Navigating beyond the ligament of Treitz: an introduction to learning enteroscopy

Gastroenterologists are often faced with the task of introducing new techniques and technology. Various advances in technology have brought the diagnosis and treatment of small-bowel disease within our reach and into everyday practice. In this month’s Fellows’ Corner, Drs. Michael Schafer and Simon K. Lo have shared some advice for fellows (and those in practice) wanting to train in advancing the endoscope beyond the ligament of Treitz. Since the introduction of fiberoptic instruments in the 1970s, endoscopic examination of the esophagus, stomach, duodenum, and colon have become cornerstones in the diagnostic and therapeutic armamentarium of gastroenterologists. Training gastroenterology fellows in the indications, techniques, and possible complications of GI endoscopy make up a large portion of the fellowship experience. Until recently, however, examination of the small intestine beyond the reach of a diagnostic gastroscope was limited to only rudimentary diagnostic (primarily radiologic) tests that offered very few therapeutic options.

Wireless capsule endoscopy, introduced in 2001, enabled the gastroenterologist to explore the small bowel with previously unheard-of accuracy. Although truly a breakthrough technology, capsule endoscopy remains a purely diagnostic entity, limiting its role.

Newer techniques and technologies, including single-balloon enteroscopy (SBE) and double-balloon enteroscopy (DBE) as well as spiral enteroscopy, have allowed us to examine the small intestine first hand. For the first time, gastroenterologists not only can diagnose, but can treat pathology that was previously only accessible to the surgeon.

With the introduction of any new technology, the question of who should implement these techniques and use these new tools is often a cause of much debate. Our GI societies are delegated with the task of establishing practice guidelines in the proper use and credentialing of these techniques. How should these technologies be implemented? Which patients should be treated? Perhaps most importantly, who should perform the procedures and how should they be trained? These are questions that are still being answered.

EXAMINATION OF THE SMALL BOWEL

Small-intestinal bleeding is the most common indication for examination of the small intestine. In fact, as many as 5% of patients presenting with GI bleeding will have a source beyond the ligament of Treitz. Obscure GI bleeding, abnormal small-bowel radiographic findings, abnormal capsule endoscopy results, refractory celiac disease, retained foreign bodies, and Crohn’s disease are other major indications for enteroscopy.

PUSH ENTEROSCOPY

Most endoscopists’ experience with enteroscopy is limited to push enteroscopy. Because there is no need for specialized equipment (either a pediatric colonoscope or standard enteroscope can be used), the technique is accessible to almost all gastroenterologists. Most experienced endoscopists are capable of reaching the proximal jejunum, but the examination rarely reaches the mid-jejunum. Gastroenterologists are typically trained in push enteroscopy as a part of a general fellowship, as an example.
Pancreatitis occurs in at least 0.3% of patients, does occur more frequently in patients with surgical anastomoses.11

**DBE**

DBE was first described by Yamamoto et al in 2001. The equipment has been available for clinical use in the United States since 2004 and since then has been in use in more than 70 centers across the country.

DBE is a physically demanding and time-consuming procedure that requires 2 persons to perform; yet the concept is amazingly simple. A 200-cm enteroscope fitted with an overtube is passed either orally or rectally. A balloon is fastened to the end of both the enteroscope and the overtube, which is roughly 50 cm shorter than the enteroscope. By sequentially inflating and deflating the balloons and by pushing and pulling the enteroscope, the small intestine can be pleated onto the overtube, allowing the enteroscope to be advanced deep into the small bowel. Through a combination of oral and rectal approaches, a total enteroscopy can be achieved in as many as 86% of patients.7

Although the concept of DBE is simple and most endoscopists can acquire the procedural skill, it takes extensive practice to become an expert in the procedure.4 Performing therapeutics through the DBE can be particularly frustrating for the beginner and takes many attempts to master.

As with push enteroscopy, there are no published guidelines relating to procedural competency for DBE. Mehdizadeh et al8 found that after having performed 10 DBEs, the average procedure time decreased while the mean depth of insertion remained constant. They suggested that the mean depth of insertion should be used to determine procedural competence. Gross and Stark9 found that the mean depth of insertion should be used to determine procedural competence. Gross and Stark8 found that the rate of total enteroscopy, hence the depth of examination, significantly increased after 150 DBE cases. It seems that it would take 100 to 150 cases to achieve a high level of proficiency in their experience.

Retrograde DBE requires even more skill to master and has its own unique learning curve. Navigating the enteroscope and overtube through the ileocecal valve can prove quite challenging and invariably frustrating. Mehdizadeh et al10 suggest a minimum of 20 retrograde DBEs be performed to achieve the best technical results.

There are some complications unique to DBE. Perforation does occur more frequently in patients with surgical anastomoses.11 Pancreatitis occurs in at least 0.3% of patients, and this seems to be limited to the peroral approach.

**SBE**

In 2006, Olympus introduced an SBE system. The theory and technique are very similar to that of the double-balloon system, the only difference being that there is no balloon on the end of the enteroscope. The system takes less time to set up than the double-balloon system.

Data regarding the learning curve and complications from SBE are lacking, but are probably slightly superior to the DBE. There are some advantages of the single-balloon system, with one being the ability to remove the endoscope while maintaining the overtube in place. The other significant advantage of the single-balloon system is that the balloon itself is made from silicon, rather than latex, obviating the concern for latex allergy. Depth of insertion seems, however, to be inferior to that with DBE.13

**SPIRAL ENTEROSCOPY**

Spiral enteroscopy is a newly approved technique to examine the small bowel. It is a 2-person procedure, with a nurse or physician rotating an overtube with a soft spiral element attached to the distal 20 cm of the tube while the endoscopist keeps the lumen of the small bowel in view.14 The duodenojejunal transition seems to be the most difficult area to glide the instrument through, and it is likely because of the natural angulation in this area. The principles of endoscopic advancement and retrieval are vastly different from those of a standard endoscope and mandate special training for spiral enteroscopy.

The technology is too new to have published data regarding learning curves and true complication rates. Small series suggest a 41% minor complication rate (esophageal mucosal trauma and sore throat)15 and severe complication rate of 0.4%.

**HOW ARE ENDOSCOPISTS CURRENTLY TRAINED AND CERTIFIED IN ENTEROSCOPIES?**

The first step for dedicated examination of the small intestine is likely to be capsule endoscopy, which is both minimally invasive and most capable of visualizing the entire small intestine. Familiarity with and competency in interpreting capsule endoscopies, therefore, cannot be overemphasized. The first group of capsule endoscopists chose to learn the technology because of their long-standing interest in small intestinal disorders and were trained by a medical director of Given Imaging Inc. They shared their experience and compared notes in multiple annual international capsule endoscopy conferences. Since then, the American Society for Gastrointestinal Endoscopy has published guidelines for credentialing and competency for capsule endoscopy. Briefly, these training requirements include documented competence and privileges to perform EGD, colonoscopy, and for small-bowel capsule endoscopy in enteroscopy. Additionally, formal training in capsule endoscopy during fellowship or completion of a hands-on course (with a minimum of 8 hours continuing medical education credit) is necessary before competency can be assessed.16

Based mostly on expert opinion, the current capsule enteroscopy training guidelines have not been validated. De-
Gastrointestinal Endoscopy has been a leader in providing relative ease in learning SBE. There are now courses set up to that for DBE and spiral enteroscopy, perhaps because of the facilities. The training for SBE has been less regimented than enteroscopists with hands-on workshops in these training in Central and South America and have trained a few dozen pioneers of spiral enteroscopy perfected the technique in and began training others in their own centers. Similarly, the take part in DBEs. Many of them have since become experts traveled to Japan and Europe to observe and, in some cases, the most difficult enteroscopy skill to master is that of DBE. which can be learned in a classroom environment. Perhaps more difficult to acquire than those of capsule endoscopy, the first reported in a preliminary study where some certified capsule endoscopists were found to be more mistake-prone than those in a specialized capsule endoscopy referral center. The depth and quality of training at the fellowship level also vary substantially and are mostly reliant on the interest, referral volume, and reading skill of a single endoscopy attending.

Enteroscope-based enteroscopy are skill sets that are more difficult to acquire than those of capsule endoscopy, which can be learned in a classroom environment. Perhaps the most difficult enteroscopy skill to master is that of DBE. The first endoscopists performing DBE in the United States traveled to Japan and Europe to observe and, in some cases, take part in DBEs. Many of them have since become experts and began training others in their own centers. Similarly, the pioneers of spiral enteroscopy perfected the technique in Central and South America and have trained a few dozen enteroscopists with hands-on workshops in these training facilities. The training for SBE has been less regimented than that for DBE and spiral enteroscopy, perhaps because of the relative ease in learning SBE. There are now courses set up to teach enteroscope-based enteroscopies to practicing endoscopists in the United States, and the American Society for Gastrointestinal Endoscopy has been a leader in providing conferences that emphasize both cognitive and technical skills. Although these courses and conferences are not yet widely integrated into the traditional fellowship training, most trainees opting for a fourth year in interventional endoscopy will gain the necessary experience. When it comes time for a trainee to independently perform the first few cases of enteroscopy, most manufacturers would offer their field-educators to assist with the cases because of their familiarity of their equipment.

**PROCEDURE COMPETENCY**

Fellows wishing to obtain the technical and cognitive skill necessary to safely and effectively perform enteroscopy should first achieve competence in standard endoscopic technique. Aside from a fourth-year interventional endoscopy fellowship, a trainee wishing to learn enteroscopy should consider a rotation as a visiting fellow at a high-volume enteroscopy center to develop these skills. Because capsule endoscopy has become a standard endoscopic procedure in virtually all medical communities, it is advisable for all fellows in training to acquire the reading skill. It is certainly essential for all endoscopists who wish to develop expertise in enteroscope-based enteroscopy. Some recommendations, based on personal experience for establishing procedural threshold and competency in enteroscopy, are listed in Table 1.

![Table 1](https://www.giejournal.org)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Minimal training (in practice)</th>
<th>Minimal training (in fellowship)</th>
<th>Procedural threshold (practicing endoscopist)</th>
<th>Procedural threshold (fellow in training*)</th>
<th>Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>1-day seminar; includes hands-on lab</td>
<td>Equivalent to 1-day seminar; supervised reading</td>
<td>20 supervised cases</td>
<td>40 supervised cases</td>
<td>90% correlation with established major findings and interpretations in 10 cases;</td>
</tr>
<tr>
<td>DBE</td>
<td>1-day seminar; includes hands-on lab</td>
<td>Equivalent to 1-day seminar; supervised patient procedures</td>
<td>Observed 3 live cases including 1 retrograde case</td>
<td>Actively participate in 10 cases including 2 retrograde cases</td>
<td>Practitioner: observed by experienced enteroscopist as acceptable in 2 cases. Fellow: considered competent by qualified attending as acceptable in 2 observed cases</td>
</tr>
<tr>
<td>SBE</td>
<td>1-day seminar; includes hands-on lab</td>
<td>Equivalent to 1-day seminar; supervised patient procedures</td>
<td>Observed 3 live cases including 1 retrograde case</td>
<td>Actively participate in 10 cases including 2 retrograde cases</td>
<td>Practitioner: observed by experienced enteroscopist as acceptable in 2 cases. Fellow: considered competent by qualified attending as acceptable in 2 observed cases</td>
</tr>
<tr>
<td>SE</td>
<td>1-day seminar; includes hands-on lab; patient experience preferred</td>
<td>Equivalent to 1-day seminar; supervised patient procedures</td>
<td>Participated in 3 cases</td>
<td>Actively participate in 10 cases</td>
<td>Practitioner: observed by experienced enteroscopist as acceptable in 2 cases. Fellow: considered competent by qualified attending as acceptable in 2 observed cases</td>
</tr>
</tbody>
</table>

*Fellows require a higher level of training than practicing endoscopists because of the lack of practical experience.

†All seminars should include lectures in instrument designs, mechanisms of action, indications, contraindications, complications, current literature review, alternative procedures, integration of complementary technologies, pathology recognition, common small-bowel diseases, and basic and advanced procedure techniques.

‡No data support. Recommendation based on personal experience.
CONCLUSIONS

The small bowel is no longer the final frontier of GI endoscopy. Recent advances have allowed for complete or nearly complete, real-time small-intestine examination with the ability to aid diagnosis by taking biopsy specimens as well as providing therapy for various GI ailments. How these new technologies are taught and put into practice is still evolving. As the discipline matures, a more structured approach will perhaps emerge.

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Abbreviations: DBE, double-balloon enteroscopy; SBE, single-balloon enteroscopy.

REFERENCES


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