The Royal College of Surgeons of England

SURGICAL ONCOLOGY

Ann R Coll Surg Engl 2005; **87**: 432–436
doi 10.1308/003588405X51083

Transanal endoscopic microsurgery – impact on the practice of a colorectal surgeon in a district general hospital

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ABSTRACT

INTRODUCTION The objective was to assess the impact on the management of colorectal patients treated in a district general hospital within the first year after the introduction of transanal endoscopic microsurgery (TEM).

PATIENTS AND METHODS Data were collected for consecutive unselected patients who underwent TEM. Comparative data were derived from a matched group of patients who underwent anterior resection, peranal procedures (PAR) or transanal resection (TAR) in this unit.

RESULTS Twenty-two patients underwent TEM (11 men and 11 women; aged, 29–87 years; median, 75 years). Eighteen patients had a pre-operative diagnosis of benign rectal neoplasms; three were found to have invasive carcinoma, which might have been missed during TAR. Four patients had a pre-operative diagnosis of rectal cancer and TEM provided local tumour control in three cases. The operating time ranged between 20–150 min (mean, 65 min; median, 57 min). Hospital stay ranged between 0–10 days (mean, 3.7 days; median, 3 days), with a total of 97 in-patient days for the entire group of patients. Twenty-four operations were performed (22 TEM and two salvage anterior resections), with an estimated cost of £1544 for consumables used. Alternative treatments in the absence of TEM were considered to involve 10 anterior resections, 5 closures of ileostomy, 30 TAR procedures and one PAR procedure, with an estimated 306 days of in-patient admission, 46 operations and £6245 spent on consumables.

CONCLUSIONS Availability of TEM allows more efficient treatment for a significant number of patients with rectal tumours. The cost of the equipment is offset by a significant decrease in the length of in-patient admissions.

KEYWORDS

Transanal endoscopic microsurgery (TEM) – Financial implications

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Management of rectal neoplasms represents a frequent problem in the practice of a colorectal surgeon. In recent years, therapeutic options have been changing and expanding, with some differences in the availability of each technique between centres.

For rectal cancers, total mesorectal excision is the gold standard for curative resection in patients with acceptable anaesthetic risk. Such operation caries substantial morbidity and mortality and may be inappropriate for frail or older patients, in whom local excision under direct vision by the peranal 'Parkes' approach (PAR) has historically offered a potential compromise for tumours in the lower third of the rectum. Transanal resection (TAR) using a resectoscope to debulk or ablate tumours can also be used as a palliative operation.

The 'classical' management of benign rectal tumours not suitable for flexible endoscopic excision includes both techniques – PAR and TAR. The use of PAR is limited by the height and location of the tumour as well as restriction on access in some patients. Although the range and access provided by TAR is better, the technique may not provide adequate local control and does not produce a single specimen for histological assessment. This limits tumour assessment and frequently leads to local recurrence.

Transanal endoscopic microsurgery (TEM) provides an answer to many of the limitations of both PAR and TAR. Originally described by Buess *et al.*,[1,2] TEM has been used in both the UK and US for rectal adenomata and early cancers (T1–T2),[3,4] but it is not widely available in colorectal practice outside tertiary referral centres. Its advantages are well described and include direct stereoscopic vision, access to lesions up to the upper third of the rectum (especially posteriorly) and the production of a single, complete histological specimen. Although the technique is associated with a

Table 1 Pathological and postoperative data of TEM patients

Index no.	preTEM treatment	Pre-op histology	Intention	Postoperative histology	Postoperative salvage procedures	Alternative management
1	Incomplete polypectomy	Tubulovillous adenoma	For cure	Tubulovillous adenoma		Low anterior resection
2	Incomplete polypectomy	Tubulovillous adenoma	For cure	Tubulovillous adenoma		TAR (n)
3	Incomplete polypectomy	Villous with dysplasia	For cure	Tubulovillous adenoma		PAR
4	Nil	Tubulovillous adenoma	For cure	Carcinoma	Declined	TAR (n)
5	Nil	Tubulovillous adenoma	For cure	Tubulovillous adenoma		High anterior resection
6	Nil	Tubulovillous adenoma	For cure	Tubulovillous adenoma		TAR (n)
7	PAR	Tubulovillous adenoma	For cure	Tubulovillous adenoma		TAR (n)
8	Incomplete polypectomy	Tubulovillous adenoma	For cure	Tubulovillous adenoma		TAR (n)
9	Incomplete polypectomy	Tubulovillous adenoma	For cure	Tubulovillous adenoma		High anterior resection
10	PAR	Tubulovillous adenoma	For cure	Tubulovillous adenoma		TAR (n)
11	Incomplete polypectomy	Tubulovillous adenoma	For cure	Tubulovillous adenoma		High anterior resection
12	PAR	Tubulovillous adenoma	For cure	Tubulovillous adenoma		Low anterior resection
13	PAR	Tubulovillous adenoma	For cure	Tubulovillous adenoma		TAR (n)
14	Nil	Tubulovillous adenoma	For cure	Tubulovillous adenoma		TAR (n)
15	Nil	Tubulovillous adenoma	For cure	Tubulovillous adenoma		Ultralow anterior resection
16	PAR	Tubulovillous adenoma	For cure	carcinoma	Declined	TAR (n)
17	Nil	Tubulovillous adenoma	For cure	Tubulovillous adenoma		TAR (n)
18	Nil	Tubulovillous adenoma	For cure	Carcinoma	High anterior resection	high anterior resection
19	PAR	Invasive carcinoma	For compromise	Carcinoma		Low anterior resection
20	Nil	Suspicious of invasion	For compromise	Carcinoma	Declined	High anterior resection
21	Nil	Invasive carcinoma	For	Carcinoma	Low anterior resection	Low anterior resection
22	Polypectomy	Invasive carcinoma	For cure	Carcinoma		Follow-up

learning curve, a significant limitation to its wider use remains the cost of the equipment. It is arguable, therefore, that the technique is offered to fewer patients than might benefit from it.

Within the current healthcare environment, the logistic and cost implications of a procedure or technique may have just as great an impact on its adoption as the perceived clinical benefits to patients. This study was, therefore, undertaken in order to assess the impact on the management of colorectal patients treated in a district general hospital within the first year after the introduction of TEM. We aimed to assess the likely change in the type of treatment offered as well as the resource implications in terms of direct costs and in-patient time.

Patients and Methods

Data collection

A database was created by prospective collection of demographic, clinical and operative information on all patients treated in our unit. During each admission, POSSUM data, operative data (surgeon, duration, position of patient, tumour position and distance from anal verge), peri-operative complications and follow-up data were collected using standardised proformas. Data are presented for the first 22 consecutive unselected patients who underwent TEM in the first year after introduction of the technique in our centre.

Comparative data were derived from a group of patients who were matched for age, sex and ASA class. In some cases, controls were patients who underwent anterior resection with or without ileostomy formation and closure during the same period. For data regarding PAR and TAR, a mix of historical and contemporaneous controls were used also matched for age, sex and ASA class. Two controls were used for every TEM patient.

Equipment

A conventional Wolf® TEM operating set was used, including stereoscopic operating microscope and 150–250 mm operating proctoscopes (R Wolf UK Ltd, Wimbledon, UK). An Erbe® ICC 350 unit provided surgical diathermy for cutting and coagulation (Erbe Medical UK Ltd, Leeds, UK).

Surgical technique

All patients had prophylactic antibiotics (5-day course of oral levofloxacin 500 mg bd and metronidazole 400 mg tds) and thromboprophylaxis. Patient position on the operating table was decided using information provided by rigid proctoscopy in the anaesthetic room. Multiple positions were used for larger lesions. All patients had surgery under general anaesthesia with muscle relaxation. A conventional operative technique was employed with the dissection completed in a plane to ensure complete excision of the tumour at the deep margin. For carcinomas diagnosed on pre-operative transrectal ultrasound or biopsy, a full thickness excision was always used. Full or deep partial thickness excisions were sutured closed.

Assumptions made

In the preparation of the data, several assumptions had to be made.

CHOICE OF OPERATION

For the purpose of comparison, it was decided for each individual patient what the most likely alternative surgical treatment would have been offered in the absence of the availability of TEM. This decision was made by the senior author (NB) by reviewing clinical notes, in particular tumour height, size and location and patient's age, co-morbidity, body habitus and likely motivation for resection. For pre-operatively diagnosed benign lesions, a general policy of definitive resection would only have been followed for younger patients, with TAR deemed the most likely alternative for older patients. For pre-operatively diagnosed carcinomas, gold standard open resection was considered to be the treatment of choice that would have been offered unless the patient was medically unfit. This process was potentially biased by the involvement of the same author and failed to take into account whether patients would necessarily accept the alternative recommended treatment. Despite these limitations, it was considered that individual decisions reflect the current standard of colorectal practice in the UK.

REPEATED PROCEDURES

An important assumption for the comparison of TEM to other treatments is the likelihood of repeat procedures being necessary. It was assumed that patients who would have been offered TAR would have undergone three further TAR procedures. This was calculated from the mode of the data from the historical controls of patients having undergone multiple TAR procedures for similar pathology. This could have been biased by the use of data derived from historical rather than contemporary surgical practice but was felt to represent a reasonable assessment of the likely risk of recurrence after TAR.

Cost calculations

All operating room consumables were priced according to actual local costs (price at the point of use). For an anterior resection, the cost of stapling guns (GIA60, TX30, TX30 reload, CDH29/33), catheters, sutures and epidural catheters was estimated to be £563. For TAR, the costs of the irrigation system was estimated at £19. For PAR, £45 were estimated to be the cost of single use retractor and sutures. For TEM, the cost of silver clips and sutures used was £19. The capital cost of the TEM equipment (£32,250) excluded the cost of the diathermy unit, which was already available.

It was assumed that basic anaesthetic, theatre and sterilisation costs are the same for any operative procedure.

Results

Clinical details

In the first 12 months after the appointment of a new colorectal surgeon with a special interest in the technique, 22 patients underwent TEM. There were 11 men and 11 women, aged 29–87 years (mean, 70.6 years; median, 75 years). The pre-operative diagnosis was benign rectal neoplasms in 18 patients and rectal cancer in 4 patients (Table 1). Follow-up was by 3-monthly flexible sigmoidoscopy and, when necessary, biopsy. The duration of follow-up was a median of 13.5 months (range, 7–16 months). No recurrences were diagnosed during the period of study.

EIGHTEEN PATIENTS WITH PRE-OPERATIVE DIAGNOSIS OF ADENOMA

Seven patients had no previous treatment, six had previous incomplete polypectomies and five patients presented with recurrence after previous PAR procedures. Three patients were found to have invasive carcinoma present in the specimen. One proceeded to anterior resection (index no. 18) and two declined further treatment, having already had local control achieved (index nos 4 and 16). These cancers would have been missed during TAR. No patients required repeat TEM during the period of follow-up.

FOUR PATIENTS WITH A PRE-OPERATIVE DIAGNOSIS OF ADENOCARCINOMA

Two patients had TEM as a compromise operation that provided local tumour control. In one, ultralow anterior resection was considered inappropriate (index no. 19) and one declined salvage anterior resection but agreed to a course of adjuvant pelvic radiotherapy (index no. 20). One patient (index no. 21) had a more advanced tumour stage than assessed on pre-operative transrectal ultrasound and proceeded to a salvage anterior resection. One patient (index no. 22) with a pT1 Haggett level 3 polyp cancer diagnosed after endoscopic polypectomy, declined ultralow anterior resection and underwent TEM excision of the polyp base to guarantee complete local excision.

Technical details

Lesions were situated between 2 and 19 cm from the anal verge (mean, 8.4 cm; median, 6 cm). Total blood loss was minimal (0–30 ml; mean, 10 ml). The operating time was 20–150 min (mean, 65 min; median, 57 min), with no significant change during the interval studied. Hospital stay varied between 0–10 days (mean, 3.7 days; median, 3 days). This reduced during the period of the study as the technique became more familiar to the ward and junior medical staff.

In-patient stay

For the entire group of patients, a total of 82 days as in-patients were used for TEM procedures. In addition, the two salvage procedures added a further 15 days of in-patient admission.

The median length of admission for historical controls was calculated to be 10 days for anterior resection (n = 32; range, 6–57 days), 4 days for closure of ileostomy (n = 12; range, 3–15 days), 3 days for TAR (n = 15; range, 1–8 days) and 7 days for PAR (n = 7; range, 1–8 days).

Using the above figures, it was estimated that alternative treatments in the absence of TEM would have required a total of 306 days of in-patient admission.

Alternative management

Based on individual patient details it was estimated what would have been the ideal treatment offered in the absence of TEM (Table 1). Overall, in the absence of TEM the management of this group of 22 patients could have involved 10 anterior resections, 5 closure of ileostomies, 30 TAR procedures (three procedures for each 10 patients) and one PAR.

Costs incurred

The 22 patients undergoing TEM spent a total of 97 days as in-patients. They underwent 24 operating sessions (22 TEM and two salvage anterior resections), during which the cost of consumables was estimated to be £1544.

The alternative management in the absence of TEM would have needed a total of 46 theatre sessions, 306 days' in-patient admissions and approximately £6245 spent on consumables.

It appears, therefore, that over a 1-year period, the use of TEM allowed savings of 210 days' in-patient admissions, 22 theatre sessions and £3700. In the absence of an estimate of the costs for 1-day in-patient admission, exact cost comparisons are difficult but it can anticipated that the cost of purchasing the TEM equipment could be 'reimbursed' over several years (Table 2).

Discussion

Transanal endoscopic microsurgery (TEM) is not a new procedure and data showing the excellent outcomes following the procedure for both benign and malignant rectal neoplasia have been previously published.[3–11] One possible reason why TEM may not be as widely used in the UK as it might be could be the capital cost of the equipment; this may have as great an

Table 1 Comparison of theatre sessions and in-patient admission between TEM and 'alternative management'

	Theatre sessions	In-patient admission
TEM patients	22 TEM + 2 salvage anterior resections	**97 days**
'Alternative management' in the absence of TEM	10 anterior resections (5 high, 4 low, 1 ultralow)	143 days
	5 closure of ileostomy	26 days
	10 TAR (x 3)	132 days
	1 PAR	13 days
	Total	**306 days**

impact on the introduction of a new procedure as any perceived clinical benefits. The number of centres providing the technique and training in its use may also limit its wider uptake. This paper describes the practice in a district general hospital within the first year after the introduction of TEM with the appointment of a coloproctologist with an interest in TEM. Although not a tertiary referral centre, the unit maintains a good referral pattern and with the concentration of cases potentially suitable for TEM in the hands of one surgeon within the first year, TEM was considered appropriate treatment in 22 patients. Over 200 operations for colorectal cancer were performed in the same period of time.

This study was undertaken to assess the practical and financial implications of the technique. It is felt that TEM offers the advantage of a single, usually curative, procedure for patients with benign conditions (tubullovillous adenomas) avoiding possible repeated transanal resections or ablations for mid-to-upper rectal lesions and offers an easier and potentially more reliable procedure than PAR for lower rectal benign lesions. In common with current guidelines, TEM for potential cure is restricted to patients with early rectal cancers (uT1–uT2) for whom a low anterior resection is either not appropriate or associated with considerable morbidity and mortality. We routinely consider the addition of postoperative adjuvant radiotherapy or salvage surgery in those patients where it is considered an oncological compromise (pT2 and pT3). Although the follow-up period for this group of patients is limited, the initial data are encouraging and seem to reflect other published data.[5,7,10,11]

It is important to note that 4 out of 18 patients with a preoperative diagnosis of benign rectal lesions were found to have a carcinoma on the histological diagnosis of the intact specimen. This diagnosis might have been missed if the pathologist had received only small fragments removed during TAR procedure. This observation has implications for the accurate diagnosis and appropriate management for a considerable proportion of patients treated in a colorectal unit.

Several assumptions were made at the beginning of this study based on the premise of needing to offer the alternative 'next best' treatment. Although referral of these patients could have been made to other centres offering TEM, the population served by our Trust is such that we believe the use of TEM is justified for our population alone and frequent referrals to more distant centres not only has implications for the Trust but also goes against the principle of offering the most appropriate treatment locally where possible.

The comparison with the alternative treatment that was considered would have been recommended in the absence of TEM is potentially biased and the problems of this comparison have been acknowledged and discussed above. This is an unavoidable feature of the study. It is impossible to determine whether each individual patient would have accepted the alternative management considered by us to be appropriate and necessary in the absence of TEM. The exact figures quoted for hospital stay and costs incurred in the absence of TEM are, therefore, open to criticism. They show, however, that introduction of TEM may be beneficial not only on clinical criteria but also on financial criteria by decreasing the overall cost of care.

Calculating cost implications for each operative procedure and for each hospital admission is a difficult task. The initial cost of the equipment is a considerable strain on the budget of any operating department. However, the data seem to suggest that savings made within several years could offset this investment.

Conclusions

Availability of TEM in a district general hospital allows more efficient treatment for a significant number of patients with rectal tumours. The clinical benefit for the care of individual patients is generated with additional cost advantages that could become apparent within the first few years after the introduction of the technique in a district general hospital with a significant colorectal practice.

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