Needlescopic operation: surgery of the future?

Few other areas in clinical medicine have had advances that match the explosive and indeed dazzling development of minimal access, or 'keyhole', surgery over the past decade. Progress in this field has been driven by multiple factors. For example, modern endoscopes have become equipped with state-of-the-art optics that provide excellent illumination and remarkably clear visualisation of internal body cavities. Consequently, most surgery can now be safely conducted endoscopically. Long-gone are the days when we believed that "big surgeons should make big incisions" to gain optimal exposure and visibility at the operation site.

Improved laparoscopic surgical skills and anaesthetic techniques, together with better-designed laparoscopic instruments, have also made minimal access surgery a safe and effective modality. Laparoscopic cholecystectomy has even overtaken the open procedure as the treatment of choice for gallstone diseases. The minimal access technique often results in less postoperative pain, a shorter hospital stay, and a faster recovery than does the open approach. And with a clear superiority in cosmetic results and hence patient acceptance, laparoscopic surgery has very rapidly become the worldwide-favoured surgical option in the 1990s—partly driven by the market force and much facilitated by the industry. The list of surgical operations that can now be performed safely using the laparoscope has expanded incessantly, covering a wide range of procedures across all surgical specialties, in adults, children, and even newborn infants.

The recent development of miniaturised laparoscopic instruments of 3-mm diameter or less has caused surgeons worldwide to shift towards performing operations using needlescopic instruments. These devices result in considerably smaller incisions than do previously available implements; thus, they lead to smaller or even 'scarless' wounds and likely further reduce surgical trauma. Studies have now confirmed that needlescopic surgery is feasible and safe.[1,2] The prospective study in this issue by Lai et al[3] describes the use of needlescopic cholecystectomy among 150 patients and illustrates that the technique is well practised by surgeons in Hong Kong. The authors should be commended for their very successful results. Yet, one must always be mindful that performing minimal access surgery using needlescopic instruments neither automatically nor necessarily implies reduced surgical trauma, or minimal invasiveness, to patients. Prospective randomised controlled studies that compare needlescopic and standard laparoscopic cholecystectomy have yielded conflicting results regarding their relative advantages. Whereas some studies have reported that the needlescopic approach results in less postoperative pain than does laparoscopy, other studies have shown no significant advantage of the needlescopic approach over the standard laparoscopic technique, in terms of postoperative pain, hospital stay, morbidity, and recovery time.[1,4,5] With the currently available technology, needlescopic instruments still pose restrictions to both surgical view and manipulability. For example, because of limitations in the optics, small-calibre needlescopes (especially those 2-mm diameter or less) offer poor illumination, resolution, and clarity; furthermore, tiny laparoscopic instruments are not as sturdy and manipulable than larger instruments. These problems tend to compromise the operation, thereby prolonging the procedure time or even increasing morbidity and frequency of complications. In addition, there are increased risks of tissue damage during dissection using the pointed ends of the fine graspers. Nevertheless, given the tremendous pace in technological advancements, it should not be long before we have at hand-better fine needlescopes that have superb illumination and resolution, or miniaturised laparoscopic instruments that are sturdy enough to withstand most surgical procedures. Many of the currently encountered technical obstacles will then cease to be a problem.

The results from the study by Lai et al[3] also underscore the importance of proper training and surgical expertise to perform laparoscopic surgery. As the authors point out, their success rate of the needlescopic procedure improved with increasing experience, reaching a remarkable 96% with the last 50 consecutive patients. Obviously, even for a skilled laparoscopic surgeon, a learning curve would still be required to allow adaptation to the fine needlescopic instruments involved, and to achieve ever-improving results. Unlike conventional open surgery, in which operative manoeuvres are mostly intuitive, surgeons practising laparoscopic surgery have first to master the necessary endoscopic surgical skills and learn to operate under a limited telescopic view rather than under direct vision. Instead of having a 3-D perspective of the surgical field, surgeons must see and assess organ structures only on a television monitor showing a flat 2-D picture; the important sensation of touch is also lost. Movements are restricted by the keyhole access and become paradoxical in nature.

Accordingly, endoscopic techniques can no longer be learned using live surgery on patients, and prior adequate training in laparoscopic surgery in a simulated environment (ie in virtual reality) have become mandatory. Training facilities in the laboratory-setting—similar to those designed for training airplane pilots—have been proven to be effective and indispensable in most developed countries. These facilities allow repetitive training and practice of skills in different simulated scenarios, with high cost-effectiveness and without risk to patients.[6] In particular, this type of training would allow skill acquisition and practice of complicated laparoscopic or needlescopic procedures before they are applied on real patients.

Surgery for tomorrow is certainly not what it used to be. Technology is advancing very rapidly, and what cannot be done today may become a reality in the near future. The responsibility is back on the surgeons' shoulders to acquire and practise new minimal access surgical skills—for the ultimate benefit of the patients.

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References

1. Mamazza J, Schlachta CM, Seshadri PA, Cadeddu MO, Poulin EC. Needlescopic surgery. A logical evolution from conventional laparoscopic surgery. Surg Endosc 2001;15:1208-12.
2. Reardon PR, Kamelgard JI, Applebaum B, Rossman L, Brunicardi FC. Feasibility of laparoscopic cholecystectomy with miniaturized instrumentation in 50 consecutive cases. World J Surg 1999;23:128-32.
3. Lai EC, Fok M, Chan AS. Needlescopic cholecystectomy: prospective study of 150 patients. Hong Kong Med J 2003;9:238-42.
4. Cheah WK, Lenzi JE, So JB, Kum CK, Goh PM. Randomized trial of needlescopic versus laparoscopic cholecystectomy. Br J Surg 2001; 88:45-7.
5. Look M, Chew SP, Tan YC, et al. Post-operative pain in needlescopic versus conventional laparoscopic cholecystectomy: a prospective randomised trial. J R Coll Surg Edinb 2001;46:138-42.
6. Torkington J, Smith SG, Rees BI, Darzi A. Skill transfer from virtual reality to a real laparoscopic task. Surg Endosc 2001;15:1076-9.