Laparoscopic colorectal surgery

Oliver M Jones, Ian Lindsey, Chris Cunningham

The uptake of laparoscopic colorectal surgery is increasing annually. Colon resection using this approach was first reported in 1991, but hospital episode statistics (HES) data show that 22% of colon resections in the United Kingdom were performed in this manner by 2008-9.\(^1\)\(^2\) The laparoscopic approach minimises surgical trauma and allows faster recovery from surgery, and it has been evaluated for other operations, such as cholecystectomy. Early reports of the outcomes of laparoscopic colorectal surgery comprised mostly non-malignant cases, but more recently laparoscopic surgery has become widely used for colorectal cancer. Updated guidance (2010) from the UK National Institute for Health and Clinical Excellence recommends that all patients deemed suitable must be offered laparoscopic surgery even if this means onward referral to a suitably qualified surgeon.\(^3\) We review the effectiveness of laparoscopic colorectal surgery compared with open surgery and the potential adverse effects.

What are the benefits of laparoscopic colorectal surgery?

The rationale for using laparoscopic surgery is that it can help minimise the trauma of access, reduce pain, and accelerate postoperative return of bowel function and general mobility. All these factors may shorten hospital stay. Other potential benefits include reduced formation of adhesions and lower rates of incisional hernia.

A trocar, which acts as a conduit for the camera and operating instruments, is introduced through small incisions (usually 5-12 mm in length) (fig 1). The operation within the abdominal cavity is similar to that performed during open surgery. Occasionally, a decision is made during surgery that the operation cannot be safely completed laparoscopically (commonly because of adhesions, bleeding, poor views of the anatomy, or an unexpectedly advanced tumour) and a conventional abdominal incision is made. Such patients are said to have undergone “conversion” to an open operation.

We review the evidence for benefit of laparoscopic surgery over open surgery according to specific colorectal pathology.

Colorectal cancer

The earliest large randomised trial that compared laparoscopic and open surgery for colon resection was the multicentre CLASICC trial in which patients with both colonic cancer and rectal cancer were randomised on a 2:1 basis to laparoscopic surgery or open surgery. The trial was conducted early in the global experience of laparoscopic colorectal surgery, and this was reflected in 29% of patients in the laparoscopic surgery arm undergoing conversion to open surgery.\(^4\) Involvement of the circumferential resection margin was significantly higher for upper rectal cancers in the laparoscopic arm; this may have been because relatively inexperienced surgeons (with as few as 20 previous resections) could participate in the trial. Despite this, short term outcomes and longer term oncological outcomes were similar between the groups.\(^5\) Furthermore, rates of incisional hernia and admissions with adhesional intestinal obstruction were non-significantly lower in patients randomised to laparoscopic surgery, although they were higher in the subgroup converted to an open operation.\(^6\)

Many more trials followed. A Cochrane review of short term outcomes among 3526 patients from 25 randomised trials, published in 2005, showed that quality of life was improved in patients undergoing laparoscopic surgery and hospital stay was reduced by 1.4 days.\(^7\) A similar systematic review of longer term outcomes has also shown equivalence between approaches and, importantly, no difference between tumour recurrence rates.\(^8\)

Ulcerative colitis

Subtotal colectomy is the most commonly performed operation for colitis (fig 2). At index operation or some months later, the rectum and anus may be removed, or the rectum only—with preservation of the anal canal—in patients keen to avoid a long term stoma. A pouch or reservoir is formed from terminal ileum and anastomosed onto the anal canal to restore continuity, with the aim of avoiding a lifelong stoma.
A meta-analysis of laparoscopic surgery for ulcerative colitis was published in 2006. It comprised six studies that compared open and laparoscopic surgery for ulcerative colitis within the same institution and four case matched studies. The results indicated that, overall, patients undergoing laparoscopic surgery had a weighted mean difference (reduction) in hospital stay of 2.6 days. After colectomy, morbidity was significantly lower in the laparoscopic group (40% vs 68%), although morbidity after laparoscopic pouch surgery was similar. Mortality was rare and did not differ significantly between approaches. A retrospective questionnaire review of a case series of patients who had undergone pouch surgery (100 laparoscopic; 189 open) found that overall sexual function scores for men and women were similar regardless of which approach was used, although male orgasmic function was significantly inferior in the laparoscopic group.

Crohn’s disease
There are many possible anatomical resections for Crohn’s disease, but because of the distribution of disease, the most common is ileocolic resection. A recent Cochrane review of two randomised trials (120 patients) comparing laparoscopic and open ileocolic resection for Crohn’s disease found that—although there was a trend towards fewer wound infections and reoperations with laparoscopic surgery—the two approaches were equivalent. The authors concluded that laparoscopic surgery was as safe as the open approach.

Diverticulitis
Two trials have evaluated laparoscopic surgery for elective resection of diverticulitis. In a single blinded randomised controlled trial of 113 patients, the laparoscopic approach took longer but was associated with a marginal reduction in postoperative pain and a reduction in length of hospital stay from seven to five days. A double blind randomised controlled trial of 104 patients reported a reduction in length of hospital stay (from 10 to eight days) and in major morbidity for patients randomised to laparoscopic surgery, along with less pain and better reported quality of life indicators. With more experience, morbidity, mortality, and length of stay might be reduced further, and it might be possible to use laparoscopic surgery in patients with complicated disease (such as fistulas and abscesses).

The role of laparoscopy in patients with acute diverticulitis is less certain. A recent report enrolled 100 consecutive patients with perforated diverticulitis that had been confirmed by computed tomography. All underwent laparoscopy, and the eight patients with fecal peritonitis had an open resection. The remaining 92 patients with purulent peritonitis were managed with laparoscopic lavage, drain placement, but no resection. Morbidity and mortality in this series were 4% and 3%, respectively. At median follow-up of three years, only two patients had returned with recurrent diverticulitis. Randomised trials are awaited, but this study may herald an important shift in the operative management of acute diverticulitis.

Pelvic floor dysfunction
From the colorectal perspective, pelvic floor dysfunction focuses on the posterior compartment. We summarised the role of laparoscopic surgery in the treatment of this problem in our recent clinical review.

Possible disadvantages and contraindications
A recent meta-analysis of 10 randomised trials comparing laparoscopic surgery and open surgery suggested that the laparoscopic approach is associated with a higher rate of intraoperative complications, particularly bowel injury (odds ratio 1.88, 95% confidence interval 1.10 to 3.21; P=0.02). Such adverse events (if recognised immediately) may result in conversion to open surgery. Outcomes are often worse in this “converted” group than in the “successfully completed laparoscopic” and open groups.

What is fast track surgery and does it benefit patients?
Fast track surgery protocols or enhanced recovery protocols aim to reduce the physiological insult of surgery and expedite patient recovery, discharge, and return to normal function. The protocols include preoperative measures such as patient education, avoidance of routine bowel preparation, reduction in preoperative starvation, and the use of preoperative carbohydrate and protein loading. Tailored anaesthesia, avoidance of perioperative fluid overload, and early postoperative mobilisation are also important components.

Such protocols have been widely adopted by laparoscopic surgeons, although the early reports related to open surgery. A recent meta-analysis comparing enhanced recovery programmes with “standard” management identified six randomised controlled trials with 452 patients (undergoing both open and laparoscopic colorectal surgery) and found a reduction in hospital stay of 2.5 days.

Most large studies that have compared laparoscopic and open colorectal surgery have not used an enhanced recovery approach. Enhanced recovery may be more important than the surgical approach itself. Indeed, a randomised blinded study of laparoscopic colonic resection versus

<table>
<thead>
<tr>
<th>Potential complications from laparoscopic and open colorectal surgery*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of complication</td>
</tr>
<tr>
<td>Technical</td>
</tr>
<tr>
<td>Infective</td>
</tr>
<tr>
<td>Thromboembolic</td>
</tr>
<tr>
<td>Abdominal wall</td>
</tr>
<tr>
<td>Cardiovascular</td>
</tr>
<tr>
<td>Gastrointestinal</td>
</tr>
<tr>
<td>Stoma related</td>
</tr>
</tbody>
</table>

*Many of these complications manifest a few days after surgery and with the trend to early discharge may become increasingly relevant to primary care doctors.
open resection in the context of enhanced recovery (60 patients) reported similar hospital stay in both groups (two days), with equivalent return of functional activities and no significant differences in morbidity. The recently reported LAFA study randomised patients to laparoscopic or open surgery for colon cancer and to enhanced recovery or standard care, resulting in four treatment groups. The shortest postoperative length of stay was in the laparoscopic and enhanced recovery group (median stay five days; P<0.001); however, regression analysis suggested that laparoscopy was the only factor that predicted reduced hospital stay and reduced morbidity.

Enhanced recovery protocols will probably be modified as further evidence becomes available. As an example, avoidance of routine mechanical bowel preparation was included in the protocols on the basis of large meta-analyses attesting to the safety of this approach. However, more recent evidence has shown that in specific subgroups, such as patients undergoing surgery for rectal cancer, this practice may be associated with higher rates of morbidity.

Reducing the postoperative stay in hospital and its potential sequelae

Some patients are now staying in hospital for less than 24 hours after colorectal resection. One study reported 10 patients who underwent laparoscopic colectomy and were discharged within 23 hours of surgery with no morbidity and no readmissions. Indeed, enhanced recovery protocols do not seem to increase hospital readmission rates, and neither does laparoscopic colorectal surgery compared with open surgery according to HES data.

As discussed, laparoscopic surgery has been shown to reduce morbidity without increasing readmission. Broadly, the type of postoperative morbidity after colorectal surgery is similar for both laparoscopic and open approaches (table). Although many studies have shown a reduction in morbidity with laparoscopic surgery, earlier discharge may partially offset this benefit in terms of the amount of morbidity seen in primary care.

What advances in laparoscopic surgery may improve outcomes further?

Single port surgery

Attempts to minimise the trauma of access from laparoscopic surgery have led to the development of single port surgery (fig 3). This approach uses a single incision (often in the umbilicus or at a future stoma site) through which all laparoscopic instruments are passed. The obvious advantage of this approach is improved cosmesis—for example, a subtotal colectomy can be performed via a single 2 cm incision at the future ileostomy site, so the operation is essentially scar free apart from the ileostomy itself. It is unclear whether the benefits over conventional laparoscopy are substantial enough to justify the technical difficulties experienced by the surgeon from lack of triangulation and instrument clash.

Natural orifice surgery

This approach uses internal transvisceral incisions rather than incisions in the abdominal wall (fig 4). The technique has the potential to reduce pain, wound complications, and the physiological stress of surgery while also having cosmetic benefits. The transvaginal and transgastric routes have been the most commonly used access points to date. Technical challenges remain, such as defining the optimal method of gaining access transviscerally and the safest way to close these orifices.

Combined laparoscopy and endoscopy

Laparoscopy is useful in the colonoscopic treatment of large polyps and early cancers. Laparoscopy can improve colonoscopic access to the polyp, and it has been used in endoscopic assisted transluminal resection, endoscopic guided laparoscopic local or wedge excision, and to help assess the integrity of the bowel after endoscopic excision of the polyp. Several reports have attested to the safety and applicability of this approach.

Robotic surgery

Robotic surgery can be used as an adjunct to all laparoscopic colorectal procedures. Its limitations include set
up time and expense, as well as limited flexibility when surgery takes place in more than one quadrant of the abdomen, and in the future its main role will probably be in the pelvis. The early results of a prospective comparative study comparing conventional and robotic laparoscopic total mesorectal excision for low rectal cancer have shown that the robotic approach is safe.29 A recent systematic review and meta-analysis of the efficacy of the robotic approach in abdominal surgery concluded that although it took longer to perform and was more expensive, it was associated with a lower risk of conversion to open surgery.29

Conclusion
The laparoscopic approach to colorectal surgery is now well established in the UK and throughout the world. Since the early large trials that established the safety of this approach, technology has improved and further advances have been made in surgical experience and formal training. It is not yet known whether this will translate into improved functional or oncological outcomes compared with conventional surgery. In the interim, patients should be offered a laparoscopic alternative to open surgery and referred to hospitals where the appropriate expertise exists if necessary. OMJ performed the literature search and wrote the initial draft. All three authors reviewed the final draft, prepared the illustrations, and wrote the final draft. OMJ is guarantor.

Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: no support from any organisations that might have an interest in the submitted work in the final draft. OMJ is guarantor.

Provenance and peer review: Commissioned; externally peer reviewed.

Patient consent obtained.


