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The Functional Consequences of Rectal Cancer Surgery

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Abstract

Total Mesorectal Excision (TME) represents the basis of treatment for rectal cancer. Oncological outcomes have improved significantly over the last 20 years, and now there is a shift towards reporting functional outcomes.

Bowel, bladder and sexual function are frequently affected following TME, due to the intimate relationship between the rectum and other pelvic structures.

'Anterior Resection Syndrome' is present in 60-90% post-op. The duration of symptoms is quoted between six months and several years. Quality of life alone is not an indication to choose primary anastomosis over end colostomy, but the impact of different surgical techniques on GI disturbance is not well known. Pre-operative radiotherapy is associated with increased stool frequency and incontinence.

Sexual function is more commonly affected after rectal surgery than urinary function, particularly in males. Urogenital functional outcomes in females are less well reported. Laparoscopic and robotic surgery allows better visualisation of autonomic nerves and therefore more precise dissection and preservation.

It is important that procedures are standardised as much as possible, and that new research into functional outcomes uses validated outcome questionnaires, so that there is a body of homogeneous data available for meta-analysis.

Keywords: Rectal Cancer; Rectum; Urogenital Dysfunction

Introduction

Of the UK's 40,695 new diagnoses of colorectal cancer in 2010, 34% were rectal cancers [1], and surgical resection forms the basis of curative treatment [2]. However surgery of the rectum is particularly challenging due to the anatomy of the pelvis and intimately associated structures. Oncological clearance is the primary objective of rectal cancer surgery, and total mesorectal excision (TME) has become the gold standard since the 'Holy Plane' was described over 20 years ago [3]. As the local recurrence rates of rectal cancer have improved with the universal adoption of TME surgery, additional important surrogate markers such as functional outcomes have become increasingly emphasised in recent years. Assuming that a patient undergoes a curative resection, the sequelae of rectal surgery can have a significant impact on quality of life.

Functional problems after rectal surgery are those relating to the disruption of bowel, bladder and sexual function. Poor outcomes in either one will adversely affect patients' quality of life. Important considerations include patient age, gender and pre-operative sphincter function; as well as tumour stage, grade and height from the anal verge, and surgical technique [4]. Tumours of the middle and lower third of the rectum pose the greatest challenges, and there are variable surgical options. Within the last decade the acceptance of a shorter distal resection margin [5,6] has led to an exploration of sphincter preserving surgery [7].

The present review describes the functional consequences of rectal cancer surgery for the surgeon and the patient.

Surgical Anatomy of the Rectum

The rectum forms the distal part of the lower gastrointestinal tract. It lies in the pelvis and is intimately surrounded by important neurovascular structures which impact on bowel, bladder and sexual function. The exact beginning of the rectum remains a point of contention which introduces the concept of surgical anatomy as opposed to cadaveric anatomy. This explains the different values given for the length of the rectum which is stated to be in the range of 13-20cm.

The rectum displays a unique feature; a circumferential lymphovascular envelope called the mesorectum which surrounds it along the majority of its length. The fascia surrounding it acts as an initial oncological barrier to the spread of tumour. The outermost boundary of this fatty layer is defined by the mesorectal fascia (MRF). The degree to which tumour is able to infiltrate this layer is an independent risk factor for local recurrence [8].

Oncological surgery of the rectum involves excision of the tumour and the surrounding mesorectum – total mesorectal excision (TME). The lines of excision are defined by the embryological legacy of the primitive gut and are readily visible on high-resolution magnetic resonance imaging (MRI). This is the circumferential resection margin (CRM) and informs the surgeon of the likelihood of oncological clearance. It is important for the surgeon to adequately excise the

tumour en-bloc with the mesorectum whilst preserving the important nerves which traverse the pelvis.

Anterior Resection Syndrome

Roughly 60% of patients undergoing rectal resection and anastomosis experience some change in bowel function post-operatively [9,10]. The term 'Anterior Resection Syndrome' (ARS) has been coined to describe a loosely defined set of symptoms relating commonly to increased frequency and urgency of passing stools and, less commonly, obstructive symptoms. Bryant et al. suggested that the group of symptoms be brought under the simple definition; “disordered bowel function after rectal resection, leading to a detriment in quality of life” [11]. However Ziv et al. [12] classified the syndrome in to mild, moderate and severe as follows in Table 1:

Severity	Symptoms
Mild	Four to six stools per day or incontinence for flatus
Moderate	As for 'mild' with inconcinence for liquid stools
Severe	Seven or more stools per day or incontinence for solid faeces
Absence	Three or fewer bowel movements daily and full sphincter control

Table 1: Classification of Anterior Resection Syndrome

In recent years there has been an attempt to standardise the definitions of such functional outcomes with the use of questionnaires to score functional disruption. Emmertsen and Laurberg [10] proposed a scoring system for bowel dysfunction after low anterior resection which provides a more thorough assessment of bowel function than the commonly used incontinence scores like the Rockwood and St Marks' [13,14].

In a meta-analysis of quality of life in abdominoperineal excision of the rectum (APER) versus anterior resection (AR), Cornish et al. [4] highlighted that opinion is divided regarding the expected duration of these symptoms. Some clinicians reported that there is improvement towards baseline by six months to a year [15], and others described longer term effects beyond a year [16,17]. A further study described an association between ARS and reduced sphincter resting pressures and a reduced rectal capacity before maximal inhibition of the anal sphincter. This combination predisposed the patients to both leaking and urgency [17]. Dehni et al displayed a return towards baseline up to five years post-surgery, and hypothesised that improving sphincter function and returning anorectal reflexes may play a role in this [18].

One surgical option with the aim of avoiding frequency and urgency post-op is to form a colonic pouch instead of an end-to-end colo-rectal/colo-anal anastomosis. End-to-side anastomoses are a technically simpler way of avoiding an end to end anastomosis, but in Mulsow and Winter's extensive review of sphincter preserving surgery [19], they stated there is only limited data to suggest comparable outcomes. Whether pouches are effective because of a larger neorectal capacity, or whether it is because colonic peristalsis is halted [20,21] it seems that a pouch will particularly improve urge and frequency symptoms in the short term when compared to straight anastomosis [22-25] and this relative benefit may continue up to two years [26,27]. The stated optimal pouch size is 5cm, situated 8cm from the anal verge [19].

As most patients present with locally advanced disease, an increasing number of patients are being offered neo-adjuvant radiotherapy to improve local recurrence rates, however radiotherapy has a detrimental effect on anorectal function following TME [27,28]. Unfortunately, within the most recent systematic review and meta-analysis by Loos et al [29], there was too much heterogeneity between studies to confidently compare the outcomes of different surgical approaches with the use of radiotherapy. It was found in multi-centre, randomised trials [27,28] that there was a higher rate of incontinence, frequency and pad wearing up to five years post-operatively, and significantly higher urgency at four months in the irradiated groups. Multiple non-randomised studies have corroborated these findings [30-34].

There is some encouraging evidence that sphincter 'rehabilitation' with biofeedback therapy is useful following rectal surgery for cancer. The success rates for biofeedback as a treatment for faecal incontinence over all are stated between 50 and 92% [35-37]. In patients already suffering from incontinence post-surgery [38], and in another comparison study between irradiated and non-irradiated patients [39], biofeedback training seemed to offer encouraging results. More recently, in a small cohort, a rehabilitation program as standard post-laparoscopic TME has been shown to improve quality of life, despite a similar level of continence between the intervention and control groups [37].

In an attempt to identify patients with iatrogenic sphincter disruption intra-operatively, Kneist et al have developed a technique for assessing sphincter response to neurostimulation, and have predicted outcomes in their small cohort [40]. It may be of use as a predictive marker for high risk patients, an intra-operative decision making tool, and as a learning aid.

As with any colorectal or cancer surgery, the usefulness of a dedicated multidisciplinary team cannot be underestimated. Taylor and Bradshaw's article provides an interesting insight into the patient experience of altered bowel function post-rectal resection, and describes the feeling of being 'tied to the toilet', rather than face the uncertainty and vulnerability of unpredictable bowel movements. They emphasised the need for appropriate patient counselling and collaboration pre and post-operatively, and the benefits of support from nurse specialists [41]. Selecting the right patients for the right procedure is an important step in helping quality of life expectations meet outcomes after rectal surgery.

Urogenital Dysfunction

Urological and sexual disturbances are relatively common after rectal surgery [42]. The close relationship between the rectum and the hypogastric and splanchnic nerves in the pelvis leaves the nerves at risk of damage [43], especially when the risk of circumferential involvement can require dissecting in a plane millimetres wide.

Sexual dysfunction in males refers to impotence, inability to ejaculate/orgasm and lack of libido, whereas in women the equivalents are lubrication, orgasm, dyspareunia and libido. Male urinary disturbances refer to urgency, frequency, flow and nocturia, and in women include urgency, frequency and stress incontinence [44].

Sexual function is more commonly disrupted by rectal surgery than urinary function, probably due to a reliance on autonomic nervous stimulation rather than the multi-factorial nature of urinary function, i.e. prostate size in men and pelvic floor function in women [44].

Female urogenital dysfunction is relatively under reported in the literature [29], but in an example the few studies that exist, sexual function is negatively affected but urinary function not [45].

Male sexual dysfunction is the most highly reported of all the urogenital functional complaints. Although radiotherapy plays a part, surgical nerve damage is the most common cause of sexual dysfunction. In Nagpal and Bennett's review [46], they quoted the rate of new onset sexual dysfunction at 23-69%, and note that both impotence and ejaculatory dysfunction are worse with APER than with sphincter preserving surgery. In a single centre study, Nishizawa et al reported a rate of impotence as high as 80% in sexually active patients following TME, with ejaculatory problems at 82%. These both decreased to 76% and 67% respectively after one year. They noted that Sildenafil was effective in 69% of the patients requesting the drug at follow up [47].

In the knowledge that the precision of dissection contributes to nerve damage, it had been accepted historically that laparoscopic surgery has worse urogenital outcomes [48,49]. It was hypothesised that laparoscopic surgery didn't allow the surgeon to demonstrate the plane with retraction in the same way as with an open technique [49], but this may be a result of minimally invasive rectal surgery in its infancy, and in McGlone et al's report from a high volume centre, they find that laparoscopic TME shows major advantages in regards to sexual outcomes (particularly in women), but no difference in urinary symptoms [44]. In experienced hands laparoscopic rectal surgery is as effective as open surgery, and some clinicians argue that gentle gravitational retraction is kinder to the tissues, and that the surgeon can be offered a better view of pelvic nerve plexuses than with open surgery [50]. Hida et al made use of video playback to retrospectively analyse their cohort of lap TME cases for autonomic nerve damage [51]. This is a unique property of minimally invasive surgery that can be exploited on a larger scale for the sake of education, perfection and standardisation of technique. Robotic surgery, currently in its infancy, will undoubtedly become more popular as availability increases. Luca et al, with a cohort of 74 patients, argue that robotic surgery allows for more precise manipulation and dissection, with the advantage of a magnified view of the inferior hypogastric plexus [52].

Radiotherapy has a detrimental effect on sexual function, but not urinary function in both men and women [29]. Meta-analysis of large, multi-centre studies have demonstrated that sexual activity was 18% lower in women who had undergone radiotherapy rather than surgery alone, and in men sexual function was worse up to 18 months post-operatively, with ejaculatory dysfunction between 39-44% compared to 29-32% in non-irradiated patients [27,53].

Quality of Life With and Without a Stoma

In low rectal cancers, it has been shown that low resection and anastomosis is as oncologically safe as abdominoperineal resection [54]. With this in mind, it is an attractive option to avoid the need for a permanent stoma, and it's associated limitations on quality of life, i.e. body image, sexual inhibition and issues such as prolapse and retraction [55,56]. However, many recent studies have compared the quality of life (QoL) outcomes between patients undergoing low rectal anastomoses and those living with permanent colostomies, and in many cases found that outcomes to be comparable [4,19,57-62]. It seems that global QoL alone is not a reason to avoid permanent colostomy [4,59], but the procedure should be discussed on a patient-by-patient basis.

Conclusion

The last two to three decades have witnessed a massive improvement in the oncological outcomes for patients with rectal cancer, primarily due to the widespread standardisation of resection technique to reduce local recurrence. Beyond this, surgeons now have access to high resolution imaging and equipment, allowing optimal assessment of tumours and more precise surgery through laparoscopy. The treatment options for patients are increasing, and we need to offer transparency regarding the expected outcomes for each of these options. Being able to offer prognostic information with a solid evidence base can only come about with more available research, and currently this is hampered by a lack of homogeneity between studies. It is the mantle of the current generation of colorectal surgeons to standardise new techniques [63], firstly for the sake of oncological confidence, and further so that we can accurately compare the functional outcomes, which may have been under-reported in the past.

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