Who should be treating rectal cancer in 2013?

Management of rectal cancer has advanced significantly over the last 30 years. As the complexity of treatment increases the question of superspecialization has arisen as a means of concentrating expertise and improving outcome. This article argues that this may have merit, but only for very early and very advanced tumours.

Rectal cancer remains one of the more challenging solid tumours to treat, in part because of the relative inaccessibility of the rectum and the functional consequences of rectal resection. The four aims of treatment of rectal cancer are set out in *Table 1*. Since the first descriptions of attempts at per-anal resection of rectal cancers in the late 19th century, there has been a long process of incremental improvements in treatment of rectal cancer (Galler et al, 2011) and, with it, a shift from 'eminence based medicine' to 'evidence based medicine'. This article discusses the evolution of the treatment of rectal cancer and looks at the case for centralizing the management of this challenging tumour.

Historical considerations

Thirty years ago, rectal cancer was regarded as a 'surgical' disease. Surgical techniques were crude and usually based on blunt dissection of the rectum from the pelvis, risking breach of the fascial envelope surrounding the rectum with the potential for tumour foci to be left in the pelvis. Consequently, local recurrence was common with reported rates as high as 25–30%. Restorative resection of the mid and low rectum was the exception, with many patients undergoing abdomino-perineal resection and permanent stoma formation. Radiotherapy and chemotherapy were used only in patients with advanced disease, not deemed suitable for resection, or to palliate the many patients who developed recurrent disease following resection.

In the late 1970s and early 80s, two major advances revolutionized the surgical treatment of rectal cancer. The first was an appreciation of the importance of the fascial planes surrounding the rectum and the evolution of the concept of total mesorectal excision by Heald (Heald et al, 1982; Heald and Ryall, 1986). This led the way to accurate sharp dissection in the embryological 'holy plane' between the visceral fascia of the mesorectum and the parietal fascia overlying other pelvic wall structures. This approach reduced local recurrence rates to below 10% in many centres that adopted this technique (Martling et al, 2002; Nesbakken et al, 2002; Wibe et al, 2003). Furthermore, as well as improving the chances of cure, morbidity of surgery was reduced as pelvic nerve function was more likely to be preserved. The second development was the widespread introduction of the circular stapling gun. Initially developed in Soviet Russia, the technology was introduced into the west in the 1960s (Goligher et al, 1979) and, by 1977, the US Surgical Corporation had reported the successful use of their end-to-end anastomosis stapling device. Introduction of this instrument made restorative resection of the rectum much more feasible for mid and low rectal tumours and spared many patients a permanent stoma, thus maintaining anal continence.

Table 1. Aims of treatment of rectal cancer

Cure the patient of the tumour
Limit morbidity of any treatment
Maintain continence
Improve the patient's quality of life

Mr Chris Thompson *is Specialty Registrar and* **Mr J Graham Williams** *is Consultant Colorectal Surgeon in the Department of Colorectal Surgery, Royal Wolverhampton Hospitals NHS Trust, Wolverhampton WV10 0QP*

Correspondence to: Mr JG Williams (graham.williams4@nhs.net)

Variation in outcome

Despite these advances in surgical treatment of rectal cancer, variation in outcome following treatment has been recognized for some time. The landmark Large Bowel Cancer Project analysed in detail follow-up data on 2220 patients undergoing curative resection for colo-rectal cancer by 94 consultant surgeons. There was wide variation in local recurrence rates for rectal cancer from less than 5% to over 20% between surgeons who had performed more than 30 resections (Phillips et al, 1984). The influence on outcome of surgical case volume, both by hospital and for individual surgeons, as well as the presence or absence of specialist training or professional interest in colorectal cancer has since been studied in detail. In 1991, McArdle and Hole presented 10-year follow-up data on 645 colorectal procedures from a single hospital. The original operations were performed between 1974 and 1979, by 13 surgeons, none of whom were declared colorectal specialists. Significant variation in volume of cases undertaken and their outcome was observed. This was not accounted for by variation in patient demographics, mode of presentation and stage of disease. This study highlighted the conten-

tious issue of inter-surgeon variability regarding operative technical quality and its impact on patient outcome, although care should be exercised when extrapolating from a single centre study to a national basis.

The specialism of the operating surgeon has been studied as part of the analysis of inter-surgeon variability. How a 'specialist' is defined varies between studies and includes self-declaration by the surgeon, using surrogate markers such as the presence of dedicated colonoscopy sessions in the surgeon's job plan, membership of specialist associations or sub-specialist training. Dorrance et al (2000) compared the outcome of colorectal cancer surgery between specialist colorectal cancer surgeons and general, vascular and transplant surgeons. They showed a significant difference in local and overall recurrence rates when the procedure was carried out by a colorectal surgeon.

In a follow up to their 1991 paper McArdle and Hole (2004) showed that specialization (as adjudged by a panel of peers) was associated with improved 5-year cancer specific survival (72.7% for specialists and 63.8% for non-specialists). However, this difference may simply reflect the wide variation in the proportion of patients presenting as an emergency. This study did not show a link between volume of cases and cancer survival. Martling et al in 2002 explored the effect of volume and participation in a specialist training course on outcomes of rectal cancer surgery. They found that high volume surgeons had better outcome as regards local recurrence and death from rectal cancer. All of the high volume surgeons had participated in a total mesorectal excision training course, indicating their own interest in producing high quality surgical outcomes. Thus volume and specialist interest are often interlinked.

The Wessex colorectal cancer audit performed between 1991 and 1994 studied 5173 patients (Smith et al, 2003). During this period, total mesorectal excision techniques were practiced but the oncological treatment of colorectal cancer was not widely implemented and therefore did not contribute to the outcome. This study found that survival and recurrence rates were better for specialist surgeons performing higher volumes of resections, with being a declared specialist a more powerful predictor of improved outcome than case volume alone, although the two naturally seemed to go hand in hand. The criterion for being a declared specialist in this study was being a member of the Association of Coloproctology of Great Britain and Ireland. Latterly, membership of the dedicated colorectal multidisciplinary team is used as a marker of specialization. However, the published evidence looking at the effect of specialization on outcome does not uniformly show a beneficial effect. A large study from Sweden of 1697 patients with rectal cancer operated by total mesorectal excision showed no difference between degree of specialization or surgeon caseload (Brännström et al, 2011), although it could be argued that the overall low caseload in this study (median 9 per year) meant that the effect of volume on outcome was hard to detect. It could also be argued that the uptake of total mesorectal excision has been so widespread that all surgeons are using the technique regardless of specialism.

A large study of UK hospital practice in the post total mesorectal excision and post multidisciplinary team era included 2883 patients undergoing resection of rectal cancer and showed a greater proportion of R0 resections and improved overall survival for high volume surgeons (who performed over 22 resections per year) but it should be noted that this effect disappeared when adjusting for case mix. Taking all colorectal resections into account, although a difference in outcome was shown between high (>40/year) and low volume surgeons (<27/year), there was little difference between high volume surgeons and medium (27–40/year) caseload surgeons. Thus there appears to be a 'law of diminishing returns' when it comes to volume and the authors recommend an average caseload of 20–25 patients per surgeon per year to optimize the beneficial effect of volume on outcome (Borowski et al, 2010).

Therefore, while there are many methodological issues with the published literature relating to how a specialist is defined as well as variation in end points studied, it is apparent that better results are achieved by surgeons who specialize in the treatment of rectal cancer and as a consequence treat more patients with this disease.

Evolution of modern treatment of rectal cancer

Over the past 30 years there has been a dramatic evolution in the treatment of rectal cancer. As well as surgical advances, there have been considerable advances in other aspects of the treatment of rectal cancer. Imaging of the rectum has become much more sophisticated with the introduction of endorectal ultrasound allowing accurate T staging of 'early' rectal cancer (Schaffzin and Wong, 2004) and magnetic resonance scanning producing accurate staging information as to the local extent of the tumour (especially its relation to the plane of surgical excision or lateral resection margin) and likelihood of mesorectal lymph node involvement (Brown et al, 2003).

Radiotherapy has become an important part of the treatment. Several large trials have shown the benefit of short course radiotherapy before surgical resection in reducing the risk of local recurrence for T3 tumours (Kapiteijn et al, 2001; Sebag-Montefiore et al, 2009). Long-course preoperative chemo-radiotherapy has been shown to 'down-stage' tumours that involve or threaten the circumferential resection margin, increasing the possibility of performing a sphincter-preserving resection (Bosset et al, 2006). In a proportion of patients (around 10–15% in most series), the tumour can disappear entirely on histological examination, realizing the possibility of avoiding the need for surgery in this group of patients (Habr-Gama et al, 2010; Glynne-Jones and Hughes, 2012). Chemotherapy treatments have become more complex and effective, both in the adjuvant setting and as treatment for recurrent disease.

Technological advances have increased the treatment options available for 'early' rectal cancer. These small T1/T2 tumours have become more common with the advent of bowel cancer screening. Polyp-cancers (T1 tumours arising in an adenoma) can be successfully treated by endoscopic resection with snare or by endomucosal resection. Small tumours in the very lower rectum are amenable to traditional perianal resection under direct vision. The development of endoscopic microsurgical techniques has extended the scope of transanal resection of early rectal cancer by transanal endoscopic microsurgery introduced by Buess et al (1992) from Germany and more recently transanal minimally invasive surgery (Slack et al, 2012). Full-thickness excision with an adequate margin can be performed and the defect in the rectal wall closed by an endoscopic suturing technique. Two-year local recurrence rates of 9.5% for T1 tumours and 23.7% for T2 tumour have been reported (Bach et al, 2009). More recently, transanal excision has been combined with neoadjuvant radiotherapy in an effort to reduce local failure rates.

Another advance has been better understanding of the reason for local recurrence following abdomino-perineal resection and an appreciation of the surgical anatomy of the ano-rectal junction. This has led to the concept of the 'cylindrical' resection of the ano-rectum – the so-called extra-levator abdomino-perineal resection (ELAPE) and the improved access achieved by performing the perineal phase in the prone jack-knife position (Marr et al, 2005). This concept has been rolled out throughout the UK via the Low Rectal Cancer National Development Programme (LOREC).

Surgical techniques have evolved to enable resection of locally advanced tumours of the rectum, which involve en-bloc multi-visceral excision (usually including vagina, uterus +/- bladder in a woman or prostate and bladder in a man), and in certain circumstances, resection of the lower sacral vertebrae. With careful staging, there can be reasonable expectation of a R0 resection, translating into worthwhile 5-year survival rates, all be it with considerable impact on quality of life (Sagar, 2006; Sagar et al, 2009; Harji and Sagar, 2012).

Thus in 2013, rectal cancer has evolved from a disease treated by the lone surgeon chipping away in the pelvis to a 'team sport' involving a group of specialists, including radiologists, pathologists, oncologists, specialist nurses, as well as the traditional surgeon with help provided by other specialists such as gastroenterologists, geneticists and plastic surgeons as required. This cancer multidisciplinary team working is well established and while it undoubtedly streamlines the treatment of rectal cancer, evidence that multidisciplinary team working alone leads to improved survival is lacking.

As a direct consequence of modern multidisciplinary team working, the management of rectal cancer is already in the hands of 'experts' in their field, working under the umbrella of the colorectal multidisciplinary team. The question now arises as to whether the management of rectal cancer should be centralized in a limited number of 'super specialist' multidisciplinary teams because of the complexity of treatments available (Lindsey, 2012). At first glance there are arguments in favour of this re-configuration. Even with current arrangement of multidisciplinary teams there is evidence of wide variation in surgical treatment of rectal cancer. Morris et al (2008) showed that the rate of abdomino-perineal resection for rectal cancer by individual units varied around England from 11% to 52%. Case mix may account for some of this variation, but this can not be the only explanation, which probably reflects variation in expertise available to perform restorative ultra-low rectal resection from unit to unit. It should be remembered that with 15 000 new cases of rectal cancer diagnosed each year in the UK, it would be impractical to centralize the management of all patients with rectal cancer in a few specialized units, especially as it would have knock-on effects on the treatment of colonic cancer and provision of an emergency surgical rota in many district general hospitals.

Rectal cancer: the good, the bad and the ugly

While formal reorganization of all rectal cancer treatment may be impractical and has not yet been proposed for the NHS, natural evolution will result in some reorganization around specific areas of the management of rectal cancer. This is can best be understood by dividing rectal cancers into three broad groups and consider what facilities and expertise are required to treat cancers falling within each scenario. These groups are described as the 'good', the 'bad' and the 'ugly' (*Table 2*).

The 'good' rectal cancer

This group includes 'early' rectal cancer, T1 and T2 tumours without evidence of lymph node involvement and smaller than 3 cm in diameter (*Figure 1*). Such tumours may be considered suitable for treatment by transanal excision, with or without preoperative radiotherapy, contact radiotherapy or radical rectal resection. Decision making requires access to high quality magnetic resonance imaging as well as endorectal ultrasound to accurately stage the tumour. Treating such tumours appropriately requires availability of local resection techniques (transanal endoscopic microsurgery or transanal

Table 2. A classification of rectal tumours

Tumour classification	Description	Stage included
Good	Small (<2.5 cm) tumour, very mobile. No evidence of spread, amenable to local treatment	T1/T2, N0, M0
Bad	Mobile or tethered tumour >2.5 cm. Not involving pelvic sidewalls or adjacent organ. Good response to downstaging if margin threatened	T1–T3, N1/N2, M0/M1
Ugly	Locally advanced or 'fixed' tumour, involving adjacent genital organs and/or pelvic side wall and/or lower sacrum	T4, N1/N2, M0/M1

minimally invasive surgery) as well as appropriate radiotherapy techniques. While early rectal cancer has become more common following the introduction of the National Bowel Cancer Screening Programme, such tumours remain the exception and account for fewer than 1 in 10 rectal cancers in most centres in the UK. Because of the requirement for specific staging investigations and access to expensive and complex equipment to perform transanal excision, management of these early (good) cancers should probably be confined to specific multidisciplinary teams that have the facilities to offer the full range of treatments.

The 'bad' rectal cancer

The 'bad' rectal cancers include the majority of rectal cancers encountered in UK practice (*Figure 2*). These tumours are too large and advanced for local treatments. They range from T1 to some T4 tumours and may be staged as N0, N1 or N2. Tumours in this group are amenable to radical surgical resection, with or without preoperative radiotherapy or downstaging chemo-radiotherapy (where the lateral resection margin is involved or threatened). Such tumours probably account for 80% of rectal cancers (roughly 12 000 nationwide). Treatment of such tumours requires good preoperative staging by magnetic resonance imaging and computed tomography scans. Endorectal ultrasound adds little to staging information of these larger or more advanced tumours.

Surgical resection will involve total mesorectal excision for tumours in the low and mid rectum and partial total mesorectal excision for tumours in the upper rectum. Surgeons should be familiar with performing low stapled anastomosis of the rectum as well as hand-sewn colo-anal anastomosis. Management of these tumours is well within the scope of established colorectal multidisciplinary teams. Skills should be maintained by performing an adequate number of resections and regular training in new techniques as they emerge. The multidisciplinary team will have agreed protocols for the use of short-course and long-course neoadjuvant radiotherapy. There should be no imperative to centralize treatment of these tumours in fewer more specialized multidisciplinary teams, especially as the numbers of patients involved would be large and the logistics of moving patients to other units would be great, with potential for delay in treatment.

The 'ugly' rectal cancer

The 'ugly' rectal cancer (*Figure 3*) is one that is locally advanced, breaching the mesorectal fascia and involving adjacent structures, such as the sacrum, bladder or prostate. Such tumours usually lie in the mid or low rectum, where access is more difficult. There is often metastatic disease at the time of presentation. These tumours are challenging to treat and usually require down-staging neoadjuvant chemo-radiotherapy. Surgical resection is often demanding and will require input from other surgical specialties, such as urology, gynaecology, neurosurgery and plastic surgery. Such expertise is available on one site

Figure 1. The good. a. Endoscopic view of an 'early' rectal cancer. Note that it appears to be an exophytic tumour with only slight ulceration in the centre. On palpation, the tumour is very mobile. b. Endorectal ultrasound of early rectal cancer (T2 lesion). There is a clear break in the muscularis mucosae (white arrows), but the muscularis propria is not disrupted (black arrows) indicating that the tumour invades through the submucosa and into but not through the outer wall of the rectum.

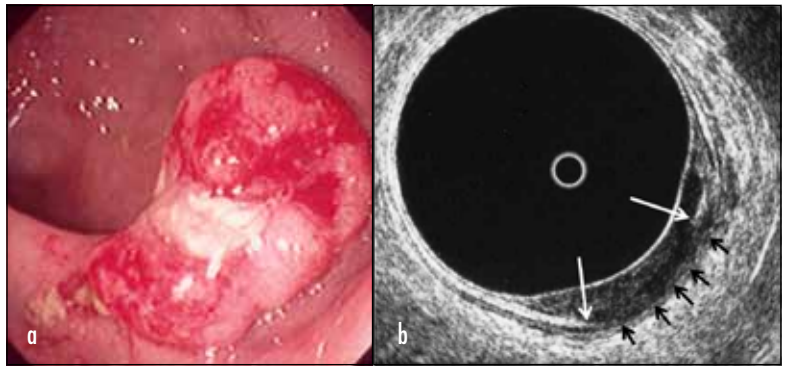
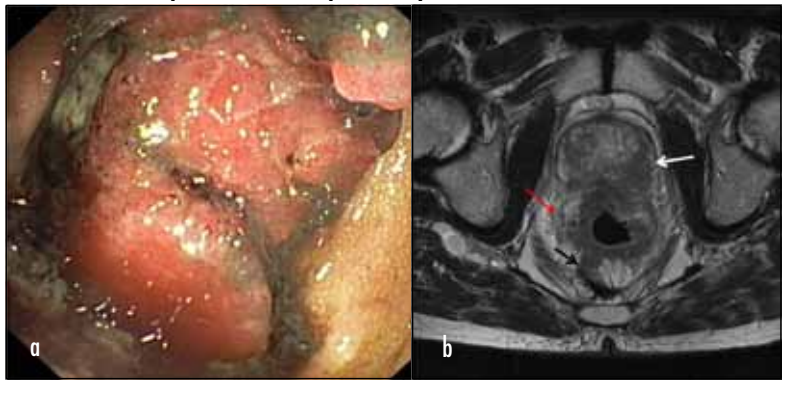


Figure 2. The bad. a. Endoscopic view of typical rectal cancer. The tumour is exophytic and fills most of the lumen of the rectum, but involves roughly half of the circumference of the rectal wall. On digital examination the tumour is mobile, but feels 'tethered' to the rectal wall. b. Magnetic resonance imaging scan of typical rectal cancer. Tumour mass is on the right side of the rectal wall with tumour extending directly into the mesorectal fat (white arrows), T3 lesion. In addition, there is a lymph node adjacent to the mesorectal fascia on the right side (red arrow). This has similar signal to tumour and should be regarded as an involved node (N1).

Figure 3. The ugly. a. Endoscopic view of a large, fixed rectal cancer. The lumen of the rectum is obliterated by the tumour and on digital examination the tumour is fixed within the pelvis. b. Magnetic resonance imaging scan of a locally advanced cancer of the mid rectum. Tumour ramifies extensively in the mesorectal fat (red arrow) and involved the mesorectal fascia posteriorly (black arrow). Of greater significance is the tumour extension anteriorly to invade directly into the prostate (white arrow).



in only a few centres, which develops expertise at multivisceral and bony resection and reconstruction of large perineal defects. In addition, radiologists involved in managing such tumours will need access to more advanced imaging modalities. Furthermore, such a team will gain expertise in the management of recurrent rectal cancer which, following adequate initial rectal resection by total mesorectal excision, usually involves anterior urological organs or the wall of the pelvis.

The proportion of ugly tumours is small, probably less than 10% of rectal cancers presenting to most institutions. Because of the requirement for access to an extended team of surgical experts, management of these advanced (ugly) cancers should be confined to specific advanced rectal cancer multidisciplinary teams and while several exist in the UK, more are needed to provide wider coverage across the country.

Conclusions

Rectal cancer treatment has evolved dramatically over the last 30 years with improvements in surgical technique, imaging, pathology, chemotherapy and radiotherapy all contributing to improving outcomes and reducing morbidity from treatment of rectal cancer. The modern management requires a team of experts in all these fields, supported by specialist nurses and other health-care professionals. While it is tempting to recommend that treatment of rectal cancer be limited to super-specialist multidisciplinary teams, this would be impracticable for the majority of tumours, whose treatment should be well within the capability of the colorectal multidisciplinary team. However, a good case can be made for centralizing treatment of certain early cancers as well as advanced tumours to dedicated multidisciplinary teams. **BJHM**

Conflict of interest: none.

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KEY POINTS

- Treatment of rectal cancer requires true multidisciplinary working.
- Surgical resection of the tumour is still required to 'cure' rectal cancer, despite advances in chemotherapy and radiotherapy.
- Some 'early' rectal cancers are amenable to local surgical excision and/or radiotherapy, techniques that are not available in all centres.
- Treatment of advanced rectal cancer requires a team of oncologists and surgeons with specific specialist skills available in only a few larger units.
- Centralization of all rectal cancer treatment is impracticable because of the number of patients involved. However, centralization of the management of early rectal cancer and locally advanced cancer is appropriate and will concentrate expertise in the management of these challenging tumours.