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Rectal Cancer: The Surgical Options

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The hypothesis is considered that the tissue block relevant to optimal cure encompasses the integral visceral mesentery of the hind gut, or mesorectum. Surgical technique can recreate the tissue planes around an intact globular specimen which must not be torn or the margin compromised. This emphasis on the "perfect tumour package" has reduced the local recurrence rates in a consecutive personal series of 333 rectal cancer operations to 4% in those operated upon for cure. If patients with metastases or residual disease at presentation are included, the figure increases to 7%. Introduction of selective pre-operative high dose radiotherapy (DXT) for locally unfavourable cancers has combined with further attention to surgical detail to achieve a 5-year follow-up period (January 1990–January 1995) without a single case of locally recurrent disease. Problems remain with healing of the ultra-low anastomosis.

Key words: total mesorectal excision, rectal cancer, local recurrence, cure
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INTRODUCTION

THE MOST important and exciting current developments in colorectal cancer management are coming from Europe. Professor Paul Hermanek's survey of rectal cancer outcomes in seven major German cities represents a truly seminal contribution. He has observed that individual surgeons vary in their outcomes from less than 10% local recurrence to more than 50% [1]. Hermanek also points to the knock-on effect on survival so that patients of the surgeon with a low local recurrence rate have an 80% chance of cure whilst those of the latter group have less than 40% "cures". This comes as a timely restatement of the surgeon variability originally observed by Fielding and colleagues in the U.K. [2].

It is, therefore, within the power of the surgeon to double the expectation of cure and to reduce by 5-fold or more the incidence of local recurrence. Professor Hermanek concludes with the careful deduction that the sum total of chemo- and radiotherapy improvement can be measured at approximately 20% on the most optimistic calculations whilst improvement in surgical techniques can expect to achieve up to 80% improvement. In no other cancer have such wide variations in outcome been observed by anyone. There is thus no more important issue in rectal cancer management than the question "What is it that the best surgeons are doing that the worst are failing to do?"; or "What determines success or failure?"

The surgical options range from the ruthlessly "radical" to the minimally mutilating. In the author's view, neither extreme is "optimal" in any sense and significant destruction of function — sexual, urinary or anal—is in no way necessary for optimal oncological outcomes.

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CHOICES OF OPERATIVE TECHNIQUE

At the beginning of this century, rectal cancer surgery carried both a high mortality and a near 100% recurrence rate. Miles developed his radical abdomino–perineal operation, removing the pelvic mesocolon, comprising "the zone of upward spread" in a combined abdominal and perineal approach [3]. In 1923, he could demonstrate the adequacy of this procedure which resulted in improvements in local recurrence to 29.5% of cases. The procedure became the "gold standard" in treatment for rectal cancer, up to 15 cm from the anal verge, throughout the following decades. This is remarkable in view of its mutilating character, its impact on urinary and sexual function and still considerable failure rate.

To improve local control, more extensive operations were advocated. However, local recurrence rate and survival did not improve significantly by either high ligation of the inferior mesenteric artery, or by more extended lateral pelvic lymphadenectomy [3–8].

Sphincter preservation by means of an anterior resection became a controversial item in the early 1950s. It was supposed adversely to affect local recurrence rates and was rejected by many for this reason. New technical developments, such as staplers, made restorative anterior resections possible in even the very low-lying lesions, and transanal local excision of selected cancers has met with success in some hands. The different surgical techniques actually practised are listed in Table 1. Since tumours involving the muscle coat of the bowel wall have 10–20% of involved nodes in the mesorectum, the role of local excision should probably be limited to those with T1 tumours, except perhaps in the very frail and the very old.

When Enker and Heald operated together on a patient, the two personal techniques ANSPSWD and TME proved to be virtually identical. This further reduces the current possible choices of operative techniques since 4 and 6 are the same. In view of the huge variations in outcomes from conventional AR and APE, it is urgent that a clear set of operative objectives be

Table 1. Operations in current practice

Operations	Abbreviation
Abdomino-perineal excision with permanent colostomy (Miles [3])	APE
Various conventional "anterior resections"	AR
Extended pelvic lymphadenectomies with or without sympathetic or parasympathetic nerve preservation (Moriya, Hojo, and others [7])	EPL
Autonomic nerve preserving pelvic sidewall dissection (Enker [8])	ANSPSWD
Local excision by transanal endoscopic microsurgery [9]	TEM
Total mesorectal excision with autonomic nerve preservation (Heald [10])	TME

Table 2. Choices of defined tissue block

Operation	Block
APE	Crude and imperfect margins due to "plane confusion" in synchronous combined procedure
TME	Whole mesorectum and "pedicle package" (embryologically and surgically defined planes)
EPL	Added outlying tissues and nodes — internal iliac, obturator, para-aortic etc.

laid down so as to standardise the technique and improve results. In particular, it is necessary to define the block of tissue to be removed and the operative accidents to be avoided. The choices for the block of tissue to be excised are listed in Table 2.

Although scientific data to underpin important operative detail are difficult to acquire, it is becoming increasingly clear that other operative objectives must also be defined and specific errors avoided. These concern mainly possible tearing of the specimen and contamination of the operative field with viable tumour cells, resulting from the listed accidents in Table 3.

The theoretical basis for practising this TME technique, the so called "TME hypothesis", comprises two rational but unproven suppositions [2, 3].

(i) The surgical planes between the integral visceral mesentery of the hind gut and the surrounding parietes provide a unique opportunity for defining a surgically achievable "tumour package".
(ii) By serendipity, the field of spread of rectal cancer is commonly limited to this package, i.e. the mesorectum. Its total removal encompasses virtually every tumour satellite except in cases which are already widely disseminated.

Table 3. Operative errors likely to compromise outcomes

Rupture or tearing of the specimen
Peeling across the tumour edges
Contamination of the operative field by viable tumour cells — intraluminal exfoliated cancer cells undoubtedly can implant to raw surfaces, and sealing of the cut bowel ends plus fastidious washout routines are as basic in cancer surgery as the washing of the surgeons' hands for a sterile operation

Table 4. Results of 333 consecutive personal rectal cancer operations 1978–1994

Category of case assessed at operation	Local recurrence (with or without distant spread) (%)	Overall recurrence or persistence of cancer anywhere (%)
Believed "curative" AR and APE (n = 261)	3 (0–7)	19 (17–25)
All cases excluding only those with metastases (n = 301)	6 (2–10)	25 (18–32)
All cases including those with metastases (n = 333)	6 (2–11)	31 (25–38)

Kaplan–Meier life table analysis. Figures at 5 years after operation. Mean follow-up time: 7 years. 95% confidence intervals in parentheses.

Even in cases where fixation to the pelvic walls has occurred, this is usually by inflammatory tissue due to progressive expansion against the rigid pelvis. Radiotherapy may have a role in reducing local recurrence in such cases [10, 11].

PATIENTS AND OUTCOME

The only way to test the hypothesis was the careful evaluation of all patients treated by TME. At the Colorectal Research Unit of the North Hampshire Hospital in Basingstoke, a prospective data collection was started in 1978. It comprised consecutive cases, without exclusion. All operations were performed by one surgeon, or under his direct supervision. The time varied from 3 to 6 h. A meticulous dissection was carried out to define the "tumour package", and special attention was paid to avoid circumferential margin "tearing".

The tumour-bearing bowel segment to be resected was sealed and copious intraluminal washouts below clamp or stapler to avoid tumour cell implantation were part of the standardised procedure. A temporary colostomy was fashioned in most patients, with tumours within 6 cm of the anal verge.

During the last 5 years, selected patients without metastases who were judged to have rigidly fixed or fistulating primary tumours, have received a long course of pre-operative radiotherapy, 50–55 Gy over 6 weeks, usually after a defunctioning colostomy was constructed. Only 12 cases have been managed in this way, and most of these so recently they cannot yet have influenced the life tables significantly. Again, only very recently have any patients received postoperative chemotherapy — selected because of severe "C" tumours with multiple nodes, in younger patients specifically requesting it. All cases have met the following criteria:

(i) one surgeon;
(ii) consecutive cases without exclusion;
(iii) 3–5 h of meticulous dissection to define the "tumour package";
(iv) specific avoidance of circumferential margin "tearing"; and
(v) sealing and washouts to avoid implantation.

A rigorous follow-up routine by a surgeon and a consultant oncologist, every 3 months for 2 years, every 6 months for 3 years and annually thereafter, was adhered to. Each visit included a clinical and pelvic examination by a consultant plus special

investigations including a carcino-embryonic antigen (CEA) test and various scans when relevant.

The last APE in the series (by February 1995) to be followed by local recurrence was performed 6 years ago and the last AR 14 months earlier, i.e. 7 years ago. There have been 126 further operations added to the ongoing follow-up audit already encompassing over 100 survivors with over 5 clear years without recurrent pelvic disease being detected. No patient who has completed pre-operative radiotherapy (DXT) and survived resection has been seen with pelvic recurrence. It is too early to present detailed data of the small numbers of patients receiving adjuvant therapy. A total of 13 patients only in the 17 year period did not undergo surgery because they were never fit enough to do so and these are excluded.

DISCUSSION

There are understandable reasons for scepticism about these figures which are so different from many that have been accepted as "normal", i.e. local recurrence rates of 15–45%. Many have pointed to the relatively small numbers and have confidently predicted that the figures will deteriorate with time. It appears that the reverse is true: either that they are improving slightly with better technique or that the selective use of high dose pre-operative radiotherapy has been beneficial. Indeed, a 5-year period with no local failures leads to the assertion that locally persistent or recurrent rectal carcinoma usually represents a failure in management and can largely be prevented.

Almost one-third of rectal cancer patients continue to die of the disease — half of these having metastases apparent at the time of surgery and the other half developing them during the follow-up period. In the area of sphincter conservation, however, the reduction of APE to less than 10% has carried a heavy penalty in terms of morbidity and anastomotic failure. Thus, on the favourable side, no oncological penalty was shown in reducing the margin to 1 cm (after fixation) plus the stapler doughnut [12].

Two of our previous papers have reported an 11% clinical leak rate plus a further 6% radiological leak rate [13, 14]. Furthermore, the permanent stoma rate in practice has been raised from the 9% APE rate by the addition of a further 5% of attempted but failed sphincter preservations [14]. Temporary defunctioning plus the use of the short colon pouch together with improved haemostasis, stapling techniques, and more precise pelvic dissection can be expected to conquer this problem by the end of the century.

During recent years, some remarkable and probably unique developments have occurred in the field of international co-operation in the development of surgical technique. Two examples are the initiatives by Prof. CJH v de Velde from the Surgical Department of Leiden University, The Netherlands. These resulted in the active on-site participation of Professor M. Sasako from the National Cancer Centre Hospital in Tokyo, to teach Japanese-style gastric cancer treatment. More recently, Professor Y. Moriya from the same institute worked for 4 months in The Netherlands, to demonstrate his surgical approach towards rectal cancer.

A preliminary personal series of 45 operative procedures during the visits to Scandinavia by the author can be added. He was invited to assist surgeons in Norway and Sweden during the last 18 months in order to introduce total mesorectal excision. A combination of appropriate specialisation, plus teaching workshops is now well advanced in Scandinavia where it is planned that TME will be the standard audited method within a few years. Closed circuit broadcast quality TV was extensively used to communicate the difficult detail of the deep pelvic dissection to other surgeons during the workshops and live demonstrations. This has resulted in a unique visualisation of the autonomic nerve plexuses in the pelvis, which until now had not been achieved.

In consequence of the renewed interest in rectal cancer surgery, the special skills required have been recognised. In Norway, this has led to the removal of rectal cancer from the general surgery "list" and pressure to limit it to surgeons likely to treat 10 or more cases per year. To this idea the argument was added that two specialist surgeons are ideally required to perform a good deep pelvic dissection.

It is too early to report on oncological consequences, but figures concerning morbidity in the first 350 Norwegian cases are available. There has been a general reluctance to defunction. Anastomotic leakage rate in unprotected anastomosis was over 20%. Those patients required emergency surgery and experienced significant morbidity and 2 patients died as a direct consequence. A highly significant contribution to audit has been made by Quirke who has introduced into Scandinavia, as part of this project, his method of examining the surgical specimen. He has shown a close correlation between circumferential margin involvement and subsequent local recurrence, and opened up the possibility of real quality assurance in rectal cancer surgery [15].

There are major difficulties in defining and standardising complex surgical procedures. This is particularly true in bowel cancer when there is a high probability that dynamic factors such as the rupture of the specimen, breaching of its surface or contamination of the operative field with cancer cells are all extremely important. Even definition of the actual block of tissue to be excised is dependent upon the most subtle surgical development of areolar planes between structures of different embryological origin. It is, therefore, of great importance that practical definable objectives be arrived at for this common cancer where such enormous variation in outcomes has been observed. Colorectal cancer is a tumour with a great propensity for locoregional lymphatic spread, but a remarkable tendency for this to be limited to the integral visceral mesentery.

The essence of this paper is the claim that total mesorectal excision should become the defined objective of rectal cancer surgery, that nerve visualisation and preservation should be possible in most cases, and that the anal sphincters need be sacrificed in no more than 15% of patients. There is no area of cancer treatment where the development of better surgical technique has so much to offer the patient.

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