

The Training of Surgical Residents in Laparoscopy

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“Man is the only animal capable of tying a square knot. During the course of an operation you may be asked by the surgeon to tie a knot. As drawing and coloring are the language of art, incising, suturing and knot tying are the grammar of surgery. A facility in knot tying is gained only by tying ten thousand of them. When the operation is completed, take home with you a package of leftover sutures. Light a fire in the fireplace and sit with your lover on a rug in front of the fire. Invite her to hold up her index finger, gently crooked in a gesture of beckoning. Using her finger as a strut, tie one of the threads about it in a square knot. Do this one hundred times. Now make a hundred grannies. Only then may you permit yourself to make love to her. This method of learning will not only enable you to master the art of knot tying, both grannies and square, it will bind you, however insecurely, to the one you love.”¹

This advice by accomplished surgeon-author Richard Selzer quoted from *Letters to a Young Doctor* clearly portrays one of the essential components necessary to master the art of surgery—repetition. Although the science of surgery can be garnered from isolated clinical experiences as well as “book knowledge,” the art of surgery, i.e., the ability to operate, is a technical exercise requiring diversity and vol-

ume. Thus, the question “how does one become a surgeon?” has the same answer as the solution to the riddle “how does one get to Carnegie Hall?” *Practice! Practice! Practice!* This requirement has been especially problematic with the development and incorporation of laparoscopy into general surgery. Simply put, before the students (residents) can develop expertise in laparoscopic surgery, their teachers

must attain this same expertise to serve as instructors. Volume (repetition) is limited initially. Yet surgical programs throughout the United States have integrated laparoscopic surgery into their residencies. This report will attempt to describe the evolution of this important surgical technology, define the requirements for surgical residencies as mandated by the Residency Review Committee (RRC) and the American

Board of Surgery (ABS), illustrate how a single surgical residency integrated laparoscopy into its program, and finally suggest some unique teaching resources for surgical training.

HISTORICAL OVERVIEW OF LAPAROSCOPY

Although laparoscopy is nearly a century old, its universal acceptance as a valuable adjunct for the general surgeon did not occur until the late 1980s with the successful removal of the gallbladder laparoscopically.² A variety of milestones in the evolution of laparoscopy would cause one to wonder why this endoscopic tool was not adopted much earlier.² In 1911, H. C. Jacobaeus reported his experience with 72 patients in performing laparoscopy and thoracoscopy. Using this technique, he was able to identify syphilis, tuberculosis, cirrhosis, and malignancy. John C. Ruddock, an internist, detailed his personal laparoscopic experience of 500 patients over a four-year period. This work was published in 1937 in a major surgical journal—*Surgery, Gynecology and Obstetrics*—and it described methods for obtaining biopsies, techniques for assessing resectability of organs, and other aspects of laparoscopy which one would assume would be of interest to the general surgeon. Other milestones can be listed, from the inception of laparoscopy in 1901 to the successful removal of the gallbladder in the late 1980s. However the single most influential ingredient necessary in transforming laparoscopy from a neglected, maligned procedure to a highly valued surgical tool was the development of videolaparoscopy. The ability to display cholecystectomy, the first major general surgical laparoscopic therapeutic procedure on video monitors, provided the mechanism for instruction of innumerable students, from residents to fully trained surgeons. Prior to videolaparoscopy, the laparoscopist was hindered by the mechanics of the rigid laparoscope. Viewing through the eyepiece of the laparoscope was not only awkward but required that the instrument be stabilized by the laparoscopist, thus making the surgeon/laparoscopist a “one-handed” operator. Teaching attachments would in general allow only one other individual to visualize the laparoscopy. Others, such as assistant surgeons, medical students, and nurses, were literally left in

the dark during the procedure. The educational experience was thus very limited and the possibility of performing major therapeutic interventions unlikely. Videolaparoscopy eliminated all of these obstacles. With the successful accomplishment of laparoscopic cholecystectomy and the widespread availability of videolaparoscopy, one final barrier remained before therapeutic laparoscopy would become integrated into general surgery and resident education—the acceptance of this procedure by surgical academics.

Laparoscopic cholecystectomy began in the community. Its initial growth was patient- and industry-driven. However, when it became apparent that the patient demand for this procedure could not be arrested, that the procedure appeared reasonably safe, and that there did appear to be major advantages of laparoscopic cholecystectomy over open cholecystectomy, the academic community accepted the procedure, and select academic surgeons acquired training and expertise in it. The introduction of laparoscopy into residency training has developed at differing rates; accreditation and certification has been provided by mainly two governing bodies—the Residency Review Committee and the American Board of Surgery.

The Residency Review Committee and the American Board of Surgery

Residency training, also known as Graduate Medical Education, takes place in programs which receive their accreditation from the Residency Review Committee (RRC) under the authority of the Accreditation Council for Graduate Medical Education (ACGME). Accreditation refers to the process for determining whether an educational program is in compliance with established standards. In the case of general surgery, the program requirements are developed by the Residency Review Committee of Surgery. Accreditation must be differentiated from certification. The latter refers to the process for determining whether an individual has met established requirements within a particular specialty. For general surgery, certification of individuals who have completed residency training is determined by the American Board of Surgery.

The Residency Review Committee defines the categories of general

surgery and the numbers and distribution of complex cases in these categories judged necessary to achieve adequate operative skill and surgical judgement. The defined categories of general surgery are as follows:

1. Skin and soft tissues and breast
2. Head and neck
3. Alimentary tract
4. Abdomen
5. Liver
6. Pancreas
7. Vascular
8. Endocrine
9. Thoracic
10. Pediatric
11. Plastic
12. Trauma
13. Endoscopy

Recommended numbers of cases for each category range from a low of 3 (pancreas) to a high of 65 (abdomen). The category of endoscopy includes all endoscopic procedures except rigid or flexible sigmoidoscopy. The recommended number of cases for endoscopy is 29. It would seem obvious that considering the range of endoscopic procedures, expertise as a *surgical endoscopist* is unlikely to occur with such minimal experience. While avoiding specific numbers, the Accreditation Council for Graduate Medical Education mandated that “the resident must have personal experience with a variety of rigid and flexible endoscopic techniques, including laryngoscopy, bronchoscopy, esophagoscopy, gastroscopy, colonoscopy, peritoneoscopy and intraoperative choledochoscopy: this shall include new and developing endoscopic techniques” (Directory of Residency Training Programs, July 1, 1986). Thus, although the RRC and the ACGME establish the standards of training for surgical residents, these authoritative bodies have provided only general guidelines regarding endoscopic training in general and laparoscopic training in particular. The American Board of Surgery has taken a similar approach. As indicated above, the ABS is not an accrediting body but rather provides the mechanism for certification. This consists in the creation, administration, and evaluation of two examinations: the Qualifying Exam in Surgery (written) and the Certifying Exam (oral). These examinations are taken after residents have completed a

residency in surgery in a program accredited by the RRC. Additionally, documentation by the residency program director that all requirements have been met and the resident is competent to practice general surgery is necessary before the qualifying exam can be taken. In 1980, the American Board of Surgery mandated that the general surgeon should *be able to perform adequately* such procedures as bronchoscopy, esophagoscopy, gastroscopy, colonoscopy, peritoneoscopy and choledochoscopy.³ The means to provide the training and experience to accomplish this mandate in most surgical residency programs was not available. Consequently, the American Board of Surgery subsequently revised its guidelines to read that surgical residency training programs should be able to provide *familiarity* with gastrointestinal endoscopic techniques.⁴

Despite the monumental changes which have occurred in general surgery with the acceptance of laparoscopic cholecystectomy and its consequences, no new recommendations have been proposed by the RRC and the ABS. The Society of American Gastrointestinal Endoscopic Surgeons (SAGES) was the first organization to provide guidelines for credentialing and training in laparoscopic general surgical procedures (Table 1).⁵

THE CASE WESTERN RESERVE EXPERIENCE

From the above, it is obvious that guidelines for residency training in laparoscopy have been slow in developing; in reality, the external forces of patient demands and competition with community surgeons were the most important forces driving the development of laparoscopy in the academic setting and consequently the surgical residency training program. A description of our own surgical training program is instructive since it parallels other training programs in both the manner and timing of the incorporation of laparoscopy into the residency. The Case Western Reserve University (CWRU) Integrated Surgical Residency introduced laparoscopic cholecystectomy into its training program in 1990. At that time the CWRU surgical program consisted of three hospitals: University Hospitals of Cleveland, Cleveland Veterans Administration Hospital, and MetroHealth Medical

Center (in 1994-95 a fourth hospital, Mount Sinai Medical Center, became fully integrated into the CWRU Surgical Residency).

We will analyze the experience of University Hospitals (U.H.) since it is the hub of the surgical residency program, serves as the clinical base for the senior author (TAS), and was the first of the three hospitals to initiate a laparoscopic cholecystectomy pro-

gram. The first laparoscopic cholecystectomy at U.H. was accomplished in April 1990. During most of the first year following the initial successful cholecystectomy, senior surgical residents either first assisted or served as the camera operator during these procedures. In addition, a monthly pig laboratory was established which continued for 18 months. This consisted of a didactic session followed by a

Table 1. Excerpt from SAGES Guidelines: Granting of Privileges for Laparoscopic (Peritoneoscopic) General Surgery

TRAINING AND DETERMINATION OF COMPETENCE

A. Formal fellowship or residency training in general surgery
B. Determination of competence in Laparoscopic Surgery

1. Completion of a surgical residency/fellowship which incorporates structured experience in laparoscopic surgery. Competence should be documented by the instructor(s).
2. Proficiency in laparoscopic surgical procedures and clinical judgment equivalent to that obtained in a residency/fellowship program. Documentation and demonstration of competence is necessary.
3. For those without residency training or fellowship which included laparoscopic surgery or without documented prior experience in laparoscopic surgery, the basic minimum requirements for training should be:
 - a. completion of approved residency training in general surgery,
 - b. credentialing in diagnostic laparoscopy,
 - c. training in laparoscopic general surgery by a surgeon experienced in laparoscopic surgery or completion of a university-sponsored or academic society-recognized didactic course with clinical experience and hands-on laboratory practice, and
 - d. observation of laparoscopic surgical procedures performed by a surgeon (or surgeons) experienced in the performance of such procedures.
4. The applicant's laparoscopic training director should confirm in writing the training, experience (including the number of cases for each procedure for which privileges are requested) and actually observed level of competency. It is recognized that by virtue of completing a residency program in surgery the laparoscopic surgeon will have acquired at least five years of cognitive experience in anatomy, physiology, disease processes, combined with the progressive development of visual and psychomotor skills and experience necessary for the performance of diagnostic and therapeutic procedures in the abdominal cavity. Such experience includes indications, complications and alternative approaches. The training director's opinion and recommendation should be considered prima-facie evidence for the trainee's acceptance as an individual qualified in laparoscopic surgery. Likewise, attendance at short courses which do not provide supervised hands-on training is not an acceptable substitute for the development of competency.

C. New procedures

Self-training in new techniques in laparoscopic surgery must take place on a background of basic surgical and endoscopic skills. The laparoscopic surgeon should recognize when additional training is necessary.

From the Society of American Gastrointestinal Endoscopic Surgeons. Granting of privileges for laparoscopic (peritoneoscopic) general surgery. Los Angeles: Society of American Gastrointestinal Endoscopic Surgeons; 1990.

three-pig hands-on laparoscopic cholecystectomy involving one instructor (TAS) and three students. Initially these students were surgical attendings (general surgeons and pediatric surgeons). Once all attendings completed this experience, the laboratory was then attended by chief residents in general surgery. After the first group of chief residents rotated through this laboratory, it was not continued because the clinical experience grew at such a rapid rate that the laboratory was felt to be superfluous. During the academic year beginning in July 1991, the number of laparoscopic cholecystectomies performed by chief residents in our program ranged from 15 to 36 with a mean of 27 per chief resident. No junior residents had an opportunity to act as surgeon for this procedure. With each succeeding year, the number of these cases as well as other laparoscopic cases have increased for our chief residents such that for the present year (at which time we will finish eight chief residents, since a fourth hospital, Mount Sinai, is now integrated into our program), the average number of laparoscopic cholecystectomies for each chief resident is nearly 50. Despite this increase, all of our PGY (postgraduate year)-2 residents have also performed this procedure as surgeons, with some performing as many as 10 during this second year of residency. From a "numbers" perspective alone, it is obvious that (1) the absolute

number of laparoscopic cholecystectomies has increased; (2) the clinical volume of laparoscopic cholecystectomies for our chief residents has increased and has probably surpassed an arbitrary critical minimal level; (3) chief residents are now allowing junior residents to function as surgeons, which is evidence that a critical minimal volume has been achieved; and (4) all of the above supports the opinion that for basic laparoscopic procedures, a pig laboratory is probably no longer essential. Although numerous other laparoscopic procedures are performed in our residency, the laparoscopic cholecystectomy remains the most important clinical resource in gaining skill in laparoscopy. This procedure encompasses the entire range of laparoscopic skill, from the basic techniques of gaining access to the peritoneal cavity and trocar placement to the advanced techniques of bile duct exploration, laparoscopic choledochoscopy, and intracorporeal suturing. Thus this procedure provides the foundation for other advanced laparoscopic procedures. Prior to the development of laparoscopic cholecystectomy, "routine" open cholecystectomy was commonly performed by PGY-2 residents under attending supervision. Although this has not been attained as yet for laparoscopic cholecystectomy, the increasing experience with this procedure by our PGY-2 residents will provide the opportunity for this procedure

to become once again a "junior" level experience. All of this growth within the residency will have a domino effect. Residents at all levels become more experienced in laparoscopy; senior-level residents become better assistants at more advanced laparoscopic procedures and have a greater opportunity to act as surgeon for these more advanced procedures.

This scenario of resident education in laparoscopy is not unique. Zucker and colleagues from the University of Maryland describe an almost identical evolution of laparoscopic residency training.⁶ They also agree that "the longer period of training and the large number of laparoscopic procedures performed by the surgical housestaff allow them to receive adequate training without animal laboratory experience."⁶ Schirmer and associates from the University of Virginia echoed similar conclusions; additionally, they were able to demonstrate that there was no difference in the complication rate for cases in which residents were in the surgeon's position versus cases in which they were not.⁷ Concerns have been raised by these surgeons and others about the lack of experience which will occur with open cholecystectomy. These concerns may be unfounded. Visualization and appreciation of biliary anatomy is best obtained at laparoscopic cholecystectomy. The overall volume of cholecystectomies has increased with the introduction of the laparoscopic approach.⁸ A finite number of cholecystectomies will continue to be performed open. Finally, the surgical residency is a long educational process, and every procedure contributes to the overall skill of the surgeon.

Teaching Resources for Surgical Training

As indicated above, the most important resources for the initiation of laparoscopy into the curriculum of the surgical residency are qualified teachers and adequate clinical volume. For more advanced laparoscopic procedures, the laparoscopic training device becomes almost indispensable (Fig. 1). As opposed to open surgery in which suturing can be practiced on "noncritical" tissues such as skin, expertise in laparoscopic suturing must be attained prior to its application in the patient. The laparoscopic training device allows one to practice the maneuvers neces-

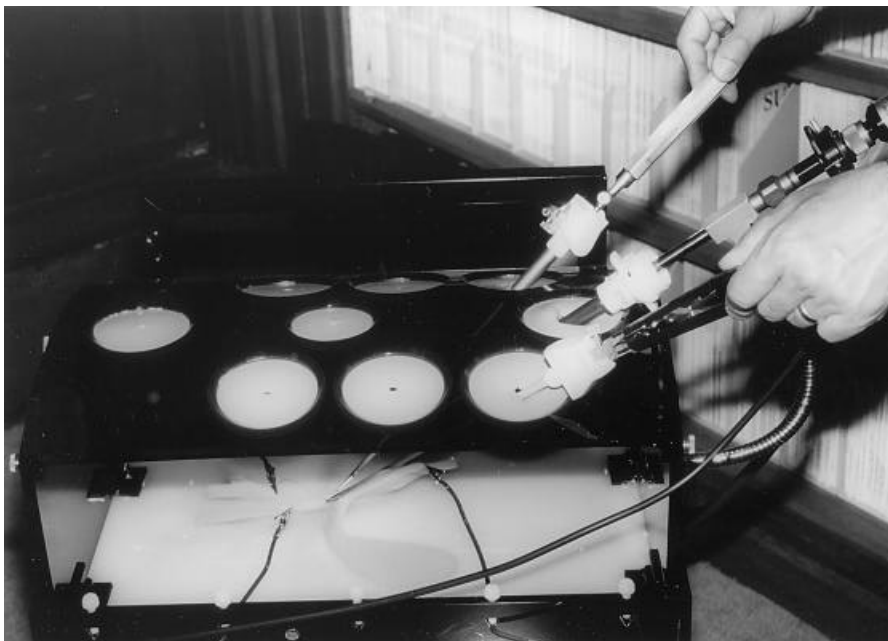


Figure 1. Laparoscopic trainer with needle holder and grasper in place. This device is invaluable in obtaining expertise in laparoscopic suturing and intracorporeal knot tying.

sary for laparoscopic suturing. This may utilize a variety of materials into which sutures are placed: foam, latex (penrose drains), commercial anatomic models, ex vivo animal tissue (chicken parts, pig intestine, etc.). Imagination in constructing such resources allows a variety of challenges for the laparoscopic surgeon. Simulated surgical tasks can be developed with increasing complexity; in all of these exercises, two-handed operating technique is essential.⁹ This and similar activity can prepare the resident for the advanced laparoscopic procedures that are now becoming commonplace. Most of the above are relatively inexpensive and readily available. Less available, more

expensive and somewhat untested are computer simulators, multimedia, and virtual reality.¹⁰ These may become the commonplace laparoscopic trainers of the 21st century! **STI**

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