A comparison of laparoscopic and open restorative proctocolectomy in children

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ABSTRACT

Aim: Restorative proctocolectomy (RP) is the gold standard for children requiring removal of their colon and rectum. The aim of this study is to contrast conventional (open) and laparoscopic RP.

Methods: All children undergoing RP by one surgeon were prospectively recorded in a customised database. Outcome variables were length of stay in days (LOS), duration of surgery in minutes (DS), blood loss in ml, and complications. Explanatory variables included technique of resection (open or laparoscopic (lap)) and indication for surgery.

Results: Eighty-two (43 girls) children underwent RP at median age 12 (0.5–20) years. RP was performed as Open (n = 37) or Laparoscopic (n = 45). Indications were: colitis (n = 56), polyposis (n = 12), constipation (n = 7), Hirschsprung’s (n = 5), fibrosing colonopathy (n = 2). Significantly, more children had three-stage surgery among the lap group (P = 0.04). LOS was significantly shorter in the lap group [15 (8-114) days vs 17(13–60) days; P = 0.04], but there was no difference in DS or complication rates between laparoscopic and open surgery. Laparoscopic surgery was associated with significantly lower blood loss [150 (0–840) ml vs. 334 (0-1480) ml; P = 0.02].

Conclusion: Laparoscopic RP is associated with lower blood loss, shorter LOS, but no difference in duration of surgery or complication rate.

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Restorative proctocolectomy (RP) is considered to be the gold standard for patients who must undergo removal of their colon and rectum for a variety of disease processes [1,2]. When performed in childhood it has comparable outcomes and complication rates to large adult series [3]. The procedure can be performed laparoscopically [4] although experience in children is limited [5]. The largest reported series did not actually compare the outcomes of this technique with a comparable open series [6].

In 2009 we reported our initial experience with our first 11 cases of laparoscopic RP, contrasting with the prior 11 open RP procedures [7]. This report updates and extends our experience and compares their outcomes with children who underwent open RP in our institution. We have also previously published an analysis of complications following this major procedure, in which our first 60 patients were described [3].

The aim of this report is to present a comparison of the open and laparoscopic techniques with sufficient patients now accrued for this purpose.

1. Patients and methods

Between 1998 and 2013, 82 children underwent RP. Following patient 37, all cases were performed laparoscopically. All children undergoing RP in the North East of England are operated on in our institution by the senior author. All operations are recorded prospectively on a customised database.

The following outcomes were recorded. Blood loss, duration of surgery (DS), length of hospital stay (LOS), and any complications within 30 days of each stage of surgery. Possible explanatory variables were technique of resection (open or laparoscopic) and indication for surgery.

All procedures were staged. Patients either underwent proctocolectomy with ileo-anal J pouch reconstruction utilising a covering ileostomy, which was closed 6 weeks later as a two-stage procedure, or initial colectomy with ileostomy, followed by subsequent proctectomy with ileo-anal J pouch anastomosis with a covering ileostomy which was closed 6 weeks later as a three-stage procedure. The ileal pouch is formed extra-corporeally using what becomes the ileostomy wound in the right iliac fossa.

A midline incision was used for open surgery. Four 5 mm ports were placed in the epigastrium, supra-pubically and in each flank, with a 12 mm port in what becomes the ileostomy site in the right iliac fossa for laparoscopic surgery.

For laparoscopic resection, the harmonic scalpel (Ethicon endo-surgery) was used for all dissection. All vessels were sealed with this device and no other form of haemostasis was required. When performing a three stage procedure, the rectum was divided just below the peritoneal reflection using a laparoscopic stapler. All procedures were entirely laparoscopic, with no use of Pfannenstiel incisions or hand assisted surgery.
For both open and laparoscopic resections, the rectum was mobilized trans-anally with the patient prone, jack-knife. Dissection commenced just above the dentate line, except in where the indication for surgery is polyposis, when dissection started at the ano-cutaneous margin. Dissection proceeds submucosally to the top of the anus, where the close rectal plane outside the rectal muscularis propria is entered. This plane is strictly adhered to until the peritoneum is breached, or until further dissection trans-anally is not possible by virtue of poor access. The patient is then turned supine and rectal dissection is completed from the peritoneal cavity. The patient is moved into Lloyd–Davies position for pouch-anal anastomosis which was always hand sewn trans-anally. The decision whether to perform 2 or 3 stage surgery was dictated by the general condition of the child, with chronically sick children in poor condition undergoing three stage surgery.

Data are expressed as median (range). Data were compared using Mann–Whitney test, or $\chi^2$ with a significance level of 5% using the SPSS statistical program.

2. Results

82 children (43 girls), underwent RP at a median age 12 (0.5–20.4) years. Indications were: colitis (n = 56), including two cases of Crohn’s colitis, polyposis (n = 12), constipation (n = 7), total colonic Hirschsprung’s (n = 5) and fibrosing colonopathy (n = 2).

RP was performed as Open (n = 37) or Laparoscopic (n = 45). These was performed as two-stage (n = 50: open n = 27 and lap n = 23) or three-stage (n = 32: open n = 10 and lap n = 22) surgery. The increased use of three-stage among the lap group was significant (P = 0.04). Two laparoscopic cases were converted to open surgery, in one case because of failure to progress, in the other because of a short small bowel mesentery. Both were analysed as laparoscopic cases.

There was no significant difference in duration of surgery between lap and open surgery (Lap three-stage vs. open three-stage: 492 (205–900) min vs. 530 (335–820) min; P = 0.7). Lap two-stage vs. open two-stage: 370 (200–780) min vs. 390 (210–675) min; P = 0.4].

Total median LOS was 14 (8–43) days for 2 stage surgery and 20 (12–114) days for 3 stage surgery. Median LOS was greater for open surgery [15 (8–114) days vs. 17 (13–60) days; P = 0.04].

Lap surgery was associated with significantly lower median blood loss [150 (0–840) ml vs. 334 (0–1480) ml; P = 0.02].

Complications are listed in Table 1. 24 (29%) children experienced 29 significant complications. Complications were seen in 9 of 37 (24%) open patients and 15 of 45 (31%) lap patients (P = 0.49). Notable complications include three cases where the pouch was permanently removed, and two cases where our inability to form an ileo-anal anastomosis led to a permanent stoma. Therefore 3 of our 80 completed pouches (3.7%) have been removed, or 5 (6%) of our 82 attempted RP have in fact been left with a permanent stoma.

There was no relationship between the occurrence of a complication and the disease which necessitated RP ($\chi^2 = 0.3$; P = 0.3), Table 2.

3. Discussion

This is the largest study to compare laparoscopic RP with open RP in children. We have found no difference in length of procedure, or complication rate between the two procedures, but significantly lower blood loss and length of stay with laparoscopic RP.

There are two main weaknesses of this study. Firstly the two study groups were not randomised, but consecutive. Clearly the latter group will have benefited from the expertise built up during the initial series, and might be expected to show fewer complications as a result. However, laparoscopic resection is a very different technique, and the laparoscopic group will also have undergone a learning curve, which to some extent, will counteract the consecutive nature of the two groups. Secondly the children suffered from five distinct pathologies, which have been grouped together to allow a larger number of cases to be studied. It can be argued that it is incorrect to include small children with Hirschsprung’s disease in the same comparison as adolescents with colitis. By the same token, patients with polyposis tend to be in good health, while patients with colitis refractory to medical management tend to be poor operative candidates. However, we could discern no effect of the presenting disease on the incidence of complications, but acknowledge some of the disease sets had small numbers.

We were unable to quantify post-operative pain, which could be expected to be a feature which might be lessened by the use of minimally invasive techniques. Post-operative analgesia used a heterogeneous variety of techniques, including morphine infusion, patient controlled morphine infusion, epidural infusion and local anaesthetic blockade. Because of this we were unable to quantify morphine dosage as a proxy for pain. We had no post-operative pain scores.

We have made no attempt to objectively analyse cosmesis, which again might be expected to be improved by laparoscopic techniques. However, we have found this issue to be of particular importance to adolescents.

It is interesting that adoption of laparoscopic RP did not lead to more pronounced reduction in length of hospital stay. We suggest that the reason for this is that hospital stay is not actually related to post-operative pain or mobility, but rather to stomal output. We find that these children commonly have a period of high stomal output which necessitates their remaining in hospital, irrespective of the technique of surgical resection. Still, other authors have reported shorter hospital stay for children undergoing laparoscopic RP.

The operative duration is essentially the same for open and laparoscopic techniques. Our view is that with experience, laparoscopic resection is a very different technique, and the laparoscopic group will also have undergone a learning curve, which to some extent, will counteract the consecutive nature of the two groups. Secondly the children suffered from five distinct pathologies, which have been grouped together to allow a larger number of cases to be studied. It can be argued that it is incorrect to include small children with Hirschsprung’s disease in the same comparison as adolescents with colitis. By the same token, patients with polyposis tend to be in good health, while patients with colitis refractory to medical management tend to be poor operative candidates. However, we could discern no effect of the presenting disease on the incidence of complications, but acknowledge some of the disease sets had small numbers.

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The lower blood loss
occurring during laparoscopic surgery reflects the excellent haemostasis of the harmonic scalpel, and the need for perfect bleeding control during minimally invasive surgery.

Our overall complication rate is comparable to other studies of this major procedure [5]. It is noticeable that the lap group had a higher rate of intestinal obstruction. Most of these were related to kinks or twists immediately proximal to the diverting ileostomy, and it may be that laparoscopic surgery does not always allow correct orientation of the stoma between the proximal bowel and the pelvic pouch. We have amended our practice to always re-visualise the stoma laparoscopically at the conclusion of the procedure. We have previously drawn attention to the possibility of lower limb compartment syndrome arising during lengthy operative procedures with the legs positioned other than supine [3]. We urge all operators undertaking this procedure to be aware of this potential complication.

A more pertinent question perhaps is whether a diverting stoma is required at all? The literature is divided on the need for this technique, with some studies suggesting no increase in complications when a diverting stoma is not used [10–12], while other studies suggest a reduction in complications with the use of a diversion [13]. We intend to continue to divert our patients, but recognise this may be unduly conservative and will indeed be the cause of some complications. Other authors have reported no difference in complication rates between laparoscopic and open RP in children [5].

In summary, laparoscopic RP may be adopted in children with the expectation of no increase in operative complications or operative duration. There may be benefit in reduction in hospital stay, and a reduced operative blood loss.

References


Discussion

Discussant: Ian Sugarman (Leeds, UK): This is a big series so well done on this. Is it right to assume the complications the pouchitis, the recto-vaginal or pouch-vaginal fistulas pouch removed, were only in children with ulcerative colitis and not in children with Hirschsprung’s, or constipation?

Response: Miss Sheth: I would need to go back to the results to check on this and be accurate. One of our pouch-vaginal fistulas was in a patient who had colitis, but I would need to check on those results.

Ian Sugarman: Can you confirm that the complications were in the IBD group?

Response: Miss Sheth: Mainly yes. One of our constipation patients continued to be incontinent following their pouch surgery. They had a disease diagnosed as being on the autistic spectrum and I don’t know if that was related or not. But they were incontinent prior to surgery thought to be to be secondary to constipation and proven to be secondary to constipation on a lot of investigations but had continued to have problems and were converted back to an ileostomy.

Discussant: Joe Curry (Great Ormond Street Hospital, London): One of the issues many of us have with this surgery is when to do it, and how patients get transitioned into adult services as probably adult surgeons have more experience. Can you just comment on the ages of these children, how they transition to adult services and what your longer term follow up of these patients will be in 5–10 years’ time.

Response: Miss Sheth: Our median age was 12. We had quite a diverse population, so the patients who had surgery for Hirschsprung’s were younger but patients with polyposis conditions and ulcerative colitis tended to be older. We have a good working relationship with our adult colleagues and we send them along after a formal referral, but if there are any problems they can still contact our nurses or us.

Discussant: Mervyn Griffiths (Southampton): What about your younger ones?

Response: Miss Sheth: Five had Hirschsprung’s disease and the constipation patients were younger, but I don’t have exact details at present.