Original article

Outcomes following laparoscopic rectal cancer resection by supervised trainees

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Background: **The aim was to evaluate the applicability of laparoscopic surgery in the treatment of primary rectal cancer in a training unit.**

Methods: **A cohort analysis was undertaken of consecutive patients undergoing elective surgery for primary rectal cancer over a 7-year interval. Data on patient and operative details, and short-term clinicopathological outcomes were collected prospectively and analysed on an intention-to-treat basis.**

Results: **A total of 306 patients (213 men, 69·6 per cent) of median (i.q.r.) age 67 (58–73) years with a median body mass index of 26·6 (23·9–29·9) kg/m^2 underwent surgery. Median tumour height was 8 (6–11) cm from the anal verge, and 46 patients (15·0 per cent) received neoadjuvant radiotherapy. Seven patients (2·3 per cent) were considered unsuitable for laparoscopic surgery and underwent open resection; 299 patients (97·7 per cent) were suitable for laparoscopic surgery, but eight were randomized to open surgery as part of an ongoing trial. Some 291 patients (95·1 per cent) underwent a laparoscopic procedure, with conversion required in 29 (10·0 per cent). Surgery was partially or completely performed by trainees in 72·4 per cent of National Health Service patients (184 of 254), whereas private patients underwent surgery primarily by consultants. Median postoperative length of stay for all patients was 6 days and the positive circumferential resection margin rate was 4·9 per cent (15 of 306).**

Conclusion: **Supervised trainees can perform routine laparoscopic rectal cancer resection.**

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Introduction

Rectal cancer resection is considered more complex than other colorectal surgery. Although the use of laparoscopic surgery to treat colonic cancer has become widely accepted[1,2], in rectal cancer its use is still debated and training has been said to be problematic[3]. The technical complexity of the intervention, owing to the confines of the pelvis, has limited adoption of the laparoscopic approach[4,5]. Initially, the only level 1 evidence supporting oncological safety in laparoscopic rectal cancer resection was from a subset of the MRC CLASICC (Medical Research Council Conventional *versus* Laparoscopic-Assisted Surgery In Colorectal Cancer) trial[6]. More recently, the COREAN (Comparison of Open *versus* laparoscopic surgery for mid and low REctal cancer After Neoadjuvant chemoradiotherapy)[7], COLOR (COlorectal cancer Laparoscopic or Open Resection) II[8] and EnROL (Enhanced Recovery Open *versus* Laparoscopic)[9] studies compared laparoscopic and open resection for rectal cancer, where surgeons beyond the learning curve performed the surgery. These trials demonstrated similar safety and resection margins, with improved recovery in the minimally invasive group. However, because of the technical difficulties associated with rectal cancer excision, it is uncertain what proportion of primary rectal cancer surgery can be safely undertaken laparoscopically. In particular, it is not clear what proportion can be undertaken by surgeons on the proficiency gain curve, rather than by specific high-volume practitioners.

Recently, a number of alternative surgical approaches for rectal cancer resection have been proposed and have received attention in the literature. Both robotic[10,11] and transanal[12,13] TME have been suggested to make the 'difficult' tumour in a narrow pelvis more accessible to minimally invasive resection. These techniques require further study before widespread adoption. It is also important to define the proportion of patients with rectal cancer who will benefit from laparoscopic surgery and whether

satisfactory outcomes are achievable when trainees are performing the surgery.

Methods

A cohort analysis was undertaken of prospectively collected data from consecutive patients undergoing elective resection of primary rectal cancer, between October 2006 and March 2014. Patients were included even if operations comprised multiple bowel resections or local extension of the resection margin to effect clearance (for example partial prostatic, vaginal or bladder excision, or total hysterectomy), but were excluded when the following procedures were performed: total cystectomy, total prostatectomy or sacrectomy. Exclusions comprised patients aged less than 18 years, histology other than adenocarcinoma, recurrent rectal cancer, and those managed only through a transanal approach. There was no selection policy regarding referral within the unit to either of the two surgeons. No transanal endoscopic microsurgery was undertaken in the unit during the study.

Rectal cancer was defined as tumour 15 cm or less from the anal verge on rigid sigmoidoscopy performed in the left lateral position with the patient awake. It was subdivided into high, mid or low based on its location in the upper (12–16 cm), middle (7–11 cm) or low (6 cm or less) rectum[14]. Neoadjuvant therapy was administered only when the primary lesion or satellite/nodal disease threatened (within 1 mm of the mesorectal fascia) or breached the circumferential resection margin (CRM) on pelvic MRI. All patients underwent preoperative pelvic MRI and CT unless there was a contraindication.

Outcomes

Patient demographics, operative details and short-term surgical and oncological outcome data were analysed. Postoperative complications that occurred within 30 days of the procedure were graded using the Dindo–Demartines–Clavien classification[15]. Anastomotic leak was subdivided according to the International Study Group of Rectal Cancer Classification (ISGRCC)[16], with transanal transanastomotic drainage of abscess under anaesthetic being defined as grade B. Primary endpoints were length of postoperative hospital stay, positive CRM rate, morbidity and mortality. Mortality was defined as combined in-hospital and 30-day death rate.

Laparoscopic conversion was defined as the inability to complete mobilization of the specimen by a laparoscopic approach, including the vascular ligation, usually, but not always, resulting in a larger wound than that required to remove the specimen[17]. The primary indication for conversion was recorded and subclassified as being for technical, oncological or anaesthetic reasons. 'Oncological' relates to conversion owing to a bulky tumour, inflammatory tumour mass or local tumour invasion requiring extension of the resection plane; 'anaesthetic' indicates conversion because of either respiratory or cardiovascular instability during the operation; the reason was 'technical' when the conversion was due to inability to complete the resection. A secondary analysis in patients whose procedure was converted was made on the basis of wound incision length, with the population dichotomized at 16 cm because this was the shortest incision length for an open operation in the present series. All patients underwent surgery within a standard enhanced recovery pathway[18].

Pathological grading and staging of specimens was reported using version 5 of the International Union Against Cancer (UICC) TNM classification[19]. Longitudinal resection margins and CRMs were assessed and staged based on the TNM and Dukes' staging systems. An R1 resection was classified as the presence of tumour cells within 1 mm of the CRM, whereas R2 was classified as residual macroscopic disease remaining unresected.

Surgical technique

All procedures were performed or supervised by one of two consultant colorectal surgeons. The laparoscopic technique was standardized between surgeons, with all performing a medial to lateral mobilization of the left colon to minimize variation in technique, make surgery more efficient and improve outcome[20]. The splenic flexure (including the left half of the transverse colon) is mobilized routinely in TME and slightly less frequently for high anterior resection. Rectal dissection was carried out in the mesorectal plane, with TME or partial mesorectal excision (PME) performed depending on the height of the tumour. During PME, 5 cm of rectum was resected distal to the lower border of the tumour. A double-stapled end-to-end or side-to-end anastomosis was constructed except in those who required ultralow anterior resection with coloanal, hand-sutured anastomosis. Indications for defunctioning ileostomy included patients undergoing TME, restorative proctocolectomy or following radiotherapy. Laparoscopic rectal stapling and division were performed in the sagittal plane, via a suprapubic 12-mm port, using an articulating laparoscopic stapler (ATS 45; Ethicon Endosurgery, Cincinnati, Ohio, USA). Surgery on the rectum was always carried out with the laparoscope placed in a port offset to the right and inferior to the umbilicus and never at the umbilicus, with the surgeon's operating instruments placed

via the umbilical and right suprapubic ports. Before rectal transection during TME, the height of the stapler and its position perpendicular to the long axis of the rectum were verified by transanal palpation with reference to the dentate line, thus ensuring accurate transection. Rectal washout with povidone–iodine was performed in all patients before rectal transection. Specimen extraction was generally via a small left iliac fossa, muscle-separating incision. Preoperative rectal tattooing was not undertaken as it prevented tissue planes being seen clearly.

Training scheme

Trainees were in the final year of their surgical training in the UK. Operative training was delivered in a modular format as described previously[21]. Modules were graded by difficulty from one to five, with trainees graduating on to increasingly more complex modules. The multimodal training concept employed at the institution encourages the use of educational adjuncts such as pre-prepared videos of operative modules, preoperative mental practice, regular performance-enhancing feedback, and other adjuncts including video playback and self-editing of previous operations. To ensure an appropriate training environment, operation lists were prepared with adequate time to train.

Statistical analysis

Data were analysed on an intention-to-treat basis. Comparisons were made using the χ^2 test for all categorical variables, and the *t* test and Mann–Whitney *U* test to evaluate differences between continuous normally and non-normally distributed variables respectively. Statistical significance was indicated by two-tailed $P \leq 0{\cdot}050$. Statistical analysis was done using SPSS® version 20 for Mac (IBM, Armonk, New York, USA).

Results

A total of 306 patients (213 men, 69·6 per cent) of median (i.q.r.) age 67 (58–73) years underwent elective resection for rectal cancer during the study interval. The median body mass index (BMI) was 26·6 (23·9–29·9) kg/m^2. Trainees completely or partially performed 184 (60·1 per cent) of 306 procedures under direct supervision; this increased to 184 (72·4 per cent) of 254 when only patients within the National Health Service (NHS) were considered (private patients excluded). Median tumour height was 8 (6–11) cm. Eighty-one patients (26·5 per cent) had low rectal cancers (6 cm or less from anal verge), with ten requiring handsewn, coloanal anastomoses following intersphincteric dissection. Forty-six patients (15·0 per cent) received neoadjuvant treatment before surgery: long-course chemoradiotherapy in 45 and short-course radiotherapy in one. A trainee was the primary operator for 28 of these 46 patients.

The median operating time was 250 (210–300) min. Median blood loss was 50 (20–190) ml. Increasing BMI was associated with longer incision length ($r_s = 0{\cdot}216$, $P = 0{\cdot}001$), increased blood loss ($r_s = 0{\cdot}130$, $P = 0{\cdot}037$) and a trend towards a higher conversion rate ($P = 0{\cdot}075$). As there were no differences in outcomes between trainee- and consultant-performed operations, the whole cohort was analysed together.

A total of 299 patients (97·7 per cent) were suitable for laparoscopic surgery; laparoscopic resection was attempted in 291 patients (95·1 per cent) and in 29 (10·0 per cent) the procedure was converted to open surgery (*Table 1*). Eighteen (9·8 per cent) of 184 procedures in patients receiving supervised, trainee-performed surgery were converted. Among the 46 patients receiving neoadjuvant treatment owing to a threatened CRM on MRI, resection was attempted laparoscopically in 42, with six procedures requiring conversion. The 15 patients who underwent primary open surgery included eight who were suitable for laparoscopic treatment, but were randomized to open surgery within the context of a randomized trial (EnROL trial[9]) and seven who were unsuitable for laparoscopic resection for the following reasons: previous complex open rectal resection (1), two previous open left colonic resections in a patient with a tumour 1 cm from the dentate line (1), previous total colectomy with incisional and parastomal hernias (1), bulky rectal cancer requiring extension of resection margins into surrounding organs (2), and severe respiratory disease precluding laparoscopy on anaesthetic grounds (2).

The predominant reasons for conversion to open surgery were secondary to anaesthetic problems in nine, oncological issues in nine and due to technical problems in 11 patients. Patients with anaesthetic problems had difficulties with ventilation or cardiac ischaemia and, compared with the other two groups, were more obese, required a longer incision and had an increased hospital stay (*Table 2*). The oncological reasons for conversion were contiguous organ involvement in the pelvis (6 patients) or locally advanced tumour in a narrow pelvis (3). Technical reasons for conversion varied; adhesions were implicated in many, and other diverse issues included a fibroid uterus, staple gun misfiring and a narrow pelvis. In two of this group, adhesions were divided via a small open incision and the operation was then completed laparoscopically. On many occasions much of the operation could be performed laparoscopically (such as inferior mesenteric artery ligation and splenic flexure

Table 1 Baseline demographics, and details of patients undergoing surgery for rectal cancer

	Total ($n = 306$)	Open ($n = 15$)	Laparoscopic converted ($n = 29$)	Completed laparoscopically ($n = 262$)	P§
Age (years)*	67 (58–73)	63 (53–74)	71 (65–79)	66 (57–72)	0·017¶
Sex ratio (M : F)	213 : 93	13 : 2	20 : 9	180 : 82	0·182
BMI (kg/m^2)*	26·6 (23·9–29·9)	27·7 (23·5–30·6)	28·0 (25·3–30·0)	26·3 (23·3–29·8)	0·005¶
ASA fitness grade ≥ II	249 of 299 (83·3)	11 of 14	25 of 29	213 of 256	0·255
Distance from anal verge (cm)*	8 (6–11)	8 (6–12)	7 (6–10)	8 (5–11)	0·623¶
Neoadjuvant therapy	46 (15·0)	4	6	36	0·004
Procedure type					0·212
Anterior resection	236 (77·1)	10	19	207	
Restorative proctocolectomy	6 (2·0)	0	0	6	
Panproctocolectomy	6 (2·0)	1	0	5	
Low Hartmann's†	18 (5·9)	2	5	11	
APER‡	40 (13·1)	2	5	33	
Trainee primary operator	184 (60·1)	12	18	154	0·913

Values in parentheses are percentages unless indicated otherwise; *values are median (i.q.r.). †Total mesorectal excision and formation of end sigmoid colostomy; ‡24 extralevator abdominoperineal excision of the rectum (APER) and 16 standard APER. BMI, body mass index; ASA, American Society of Anesthesiologists. §χ^2 test, except ¶Mann–Whitney U test.

Table 2 Clinical outcomes in 291 patients undergoing attempted laparoscopic resection

		Reason for conversion			
	Completed laparoscopically ($n = 262$)	Technical ($n = 11$)	Oncological ($n = 9$)	Anaesthetic ($n = 9$)	P†
BMI (kg/m^2)*	26·3 (23·3–29·8)	26·0 (24·8–29·0)	25·6 (24·4–28·9)	31·5 (31·0–32·0)	0·005‡
BMI > 30 kg/m^2	55 (21·0)	1	0	7	< 0·001
Incision length (cm)*	6 (5–7)	14 (9–17)	15 (13–17)	20 (16–21)	< 0·001‡
Distance from anal verge (cm)*	8 (5–11)	9 (7–10)	6 (3–8)	6 (6–10)	0·633‡
Length of hospital stay (days)*	6 (4–8)	7 (6–10)	8 (7–12)	17 (12–46)	< 0·001‡
Leak rate	29 of 213 (13·6)	0 of 10	0 of 3	3 of 6	0·034
Positive CRM	12 (4·6)	0	2	0	0·096

Values in parentheses are percentages unless indicated otherwise; *values are median (i.q.r.). BMI, body mass index; CRM, circumferential resection margin. †χ^2 test, except ‡Mann–Whitney U test.

mobilization) before conversion via a small lower midline incision, thus allowing the incision length to be minimized.

Some 222 patients underwent TME and 84 had PME. Forty-four of 81 patients with low rectal cancers underwent a non-restorative procedure (35 abdominoperineal excision of the rectum, 4 Hartmann's procedure and 5 panproctocolectomy) with a median tumour height of 3 (2–4) cm from the anal verge.

A total of 132 patients (43·1 per cent) had a complication associated with the surgery; 25 (8·2 per cent) required readmission and 28 (9·2 per cent) needed further surgery within 30 days of the index operation (*Table 3*). Among 242 patients undergoing a restorative procedure, an anastomotic leak was detected in 35 (14·5 per cent), of whom 11 required no change to patient management, all leaks being detected on contrast enema after discharge (grade A ISGRCC); 15 required active therapeutic intervention such as antibiotics, transanal or percutaneous drainage (grade B), and nine required relaparotomy (grade C). Five deaths (1·6 per cent) occurred in hospital or within 30 days of operation, and a further patient died within 90 days of surgery (90-day mortality rate 2·0 per cent). Deaths were from myocardial infarction in two patients, and soft tissue malignancy, anastomotic leakage, aspiration and acute respiratory failure in one each.

Patients undergoing laparoscopically completed operations had a significantly shorter duration of hospital stay than those experiencing conversion (6 (4–8) days *versus* 10 (6–15) days; $P < 0·001$). However, after conversion when the incision length remained less than 16 cm (13 (45 per cent) of 29 procedures; 16 cm was the shortest incision length for open surgery), length of stay was similar (median 6 (6–8) days) to that for laparoscopically completed procedures. This suggests that patients who have a converted procedure with a relatively short incision may still benefit from a laparoscopically assisted procedure.

Table 3 Operative outcomes

	Total ($n = 306$)	Open ($n = 15$)	Laparoscopic converted ($n = 29$)	Completed laparoscopically ($n = 262$)	P‡
Obesity (BMI > 30 kg/m^2)	67 of 302 (22·2)	4 of 15	8 of 29	55 of 258	< 0·001
Duration of operation (min)*	250 (210–300)	213 (190–300)	270 (240–300)	250 (210–300)	0·116§
Blood loss (ml)*	50 (20–190)	400 (200–700)	250 (150–500)	40 (10–100)	< 0·001§
Incision length (cm)*	6 (5–16)	24 (20–30)	16 (13–20)	6 (5–7)	< 0·001§
Primary length of hospital stay (days)*	6 (5–8)	7 (5–14)	10 (6–15)	6 (4–8)	< 0·001§
Total length of hospital stay (days)*	6 (5–9)	9 (5–14)	11 (7–19)	6 (4–8)	< 0·001§
Patients with any complication	132 (43·1)	9	20	103	0·001
Patients with grade III–V complications*†	43 (14·1)	1	8	34	< 0·001
Reoperation	28 (9·2)	1	4	23	0·172
Readmission	25 (8·2)	1	3	21	0·384

Values in parentheses are percentages unless indicated otherwise; *values are median (i.q.r.). †Grade III, requiring surgical, endoscopic or radiological intervention; grade IV, life-threatening; grade V, death[6]. BMI, body mass index. ‡χ^2 test, except §Mann–Whitney U test.

Table 4 Oncological outcomes

	Total ($n = 306$)	Open ($n = 15$)	Laparoscopic converted ($n = 29$)	Completed laparoscopically ($n = 262$)	P‡
Positive resection margin	16 (5·2)	2	2	12	0·332
Lymph node yield*	18 (12–26)	17 (13–24)	16 (12–23)	19 (12–26)	0·612§
TNM tumour category					0·538
T1†	71 (23·2)	5	5	61	
T2	73 (23·9)	3	5	65	
T3	145 (47·4)	5	16	124	
T4	17 (5·6)	2	3	12	
UICC TNM stage					0·214
I†	106 (34·6)	7	8	91	
II	77 (25·2)	1	6	70	
III	104 (34·0)	5	15	84	
IV	19 (6·2)	2	0	17	

Values in parentheses are percentages unless indicated otherwise; *values are median (i.q.r.). Data refer to results after chemoradiotherapy. †Includes eight ypT0 N0. UICC, International Union Against Cancer. ‡χ^2 test, except §Mann–Whitney U test.

The proportion of patients potentially benefiting from laparoscopic surgery is thus defined as the total percentage suitable for laparoscopy minus the percentage with a converted procedure involving an incision longer than the shortest incision required for open surgery. The proportion in this analysis is 92·2 per cent (97·7 per cent – (55 per cent of 10·0 per cent)).

Oncological outcomes are shown in *Tables 4* and *5*. The CRM was found to be involved in 15 patients (4·9 per cent) (14 R1 and 1 R2) and the longitudinal margin in one. Five of these 16 patients were treated with preoperative radiotherapy. In two of the 15 patients with an involved CRM, the site of CRM positivity was a microscopic deposit within a node that could not be visualized on preoperative MRI (1 patient) and microscopic venous invasion not visible on imaging (1).

To identify a group that would allow appropriate comparison with results following transanal endoscopic TME, clinical outcomes were considered in relation to tumour height in patients who underwent laparoscopic surgery and reconstruction (*Table 6*). These data indicated an increased hospital stay with proximity of the tumour to the anal verge, but no apparent association with conversion, anastomotic leakage, margin positivity or complications, accepting that there were smaller numbers in the low rectal cancer category. Outcomes were also examined after stapled anastomosis in men and compared with those in all other patients undergoing reconstruction. There was no significant difference (data not shown) in any outcome assessed between the two groups, including hospital stay, anastomotic leakage, CRM rates, complications, readmission and grade of operating surgeon. Men with a stapled anastomosis had a conversion rate of eight (6·6 per cent) of 122, a morbidity rate of 52 (43·0 per cent) of 121 and a major complication rate of 21 (17·4 per cent) of 121.

Table 5 Circumferential resection margin positivity rate in relation to delivery of preoperative chemoradiotherapy

	Proportion with positive margin		
Rectal tumour site	Total ($n = 306$)	No chemoradiotherapy ($n = 260$)	Chemoradiotherapy ($n = 46$)
Upper	0 of 88 (0)	0 of 87	0 of 1
Middle	5 of 137 (3·6)	4 of 119	1 of 18
Low	10 of 81 (12)	6 of 54	4 of 27
Reconstructed	2 of 37 (5)	2 of 28	0 of 9
Without reconstruction*	8 of 44 (18)	4 of 26	4 of 18

Values in parentheses are percentages. One patient received short-course chemoradiotherapy only. *Positive margins in five of 40 abdominoperineal excisions of the rectum.

Table 6 Clinical outcomes in relation to tumour height in 232 patients in whom laparoscopic resection and reconstruction was attempted

Rectal tumour site	No. of patients	Conversion	Leak	Positive CRM	Median hospital stay (days)*	Any complication	Trainee primary operator
Upper	81	4	6	0	5 (4–8)	27	43
Middle	114	13	18	2	6 (5–10)	52	74
Low	37	2	8	2	6 (5–7)	15	20
Stapled	29	0	6	2	6 (4–7)	12	15
Handsewn	8	2	2	0	6 (6–7)	3	5
P†		0·205	0·183	0·300	0·010‡	0·280	0·045

*Values are median (range). CRM, circumferential resection margin. †χ^2 test, except ‡Mann–Whitney U test.

Discussion

This study reports on consecutive patients with rectal cancer who were treated preferentially using laparoscopic resection, with trainee-performed, consultant-supervised surgery in nearly three-quarters of NHS patients. Conversion to open surgery was relatively rare. In the subset of patients who had a converted procedure with an incision shorter than the shortest open incision, the median postoperative stay was the same as for patients undergoing completed laparoscopic surgery, suggesting they gained benefit from laparoscopy. The study reinforces the considerable evidence that supervised trainees can provide safe and competent colorectal cancer surgery[22,23]. Notably, it appears to extend this argument for laparoscopic rectal cancer resection, with a highly structured approach to training[21].

In a comparable study reported by Buchanan and colleagues[17] in 2008, among patients with a threatened CRM on preoperative MRI, laparoscopic resection was converted in all in whom it was attempted. In the present study, laparoscopic resection was completed in most patients with a threatened CRM. This improvement in ability to resect this most difficult subgroup of tumours laparoscopically, despite the fact that the senior surgeon was the same in both series, is assumed to be due to operative experience. The data in the previous paper relate to an earlier phase of laparoscopic rectal surgery. The experience gained by the two senior surgeons in undertaking a relatively high volume of laparoscopic colorectal surgery (over 100 resections per year each) within a specialist centre is crucial. The potential for laparoscopic surgery would be irrelevant if it did not confer an improvement in outcome. It now seems clear that laparoscopy reduces complications and hospital stay, even when enhanced recovery care is employed[9,18,24]. In addition, it is possible that laparoscopy may confer a survival benefit after rectal cancer resection; within the COLOR II trial[25] patients with stage III disease had a significant improvement in disease-free survival after laparoscopic resection.

Some publications have questioned the role of laparoscopy in rectal cancer surgery, but as most did not include all patients it is usually difficult to know what proportion of patients were suitable for laparoscopy and thus its value. Laurent and co-workers[26] examined outcomes following reconstructive TME during the 6-year interval to 2006. Only 69 per cent of procedures were attempted laparoscopically but, in those attempted, men with a stapled (as opposed to handsewn) anastomosis had a conversion rate of 34 per cent and morbidity rate of 58 per cent. These data relate to a period earlier than the present study and this may explain why such adverse outcomes are not reported here. In addition, it is concluded that stapling via a suprapubic port within the sagittal plane, as reported here, allows transection of the rectum satisfactorily without excess complications.

The recent development of transanal TME has been stimulated by the suggestion that, in comparison with laparoscopic resection, it has the potential to decrease positive margins, reduce leak rates and shorten operating time, and is easier to teach[27–30]. In the only randomized trial[27] available to date, Rullier's group reported significantly higher positive CRM rates after laparoscopic resection (18 per cent *versus* 4 per cent after transanal TME; $P = 0{\cdot}025$). CRM positivity rates of 5·4 per cent[29], 4 per cent[30] and 0 per cent[23] have been reported in small, and possibly very selected, cohort studies of patients undergoing transanal TME. It is difficult to interpret data from these latter three reports as they are selective by comparison to the consecutive series reported here. The low positive margin rate in the present data does not support the contention that laparoscopic TME delivers a deficient outcome in terms of CRM. It must be concluded that more data are necessary from methodologically robust research[31] to interrogate the potential for transanal TME, before turning away from laparoscopic rectal resection. Transanal TME may well have a role in the difficult male pelvis or in obese men, and this needs to be clarified. In addition, trials of new methods of rectal resection, including robotics, should include the whole primary rectal cancer population treated in order to improve validity when making assertions regarding efficacy.

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