

Extra-levator abdomino-perineal excision in advanced low rectal cancer surgery

The anatomy of the lower rectum can pose anatomical and technical challenges that can make excision of cancers in this region difficult. It is proposed that extra-levator abdomino-perineal excision optimizes the surgical treatment of advanced low rectal cancer.

Precise definitions of the rectum vary but it is now generally accepted that the rectum extends to 15 cm from the anal verge and that the height of a rectal cancer is measured by a rigid scope in an awake patient lying in the left lateral position (Salerno et al, 2006b). The 15 cm rectum is then arbitrarily divided into the lower rectum (0–6 cm), the mid rectum (7–11 cm) and the upper rectum (12–15 cm), with recognition that the lower the tumour the more complex the problem because of the difficulty in reconstruction and the proximity of lower rectal tumours to the anal sphincter mechanism.

More recently a more objective mechanism for categorizing the lower rectum has been described using a magnetic resonance imaging-based anatomical definition where the mesorectum tapers at the origin of the levators, at the pelvic sidewall (Shihab et al, 2009). Thus a low rectal cancer is a tumour with its lower edge at or below the origins of the levator on the pelvic sidewall. This usually corresponds to a measurement of within 6 cm from the anal verge.

The anatomy of the lower rectum is complex. The rectum, levators and anal canal have been described as a 'tube within a funnel'; the funnel being the levators, the stem of the funnel being the sphincter complex and the tube within, the rectum (Shihab et al, 2009). The mesorectum, the embryological lymphovascular package surrounding the rectum (Heald et al, 1998), tapers in its lower part resulting in a 'waist' (described below) around this level (Salerno et al, 2008). This potentially predisposes a tumour in the region of the waist (3–4 cm from the anal verge) to be exposed during excision, leading to suboptimal surgery (Salerno et al, 2006a) with increased rates of local recurrence and poor survival (Wibe et al, 2004; Nagtegaal et al, 2005).

Surgical treatment of low rectal cancer

Major surgical resection for low rectal cancer can be broadly divided into sphincter-saving procedures and abdomino-perineal excision where the sphincter is excised with the specimen. In the early 1980s Heald and colleagues introduced the concept of the mesorectal fascia as the correct plane of dissection for rectal cancer and proposed that the practice of blunt dissection with the surgeon's fingers to separate the rectum from surrounding structures be replaced with precise sharp dissection under direct visualization along this 'holy plane' (Heald, 1988). Systematic educa-

tional programmes for surgeons around the world in this technique of total mesorectal excision have improved oncological outcomes (Wibe et al, 2003; Martling et al, 2005). It is now widely accepted that a positive circumferential margin or even disruption of the fascial encasement of the rectum and its mesentery (mesorectal fascia) is associated with worse prognosis, both in terms of local recurrence and disease-free survival (Birbeck et al, 2002).

For tumours in the upper rectum (12–15 cm from the anal verge), a portion of the rectum can be left in place as long as the circumferential dissection is complete and the distal transection is 4–5 cm distal to the lower edge of the tumour. 'Coning in' on the mesorectum should be avoided as it increases the risk of pelvic recurrence (Kosinski et al, 2012).

For tumours in the mid to low rectum, total mesorectal excision should be taken to the level of the pelvic floor. For a low rectal cancer a distal resection margin of at least 1–2 cm may be all that is obtainable. Williams et al (1983) reported a very low rate of intramural spread beyond 1 cm and this led to a decrease in the acceptable distal margin to 2 cm. More recently Leo et al (2009) found no significant difference for survival, local recurrence and distant metastasis between a negative <1 cm or >1 cm distal resection margin. Penninckx (2012), in his editorial, concluded that 'reduction of the distal margin does not increase local recurrence or compromise survival provided a good quality total mesorectal excision, wash-out before stapling or during hand-sewn colo-anal anastomosis, and negative margins are all achieved'.

For advanced tumours in the low rectum, and particularly in the lowest 2–3 cm of the rectum, the adjacent structures are the sphincters and the levator ani muscles. For fixed tumours at the level of the levator ani muscles or the anal sphincter, a non-sphincter preserving operation is required. It has been documented that cancers of the lower rectum that are treated by conventional abdomino-perineal excision are associated with poor oncological

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outcomes in many cases (Shihab et al, 2010). Abdomino-perineal excision specimens audited by pathologists revealed high rates of circumferential resection margin involvement, specimen perforation and suboptimal total mesorectal excision quality (Nagtegaal et al, 2005). The reason attributed to this was that surgeons had no well-defined or distinct anatomical plane during the perineal dissection phase of the operation, resulting in exposure of the muscle tube and tumour perforation below the level of the total mesorectal excision dissection (Shihab et al, 2009). This led to a re-focus on how surgical outcomes could be optimized.

Holm et al (2007) proposed a technique to overcome some of these difficulties, describing a ‘cylindrical’ abdomino-perineal excision approach which involved wide excision of the levator complex thereby potentially reducing the inadvertent bowel perforation rate and positive circumferential margin involvement. The technique involved turning patients into the prone jack-knife position to facilitate the perineal dissection. The concept of wide excision of the levators was interestingly outlined nearly

100 years ago by Miles (Hoch and Smrcka, 2009) but presumably had been ‘lost in translation’ through the years for many surgeons. For those surgeons who had always practiced the Miles operation (Mathis et al, 2012), this re-introduction by Holm and colleagues was not something new, but for others this technique came as an important addition (Finan and Haboubi, 2012). Holm, like Heald beforehand (Heald et al, 1982; Heald, 1988), had realized the importance of surgical technique and should be credited for standardizing this operation (West et al, 2008).

There has been much debate with regard to patient position during the procedure and the need to remove the coccyx. Holm suggested turning the patient prone, after completion of the abdominal part of the operation and formation of an end colostomy, to facilitate what is technically a difficult procedure, particularly in a man with an advanced tumour. He also advocated removal of the coccyx for better access. Some authors have reported similar results in the modified Lloyd-Davies position (Mathis et al, 2012). It was soon realized that positioning of the patient during the perineal phase, whether prone or supine, was less important as long as there was no compromise in tumour removal (Moore and Moran, 2012). Miles (1908) in fact described completion of the perineal procedure in the right lateral position and indeed advocated removal of the coccyx for access. Moore and Moran (2012) have proposed that the concept of ‘extra-levator’ dissection (see below) is the key and can be done either supine as described by Mathis et al (2012), prone as per Holm et al (2007) or indeed in the right lateral position as outlined in wonderful detail and concise precision by Miles (1908).

The terminology of the abdomino-perineal approach has created some confusion. Miles described this as abdomino-perineal excision in 1908, but over the years different terminologies (e.g. abdomino-perineal resection) have emerged to describe the same operation. Also what came to be described as the standard abdomino-perineal excision did not necessarily follow the Miles principles of wide excision during surgery. Moore and Moran (2012) have proposed an anatomically-based terminology of extra-levator abdomino-perineal excision (ELAPE), which brings together the work of Miles and Holm and many others who achieve excellent oncological results with this operation.

Extra-levator abdomino-perineal excision for advanced low rectal cancer

Shihab et al (2012) described in detail the different steps of ELAPE. The principle of ELAPE is based on avoiding dissecting the mesorectum off the levators in the abdominal phase of the operation. This leaves the levators adjacent to the lower mesorectum and in the perineal phase the levators are divided laterally at their point of insertion to the pelvic bony-ligamentous ring. This reduces the risks of breaching the tumour and prevents ‘waisting’ of the specimen (Figures 1 and 2).

Figure 1. Synchronous combined abdomino-perineal resection. a. Dissections from above and below meet above the anal canal. b. This creates a waist in the specimen.

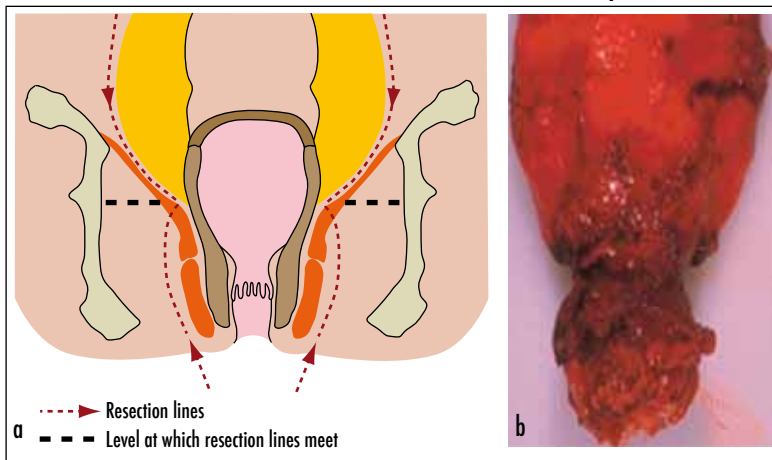
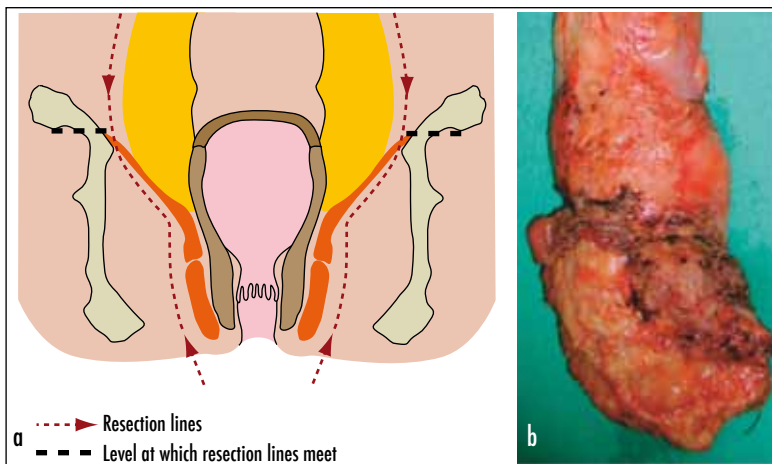


Figure 2. Extra-levator abdomino-perineal excision. a. Dissections from above and below meet at the top of the extralevator muscle. b. This leaves the levator attached to the mesorectum leaving a cylindrical specimen.



The advantages of the prone position for the perineal dissection are reported as the prone position allows direct visualization of the anterior plane between the lowest parts of the rectum and the vagina in the female or prostate in the male and facilitates visualization of the neurovascular bundle of Walsh (2005) running along the posterolateral aspect of the prostate in males where vision and access are compromised by the urogenital organs. Safeguarding these neurovascular bundles is crucial to reduce the incidence of sexual and bladder dysfunction (Enker et al, 1997; Maurer et al, 2001; Junginger et al, 2003).

Perineal wound healing is an important aspect in all patients who have had an abdomino-perineal excision and may be more problematic in ELAPE where a more extensive levator resection is often performed. West et al (2010) reported a multicentre study which suggested that ELAPE was associated with a significantly higher rate of perineal wound breakdown and herniation than 'conventional' abdomino-perineal excision despite comparable use of radiotherapy. From an anatomical point of view removal of the sphincter and any part of the levator will result in a muscle defect which is usually difficult to approximate without tension, resulting in an immediate or very early pelvic floor dehiscence (Moore and Moran, 2012). A biological mesh interposition or tissue flap procedure (gluteus maximus, gracilis and vertical rectus abdominus) are the alternatives available to reconstruct the perineal floor. However, the use of flaps is generally dependant on the availability of a plastic surgeon, which has logistic implications for many hospitals where rectal cancer surgery is performed without in-house plastic surgical services and may require considerable pre-planning (Shihab et al, 2012). Further work is required before a consensus is reached with regards to an optimal way of closing the pelvic floor defect and whether a biological mesh might be equivalent to a flap technique (Bell et al, 2005; Wille-Jorgensen et al, 2009).

Conclusions

ELAPE facilitates an oncologically superior operation for selected patients with advanced low rectal cancer by improved vision and access and enabling a wider cuff of tissue. However, ELAPE may be associated with an increased wound morbidity as a consequence of a bigger wound in an area where wound healing is not optimal, particularly if neoadjuvant therapy has been used.

Figures 1 and 2 are reproduced from Holm et al (2007) by kind permission of John Wiley & Sons Ltd.

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Bell SW, Dehni N, Chaouat M et al (2005) Primary rectus abdominis myocutaneous flap for repair of perineal and vaginal defects after extended abdominoperineal resection. *Br J Surg* **92**: 482–6

Birbeck KF, Macklin CP, Tiffin NJ et al (2002) Rates of circumferential resection margin involvement vary between surgeons and predict outcomes in rectal cancer surgery. *Ann Surg* **235**: 449–57

- Enker WE, Havenga K, Polyak T, Thaler H, Cranor M (1997) Abdominoperineal resection via total mesorectal excision and autonomic nerve preservation for low rectal cancer. *World J Surg* **21**: 715–20
- Finan P, Haboubi N (2012) The Miles operation—extralevator abdominoperineal excision. *Colorectal Dis* **14**: 1171–2
- Heald RJ, Husband EM, Ryall RD (1982) The mesorectum in rectal cancer surgery—the clue to pelvic recurrence? *Br J Surg* **69**: 613–16
- Heald RJ, Moran BJ, Ryall RD, Sexton R, MacFarlane JK (1998) Rectal cancer: the Basingstoke experience of total mesorectal excision, 1978–1997. *Arch Surg* **133**: 894–9
- Heald RJ (1988) The 'Holy Plane' of rectal surgery. *J R Soc Med* **81**: 503–8
- Hoch J, Smrcka Z (2009) [100 years of Miles' surgery—W. Ernest Miles 1869–1947]. *Rozhl Chir* **88**: 288–91
- Holm T, Ljung A, Haggmark T, Jurell G, Lagergren J (2007) Extended abdominoperineal resection with gluteus maximus flap reconstruction of the pelvic floor for rectal cancer. *Br J Surg* **94**: 232–8
- Junginger T, Kneist W, Heintz A (2003) Influence of identification and preservation of pelvic autonomic nerves in rectal cancer surgery on bladder dysfunction after total mesorectal excision. *Dis Colon Rectum* **46**: 621–8
- Kosinski L, Habr-Gama A, Ludwig K, Perez R (2012) Shifting concepts in rectal cancer management: a review of contemporary primary rectal cancer treatment strategies. *Cancer J Clin* **62**: 173–202
- Leo E, Belli F, Miceli R et al (2009) Distal clearance margin of 1 cm or less: a safe distance in lower rectum cancer surgery. *Int J Colorectal Dis* **24**: 317–22
- Martling A, Holm T, Rutqvist LE et al (2005) Impact of a surgical training programme on rectal cancer outcomes in Stockholm. *Br J Surg* **92**: 225–9
- Mathis KL, Larson DW, Dozois EJ et al (2012) Outcomes following surgery without radiotherapy for rectal cancer. *Br J Surg* **99**: 137–43
- Maurer CA, Z'Graggen K, Renzulli P et al (2001) Total mesorectal excision preserves male genital function compared with conventional rectal cancer surgery. *Br J Surg* **88**: 1501–5
- Miles WE (1908) A method of performing abdomino perineal excision for carcinoma of the rectum and of the terminal portion of the pelvic colon. *Lancet* **ii**: 1812–13
- Moore TJ, Moran BJ (2012) Precision surgery, precision terminology: the origins and meaning of ELAPE. *Colorectal Dis* **14**: 1173–4
- Nagtegaal ID, van de Velde CJH, Marijnen CAM, van Krieken JHJM, Quirke P (2005) Low rectal cancer: a call for a change of approach in abdominoperineal resection. *J Clin Oncol* **23**: 9257–64
- Penninckx F (2012) The safe distal tumour-free margin after sphincter preserving resection for rectal cancer: an ongoing debate. *Colorectal Dis* **14**: 131–2
- Salerno G, Daniels IR, Moran BJ, Wotherspoon A, Brown G (2006a) Clarifying margins in the multidisciplinary management of rectal cancer: the MERCURY experience. *Clin Radiol* **61**: 916–23
- Salerno G, Sinnatambay C, Branagan G et al (2006b) Defining the rectum: surgically, radiologically and anatomically. *Colorectal Dis* **8** Suppl 3: 5–9
- Salerno G, Chandler I, Wotherspoon A et al (2008) Sites of surgical wasting in the abdominoperineal specimen. *Br J Surg* **95**: 1147–54

KEY POINTS

- The anatomy of the lower rectum is complex and this can give rise to technical difficulties leading to suboptimal excision of cancers in this region.
- Magnetic resonance imaging definition of the lower rectum is more objective.
- Extra-levator abdomino-perineal excision is the surgical procedure of choice in selected patients with advanced low rectal cancer.
- An optimal technique to close the pelvic floor after extra-levator abdomino-perineal excision is still under debate.

- Shihab OC, Heald RJ, Rullier E et al (2009) Defining the surgical planes on MRI improves surgery for cancer of the low rectum. *Lancet Oncol* **10**: 1207–11
- Shihab OC, Brown G, Daniels IR et al (2010) Patients with low rectal cancer treated by abdominoperineal excision have worse tumors and higher involved margin rates compared with patients treated by anterior resection. *Dis Colon Rectum* **53**: 53–6
- Shihab OC, Heald RJ, Holm T et al (2012) A pictorial description of extralevator abdominoperineal excision for low rectal cancer. *Colorectal Dis* **14**: e655–60
- Walsh PC (2005) Anatomical studies of the neurovascular bundle and cavernosal nerves. *J Urol* **174**: 566
- West NP, Finan PJ, Anderin C et al (2008) Evidence of the oncologic superiority of cylindrical abdominoperineal excision for low rectal cancer. *J Clin Oncol* **26**: 3517–22
- West NP, Anderin C, Smith KJE et al (2010) Multicentre experience with extralevator abdominoperineal excision for low rectal cancer. *Br J Surg* **97**: 588–99
- Wibe A, Eriksen MT, Andersen E et al (2003) Total mesorectal excision for rectal cancer—what can be achieved by a national audit? *Colorectal Dis* **5**: 471–7
- Wibe A, Syse A, Andersen E et al (2004) Oncological outcomes after total mesorectal excision for cure for cancer of the lower rectum: anterior vs. abdominoperineal resection. *Dis Colon Rectum* **47**: 48–58
- Wille-Jørgensen P, Pilsgaard B, Møller P (2009) Reconstruction of the pelvic floor with a biological mesh after abdominoperineal excision for rectal cancer. *Int J Colorectal Dis* **24**: 323–5
- Williams NS, Dixon MF, Johnston D (1983) Reappraisal of the 5 centimetre rule of distal excision for carcinoma of the rectum: a study of distal intramural spread and of patients' survival. *Br J Surg* **70**: 150–4

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