



Abdominoperineal excision or extralevator abdominoperineal excision: which is the best oncological treatment?

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Abstract: Surgery of tumors of the lower third of the rectum is particularly difficult due to the complex anatomy of the pelvis, which can lead to an incomplete radical resection. Abdominoperineal excision (APE) is the operation of choice for tumors of the low rectum that infiltrate levatorani or sphincter muscles. Regardless, APE causes an important morbidity, a higher incidence of circumferential resection margin (CRM) infiltration, iatrogenic tumor perforation incidence and worsens the mesorectum quality due to the conicity induced during surgery while dissection between both distal mesorectum and levatorani planes is performed. An extralevator abdominoperineal excision (ELAPE), which involves a broader resection of the pelvic floor muscles, would theoretically reduce the risk of CRM infiltration and tumor perforation rate, independently from the position (prone *vs.* supine) or the approach (open *vs.* laparoscopic). This review is focused on the analysis of the scientific evidence published so far comparing both techniques, APE or ELAPE. In spite of some publications observe a possible benefit in terms of reduction in CRM involvement, iatrogenic perforations or local recurrence, there is not enough evidence to affirm the superiority of ELAPE compared to conventional APE in terms of oncological results. In general, similar rates of postoperative complications are described for both techniques. Further prospective, controlled and randomized studies are needed to conclude which of the two techniques is the best oncological treatment.

Keywords: Rectal cancer; extralevator abdominoperineal excision (ELAPE); conventional abdominoperineal excision (conventional APE)

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Introduction

In tumors of the lower third of the rectum, surgical technique is particularly difficult due to the complex anatomy of the pelvis where the mesorectum tapers at the origin of the levators and can lead to an incomplete radical resection (1). There is a maximum area of surgical narrowing at 3–4 cm above the anal verge where the perineal and abdominal phases of the abdominoperineal excision (APE) usually meet. APE can increase rates of

circumferential resection margin infiltration and iatrogenic tumor perforation. When compared with low anterior resection of the rectum, APE has been related with a worse quality of the mesorectum probably due to the conicity induced during surgery while dissection between both distal mesorectum and levatorani planes is performed (2–4). APE is performed in 25–30% of patients with rectal cancer, with a significant morbidity that reaches 40% (5).

In 2007, Holm described a new technique for patients with low rectal cancer when abdominal perineal excision

was indicated. This modified approach consisted of a broader resection of the pelvic floor muscles, called extralevator abdominoperineal excision (ELAPE) (6). In theory, a specimen cylindrically shaped obtained with an ELAPE would reduce the risk of infiltration of the circumferential resection margin (CRM) and tumor perforation incidence improving oncological results, including local recurrence (2,7).

The present review focuses on the analysis of the published scientific evidence on which of the two techniques, APE or ELAPE, is the best oncological treatment. Overall survival and progression-free survival, local recurrence and quality of mesorectal excision have been analyzed, as well as postoperative complications and quality of life. Other aspects considered were the position of the patient for the operation and open *vs.* laparoscopic approach.

PubMed database were searched for publications comparing APE *vs.* ELAPE for rectal cancer of the last 5 years (between 2012 and 2018). In addition, relevant articles involved in the description of both techniques have been also included.

Indications and surgical technique

A proper definition of rectal cancer is important to plan the best oncological treatment, including neoadjuvant therapy and surgical strategy. “Low” rectal cancer is currently defined as an MRI-based anatomical definition of an adenocarcinoma with its lower edge, at or below the origin of the levators at the pelvic side-wall, which is commonly located within 6 cm of the anal verge (8). The origin of the definition has been adopted from the Low Rectal Cancer Development Program (LOREC) and accepted by the most recent Guidelines (2,8,9).

In order to achieve a total mesorectal excision (TME), the operative strategy should be tailored to individual patients (10). For low rectal cancer lying above the level of the anal sphincter more than one millimeter of the levator muscle or mesorectal fascia, a TME and coloanal anastomosis may be feasible. In the presence of contraindications, an APE (conventional or intersphincteric) should be performed (8). Likewise, if the tumour is lying at the level of the sphincter involving the submucosa only or the inner layer of the muscularis propria, the mesorectal plane can be dissected, continuing inferiorly into the intersphincteric plane as an APE (conventional or intersphincteric). On the other hand, a low rectal cancer situated over the anal sphincter, which is less than one millimeter from the levator muscle or mesorectal fascia or invading the levator, or lying at

the level of the sphincter involving the entire broadness of the muscularis propria or extending into or beyond the intersphincteric plane to involve the external sphincter, an APE should be performed (8,11).

APE technique comprises a dissection on TME plane to the prostate in men or below the cervix in women and the resection of the anus and distal rectum performing a perineal procedure (2). The circular external sphincter is closed primarily with suture, with resulting superior healing rates in most patients, even in those who have had preoperative therapy (8). ELAPE is initially performed via an abdominal approach. Limits of the TME are under the vesicles in men and cervix in women anteriorly, the uppermost part of the coccyx posteriorly, and under the autonomic nerves laterally. Thereafter, for the perineal phase the patient might remain in supine position or turned to a prone position. Depending on the tumor infiltration, the perianal incision can be made at the lateral margin of the external anal sphincter or wider and continue the dissection in the ischioanal fossa to the insertion of the pelvic floor muscles. The disarticulation of the coccyx might be necessary for a total excision. As a result of a wider excision, it results in a larger perineal defect and reconstructions of this defect haven been proposed such as surgical flap (biological graft, rectus abdominis or gluteus maximus myocutaneous flap) or biological mesh (2,8). A tailored ELAPE approach consisting of unilateral or bilateral excision based on clinical examination and MRI imaging has been proposed in order to reduce morbidity (8).

ELAPE technique can be performed both prone and supine position. It is discussed which one is best for optimal dissection during the perineal phase. Comparing prone ELAPE to supine ELAPE, the prone position provides greatly pelvic exposure allowing a top-down dissection under excellent visualization of the plane between the rectum and the prostate or vagina, and direct vision which is more comfortable for the operating surgeons and so facilitates training, but requires turning the patient during the operation (12). Nevertheless, there is no evidence of better oncologic results or less morbidity and mortality in prone position (3). For this reason, it may also be adequate to complete the surgery in the supine Lloyd-Davis position (8). A recent survey to the membership of the Association of Coloproctology of Great Britain and Ireland (ACPGBI) showed that most of the surgeons (67%) perform perineal phase in the supine position (13).

If we compare laparoscopic *vs.* open approach for the abdominal phase of ELAPE, laparoscopy seems to

be the best surgical approach, although it has not been demonstrated by large prospective studies so far (3,14,15).

Postoperative complications

Different studies have described and compared the postoperative complications of APE and ELAPE. It is also believed that ELAPE might cause higher morbidity rates due to the final larger perineal defect (12). The most recent meta-analysis published in 2017 by Chen *et al.* (16) included high quality clinical studies (11 observational studies and one randomized controlled trial) comparing the APE and ELAPE between 2007 and 2016 and analyzed intraoperative perforation rate, CRM involvement, local recurrence rate and perineal wound complications. Regarding perineal wound complications, there were no significant differences between both groups [risk ratio (RR) =0.94, P=0.8].

A different meta-analysis published in 2016 by Negroi *et al.* included one randomized controlled trial and 10 nonrandomized studies that compared ELAPE with conventional APE (7). As for the postoperative complications, the results showed less blood loss in ELAPE patients. A propensity case-matched analysis performed by Ortiz *et al.* (2) comparing APE and ELAPE postoperative overall morbidity incidence (including surgical-site infection, perineal wound problems, urinary infections, respiratory and heart complications) did not find differences between both techniques in term of postoperative complication rates (52.3% *vs.* 48.1%; P=0.209), need for reoperation (7.7% *vs.* 7.0%; P=0.703), perineal wound problems (26.0% *vs.* 21.9%; P=0.141) and postoperative mortality rate (2.0% *vs.* 2.0%; P=1.000). Similarly, Han *et al.*, in a randomized clinical trial, did not find differences between APE and ELAPE approaches in terms of sexual dysfunction, urinary retention, peristomal hernia, and perineal wound complications (17). Another prospective controlled study published in 2015 by Shen *et al.* comparing the safety and oncological outcomes of conventional APE *vs.* ELAPE, showed lower rates of blood loss (P=0.021) and perineal wound complication (P=0.039) in ELAPE (18). In relation to urinary function, sexual function and quality of life there were no statistical difference between both groups in this last study.

Wang *et al.* (19) have reported high rate of sexual dysfunction, perineal complications and urinary retention among patients that underwent ELAPE for primary locally advanced low rectal cancer (40.5%, 23.5% and 18.6% respectively). In addition, 13.7% of the included patients presented chronic perineal pain. Reconstruction of

pelvic floor with biologic mesh was associated with lower rate of perineal dehiscence and overall perineal wound complications compared with primary closure.

In summary, according to the current evidence, relevant differences have been not observed between APE and ELAPE in terms of postoperative complications including perineal wound complications, surgical-site infection, urinary infections, respiratory and heart complications, need for reoperation and postoperative mortality rate. It seems to be less blood loss in ELAPE patients (7,20).

Quality of mesorectum

According to the latest recommendations and in order to describe if it is involved by the tumor, after an APE, it is mandatory for the pathologist to analyse the margin of the circumferential resection of the not peritonealized rectum (8). It can be scored in three grades: mesorectal (complete), intramesorectal (nearly complete) and muscular (incomplete). The mesorectal plane implies no affection of the fascial covering, with no cones in the distal margin and no defects more than 5 mm deep. Intramesorectal grade admits a moderate degree of coning towards the distal margin, but no visible muscle except in the area of insertion of the levator muscles. In the muscularis propria grade, it might be substantial areas where the mesorectal tissue is missing with deep cuts and tear the muscularis propria (8).

Likewise, an excision plane of the sphincter is recorded after APE in three grades: extractor, sphincter and intrasphincteric-submucosa-perforation. In the extractor grade the surgical plane is located outside the levatorani muscles, which are removed in bloc with the mesorectum and the anal canal, creating a more cylindrical sample. In the sphincter grade either there is no levator muscles attached to the sample or just a very small cuff with the CRM formed by the surface of the sphincter muscles. Moreover, the specimen shows conicity at the puborectal muscle level that results in the classic surgical waist. Other dissections entering the sphincter muscle or into the submucosa or perforations should be classified separately (8).

The number of lymph nodes recovered should be a median of at least 12 per specimen. The involvement of CRM ≤ 1 mm is associated with a bad prognosis and should be recorded routinely (8).

Oncological results

ELAPE technique involves a wider tissue removal and,

Table 1 Oncological results and complications ELAPE vs. APE

Author	Year	Study type	Surgery (ELAPE/APE)	Intraoperative perforation rate	CRM infiltration	Local recurrence	Overall complications
Chen <i>et al.</i> (16)	2017	Meta-analysis	2,141/1,647	0.52 (0.34–0.79); 0.002*	0.72 (0.49–1.07); 0.10*	0.55 (0.24–1.29); 0.17*	0.94 (0.58–1.53); 0.8* [‡]
Wang <i>et al.</i> (21)	2017	Meta-analysis	1,802/1,376	0.54 (0.31–0.93); 0.03*	0.55 (0.28–1.06); 0.07*	0.30 (0.21–0.42); <0.00001*	–
Negoi <i>et al.</i> (7)	2016	Meta-analysis	1,736/1,320	0.39 (0.22–0.68); <0.01 [#]	0.58 (0.31–1.09); 0.09 [#]	0.43 (0.13–1.42); 0.17 [#]	1.01 (0.85–1.21); 0.89 [‡]
Zhou <i>et al.</i> (20)	2015	Meta-analysis	1,531/1,141	0.79 (0.40–1.57); 0.5*	0.61 (0.37–1.00); 0.05*	–	0.91 (0.71–1.16); 0.44*
Shen <i>et al.</i> (18)	2015	Observational	36/33	5.6 vs. 21.2; 0.028 [†]	4 vs. 12; 0.297 [†]	0 vs. 15.1; 0.034 [†]	33.3 vs. 33.3; 1.00 [†]
Ortiz <i>et al.</i> (4)	2014	Observational	457/457	7.7 vs. 7.9; 0.902 [†]	13.6 vs. 13.1; 0.846 [†]	5.6 vs. 2.7; 0.664 [†]	48.1 vs. 52.3; 0.209 [†]
Prytz <i>et al.</i> (22)	2016	Observational	518/209	8 vs. 11; 0.19 [†]	6 vs. 10; 0.12 [†]	4.91 (1.53–15.74); 0.007*	45.9 vs. 41.6; 0.32 [†]
Klein <i>et al.</i> (23)	2015	Observational	301/253	2 vs. 3; 0.28 [†]	2.59 (1.31–5.12); 0.006*	–	11 vs. 10; 0.51 [†]
Han <i>et al.</i> (17)	2012	RCT	35/32	5.7 vs. 15.6; 0.246 [†]	5.7 vs. 28.1; 0.013 [†]	2.8 vs. 18.8; 0.048 [†]	51 vs. 59; 0.515 [†]
West <i>et al.</i> (12)	2010	Observational	176/124	4.21 (1.69, 10.50); <0.001 [#]	4.66 (1.89–11.47); <0.001 [#]	–	38 vs. 20; 0.019 [‡]

*, RR, 95% CI, P values; [#], OR, 95% CI, P values; [†], percentage, P values; [‡], only perineal wound complications. ELAPE, extralevator abdominoperineal excision; APE, abdominoperineal excision; RCT, randomized controlled trial; CRM, circumferential resection margin. Risk Ratio Odds Ratio

as some studies have showed, also a reduction in CRM involvement or intraoperative perforation (12). Chen *et al.* describe lower intraoperative perforation rate of ELAPE than APE (RR =0.52, P=0.002), without significant differences of CRM involvement (RR =0.72, P=0.10) and local recurrence rate [(odds ratio (OR) =0.55, P=0.17)] (16). Negoi *et al.* describe similar results concluding that ELAPE significantly lessens the intraoperative perforation incidence, with no benefits in regard to CRM infiltration and local recurrence rate (7). The Spanish study did not find either differences between APE and ELAPE in terms of CRM involvement (13.1% vs. 13.6%; P=0.846), intraoperative tumor perforation (7.9% vs. 7.7%; P=0.902) and local recurrence rate at 2 years (2.7% vs. 5.6%; P=0.664) (2). Similarly, Zhou *et al.* published a meta-analysis in 2015 and did not find differences in those criteria either (20).

Nevertheless, other authors showed lower intraoperative perforation rate and local recurrence in ELAPE compared to conventional APE, with greater CRM involvement in the

conventional APE group without statistical significance (18). Moreover, overall survival and progression-free survival were similar between groups, even after that survival was analyzed according to TNM stage, T stage, N stage, and with or without neoadjuvant chemoradiotherapy.

Other authors found that ELAPE for low rectal cancer, performed in the prone position, is associated with a reduction in CRM infiltration, intraoperative perforations, and local recurrence (19). Similarly, Han *et al.* showed improvement in terms of local recurrence with a median follow-up time of 29 months in the ELAPE group and 22 months in the APE group (17). However, no significant differences in overall survival and disease-free survival were observed.

According to our findings and even though there are some publications recording a possible benefit in terms of reduction in CRM infiltration, iatrogenic perforations or local recurrence (Table 1), there is not enough evidence to affirm that the ELAPE leads to better oncological results

when compared to conventional APE (21-24).

Conclusions

Several studies comparing APE and ELAPE approaches in patients with distal rectal cancer have been published. Nevertheless, when high-level quality studies are considered, differences between both techniques in terms of oncological results and postoperative complications are not evident. Further prospective, controlled and randomized studies are needed to conclude which of the two techniques is the most appropriate oncological treatment.

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