

Medical Education

Laparoscopic training in India: Need for criterion-based training and objective assessment of surgical skills

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ABSTRACT

Over the past 2 decades, laparoscopic techniques have evolved from diagnostic laparoscopy to more complex procedures. Minimally invasive techniques are routinely used for bariatric, colonic and advanced gastrointestinal surgical procedures. These new techniques require highly developed psychomotor skills and place an extra demand upon surgeons to acquire, maintain and develop a wide range of operative skills in the middle of their careers. In developed countries, training is imparted in skills centres, which use various models not only to teach a skill, but also as a means of assessment, both of technical competence and of decision-making. In addition, these centres are playing an expanding role in providing credentials to surgeons and maintaining the standards of skills. In India, laparoscopic training for community surgeons is unstructured and opportunistic, while resident's training is not uniform. There is a need for structured training programmes that include giving residents and community surgeons experience in skills laboratories, along with an objective assessment of acquired skills.

Natl Med J India 2009;22:188–91

INTRODUCTION

A major revolution that has changed surgery during the past 20 years all over the world is minimal access surgery.^{1,2} Patients have experienced the benefits of smaller incisions, a shorter hospital stay and decreased postoperative pain, and have been able to resume normal activities within a week of the surgery.^{3,4} The new techniques have placed an extra demand upon surgeons to acquire, maintain and develop a wide range of operative skills in the middle of their careers. A few attempts have been made to educate surgeons, but these have been inadequate. The problem is more evident in India as there are no formal requirements for continuous monitoring of the competence of practising surgeons.

THE NEED FOR TRAINING

Over the past few decades, laparoscopic techniques have evolved from diagnostic laparoscopy to more complex procedures. Minimally invasive techniques are now used frequently for bariatric, colonic and advanced foregut procedures.⁵ Laparoscopic cholecystectomy has become a part of general surgical practice during the past 2 decades. As this procedure has been widely accepted and is currently one of the most common operations in general surgery, training residents to perform laparoscopic cholecystectomy is no longer a

major problem. Laparoscopic fundoplication and laparoscopic splenectomy are two of the advanced procedures which have proven benefits in terms of cost, morbidity and patient satisfaction, compared with the equivalent open procedures.⁶ In spite of documentation of the superiority of advanced laparoscopic procedures, not all surgeons offer these options to patients, essentially because they lack the necessary training.⁷ A North American study found that only 50% of teaching hospitals and 37% of non-teaching hospitals do laparoscopic appendicectomy.⁸ Laparoscopic colectomies are done in <10% of hospitals all over the world.⁸ There are many expert laparoscopic associations and surgeons have started offering non-accredited training opportunities in laparoscopic surgery, but the value of this is doubtful.⁶ Twenty years after the introduction of these new procedures, there is still a felt need for training opportunities at all levels.⁹

CHALLENGES OF TRAINING

Laparoscopic surgery requires a high degree of resolution, dexterity and technical skills. The skills required to perform laparoscopic surgery are different from those for open surgery, being more allied to endoscopy than to a traditional laparotomy. The surgeon has to enter the peritoneal cavity using a smaller incision, use long instruments, only the tips of which are visible, and become accustomed to the fulcrum effect.¹⁰ The procedures are performed by viewing a 2-dimensional video image on a screen up to 2 metres away, with limited tactile feedback.^{11–14} In fact, due to the haphazard training of surgeons in the initial years of laparoscopic surgery, there was a higher rate of complications than with open surgery.^{15–18} The learning curve for the acquisition of skills for laparoscopic surgery is longer than that for traditional surgery. The initial training period or learning curve often has a steep gradient, which varies between surgeons and procedures, representing the rapid change in the ability to complete the task until 'failure' is eliminated or reduced to a minimum constant rate. Ramsay *et al.*^{19,20} reviewed 272 articles which formally assessed the learning curve in minimal access (51%), other surgical (41%) and diagnostic (8%) procedures. They concluded that though data on learning curves from health literature are crude, the number of procedures done, and the length and rate of learning were useful in assessing the final level of skill acquired.

TRAINING METHODS AVAILABLE ABROAD

All over the world, the model of training for laparoscopic surgery was of the haphazard 'apprenticeship' type; apart from being educationally and ethically unsound, this traditional approach is medico-legally unacceptable.^{21,22} Simulation provides opportunities in the area of automating psychomotor skills and experience in vastly varied areas. Surgery has been using

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simulation, in the form of cadaver and animal models, for centuries and, recently, materials that represent a tissue or an organ. Since animal and cadaver models are not easily available, skills laboratories are used most commonly the world over. Synthetic models enabled surgeons to practise tasks in box trainers and equipped them to perform tasks ranging from simple ones with different laparoscopic instruments to entire procedures.^{23,24} The rapid introduction of new technologies, combined with the modern concepts of training as well as ethical and medicolegal requirements, have consigned 'learning curves' to skills laboratories, away from live patients.

Training imparted in skills centres is being used not only to teach a skill, but also as a means of assessment, both of technical competence and of decision-making. In addition, skill centres are playing a growing role in providing credentials to surgeons and maintaining the standards of skills.²⁵⁻³¹ There are both subjective and objective criteria for the evaluation of skills, the former including evaluation by senior surgeons and the latter including the global rating scale or OSATS (objective structured assessment of technical skills).³² Objective valid assessment could be in the form of dexterity analysis,³³⁻³⁶ and video-based assessment,³⁷⁻³⁹ which also facilitates structured progression during training and the identification of the needs of the trainees. Though there is no consensus on the use of assessment methods for laparoscopic training, an objective assessment in the form of an assessment device or rating scale is better than subjective assessment by a single surgeon.

TRAINING MODELS

The best way would probably be hands-on training in the operation theatre, but this puts the patient at a higher risk of complications and, hence, is ethically unsound.^{27,40} There are other methods available by which one can learn laparoscopic skills. These range from simple box trainers to high-fidelity simulations.

High-fidelity virtual reality simulators

The Center for Advanced Technology in Surgery at Stanford has joined with others to form the SurgSim group (LapSim). Endo-urological surgery also uses high-fidelity devices, such as the UROMentor™ (Symbionix, Tel Aviv, Israel; <http://www.symbionix.com>). This is a commercially available virtual reality multimedia simulator and intelligent tutoring system for training in a variety of endo-urological procedures. Recently, a renal percutaneous needle access module has been developed by the same company (the PERC Mentor™), which accurately simulates fluoroscopic access for percutaneous nephrolithotomy. These models lack bleeding, but can be applied to image-based procedures such as endoscopy, laparoscopy and interventional radiology, each of which has immediate relevance to the practice of laparoscopic surgery.⁴¹

Animal models

Experiments on animals are sometimes used for testing new surgical techniques, but practical as well as ethical reasons restrict their use in everyday surgical training. The animal laboratory is also expensive to maintain and such training is not available in most developing countries. The porcine model is commonly used for laparoscopic training.⁴²

Cadaver as a model

The human cadaver is anatomically identical to the patient in the operating room, and has been used to teach anatomy to medical

students. The availability of such a model should enable surgeons to practise their skills before performing operative procedures. At our centre, we used cadavers with a special feature—they were unembalmed human cadavers preserved within an hour of death.⁴³ This model has the fidelity of the anaesthetized patient. The advantages of the cadaver model are that the trainee deals directly with human anatomy and it makes for a real-size experience. Further, the experience is much closer to dealing with a live patient as far as the handling of instruments and tissues is concerned. The drawbacks are the absence of active bleeding and the limited duration for which the cadaver can be used.

Box trainers

Box trainers provide an economical method of training surgeons outside the operation theatre. There are a variety of box trainers which use different materials. Usually they comprise a box, shaped like an abdomen, which has a mirror and camera, along with instruments. Graded tasks, such as tracking, traversing, aiming, haptics and visio-spatial perception, can be learned using box trainers. This model has by now been used at many laparoscopic workshops and has helped many surgeons learn the new techniques. We studied the effectiveness of box trainers, and found that a short-term, intensive and focused course does improve the laparoscopic skills of trainees.⁴⁴ However, box trainers have been criticized for being unrealistic and for not allowing for any form of objective assessment.

Which model to use?

Training in surgery must evolve in a step-wise, curricular manner and it is necessary to learn manipulative skills, which are then combined to achieve proficiency in tasks such as laparoscopic suturing or division of a vessel.⁴⁵ Basic psychomotor skills can be learnt with a simple, cheap version of a video box trainer.⁴⁶ The acquisition of skills of a higher level, such as dissection and the use of high-energy instruments, necessitates the use of more realistic tissues, and this can be achieved by using porcine or human cadaver models. Recent advances in virtual reality simulation are also beginning to produce realistic simulations of complete procedures such as laparoscopic cholecystectomy.⁴⁷

TRAINING COURSES: THE GLOBAL SCENARIO

A variety of courses have emerged for laparoscopic training. Courses lasting for 2–3 days and consisting of didactic lectures, with some hands-on simulator practice, are common. Many courses involve performing a laparoscopic cholecystectomy on a cadaver porcine model, and some on an anaesthetized pig.⁴⁸ This way, surgeons are able to acquire the basic skills required for proficiency in laparoscopic surgery in a controlled environment, free of the pressures of operating on real patients. Emphasis is laid on the fact that attendance at such courses is not to be interpreted as a licence to perform unsupervised laparoscopic procedures.²⁷ The success of this form of training is evident from the large number of laparoscopic courses now available worldwide.

LAPAROSCOPIC SURGERY IN INDIA

The first laparoscopic cholecystectomy in India was done in 1990 at the J.J. Hospital, Mumbai.¹⁹ Though residents at a few institutions had the opportunity to acquire laparoscopic skills from consultants on a one-to-one basis, there was no such uniform trend. In 2005, only 10% of residency programmes in India had a laparoscopic training component.^{49,50}

LAPAROSCOPIC TRAINING IN INDIA

The current model

There are 2 levels of training models in India. The first model is for training surgeons who practise in the community. Such training is imparted by the two main associations of laparoscopic or minimal access surgeons. These associations conduct 3-day fellowship courses in laparoscopic training for surgeons in practice; both associations enrol surgeons who have finished 3 or 5 years of clinical practice. Surgeons with shorter experience do not qualify for the fellowship. The curriculum consists mainly of didactic lectures, with minimal interaction. The average number of surgeons in the classes ranges from 60 to 120. These courses are like mini-conferences. There are additional video sessions on basic and advanced laparoscopic procedures (master videos) done by experts. Both courses have a component of dexterity training, for which box trainers are used. A set of 10–12 box trainers is available for the participants to practise. The average amount of time that a candidate gets to practise is 1–3 hours. The surgeons are guided by a few experts and they learn in a stress-free environment. They are subjected to a comprehensive assessment at the end of the course. The assessment includes a multiple-choice question test, video quiz, test of skills with box trainers and an oral interview. The fellow-ship is awarded if a surgeon fares well in the assessment. These courses have several limitations, such as the short period of training, inadequate training in skills, large number of participants and inadequate individual attention. Though the assessment is comprehensive and has varied components, the standardization is poor and hence, the fellows who qualify have variable skills.

The second level of training is as a resident in surgery. In India, this has been time-based and a one-time assessment is made only at the end of residency. Students are assessed for the outcome of learning. Emphasis is laid on the understanding of basic concepts and principles, and skills are evaluated globally. Many curricula are theoretical and there is not enough emphasis on training in skills. Currently, laparoscopic surgical training is mostly opportunistic and consists of one-to-one teaching. There is also a need to emphasize structured skill development rather than 'see one, do one and teach one'. Though many practising surgeons have learned laparoscopy through short-term courses, training programmes for residents have consisted of training modules using box trainers.

Our model

Considering the need to train practising surgeons, we started a laparoscopic training course at a superspecialty postgraduate training department in our tertiary care hospital. The department has a high clinical load. We have a 30-bed ward, well-equipped operation suite, conference hall with audiovisual facilities, live relay of images from operations and a box training laboratory near the conference hall.

We conduct intensive six-day training courses every 2 months and around 10 practising surgeons are enrolled in each course. The surgeons must have at least 5 years of clinical practice and a desire to learn laparoscopy. Other than interactive lectures on laparoscopy, the curriculum covers the general techniques, instruments and equipment used, basic and advanced laparoscopic procedures, equipment maintenance, and recording. From the second day of the course, three laparoscopic operative procedures are relayed to the conference hall daily till the end of the course. Some of the participants are allowed to assist the consultants and hold the camera. Other participants observe the live operations

and discuss them with the consultant through a two-way communication system.

In addition, a box training session lasting over 3 hours is held every day. The sessions, 6 in all, are structured and one task is covered each day.⁵¹ The tasks are as follows:⁶

Instrument navigation: To use a calculator within the box

Transfer: To transfer pearls, polo rings

Traversal: To walk along a long piece of tube

Cutting: To cut a circle in a glove

Precision and speed: To create a pearl chain

Suturing and knotting: To suture on a stretched glove

This structured training ensures that all participants learn the desired laparoscopic techniques. There are sufficient box trainers for everyone.

Over the past 5 years, we have conducted 22 such courses and trained 216 surgeons from all over India. Cadaver training is optional. The participants have expressed satisfaction with the course and their skills on box trainers are much enhanced after the 6 days of training.^{43,44} A long-term study of these participants is being initiated. The course definitely plays a role in teaching minimal access surgery to surgeons in practice.⁵²

OUR PROPOSITION

We propose that laparoscopic training be made mandatory for residents in all general and gastrointestinal surgery programmes in India. Operative training should also be structured and a minimum number of procedures which the trainee should perform under supervision, perform independently or assist should be prescribed. Every residency programme must have facilities for a skills laboratory. These can consist of simple box trainers to high-fidelity simulators, depending on the resources available. All residents in surgery should undergo a basic course in minimal access surgery in the first year and an advanced course in the third year. The courses can be conducted by local institutions or professional organizations. All residents must be objectively assessed periodically to ascertain their progress.

Other than residents, there are a large number of surgeons, including practising surgeons, who need to be trained in this field. Training in minimal access surgery must be made compulsory for all practising surgeons. The current model for such training needs to be enhanced, if not replaced by structured training that encompasses various models of training and allows for objective assessment for certification and practice. Medical schools in all regions of India can initiate structured training programmes. Such training would ensure safe laparoscopic surgery and ultimately benefit the community.

Minimal access surgery has come to stay. It will surf, swindle and swipe those who try to resist it. If we cannot change the wind, it is time to adjust our sails.

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