Local excision of rectal tumours by minimally invasive transanal surgery

Rectal tumours which are not amenable to endoscopic resection have been managed traditionally by radical surgery. Transanal techniques are less invasive and have a lower mortality and morbidity, but a higher local recurrence rate. This article reviews and compares some of these techniques.

Cancer of the rectum is the third most common cancer in men and the second most common in women worldwide. The survival rate depends on the cancer stage at presentation, stage I (early disease) has 5-year survival rates of about 90% whereas stage IV (metastatic disease) has 5-year survival rates of about 7% (American Cancer Society, 2012).

Radical surgery with total mesorectal excision remains the 'gold standard' and involves excision of the primary tumour and surrounding lymph glands. However, it carries significant risk of morbidity and mortality and poor functional outcome, particularly in elderly and unfit patients. The perioperative mortality rate is 0.5% for patients who are American Society of Anesthesiologists (ASA) grade I (healthy) but more than 25% for patients who are ASA grade IV (patients with significant comorbidity) (Al-Homoud et al, 2004; Fazio et al, 2004). Surgical morbidity includes anastomotic leak, sexual and urinary dysfunction (Havenga et al, 1996).

Conversely, local treatment including local excision aims to minimize mortality and morbidity at the same time as offering cure. With the introduction of the NHS Bowel Cancer Screening Programme, more early rectal cancers are being identified in an increasingly elderly population, often with significant comorbidity. In addition, there are a significant number of patients who are 'stoma phobic' and refuse conventional radical surgery. The decision to offer local treatment must involve all members of the multidisciplinary team. Although local treatment has a higher local recurrence rate than radical surgery, it may be possible to perform radical surgery if local recurrence occurs (Hershman and Myint, 2007).

Previously, local excisional techniques via the transsphincteric (York Mason) or pre-sacral (Kraske) routes have been used, but have largely been abandoned as a result of high complication rates. Transanal resection (Parks operation) carries a high recurrence rate and can only be used for low tumours. Recently, endoscopic mucosal resection and endoscopic submucosal dissection have been developed and are used for benign disease and very early rectal tumours. However, in the authors' view, transanal endoscopic microsurgery remains the local excisional technique of choice.

Transanal endoscopic microsurgery

Transanal endoscopic microsurgery was first described by Buess in the early 1980s (Buess et al, 1992) and introduced to the UK in 1993 (Curran et al, 1994; Steele et al, 1996). Transanal endoscopic microsurgery permits full thickness resection and has low mortality and morbidity, reduced hospital stay and minimal effects on sphincter function.

Instruments and technique

Transanal endoscopic microsurgery instruments consist of a three-dimensional optic viewing system with dedicated operating instruments and an endosurgical unit (Wolf). The operating instruments include the operating rectoscope (4 cm in diameter and 12 or 20 cm in length), the stereoscope, and instruments for dissection, excision and suturing. The endosurgical unit provides insufflation (carbon dioxide), suction, irrigation and continuous monitoring of intrarectal pressure. There is an airtight faceplate with three ports sealed by capped rubber sleeves through which the optical stereoscope, suction and two long-shafted operating instruments are inserted. A binocular stereoscopic eyepiece gives a three-dimensional view of the operating field with 6-fold magnification. The stereoscopic eyepiece itself includes dual lenses, an insufflation channel, and a lens irrigator operated by a foot pedal. An accessory monocular scope is connected to a video screen to allow the surgical team to view the procedure. All operating instruments are 5 mm in diameter and include graspers, scissors, a high-frequency knife, needle driver and clip applier. Most instruments are angulated. The rectoscope and its attachments are secured to the operating room table using a multijointed clamp, the Martin's arm.

Preoperative bowel preparation is either by mechanical bowel preparation or enemas. Transanal endoscopic microsurgery procedures usually require general anaesthesia although spinal anaesthetic is sometimes used. The patient is placed on the operating table so that the

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tumour is beneath the lip of the proctoscope and so may be in the lithotomy, lateral or prone jackknife position.

Full thickness excision is performed in the extraperitoneal rectum and submucosal or partial thickness excision in the intraperitoneal rectum. The 'harmonic scalpel', a high frequency ultrasonic dissector, enables almost bloodless dissection. The resection bed for lesions in the low rectum below the peritoneal reflection may be left open or closed using a running suture with 3-0 polydioxanone suture (PDS). Knot tying using transanal endoscopic microsurgery equipment is very difficult and silver clips secured to the suture are usually used. Closure of all intraperitoneal defects is mandatory.

Indications for transanal endoscopic microsurgery

In addition to early rectal cancer, transanal endoscopic microsurgery has been used to excise benign adenomas, carcinoids and gastrointestinal stromal tumours (Steele et al, 1996; Kumar et al, 2012). Transanal endoscopic microsurgery is an accepted technique when the rectal cancer does not invade the submucosa (T1) (Darwood et al, 2008) and can also be used for selected tumours that invade muscularis propria (T2), particularly in combination with neoadjuvant chemoradiation.

Transanal endoscopic microsurgery is also a curative treatment option in medically unfit patients (ASA 3 or above) or those who refuse any radical resection and permanent colostomy. In this situation, a multimodality approach including radiotherapy may be used. This may involve either preoperative, postoperative or radical radiotherapy alone (Hershman et al, 2003). Thorough preoperative assessment is mandatory before using local treatment techniques for curative resection (Turner and Saclarides, 2008). Selection and exclusion criteria for local treatment of early rectal cancer are summarized in *Tables 1* and *2*. Finally, transanal endoscopic microsurgery can be used for palliative rather than curative use in more advanced tumours (Middleton et al, 2005).

Complications

The overall complication rate of transanal endoscopic microsurgery for benign and for malignant lesions has been reported to range from 6% to 31% (Lezoche et al, 1998, 2005a; Dafnis et al, 2004; Endreseth et al, 2005; Floyd and Saclarides, 2006; Stipa et al, 2006; Baatrup et al, 2007; Maslekar et al, 2007; Guerrieri et al, 2008; Kreissler-Haag et al, 2008; Serra-Aracil et al, 2008; Bach et al, 2009). Perioperative complications include haemorrhage and peritoneal entry, which may require conversion to laparotomy or even a stoma. The intraperitoneal perforation rate varies from 0% to 9% (Dafnis et al, 2004; Endreseth et al, 2005; Ganai et al, 2006; Stipa et al, 2006; Guerrieri et al, 2008; Bach et al, 2009) although this can usually be salvaged by transanal endoscopic microsurgery.

Postoperative complications may be significantly greater after neoadjuvant chemoradiation and include pain, wound dehiscence and readmission (Lezoche et al, 2005a; Perez et al, 2011). Pelvic sepsis, which occurs in about 3% of cases, is more common in lesions within 2 cm of the dentate line. Use of the harmonic scalpel reduces the complication rate compared to diathermy (Bignell et al, 2010). Lesions located on the lateral rectal wall may have an increased risk of bleeding and high overall complication rate when tumours are >2 cm in diameter and >8 cm from the anal verge (Kreissler-Haag et al, 2008).

Table 1. Selection criteria for suitability of local treatment

Mobile non-ulcerative exophytic tumours <10 cm from anal verge (clinical assessment: digital rectal examination)
Tumour <3 cm or occupying less than one third of the circumference (endoscopic assessment)
T1, Tx, N0 or M0 (radiological assessment: endorectal ultrasound or magnetic resonance imaging)
Well to moderately well differential tumours (histological assessment)
No lymphovascular or venous invasion (histological assessment)
Patient must agree to long-term follow up

Tx: Primary tumour cannot be assessed; T1: Tumour invades submucosa; T3: Tumour invades through muscularis propria into subserosa or into non-peritonealized pericolic or perirectal tissues; T4: Tumour directly invades other organs or structures (T4a), Tumour perforates the visceral peritoneum (T4b); N0: No regional lymph node metastasis; M0: No distant metastases. Criteria based on clinical practice of Professor AS Myint and Mr MJ Hershman

Table 2. Exclusion criteria for local treatment

Poorly differentiated tumour
T3/T4 tumour
Clinically tethered or fixed tumour of any radiological T stage
Deeply infiltrative ulcerative tumour

T3: Tumour invades through muscularis propria into subserosa or into non-peritonealized pericolic or perirectal tissues; T4: Tumour directly invades other organs or structures (T4a), Tumour perforates the visceral peritoneum (T4b). Criteria based on clinical practice of Professor AS Myint and Mr MJ Hershman

Recurrence

The adenoma recurrence rate following transanal endoscopic microsurgery ranges from 0% to 16% (Dafnis et al, 2004; Endreseth et al, 2005; Guerrieri et al, 2008). The recurrence rate following transanal endoscopic microsurgery for T1 lesions ranges from 0% to 11% (Floyd and Saclarides, 2006; Stipa et al, 2006; Maslekar et al, 2007; Lezoche et al, 1998, 2008). Several studies comparing transanal endoscopic microsurgery and radical surgery for T1 cancers demonstrated no statistically significant difference in recurrence rate or survival for transanal endoscopic microsurgery compared with radical surgery (Winde et al, 1996; Lezoche et al, 2005b; Zieren et al, 2007; Moore et al, 2008).

Transanal endoscopic operation

The transanal endoscopic operation (Stortz) is a newer simpler system which is becoming increasingly used. It does not use the three-dimensional optical system or continuous pressure monitoring and is less expensive than transanal endoscopic microsurgery instruments. Transanal endoscopic operation uses a shorter rectoscope (diameter 4 cm; working length 7.5–15 cm) through which standard laparoscopic equipment including the harmonic scalpel can be introduced (*Figures 1a* and *b*).

Early results are encouraging: Lirici et al (2003) reported that operating time was reduced by approximately 40 minutes when the two-dimensional (transanal endoscopic operation) was compared to the three-dimensional (transanal endoscopic microsurgery) technique. Another prospective study (Nieuwenhuis et al, 2009) reported that resection of tumours up to 15 cm from the anal verge had results comparable with those using the three-dimensional transanal endoscopic microsurgery apparatus. In addition, they reported improved ergonomics and reduced expense with the transanal endoscopic operation.

There was no operative mortality or intraoperative complication. With a median follow up of 15 months (range 1–35 months), two local and no distant recurrences occurred. The results appear to be comparable with the results for patients with the same lesions treated using different instruments (Chiavellati et al, 1994; Neary et al, 2003; Whiteford, 2007).

A prospective study by Maslekar et al (2006) showed that transanal endoscopic surgery is cost effective compared with open resection of early rectal cancer (Lirici et al, 2003; Nastro et al, 2005). The use of standard laparoscopic equipment reduces the costs even more because there are fewer costs for the equipment than for the three-dimensional system.

Other transanal techniques

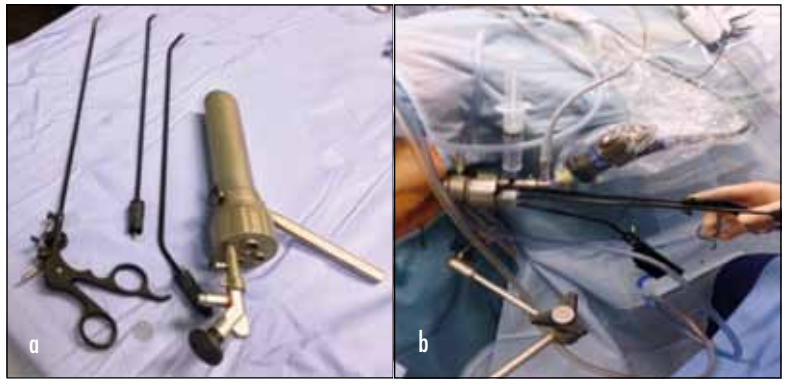
A number of newer techniques based on a single port introduced into the anus have more recently become available. Transanal minimal invasive surgery is a hybrid between transanal endoscopic microsurgery and single-port laparoscopy for the excision of both benign and malignant lesions of the rectum (Atallah et al, 2010). To perform transanal minimal invasive surgery, a single-incision laparoscopic surgery port is introduced into the anal canal by applying steady manual pressure. Once seated in position, endoscopic access to the rectal vault is gained and pneumorectum is established. With this access, ordinary laparoscopic instruments, including graspers, thermal energy devices and needle drives, are used to perform the transanal excisions. This GelPOINT path transanal access platform is specially designed for multiple instruments or camera access through the anus for rectal procedures such as transanal endoscopic microsurgery, flap revision and fistula repair. Transanal minimal invasive surgery appears to be a feasible and safe treatment option because set up time is far less than conventional transanal endoscopic microsurgery surgery.

A similar technique is the use of a single incision laparoscopic surgery port called transanal endoscopic video-assisted excision (Ragupathi et al, 2012) and another is the use of a modified surgical glove instead of the single incision laparoscopic surgery port.

Conclusions

Management of low rectal tumours, including benign adenomas and carefully selected early T1 cancers, has been revolutionized by the introduction of transanal endo-

Figure 1. a. Transanal endoscopic operation instruments. b. Transanal endoscopic operation instruments in situ.



KEY POINTS

- Conventional management of rectal tumours is by radical surgery, which has a significant mortality and morbidity.
- Early rectal cancer may be managed in selected cases by local excision using minimally invasive transanal techniques.
- Transanal endoscopic microsurgery and related techniques have a low mortality and morbidity, and minimal risk of stoma formation.
- Local excision surgery has a higher risk of local tumour recurrence, but this can be managed by salvage radical surgery.
- Multimodality treatment combining transanal excision with radiotherapy (external beam and/or Papillon) and chemotherapy is giving promising results.

scopic microsurgery. Newer techniques such as transanal endoscopic operation and transanal minimal invasive surgery have quicker set up time and lower cost. **BJHM**

Conflict of interest: none.

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