

Principles of Total Mesorectal Excision for Rectal Cancer

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Total mesorectal excision (TME) has significantly improved outcomes in the treatment of rectal cancer. With widespread utilization of TME, local recurrence rates have decreased, from up to 37% following conventional surgery to less than 10% following TME. The goal of TME is to excise the rectum, with its surrounding soft tissue and lymphatics, as an intact unit covered by the mesorectal envelope. Injury to this envelope is associated with a higher probability of local recurrence. Identification and preservation of the autonomic nerves during dissection is necessary to preserve adequate urogenital function. Bowel continuity can be reestablished with straight coloanal anastomosis, colonic J-pouch, or transverse colectomy. TME is associated with a slightly higher incidence of anastomotic leakage, which can usually be prevented (and the effects minimized) by a diverting ostomy. Lateral lymph node dissection is not routinely performed. Preoperative radiotherapy, as well as the surgeon's experience and training, appear to improve outcomes in TME.
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Every year, approximately 40,000 people in the United States are diagnosed with rectal cancer.¹ As with most solid tumors, surgical resection remains the cornerstone of treatment. Local recurrence rates after surgical resection have varied historically, from 9 to 37%.^{2,3} The reason for this wide variability in recurrence rates was unclear until recently, when the impact of surgical technique and surgeon's experience became evident.

In 1979, Heald emphasized the importance of removing the rectum with its surrounding soft tissue (ie, mesorectum) as an intact unit in the surgical treatment of rectal cancer.⁴ By using this technique of total mesorectal excision (TME), he was able to achieve local recurrence rates of less than 5%.⁵ The impact of TME in reducing rates of local recurrence has been confirmed in multiple subsequent studies. This article will analyze the principles of TME in the treatment of rectal cancer.

Historical Background

Lisfranc described the first successful procedure for excision of rectal cancer via a transanal approach in 1826.⁶ In 1894, after being unable to remove a cancer through the perineum, Czerny combined the procedure with an abdominal operation, thus becoming the first surgeon to perform an abdominoperineal resection (APR) for rectal cancer.⁷ His technique was modified and published by Miles in 1908.⁸ Also in 1908, Moynihan described an abdominal procedure by which rectal and sigmoid cancers were resected and a primary anastomosis was performed.⁹ It was not until the 1940s, however, that anterior resection of the rectum with restoration of bowel continuity gained popularity, thanks to the work of Wangenstein¹⁰ and Dixon.^{11,12} With the development of circular staplers¹³ and improvements in surgical technique, progressively lower anastomoses became possible, making low anterior resection the preferred procedure for surgical treatment of most rectal malignancies.¹⁴ However, local recurrence rates varied widely: from less than 10% to almost 40%.^{2,3}

In 1979, Enker pointed out the importance of wide anatomic resection and lymphadenectomy to improve outcomes in rectal cancer surgery.⁴ That same year, Heald detailed his technique of LAR with sharp dissection, under direct vision, to excise the rectum and surrounding soft tissue,¹⁵ a tech-

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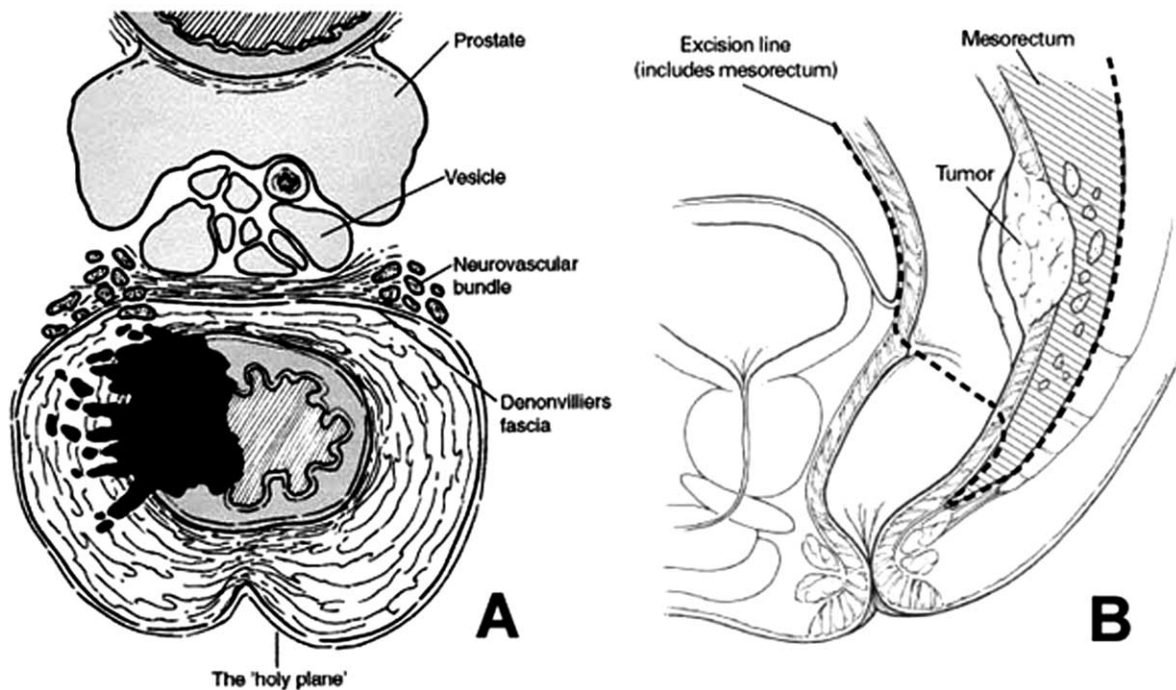


Figure 1 Transverse (A) and sagittal (B) views of the rectum and mesorectum showing the correct plane for total mesorectal excision (Reproduced with permission from (A) Kapiteijn E, van de Velde CJH: The role of total mesorectal excision in the management of rectal cancer. *Surg Clin N Am* 82:995-1007, 2002, and (B) Nelson H, Sargent DJ: Refining multimodal therapy for rectal cancer. *N Engl J Med* 345:690-692, 2001.)

nique that would later be called TME. Utilizing this technique, he was able to obtain local recurrence rates in the single digits.⁵ Some minor modifications to the technique, such as the deliberate tracking and preservation of the autonomic nerves,¹⁶ have improved overall results.

Surgical Anatomy

The rectum comprises the last 15 cm of the large bowel, extending from the sacral promontory to the dentate line. It is primarily an extraperitoneal structure and therefore does not have a typical peritoneal mesentery.¹⁷ Despite this, the term “mesorectum” has been used to describe the perirectal soft tissue surrounded by fascia and containing lymphatic, neural, and vascular structures (Fig. 1).

The rectum and surrounding soft tissues are enclosed within the endopelvic fascia, which has a parietal and a visceral component. The parietal endopelvic fascia lines the walls of the pelvis and extends from the retroperitoneum down to the anorectal ring.¹⁸ The posterior component of the parietal fascia is the presacral fascia, also known as Waldeyer’s fascia.¹⁹ It covers the sacrum, the coccyx, and the associated nerves and vessels. Disruption of this fascia during rectal surgery may produce significant bleeding from the underlying presacral veins. As the presacral fascia turns laterally, it meets the “lateral ligaments” of the rectum, condensations of the visceral fascia that connect the rectum to the pelvic sidewall. Anteriorly, the fascia terminates in the rectovaginal or rectovesical septum.

At the level of S4, a thickened reflection of fascia travels

anteriorly and inferiorly to connect the presacral fascia with the visceral fascia of the rectum. This condensation is known as the rectosacral fascia. It is of particular importance in rectal resection, since inadequate blunt technique may carry the dissection into the mesorectum, potentially leaving cancer cells adherent to the pelvis.

Anterior to the middle and lower rectum, a dense layer of collagen is intimately associated with the vagina or prostate anteriorly, and with the anterior mesorectum and visceral fascia posteriorly.^{20,21} In the male, this layer has been labeled Denonvillier’s fascia. This “fascia,” in fact, may represent two layers of peritoneum that have been trapped between the posterior prostate and the anterior rectum.

The visceral endopelvic fascia, or fascia propria of the rectum, is a collagenous layer of variable thickness that encloses the rectum, surrounding fat, blood vessels, nerves, and lymphatics.²² The soft tissue contained within the fascia propria comprises the mesorectum.¹⁸ The retrorectal space lies between the fascia propria anteriorly, the presacral fascia posteriorly, the rectosacral fascia inferiorly, and the lateral ligaments of the rectum laterally. It is filled with loose areolar tissue devoid of vessels and nerves and constitutes the posterior plane of TME. Despite consensus among surgeons for the proper plane of dissection laterally and posteriorly in TME, choice of the specific plane for anterior dissection remains controversial. Three anterior approaches have been advocated: a close rectal plane leaving the anterior fascia on the back of the prostate or vagina; dissection between the fascia propria and part of Denonvilliers’ fascia anteriorly; or an extramesorectal dissection, including all layers of Denon-

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