Communication from the ASGE Technology Committee

TECHNOLOGY STATUS EVALUATION REPORT

Enteroscopy

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This document was reviewed and approved by the Governing Board of the American Society for Gastrointestinal Endoscopy.

The 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, performing 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 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 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 October 2014 for articles related to endoscopy in patients by using the key words "enteroscopy," "enteroscope," "overtube," "double-balloon," "single-balloon," "spiral," "intraoperative," and "push pull" paired with "endoscopy," "small intestine," and "small bowel."

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BACKGROUND

Enteroscopy refers to endoscopic examination of the small intestine. Although limited small-bowel evaluation is undertaken during EGD and is possible during colonoscopy, enteroscopy typically refers to more extensive endoscopic examination of the small intestine, extending into the jejunum and/or ileum. Diagnostic evaluation of the small bowel can be performed by noninvasive imaging (CT or magnetic resonance enterography) or by wireless capsule endoscopy (WCE). Whereas these modalities currently lack therapeutic ability, they often precede and serve to guide and direct therapy via enteroscopy. WCE was discussed in a previous ASGE Technology Committee document.[1] This document will focus on endoscopes, devices, and techniques used for enteroscopy and represents an update of a previous ASGE Technology Status Evaluation Report titled "Enteroscopes."[2]

TECHNOLOGY UNDER REVIEW

Push enteroscopy

This procedure may be performed with a specifically designed enteroscope or by using a colonoscope with or without an overtube. Typically evaluation is limited to the proximal jejunum.

Device-assisted enteroscopy

Deeper evaluation of the small bowel can be accomplished with enteroscopes coupled with a specialized overtube apparatus. The procedure can be performed via an antegrade approach (via the mouth) or via a retrograde approach (via the anus). In the United States, current options for device-assisted enteroscopes include double-balloon enteroscopy (DBE), single-balloon enteroscopy (SBE), and spiral enteroscopy. A newer through-the-scope

TABLE 1. Technical specifications of enteroscopes

Endoscope make/model	Type	Length, mm	Outer diameter, mm	Working inner channel, mm	Field of view	Overtube required	List price, $
Fujinon							
EN-450T5	DBE scope	2300	9.4	2.8	140°	Yes	55,250
EN-450T5/W	DBE scope	2300	9.4	2.8	140°	Yes	Not available in the U.S.
EN-450P5/20	DBE scope	2300	8.5	2.2	120°	Yes	51,350
EC-450BI5	DBE scope	1820	9.4	2.8	140°	Yes	37,900
Olympus							
SIF-Q180	SBE scope	2000	9.2	2.8	140°	Yes	46,400
Pentax							
VSB-3430K	PE	2200	11.6	3.8	140°	No	41,400

DBE, Double-balloon enteroscopy; *SBE,* single-balloon enteroscopy.

balloon-assisted device that allows "on-demand" enteroscopy is also available.

Intraoperative enteroscopy

This is a technique in which an endoscope is inserted orally or via an enterotomy and is guided through the small bowel with surgical assistance.

TECHNICAL CONSIDERATIONS

Certain general principles and techniques applicable to all forms of enteroscopy deserve consideration. Foremost, mucosal inspection should be accomplished during both insertion and withdrawal because minor mucosal abrasions caused by instrumentation can mimic vascular or inflammatory lesions. Second, the use of fluoroscopy to assess enteroscope and/or overtube position, and advancement varies and depends on many factors including the type of enteroscopy being performed, the approach (antegrade vs retrograde), the indication, and endoscopist preference. Although fluoroscopy was widely used previously, many endoscopists currently perform enteroscopy without fluoroscopic guidance. Finally, an important variable is the use of CO_2 for insufflation rather than air because studies specific to enteroscopy have shown enhanced insertion depth and better patient tolerance with CO_2 insufflation.[3-6] The technical specifications of push and device-assisted enteroscopes and overtubes are listed in Tables 1 and 2.

Push enteroscopes

Push enteroscopy may be performed with dedicated enteroscopes or by using colonoscopes. Push enteroscopes are longer versions of standard endoscopes with a working length of 200 to 250 cm, external diameters of 10.5 to 11.7 mm, and channel diameters of 2.8 to 3.8 mm. However, the length of the instrument does not necessarily correlate with deeper insertion or improved diagnostic yield.[7] The use of overtubes has been proposed to allow for greater insertion depth during push enteroscopy; however, it is again unclear whether this results in a greater diagnostic yield.[8-10] Overtubes are not routinely used because of greater patient discomfort and reported adverse events related to their use.[9-12] Overtubes have been detailed in a separate ASGE Technology Committee document.[13]

Technique. The endoscope is introduced through the mouth and advanced into the small bowel as far as possible until looping limits forward progression. Torque and withdrawal are performed to reduce loops, and the endoscope is then re-advanced and the process is repeated. If the endoscope cannot be advanced further with these maneuvers, patient position can be changed and abdominal pressure can be applied. If a variable-stiffness colonoscope is used, stiffening of the instrument may allow further advancement. In procedures in which an overtube is used, it is backloaded up to the hub of the endoscope before insertion. The endoscope is then advanced to the second or third portion of the duodenum, and loop reduction is then performed. The overtube is then advanced to the level of the tip of the endoscope, and the endoscope is then re-advanced further. Fluoroscopy may guide loop reduction, assessment of endoscope position, and advancement.

Device-assisted enteroscopy

Double-balloon enteroscopes. DBE was first introduced in 2001 and was developed for evaluation of the entire jejunum and ileum. DBE uses a specially coupled enteroscope and overtube apparatus with latex balloons mounted on the distal ends of each component. The balloons are intended to anchor the endoscope in position during insertion to allow for pleating of the bowel over the endoscope shaft, reducing loop formation and allowing for greater insertion depth. Three DBE systems are currently available. The most commonly used system is an enteroscope with a 9.4-mm diameter, a 2.8-mm working channel, and a 200-cm working length (EN-450T5; Fujinon, Saitama, Japan). DBE systems designed with a smaller