

Effect of the introduction of total mesorectal excision for the treatment of rectal cancer

E. CARLSEN, E. SCHLICHTING, I. GULDVOG, E. JOHNSON and R. J. HEALD*

Surgical Department, Ullevaal Hospital, University of Oslo, Oslo, Norway and *Colorectal Research Unit, Basingstoke District Hospital, Basingstoke, UK

Correspondence to: Dr E. Carlsen, Surgical Department, Ullevaal Hospital, University of Oslo, 0407 Oslo, Norway

Background Total mesorectal excision (TME) has been reported to reduce local recurrence and improve survival rates in patients with rectal carcinoma. This paper reports the problems that have arisen with the introduction of this new surgical technique.

Methods This was a prospective study of two consecutive groups of patients: one who underwent TME ($n=76$) and one who did not (non-TME, $n=76$).

Results Postoperative mortality rate in the non-TME and TME group was 5 and 7 per cent respectively, and the rate of anastomotic failure was 8 and 16 per cent respectively. Anastomotic leaks in TME patients were located in the mid and lower rectum. TME patients with anastomotic failure had lower anastomoses and a longer duration of operation than non-TME patients. Intraoperative problems were encountered in 71 per cent of the failures. All TME patients who had a leak required reoperation compared with 25 per cent of non-TME patients. TME patients without postoperative complications stayed significantly longer in hospital than non-TME patients.

Conclusion Anastomotic dehiscence increased after introduction of the TME technique but this improved with experience.

Rectal cancer in Norway has increased from 6.5 per 100 000 population in 1953 to 15 per 100 000 in 1992, and is expected to reach 21.5 by 2012¹. The reported incidence of local recurrence after radical resection varies widely between 2.6 and 32 per cent². In a Norwegian survey carried out between 1986 and 1988, Norstein *et al.*³ reported a local recurrence rate of 29 per cent in patients younger than 75 years after a median observation of 60 months. Only 38 per cent of patients could have a second radical resection. Radiotherapy, before and after surgery, has been shown to reduce local recurrence, but has no effect on 5-year survival rate⁴. Postoperative irradiation in combination with chemotherapy decreases local recurrence and increases survival^{5–7}, and is now standard adjuvant treatment for rectal cancer stages II and III in North America.

Total mesorectal excision (TME) was introduced as a new surgical technique for rectal cancer. Local recurrence rate after 5 and 10 years is reported to be less than 5 per cent in curative cases and 5-year survival rate is 80 per cent. This is much better than any comparable studies, even with adjuvant therapy^{8–10}.

In 1994 the authors introduced TME for rectal cancer in Ullevaal Hospital. The aim of this report is to audit the introduction of a new surgical technique with regard to changes in various operative parameters, postoperative morbidity and mortality.

Patients and methods

Two groups of patients undergoing surgery for rectal carcinoma were prospectively compared (Table 1). Seventy-six consecutive patients (non-TME) had surgery between January 1992 and December 1993 before TME was introduced, using standard

techniques¹¹. The operations were performed by both trainees and senior surgeons.

In 1994 two senior surgeons were trained (by R.J.H.) in TME and, thereafter, participated in every subsequent operation to ensure proper technique¹². Between January 1994 and December 1995, 76 consecutive patients underwent operation using TME. Until February 1995 a decision was made whether or not to use a diverting loop ileostomy. After that, faecal diversion became routine if the anastomosis was located below 13 cm.

In this paper the site of rectal cancer was defined according to International Guidelines for Cancer Registrars and The Cancer Registry¹ of Norway; i.e. 7 cm or less from the anal verge, low rectum; over 7 cm but less than or equal to 12 cm, mid rectum; over 12 cm but less than or equal to 20 cm, upper rectum.

All patients received antithrombotic therapy before surgery (Macrodex; Medisan AB, Uppsala, Sweden) and antibiotic prophylaxis (doxycyclin 400 mg and metronidazole 1500 mg intravenously before operation).

Table 1 Clinical details

	Non-TME	TME
No. of patients	76	76
Sex ratio (men:women)	40:36	34:42
Mean (range) age (years)	69.6 (36–91)	67.9 (37–90)
Dukes stage		
A	13 (17)	18 (24)
B	30 (39)	30 (39)
C	16 (21)	12 (16)
'D'	9 (12)	8 (11)
Miscellaneous*	8 (11)	8 (11)
Abdominoperineal resection	22 (29)	28 (37)
Low anterior resection	53 (70)	44 (58)
Hartmann's operation	1 (1)	4 (5)

Values in parentheses are percentages. *Miscellaneous diagnoses included ten adenomatous lesions (three total mesorectal excision (TME), seven non-TME), four villous adenomas presumed malignant (three TME, one non-TME) and two anal carcinomas (both TME)

Statistical analysis

Differences between the two groups were measured by contingency tables (χ^2 test). Comparisons with reference to continuous parameters were carried out using the Student's *t* test. Statistical significance was accepted at $P \leq 0.05$.

Results

The distance from anal verge to rectal tumour was lower in patients who had undergone abdominoperineal resection (APR) who had TME than in non-TME patients (3.1 *versus* 5.4 cm, $P = 0.004$). There was no difference in this distance in patients who had low anterior resection (LAR) (non-TME 11.6 cm; TME 11.4 cm).

The distance from the anal verge to the anastomosis in patients who had LAR was significantly less in the TME group (6 cm) than in the non-TME group (7.1 cm) ($P < 0.03$).

Operative details

TME operations were shorter than non-TME operations (mean 176 *versus* 186 min), both for APR (mean 188 min for TME *versus* 211 min for non-TME) and LAR (mean 169 min for TME *versus* 176 min for non-TME).

There were no significant differences in mean blood loss between non-TME and TME operations either after APR (1213 *versus* 1269 ml) or LAR (887 *versus* 973 ml).

Intraoperative perforation of the rectum was evident in 29 per cent of non-TME patients and 16 per cent of TME patients. Perforations were more common during APR (non-TME 59 per cent *versus* TME 32 per cent) than LAR (non-TME 13 per cent *versus* TME 7 per cent). All APR perforations were located in the anal canal and only occurred in low-placed tumours in the LAR group (non-TME 8 cm *versus* TME 3.8 cm).

Complications

There were no significant differences in the number of patients with complications (Table 2), or in the number of complications per patient (non-TME 2.18 *versus* TME 2.73). In-hospital mortality rates were 5 and 7 per cent in the non-TME and TME groups respectively. Anastomotic dehiscence (non-TME one; TME three) and cardiopulmonary complications (non-TME three; TME two) were the causes of postoperative death.

Table 2 Complications

	Non-TME	TME
Complications		
Total	34 (45)	40 (53)
APR	11 (50)	20 (71)
LAR	23 (43)	19 (43)
Mortality		
Total	4 (5)	5 (7)
APR	1 (5)	0
LAR	3 (6)	4 (9)
Anastomotic dehiscence		
Reoperation required	1 (2)	7 (16)*
Level of anastomosis (cm)		
With anastomotic dehiscence	6.8	4.7
Without anastomotic dehiscence	7.4	5.9

Values in parentheses are percentages. TME, total mesorectal excision; APR, abdominoperineal excision of the rectum; LAR, low anterior resection. * $P = 0.05$, χ^2 test

Table 3 Number of patients with complications according to the distance of the tumour from the anal verge

	Non-TME (n = 53)	TME (n = 44)
Upper rectum	6 (30)	6 (40)
Mid rectum	12 (46)	6 (33)
Lower rectum	4 (57)	8 (73)

Values in parentheses are percentages. TME, total mesorectal excision

There were more patients who underwent APR with postoperative complications in the TME than in the non-TME group (Table 2). Patients with lower tumours had more postoperative complications than patients with higher tumours (Table 3).

All patients in the TME group with leaks underwent reoperation compared to only one in the non-TME group (Table 2). Mean time from operation until the leak was diagnosed was 8 (range 4–15) days in the TME group, and the mean time from first symptom of leak to reoperation was 1 day (range 6–48 h). Three of the patients with TME and a leak died.

TME patients without faecal diversion had a higher incidence of anastomotic leakage (25 per cent) than those defunctioned (8 per cent). From February 1995 faecal diversion became routine after LAR and since then there has been no leak in 31 further operations (Fig. 1). The anastomoses were lower in patients with leaks in the non-TME as well as in the TME group (Table 2). Tumours in TME patients with a leak were located either in the low ($n = 4$) or mid ($n = 3$) rectum.

Operating time in TME patients with anastomotic failure was significantly longer than in patients without (193 *versus* 164 min, $P = 0.035$) and it was also longer than in patients with other complications (193 *versus* 177 min). This could be explained by significant intraoperative problems in five of the seven patients with an anastomotic leak.

There were no correlations between anastomotic failure and ligation of the ascending left colic artery, mobilization of the splenic flexure, distribution of American Association of Anesthesiologists (ASA) scores or

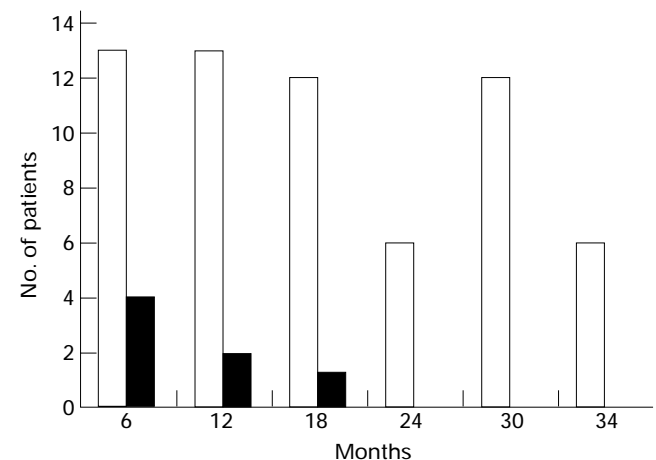


Fig. 1 Occurrence of anastomotic dehiscence in low anterior resection (LAR) with total mesorectal excision during 34 months. □, LAR; ■, leak

additional diseases (two had cardiac problems, one had cardiac problems and diabetes). The seven anastomotic failures were equally distributed among four surgeons.

Hartmann's operation

Two patients who had Hartmann's operation and TME developed complications. One patient died on the 6th day after operation from a cardiac arrest.

ASA score and complications

There was no difference in the distribution of ASA scores between non-TME and TME patients (data not shown). In the non-TME group there was an increase in complications with increasing ASA score (ASA I, 25 per cent; ASA III, 78 per cent). This was not seen in the TME group (ASA I, 54 per cent; ASA III, 59 per cent).

Postoperative stay in hospital

Patients with postoperative complications stayed significantly longer in hospital than those without (non-TME, 21.7 versus 9.4 days, $P < 0.001$; TME, 19.2 versus 12.9 days, $P = 0.002$). TME patients without complications stayed significantly longer in hospital than non-TME patients (TME, 12.0 days; non-TME, 9.4 days, $P < 0.001$).

Discussion

In patients with primary rectal cancer the rectum and mesorectum is increasingly regarded as a single unit of regional disease to be resected *en bloc* by TME¹⁰⁻¹³. The introduction of a new operative technique may, however, influence postoperative morbidity and mortality.

As reported by others^{14,15}, postoperative complications occurred in 50 per cent of both groups. The number of complications per TME patient was higher than that per non-TME patient. This may be explained by more anastomotic failures after TME. As also reported elsewhere¹⁶, complications were more frequent after APR than LAR in patients with low tumours. Presently, the authors perform a partial mesorectal excision for tumours above the peritoneal reflection, taking 5 cm of the rectum and mesorectum distal to the tumour.

The postoperative mortality rate was in accordance with some reports^{8,14}, but higher than in others^{13,15}. One explanation may be that patients in this series were older. Anastomotic leakage was the most important cause of postoperative death in LAR patients who had TME¹⁵⁻¹⁸. Leaks after TME occurred between the 4th and 15th days after operation and, with one exception, all were diagnosed and operated on within 24 h of the onset of symptoms. Time to operation in those who died was even shorter (between 12 and 24 h). It seems unlikely that a routine contrast enema could have quickened diagnosis and thus reduced mortality.

The advantage of a defunctioning stoma has been reported by Karanjia *et al.*¹⁸. In the present study no clinically significant anastomotic leak has been seen in 31 consecutive LAR operations since faecal diversion became routine. All previous leaks occurred in patients with low anastomoses, and tumours located either in the mid or lower rectum¹⁷.

The longer duration of operation, and observation of intraoperative incidents in five of seven TME patients who leaked, strengthens the hypothesis of a relationship between surgical problems and anastomotic dehiscence. There was no correlation between leaks and ligation of the left colic artery or mobilization of the splenic flexure^{17,19}.

Use of the TME technique has been reported to decrease the number of APRs⁸, but the opposite was observed. The distance from tumour to anal verge was significantly less in the TME group, indicating that the reason for more APRs was the referral of a group of patients with lower tumours rather than a change in technique. A significant reduction in the distance from the anal verge to the anastomosis was observed after LAR indicating a more complete removal of the distal mesorectum by TME.

TME usually increases the duration of operation^{13,14}, but there was an average reduction of 10 min in this study, probably because of the participation of an experienced surgeon at every operation.

Intraoperative perforation of the rectum may spill tumour cells and increase local recurrence²⁰⁻²². Changing operative technique to TME reduced the rate of intraoperative perforation. Most were seen during anal dissection in APR. All leaks during LAR were in patients with big tumours in the lower rectum.

Since 1996 patients with a perforation have received postoperative radiotherapy. Preoperative radiotherapy is an alternative for locally advanced tumours.

As expected, patients with postoperative complications had a significantly longer hospital stay in both groups. However, patients with LAR and TME stayed longer in hospital than patients without TME. This may be explained by the more extensive use of faecal diversion after TME and the necessary adaptation of the patients to the use of stomal bags.

On the introduction of a new surgical technique it is important to record all complications for continuous evaluation. This study has confirmed that the introduction of lower anastomoses with TME increases morbidity and mortality, though these problems can decrease with experience. The present rate of complications makes TME an acceptable risk for surgery of rectal cancer. Routine faecal diversion appears to offer protection against the complication of anastomotic dehiscence.

Acknowledgements

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