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A defunctioning stoma significantly prolongs the length of stay in laparoscopic colorectal resection

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Abstract
Background Reduction in length of stay has several advantages, including healthcare costs, patient choice, and minimizing hospital acquired infections. Additionally, length of stay is a surrogate marker of rate of recovery from the physiological insult of anaesthesia and surgery and complications thereof. A well-documented short-term benefit of laparoscopic compared to open colorectal resection is reduced length of stay.
Methods This was a review of prospectively collected data on all laparoscopic colorectal resections performed in our unit. We analyzed patients having primary colorectal anastomosis, to assess the effect of conversion compared to completion laparoscopically. Furthermore we compared those with or without diverting stoma, for the effect of stoma formation on postoperative length of stay (LOS).
Results Two hundred and thirteen patients had a colorectal resection. Of these 133 (62%) were left-sided or rectal resections. Resection with primary colorectal anastomosis was undertaken in 112 patients. A defunctioning stoma was performed in 13/112 (12%), and 32/112 (29%) were converted as the procedure could not be completed laparoscopically.
Conversion was not significantly associated with increased LOS with weighted median of 6.5 and 6 days for conversion and no conversion, respectively. However, stoma formation significantly increased LOS to a median of 10 days compared with a median of 6 days in patients without a stoma ($p = 0.001$, Mann–Whitney U).
Conclusions The need for conversion, if performed in a timely and appropriate manner, has little impact on patient outcome compared to those completed laparoscopically, with no significant increase in LOS in our experience. In contrast, a diverting stoma does prolong LOS and some of the benefits of laparoscopic surgery may be lost unless patients requiring a stoma are identified preoperatively and have intensive pre- and postoperative stoma training.

Keywords Length of stay · Stoma · Conversion · Laparoscopy · Colorectal

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Reduction in length of stay has several advantages, including healthcare costs, patient choice, and minimizing hospital acquired infections. Additionally, length of stay is a surrogate marker of rate of recovery from the physiological insult of anaesthesia and surgery and complications thereof. A well-documented short-term benefit of laparoscopic compared to open colorectal resection is reduced length of stay [1–5], perhaps mainly a result of minimizing the abdominal access trauma and visceral manipulation required to adequately mobilize, resect, and safely reconstruct the gastrointestinal tract.

Some cases of laparoscopic colorectal resection require conversion to an open procedure to safely complete these complex tasks. There is ongoing debate in the surgical literature as to the effect, outcome, and significance of conversion of a laparoscopic procedure in all laparoscopic surgery, especially so in colorectal surgery [4, 6–8] where detrimental effects on patient outcomes have been reported with increased postoperative length of stay, morbidity, and perhaps mortality compared to open surgical resection [4].

Nevertheless the need for conversion should be considered as sound judgement rather than failure and reports suggest that many adverse outcomes may result from undue delay, in changing from a laparoscopic to a modified technique including open access incision [6–8].

Similarly the need for a diverting stoma to reduce the consequences of an anastomotic leak, whether in open or laparoscopic reconstructive surgery, is an essential requirement in selective left-sided, colonic and rectal, resections. Controversy persists as to whether proximal defunctioning decreases the anastomotic leak rate [9] but it is generally accepted that the clinical consequences of a leak are reduced in patients with anastomotic complications if a proximal diverting colostomy or ileostomy has been performed [10]. The indications for proximal diversion are variable and depend on patient factors, such as an air leak on anastomotic testing, high-dose preoperative chemo-radiotherapy or excessive pelvic bleeding, etc., although commonly decisions may be based on local routine practice or surgeon choice. The formation of any intestinal stoma requires the patient to be trained in, and confident with, appliance application, drainage, and management and may be a potent factor in prolonging length of stay after any surgical procedure.

The effect of a stoma in prolonging length of stay has not been widely studied in either laparoscopic or open surgery. Stoma formation may be anticipated in some cases, such as selective patients undergoing anterior resection, and thus amenable to preoperative counseling and educational instruction.

The purpose of this study was to evaluate the effect of conversion of laparoscopic colorectal resections on length of stay and compare the magnitude of this effect to that in patients with, or without, a temporary defunctioning stoma. We report our experience with laparoscopic colorectal resection under the care of a single consultant surgeon (TDC), since the commencement of laparoscopic colorectal surgery in our institution. This in a setting without an enhanced recovery program and without outpatient preoperative meeting with stoma care nurses.

Methods

This was a review of prospectively collected data on all laparoscopic colorectal resections performed in our unit. We analyzed patients having primary colorectal anastomosis, to assess the effect of conversion compared to completion laparoscopically. Furthermore we compared those with or without diversion, for the effect of stoma formation on postoperative length of stay (LOS) (Mann–Whitney *U*; SPSS 15, SPSS Inc., USA). Conversion was defined as any incision (or extension of an incision) performed in order to progress the intra-abdominal dissection. We documented the reasons for conversion and subsequent complications.

Results

In total, 213 patients had a colorectal resection. Of these 133 (62%) were left-sided, colonic or rectal, resections. These included 111 anterior resections, 12 abdomino-perineal resections, five completion proctectomies, three Hartmann resections, one resection rectopexy, and one left hemicolectomy.

Resection with primary colorectal anastomosis was undertaken in 112 patients. A defunctioning stoma was performed in 13/112 (12%) and 32/112 (29%) were converted as the procedure could not be completed laparoscopically. Indications for operation, shown in Table 1, included benign and malignant disease.

There were 65 females and 47 males. The leakage rate was 3% overall (two clinical requiring surgical intervention and one radiological). Both clinical leaks were in patients who were neither defunctioned nor converted. The radiological leak was in a patient who was both defunctioned and converted. There was one postoperative death, on day 1 in a patient who was neither converted nor had a stoma, from pulmonary edema secondary to known severe aortic stenosis.

Seven patients had additional organs resected. Six of these were converted as shown in Table 2, one had laparoscopic bilateral salping-oophrectomy. Further indications for conversion are shown in Table 3.

The means of conversion was midline laparotomy in six and a Pfannenstiel incision in 26. The median (range) length of incision in those converted was 15 cm (range 12–25 cm) compared to a specimen extraction wound length of 5 cm (range 4–10 cm) in those not converted.

We analyzed these 112 patients who had a primary colorectal anastomosis for the effect of conversion and in a

Table 1 Indication for colorectal resection in 112 patients with colorectal anastomosis

Indication	Number (%)
Diverticular disease	51 (46%)
Malignant tumor	51 (46%)
Benign polyp	4 (4%)
Endometriosis	2 (2%)
Volvulus	2 (2%)
Colonoscopic perforation	1 (1%)
Rectal prolapse	1 (1%)
Total	112 (100%)

Table 2 Converted patients undergoing an additional resection

Additional procedures	Disease process	No stoma/stoma
Hysterectomy and oophrectomy, right hemicolectomy	Tumor involvement	No stoma
Hysterectomy and oophrectomy, bladder resection	Tumor involvement	No stoma
Hysterectomy and oophrectomy	Colo-uterine fistula	Stoma
Hysterectomy and oophrectomy	Inflammatory involvement	No stoma
Small-bowel resection	Tumour involvement	No stoma
Bladder resection	Inflammatory involvement	Stoma

Table 3 Indications for conversion in those not requiring an additional resection

Indication for conversion	Number
Inability to get confidently below tumor and cross staple	5
Inflammatory mass/abscess	5
Adhesions	3
Fistula not amenable to laparoscopic management	2
Bleeding	2
Inadequate view	2
Difficulty of ureteric anatomy	2
Other/not specified	5

Table 4 Length of stay (LOS) for patients converted and not converted ($p = 0.065$, Mann–Whitney U)

	Number	Median LOS (inter-quartile range)
Not converted	79	6 (5–8)
Converted	32	6.5 (5–10)

separate analysis the effect of a defunctioning stoma on LOS. We excluded the patient who died in the early postoperative period.

Conversion was not significantly associated with increased LOS with weighted median of 6.5 and 6 days for conversion and no conversion, respectively (Table 4, Fig. 1). However, stoma formation significantly increased LOS to a median of 10 days compared with a median of 6 days in patients without a stoma ($p = 0.001$, Mann–Whitney U; Table 5, Fig. 2).

Discussion

There are conflicting reports in the literature concerning the effect on patient outcome when conversion of laparoscopic colorectal resection is performed. Some of the differences may result from an absence of consensus as to the definition of conversion, whereby many surgeons only count conversion as a major enlargement of the specimen extraction wound or even midline laparotomy. We have used a much tighter definition and have defined conversion

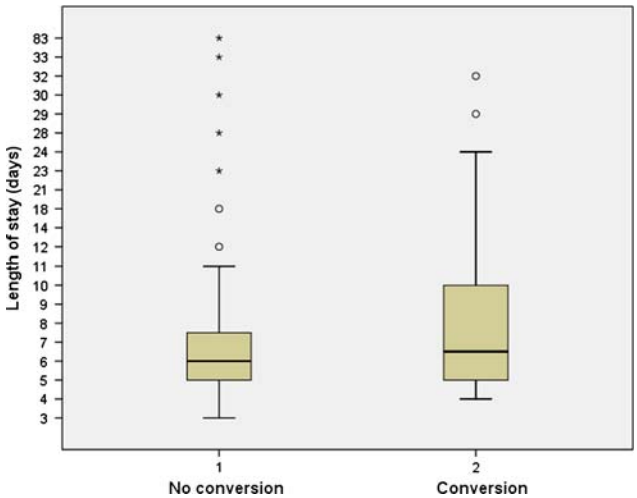

Fig. 1 Box–whisker plot of length of stay for patients converted and not converted

Table 5 Length of stay (LOS) for patients with and without a stoma ($p = 0.001$, Mann–Whitney U)

Procedure	Number	LOS (interquartile range)
No stoma	98	6 (5–8)
Stoma	13	10 (7.5–22.5)

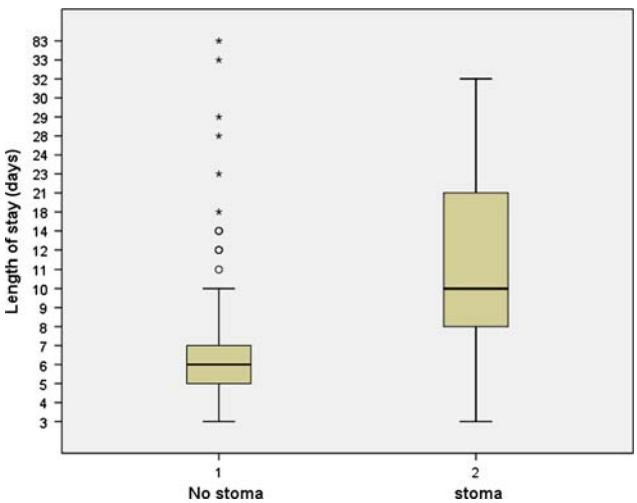

Fig. 2 Box–whisker plot of length of stay for patients with and without a stoma

as any extension of an abdominal wound to facilitate dissection.

Some reports suggest significantly worse outcome in patients converted, both in comparison to those completed laparoscopically and to patients having conventional open surgery [4]. Others have documented that the outcome is not significantly worse than conventional open resection [6, 7], or that outcomes are equivalent in some, but not all, parameters as compared to patients whose surgery was completed laparoscopically [7].

Our approach to conversion, and definition thereof, is not black and white but more of a spectrum perhaps described as a grey scale. Indeed we favor the terminology of 'adapting' the access technique (Brian Rees, personal communication), rather than 'conversion' in individual situations to safely complete dissection, specimen resection, or gastrointestinal tract reconstruction. Adapting the wound ranges from enlarging an extraction wound to remove a bulky specimen, extending the extraction wound to enable optimal dissection or placement of a right-angled stapler across the rectum (perhaps enabling a safer anastomosis with less likelihood of requiring a defunctioning stoma) through to a full midline laparotomy for the entire procedure. We believe this provides maximum benefits with minimal disadvantages in a patient where complex colorectal resection cannot be completed in a safe and timely fashion laparoscopically. This is consistent with other reports suggesting that timely and appropriate conversion may gain most benefit, with least morbidity, effect on recovery, or operative duration [7, 8].

The addition of a defunctioning stoma is, however, significantly associated with increased LOS at the primary procedure, in our experience. Additionally, further admission for stoma reversal is needed, though we have not counted this in calculating LOS in this study. The confident management of an intestinal stoma unquestionably adds to the LOS and patient anxiety. Stoma management can be one of the most difficult early issues in patients who have had a colorectal resection, especially as many are elderly, often with poor manual dexterity due to coincidental disease such as rheumatoid arthritis. However, some may argue that it may not be the stoma per se but the particular problem that required a stoma such as an anastomotic problem which may prolong LOS. It is notable, however, that a 2004 study reported that intensive preoperative and postoperative training in stoma care led to a 2 day decrease in LOS [11], a similar figure to the benefit of laparoscopic over open colorectal resection in LOS [1]. This suggests that the stoma itself is a major factor in increasing LOS, though we did not expressly document causes of patients LOS in this study.

Difficulty in transecting the rectum with one firing of the current laparoscopic stapling instruments, such that overlapped transverse staple lines are required, may affect confidence in anastomotic integrity. Our diverting stoma rate of 13% may reflect, in part, a willingness to extend a specimen retrieval incision to either complete the pelvic dissection or to cross-staple the rectum with a conventional linear stapling gun.

The need for a diverting stoma can, in part, be predicted due to reported associations of increased anastomotic leak rates with low anastomosis [9], male sex [10], smoking and alcohol intake [12], and preoperative radiotherapy [13]. Many of those patients with a high probability of requiring a diverting stoma could be identified and given intensive stoma education preoperatively and in the immediate postoperative period.

In conclusion, the need for conversion, if performed in a timely and appropriate manner has little impact on patient outcome compared to those completed laparoscopically, with no significant increase in LOS in our experience. In contrast, a diverting stoma does prolong LOS and some of the benefits of laparoscopic surgery may be lost unless patients requiring a stoma are identified preoperatively and have intensive pre- and postoperative stoma training.

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