



# Flexible endoscopy: surgical education

Joshua S. Winder<sup>1</sup>, Ryan M. Juza<sup>2</sup>

<sup>1</sup>Department of General Surgery, Penn State Milton S. Hershey Medical Center, Hershey, PA, USA; <sup>2</sup>Department of Surgery, Division of General Surgery, University Hospitals, Cleveland, OH, USA

*Contributions:* (I) Conception and design: All authors; (II) Administrative support: All authors; (III) Provision of study materials or patients: None; (IV) Collection and assembly of data: None; (V) Data analysis and interpretation: None; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

*Correspondence to:* Ryan M. Juza, MD. Assistant Professor, Department of Surgery, Division of General Surgery, University Hospitals, 11100 Euclid Ave. Office: Lakeside, 7113, Cleveland, OH 44106, USA. Email: Ryan.Juza@UHhospitals.org.

**Abstract:** Flexible endoscopy plays a major role in the diagnosis and treatment of gastrointestinal disease. To fulfill that role, the American Board of Surgery and the Society of Gastrointestinal and Endoscopic Surgeons created a formalized curriculum to ensure competency of surgical trainees. A robust didactic and skills-based curriculum was developed and initiated across all general surgery training programs in the US. In this article, we will review the current curricula, its components, testing, and validation.

**Keywords:** Flexible endoscopy; fundamentals of endoscopic surgery (FES); education

Received: 02 April 2019; Accepted: 15 April 2019; Published: 26 April 2019.

doi: 10.21037/ales.2019.04.07

**View this article at:** <http://dx.doi.org/10.21037/ales.2019.04.07>

## Introduction

Since its introduction, flexible endoscopy has remained a core component of the diagnosis and management of gastrointestinal (GI) disease. Gastroenterologists historically have performed a large portion of the diagnostic and therapeutic endoscopy at larger centers where many of the surgical training programs exist. However, as the techniques and devices evolve, more surgeons are reincorporating endoscopy into their practice. In order to formalize a training curriculum for general surgery residents, the American Board of Surgery (ABS) jointly with the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) have developed the fundamentals of endoscopic surgery (FES). This comprehensive curriculum incorporates a robust didactic and hands-on curriculum and testing to teach and verify proficiency of trainees. As of 2018, all graduating general surgery residents are required to demonstrate completion of the FES curriculum in order to be eligible for graduation. In this review, we examine the components of the FES curriculum, its development, and initial reception.

## History

Flexible endoscopy has existed for a century and has rapidly evolved into an irreplaceable tool in the diagnosis and management of GI disorders. Though gastroenterologists provide the majority of the diagnostic and therapeutic endoscopy in the US, the evolution of diagnostic and therapeutic techniques have been advanced jointly by gastroenterology and surgery. Surgeons first described endoscopic removal of foreign bodies from the GI tract, examination of the colon and intubation of the cecum, colonoscopic polypectomy, endoscopic tattooing of colonic malignancy, percutaneous endoscopic gastrostomy (PEG), and endoscopic retrograde cholangiopancreatography (ERCP) (1). These techniques have been advanced jointly by gastroenterology and surgery. As the technology advances, and more endoscopic tools are developed, surgeons are making flexible endoscopy a more central part of their practice across the US (1).

## Endoscopic training requirements

Surgical residents are required to keep a detailed log of

all cases in which they are involved. In general, in order for a resident to receive credit for any given case, they are required to participate in at least 50% of the case as the operating surgeon. Residents are required to meet defined minimums in various areas of surgical training (2). Endoscopy is one of the core categories and is broadly divided into upper and lower endoscopy. There is no further subdivision (i.e., therapeutic *vs.* diagnostic, etc.) and specific procedures (i.e., polypectomy, PEG, ERCP, etc.) are not delineated. In order to increase residents' experience and exposure to endoscopy, the Resident Review Committee (RRC) increased the minimum endoscopic procedural numbers from 29 to 85 for graduating residents (2). In doing so, the ABS cited literature showing that markers of competence were achieved within the required number of procedures, as long as skills were regularly utilized (3,4).

Major gastroenterologic societies released the first formal curriculum for endoscopy in 1996 (5). Likewise, the ABS recognized the need for ongoing education and training for surgeons who were increasingly utilizing endoscopy in their practices and released an endoscopy curriculum for surgical residents in 2014 called the flexible endoscopy curriculum (FEC) (6). Concurrently SAGES developed a validated endoscopy proficiency test in the FES. After a short introductory period, the ABS mandated completion of the FEC, including passing the FES testing program, by all surgical residents in order to graduate starting with the 2017-2018 academic year.

## FEC

The FEC created by the ABS consists of 5 sections that sequentially build and are intended to be completed by residents as they progress through a 5-year residency. The curriculum contains both cognitive and technical milestones that are meant to supplement, not replace, the defined endoscopic minimums throughout surgical residency.

The level 1 curriculum is focused on introduction to the basics of upper and lower endoscopy, patient selection, pre-procedural planning, indications and contraindications, pertinent anatomy, and key steps to completion of each procedure. The curriculum consists of both online didactic material and skills acquisition. This first level of introduction is not intended to be performed on patients, rather the skills portion is to be completed on simulated tasks using commercially available trainers. The level 1 FEC curriculum is incorporated into the Phase 1 core skills curriculum of the American College of Surgeons (ACS) to teach core surgical

skills and define designated milestones (7).

The second level of the FEC is a continuation of level one with a more robust online component and list of online resources and introduces the first portion of the FES curriculum (8). The FES was designed to ensure a defined minimum skill and knowledge level in diagnostic and therapeutic endoscopy for surgical trainees and should be completed by the end of the second year of training.

Upon reaching the third level of the FEC, clinical encounters are introduced. It is expected that the trainee will already be able to demonstrate basic techniques and skill gained during simulation so that once introduced to clinical cases the resident will be competent with basic maneuvers. Additionally it is expected that the resident spend, at a minimum, one month on a dedicated endoscopy rotation to reinforce the skills learned. This can be achieved on either a surgical, or gastroenterology service, as long as the proctor is a specialist in endoscopy. Technical ability during the clinical experience is reported using the Global Assessment of Gastrointestinal Endoscopic Skills (GAGES) and residents at this level should consistently achieve scores above 17 out of 25 (9). During this third level of FEC, therapeutic interventions are also introduced.

The fourth level of FEC continues to build on the didactic and technical training of the resident, but now includes therapeutic skills including endoscopic control of hemorrhage. It is expected that the resident will continue to have exposure to endoscopy through their routine clinical practice, and as such a dedicated endoscopy rotation is not required beyond the third level.

The final level of the FEC introduces more advanced techniques such as ERCP though performing and becoming facile in these advanced techniques is not a requirement of graduation. Prior to graduation, the resident must complete the defined minimums established by the RRC, namely 35 upper endoscopies, and 50 lower endoscopies. Additionally, residents must pass the cognitive and skills test required by FES in order to be eligible for graduation.

## FES

In order to ensure competency in endoscopic techniques, a task force within SAGES was created to develop a curriculum for surgical trainees. This curriculum was designed to incorporate both didactic and skills acquisition, and to both teach and test trainees for proficiency. SAGES had previously successfully developed a didactic and skills training model, Fundamentals of Laparoscopic Surgery

(FLS) curriculum (10,11). The resulting FES curriculum similarly consists of a stepwise online didactic course with supplemental skills acquisition. Upon completion of the self-guided curriculum the trainee is then tested by both a written test, and a skills test performed on an endoscopic simulator at a designated testing center.

### *Cognitive training and testing*

For those not in a US surgical residency, or those who are already out in practice, the online curriculum is available on the SAGES website. The curriculum consists of a self-directed, interactive online series of 12 modules. The 12 modules guide the learner through topics including technology, patient preparation, sedation and analgesia, upper and lower endoscopy, ERCP, procedures for gastrointestinal hemorrhage, tissue removal, and enteral access. Each module has specific objectives, which are then evaluated at the completion of the module in the form of multiple-choice questions.

The final written exam is administered electronically and consists of 75 multiple-choice questions given over a 90-minute period. Prior to implementation, the cognitive exam was evaluated by the FES task force and Kryterion Inc. (Phoenix, AZ, USA). Potential test questions were beta tested on novices and experts in the fields of both gastroenterology and surgery (12). A minimum passing score was determined and a contrasting group method was used to compare how experienced endoscopists would answer questions compared to inexperienced endoscopists.

### *Hands-on skills testing*

An expert panel of endoscopists identified 7 core skills that are essential to safe and competent completion of endoscopic procedures. These skills include: (I) scope navigation (tip deflection, scope traversal, torque, and use of two-handed technique); (II) loop reduction; (III) retroflexion; (IV) traversing a sphincter; (V) management of insufflation; (VI) mucosal evaluation; and (VII) targeting (13). These skills were then modeled in virtual reality skill modules on the GI Mentor II endoscopic simulator (Simbionix™ Ltd, Airport City, Israel). The FES task force, jointly with Simbionix, created 5 modules designed to test the 7 core skills identified. The 5 modules are not available to trainees prior to the exam, and the ABS does not mandate purchase of a simulator by training programs, rather the skills are expected to be acquired during regular surgical training.

To validate the hands-on portion of the FES test, 160 individuals were tested and analyzed. A contrasting-group method was used to compare performance on the five required modules. One group consisted of individuals who were deemed “likely to succeed” based on their prior endoscopic experience, which was defined as more than 100 previous endoscopies. The second group consisted of novice endoscopists (<100 cases). Overall performance had a high correlation with the level of experience and demonstrated good internal consistency with a high test-retest reliability. A final passing score was determined and the test administered to 25 experienced endoscopists who demonstrated a 92% pass rate (14). The hands-on test was further validated by Mueller *et al.* who found a strong correlation between GAGES scores and FES pass rates (15).

## **Conclusions**

The FEC and FES are the result of a combined effort between the ABS and SAGES to fill a need for a formalized, didactic and skills-based curriculum. Furthermore, mandated testing of proficiency helps to ensure that a minimum-standard is reached by graduating surgical residents. As demonstrated above, these tests have been previously validated by experienced endoscopists. This curriculum has been rapidly incorporated into modern surgical training and as of the 2017–2018 academic year, has become the standard requirement for graduating surgical residents. As endoscopic techniques and technologies progress and evolve, the curriculum will require revision and updating. However, this major effort demonstrates a significant improvement in the endoscopic training provided to current surgical residents and has rapidly become the new standard in modern surgical education.

## **Acknowledgments**

*Funding:* None.

## **Footnote**

*Provenance and Peer Review:* This article was commissioned by the editorial office, *Annals of Laparoscopic and Endoscopic Surgery* for the series “Surgical Endoscopy: Essential Skills in Gastrointestinal Surgery”. The article has undergone external peer review.

*Conflicts of Interest:* Both authors have completed the

ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/ales.2019.04.07>). The series “Surgical Endoscopy: Essential Skills in Gastrointestinal Surgery” was commissioned by the editorial office without any funding or sponsorship. RMJ served as the unpaid Guest Editor of the series. The authors have no other conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

*Open Access Statement:* This is an Open Access article distributed in accordance with the Creative Commons Attribution-NonCommercial-NoDerivs 4.0 International License (CC BY-NC-ND 4.0), which permits the non-commercial replication and distribution of the article with the strict proviso that no changes or edits are made and the original work is properly cited (including links to both the formal publication through the relevant DOI and the license). See: <https://creativecommons.org/licenses/by-nc-nd/4.0/>.

## References

1. Ponsky JL, Rodriguez JH. Surgical Endoscopy: A Historical Perspective. In: Kroh M, Reavis K, editors. The SAGES Manual Operating Through the Endoscope. Springer; 2016.
2. Defined Category Minimum Numbers: General Surgery. In: Effective for Program Graduates Beginning Academic Year 2017-2018. 2017. Available online: <https://static1.squarespace.com/static/5755bee7c6fc08efd68ab265/t/57e3fe69e6f2e1094b15aa9e/1474559594675/ACGME+defined+category+minimums.pdf>.
3. Wexner SD, Garbus JE, Singh JJ. A prospective analysis of 13,580 colonoscopies. Reevaluation of credentialing guidelines. *Surg Endosc* 2001;15:251-61.
4. Reed WP, Kilkenny JW, Dias CE, et al. A prospective analysis of 3525 esophagogastroduodenoscopies performed by surgeons. *Surg Endosc* 2004;18:11-21.
5. American Association for the Study of Liver Diseases; American College of Gastroenterology; AGA Institute; American Society for Gastrointestinal Endoscopy. A journey toward excellence: training future gastroenterologists--the gastroenterology core curriculum, third edition. *Am J Gastroenterol* 2007;102:921-7.
6. Hur H, Park IY, Sung GY, et al. Intrahepatic cholangiocarcinoma associated with intrahepatic duct stones. *Asian J Surg* 2009;32:7-12.
7. ACS/APDS Surgery Resident Skills Curriculum - Phase 1. Available online: <http://www.facs.org/education/program/resident-skills/phase1>. Accessed 2018 American College of Surgeons.
8. Soper NJ, Scott-Conner CE, editors. The SAGES Manual: Volume 1 Basic Laparoscopy and Endoscopy. 3rd ed. Springer; 2012.
9. Vassiliou MC, Kaneva PA, Poulouse BK, et al. Global Assessment of Gastrointestinal Endoscopic Skills (GAGES): a valid measurement tool for technical skills in flexible endoscopy. *Surg Endosc* 2010;24:1834-41.
10. Peters JH, Fried GM, Swanstrom LL, et al. Development and validation of a comprehensive program of education and assessment of the basic fundamentals of laparoscopic surgery. *Surgery* 2004;135:21-7.
11. Sroka G, Feldman LS, Vassiliou MC, et al. Fundamentals of laparoscopic surgery simulator training to proficiency improves laparoscopic performance in the operating room-a randomized controlled trial. *Am J Surg* 2010;199:115-20.
12. Poulouse BK, Vassiliou MC, Dunkin BJ, et al. Fundamentals of Endoscopic Surgery cognitive examination: development and validity evidence. *Surg Endosc* 2014;28:631-8.
13. Vassiliou MC, Dunkin BJ, Marks JM, et al. FLS and FES: comprehensive models of training and assessment. *Surg Clin North Am* 2010;90:535-58.
14. Vassiliou MC, Dunkin BJ, Fried GM, et al. Fundamentals of endoscopic surgery: creation and validation of the hands-on test. *Surg Endosc* 2014;28:704-11.
15. Mueller CL, Kaneva P, Fried GM, et al. Colonoscopy performance correlates with scores on the FES manual skills test. *Surg Endosc* 2014;28:3081-5.

doi: 10.21037/ales.2019.04.07

**Cite this article as:** Winder JS, Juza RM. Flexible endoscopy: surgical education. *Ann Laparosc Endosc Surg* 2019;4:43.