Minimally Invasive Surgery for Colorectal Diseases

Application of Laparoscopic Techniques in Colorectal Surgery

Dr Richard Sim

The laparoscopic approach has become the gold standard for cholecystectomy, Nissen's fundoplication and adrenal surgery, all of which are end-organ, isolated types of procedures. It has taken two decades for laparoscopic techniques to reach the current level of acceptance and widespread application for the treatment of various colorectal diseases. This is because laparoscopic colorectal surgery presents greater challenges, ie, operating over multiple quadrants, retracting the small bowel, exposing and dissecting large tissue planes, removing a large, bacteria-laden organ that may contain a malignancy, and performing a bowel anastomosis.

Indications and Contraindications

In developed countries, colorectal cancer is the leading indication for large bowel surgery, followed by complicated diverticular disease and inflammatory bowel disease. Other indications include large or difficult-to-remove polyps, creation of stomas, sigmoid volvulus, rectal prolapse and colonic motility disorders.

While there was initial concern about the use of laparoscopic bowel resection in cases of malignancy, many randomised trials have now shown that in experienced hands, the oncological result is at least as good as open surgery, although there is still some concern about extrapolating this to rectal cancer surgery.

Laparoscopic colorectal cancer surgery requires very advanced laparoscopic surgical skills. There is justifiable concern that, even if there are significant advantages in the laparoscopic approach, this is achievable only in the hands of the few dedicated laparoscopic colorectal surgeons. Training and competency in laparoscopic colorectal surgical techniques should become less of an issue, as it is being increasingly addressed with the introduction of basic and advanced laparoscopic training into general surgical and colorectal residency programmes.

There is no absolute contraindication to laparoscopic bowel resection as even the obese or elderly patients, and those with previous abdominopelvic surgery and adhesions or minor coagulopathy, can be approached laparoscopically with a low threshold for conversion to open surgery. It is, however, usually prudent to proceed directly to open surgery in patients with severe cardiopulmonary disease who may not tolerate pneumoperitoneum or prolonged surgery in a head-down position (which is often required for laparoscopic pelvic surgery).

Laparoscopic curative resection of colorectal cancer has three major contraindications:

1. infiltrating tumours;
2. large and bulky tumours; and
3. obstructing or perforated tumours.

Infiltration of adjacent structures by a cancer is an indication for an open procedure because currently an *en bloc* multivisceral resection cannot be adequately assessed and managed laparoscopically. However, in selected cases of small bowel, bladder, uterus, fallopian tubes and ovary involvement, *en bloc* resection (with EndoGIA staplers) may still be feasible without compromising curative intent.

Laparoscopic resection of any tumour larger than 8cm in diameter is best avoided because controlling a large mass in the peritoneal cavity using laparoscopic techniques is difficult. In any case, such a lesion would require a long abdominal incision to remove intact. In these instances, however, a hand-assisted approach may retain the benefits of laparoscopic surgery while allowing tactile control to expedite surgery.

Obstruction leading to significant bowel distension makes for difficult overall visualisation and exposure of the mesentery for proximal lymphovascular ligation, and is best managed with conventional open techniques. Nevertheless, if the expertise is available, a staged laparoscopic resection may be possible after colonic stenting to relieve the obstruction first.

Results and Benefits

Most published series conclude that the laparoscopic technique is technically feasible and safe, and may be used for benign and malignant colorectal diseases. Evidence shows that laparoscopy is accompanied by fewer complications and wound infection, smaller incisions and better cosmesis, less blood loss and postoperative pain, faster return of bowel function, shorter hospital stay, more rapid convalescence, and less immunosuppression.

Histopathological comparisons of cancer clearance between laparoscopic and open resections in

Figure 1. An example of a commercially available port in use during SILS right colectomy

Figure 2. Immediate appearance of the wound after SILS right colectomy

controlled studies have also shown no difference in surgical margins, lymph node clearance, and tumour stage. Port-site recurrence occurs as an early but rare phenomenon and is not unique to laparoscopic surgery. It is expected that the long-term survival and recurrence for laparoscopically resected colorectal cancers will not be inferior to open surgery. Intra-abdominal adhesions and incisional hernias may also be fewer with the laparoscopic approach.

Operative time and cost, however, are consistently higher especially in laparoscopic converted to open cases. Training and developing an experienced team, patient selection and decreased conversion rate remain crucial to obtain the best results and extend the full benefits of MIS for colorectal diseases.

Recent Developments

Combined endolaparoscopic surgery (CELS)

As the name suggests, this is an approach combining colonoscopy and laparoscopy to safely resect large or difficult polyps which would otherwise require a colonic resection. Laparoscopy is utilised to monitor and manipulate the lesion during endoscopic resection and suture the colon if required.

Natural orifice transluminal endoscopic surgery (NOTES)

While the concept of operating and removing specimens through a natural orifice (mouth, vagina or anus) is revolutionary, it has not been considered safe to be performed in humans on a wide scale as yet. It has, however, led many surgeons to develop hybrid techniques where the anus (or vagina) is used as the portal of specimen extraction, thereby eliminating the usually large abdominal incision.

Single-incision laparoscopic surgery (SILS)

This approach, known by many different acronyms with minor variation in techniques, is centred on using a single port (usually at the umbilicus) with multiple access channels or multiple standard ports inserted close together through a single extended umbilical incision. SILS is technically more demanding than the standard laparoscopic approach, and like the hand-assisted technique, incurs the extra cost of a port-device [**Figures 1 and 2**].

Robotics-assisted laparoscopic surgery

Robotics-assisted minimally invasive surgery has made the biggest impact in prostatic surgery. In colorectal diseases, its role and impact is still uncertain but it may enable laparoscopic colorectal surgeons to attempt and safely complete more difficult pelvic dissection for rectal cancer, due to its enhanced stereoscopic visualisation and multi-degree freedom of rotations. The main disadvantages are cost and longer operating hours, including set-up time.

Advances in Perioperative Care

While much effort and attention is focused on basic science research and technological advances, it must not be forgotten that the perioperative management of surgical patients, both laparoscopic and conventional, can continue to improve with, for example, integrated multimodal enhanced recovery programmes. Such programmes accelerate postoperative recovery by taking advantage of the knowledge about stress response in surgical patients to prevent the postoperative cascade (pain and ileus) that prolongs recuperation.

Conclusion

Minimally invasive surgery for colorectal diseases is safe and effective when performed by experienced surgeons, although there is a considerable learning curve. In Singapore, the utilisation of minimally invasive surgery for colorectal diseases is estimated at 40-60% of cases in the major teaching hospitals, and is expected to increase steadily.

Dr Richard Sim is a senior consultant in the Department of Surgery, Tan Tock Seng Hospital (TTSH). He is Past President of the Society of Colorectal Surgeons (Singapore) and is currently Honorary Secretary of the Asean Society of Colorectal Surgeons. His areas of interest include minimally invasive endolaparoscopic surgery and enhanced recovery protocols. He has also made contributions to the MOH Guidelines for the Management of Colorectal Cancer and sits on the MOH Steering Committee for Colorectal Cancer Screening. As medical advisor to the Colon Cancer Support Group at TTSH, he champions patient empowerment and is actively involved in public education.