniques before they are needed in an emergency situation. As with all GI bleeding, an appreciation of the team approach with surgeons should be fostered and routine measures for lower GI bleeding performed.

Colonic angiectasias (angiodysplasia). Angiodysplastic lesions may be difficult to visualize, especially in an acute bleeding situation. Trainees need to be able to identify these lesions and distinguish them from other vascular markings in the colonic mucosa. Optimal bowel preparation is essential. Transfusion may be useful to enhance identification. Avoidance of meperidine or the use of naloxone once the colonoscope is in the cecum is reported to improve visualization of angiodysplasia and may be considered in all patients in who these lesions are suspected.[41] In addition, trainees must be taught to pay attention to the mucosal detail during initial colonoscope advancement to prevent and recognize mucosal hemorrhage from colonoscope trauma. Techniques for obliteration of angiodysplasia are straightforward, and trainees should be familiar with the argon plasma coagulator, which is frequently used for obliteration of angiectasias because this instrument generally produces more superficial cautery effect thereby reducing deep tissue injury.[42,43] It may be especially advantageous in radiation-induced angiectasia of the rectum, although multipolar and heater probe are well accepted for treatment of this condition as well. Thermal devices (multipolar and heater probes) are also effective to coagulate and obliterate angiodysplasia and should be taught to trainees.

Colonoscopy in severe lower GI bleeding. A full discussion of evaluation and treatment of lower GI bleeding is beyond the scope of this document. The value of colonoscopy in the evaluation of acute lower GI bleeding is largely determined by the quality of the bowel preparation.

Authorities recommend that if colonoscopy is to be performed in this setting, rapid, large-volume polyethylene glycol bowel preparation be performed to maximize visualization of the bowel wall and identify the source of the bleeding.[44]

Trainees must understand that bleeding sites identified can be treated endoscopically in some cases: cautery for angiodysplasia, polypectomy for bleeding polyps, injection and endoclip placement for diverticular bleeding, and injection and cautery for some ulcerated lesions. In addition, placement of endoclips in a region of suspected hemorrhage may aid in angiographic localization if endoscopic therapy cannot control bleeding. Thus, endoscopic techniques may be considered in these select cases as part of a multidisciplinary team approach in which angiography and surgery are also considered.

Colonoscopic obstruction

Acute colonic pseudo-obstruction (Ogilvie syndrome). Acute colonic pseudo-obstruction is caused by a variety of medical conditions, medications, and metabolic abnormalities. Colonic decompression is most often recommended in such cases if the cecal diameter on abdominal radiographs is 12 cm or greater and reversal of obvious precipitating factors or initial medical treatments (eg, neostigmine) fail.[45] Colonoscopy must be undertaken without benefit of bowel preparation with minimal air inflation and maximal suction used while negotiating the colon. Therefore, these emergency procedures are best performed by experienced colonoscopists with experienced trainees under extremely close supervision. Reasonable attempts to achieve cecal intubation should be made; prolonged attempts are not advisable.

Placement of a colonic decompression tube should be strongly considered, given the high recurrence rate after colonic decompression alone. Trainees should become fa-

miliar with the various techniques used to place decompression tubes, including the use of guidewires and fluoroscopy.

Volvulus. Colonoscopy is frequently used for derotation and decompression of sigmoid volvulus. Trainees should be instructed that once the narrowing of the volvulus is traversed with gentle pressure, prolonged suctioning should be applied and the mucosa should be inspected for signs of ischemia. Emergency surgery is indicated if gangrenous mucosa is identified. If not, colonoscopic decompression can be a temporizing method to allow patient preparation for elective surgery. Trainees should understand that with colonic decompression alone, recurrence rates are high.[46]

Stents. Self-expandable metal stents designed for colonic use can provide palliation of obstruction or allow preoperative bowel preparation in patients with obstructing colorectal tumors.[47,48] Training in the use of self-expandable metal stents may be appropriate for select trainees if expert trainers and sufficient procedure volume is available, but education in this therapy is usually reserved for trainees in advanced endoscopy fellowship programs.

Other maneuvers

Tattooing, clipping, and staining. Tattooing is often used to mark the site of a lesion to localize the affected area before resection. In addition, polypectomy sites may be tattooed to allow accurate localization during future surveillance colonoscopy. This is performed by using a commercially available carbon suspension. Trainees should be able to perform this technique, which is identical to submucosal injection used to remove sessile polyps, and learn how to minimize transmural staining of the peritoneum.

Hemoclips can also be used to temporarily localize lesions in the GI tract and have the advantage of being radio-opaque, which can allow radiographic localization of lesions as well. However, most fall off within several weeks, and they are relatively expensive and thus may be useful for marking lesions only in select cases.

TRAINING PROCESS

Duration of training

The duration of colonoscopy training needed to achieve minimal competence in colonoscopy varies from one trainee to another. It is well understood that simply completing some absolute number of procedures or training for some duration does not ensure competence, but these estimates can be helpful to training programs in determining how much time and resources are devoted to colonoscopy training to ensure all of a program's trainees can achieve basic competence. Recent research has supported what experienced teachers have long suspected—that it likely requires many more procedures to become competent than previous guidelines of 140 colonoscopies have suggested. Recent data examining specific core cognitive and motor skills suggest that it can take between 175 and 400 procedures for learners to achieve minimal competence, but, on average, 275 colonoscopies are required for the average trainee.[49,50] With this wide range of learning curves, it is important not only for programs to ensure that adequate volumes of procedures are available for each trainee but also that adequate ongoing competency assessments are performed to ensure that training goals are met by all.

ASSESSMENT OF TRAINING

Assessment of competence

An important, but often overlooked, part of colonoscopy training is assessing the trainees to ensure that the requisite skills have been acquired. Traditional assessment has typically been based on rather informal global pass/fail type evaluations performed near the end of training. This has continued despite more than a decade of experts calling for ongoing objective skills assessment. This is primarily because of the difficulty of defining what constitutes competence in both the cognitive and motor aspects of colonoscopy. Evaluation tools capable of assessing the core skills of colonoscopy hold promise in defining competency endpoints.[51] Multisociety discussions are underway to define the best evaluation tool to help define competency in trainees. Until an alternative tool is offered or developed, we recommend using the Mayo Colonoscopy Skills Assessment Tool throughout colonoscopy training with a goal of demonstrating a minimal competency threshold score of 3.5 for all parameters.[50] Regardless of the method ultimately used, it is recommended that some form of continuous assessment be performed and the results ideally used in both a formative manner—to give feedback to trainees in areas where further work may be needed—and a summative assessment of skills that can be used for competency assessment.

Quality measurement and improvement

Decreasing polyp miss rates. As part of colonoscopy training, trainees must be taught the inherent limitations of this diagnostic test. The concept of a "personal miss rate" should be understood by all trainees. Every colonoscopist is different with regard to skill and meticulousness. Colonoscopists with lower polyp miss rates are significantly more likely to clear any residual stool, to look behind colonic folds, to distend the colon more, and, overall, to spend more time performing the examination. Other research has identified a correlation between polyp detection rates and withdrawal times, suggesting that withdrawal times of 6 minutes or more resulted in a significant improvement in polyp detection rates.[52,53] Although further studies of individual's techniques may yield more insight into how to minimize polyp miss rates, the conclusion is intuitive: the more meticulous the colonoscopist is, the less likely a lesion will be missed. This should be stressed to all trainees during every colonoscopy.

Quality metrics

The documentation of endoscopy "quality" has become a necessary metric for practicing gastroenterologists because there is increasing pressure to link these metrics with physician reimbursement rates. A great deal of work has been done to identify a large number of important quality parameters and published by the ASGE Taskforce on Quality.[54] These include some directly related to the performance of the examination such as cecal intubation, polyp detection rates to others that take place in the pre- and postprocedure setting including documentation of consent and recommendations for appropriate follow-up intervals. Trainees should understand the importance of developing and maintaining a portfolio to document their own performance quality once out in practice and establish a system to update this in a continuous way. In addition to aiding in reimbursement issues, this will aid in identifying areas where improvements may be needed.

DISCLOSURE

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Appendix 1: ASGE INSTRUCTIONAL VIDEOS

Waye JD. Colonoscopy and polypectomy. ASGE Learning Resource Center, Video GE-02: Milner-Fenwick, Timonium, MD; 1999.

Christie J, et al. Colonoscopy insertion to the cecum. ASGE Learning Resource Center, Video GE-53: Milner-Fenwick, Timonium, MD; 1999.

Carr-Locke D. ASGE Postgraduate course 1996: Tape 4: Colonic disorders. ASGE Learning Resource Center, Video GE-38: Milner-Fenwick, Timonium, MD; 1996.

Christie J, et al. Colonoscopy-polypectomy techniques I. ASGE Learning Resource Center, Video GE-54: Milner-Fenwick, Timonium, MD; 1999.

Christie J, et al. Colonoscopy-polypectomy techniques II. ASGE Learning Resource Center, Video GE-55: Milner-Fenwick, Timonium, MD; 1999.

Cho E. Endoscopic resection of large colorectal polyps. ASGE Learning Resource Center, Video GE-14: Milner-Fenwick, Timonium, MD; 1999.

Yamamoto H. Endoscopic mucosal resection (EMR) using a mucinous substance sodium hyaluronate (revised). ASGE Learning Resource Center, Video GE-52: Milner-Fenwick, Timonium, MD; 2000.

Uno Y. Non-lifting sign for invasive colorectal cancer. ASGE Learning Resource Center, Video GE-05: Milner-Fenwick, Timonium, MD; 1999.

Mitooka H. Contrast chromoscopy and magnifying colonoscope for colonic lesions. ASGE Learning Resource Center, Video GE-13: Milner-Fenwick, Timonium, MD; 1999.

Christie J, et al. Colonoscopy-polyps and tumors of the colorectum and management of large colorectal polyps. ASGE Learning Resource Center, Video GE-56: Milner-Fenwick, Timonium, MD; 1999.

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