

# The Fundamentals of Laparoscopic Surgery:

## Its time has come

by Nathaniel J. Soper, MD, FACS;  
and Gerald M. Fried, MD, FACS

The incorporation of laparoscopic surgery into the armamentarium of general surgeons occurred rapidly in the early 1990s. There was a distinct learning curve during the uptake of laparoscopic cholecystectomy, and an increase in bile duct injuries was noted.<sup>1</sup> Much of the education offered in laparoscopic techniques for established surgeons was provided by industry and many surgeons learned “one-handed” operating techniques while the underpinning cognitive aspects unique to laparoscopy were given short shrift. Courses were usually brief, extremely variable in quality and content, and directed at teaching a specific operation (that is, laparoscopic cholecystectomy). Upon completion, course attendees were presented with a certificate of attendance that then formed the basic currency for acquiring clinical privileges in laparoscopy in their institution.

In the late 1990s, the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) began development of the Fundamentals of Laparoscopic Surgery (FLS), a comprehensive program designed to teach the cognitive and psychomotor aspects unique to laparoscopic surgery, associated with a mechanism for assessment. It was not SAGES’ intent to develop a certifying examination

but rather to provide tools for the teaching and assessment of the cognitive knowledge, technical skills, and clinical judgment related specifically to basic laparoscopic surgery. The final product was the result of the combined effort by many surgical experts, educators, and administrators and represents one of the first fully developed competency evaluation tools available for surgeons.<sup>2</sup>

The FLS program thus consists of two components: a didactic module for education and an examination to assess competency. The didactic component covers the knowledge, judgment, and technical skills that form the basis for performing basic laparoscopic surgery. The cognitive portion addresses four broad content areas: preoperative, intraoperative, and postoperative considerations and basic laparoscopic procedures. It is presented electronically, on CD-ROM (and more recently a Web-based format), making extensive use of illustrations and multimedia with videos and animation. The content was thoroughly vetted by a panel of content experts in laparoscopy to ensure that the material is essential for basic laparoscopic surgery and independent of specific procedures or surgical specialties.

The second portion of the educational program incorporates an inexpensive, portable, and flex-

---

ibly designed physical model to teach the specific skills fundamental to performance of laparoscopic surgery. A portable pelvic trainer box with built-in video camera was developed to facilitate the manual skills component of FLS. These technical skills were derived from a review of operative videos by experienced, practicing laparoscopic surgeons. They were asked to identify the skills that are unique to laparoscopy. The list they compiled then formed the objectives for the manual skills component. A series of exercises that could be performed in the simulator, using actual laparoscopic instruments, under the monocular magnified optical system characteristic of laparoscopic surgery, was developed. Performance of each task was evaluated using metrics designed to reward efficiency and precision, with penalties applied for errors.

The manual skills training practicum was based on the McGill Inanimate System for Training and Evaluation of Laparoscopic Skills program, originally developed by Dr. Fried and colleagues at McGill University in Montreal, QC.<sup>3-5</sup> Each of these tasks is demonstrated on the digital educational platform and related to the specific clinical skills it was designed to teach. The manual skills include bimanual transferring, precise cutting, use of ligating loops, and suturing with intracorporeal and extracorporeal knotting. A cannulation exercise is currently being validated and will be added to the current skill set.

Competence is assessed through a two-part examination. The cognitive examination is computer-based and consists of a timed, secure test with multiple-choice questions and clinical scenarios. These questions and scenarios were subjected to rigorous oversight by medical educators.<sup>2</sup> The proctored test is taken at designated testing locations and raw data are then transmitted to a central administrative center for grading and analysis. The technical skills examination is proctored, taken on the standardized endoscopic training boxes with uniform equipment and testing materials, also at designated test locations. This manual skills test has been shown to have excellent reliability and has been subjected to extensive validation. The FLS simulator scores correlate with laparoscopic experience and are predictive of performance in the operating room.<sup>6</sup>

After developing the teaching and evaluation

modules of FLS, this program was subjected to beta testing among seven designated testing centers located across North America. Surgical trainees and practicing surgeons with differing levels of laparoscopic experience and skill took part in this evaluation that has been reported elsewhere.<sup>7</sup> The beta test results for the FLS examination demonstrated that it was feasible to administer, had appropriate psychometric properties, and that it met standards of reliability and validity required for high-stakes assessment.

In 2005, the American College of Surgeons partnered with SAGES to lend support to this first fully developed competency evaluation tool available for surgeons. FLS is now a joint program of SAGES and ACS and is managed by a steering committee that includes representatives from both organizations. Since that time, great momentum has developed around the FLS program, and many general surgery residency programs have incorporated the FLS program as a key component of laparoscopic training for residents. The recently released joint ACS-Association of Program Directors in Surgery technical skills curriculum for surgical residents includes the components of the FLS program in both its basic and advanced laparoscopic modules. Several hospitals have mandated that surgeons practicing laparoscopic surgery must have passed the FLS examination to be privileged to perform these operations. At least one captive malpractice insurance company has provided financial incentives for participating laparoscopic surgeons to complete the FLS program and attain certification.

---

*Dr. Soper is the  
Loyal and Edith Davis  
Professor and chairman,  
department of  
surgery, Northwestern  
University Feinberg  
School of Medicine,  
Chicago, IL.*



There also has been increased interest in the FLS program among international groups of surgeons. For instance, the Royal Australasian College of Surgeons has now incorporated FLS into its training programs for all surgical residents and will be using it as a component of board certification among practicing surgeons.


Despite these advances, there has been a great deal of concern that the cost of the FLS program made it prohibitive for most general surgery training programs. In response to this concern, Covidien recently funded a large educational grant to the FLS program to support rapid dissemination among surgical training programs.\* This generous grant will allow each general surgery resident training program in the U.S. and Canada to obtain one of the FLS video training boxes as part of simulation efforts mandated by the Residency Review Committee on Surgery. Furthermore, complimentary vouchers for completing the testing component of FLS will be supplied for each graduating chief resident in general surgery as well as fellows in the Fellowship Council and gastrointestinal surgery and colorectal fellowships within the U.S. and Canada.

In April, notices were sent out to all general surgery and fellowship program directors informing them of this program and how to register to receive the FLS program and test vouchers. By mid-June, 166 residency programs and 45 fellowships had enrolled in the Covidien Educational Fund, representing more than 1,000 postgraduates in their fourth or fifth year and approximately 230 fellows. It thus seems likely that FLS will be incorporated in virtually all North American residency training programs. Most recently, the American Board of Surgery (ABS) determined that passing the FLS certifying examination will be a requirement for taking the ABS qualifying (written) examination.

In summary, the FLS program was developed because of an identified need to educate surgeons in the underlying principles and basic skills of laparoscopic surgery and because of the growing demand to document competency in surgical practice. This program has been shown to be reliable and valid by a rigorous metrics process and multi-institutional beta testing. Given the partnership

\*See related story on page 33 of the August issue of the *Bulletin*.

between SAGES and the American College of Surgeons, the recent mandate for FLS certification before sitting for the ABS examination, the growing recognition of FLS internationally, and the recent Covidien Education grant facilitating widespread adoption by general surgery trainees, the FLS program has the potential to have a large impact on the quality of education in laparoscopic surgery and to promote patient safety.

More information about the FLS program is available at <http://www.flsprogram.org/>. 

## References

1. Strasberg SM, Hertl M, Soper NJ. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. *J Am Coll Surg*. 1995;180:101-125.
2. 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;135:21-27.
3. Derossis AM, Fried GM, Abrahamowicz M, et al. Development of a model for training and evaluation of laparoscopic skills. *Am J Surg*. 1998;15:482-487.
4. Fried GM, Feldman LS, Vassiliou MC, et al. Proving the value of simulation in laparoscopic surgery. *Ann Surg*. 2004;240:518-528.
5. Fried GM, Feldman LS. Objective assessment of technical performance. *World J Surg*. 2008;32(2):156-160.
6. McCluney AL, Vassiliou MC, Kaneva PA, et al. FLS simulator performance predicts intraoperative laparoscopic skill. *Surg Endosc*. 2007;21(11):1991-1995.
7. Swanstrom LL, Fried GM, Hoffman KI, Soper NJ. Beta test results of a new system assessing competence in laparoscopic surgery. *J Am Coll Surg*. 2006;202:62-69.

**Dr. Fried** is professor of surgery and Adair Family Chair of Surgical Education at McGill University, Montreal, QC.

