

Canadian consensus conference on the development of training and practice standards in advanced minimally invasive surgery

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Despite the complexities of minimally invasive surgery (MIS), a Canadian approach to training surgeons in this field does not exist. Whereas a limited number of surgeons are fellowship-trained in the specialty, guidelines are still clearly needed to implement advanced MIS. Leaders in the field of gastrointestinal surgery and MIS attended a consensus conference where they proposed a comprehensive mentoring program that may evolve into a framework for a national mentoring and training system. Leadership and commitment from national experts to define the most appropriate template for introducing new surgical techniques into practice is required. This national framework should also provide flexibility for truly novel procedures such as natural orifice transluminal endoscopic surgery.

Malgré les complexités de la chirurgie minimalement invasive (CMI), il n'existe aucune approche canadienne de formation des chirurgiens dans ce domaine. Quelques chirurgiens ont été formés dans cette spécialité par le biais de stages, mais il s'impose de toute évidence d'implanter des cours avancés en CMI. Des chefs de file en chirurgie gastro-intestinale et CMI ont participé à une conférence de consensus où ils ont proposé un programme de mentorat exhaustif qui pourrait devenir le cadre d'un système national de mentorat et de formation. Les experts nationaux doivent faire preuve de leadership et d'engagement pour définir la meilleure façon d'implanter dans la pratique les nouvelles techniques chirurgicales. Le cadre national doit aussi être suffisamment souple pour permettre l'intégration d'interventions de pointe telles que la chirurgie endoscopique transluminale par orifice naturel.

Minimally invasive surgery (MIS) is one of the fastest growing areas in surgery today and is an approach that is desirable among patients and physicians because of the shorter hospital stay and overall recovery time. Currently, the standard of care for training in this field is largely based on a process of self-guidance and self-instruction among surgeons, which could be highly inappropriate for the stakeholder groups involved. Patients can experience unnecessary and preventable morbidity, practising surgeons struggle to learn new and complex techniques, and surgeons with expertise are unable to guide their colleagues and realize the full potential for advanced techniques in MIS.

Most surgical leadership and specialty societies have not yet produced clear guidelines on how to implement advanced MIS. The exception is the province of Ontario, which has some principles in place. Existing statements are controversial and have failed to truly benefit surgeons in practice.¹ Ultimately, guidelines should facilitate the appropriate integration of advanced MIS and ensure patient safety during the adoption of new surgical techniques or technologies. Additionally, implementation of new procedures under a system of meaningful guidelines would facilitate a clear understanding of the true effectiveness or reproducibility of complex MIS surgical procedures.

For these reasons, a Canadian consensus conference convened in Edmonton, Alta., on Jun. 1, 2007, to bring together leaders in the fields of gastrointestinal surgery and MIS with the goal of drafting a position paper to guide regional, provincial and national policy on the adoption of advanced MIS into

surgical management. The conference focused on the idea of a national mentorship program that would allow expert surgeons in the area of MIS to serve as trusted counsellors or teachers, especially in an occupational setting. The meeting proceedings are available online in Appendix 1 at www.cma.ca/cjs.

This consensus conference was hosted by the Centre for the Advancement of Minimally Invasive Surgery (CAMIS) and the University of Alberta and sanctioned by the Canadian Association of General Surgeons (CAGS). The following key questions were addressed at the conference:

- Is advanced minimally invasive gastrointestinal surgery practical for most Canadian general surgeons?
- What are the barriers to the adoption of advanced MIS for Canadian general surgeons?
- Does the safety and effectiveness (reproducibility) of advanced MIS depend on the way in which these procedures are introduced?
- What is the most appropriate template for a mentorship program in advanced minimally invasive gastrointestinal surgery?
- What are the main costs of a national or provincial mentorship program in MIS and how can support for such a program be established?
- Will certification or credentialing become important in a systematic approach to the implementation of advanced MIS?

The panel agreed that a measure of success of the conference would be an indication that recommendations had been adopted by funders and other organizations such as CAGS and other surgical groups. Leaders in the fields of gastrointestinal surgery and MIS presented information and evidence applicable to each question.

IS ADVANCED MINIMALLY INVASIVE GASTROINTESTINAL SURGERY PRACTICAL FOR MOST CANADIAN GENERAL SURGEONS?

There is good evidence to support the safety and efficacy of advanced MIS for gastrointestinal disease. However, few studies have addressed the effectiveness of these procedures (i.e., whether they can be reproduced by most surgeons).

Many general surgeons entering community practice have been exposed to a variety of MIS procedures during training and may wish to integrate advanced MIS techniques into their surgical practices. Others may wish to obtain further training to offer advanced MIS procedures to their patients. It is unclear whether advanced MIS procedures developed by experts are reproducible in settings where resources and facilities differ from those of the institutions in which the techniques were created. Early studies have shown the positive impact that a focused environment and trained laparoscopic team can have on the outcomes following laparoscopic cholecystectomy.²

It has been shown that most general surgeons currently

practising MIS in Ontario are self-taught. Few perform a high volume of advanced MIS, but most plan to introduce advanced MIS procedures into their practices.³ Although there have been several studies published regarding learning curves for individual MIS procedures, none clearly address the feasibility of introducing advanced MIS procedures into the community.⁴⁻⁶ Marusch and colleagues⁷ have emphasized surgical experience as a requirement to performing advanced MIS procedures without describing how this experience should be acquired or whether there were other limiting factors to routinely performing advanced MIS. Voitek and colleagues⁶ presented learning curves for selected MIS procedures in a community hospital with a group of experienced surgeons. There was limited discussion of the key factors that may affect the characteristics of a learning curve. Simons and colleagues⁸ addressed learning curves for advanced MIS procedures in previously trained surgeons. Lishman⁹ has outlined his impressions of the requirements for introducing MIS into surgical practice in a discussion that was largely anecdotal and presented little supporting data.

Many outstanding questions need to be addressed to understand the practicality of completing advanced MIS in varied hospital or community practice settings. More research is required to understand what may constitute a barrier for surgeons wishing to include advanced MIS techniques into their surgical practices. Empirically, the determinants for successful introduction of advanced MIS techniques may be included in the following conceptual categories: the current training of the surgeon and his or her motivation to undergo training in advanced MIS techniques, the human resources available to the surgeon (e.g., nurses, assistants, anesthesiologists) and the availability and selection of instrumentation and resources, including access to operating rooms.

Recommendations

1. Developing a new training approach for surgeons in practice will make advanced MIS more practical for most Canadian surgeons.
2. Surgeons will need to commit to an intense training process to prepare themselves and their surgical colleagues and teams for the routine performance of advanced MIS.
3. Surgeons should commit to a self-directed audit process.

WHAT ARE THE BARRIERS TO THE ADOPTION OF ADVANCED MIS FOR CANADIAN GENERAL SURGEONS?

The effectiveness of advanced MIS will be determined by the feasibility of performing these technically complex procedures in a broad range of operating environments. There have been few studies that clearly address this issue in appropriate detail.¹⁰ Moreover, the potential barriers to

incorporating advanced MIS into surgical practice must be clearly characterized.

The principle barrier to adopting advanced MIS is achieving the appropriate training for the entire surgical team. The technical complexity of the MIS operating suite has been recognized, and structured approaches have been suggested to promote efficiency.^{11,12} The positive impact that a trained laparoscopic team can have on the outcomes of laparoscopic cholecystectomy has been described.² See and colleagues¹³ have demonstrated that urologists are more likely to encounter problems in laparoscopic surgery after an instructional course if they have a variable surgical assistant. However, the overall impact of the surgical team on the success of incorporating advanced MIS into surgical practice has been poorly described.

It has been demonstrated that recently trained surgeons may be more likely to introduce advanced MIS into practice.³ This may be a surrogate marker for an increase in advanced MIS occurring at academic training centres. Although this does not give insight into the clinical outcomes achieved by recent graduates, it demonstrates that as the volume of advanced MIS increases at academic centres where residency training programs are centralized the competence of graduates in advanced MIS may also increase.

The practice of a surgeon performing advanced MIS differs dramatically from the practice of an open surgeon. There is a distinct role change within the operating room as the surgeon has a greater reliance on his or her surgical team. Each member of the MIS team plays a more important role than in open surgery, largely owing to the increased technical complexity of advanced MIS procedures.^{11,12,14} As a result, greater consideration must be given to training the entire surgical team in preparation for routine advanced MIS for gastrointestinal disease.¹⁵ There is some evidence that specialized operating room teams lead not only to increased efficiency, but also improved job satisfaction, which enhances the recruitment and retention of nurses.¹⁶

Some have suggested that the feasibility of incorporating advanced MIS into practice may be determined largely by the surgical team.³ More importantly, the impact of a trained surgical team may not be clearly recognized by surgeons, especially those inexperienced in routine advanced MIS. Surgeons seem to emphasize the significance of instrumentation and operating room access in the performance of routine advanced MIS. However, most surgeons report that they have access to a reasonable selection of laparoscopic instruments. The impression of restricted operating room access may be an artificial barrier linked to concerns of reduced throughput during the training of the MIS surgical team.

There is also a lack of recognition of several important differences in the Canadian medical scene such as rural versus urban or academic versus nonacademic settings. These distinctions must be addressed.

The performance of routine advanced MIS by surgeons may require a shift in the traditional surgical paradigm: more technically complex procedures are completed with a marginal increase in operating time to achieve important benefits for the patient (e.g., less time in hospital, reduced wound complications and reduced overall morbidity). Education should include the messages that other issues such as access to instruments and operation time are important but should not be prioritized over a commitment to an appropriate training model for surgeons and surgical nurses.

There are also medico-legal concerns to be addressed, but it would be more practical to develop a national mentoring program first and address these issues as part of the implementation plan.

Recommendations

1. The principle barrier to the adoption of advanced MIS is achieving the appropriate training for the entire surgical team. Making it easier to educate and train the team will make the adoption of advanced MIS among Canadian general surgeons feasible.
2. Surgeons must recognize the important contributions of all members of the surgical team, including operating room nurses, surgical ward nurses, anesthesiologists and surgical assistants, as well as operating room administrators and health authority administrators.
3. Other issues such as access to instruments and operating time are important but should not be prioritized over a commitment to an appropriate training model for surgeons and surgical nurses.

DOES THE SAFETY AND EFFECTIVENESS (REPRODUCIBILITY) OF ADVANCED MIS DEPEND ON THE WAY IN WHICH THESE PROCEDURES ARE INTRODUCED?

A literature search revealed the best available evidence for teaching interventions in advanced MIS for surgeons in practice; these data are summarized in Table 1.

The pioneers of MIS understood that appropriate training is key to producing satisfactory patient outcomes and ensuring patient safety.²⁷ As the standard of care in surgical management naturally evolves, a clear vision for the transfer of new skills and procedures must also evolve.

Typically, surgeons take courses with limited hands-on training in preparation for performing a new MIS technique. Early adopters of MIS recognized that short courses such as the introduction of laparoscopic cholecystectomy to gastrointestinal surgeons did not provide adequate training for these new and relatively complex procedures. As a result, numerous methods for instruction in laparoscopic skills and procedures have evolved. These approaches include comprehensive courses, training devices and virtual reality simulators.^{28,29}

Several authors have described their "learning curves"

for various procedures in MIS.^{6,30,31} Remarkable variations exist for the number of procedures that are believed to be necessary to achieve competence. A recent publication highlights this predicament: Tekkis and colleagues³¹ have suggested the learning curve for a laparoscopic right hemicolectomy may be as high as 55 procedures. The learning curve is an important concept as it describes the willingness of surgeons to embark on a “self-training” initiative in new and complex surgical procedures. The safety and appropriateness of this approach remains to be seen, although historically this has not proven to be successful. There is growing dissatisfaction with this concept, and several authors have discussed the ethical and moral dilemmas associated with the learning curve.³² Moreover, the learning curve often implies the experience of an expert surgeon with a dedicated surgical team and may have little relevance or applicability to the community of surgeons.^{2,15}

Surgeons in practice continue to introduce advanced MIS procedures either without any formal training or after attending short postgraduate courses.¹⁸ This may be related to a lack of appropriate training initiatives within Canada in which surgeons may learn new techniques and technologies. In the urology literature, See and colleagues^{13,33} described the risk associated with the adoption of MIS procedures by

American urologists after a short course and emphasized the positive impact of further training on clinical outcomes.³⁴

As standards of care advance, contemporary surgeons need a mechanism for safely and appropriately introducing new surgical techniques. As evidence accumulates for the efficacy and effectiveness of advanced MIS for gastrointestinal disease, general surgeons will seek out a way to learn these techniques.

Recommendations

1. To ensure the safety and effectiveness of advanced minimally invasive gastrointestinal procedures, it is vital to establish comprehensive educational initiatives that include an intense mentoring process.
2. Education must evolve to keep up with novel instruction and training methods. Limited teaching interventions such as short courses are no longer adequate to train surgical teams in complex gastrointestinal procedures.
3. Comprehensive educational initiatives incorporating an intense mentoring process are needed. Continuing education equals improved health care; acquiring competency in new procedural skills must comprise more than a “2-day, partial hands-on course.” Learning curves in

Table 1. Best available evidence for teaching interventions in advanced minimally invasive surgery: data summary

Intervention; study*	No. and type of participants	Summary
Courses		
See et al ¹³	128 respondents	Ongoing association with surgeons performing similar procedures decreases long-term complication rates
Colegrove et al ¹⁷	166 respondents	Few respondents are maintaining the skills acquired during the original training course, lap cases decreasing
Birch et al ¹⁸	65 respondents	Courses have positive short-term impact on knowledge, skills, practice patterns
Course and proctoring		
Heniford et al ¹⁹	32 course-only 15 course + proctoring	Proctoring after courses increased adoption rates
Heniford et al ²⁰	48 course-only 15 course + proctoring	Proctoring after courses increased adoption rates
Mentoring		
Stolzenburg et al ²¹	1 mentor/4 trainees	Mentorship, modular concept to teaching laparoscopic prostatectomy successful
Cook et al ²²	1 mentor/4 trainees	Mentorship positively impacts on MIS practice patterns
Skrekas et al ²³	1 mentor/1 trainee	Mentorship allows safe introduction of laparoscopic prostatectomy
Birch et al ²⁴	1 mentor/7 surgeons	Mentoring process is an effective strategy for introducing advanced MIS into practice
Mini-residency		
Corica et al ²⁵	32 candidates	A 5-day intensive laparoscopic surgery course seems to encourage the expansion of laparoscopic cases
Mini-fellowship		
Shalhav et al ²⁶	1 mentor/2 trainees	Provides successful training for laparoscopic urologic procedures
MIS = minimally invasive surgery. *Search strategy: “laparoscopy” AND “mentors” (MeSH); limits set to human, abstracts (21 articles identified); abstracts reviewed and manuscripts selected that discuss outcomes of comprehensive training programs. “Laparoscopy” AND “education” (subheading) OR “education, medical, continuing” (MeSH); limits set to abstracts, English, publication date from 1990 to 2007, humans, core clinical journals (141 articles identified); abstracts reviewed and manuscripts selected that discuss outcomes of comprehensive training programs.		

which surgeons practise the procedure on actual patients must also be considered unacceptable.

WHAT IS THE MOST APPROPRIATE TEMPLATE FOR A MENTORSHIP PROGRAM IN ADVANCED MINIMALLY INVASIVE GASTROINTESTINAL SURGERY?

A radically different approach to continuous professional development is required to safely and appropriately integrate advanced MIS into practice.

It has been shown that a mentor significantly helped in the introduction of advanced MIS into surgical practice.²⁴ Currently in Canada, there is no mechanism to facilitate access to expert mentors. National experts in MIS must accept the challenge to coordinate and facilitate a new training paradigm that is effective and feasible for surgeons in practice who wish to adopt advanced MIS procedures.

A survey of surgeons in Alberta has shown that respondents preferred a mentorship model to short courses.³⁵ Most (73%) respondents stated mentorship may be a more appropriate method to acquire MIS skills and may be more likely to lead to adoption of MIS procedures. Surgeons ranked time away from work as the most important obstacle to MIS training; however, 77% indicated that they would take at least 1 week to learn advanced MIS, and 36% indicated they would take at least 3 weeks.

Despite recognizing the importance of mentoring in learning MIS techniques, Canadian surgeons have little or no access to mentors. Others have shown that a system of intense mentoring can be introduced into a tertiary care environment in real time. This experience suggests that an effective strategy for training surgeons in practice is the implementation of a mentorship program.²⁴ This mentoring process included informal discussion and one-on-one instruction in the evidence for and against advanced MIS gastrointestinal procedures, instruction in new instrumentation and endomechanical devices, details of the operating theatre set-up and management, advice on patient selection and focused instruction in advanced MIS skills and specific gastrointestinal procedures. This comprehensive approach should substantially alter the learning curve from a process of self-training to one of graded and gradual adoption of advanced MIS procedures into practice. Implementation and adoption of such a program does require considerable commitment from trainees and mentors. It takes more time to complete mentored cases because of the relative inefficiency of the intense learning process in the operating theatre. The mentor must be prepared to accept this as part of the commitment of an educator and the trainee must understand the temporary operational impact in his/her practice.

The most appropriate method for introducing new techniques into surgical practice and credentialing surgeons in these techniques has yet to be established. Alternatives to short courses have been proposed.^{19,20,36} These alternatives offer longer exposure to training and consist of

a mentoring relationship between a preceptor and learner. Others have shown that mentoring in laparoscopic colorectal surgery may become a successful model; however, the limitations and feasibility for surgeons in practice has yet to be clearly defined.

A short course may serve as an introduction to an advanced MIS procedure and may allow a surgeon and his or her team to determine whether it is feasible to adopt the procedure into practice (i.e., human resources, training requirements, administrative support, adequate volume of cases).¹⁸ This course should be followed by a comprehensive approach to teaching that is rational and fulfills the needs of the surgeon trainee. This will include determining the needs of the surgical team and providing appropriate education for the nurse, assistants and surgeon. A period of observation and planning at the mentor's institution should be followed by individualized training in MIS skills and a graded approach to training in the relevant procedures. There are now training systems (e.g., Fundamentals in Laparoscopic Surgery [FLS]) and sophisticated training devices (e.g., virtual reality procedural training: minimally invasive surgery trainer [MIST-VR], Surgical education platform™ [SEP]) that may facilitate training and evaluation for surgeons in practice.^{37,38} Centralized mentoring at the mentor's institution and, finally, mentoring at the surgeon trainee's institution will complete the training program and should allow the mentor to complete an appropriate evaluation and credentialing statement (Fig. 1).

Recommendations

1. A comprehensive training program for surgeons in practice is the most appropriate method for introducing advanced MIS into practice and must be established.
2. Mentorship is a key component of this process and may be the only evidence-based approach to teaching complex gastrointestinal procedures that achieve appropriate outcomes and hold patient safety paramount.
3. This new model will require considerable commitment on the part of trainees and mentors.

WHAT ARE THE MAIN COSTS OF A NATIONAL OR PROVINCIAL MENTORSHIP PROGRAM IN MIS AND HOW CAN SUPPORT FOR SUCH A PROGRAM BE ESTABLISHED?

Although the costs of a national mentorship program in MIS still need to be defined, main areas requiring funding include physician costs, staffing, equipment, facilities, supplies and technology. Cost identification should flow from a comprehensive business planning process that identifies the vision, goals and objectives of any mentoring program. Following the identification of specific program components, including an introductory course, centralized mentoring and telementoring, the cost categories of each will be identified.

It is imperative to provide support for mentors and

trainees to define success. Further discussion is needed to investigate the measurement tools required to quantify the benefits of a national mentoring program. In addition, it will be important to identify to whom the benefits accrue in terms of funders, physicians and the public. Revenue-generation opportunities likely also exist and should be identified to prospective funders.

Recommendations

1. Surgeons must subscribe to a national mentorship framework with local flexibility that will solicit support from appropriate provincial and federal government bodies for a new process of teaching surgeons in practice.
2. Sustainability will be based on government and industry partnerships that support mentors and trainees and on the success of training programs.
3. The costs of a mentorship program in MIS remain to be defined based on a business planning model.

WILL CERTIFICATION OR CREDENTIALING BECOME IMPORTANT IN A SYSTEMATIC APPROACH TO THE IMPLEMENTATION OF ADVANCED MIS?

Credentialing must be based on prior demonstration of competency in the performance of a specific technique

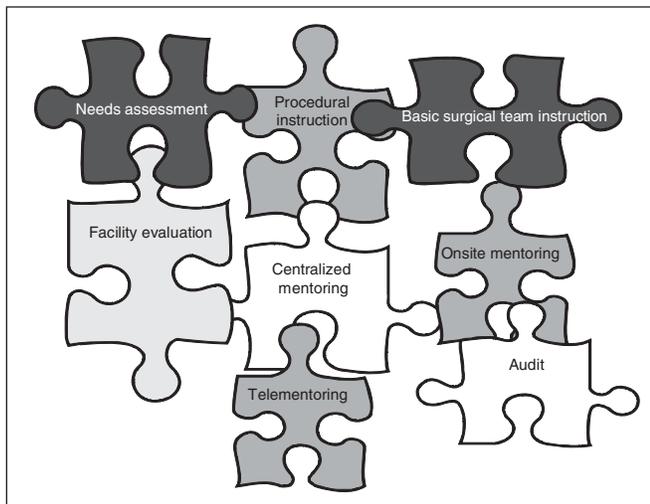


Fig. 1. Conceptual basis for a mentoring program in advanced minimally invasive surgery (MIS). Needs assessment: context-specific assessment of learning needs of the trainee. Basic surgical team instruction (1–2 d): basic MIS concepts/skills, feasibility/team training and telehealth course participation. Procedural instruction (2–3 sessions): procedure observation/assisting mentor; viewed as telehealth application from home site with surgical team. Facility evaluation: evaluation of local team’s equipment and facilities with recommendations provided. Centralized mentoring (10–15 cases over 4–6 wk): one-on-one/bedside mentoring in mentor’s environment (instrumentation and team already established). On-site mentoring (4–6 cases over 3–5 d) in trainee’s environment. Telementoring: teleconsultation with trainee to review patient selection (2–3 h per case, 4–6 cases). Audit: post-mentoring evaluation of outcomes.

established by a supervisor or mentor. Privileges should be granted after satisfactory completion of an accredited program of knowledge and skill acquisition.

Recommendations

1. Certification or credentialing should be an important validation of a process for mentoring surgeons in practice.
2. Certification for advanced MIS should not be a barrier for surgeons but may facilitate planning, support and justification for additional resources when new approaches to surgical management must be integrated into practice.

DISCUSSION

A new concept is being introduced into the Canadian surgical environment: the comprehensive teaching of surgeons in practice, which may evolve to a national mentoring and training system. This is outlined in Figure 1. Many challenges will arise as a result of intense mentoring in advanced MIS procedures. These include logistics and planning, differences in surgical approaches, practice patterns among surgeons, the need for selected cases, complications, medico-legal issues and reimbursement.

A national system of mentoring, as presented in this manuscript, may be as applicable in the United States as in Canada. Although medico-legal issues and reimbursement for surgical services differ dramatically in these countries, the need for a comprehensive approach to teaching surgeons in practice remains. Such a system will address not only concerns for patient safety and the need to teach procedures in advanced MIS, but also the need to teach future surgeons as surgical management continues to evolve.

Canadian centres of excellence may serve as the focus for new and innovative techniques; however, there are too few experts to train Canadian surgeons in advanced MIS. Leadership is needed to define the most appropriate template for introducing new surgical techniques into practice in a manner that is logistically feasible for all stakeholders. Moreover, national experts must remain committed to ensuring that Canadian surgeons can become proficient in the most efficacious approach to gastrointestinal surgery. Until a clear mechanism emerges, technically complex and challenging procedures such as advanced MIS for gastrointestinal disease may continue to be completed in selected centres with specialized resources.

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