Training For Advanced Laparoscopic Surgical Skills: Suturing, Knotting, And Anastomosis Techniques

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If surgical art can be defined as the operative relationship between the surgeon and the living tissue then it is easy to conclude that this relationship has changed. On the one hand, changed for the better as far as the end result is concerned, but on the other hand, for the worse, as far as it relates to the surgeon's effort, that is, the method by which this improved result is obtained. In essence, the surgeon will have to work a great deal harder to provide the added benefit for the patient.

One of the goals of laparoscopic surgery is *to make surgery easier for the surgeon while keeping the benefits for the patient*. This is accomplished by restructuring and adapting the two main components of surgery: skill and instrumentation.

The main stumbling block is that the benefit to the patient, which is obtained by minimizing access trauma, puts the surgeon in a handicapped position. Instead of direct vision he is looking at a video monitor with vastly inferior resolution compared that which can be seen

with the naked eye. Although the benefit of magnification and improved vantage point cannot be denied, nonetheless, the image is no longer real but "apparent", because it lacks direct and immediate confirmation and causes a sense of insecurity. In addition, the surgeon's confidence, derived from his ability in open surgery, is now missing.

The most basic and fundamental skill that allows the surgeon successful reconstruction of organs, control of large bleeders, and can otherwise get him out of trouble, is the confident suturing and knotting techniques that are taken for granted in the open setting. In the closed setting it is just as fundamental and important; however, transferring this technique is neither easy nor intuitive.

In the open setting stapling devices and techniques were adapted to expedite some of the anastomotic procedures and to replace the tedium of hand-suturing. These staplers were also developed for the laparoscopic approach; however, it does not completely eliminate the need for laparoscopic manual suturing technique.

The arduous nature of laparoscopic suturing requires that a structured, systematic program is taught by experienced suturing instructors to minimize the discouragement due to the initial difficulties. These challenges stem from magnification, a new anatomical perspective, the distant fulcrum, long instrumentation, and the closed approach.

The ideal training approach uses a gradual introduction, choreographed surgical technique, appropriately designed instrumentation, and stresses the importance of meticulous setup. 75% of surgical effort is preparation[1] and training is a large part of that. The goal for laparoscopic surgery is to have as many open procedures transferred as possible under the laparoscope to take advantage of the benefit of the minimal access; however, the differences of operating in the open and closed settings are enormous. Today only fraction of open procedures can be performed routinely via the minimally invasive approach. Some procedures such as hernia or fundoplication, however, are clearly more beneficial laparoscopically.

The instrumentation needed is long-stemmed and is pivoted about a somewhat flexible fulcrum. Guidance of the instruments requires relearning eye-hand coordination. In effect the tissue manipulation becomes a remote-controlled affair. *By combining remote tissue manipulation, an apparent image and an altered anatomical view, a new operating environment with a significantly increased difficulty level is created.*

Figures 1a,b. Laparoscopic suturing instruments (Karl Storz Endoscopy, Culver City, CA).

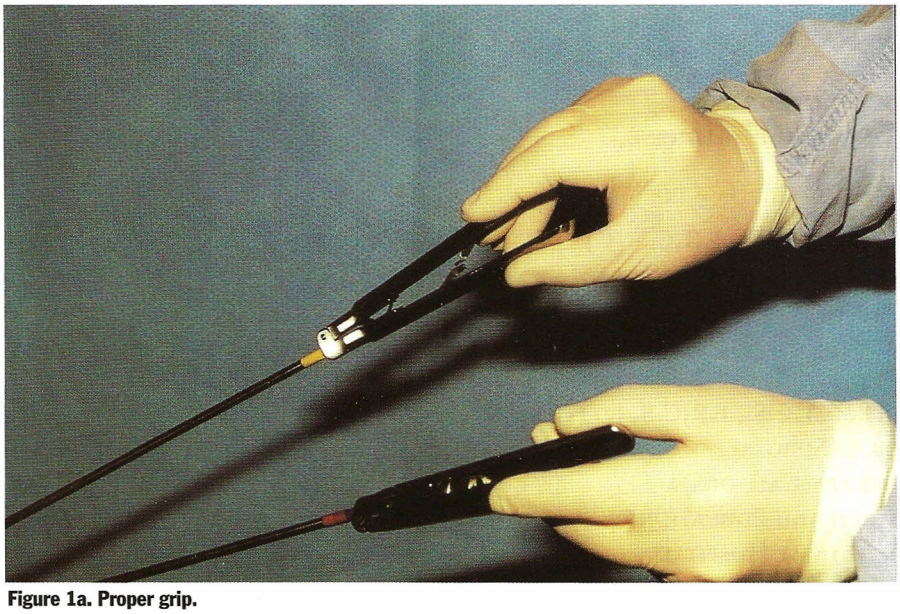

Figure 1a. Proper grip.

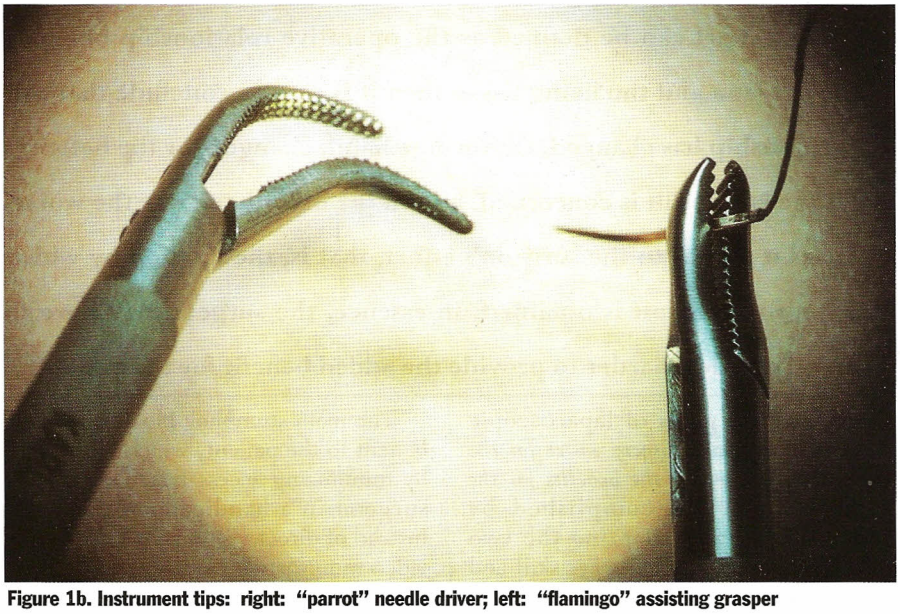

Figure 1b. Instrument tips: right: "parrot" needle driver; left: "flamingo" assisting grasper

Skill and Instrumentation

These two components go hand in hand; good instruments are a significant factor in easing the difficulty of surgery and it eliminates the need for compromising solutions. However, it is skill that reigns supreme as it is the critical component. As surgery becomes more and more beneficial to the patient by increasing operative precision as in microsurgery, or minimizing the trauma of access via laparoscopic surgery, the skill to meet laparoscopically the standards of traditional surgery (or even surpass it), requires proportionately greater skill, especially in times of transition such as we are experiencing now. With an increasing dependence on equipment and instruments their quality becomes part of the equation when calculating the level of difficulty.

Skill, the main and highly prized component, is practiced at various levels and obtained by long and arduous training. The more complicated, or "handicapped" surgery becomes, the higher the skill level is needed to obtain potentially better results. In the beginning of a revolutionary change in

surgery, obtaining a high skill level is difficult since the surgeon has to pioneer for himself a new and higher level of skill amidst conflicting ideas and interests. The best bet is to identify basic and essential skills and concentrate on learning these. Suturing is such an essential and fundamental skill and it gives *an excellent focus to the training.* The goal of the surgeon is to develop the level of suturing skill that is comparable to open suturing, so that it will be almost as easy and effortless.

Development of Training Methodology in Laparoscopic Suturing

Initially one of the authors (ZS) focused on the microsurgical (suturing) realm, both in research and training. Beginning in 1972, he taught these techniques in a multidisciplinary approach to many specialties including various reconstructive surgery fields (plastic, orthopedic, hand, ENT, maxillofacial, pediatric, etc.), neurosurgery, gynecology, urology, and other fields. These programs were developed from the ground up and became part of the training of residents, fellows, academic and private practitioners.

By 1991 laparoscopic surgeons recognized the stumbling block or "glass ceiling" resulting from their inability to confidently suture and tie knots intracorporeally. Two of the authors (ZS, GB) recognized the connection between the laparoscopic and microsurgical suturing and knotting techniques, as well as the different instruments (Figure 1a-b) that would be needed to make the task easier.[2] The MOET Institute's faculty examined the similarities between microsuturing and laparoscopic suturing and set out to develop a practical laparoscopic suturing and knotting method as well as design instruments that would be properly suited for this purpose. In the process a teaching approach and training course was established for in-house and extramural use.[3]

In the course of the next 12 months, it became apparent that a "long program" of 5-10 days in a permanent, dedicated facility using the personal tutorial format, with one surgeon per training station, and small classes provided the best learning experience, both in terms of depth and rate of progress of suturing skills. A multidisciplinary approach affords an opportunity for an exchange of ideas as well as a fresh look at the same problem.

Over a three-year period the MOET Institute was actively training and further developing educational approaches and materials, and presented over 60 lectures, more than 40 hands-on workshops (approximately 500 participants), and produced numerous publications and videotapes on laparoscopic suturing, intracorporeal knotting, anastomosis techniques for general surgery, gynecology, urology, and pediatric surgery. Training courses averaged 2.5 - 5 days (20-40 hours).

Specialties

Although the various surgical specialists have different types of laparoscopic experience and levels of skills, the suturing needs, fundamental principles, and learning methodologies are similar. Instrument companies have taken a multidisciplinary approach to their business but the specialization of clinical surgery creates sharp divisions. Occasionally individual surgeons will excel in procedures beyond their specialty's customary boundaries, but this is a more of an exception than a rule.

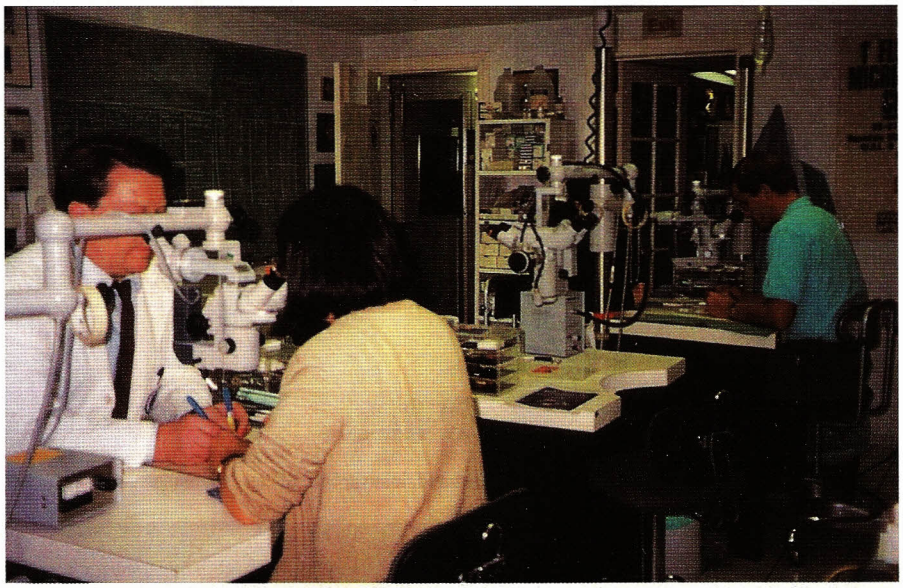

Figure 2. The microsurgical training station is used in the initial phase of training to impart magnified eye-hand coordination, needle and suture handling, as well as knotting characteristics.

Figures 3a, b. Microsurgical exercises.

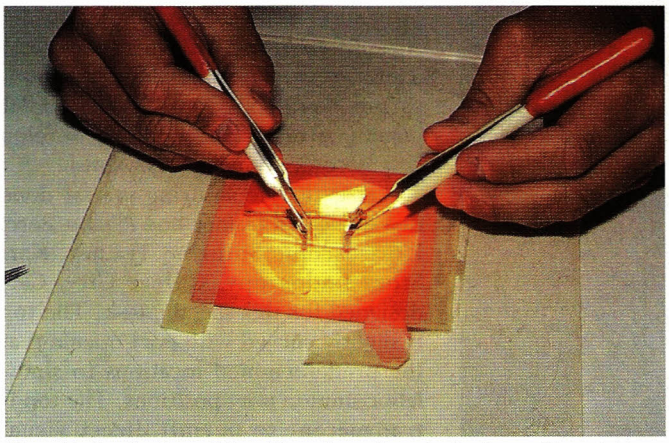

Figure 3a. Inanimate model: end-to-end anastomosis of a 2 mm silicone tubing.

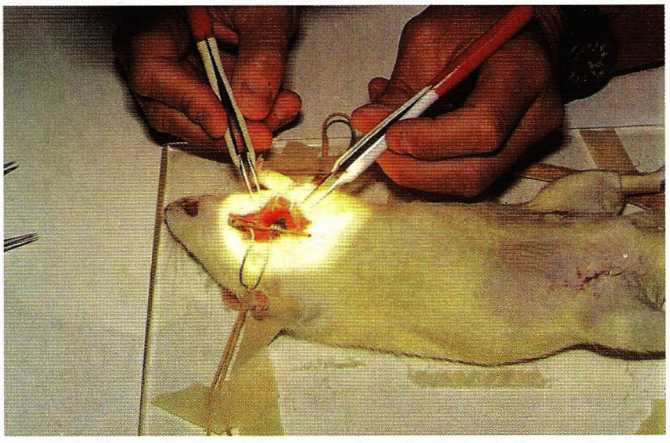

Figure 3b. Small animal model: end-to-end anastomosis of a 1 mm artery.

Figure 4a. Laparoscopic training station with inanimate model.

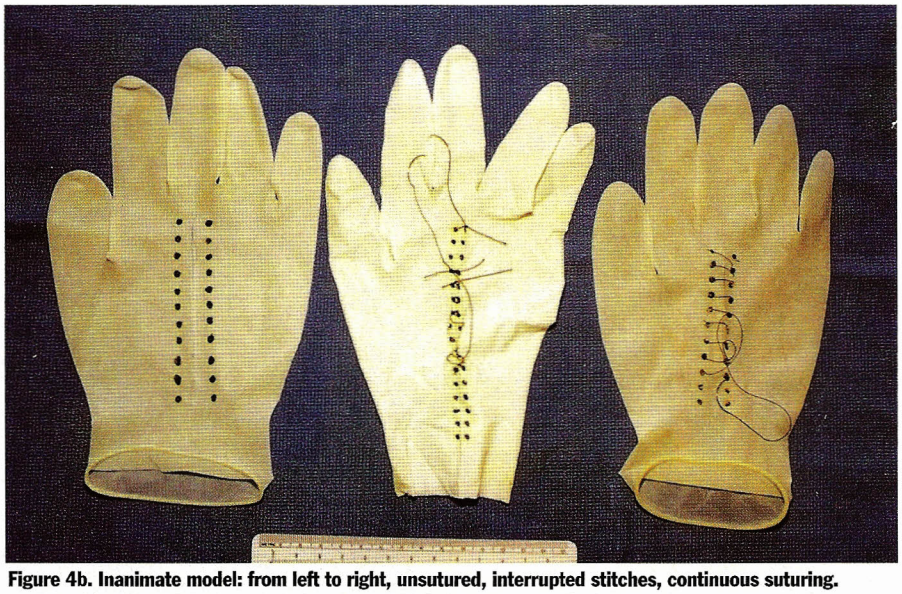

Figure 4b. Inanimate model: from left to right, unsutured, interrupted stitches, continuous suturing.

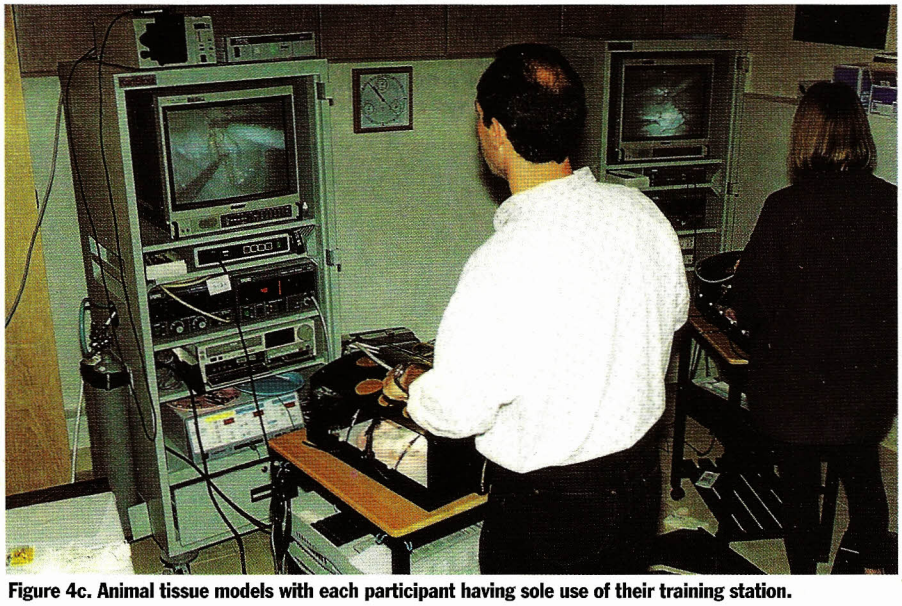

Figure 4c. Animal tissue models with each participant having sole use of their training station.

TRAINING

The personal tutorial training approach is the most successful format, although it is expensive and produces a low volume of trainees. The role of the instructor is paramount in accelerating while deepening the learning experience.[4] Although many surgeons can and have learned advanced techniques on their own, including suturing, this process takes much longer and runs the risk of developing bad habits, including shortcuts that can later prove inefficient. Often seemingly good ideas, when applied clinically, are found to be less than satisfactory. It is helpful to work with a "coach", since objective and accurate self-assessment is difficult to accomplish otherwise.

The instructor must teach in a patient, constructive manner as suturing is extremely difficult and exhausting work. Students with different levels of skill and attention spans are a factor, thus the teaching process can drain the most stout-hearted of instructors, who must teach the same procedure over and over again, calling the surgeon's attention to painstaking details.

The training station setup should be identical to clinical stations to minimize the transition lag from the laboratory to the operating room, and to avoid learning visual perception and eye-hand coordination clues that might be different from that of the clinical realm. At the MOET Institute (Figure 2) the microsurgical training station is used in the initial phase of training to impart magnified eye-hand coordination, needle and suture handling, as well as knotting techniques. First inanimate materials are used in (Figure 3): soft silicone tubing simulating a microvessel which is anastomosed in the end-to-end, end-to-side, and side-to-side fashion. The microsurgical exercises are intermingled with laparoscopic exercises (Figure 4) on similar inanimate material models to develop laparoscopic suturing techniques.

Laparoscopic suturing is best done in a dedicated trainer box (Szabo-Berci Laparoscopic Suturing Trainer, Karl Storz Endoscopy, Culver City, CA) designed for this specific task. The top is slightly curved with port openings at the predetermined locations to simulate common port positions. The top is transparent to permit direct visual confirmation of tissue and instrument

locations, but has a smoky color so that it is not distractingly bright and prevents the surgeon from instantly seeing through the top. The bottom side rails contain flexible alligator clips to place inanimate or animal tissue models in their correct anatomical position, duplicating the exact clinical exposure (Figure 5a-c). Both the port discs and the flexible alligator clips can be used to simulate stay sutures. This laparoscopic suturing box also contains a scope holder that can be passive or incorporate an active zooming device that is activated by a foot control. For gynecologists and pediatric surgeons, and others interested in laparoscopic microsurgical suturing, a special station has been designed for this purpose that uses special laparoscopic instrumentation and the operating microscope attached to a video camera (Figure 6).

These setups enable the surgeon to practice alone and duplicate the basic scope movements, zooming in and out of the field for close up and panoramic views. These training setups can accept both inanimate materials such as a dotted rubber glove, or fresh animal tissue (Figure 7), such as pig stomachs, uterine horns, etc. Practice on tissue models is important, especially in countries where live animals are not permitted for use in surgical training.

The live pig station is a close simulation of clinical surgery, and therefore is a particularly valuable experimental model, since the number of port locations can be arranged and experimented with, without concern for extra

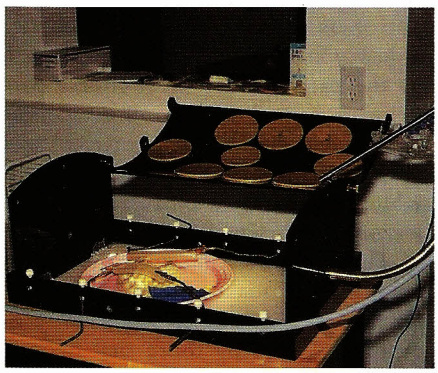

Figure 5b. The top is slightly curved with port positions at the predetermined locations for most common port positions. The top is transparent to permit direct visual confirmation of tissue and instrument locations, but has a smoky color so that it is not distractingly bright and prevents the surgeon from instantly seeing through the box. The bottom side rails contain flexible alligator clips to place inanimate or animal tissue models in their correct anatomical position, duplicating the exact clinical exposure.

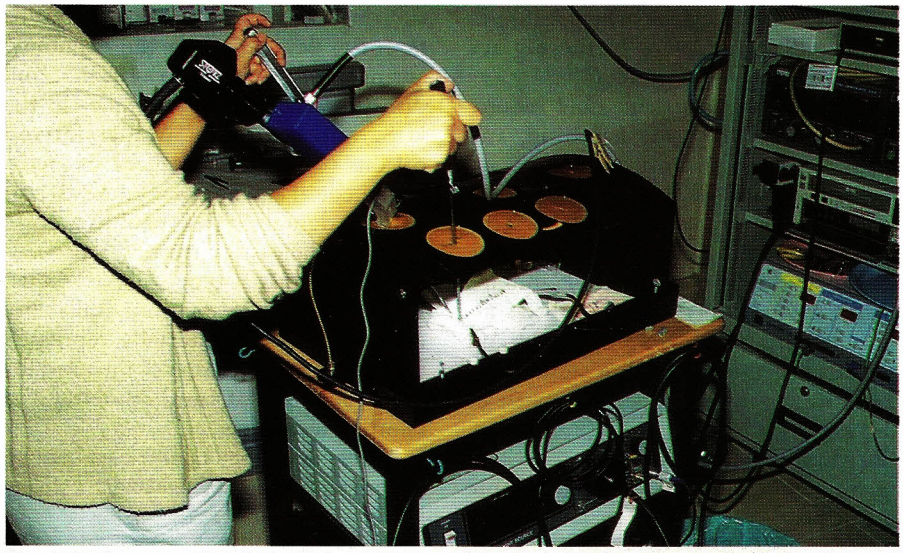

Figure 5a. Laparoscopic suturing trainer with open sides to enable easy placement and positioning of practice materials (Karl Storz Endoscopy, Culver City, CA); also shown: zooming attachment. Both the port discs and the flexible alligator clips can be used to simulate stay sutures. This laparoscopic suturing box also contains a scope holder that can be passive or incorporate an active zooming device.

Figure 5c. Foot controls for zooming device (on the floor). This setup enables the surgeon to practice alone and duplicate the basic scope movements, zooming in and out of the field for close up and panoramic views.

scars on this "patient" (Figure 8). In other respects tissues in the pig are smaller than in the human, they are more delicate and friable, and require greater care in tissue handling, and more magnification. Live animal surgery, after the initial experience, should be approached with the same respect and end result as human surgery. Sometimes smaller animals (the rat[5] or rabbit) can be used to simulate pediatric cases or for special research projects where a statistically significant number of animals need to be used.

Regional Differences

In various countries laparoscopic suturing and training is appreciated differently, depending on the economy, surgical and cultural traditions, and disease patterns. For example, in the U.S. and in highly industrialized nations there are a plethora of methods, medical and business interests, and patient demands that enable a wide range of choices for treating a particular disease, that at times can be confusing. The rapid and abundant availability of stapling devices initially repressed the surgeon's realization of the need for and feasibility of hand suturing and knotting techniques.

In less developed countries, although major stapling companies exert a strong thrust, the economy and feasibility of hand suturing naturally lends itself to wider practice. In some locations the dominance of senior professors determine who will do what; in others, bureaucratic decisions are made without soliciting advice from the surgical community.

Undoubtedly these issues will be balanced out in the long run and in the meantime training, and other advances mainly depend on the dedication of pioneers who push ahead and defy odds in the process of changing the way surgery is practiced. In the following section national and international workshop experiences are described and unique local characteristics are mentioned as it relates to the development of training. These workshops had either one or more of the authors as course directors or faculty. Most of them had already had significant and successful experiences with conducting laparoscopic cholecystectomy courses. In most cases one instructor was assigned to each animal surgery station. Although this monograph is limited to a brief description of the unique features, it affords a view of some national and international programs that feature suturing as a focus.

The single most identifiable factor shared by these programs was the prominent role of the industry in supporting these workshops. The most effective format is the "unconditional educational grant" that is given to pursue whatever curriculum or presentation is deemed necessary for the course participants. A realistic combination is a basic support from the industry in addition to course fees paid by the participants. With course participants contributing to direct course expenses, a sense of commitment and motivation is demonstrated by them, which makes for a more meaningful learning experience.

The *marketing educational* effort of companies to make programs available for free is undercutting academic programs and hurting those that depend on teaching fees. It also creates an unrealistic sense of expectation and dilutes the quality of these programs since industry's goal is to expose as many surgeons as possible to their products. Having deep pockets for educational marketing creates temporary unrealistic expectations from which no one really benefits.

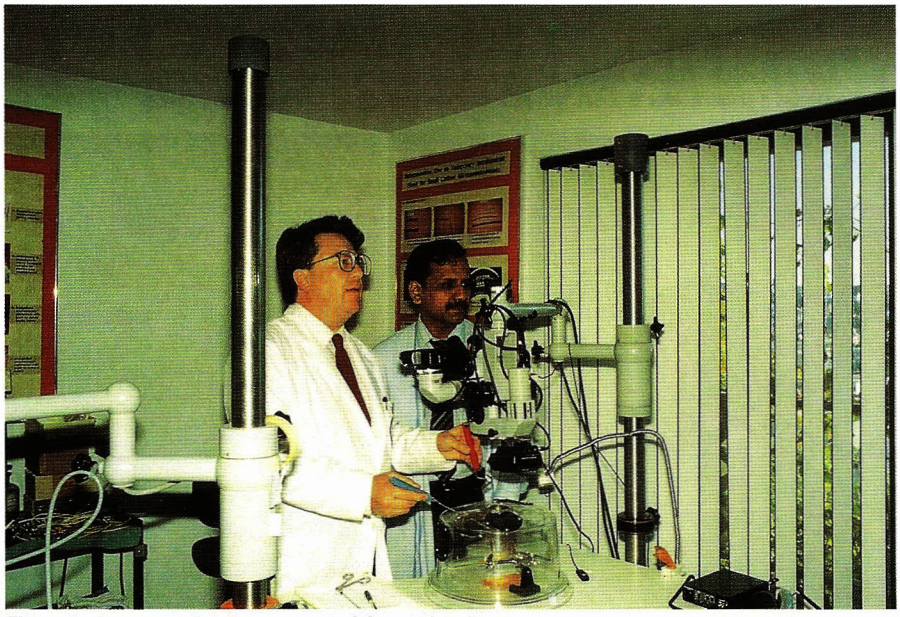

Figure 6a. Laparoscopic microsurgery training station.

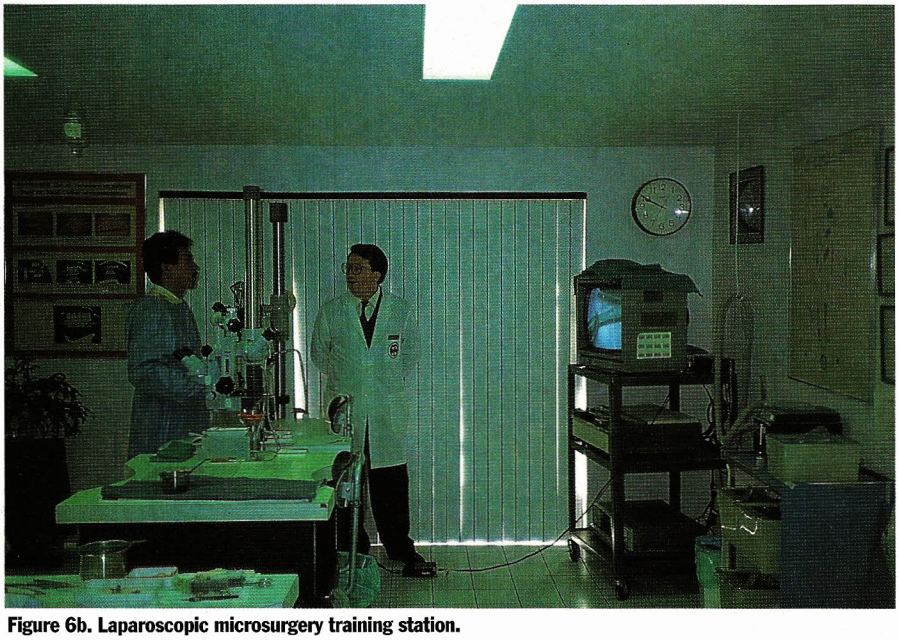

Figure 6b. Laparoscopic microsurgery training station.

U.S. Experience

University of Utah (Salt Lake City) (Figure 9)

These programs were organized by one of the authors (JGH) where the suturing focus was introduced for the first time. The workshops were 2 days in length, 16 hours total with 12 participants set up in 4 stations. The first day was spent in lectures in the morning, and trainer boxes for suturing and stapling for the afternoon. The second day was spent on the live pig model. During the first afternoon, microsurgical exercises were incorporated in the inanimate sessions to explore if it would be beneficial. It was learned that this training was indeed complementary to the laparoscopic exercises but that this training needed to be the same physical facility, otherwise it created a logistical problem. During this workshop, the faculty was still honing their own suturing techniques.

Rush St. Luke's Presbyterian Medical Center (Chicago, Illinois) (Figure 10)

These courses were directed by Mohan Airan, M.D., and S.T. Ko, M.D. The two-day format was followed, similar to the University of Utah program. The course directors had been to the MOET Institute in San Francisco to review the inanimate program and to evaluate the microsurgical exercises. Individual microsurgical stations were set up within the Chicago facility and course participants expressed positive feedback. During animal surgery a separate station was established so that a surgeon could spend additional time practicing suturing and knotting techniques. The animal operating rooms were setup in separate rooms with large windows, similar to hospital operating theaters. This afforded the surgeons sufficient space to move freely and for the animal operating rooms to have a quiet and calm environment which was especially conducive to concentration.

Cedars Sinai Medical Center (Los Angeles, California) (Figure 11)

This workshop was organized and directed by George Berci, M.D. and Jonathan M. Sackier, M.D. and followed the now established two-day format. This workshop included innovative biliary (CBD) cholangiogram model in the live pig. Small bowel suturing and anastomosis were attempted and successfully completed

Figures 7a, b, c. Animal tissue model for laparoscopic gastrojejunostomy: inspection of suture lines:

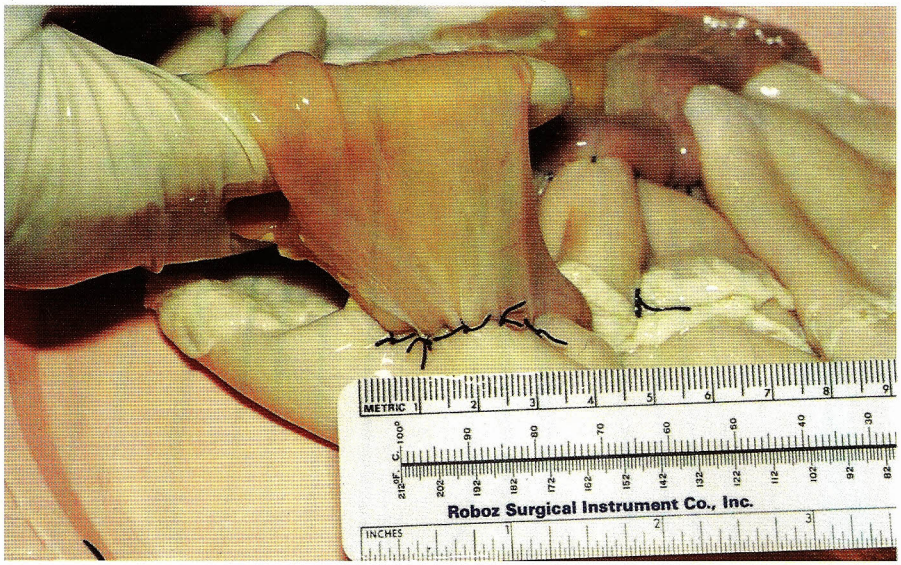

Figure 7a. external suture line.

Figure 7b. internal suture line: view from the stomach.

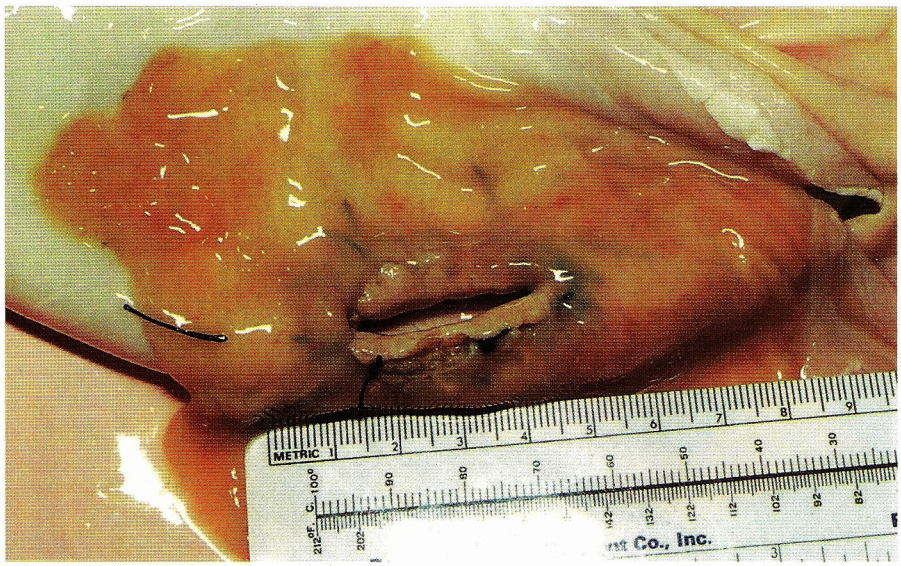

Figure 7c. view from the intestine.

Figure 8a. Instruments for advanced laparoscopic suturing techniques in the live animal model. (Karl Storz Endoscopy, Culver City, CA.)

Figure 8b. Setup for animal surgery.

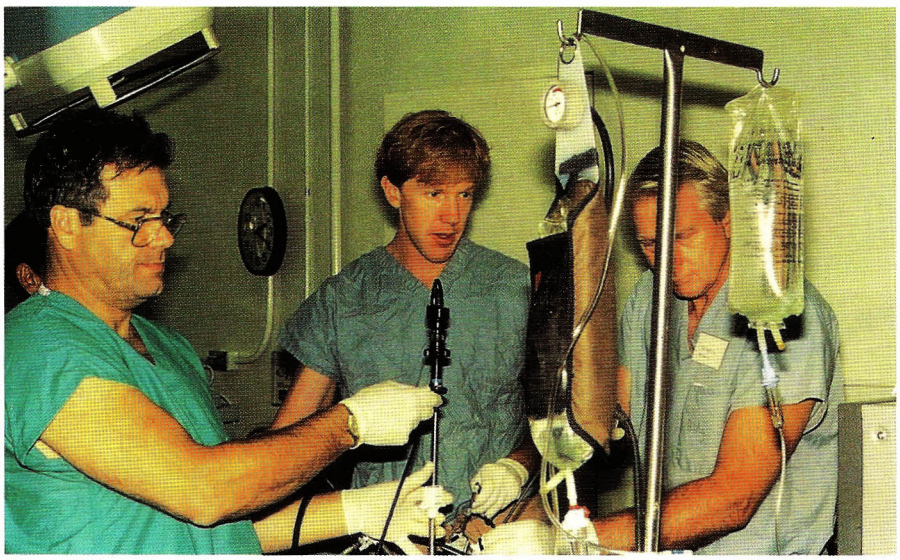

Figure 9 Advanced laparoscopic surgery workshop at the University of Utah.

by a number of course participants. This provided an impetus to develop an improved setup and selection of suture materials.

University of Southern California (Los Angeles, California)

These courses were directed by Jeffrey H. Peters, M.D., and followed the two-day format. The morning session lectures were shorter, with the inanimate session completed by midday, and the live animal model was used by the afternoon. This was followed by another full day of live animal surgery. Although the animal model was introduced earlier here than in other programs, every participant succeeded in completing the basic requirements. During the procedural exercises the choice of intra- as well as extracorporeal knotting was offered. A revealing observation was made that extracorporeal knotting was less intuitive than expected. The proper, minimally traumatic application of extracorporeal knots actually required nearly the same effort and skill as the intracorporeal knots.

University of California, Davis (Davis, California) (Figure 12)

This program was organized by Bruce M. Wolfe, M.D., and followed a two-day format. Lectures were presented on the first morning, including a spirited discussion by the faculty and participants. The afternoon sessions involved use of animal tissues.

Live animal exercises included both upper and lower GI procedures including sutured and stapled repairs. Also common bile duct exploration and stone extraction was taught by a member of the UCD urology staff, using fresh porcine tissue. One interesting revelation that was later published, was the significant number of animal deaths due to vascular catastrophies (hemorrhaging).[6] It emphasized the need for training in the live animal model. One of the courses had two surgeons per animal which proved to be especially productive in terms of practice time. A separate, manned station was available for practicing suturing and knotting techniques during surgery on the animals. This program emerged as a truly academic affair, putting an end to the fierce marketing competition among the supporting companies, and eliminating their influence on the curriculum.

University of California, San Francisco (Figure 13)

This series of courses is directed by Lawrence W. Way, M.D., with one of the authors (ZS) serving as associate course director. This program has been continuously running, on a near monthly basis, since its inception in May 1992.[7] Laparoscopic cholecystectomy courses had been offered the previous year. Four stations are set up with three surgeons per station.

This 2½-day program begins and focuses on intracorporeal suturing and knotting techniques, as well as mechanical staplers and promising novel instrumentation. The program includes a significant amount of clinical presentation and discussion by the host university's staff faculty and invited clinical faculty. Aside from the course directors, the research fellows and clinical faculty participate in the hands-on instruction. A separate area is setup for surgeons to test various other endoscopic systems such as the three dimensional video system, endoscopic ultrasound, or choledochoscopes.

The participants are composed of experienced clinicians from various institutions and residents from the university's program. Although this is an intense 2½ day program, it is still impossible to cover all relevant topics in depth. However, there is an opportunity provided to return for clinical observation in the O.R. and additional work on the live pig model.

Emory University (Atlanta, Georgia)

A new concept was established for surgeon training by one of the authors, John G. Hunter, M.D. Separate courses on surgery of particular anatomic regions or organ systems were established. Prerequisite to any of these procedural courses was completion of a bonafide laparoscopic suturing and intracorporeal knotting course. These laparoscopic suturing courses were also offered by Emory University so this requirement could be fulfilled.

At the first course a father-son surgeon team participated. The senior member was over 60 years of age. This gave the faculty a unique opportunity to compare age differences in the capacity to learn laparoscopic suturing. The conclusion was that there was no difference between the two. While the younger surgeon initially developed the needed eye-hand coordination more quickly, the elder surgeon was not far behind. Also the father's lengthy experience enabled him to apply subtle techniques to solve certain technical challenges. This observation was reinforced many times during other courses, and has led to the conclusion that, up to a certain level, physical and mental fitness is more of a factor than age.

Shadyside Hospital (Pittsburgh, Pennsylvania) (Figure 14)

The program was organized by Jon M. Lloyd, M.D., who wanted to start off the advanced phase of laparoscopy in a systematic fashion, emphasizing the fundamental and essential skills. Each participant had their own training station for the preparatory exercises but shared the live animal surgery with three surgeons per animal. A 3-day program involved a combination of microsurgical and laparoscopic exercises, using inanimate models on the first day and animal tissue on the second day. On the third day, the live pig model was used and participants were delighted to find that they had indeed learned the mechanics of suturing and knotting techniques and were able to

Figures 10a,b Advanced laparoscopic surgery workshop at the Rush St. Luke's Presbyterian Medical Center, Chicago.

Figure 10a. Microsurgical training stations.

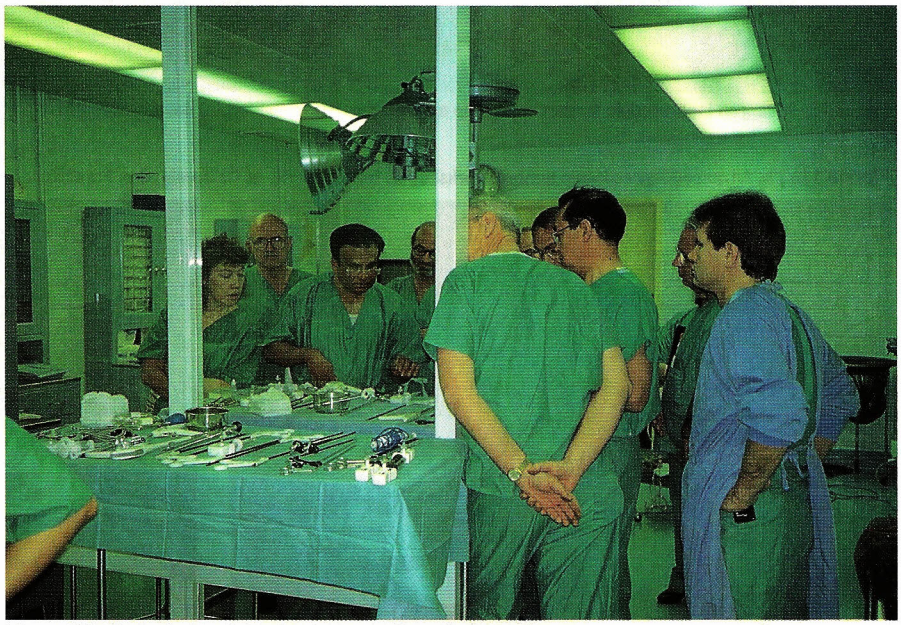

Figure 10b. Preparing for live animal surgery. Operating rooms can be closed to keep distraction at a minimum yet allows visitors to observe the activity.

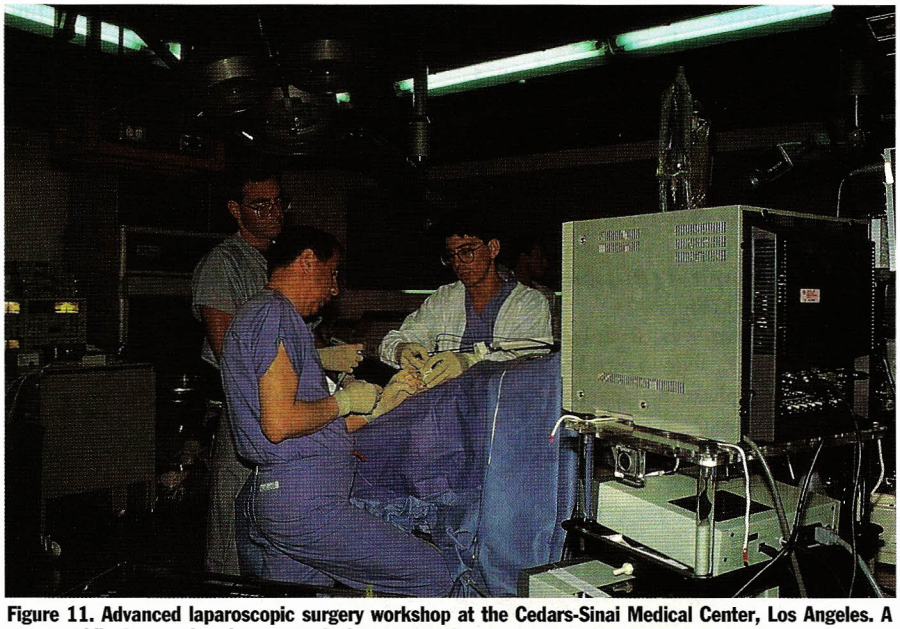

Figure 11. Advanced laparoscopic surgery workshop at the Cedars-Sinai Medical Center, Los Angeles. A common bile duct exploration system is demonstrated.

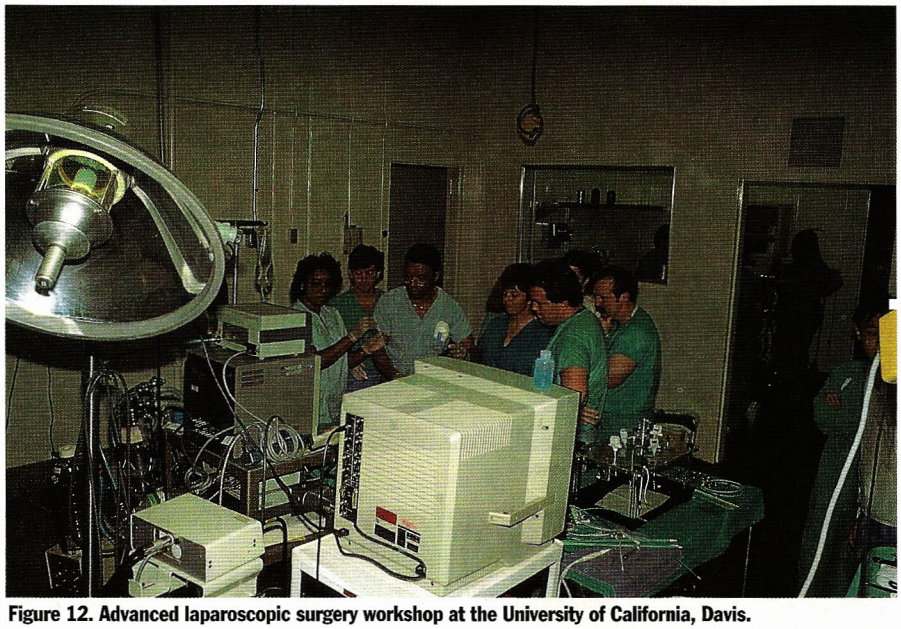

Figure 12. Advanced laparoscopic surgery workshop at the University of California, Davis.

effectively and efficiently apply them in the live animal. The surgeons' operating nurses were invited to observe and assist their surgeons which helped to create a motivated teamwork and enjoyable experience for all parties. Overall, the course was a considerable success.

St. Francis Hospital (Indianapolis, Indiana)

This program was directed by Paul Strange, M.D. with assistance by Cindy Ruegg, R.N. She assists Dr. Strange in his clinical cases as well as in teaching advanced skills in workshops. The workshop included laparoscopic setup only, and used both inanimate materials, fresh animal tissue, and live pig models.

The first two phases were conducted with each surgeon having sole use their own training station. This was enabled by support of the laparoscopic instrument company (Karl Storz Endoscopy, Culver City, CA).

The surgeons' operating nurses were invited to observe and assist their surgeons. The virtues of surgical teamwork with a trained assistant was introduced and emphasized as a means by which arduous approaches, such as laparoscopic suturing could be accomplished efficiently and effectively.

Laser Centers of America (various locations)

This organization, which specializes in O.R. management and laser surgery, organized courses in laparoscopy, concentrating on energy sources and intracorporeal suturing. During the past year, courses have been conducted in Atlanta, GA (twice), New Orleans, LA, Savannah, GA, and Toledo, OH.

These courses were one-day pro-

Figures 13a., b. Advanced laparoscopic surgery workshop at the University of California, San Francisco.

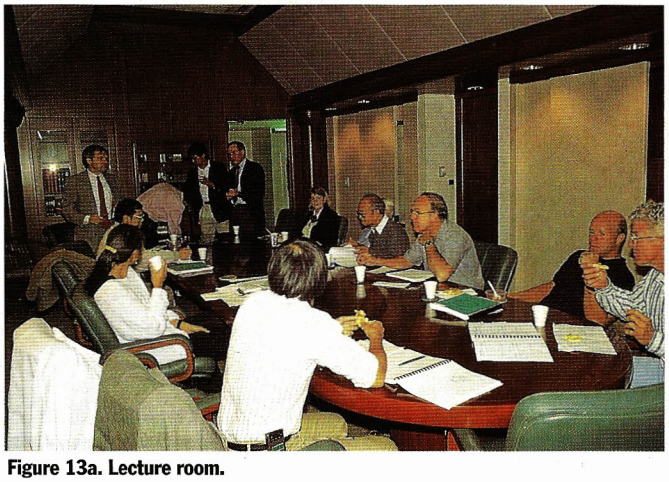

Figure 13a. Lecture room.

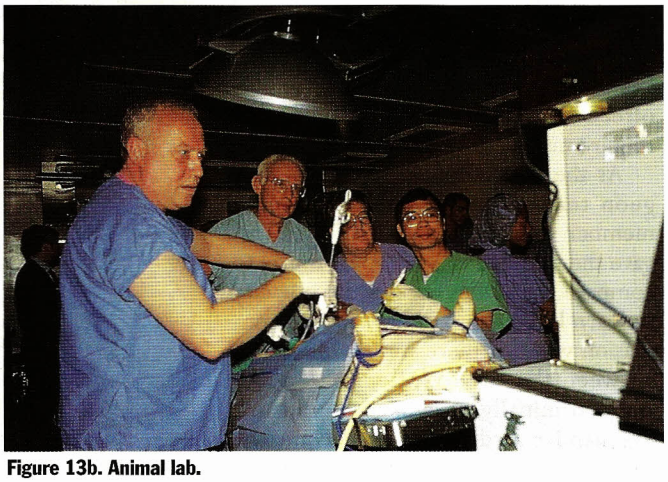

Figure 13b. Animal lab.

grams using inanimate models and fresh animal tissue. At Candler Hospital's Endoscopic Training Center the live animal model was added as well. The strength of these courses were the professional and uniform organization of the program and organizing groups of surgeons who were most likely to use their new skills clinically. These course are directed toward getting all the participants of the O.R. together, and provide an educational opportunity that everyone in the O.R. could share.

Kaiser Permanente Medical Centers, Northern California Region

Under the direction of James E. Lewis, M.D., the Kaiser gynecology departments have embarked on a systematic training of their physicians. Selected infertility and oncologic surgeons were the initial participants. Course rosters have been subsequently expanded to include other gynecologists with significant prior laparoscopic experience and general surgeons already performing laparoscopic cholecystectomy.

Groups of three to four surgeons are rotated through the most advanced (5-day, 40 hour, Monday-Friday) format (Figure 8b.) on a quarterly basis. The exercises include microsurgical and laparoscopic suturing exercises on inanimate models, animal tissues and live animal models.

Although gynecologists have had considerable experience in laparoscopy, most have had only superficial exposure to laparoscopic suturing and knotting techniques. A series of repairs was performed on the live porcine model, including repair of cystotomy and enterotomy. Simulated tubal anastomosis (the uterine horn), Burch procedure and pelvic lymphadenectomy were included.

Having a familiar group training together made for quicker learning as the exercises demand a team approach to visualization, assisting and operating skills.

Other Courses

Numerous postgraduate courses have also been conducted with the International College of Surgeons, and informal Learning Centers have also been offered at the Society of Gastrointestinal Endoscopic Surgeons (SAGES) congresses.

INTERNATIONAL EXPERIENCE

Toronto, Ontario, Canada (Figure 15)

This program was directed by Demetrius Litwin, M.D., F.R.C.S.(C.), who organized a unique academic approach to advanced laparoscopic surgery training. The Department of Education provided significant support with the participation of Robert Cohen, Ed.D and Adrienne Cohen, Ed.D, and their postgraduate educational interns, who collaborated in a project with the course faculty in designing a means to measure and analyze the course participant's skill level and progress. In doing so it is hoped that predictors for success in laparoscopic surgery will be identified.

The first course involved a two-day introductory program using the standard format of one day on inanimate models and animal tissue, and the following day spent on live pig surgery. The first course participants consisted of minimal access surgery division chiefs (university faculty) from the University of Toronto Hospitals. Chief residents and research fellows were also included to create a broad base of training. The logistics and economy of providing separate courses for beginners and the various intermediate phases were not feasible. Therefore, each program is organized along the personal tutorial style where the participants

Figures 14a,b Advanced laparoscopic surgery workshop at the Shadyside Hospital, Pittsburgh, PA.

Figure 14a. Laparoscopic training stations with one person per station.

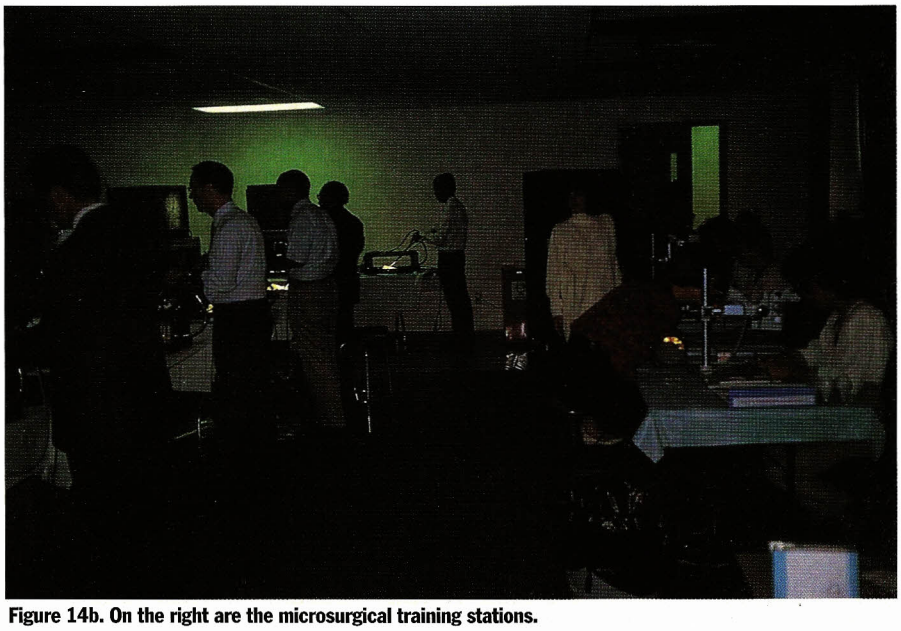

Figure 14b. On the right are the microsurgical training stations.

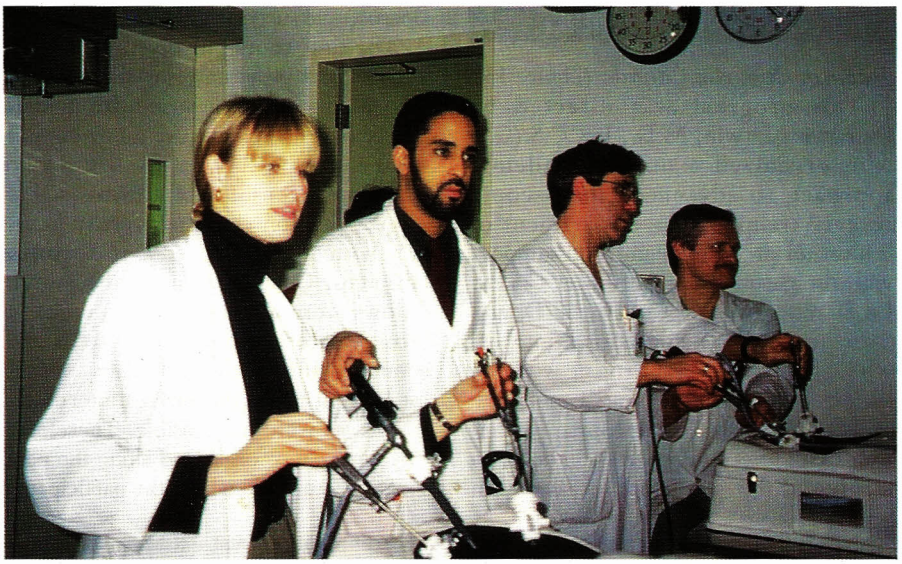

Figure 15. Advanced laparoscopic surgery workshop at the Mount Sinai Medical Center/University of Toronto.

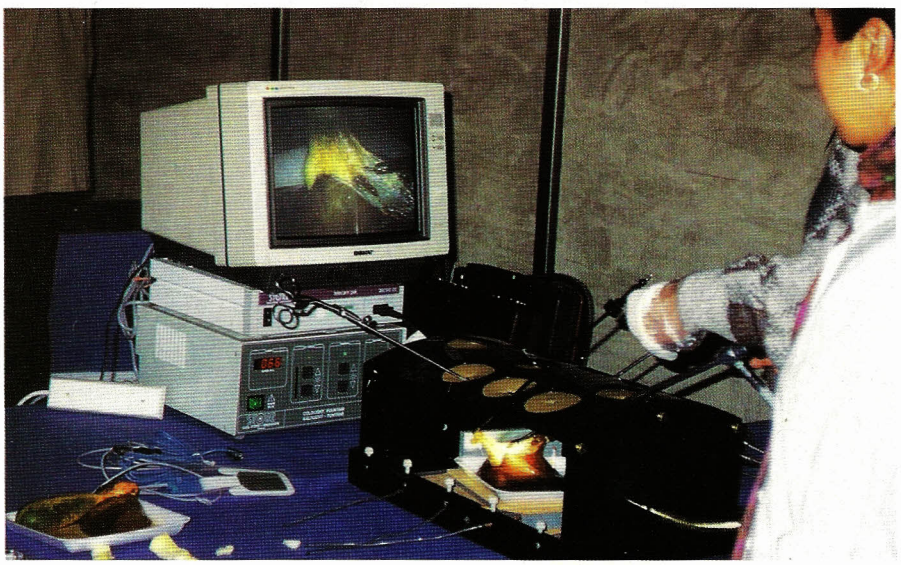

Figure 16. Advanced laparoscopic surgery workshop in Neuss (Dusseldorf), Germany using porcine tissue.

Figure 17. Advanced laparoscopic surgery workshop in L'Aquila, Italy.

skill level is evaluated by questionnaires, and skill tests administered, including actual measurements of time and quality of the repair on inanimate models. The surgeons are then grouped according to demonstrated skill and experience. Each group is then setup by the instructor with exercises that match their learning needs. This way there can be several different group activities conducted and supervised in a single program. Although this is a great challenge, it highlights the role of the instructor which is to design a natural flow of activity, and to orchestrate the exercises that presents a good challenge, maintains the surgeon's interest, and overall, give the participants a feeling of accomplishment, a sense of reality, and clear understanding of their limitations.

Whereas the introductory program was designed to teach suturing, subsequent university programs will focus on specific areas, viz. (1) upper GI tract including bile duct; (2) lower GI tract (colorectal); (3) solid organs; and (4) hernia. In this way a cadre of University of Toronto surgeons will be experienced in advanced laparoscopic surgical procedures and suturing. Formal intraoperative visitation and finally supervised visitation and finally supervised preceptorship will follow. A similar program which will target community surgeons will be embarked upon.

Although the Canadian Healthcare System leaves room for innovation, its acceptance of new technologies is probably more gradual than in the United States. At present, the urgency for surgeons to learn more advanced techniques does not exist in the way that it occurred with laparoscopic cholecystectomy. Therefore, today there is a more forgiving grace period during which surgeons can systematically obtain training and incorporate new procedures into the daily practice following a period of intraoperative observation and then preceptorship.

Neuss, Germany (Figure 16)

Directed by Prof. A.J. Coburg, this program had its beginning in the early days of laparoscopic cholecystectomy, successfully presenting a symposium that consisted of academic lectures, and hands-on exercises.

The lectures were presented by the leading clinicians in general surgery and followed by a hearty discussion and debate on various topics regarding their merits or lack thereof. The symposium and the following workshop were sepa-

Figure 18. Advanced laparoscopic surgery workshop in Singapore (ELSA congress).

rate events. Having the possibility to register in each event separately enabled those interested in the lecture and discussion to attend without the obligation to participate in the hands-on workshop.

Specialties other than general surgery were also invited to participate, creating a multidisciplinary experience. The senior members of the clinical staff had visited the MOET Institute to participate in the "training the trainers" program. The junior members participated in the organization of this event, where they presented their research and clinical materials. This hospital was the first to pioneer and clinically apply the classical hand suturing technique to laparoscopic hand sutured colon surgery.[8]

L'Aquila, Italy (Figure 17)

Courses have also be conducted overseas in conjunction with surgical congresses, e.g. at the Italian Section of the American College of Surgeons meeting under the direction of Prof. E. Lezoche.

Figures 20a, b, c. Experimental training program at the MOET Institute with medical students from Shimane Medical University, Izumo, Japan.

Figure 19. Advanced laparoscopic surgery workshop at the Ethicon Endo-Surgery training facility in Koriyama, Japan.

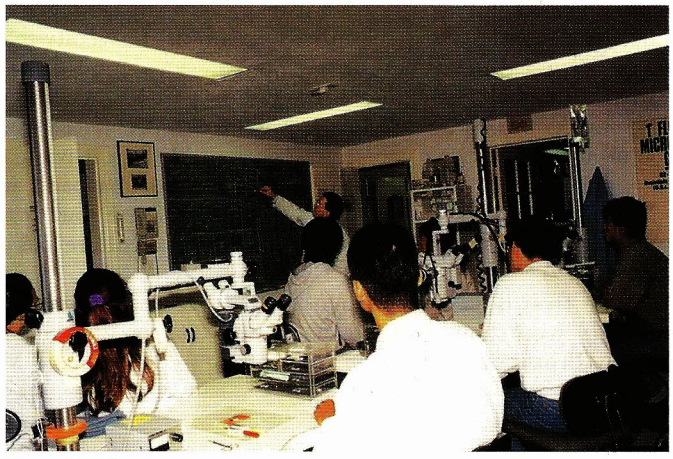

Figure 20a. Lecture.

Figure 20b. Microsurgery (anastomosis) exercises.

Figure 20c. Laparoscopic suturing exercises.

Caracas, Venezuela

Under the direction of Dr. Pablo Hernandez-Mantellini at the Experimental Surgery Institute of the Central University of Venezuela (UCV), the first demonstration of the feasibility of laparoscopic suturing techniques in Venezuela took place in December 1991. The live dog model was used and colon suturing techniques created the greatest interest.

Singapore (Figure 18)

Under the direction of Prof. Peter M.Y. Goh, the first workshop was conducted in August 1993 in conjunction with the Endoscopic & Laparoscopic Surgeons of Asia (ELSA) congress. The one-day program consisted of inanimate models in the morning and large animal exercises in the afternoon. There were two locations: one at the university and the other at one of the university affiliated hospitals.

The program created a substantial interest and many surgeons of this region adopted suturing with enthusiasm. Although the stapling companies made large quantities of staplers available, the surgeons recognized that their average patient could not afford to pay for their usage. Therefore, in order to provide the same quality care for their patients as in western countries, hand suturing was their only choice.

Japan

Koriyama (Fukashima Perfecture) (Figure 19)

The first advanced laparoscopic surgery workshops were directed by Prof. Hiroaki Suzuki and Dr. Manabu Yamamoto (Dept. of Endoscopy, Jikei University, Tokyo). Ethicon Endo-Surgery, Japan sponsored this program at their training facility near Koriyama in northern Japan. Two consecutive programs were conducted consisting of two days each.

Dr. Yamamoto had undergone an 18-month fellowship in the U.S. (University of Colorado, Denver under the guidance of Dr. Greg Steigmann). Also he participated in the "Training the Trainers" program at the MOET Institute in preparation for organizing the first advanced suturing workshop in Japan.

Although these courses were entirely supported by Ethicon Endo-Surgery Japan, the participants were charged a fee to attend. Nonetheless, the sponsoring company provided unconditional support which enabled the faculty to put on a classic academic program without marketing interference. The concept and the program created great deal of interest and praise from the participants who felt that these programs were a most unique opportunity and productive curriculum.

The two-day program was very successful and it was a pleasant surprise for the faculty that suturing principles, slowed movements, meticulous technique, and perfectionist approach were immediately understood and appreciated since it was a familiar approach for the participants and resonated with the Japanese soul that was steeped in a kindred culture and philosophy.

Izumo (Shimane Perfecture) (Figure 20)

At Shimane Medical University in Izumo, south of Osaka and Kyoto, an experimental program involving medical students was initiated by Prof. Osamu Tanaka. It involved exposing interested medical students to magnified surgical methods, both with the operating microscope and laparoscope. These students then are followed to see how this experience served and influenced them. STI

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