Communication from the ASGE Technology Committee

GUIDELINE

Devices and methods to improve colonoscopy completion (with videos)

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This document was reviewed and approved by the governing board of the American Society for Gastrointestinal Endoscopy (ASGE).

The American Society for Gastrointestinal Endoscopy (ASGE) Technology Committee provides reviews of existing, new, or emerging endoscopic technologies that have an impact on the practice of GI endoscopy. Evidence-based methodology is used, with a MEDLINE literature search to identify pertinent clinical studies on the topic and a MAUDE (U.S. Food and Drug Administration Center for Devices and Radiological Health) database search to identify the reported adverse events (AEs) of a given technology. Both are supplemented by accessing the "related articles" feature of PubMed and by scrutinizing pertinent references cited by the identified studies. Controlled clinical trials are emphasized, but in many cases data from randomized controlled trials (RCTs) are lacking. In such cases large case series, preliminary clinical studies, and expert opinions are used. Technical data are gathered from traditional and Web-based publications, proprietary publications, and informal communications with pertinent vendors.

Technology Status Evaluation Reports are drafted by 1 or 2 members of the ASGE Technology Committee, reviewed and edited by the committee as a whole, and approved by the Governing Board of the ASGE. When financial guidance is indicated, the most recent coding data and list prices at the time of publication are provided. For this review the MEDLINE database was searched through May 2017 for articles related to devices to improve colonoscopy completion using such relevant terms as colonoscopy, incomplete, abdominal binder, cap, wire, balloon enteroscopy, water irrigation, robotic colonoscopy, and colon capsule, among others. Technology Status Evaluation Reports are scientific reviews provided solely for educational and informational purposes. Technology Status Evaluation Reports are not rules and should not be construed as establishing a legal standard of care or as encouraging, advocating, requiring, or discouraging any particular treatment or payment for such treatment.

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BACKGROUND

There are multiple diagnostic and therapeutic indications for colonoscopy. Quality guidelines recommend a cecal intubation rate of at least 90% for all colonoscopies and 95% for screening colonoscopies.[1,2] Incomplete colonoscopy (IC), defined as the inability to reach the cecum,[3,4] can result in missed colorectal cancer[5] and results in increased healthcare expenditure related to follow-up procedures (eg, repeat colonoscopy or CT colonography). Reported rates of IC range from 4% to 25% for both screening and nonscreening colonoscopy.[6] Risk factors for IC that relate to technical aspects of the colonoscopy include looping, a redundant colon, and sigmoid fixation/angulation, among others.[4,6-10]

Ideally, IC should be followed by a procedure that has both a high sensitivity for detecting mucosal pathology and offers therapeutic potential.[6] This is usually a repeat colonoscopy with a different colonoscope or the addition of a device.[6,7,10] Successful completion of colonoscopy is desirable because the yield of neoplasia on repeat colonoscopy after an IC can be as high as 53%.[7] In tertiary centers

the success rate of repeat colonoscopy after an IC can be as high as 95% to 97%,[7,10,11] but there is wide variability in successful cecal intubation in this setting, and success rates as low as 29% have been reported.[5] This document reviews devices and techniques that improve colonoscopy completion that can be applied during a challenging index colonoscopy or for patients returning after a previous IC. Although other diagnostic modalities such as CT colonography or video capsule colonoscopy are also viable options after IC, these technologies are beyond the scope of this document and are not discussed.

TECHNOLOGY UNDER REVIEW

Endoscopic devices and techniques for colonoscopy completion usually provide benefit through 1 or more of the following mechanisms: prevention of looping, especially in redundant colons; safe advancement despite sigmoid fixation or angulation; pain reduction; or improved visualization. In this section we describe relevant technologies and their mechanism of action. Standard best practices such as loop reduction, patient position change, and manual abdominal pressure to aid colonoscopy completion should be attempted first before changing to an alternative scope or using additional devices. Additionally, beginning in the prone position may be helpful for colonoscopy completion in obese patients.[12] However, these routine maneuvers are not discussed in detail in this document.

Endoscopes

Pediatric colonoscopes have greater shaft flexibility and a smaller insertion tube diameter (typically 11-12 mm) than adult colonsocopes,[13] making these instruments well suited for fixed and angulated colons.[14] Ultrathin colonoscopes and standard gastroscopes have an even smaller diameter (typically ≈9-10 mm) and greater flexibility than pediatric colonoscopes.[7,10,14,15] Ultrathin colonoscopes and standard gastroscopes may allow for easier passage through angulations and narrow lumens,[14,16] although at the expense of a greater tendency to allow looping. A colonoscope with an 11.6-mm insertion tube diameter that is marketed for enhanced retroflexion (RetroView, EC-3490TLi; Pentax, Montvale, NJ, USA) features a shorter (9 cm) and slimmer (10.5 mm) bending portion that permits 210-degree retroflexion with a more compact turning radius than similar standard pediatric colonoscopes. Beyond enhanced retroflexion, this short turn radius colonoscope may allow for easier maneuverability around angulated and fixed colonic bends and has been evaluated for colonoscopy completion in patients with prior IC.[17,18]

Variable-stiffness colonoscopes (VSCs; models CF-HQ190 L/I, CF-H190 L/I, PCF-H190 L/I, PCF-PH190 L/I, CF-Q180AL/I, and PCF-Q180AL/I; Olympus America, Center Valley, Pa) allow the endoscopist to control the stiffness of the scope. A dial near the junction of the insertion tube and the control handle[19,20] can be rotated manually to alter the stiffness of the scope. The dial connects to a central cable with a surrounding metal helical coil, and tension applied to the cable compresses and stiffens the helix and thus the colonoscope.[20] Loosening has the opposite effect, allowing the scope to become more floppy. The stiffening mechanism terminates a few centimeters from the distal tip.[19-21] A proposed method of using a VSC is to use the flexible mode in the sigmoid colon to navigate angulations, then stiffening the scope to reduce looping in the transverse and right side of the colon.[21,22]

Balloon enteroscope–assisted colonoscopy

Both single-balloon and double-balloon enteroscopes have been used for completion of difficult colonoscopies; engagement of the overtube balloon with the colonic wall allows pleating of the colon with reduction maneuvers to facilitate further scope advancement. A single-balloon enteroscopy system (SIF-Q180 with overtube; Olympus America) uses a 200-cm enteroscope with a 9.2-mm outer diameter and a 140-degree field of view. The technique for single-balloon colonoscopy has been described in detail.[23,24] Various double-balloon instruments and techniques have also been used for difficult colonoscopy.[25,26] Traditionally, a standard-length double-balloon enteroscope (EN-450T5; Fujifilm, Tokyo, Japan) was used for double-balloon colonoscopy[26]; however, a shorter model (EC-450BI5; Fujifilm) that permits use of regular accessories has been cleared by the U.S. Food and Drug Administration and is available for use.[27] It has a 9.4-mm outer diameter, a working length of 152 cm, and a 140-degree field of view.

Magnetic endoscopic imaging/fluoroscopy

Historically, fluoroscopy was sometimes used as an aid during difficult colonoscopies.[28] Although now used infrequently, fluoroscopy may assist with loop reduction during difficult cases if available.[29] Magnetic endoscopic imaging (MEI) is an alternative to fluoroscopy that provides real-time 3-dimensional views of the colonoscope configuration, allowing for identification of looping during colonoscopy.[30-32] Studies using MEI correlated via imaging that looping in the sigmoid colon causes significant pain that can alter colonoscopy outcomes.[33] An image of the colonoscope is generated through small electromagnetic transmitter coils within the insertion tube of the instrument. The transmitter coils are sensed by a mobile integrated unit/receiver dish containing a magnetic field generator, a central microprocessing unit, and large sensor coils.[32] The MEI processor is a compact unit that is typically positioned with the endoscope processing unit and light source. The receiver dish is positioned in close proximity to the patient's abdomen. The use of MEI is demonstrated in Video 1 (available online at www.