



Colonoscopy core curriculum

Prepared by: ASGE TRAINING COMMITTEE

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This is one of a series of documents prepared by the American Society for Gastrointestinal Endoscopy Training Committee. This document contains recommendations for a training curriculum intended for use by endoscopy training directors, endoscopists involved in teaching endoscopy, and 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, videos, and other resources available to the trainer.

Abbreviation: ASGE, American Society for Gastrointestinal Endoscopy.

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Identifying the knowledge and skills required to perform colonoscopy safely, effectively, and comfortably is the aim of this document. Specific data on quality metrics and competency assessment are separate topics that are not the focus of this curriculum. Additional information on endoscopy training can be found in the American Society for Gastrointestinal Endoscopy's (ASGE's) "Principles of Training in GI 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; ensure the appropriate identification, removal, and ablation of lesions; and other therapeutic techniques. These skills come with mastery of the individual core elements of the procedure. The core technical, nontechnical, and cognitive skills of colonoscopy are listed in [Table 1](#). The core skills to be covered can also be classified by the Accreditation Council for Graduate Medical Education competencies.³

Training faculty

This issue is covered in depth in the document "Principles of Training in GI Endoscopy."¹ In general, teaching faculty should not only be experienced endoscopists who are committed to the entire training process (teaching and assessment) but also facile in the skills involved in instruction.^{4,5} Program directors need to ensure that an adequate number of such individuals are available to ensure quality teaching and that monitoring of faculty teaching occurs to ensure that standards are maintained.

TABLE 1. List of core technical, nontechnical, and cognitive skills for colonoscopy

Technical	Nontechnical	Cognitive
<ul style="list-style-type: none"> • Correct positioning of the endoscope • Use of endoscope controls, including angulation control knobs • Endoscope insertion • Effective endoscope advancement including tip control and torque steering • Strategies for endoscope advancement including patient position change • Loop reduction • Intubation of terminal ileum • Achieve a clear luminal view required for mucosal inspection on withdrawal, including good visualization around corners and folds and appropriate use of mucosal cleaning techniques (eg, lavage, suction) • Biopsy sampling technique • Polyp removal techniques (snare, biopsy) 	<ul style="list-style-type: none"> • Evaluate patient suitability and fitness for colonoscopy (ie, assessment of indication and risks), in consultation with anesthesia specialist in selected cases • Evaluate patient risk for sedation related to pre-existing medical conditions and provide appropriate sedation management and patient monitoring • Diagnose and manage sedation-related adverse events, including rescue from a level of sedation deeper than intended • Maintain professionalism • Obtain consent by explaining the risks and benefits of the procedure and expected outcomes • Communicate effectively with the patient and other consulting services (eg, surgery and oncology) to manage the patient as part of a multidisciplinary team • Work effectively as a member of a multidisciplinary team to ensure that knowledge is shared and understanding is reached to provide effective patient-centered care • Communicate effectively with the endoscopy assistants during the procedure • Demonstrate situational awareness including continuous assessment of the situation and problem recognition • Demonstrate leadership by supporting team members, maintaining standards, and directing problem management • Demonstrate judgment and decision-making skills to choose appropriate course of action • Communicate effectively with the patient and/or caregiver about the colonoscopic findings (explanation, significance) and follow-up plan, and provide advice regarding potential postprocedure adverse events, recommended course of action, etc • Generate a detailed procedure report with accurate description of interventions and type of devices used 	<ul style="list-style-type: none"> • Understand the indications, contraindications, and alternatives for colonoscopy • Knowledge of the equipment, including equipment maintenance and troubleshooting, and ability to select equipment • Knowledge of bowel preparation regimens and ability to select regimen in context of patient • Knowledge of anticoagulation management • Knowledge of anatomy and recognition of anatomic landmarks • Recognition of pathologic and anatomic abnormalities • Describe findings accurately, interpret abnormalities in the clinical context, and select appropriate strategy/technique for management • Knowledge of the signs and symptoms of adverse events • Knowledge of available therapeutic devices and therapeutic device settings

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 departmental and institutional standpoints.⁶ Access to simulation capability is also beneficial as discussed below in the initial hands-on training section.

ENDOSCOPIC EXPERIENCE

Initial cognitive training

Before fellows begin hands-on training, some basic cognitive, technical, and nontechnical skills are required.

Knowledge of GI anatomy, colon preparation, procedure indications and contraindications, sedation, and airway management is essential. These can be taught using various methods from didactic lectures series, core reading requirements including ASGE guidelines, and even multimedia educational tools.

Preprocedure assessment. Training in the techniques of colonoscopy must go hand-in-hand with the development of good preprocedural assessment habits. Staff should instruct trainees to review pertinent medical information (surgical history, medical history, medications, etc) on each patient.⁷ Prior sedation issues and previous endoscopic findings should be reviewed. A thorough knowledge of how each of these factors relates to

colonoscopy indications, contraindications, adverse events, informed consent, patient education, and anticoagulation management is essential and should be taught to all trainees.⁸⁻¹⁰ Full reviews of these topics are beyond the scope of this document but are covered in ASGE guidelines referenced and are also available on the ASGE website (<http://www.asge.org>).

Bowel preparation. Trainees should understand the critical importance of proper bowel preparation for optimal visualization, safety, and ease of colonoscopic examination. Trainees should acquire the knowledge to optimize bowel preparation on the basis of efficacy, compliance, patient satisfaction, and patient comorbid conditions. Trainees should become familiar with the variety of preparations available, including the standard large-volume polyethylene glycol-electrolyte solutions and smaller volume polyethylene glycol-electrolyte solutions. In addition, the trainee should appreciate that the addition of prokinetic agents, using split-dose regimens, and adding flavoring to polyethylene glycol-electrolyte solutions may help improve patient compliance with bowel preparation. Trainees should be able to describe the adverse events 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. Additionally, trainees should be able to adequately document the quality of bowel preparation in the procedure report.¹¹ Further information on this topic is available in the literature and consensus documents referenced.^{12,13}

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 among the colonoscopist, assistant, and patient are essential for patient comfort and safety, but these skills may be underdeveloped by the early trainee who is often focused only 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 sedation must also be mastered by trainees of colonoscopy. Advanced cardiovascular life support or similar training is advisable and often required. 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.¹⁴⁻¹⁶ Finally, a positive teaching environment must be maintained in the procedure room at all times, with 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 colonoscopy, communication of findings, therapeutic results, and plans for follow-up must be emphasized to the trainee as an extremely important part of patient care. This involves both discussions with the patient and 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.¹⁷ 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 endoscopic community.^{18,19}

Initial hands-on training

Initial hands-on experience. In addition to the basic cognitive and nontechnical skills outlined above, some basic motor or technical skills should exist before starting patient endoscopy. These include an understanding of endoscope mechanics, use of endoscope controls, and rudimentary skills at endoscope advancement and mucosal inspection. These motor skills have traditionally been taught at the time of the procedure, but an increasing emphasis has been placed on teaching these early skills with the use of mechanical, animal, or computer simulation aides.²⁰ For decades, trainers have used various mechanical teaching aides such as latex colon models.²¹ 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 discomfort in the early stages of training.²²⁻²⁶ Appropriate ergonomics, including posture, body positioning, and hand/limb mechanics by 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.²⁷

Rectal examination. Before the introduction of the colonoscope, the trainee should understand the importance of a careful perianal examination. A digital rectal examination is also essential to lubricate the anal canal and assess the rectal vault for palpable lesions or other abnormalities.

Colonoscope advancement techniques. The earliest skills the fellow must master are appropriate endoscope navigation skills. Teaching good habits early is especially important 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 should ideally hold the endoscope shaft with a finger grip, and steering is accomplished primarily with the use of the up-down knob alone accompanied with right-left torque of the endoscope shaft. This allows for continuous control of the colonoscope and with proper torque steering technique helps prevent the

formation of loops. A finger grip makes it easier to detect resistance and maximizes rotation of the shaft between the fingers and thumb, as compared with a fist grip.²⁸ A 2-handed technique, where 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.²⁸⁻³⁰

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 the first colonoscopy. All trainees should understand the need for frequent withdrawal of the colonoscope with appropriate use of torque.

Change in patient 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 the supine or right lateral position may be useful when encountering difficulty with navigation, tight corners, or when looping occurs. Additionally, systematic position change during withdrawal has been shown to be a simple and cost-neutral intervention to improve adenoma detection rate that does not significantly increase procedure time.³¹⁻³⁷ Position change facilitates adequate distension at different colonic segments as gas rises to the least dependent areas and fluid moves to the more dependent areas. For example, the descending colon and splenic flexure (left side of the body) are most easily navigated and best visualized with the patient in the right lateral position, the transverse colon (anterior location in the body) in the supine position, and the hepatic flexure and ascending colon (right side of the body) in the left lateral position. Additionally, the supine and/or right lateral position can help to straighten out a medially oriented cecum to facilitate ileal intubation and improve visualization. Some colonoscopists also find placing the patient in the prone position is potentially helpful when having difficulties achieving cecal intubation, although this position is not commonly required.³² Nonsedated or lightly sedated patients can cooperate with repositioning.

Transabdominal pressure. The techniques of applying transabdominal pressure should be included in the training of both endoscopists and endoscopy assistants. Abdominal pressure as an aid for colonoscopy has been well described but is often not applied in any standardized fashion.^{38,39} Upward pressure applied to the transverse colon can aid in navigation across this segment, encouraging as straight a line as possible to the hepatic flexure and helping to prevent formation of a U-loop, as the transverse colon is anteriorly positioned.²⁸ Abdominal pressure in other colonic segments is

generally not as effective because of their more posterior location.

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 endoscope withdrawal. It is critical to teach fellows good mucosal visualization habits that include a slow methodical withdrawal with circumferential inspection of the mucosa.^{40,41} The importance of suctioning retained luminal contents, intermittently readvancing the colonoscope to look behind folds, and retroflexion in the right side of the colon and rectum is also critical. Although tedious for instruction at times, especially early in training, scanning patterns will improve and become more efficient as trainees' interpretive skills grow.

Retroflexion. The inclusion of a retroflexed view of the rectum and often in the right-sided colon segment is an essential element of colonoscopy. Trainees must be aware that acquired anatomic changes such as angulations, adhesions, and scarring may preclude this maneuver.

Intermediate cognitive and hands-on training. Once hands-on training is underway, it is expected that fellows' cognitive and nontechnical skills in pathology recognition and management decision-making will develop.

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 endoscopic management is indicated or contraindicated for a specific lesion. These cognitive skills grow primarily with visual repetition of similar findings presenting themselves in multiple different ways. However, patient-based repetition can be augmented with the use of teaching aids such as atlases of endoscopic images and self-education resources such as ASGE's Gastrointestinal Endoscopy Self-Assessment Program (GESAP) and the Online Learning Center at <https://www.learn.asge.org>. Formal assessment of these interpretive skills by training programs through examinations based on endoscopic images is an important part of training because it can help identify trainees who need further education and also serves as a strong motivating factor for trainees to use the multiple learning resources describe above.

Terminal ileum intubation. If terminal ileum intubation is attempted routinely, visualization of the terminal ileum can be achieved in up to 95% of cases without adverse events.^{42,43} Attempts to intubate the terminal ileum by the trainee should be encouraged during routine colonoscopy regardless of the procedure indication. This will ensure the trainee attains proficiency in the technique for situations when ileocolonoscopy is essential.

Estimating polyp size. According to surveillance guidelines, the size of the polyp influences the timing of

subsequent evaluations.⁴⁴⁻⁴⁷ Trainees need to understand the various methods to estimate polyp size. In addition to size estimation entirely by visual inspection, trainees can judge size by placing an open biopsy forceps with a known jaw span (7-8 mm) alongside the polyp.

Basic forceps biopsy sampling. The technique of forceps biopsy sampling during colonoscopy is similar to when performed during upper GI endoscopy. Specific biopsy sampling recommendations for all disease states are beyond the scope of this document. As professional recommendations on screening and surveillance methods and frequency periodically change, trainees need to ensure 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.^{48,49} Small polyps can be adequately removed with cold biopsy forceps, but snare removal is often recommended for polyps >5 mm. The use of cold snare excision is now a generally accepted technique for resection of polyps up to 1 cm in size, with hot snare excision recommended for polyps 1 to 2 cm.⁵⁰ A wide variety of polypectomy instruments and techniques are available to the instructor and trainee with the decision to choose one or the other based on a number of factors but predominately based on polyp size and location.

Before performing hot snare polypectomy, a thorough understanding of the principles of electrosurgical cautery is essential. A number of excellent texts and other reference sources are available.^{28,29} Trainees should be introduced to the wide variety of snare designs. Trainers should also provide detailed hands-on instruction for the basic operation, troubleshooting, and safety-checking of their particular model of electrosurgical 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.

Advanced techniques for the difficult colon

Cecal intubation is possible in up to 97% of patients in expert hands.⁵¹⁻⁵⁴ 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 because of excessive looping of the instrument, redundancy of the colon, fixation of colonic segments, and the presence of strictures or simply because of the inability to adequately sedate the patient with traditional moderate sedation methods. With increasing trainee experience, techniques can be learned to help overcome some of these obstacles.

Several alternative instruments can be used in an attempt to complete a difficult colonoscopy. Trainees should be familiar with the various colonoscopes available and the differences between these endoscopes with regard to flexibility, outer diameter, length of the insertion tube, and degree of tip deflection. As fellows progress in their training, they need to become familiar with the advantages and disadvantages of each colonoscope and how to use them to optimize chances of achieving the procedure goals.

Advanced (large polyp) resection

Large polyps, especially those over 2 cm in diameter, may be challenging for the colonoscopy instructor and trainee alike. Sound clinical judgment, skill, and expertise allow for safe and effective polypectomy of most large polyps, but sensible limits apply. Referral to experts specializing in these larger colonoscopic resections may be prudent.

Large pedunculated polyps. Snare polypectomy of large pedunculated polyps requires careful assessment and technique. Trainees should be instructed never to remove a polyp if unsure about patient 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 more experienced endoscopists, or surgical intervention should be considered.

Large sessile polyps. For large polyps, all authorities advocate submucosal injection techniques with an injection needle to form a safe plane for mucosal resection. Trainees should be familiar with various injectates, including saline with or without epinephrine, newer proprietary solutions, and the use of dilute contrasting dye. Trainees should recognize the importance of the "nonlifting" sign for carcinoma or fibrosis from prior polyp instrumentation when using these injection techniques.^{55,56}

Tissue retrieval techniques. Failure to retrieve a polyp is often considered a minor adverse event of colonoscopy. Trainees must become facile in all techniques of polyp tissue removal. Diminutive polyps are removed with biopsy forceps, and snared polyps up to 7 to 8 mm may be aspirated through the biopsy channel after polypectomy. Full tissue retrieval 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 a standard snare. The technique of maintaining the captured polyp at a distance upon 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 to retrieve multiple polyps but at an added cost.

Techniques for hemostasis

Postpolypectomy bleeding. Delayed or immediate hemorrhage occurs in less than 1% of polypectomies; therefore, many trainees will have very limited direct experience with its treatment.⁵⁷⁻⁶⁰ The endoscopic trainer is urged to review the proper approach to postpolypectomy bleeding with the trainee before an actual occurrence. The techniques used are similar to those used in other types of GI bleeding, and trainees must ultimately feel confident in the management of postpolypectomy bleeding. As with all GI bleeding, an appreciation of a team approach with surgeons should be fostered and routine measures for lower GI bleeding carried out.

Colonic angiectasias (angiodyplasia). 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. In addition, trainees must be taught to pay attention to the mucosal detail during initial colonoscopy advancement to prevent and recognize mucosal hemorrhage from scope trauma. Trainees should be familiar with argon plasma coagulation, which is frequently used for obliteration of angiectasias because this instrument generally produces more superficial cautery effect and reduces deep tissue injury.^{61,62} It may also be especially advantageous for the treatment of radiation-induced angioectasia of the rectum.

Colonoscopy in severe lower GI bleeding. A full discussion of evaluation and treatment of lower GI bleeding is beyond the scope of this document. Endoscopic techniques may be considered in these selected cases as part of a multidisciplinary team approach where angiography and surgery are also considered.

Colonic obstruction

Acute colonic pseudo-obstruction (Ogilvie's syndrome). Colonoscopy for treatment of colonic pseudo-obstruction must be undertaken without the 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 inadvisable. Placement of a colonic decompression tube should be strongly considered given the high recurrence rate after colonic decompression alone. Trainees should become familiar with the various techniques used to place decompression tubes.

Volvulus. Colonoscopy is frequently used for derotation and decompression of colonic 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 inspected for signs of ischemia. Emergency surgery is indicated if gangrenous mucosa is identified. If not, colonoscopic decompression can be a temporary method to allow patient preparation for elective surgery. Trainees should understand recurrence rates are high using colonic decompression alone.⁶³

Stents. Self-expanding metal stents designed for colonic use can provide palliation or relief of obstruction to allow preoperative bowel preparation in patients with obstructing colorectal tumors.^{64,65} Training in the use of self-expanding metal stents may be appropriate for select trainees, but education in this therapy is usually reserved for trainees in advanced endoscopy fellowship programs.

Other maneuvers

Tattooing and clipping. 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. It is performed using commercially available needles and available carbon suspension. Trainees should be able to perform tattooing, which is identical to submucosal injection used to remove sessile polyps; learn to identify the correct location to allow surgical identification; to not interfere with subsequent endoscopic resection; and to minimize transmural staining of the peritoneum. Endoscopic clips can also be used to temporarily localize lesions in the GI tract and have the advantage of being radiopaque, which can allow radiographic localization of lesions as well.

SUMMARY

Colonoscopy is an essential component of GI endoscopy. This core curriculum for colonoscopy is meant to serve as a platform for education, training, and practice. By providing information to endoscopy trainers about the common practices used by experts in performing the procedure, the ASGE hopes to improve the teaching and performance of colonoscopy.

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