Telementoring: An Important Enabling Tool for the Community Surgeon

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Surg Innov 2005; 12; 327
DOI: 10.1177/155335060501200407

Telementoring: An Important Enabling Tool for the Community Surgeon

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This study evaluated the efficacy of telementoring as an enabling tool for community general surgeons to perform advanced laparoscopic surgical procedures. We present a series of 19 patients who underwent advanced laparoscopic surgical procedures in two community hospitals, between November 2002 and July 2003, by four community surgeons with no formal advanced laparoscopic training. Each surgeon was telementored by an expert surgeon from a tertiary care hospital. Telementoring was achieved with real-time two-way audio-video communications over Internet Protocol or Integrated Services Digital Network lines with bandwidths from 385 kbps to 1.2 mbps. The procedures included 10 bowel resections, 5 Nissen fundoplications, 2 splenectomies, 1 reversal of a Hartmann procedure, and 1 ventral hernia repair. Two of the 19 procedures (11%) were converted to open. There were no intraoperative complications and two postoperative complications (11%). The primary surgeon considered telementoring useful in all cases (median score, 4 of 5). The mentor was also comfortable with the quality of the laparoscopic surgery performed (median score, 4 of 5). Telecommunication bandwidth for audio and video transmission was found to be a critical factor in the quality of telementoring process. Telementoring is safe and feasible. It allows community surgeons with no formal advanced laparoscopic training to benefit from expert intraoperative advice during the performance of advanced laparoscopic procedures. It may also reduce health-care costs by avoiding the need to refer and transfer patients to tertiary care centers.

Key words: **Telementoring, community surgeons, laparoscopic procedures**

Since the introduction of laparoscopic cholecystectomy, general surgeons have had to integrate other minimally invasive surgeries into their practice because of patient demand and reported outcome benefits. Unlike new graduates, the practicing community surgeon has limited training opportunities to acquire these advanced skills. Most surgeons are unable to leave their practice to complete 1 or 2 years of training in an advanced laparoscopic fellowship. Until recently, laparoscopic courses and short-term preceptorships were the only training methods available to the community surgeon.

Telemedicine, using video conferencing technology, has been successfully used in various medical specialties to provide expert medical consultation to patients in remote and rural areas and decrease the need for travel.[1] Telementoring is an extension of this process and can be used as a tool to facilitate the acquisition of new surgical and technical knowledge. An expert surgeon (mentor), who remains in his or her own hospital, interacts with a less-experienced surgeon (mentee) in a remote location and provides live on-the-job guidance on how to perform a new operation or use new surgical technology.[2]

This study evaluated the efficacy of telementoring to provide four community surgeons with on-site advancedlaparoscopic training in their local hospitals. We present the telementoring protocol and the telecommunication network used in this series.

Patients and Methods

Study Design

This is a prospective review of 19 patients who underwent advanced laparoscopic surgical procedures in two rural hospitals between November 2002 and July 2003. The outcomes measured in this series include morbidity and mortality, the need for conversion to open procedures, length of stay, and the surgeons' satisfaction scores with telementoring.

The Mentees

Four community surgeons with no formal advanced laparoscopic training participated in this study. Their experience with open procedures such as

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Supported by a grant from the Canada Health Infostructure Partnership Program (CHIPP)

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Nissen fundoplications and splenectomies was also limited. Three of the surgeons are practicing at the North Bay District Hospital, located in Northern Ontario. It is a rural health center with 200 acute-care beds that serves the community of North Bay (population of 55,000) and the surrounding areas (total referring population of 100,000). The nearest tertiary care hospital is about 400 km away. The fourth surgeon is practicing at the Centre Hospitalier de la Sagamie, a community hospital located in Northern Québec. It is a 355 acute-care bed facility that serves a local population of 150,000, with a total referring population of 300,000. The nearest tertiary care center is about 200 km away.

The Mentor

In each case, the primary surgeon was telementored by an expert laparoscopic surgeon from the Centre for Minimal Access Surgery (CMAS). CMAS is located in a tertiary care teaching hospital (St. Joseph's Hospital) affiliated with McMaster University in Hamilton, Ontario. In collaboration with the Royal College of Physicians and Surgeons of Canada, it provides mentoring and telementoring support programs to rural and remote communities. Before starting a telementoring link, it was the mentor's responsibility to assess the feasibility of this program. The mentor had prior knowledge of the mentee's judgment, laparoscopic experience, and technical ability and had visited the mentee's hospital to assess adequacy of laparoscopic equipment and instruments.

Patient Consent

The Research Ethics Board in each hospital approved the telementoring service. The patient was clearly informed that the primary surgeon would be telementored by an expert surgeon who would have the ability to view the entire procedure. The consent form stated that the procedure would be telementored and the names of the mentee and the mentor were indicated. Patients were given the opportunity to have a teleconsultation with the expert surgeon before the surgery if they wanted. Both surgeons are medically insured by the Canadian Medical Protection Association and have privileges at the local hospital to perform advanced laparoscopic surgery. The telecommunications networks used in this series are safe and assure complete patient confidentiality.

The Telementoring Protocol

Each patient was investigated and admitted under the care of the local surgeon. Before the actual telementored procedure, the mentor and the mentee reviewed each case. In collaboration, a roadmap of the actual procedure was outlined and specific details such as trocar positions, necessary equipment, and various steps of the surgery were discussed. Should the telecommunication link be lost or temporarily interrupted, it was the mentee's responsibility to judge whether the case could safely continue with the laparoscopic approach. The mentor also had the opportunity to ask for a case to be converted to an open approach if at any time during the procedure he felt that the laparoscopic approach was not safe.

The Videoconference Network

The centre has a telecommunications network developed in collaboration with the private-sector partners (Bell Canada and Stryker Canada) that allows a private and secure connection to the remote sites. Two different network configurations were used.

In the first configuration, a combination of Integrated Services Digital Network (ISDN) and Internet Protocol (IP) was used to connect the two sites. To facilitate this circuit, a third-party bridging company was used to interconnect the two diverse networks. This network could only offer a bandwidth of 384 Kbps, without Quality of Service and a latency of around 300 milliseconds.

In the second configuration, a dedicated IP network was implemented that useda dedicated Bell Canada surgical-grade virtual private network (IP/VPN). The benefit of this network is the potentially unlimited bandwidth (a 1 to 1.2 mbps circuit was used for this program), low latency (less than 150 milliseconds) and Quality of Service. This network eliminated all the issues discovered with the first configuration.

The Surgeon's Satisfaction Score

After each case, the mentor and the mentees were asked to independently fill out a telementoring evaluation form (Table 1). This form assessed the quality of transmission and the quality of telementoring as a clinical tool.

Results

The study included 19 patients (11 women and 8 men) who underwent advanced laparoscopic procedures. The mean age was 57 years (range, 29 to 83 years). The mean body mass index (BMI) was 31 (range, 20 to 46). The mean American Society of Anesthesiology score (ASA) was 2.

The laparoscopic procedures performed were 10 bowel resections, 5 Nissen fundoplications, 2 splenectomies, 1 ventral hernia repair, and 1 reversal of a Hartmann procedure (Table 2). Six colorectal resections were for malignancy and 4 were for benign disease comprising 1 ileocolic resection, 2 right hemicolectomies, 2 sigmoid resections, 3 low anterior resections, 1 subtotal colectomy and 1 abdominoperineal resection. Two anterior resections (total mesorectal excision) were converted to open (11%). In both cases, the mentee was unable to find the appropriate plane of mesorectal dissection despite the mentor's guidance.

There were no intraoperative complications. In the postoperative period, two major complications (11%) occurred. One patient had a hemoperitoneum after a low anterior resection where a large hematoma was evacuated, presumably from the stapled inferior mesenteric pedicle, but no active cause of bleeding was found at the time of the laparotomy. The patient who had a Hartmann reversal was readmitted with a small-bowel obstruction that required reoperation.

There was no intraoperative or 30-day postoperative mortality. The median lengths of stay were 5 days for colon resection, 3 days for Nissen fundoplication, 2 days for splenectomy, 6 days for ventral hernia, and 7 days for the reversal of Hartmann.

Table 1. Telementoring evaluation forms.

- Evaluate the telecommunication link based on quality, latency, clarity of vision, clarity of sound
- Was the procedure completed as planned?
- Where there any intra-operative complications?
- Where there any unexpected occurrences?
- Did mentoring improve the quality of the surgery performed?
- Did telementoring increase the surgeon's confidence in performing the procedure?
- Would the surgeon have been able to complete the surgery without telementoring?
- Rate your overall impression of this telementoring experience.

Discussion

The ability of a community general surgeon to acquire and incorporate advanced laparoscopic skills into their practice has been a barrier to the adoption of minimally invasive techniques. Other than formal fellowship training, learning opportunities for practicing general surgeons are limited. Advanced laparoscopic courses are available at different academic centers; however, a 2-day course provides only an overview of a specific procedure and some tips and advice but with limited hands-on experience through simulators or through surgery on an animal model. On their own, these training courses are often not sufficient in preparing surgeons to safely and efficiently transition themselves from an open to a laparoscopic approach.[3]

See et al[4] showed that novice surgeons who perform a new laparoscopic procedure after attending a training course have higher complication rates. To refine the acquisition of these skills, surgeons still have to rely on the traditional preceptorship model. On-site mentoring is limited by the costs and time lost in traveling between institutions as well as the difficulty in coordinating two surgical practices. Short-term (1 or 2 days) mentoring does not shorten the length of the learning curve and does not allow ample exposure for a mentee to develop an adequate comfort level with performing the procedures.

Studies on laparoscopic cholecystectomies have shown that most major complications occur early during the surgeon's learning curve.[5,6] The challenge is to develop programs that can enable practicing surgeons to minimize complications during

Table 2. Telementored laparoscopic procedures performed and length of stay.

Procedures	*No. of cases*	*Length of stay**
Colon resections	10	5
Nissen fundoplications	5	3
Splenectomy	2	2
Ventral hernia	1	6
Reversal of Hartmann	1	7

*Median number of days.

the learning curve. We propose that telementoring is a safe and effective enabling tool that can be used to teach advanced laparoscopic skills to community surgeons. This interaction is comparable to on-site mentoring, except that the mentor cannot physically assist during the procedure.

In 1996, Moore et al[7] described the feasibility of telementored urologic laparoscopic procedures. The expert surgeon was located in a control room more than 1,000 feet from the less-experienced surgeon. There was no increase in complications and no statistical difference in patient outcome. In 1997, Rosser et al[8] described laparoscopic colectomies being performed by inexperienced surgeons telementored from another facility some 5 miles away. They concluded that telementoring was safe and potentially cost-effective. With further advances in the field of telecommunications, additional publications have described international surgical telementoring between the United States and Austria, Thailand, Brazil, and Italy.[9,10,11]

In telementored laparoscopic procedures, the telecommunication link is essential and the impact of bandwidth is a critical factor. The link must be reliable and provide adequate image clarity and color fidelity. Broderick et al[12] showed that low bandwidth connections require slow camera movements for adequate delivery of the remote video image.

All of the telementored procedures in our series were transmitted over bandwidths varying from 385 kbps to 1.2 mbps. We note that telementoring can be achieved with low bandwidths, but we recommend that a minimum of 512 kbps be used to provide a satisfactory audio-video exchange and reduce the possibility of background noise, latency, or loss of the telecommunication link. The two configurations used provided a latency of less than 300 milliseconds. The surgeons adapted to this delay without any difficulty, and latency did not influence the feasibility of the laparoscopic procedure. We found that latency was a more significant issue when the procedures were telerobotically assisted rather than telementored. The use of robotic arms during the completion of complex surgical tasks, suturing, and fine surgical dissection is influenced by the delay in signal transmission.[13]

In our study, four community surgeons used telementoring as a means to help them safely and efficiently transition from an open to a laparoscopic approach, even for procedures such as Nissen fundoplication and splenectomy where their open experience was limited. In all the cases, the mentor was satisfied with the quality of the surgery that was performed (Table 3).

The mentees also considered the telementoring process useful, as it increased their confidence in performing the procedure. Even though the four surgeons were at different levels in their learning curve, they noted that the presence of an experienced surgeon was at the least reassuring and, in many instances, vital in helping with choreography of the operation, positioning of the assistants, finding the correct plane of dissection, deciding the sequence of steps in the operation, and in the appropriate use of surgical instruments and staplers.

The surgeons also considered that this process facilitated collegial relationships between academic and community surgeons. Telementoring provides a partnership that can lead to professional growth and stimulation. As well, it decreases the sense of professional isolation often reported by surgeons practicing in remote areas.

Various technical benefits were identified by the mentees as key points that they would use in the future (Table 4). Throughout the telementoring procedure, all aspects of the surgery can be discussed. The less-experienced mentees benefited from guidance with all the steps, from appropriate trocar placement to obtaining adequate exposure through better use of assistants. In the laparoscopic colorectal cases performed for malignancy, the limits for the oncologic dissections were emphasized. When the proper plane

Table 3. Telementoring evaluation scores.

Laparoscopic procedure	*Mentor's assessment of surgical quality*	*Mentee's utility score*
Colon resections	4 of 5	4 of 5
Nissen fundoplications	4 of 5	4 of 5
Splenectomy	5 of 5	4 of 5
Ventral hernia	4 of 5	4 of 5
Reversal Hartmann	4 of 5	3 of 5

Table 4. Key technical benefits identified by the mentees.

- Port placement
- Better use of assistants
- Appropriate dissection planes
- Identifying key structures
- Limits of oncologic resection
- Intra-corporeal division of major vessels
- Controlling intra-abdominal bleeding

for the division of the mesorectum could not be accomplished by the mentee, these cases were converted. The conversion of these cases was neither due to latency nor the quality of the image provided by the telecommunication link.

The limitation of telementoring is the lack of physicality for the mentor. In an academic environment, when the trainee is unable to complete the laparoscopic dissection, the staff surgeon can step in and complete the surgery without conversion. In telementored cases, if the mentee is unable to continue, these procedures have to be converted. We believe that remote telerobotic support can address this issue. We have recently reported the use of telerobotic technology between a teaching hospital and a community hospital.[13]

At the current time, there is no specific financial reimbursement for the telementoring support program in Canada. The mentor does not receive any financial remuneration for his time and dedication. We hope that the telementoring support program will be recognized as an enabling tool for the community surgeon. We believe that if a financial remuneration would be attributed, this would facilitate the widespread availability of this service throughout Canada.

In Canada, both the mentor and the mentee are covered for medical malpractice through the Canadian Medical Practice Association. However, both surgeons are liable in case of a medicolegal incident during the case. All efforts are made to prevent such events by ensuring the patient is fully aware of the risks of surgery and what would happen in the event of a telecommunication failure. The mentor needs to have appropriate privileges in the hospital where the patient's care is taking place. If the connection crosses provincial or state lines, then the mentor requires appropriate licensing for the province or state where the patient's care is provided.

The mentor requires appropriate skills to facilitate safe and effective transfer of knowledge and experience. Currently these skills are acquired at the fellowship level by involvement of the fellows in the telementoring program. With increasing utilization, however, senior residents may also benefit from exposure to telementoring.

Conclusion

Telementoring is an important tool that can be used in providing on-site continuing medical education and surgical training to surgeons in rural and remote areas. The ease with which telementoring was integrated in the surgical practices and the relationship developed between the surgeons involved in this series leads us to believe that a national telementoring program across Canada can be envisioned.

Acknowledgments: We thank Catherine Gill Pottruff and Trevor Chapman for assistance in the preparation of the manuscript.

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