Early experience with laparoscopic extralevator abdominoperineal excision within an enhanced recovery setting: analysis of short-term outcomes and quality of life

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ABSTRACT

INTRODUCTION Conventional abdominoperineal excision for low rectal cancer has a higher local recurrence and reduced survival compared to anterior resection. An extralevator abdominoperineal excision (ELAPE) may improve outcome through removal of increased tissue in the distal rectum. Experience with ELAPE is limited and no studies have reported on quality of life (QOL) following this procedure. We describe a minimally invasive approach to ELAPE within an enhanced recovery programme, and present short-term results and QOL analyses.

METHODS All laparoscopic ELAPEs were included in a prospective database. Demographics, intra-operative and post-operative outcomes were evaluated. Postoperative QOL was assessed using the European Organisation for Research and Treatment of Cancer (EORTC) questionnaires QLQ-C30 and QLQ-CR29.

RESULTS Thirteen laparoscopic ELAPEs were performed over a two-year period. All were enrolled in an enhanced recovery programme. The median age was 76. The median tumour height was 20mm (range: 0–50mm) from the dentate line and all patients received neoadjuvant treatment. The median duration of surgery was 300 minutes (range: 120–488 minutes), the mean blood loss was 150ml and one procedure was converted to open surgery. There was no circumferential resection margin involvement or tumour perforation. The median duration of use of intravenous fluid, patient controlled analgesia and urinary catheterisation was 2, 2 and 2.5 days respectively and the median length of hospital stay was 7.5 days. Two patients developed perineal wound dehiscence. QOL analysis revealed high global health status (90.8), physical (91.3), emotional (98.3) and social functioning (100) scores, which compared favourably with EORTC reference values and published QOL scores following conventional abdominoperineal excision.

CONCLUSIONS Laparoscopic ELAPE within an enhanced recovery setting is a feasible and safe approach with acceptable short-term outcomes and post-operative quality of life.

KEYWORDS

Adenocarcinoma/pathology – Adenocarcinoma/surgery – Colorectal surgery/methods – Perineum/surgery – Rectal neoplasms/pathology – Rectal neoplasms/surgery

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Abdominoperineal excision (APE) for low rectal cancer is associated with considerably higher rates of circumferential resection margin (CRM) involvement, intra-operative tumour perforation (IOP) and local recurrence, and leads to poorer survival when compared to anterior resection (AR).^{1–4} This difference may be attributable in part to the anatomical tapering of the distal mesorectum with smaller tissue volumes surrounding lower tumours and a greater risk of IOP and CRM involvement, both of which are strong predictors of local recurrence and survival.

In response to these concerns, Holm *et al*⁵ among other groups^{4,6,7} proposed a change in approach to APE surgery towards that described more than a century ago by Miles,⁸ namely a radical removal of the perineal and pelvic structures, referred to as ‘the cylinder’.⁹ This extralevator abdominoperineal excision (ELAPE) or cylindrical APE aims to improve oncological outcome through removal of increased tissue in the distal rectum and *en bloc* excision of the levator ani. This creates a more cylindrical specimen without a waist and is associated in early reports with

Table 1 Summary of data for study sample

Demographic and pre-operative data

Age	76 (49–84)
Sex	
Male	6
Female	7
Median body mass index (range)	25.7kg/m ² (19.9–30.3kg/m ²)
Pre-operative staging	
T-stage	
T1	0
T2	0
T3	12
T4	1
N-stage	
N0	6
N1	4
N2	3
Neoadjuvant therapy	
Short-course radiotherapy	5
Long-course chemoradiotherapy	8
Median ASA grade (range)	2 (1–3)

Intra-operative data

Median operation duration (range)	300 minutes (120–488 minutes)
Mean blood loss	150ml
Perineal mesh	8
Omentoplasty	6
Conversion	1

Histopathological data

Median tumour height from dentate line (range)	20mm (0–50mm)
R0 resection	13
Median distance to CRM (range)	6.5mm (5–25mm)
Perforation	0
pT-stage	
T0	3
T1	2
T2	5
T3	3
T4	0
pN-stage	
N0	6
N1	3
N2	4
Median number of nodes harvested (range)	13 (6–22)

Table 1 Summary of data for study sample

Post-operative ERAS data

Median duration of intravenous fluid therapy	2 days (1–10 days)
Median duration of opiate patient controlled anaesthesia	2 days (1–4 days)
Median antiemetic use on post-operative days 1 and 2 (range)	0 (0–2)
Median time until first trial without a catheter	2.5 days (2–10 days)
Median time until stoma competent	6 days (3–9 days)
Median length of stay	7.5 days (4–32 days)

Morbidity data

Perineal wound complications	2
Urinary retention requiring long-term catheter	4
Disease progression at follow-up	0
Mortality at follow-up	0
Median follow-up duration	287 days (16–652 days)

ASA = American Society of Anesthesiologists; CRM = circumferential resection margin; ERAS = enhanced recovery after surgery

reduced CRM involvement, IOP and local recurrence when compared with conventional APE.^{5,7}

In theory, this more radical approach also has the potential to cause greater morbidity and reduced quality of life (QOL). However, to date no studies have considered these outcomes. A number of studies and meta-analyses have considered QOL following conventional APE,^{10–16} which may allow some comparison to QOL following ELAPE.

A further consideration is the approach to the abdominal component of APE. Laparoscopic colorectal resection is widely established and the benefits and safety of laparoscopic colorectal surgery have been reported extensively.^{17,18} Nevertheless, so far no studies with an exclusively laparoscopic approach to ELAPE have been described. Additionally, enhanced recovery after surgery (ERAS) programmes that optimise pre-, peri- and post-operative factors to minimise the stress of surgery are commonly practised but not reported in the context of ELAPE surgery.¹⁹ The present study presents our short-term outcomes and QOL analysis after laparoscopic ELAPE (lap-ELAPE) within the context of an ERAS programme.

Methods

All patients who underwent lap-ELAPE for low rectal cancer at our institution between March 2009 and March 2011 were identified from a prospectively populated database. All had been enrolled in a standard enhanced recovery programme based on the description by King *et al.*²⁰ Institutional review board approval was obtained prior to commencement of this study. Data collected included neoadjuvant therapy use, operation duration, ASA (American Society of Anesthesiologists) grade, tumour height, tumour histology, CRM involvement, IOP, relevant or major morbidity, mortality, return to theatre, ERAS-related outcomes, readmission and local or distant recurrence at follow-up.

As recommended by the Association of Coloproctology of Great Britain and Ireland guidelines for the management of colorectal cancer,²¹ the fifth edition of the American Joint Committee on Cancer TNM (tumour, lymph nodes, metastasis) classification system was used. Neoadjuvant therapy was administered as short course pre-operative radiotherapy defined as 25Gy in 5 consecutive daily fractions or long course chemoradiotherapy with 45Gy in 25 fractions with twice daily capecitabine (900mg/m²). The plane of surgery was graded as described by Nagtegaal *et al.*⁴ although the additional classification system around the levator complex was not applied until more recently. Tumour height was determined by pathological examination of the specimen and was defined as distance from the dentate line.

QOL was assessed post-operatively on a single occasion using the European Organisation for Research and Treatment of Cancer (EORTC) core questionnaire (QLQ-C30) and colorectal cancer module (QLQ-CR29).^{22–24} All scales were compared using Student's t-test with stage-matched and unmatched published EORTC reference values for patients with colorectal cancer produced by the EORTC with pooled results from clinical trials and epidemiological studies. QOL results were also compared to the QOL score following conventional APE in studies identified by Cornish *et al* in their meta-analysis.¹⁶

Operative technique

Lap-ELAPE was performed by a laparoscopic technique following the principles laid down by Holm *et al.*⁵ Patients were placed in the Lloyd-Davies position and a standard four-port technique was adopted. After a thorough evaluation, the omentoplasty was commenced by dividing the attachments of the greater omentum to the transverse colon in a right to left direction with care to preserve omental vasculature. When the lesser sac was entered, the right omental vessels were divided close to their origin at the

Table 2 Study sample European Organisation for Research and Treatment of Cancer (EORTC) QLQ-C30 scores and unmatched and matched comparisons with published EORTC QLQ-C30 reference values

Scale	Study sample scores	EORTC reference values	p-value
	<i>n</i> =13	<i>n</i> =1,773	
Global health status	90.8 (95% CI: 85.7–96.0)	60.7	<0.0001
Functional scales			
Physical functioning	91.3 (95% CI: 87.4–95.3)	79.2	0.07
Role functioning	96.7 (95% CI: 92.1–101.1)	70.4	0.01
Emotional functioning	98.3 (95% CI: 96.2–100.5)	68.9	0.0002
Cognitive functioning	92.5 (95% CI: 86.3–98.7)	85.2	0.26
Social functioning	100	76.0	0.01
Symptom scales			
Fatigue	9.44 (95% CI: 2.2–16.7)	34.7	0.01
Nausea and vomiting	0	7.3	0.18
Pain	0	24.0	0.01
Appetite loss	10 (95% CI: 0.0–20.0)	19.1	0.34
	Stages I and II	Stages I and II	
	<i>n</i> =4	<i>n</i> =230	
Global health status	91.6 (95% CI: 85.0–98.3)	59.8	0.02
Function scales			
Physical functioning	90.0 (95% CI: 81.6–98.4)	N/A	–
Role functioning	95.8 (95% CI: 97.7–104.0)	81.7	0.35
Emotional functioning	97.9 (95% CI: 93.8–102.0)	65.8	0.01
Cognitive functioning	91.7 (95% CI: 82.2–101.1)	84.3	0.51
Social functioning	100	81.4	0.17
Symptom scales			
Fatigue	8.3 (95% CI: -2.1–18.8)	27.7	0.18
Nausea and vomiting	0	6.4	0.46
Pain	0	17.5	0.21
Appetite loss	8.3 (95% CI: -8.0–24.7)	13.4	0.32
	Stages III and IV	Stages III and IV	
	<i>n</i> =6	<i>n</i> =281	
Global health status	90.3 (95% CI: 81.6–99.0)	60.7	0.001
Functional scales			
Physical functioning	92.2 (95% CI: 88.2–96.2)	N/A	–
Role functioning	97.2 (95% CI: 91.3–103.2)	80.0	0.14
Emotional functioning	98.6 (95% CI: 95.9–101.3)	67.1	0.003
Cognitive functioning	93.1 (95% CI: 84.2–101.9)	86.5	0.40
Social functioning	100	76.7	0.04
Symptom scales			
Fatigue	10.2 (95% CI: -0.5–20.9)	30.7	0.08
Nausea and vomiting	0	4.7	0.42
Pain	0	22.3	0.07
Appetite loss	11.1 (95% CI: -2.7–24.9)	14.3	0.77

CI = confidence interval

Figure 1 Operative view taken during the abdominal phase illustrating the posterior limit of the rectal dissection. The mesorectum has been retracted anteriorly using an A-Lap™ laparoscopic retractor (EZsurgical Ltd, Yoqneam, Israel) and the position of the coccyx (C) confirmed by digital rectal examination to palpate the coccyx from below while manipulating a laparoscopic bowel grasper on the coccyx from above.

right gastroepiploic artery, thereby creating an omental flap based on the left omental vessels. Once adequate length had been obtained for the omental flap to reach the pelvis, the left colonic dissection was commenced. A medial to lateral or lateral to medial dissection technique was used according to preference. The sigmoid colon was mobilised from retroperitoneal structures and the inferior mesenteric vessels were ligated. Where possible, the ascending left colic artery was preserved.

Pelvic dissection was then commenced and the rectum mobilised posteriorly to the upper border of the coccyx, which is the lower limit of the ELAPE procedure as described by Holm *et al.*⁵ The exact position of the coccyx was confirmed by digital rectal examination to palpate the coccyx from below while manipulating a laparoscopic bowel grasper on the coccyx from above (Fig 1). Where this was not possible, we performed a limited posterior perineal dissection while the patient was still supine to assist in identification of the lower limit of the laparoscopic posterior dissection. We dissected posterior to the coccyx and then used this to palpate the abdominal grasper while in this position. The perineal dissection could then be completed in the prone position as described below.

In either case, the lateral and anterior limits of the abdominal phase were then pursued with the aid of the posterior landmark, terminating the dissection below the autonomic nerves laterally and just inferior to the seminal vesicles in men or the cervix in women. The proximal colon was divided at a position to allow optimal formation of an end left-sided colostomy and the omental flap sutured to the specimen side of the colon to allow delivery of the

flap into the perineum during extraction. Haemostasis was confirmed and the colostomy fashioned in the pre-marked location on the anterior abdominal wall.

The patient was subsequently positioned in the prone jack-knife position and the perineal dissection conducted as previously described by Holm *et al.*⁵ Pelvic floor reconstruction was performed using a combination of biologic mesh and omentoplasty, and supplemented by retroverting the uterus in women. Biologic grafts used in the present study were cross-linked porcine dermis (Permacol®, Tissue Science Laboratories plc, Aldershot, UK) and porcine small intestinal submucosa (Surgisis®, Cook Surgical, Bloomington, IN, US).

Results

Thirteen consecutive lap-ELAPE cases were performed over a two-year period. Patient demographics, pre-operative, intra-operative and post-operative data are summarised in Table 1. The median age of patients was 76 (range: 49–84) and 7 patients were female. All cases were predicted TNM stage II/III pre-operatively, with T3 or T4 disease. All patients received neoadjuvant treatment, with five patients receiving short-course preoperative radiotherapy and eight patients receiving long-course chemoradiotherapy. The median operative duration was 300 minutes. Repair of the perineal defect was performed in four patients with biologic mesh alone, in one patient with omentoplasty only and in four patients with both. One procedure, in a patient with a body mass index of 30.3kg/m², required conversion owing to patient habitus and intolerance of a head-down position.

Pathologic assessment revealed a median tumour height of 20mm above the dentate line. All resections were R0, there were no perforations and the median CRM clearance was 6.5mm. Macroscopic evaluation revealed the plane of surgery for all specimens to be in the mesorectal plane with no significant breaches to the smooth mesorectal surface. Three patients had a complete pathological response. Post-operatively, the median duration of use of intravenous fluid therapy and patient controlled analgesia was 2 days and the urinary catheter was removed at a median of 2.5 days. Stoma competency was achieved at a median of 6 days post-operatively and the overall length of stay was a median of 7.5 days. There were no deaths.

One patient required a return to theatre for drainage of an infected collection and two patients developed perineal wound dehiscence. Of these two, one had received neoadjuvant short-course treatment and the other had long-course treatment. Neither patient had an omentoplasty or perineal mesh placement. One of them received vacuum-assisted therapy over a seven-week period. The other was readmitted, treated with simple dressings and discharged after ten days. At their follow-up appointment, both patients had fully healed wounds with no evidence of perineal herniation. Three of the six male patients in our series still required long-term catheterisation at the last follow-up visit.

The EORTC QLQ-C30 and QLQ-CR29 questionnaires were completed by all except three patients (owing to insufficient follow-up time) at a median of 194 days after surgery.

Table 3 Study sample QLQ-C30 scores and published QLQ-C30 scores from studies identified by Cornish *et al*¹⁶

Scale	Study sample scores	Allal, 2000 ¹⁰	Camilleri-Brennan, 2001 ¹¹	Gosselink, 2006 ¹²	Grumann, 2000 ¹³	Guren, 2005 ⁴²	Schmidt, 2005 ¹⁴	Sideris, 2005 ¹⁵
Time point taken after surgery	3–17 mths	>12 mths	Not specified	Not specified	6–9 mths	16–112 mths	6 mths	Median 4.9 yrs
Sample number	<i>n</i> =13	<i>n</i> =11	<i>n</i> =53	<i>n</i> =51	<i>n</i> =23	<i>n</i> =90	<i>n</i> =28	<i>n</i> =42
Global health status	90.8 (95% CI 85.7–96.0)	78	69.5	78	71.7	71.2	–	67
Functional scales								
Physical functioning	91.3 (95% CI 87.4–95.3)	87	70.6	82	89.0	–	66.1	87
Role functioning	96.7 (95% CI 92.1–101.1)	86	73.6	81	77.5	74.4	64.2	100
Emotional functioning	98.3 (95% CI 96.2–100.5)	84	83.2	87	77.9	–	66.8	83
Cognitive functioning	92.5 (95% CI 86.3–98.7)	88	85.5	90	94.2	–	80.0	83
Social functioning	100 55.8	85 67	78.0	73	82.5	75.3		
Symptom scales								
Fatigue	9.44 (95% CI 2.2–16.7)	24	26.7	14	–	–	40.6	22
Nausea and vomiting	0	2	4.7	3	–	–	12.5	0
Pain	0	10	20.8	9	–	16.1	25.8	0
Appetite loss	10 (95% CI 0.0–20.0)	6	5.0	4	–	–	26.7	0

The one patient who received adjuvant therapy answered the QOL questionnaire during this treatment course. The median global health status score was 90.8 (95% confidence interval: 85.7–96.0). Raw scores were transformed using a linear transformation as described by the EORTC scoring manual. For functional scales, a higher score represents a better level of functioning, while for symptom scales, a higher score represents a greater severity of symptoms.

Comparison to EORTC reference values revealed favourable global health status, function and symptom scores in our cohort (Table 2) while comparison to QOL results following conventional APE in studies identified by Cornish *et al*¹⁶ that used EORTC QLQ-C30 did not reveal QOL deterioration in any field (Table 3). Statistical comparison with such trials was not possible without raw scores or standard deviation yet it has previously been suggested that a difference of >10 points indicates clinical significance.²⁵

None of the patients in this series had any significant chronic perineal pain although three patients reported having ‘a little’ pain in the perineum on the QLQ-CR29 questionnaire. Pooled scores from the EORTC QLQ-CR29 ques-

tionnaire revealed high symptom scoring for impotence in males while both men and women had moderate urinary frequency (Table 4). At a median follow up of 186 days, no local or distant recurrences were identified.

Discussion

The development of total mesorectal excision (TME) has served as a paradigm for improving local recurrence and survival in upper and middle rectal cancer. However, APE is still required for 30% of rectal cancers and remains associated with higher rates of local recurrence and lower survival when compared to AR.²⁶ This has led to the development of the more radical ELAPE and early results suggest improved oncological outcomes.^{5,7,27} To date, ELAPE with a laparoscopic abdominal component in all cases has not been described and the role of an ERAS programme after this technique or short-term outcomes and QOL results remain unclear.

In the present study, we describe our early experience with lap-ELAPE. Minimally invasive TME surgery has con-

Table 4 Study sample QLQ-CR29 scores

Functional scale	Study sample scores
Body image	85.6 (95% CI: 71.4–99.7)
Anxiety	76.7 (95% CI: 57.1–96.3)
Weight	93.3 (95% CI: 80.3–106.4)
Symptom scale	
Urinary frequency	37.5 (95% CI: 20.3–54.7)
Urinary incontinence	12.5 (95% CI: 1.8–23.2)
Impotence (male)	75.0 (95% CI: 26.0–124.0)
Buttock pain	10.0 (95% CI: 0.0–20.0)

CI = confidence interval

tinued to evolve in recent times, with fully laparoscopic, hand-assisted or robotic series.^{28–50} This has prompted a change in outlook to laparoscopic surgery in the deep pelvis. Outcomes following an exclusively laparoscopic approach to ELAPE have not yet been described. West *et al* recently presented a multicentre experience of ELAPE and identified a small percentage of laparoscopic cases.²⁷ They noted no difference in IOP between an open or laparoscopic approach. Nevertheless, the technique used was not described and no other results from a laparoscopic approach were presented. In addition, no data on the use of ERAS or assessment of QOL have been put forward to date.

The lack of published reports may, in part, reflect the inherent difficulties of identifying the necessary landmarks in the deep pelvis that dictate when one should stop the abdominal phase of ELAPE. Excessive dissection in the TME ‘holy plane’ during the abdominal approach would separate the levator muscle from the rectum and risk exposing T3/T4 low rectal tumours, thereby resulting in a positive CRM. At our unit, we use a combination of methods to identify the posterior attachments of the levator ani onto the coccyx at laparoscopy. We subsequently use this as the landmark to define the limits of the anterolateral dissections. Using these approaches, we found that the plane of surgery for all specimens was in the mesorectal plane with no significant breaches to the smooth mesorectal surface.

An additional three-stage classification system has been proposed by Nagtegaal *et al* for the grading of APE specimens at the level of the levators.⁴ We recently adopted this system into our routine pathological reporting and found that all lap-ELAPE specimens ($n=5$) examined in this method were classified as extralevator with a CRM lying outside the levator complex (Fig 2).

Patient selection is an important consideration in ELAPE surgery and few reports have described the means by which surgical teams have selected patients for this technique. Similar to the original description of ELAPE, our preference is to select patients with magnetic resonance predicted T3/T4 disease, while conventional APE or an ultra-low anterior resection are favoured for earlier stage disease. Our early findings indicate that lap-ELAPE in these advanced cases

Figure 2 Representative image of Lap-ELAPE specimen showing the cylindrical nature of the specimen. A silk stitch has been used to mark the coccyx for orientation and the right levator muscle is shown by the letter A.

gives low rates of CRM involvement and IOP. The duration of operation for lap-ELAPE in our series is high and reflects the challenges of adopting a new technique.

A further question in ELAPE surgery is which method of perineal reconstruction to use. In our study, two patients suffered wound dehiscence and no perineal hernias were reported at the last follow-up appointment. Myocutaneous flaps are one possible solution for reduction of perineal wound related complications, yet they add significantly to the duration of the procedure and all carry the risk of longer bed rest, flap-related complications and donor site morbidity.^{5,51} Our study adds to the work of other groups on biologic grafts for repair of large perineal wounds^{52,53} and indicates that good outcomes can be obtained without the addition of a flap procedure.

One important observation in this study was the high rate of urinary retention in male cases and patient-reported impotence. Three of the six male patients required a long-

term catheter, while the average impotence scores from QLQ-CR29 was 75/100. West *et al* reported genitourinary dysfunction of 30% after ELAPE with 46% of these cases suffering urinary dysfunction.²⁷ Fowler *et al* reported bladder dysfunction of up to 30% following conventional APE.³⁴ A number of other studies also reported a high incidence of sexual dysfunction following both laparoscopic and open APE.^{35,36} Formal assessment of genitourinary function pre- and post-operatively is required to investigate further the effect of lap-ELAPE in this domain.

The present study is the first to report the use of ERAS following ELAPE surgery. ERAS programmes improve health outcomes, optimise the use of limited healthcare resources, and are an efficient intervention in high volume, major surgical procedures with prolonged hospital stays.³⁷ Our data show that an accelerated recovery can be achieved after lap-ELAPE, with short durations for intravenous fluid therapy, opiate and anti-emetic use, and time to removal of the urinary catheter.

These durations are consistent with published data relating to enhanced recovery outcomes following colorectal resection. Gatt *et al* reported the duration of intravenous fluid use to be approximately 33 hours and the duration of urinary catheterisation to be 48 hours³⁸ while King *et al* reported a median of 3 anti-emetic injections per patient.²⁰ The median length of stay in our series was longer than conventional enhanced recovery interventions, principally owing to the lengthy time to stoma proficiency. In a randomised study of intensive pre-operative community-based stoma education against conventional post-operative training, Chaudhri *et al* demonstrated significantly shorter length of stays in the intervention arm.³⁹ Similar to our results, they noted a median length of stay of 10 days in the control arm. Improved pre-operative stoma training may help further reduce the length of stay of our patients.

QOL is increasingly recognised as an important outcome measure, particularly when comparing a novel treatment to an established technique. While it has previously been thought that the presence of a stoma must lead to a reduced QOL after APE when compared to AR, recent studies and a Cochrane review have suggested that poor functional results after sphincter preserving surgery also compromise QOL.^{11,40,41} We demonstrate acceptable QOL scores following lap-ELAPE using the extensively-used EORTC QOL instruments. The average global health status score noted in the present analysis was 90.8, which was significantly higher than the published EORTC reference values and higher than five studies investigating QOL following conventional APE identified in a meta-analysis by Cornish *et al*¹⁶ (Table 3).

The conclusions that can be drawn from such comparisons are limited, however. It is acknowledged that both the EORTC reference values and those taken from the work of Cornish *et al* are not matched to our cohort for neoadjuvant or adjuvant therapy use, tumour stage or questionnaire timing. Despite these limitations, the absence of any reduction in QOL following lap-ELAPE using either approach suggests that this more radical procedure is not associated with a significant reduction in QOL. Prospective and comparative

assessment of QOL following lap-ELAPE, laparoscopic APE and open APE would be required to confirm this.

Conclusions

Despite the small sample size and non-comparative nature of the present study, this paper nevertheless adds to the evolving body of information on ELAPE and illustrates the feasibility of a minimally invasive approach to the abdominal phase of this procedure. Our results also encourage adoption of an ERAS programme in ELAPE and support the notion that post-operative QOL in these radically treated patients is acceptable. Future studies with longer follow-up periods and comparative analyses with conventional APE are necessary to allow the role of laparoscopic and open ELAPE to be defined more precisely in low rectal cancer and to help refine patient selection for neoadjuvant treatments and surgery as well as selection of the optimal method of perineal reconstruction.

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