Surgery for colorectal cancer

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Colorectal cancer remains the second commonest cause of cancer death in North America and Western Europe. Each year in the UK alone, there are more than 28,000 new cases and approximately 18,000 deaths attributable to the disease. Surgery is, and will remain for the foreseeable future, the mainstay of treatment and offers the only chance of cure.

General principles

The nature of the tumour and the extent of the disease should be established prior to surgery. Wherever possible, histological confirmation of the diagnosis should be obtained, if necessary by colonoscopy. For patients with rectal cancer, the height of the tumour should be determined...
using a rigid sigmoidoscope and the degree of fixity (mobile, tethered or fixed) should be established by palpation. Liver imaging should be performed to establish the presence or absence of liver metastases. In this context, CT and MRI have been shown to be superior to ultrasound. Synchronous lesions, either an adenoma or a second tumour which have been reported to occur in up to 30% and 6% of patients respectively, should be excluded by double-contrast barium enema or colonoscopy. Where this is not possible due to obstruction or when the patient presents as an emergency, these investigations should be carried out within 3 months of surgery.

Pre-operative preparation

Clearly many of the patients who present with colorectal cancer are elderly and many have significant co-morbidity, especially due to cardiovascular or respiratory disease. Old age does not necessarily preclude surgery, but the potential benefits and risks of any proposed intervention should be carefully assessed.

Patients undergoing surgery for colorectal cancer are at risk of venous thrombo-embolism and wound and/or deep intra-abdominal sepsis. Recent meta-analyses have shown that the incidence of deep venous thrombosis and fatal pulmonary embolism can be reduced by the use of subcutaneous heparin or low molecular weight heparin. In addition, graduated compression stockings may be of value. There is also good evidence that the use of prophylactic antibiotics can reduce morbidity, shorten hospital stay and reduce infection-related costs. All patients undergoing colorectal cancer surgery should, therefore, receive prophylactic antibiotics effective against both aerobes and anaerobes at induction of anaesthesia. The most favoured regimen in the UK is probably a combination of a cephalosporin and metronidazole. There is no good evidence that multiple doses are more effective than a single dose at induction. Mechanical bowel preparation is still widely used although good evidence that it reduces the incidence of postoperative infective complications is lacking. Patients who might require a temporary or permanent stoma should be seen, if possible, prior to surgery by a specialist stoma nurse.

Aim of surgery

At the time of laparotomy, attention should be paid to the degree of fixity of the primary tumour and the extent of spread, in particular the presence or absence of enlarged lymph nodes, peritoneal seedlings or liver metastases. Enlarged lymph nodes not included in the resection specimen or suspected peritoneal metastases should be biopsied; if there is any doubt as to the completeness of excision, the tumour bed should also be biopsied.
The aims of surgery should be to achieve cure, if possible, and to avoid loco-regional recurrence. The fixity of the primary tumour determines resectability, and the extent of spread determines ultimate survival. As a general rule, mobile tumours should always be resected, irrespective of the presence or absence of liver metastases. If the tumour is tethered to adjacent structures (e.g. small bowel, bladder or uterus) removal of these organs en bloc may be necessary. Occasionally, in patients in whom the primary tumour is fixed and resection is, therefore, not possible, the tumour may require to be bypassed or a colostomy performed.

Elective surgery for colon cancer

The standard surgical treatment for colon cancer is resection of the tumour and its mesentery with primary anastomosis. The precise extent of the resection depends on the location of the tumour and its arterial supply. There is no convincing evidence to suggest that the ‘no touch’ technique, originally described by Turnbull or more radical surgery bestows a survival advantage. Intestinal continuity may be restored using either conventional suturing techniques or staples.

Anastomotic leakage is a potentially fatal complication. It is more likely to occur with low anterior resection. There appears to be little to choose between conventional suturing techniques or staples in terms of anastomotic leakage; one study, somewhat intriguingly, suggested that local recurrence was less common following stapled anastomosis. The use of a defunctioning colostomy probably reduces the risk of a clinically obvious leak.

Elective surgery for rectal cancer

This section focuses on recent innovations that have had a major impact on surgery for rectal cancer. The recognition that lower local recurrence rates following rectal cancer surgery may be achieved both by improvements in surgical technique and the use of pre- or postoperative radiotherapy has resulted in significant improvements in outcome, particularly local recurrence.

Pre-operative staging of rectal cancer

Accurate staging of the pelvis plays a pivotal role in the management of patients with rectal cancer since clinical staging, by digital examination of the tumour alone, does not provide sufficient information to define the optimal treatment pathway for patients with rectal cancer. It is now known that the incidence of local recurrence is dependent on the
distance between the primary tumour, or metastatic lymph node, and the parietal endopelvic fascia (see Fig. 1).

Every effort should be directed to identifying patients who can undergo R0 resection (i.e. a curative resection with no residual tumour). Equally, patients whose tumours are unlikely to be amenable to R0 resection without pre-operative down-staging, also need to be identified. The contribution of radiotherapy to the management of patients with rectal cancer is discussed in a separate chapter in this volume.

The extent of pelvic disease may be defined using endoluminal ultrasound, computed tomography or magnetic resonance imaging.

**Endoluminal ultrasound (EUS)**

EUS plays an important role in the pre-operative staging of rectal cancer. The chief advantage of EUS over other staging modalities lies in its ability to delineate accurately the anatomical layers of the rectal wall.
and hence the degree of transmural tumour penetration through each of these tissue planes\textsuperscript{2,22,23}.

Using a circumferential 7.0 mHz transducer, the rectal wall is imaged as a five-layered structure (Fig. 2) which is alternatively echogenic (white lines) and echo poor (black lines). The middle echogenic layer of submucosa is extremely important, as a breach of this layer defines the presence of an invasive cancer. Thus EUS can reveal the extent of transmural spread of rectal cancers with some considerable accuracy\textsuperscript{22}. T1 tumours are confined to the submucosa, T2 tumours invade the muscular propria but do not extend beyond it and T3 cancers penetrate the perirectal fat. The reported accuracy of EUS varies between 67\% and 93\%\textsuperscript{23}, but the technique is highly user dependent. Clearly, the entire length of the tumour needs to be imaged to determine stage accurately and this is not possible in circumferential stenotic cancers that cannot be intubated.

Malignant mesorectal lymph nodes can also be identified since they are hypo-echoic and can, therefore, be distinguished from normal hyperechoic nodes. The accuracy of lymph node staging varies between 60\% and 80\%\textsuperscript{24}. If desired, the nodes can be sampled using a forward-viewing transducer with an integrated biopsy needle channel.

**Computed tomography (CT)**

Although CT continues to be used for the detection of distant metastases, its role in staging the primary rectal cancer is declining with the advent of accurate magnetic resonance imaging. In experienced hands with high quality spiral scanners, the accuracy of staging in rectal
cancer patients has been reported to be as high as 80%\textsuperscript{25}, but this figure is by no means a consistent reflection of the accuracy of this modality in the assessment of the primary tumour.

**Magnetic resonance imaging (MRI)**

MRI has recently been used with considerable success to define the extent of mesorectal and pelvic disease in patients with rectal cancer\textsuperscript{26,27}. This is covered in detail in the chapter on imaging in this volume. Initially an endoluminal coil was used, allowing the generation of images with excellent spatial resolution of the tumour and the rectal wall. However, because of the limited field of view, the mesorectum and the rest of the pelvis could not be visualised satisfactorily. Furthermore, an endoluminal coil cannot be used in all rectal cancer patients. Phased array coils provide a much larger field view, allowing careful assessment of the mesorectum and extra-rectal pelvis without a reduction in the accuracy of staging of the primary rectal cancer, when compared to endoluminal coils. Importantly, tumour-involvement of the circumferential resection margin can be predicted with high degree of accuracy and consistency allowing the clinician to make an informed decision about the necessity of pre-operative radiotherapy\textsuperscript{27}.

**Radical (curative) surgery for rectal cancer**

Radical surgery remains the primary mode of treatment for the majority of patients with non-disseminated rectal cancer. The expertise and experience of the surgeon are now recognised to be important determinants of final outcome\textsuperscript{28}. In addition to achieving cure and avoiding loco-regional recurrence, the aim of radical surgery is to undertake a sphincter-saving reconstruction thereby avoiding a permanent colostomy, to maintain adequate anorectal function and avoid autonomic nerve dysfunction.

Where curative surgery is possible, local disease control and the avoidance of autonomic nerve damage is intimately related to the technique of pelvic dissection.

**Avoidance of locoregional recurrence**

There is considerable variation in the incidence of local recurrence amongst surgeons performing rectal cancer surgery, with local recurrence rates varying from 3–30%\textsuperscript{29}. Local recurrence may arise as a result of involvement of: (i) the lateral/circumferential margin; (ii) the
presence of distal mesorectal spread; and (iii) involvement of the distal resection margin.

The lowest incidences of loco-regional recurrence are reported by surgeons who perform total mesorectal excision\(^{30-34}\). Heald and Enker have done much to develop this technique. In particular, they have drawn attention to an understanding of the fascial anatomy of the rectum within the true pelvis. The use of sharp dissection under direct vision allows complete excision of the tumour/mesorectal envelope along a relatively bloodless plane. This is the space between the visceral layer of the endopelvic fascia encasing the mesorectum and the parietal endopelvic fascia over the sacrum (see Fig. 1). This sharp dissection technique also allows preservation of the pelvic autonomic nerves, thus reducing the incidence of sexual and bladder dysfunction. Furthermore, since most of the extra-luminal regional disease is located in the mesorectum (both posterior and lateral to the rectal wall), the most effective method of ensuring complete excision of such disease is to resect along the parietal layer of the endopelvic fascia (see Fig. 1).

**Circumferential tumour spread**

The importance of adequate treatment of the circumferential tumour margin cannot be over-emphasised. Pre-operatively, efforts should be directed to detecting tumour involvement in this plane so that the patient can receive adjuvant treatment prior to radical surgery. During the surgery itself, meticulous attention is required to ensure an adequate circumferential excision. Finally, the pathologist needs to be trained appropriately in the examination of the operative specimen with this crucial factor in mind. This is highlighted by the seminal studies undertaken by Quirke and his colleagues in Leeds\(^{35,36}\). Positive circumferential margins can be avoided in patients undergoing curative surgery if sharp dissection is used to excise the tumour/mesorectal package rather than a blunt or ‘push’ technique which will damage this tissue envelope.

**Distal mesorectal spread**

Distal tumour spread within the mesorectum can occur beyond the lower margin of the intramural tumour\(^{37}\). This pattern of tumour extension may be a marker of an aggressive tumour phenotype rather than the cause of local recurrence in itself. It remains unclear as to whether such tumour spread occurs in high rectal cancers or is just confined to more distal cancers.
TME commits the surgeon to performing a very low anastomosis with the probability of temporary faecal diversion. However, TME does facilitate precise dissection of the tumour/mesorectal package within its pelvic visceral fascial sling. At the present time, TME is not recommended for all patients with rectal cancer. For a cancer at or below the pelvic peritoneal reflection TME is mandatory. In patients with high rectal cancer (located in the upper one-third of the rectum) or rectosigmoid tumours, TME is not necessary. However, an extensive circumferential mobilisation of the rectum is undertaken, using accurate sharp dissection, allowing tumour resection with a 5 cm distal margin. In this way, the distal clearance margins of both the rectal and mesorectal resections are not compromised by ‘coning down’ on to the tumour during dissection.

**Involvement of the distal resection margin**

Distal intra-mural tumour spread beyond the lowest level of the luminal cancer rarely exceeds 2 cm. Indeed, unless the tumour is particularly high grade, a distal resection margin of 2 cm does not adversely affect the incidence of pelvic recurrence. Determining adequate distal margins can be difficult, particularly in surgery for a low rectal cancer in a man with a narrow pelvis. This can only be achieved with safety after full circumferential rectal mobilisation down to the pelvic floor leaving a muscle tube of distal rectum as it inserts into the pelvic floor aperture. Palpation of an assistant’s examining finger within the distal rectum to delineate the lowermost level of the cancer may be the only reliable method of achieving adequate distal clearance.

**Sphincter-saving reconstruction**

The frequency of sphincter-saving procedures has increased significantly with the improvements in endoluminal staplers and the appreciation that a 2 cm distal clearance is generally safe. Even if the top of the anal canal cannot be stapled and transected at the pelvic floor, a transanal hand-sewn anastomosis can be performed, providing a safe distal tumour margin is achieved. There are tumours that are just too low for such surgery and there are patients, particularly men with a narrow pelvis, in whom it is technically not possible to extend the dissection safely below the tumour. Clearly, in these cases abdominoperineal excision of the anorectum may still be required. Notwithstanding such technical problems, a minimum distance of 6 cm between the lower level of the tumour and the anal verge is probably required to permit a
sphincter-saving reconstruction. However, it should be stressed again that the distal clearance of a low rectal cancer can only be assessed after full circumferential mobilisation of the rectum down to the pelvic floor.

**Anorectal function**

Total mesorectal excision for mid and low rectal cancers necessitates complete resection of the rectum. Bowel function following straight colo-anal reconstruction is very dysfunctional and can be quite unsatisfactory for patients, particularly for the first postoperative year. For this reason, the concept of a neorectal reconstruction, using a colon J-pouch, has gained considerable popularity. Some key technical points have emerged and it is important to keep these in mind in order to optimise pouch function. The pouch should be no more than 5–7 cm in length since longer pouches are prone to emptying problems. Furthermore, a J-pouch of the correct length lends itself to a stapled construction with one pass of an appropriate 75 mm transection/stapling instrument. Additionally, the sigmoid colon should be excised as this segment is often narrowed with diverticular disease and a pouchled left colon is preferred. It is not always possible to fashion a colon J-pouch if the mesentery is too bulky; in these instances, the construction of a 5–6 cm coloplasty in the distal left colon may be used to create an adequate reservoir capacity above the colo-anal anastomosis. This approach has been used safely in some North American centres (personal communication).

Interestingly, the decreased stool frequency that is often observed with a colon pouch is not associated with increased reservoir capacity or compliance when compared to a straight colo-anal reconstruction. This functional advantage is probably sustained through an anti-peristaltic effect contributed by the reversed limb of the pouch.

**Autonomic nerve dysfunction**

Sexual and urinary dysfunction can occur after rectal excision. The incidence of impotence in males can be high as 40%. However, clear data in this area are scant and only just beginning to emerge. Sexual dysfunction in women undergoing rectal excision has been studied even less and the precise components of this morbidity are not completely clear. Cadaveric dissections have provided detailed information about the anatomy of the pelvic autonomic nerves, but the application of this knowledge to the surgery of rectal excision has been a long time in coming. Injury to the hypogastric (sympathetic) nerves occurs most commonly on entry into the true pelvis at the commencement of rectal surgery.
mobilisation. The pelvic parasympathetic outflow (S2–4) is most commonly damaged by traction injuries due to blunt dissection or during division of the lateral ligament tissue.

This distressing morbidity can be largely obviated by using sharp dissection performed under direct vision with good haemostasis. The true pelvis should not be entered unless the hypogastric nerve trunks have been identified medial to the ureters above the pelvic brim. This is most easily achieved on the left side first, while the right hypogastric nerve trunk is best identified after division of the inferior mesenteric vascular pedicle. This will then ensure that the true pelvis is entered anterior to these nerves. The trunks can then be followed inferiorly and laterally during extension of the pelvic dissection. The hypogastric nerve trunks condense with the sacral outflow, medial and below the ureters, in the pelvic side wall. Enker has developed a formal autonomic nerve-preserving pelvic side-wall dissection and has reported a low incidence of impotence in men following this technique of rectal excision.

The role of adjuvant radiotherapy in rectal cancer

Although a degree of selection bias cannot be discounted, it is clear from both individual series and the results of policy changes associated with a specific surgical training programme that careful radical surgery is associated with much lower local recurrence rates than traditional surgery. This observation has clouded the issue of adjuvant radiotherapy, a treatment modality which has been the subject of intensive study over the past 30 years.

There have been several trials of both postoperative and pre-operative radiotherapy for rectal cancer and recent meta-analyses have indicated a significant reduction in local recurrence with the use of either modality. In terms of individual trials, only two have demonstrated a significant effect with postoperative radiotherapy whereas there have been seven trials indicating an effect for pre-operative therapy. In addition, there has been a single trial comparing post-operative with pre-operative radiotherapy which indicated lower morbidity and better disease control with the pre-operative treatment. In the US, postoperative radiotherapy has tended to be more popular, and is frequently given with concurrent chemotherapy in line with trials that have demonstrated an enhanced effect with combination treatment. In Europe however, pre-operative radiotherapy has been favoured. Perhaps the most influential trial was Stockholm II which employed 25 Gy in 5 fractions the week before surgery, and demonstrated a reduction in local recurrence from 27% to 11% and a significant improvement in survival.
It was argued, however, that the recurrence rates in the control arms of all trials of radiotherapy were much higher than would be expected from a surgeon practising high quality surgery with mesorectal excision. For this reason, the Dutch Rectal Cancer Group carried out a trial in which 1800 patients were randomised to pre-operative radiotherapy or no adjuvant treatment following standardised total mesorectal excision. This study brought about a remarkable reduction in local recurrence rates overall when compared with historical controls, but the radiotherapy also had an effect, reducing local recurrence rates from 8.2% to 2.4%, a result which was highly statistically significant. It has to be stressed, however, that follow-up in this trial is still relatively short and the long-term morbidity associated with pre-operative radiotherapy following total mesorectal excision has not yet been assessed. Thus, low local recurrence rates can be achieved by careful specialist surgery and adding pre-operative radiotherapy has a small beneficial effect, but with an unknown cost in terms of morbidity. For this reason, definitive guidance cannot yet be given, except to say that if the surgeon is not confident of obtaining complete excision of the rectal tumour with good circumferential clearance, then pre-operative radiotherapy should be employed.

In summary, rectal cancer can be a difficult tumour to treat. The surgery is demanding and can be associated with considerable morbidity, particularly in males with a large tumour and a narrow pelvis. It should only be performed by appropriately trained surgeons. It is essential that the treatment strategy for such patients should be clearly delineated in the context of a multidisciplinary team that includes pelvic/rectal surgeons, radiologists, histopathologists and both clinical and medical oncologists. Indeed the treatment of patients with rectal (and colon) cancer outside the context of a multidisciplinary team is now entirely unacceptable.

**Local excision of colorectal cancer**

In a proportion of cases with rectal cancer, transanal local excision is feasible, using either conventional techniques or the relatively new approach of transanal endoscopic microsurgery (TEM). There is little doubt that local excision causes less immediate postoperative morbidity than either anterior resection or abdomino-perineal excision of rectum, and this is elegantly demonstrated by a recent randomised trial of TEM versus radical surgery for T1 tumours. This trial was too small to demonstrate a significant difference in long-term outcomes, but the main concern with local excision is a higher rate of local recurrence when compared with radical surgery. There are two reasons for expecting this, firstly the inadequacy of excision of the primary tumour and secondly the inability of local excision to deal with residual tumour.
in lymph nodes. The literature is variable but it would seem that lymph node metastases are present in around 8% of T1 tumours, 25% of T2 tumours and approximately 50% of T3 tumours\textsuperscript{53}. T1 tumours can be subdivided on the basis of depth of submucosal invasion and, whereas very superficial tumour (sm1) are very rarely associated with lymph node metastases, those with full thickness invasion of the submucosa are associated with a 17% chance of lymph node involvement\textsuperscript{54}. Thus it would appear that local excision alone is only really safe for very early T1 tumours.

Unfortunately the literature on local excision of rectal cancer is unhelpful as it consists largely of small series where local recurrence ranges from 0% to 11% for T1 and T2 lesions and between 0% to 18% for series including T3 tumours\textsuperscript{55}. In recent years, there has been interest in combining local excision with radiotherapy or combination radiochemotherapy and there is some evidence that this approach may result in reasonable local recurrence rates\textsuperscript{55}. At present, however, if local excision of a rectal cancer is to be considered, a careful discussion with the patient regarding the balance between the risk of local recurrence and the morbidity associated with radical surgery is essential.

**Laparoscopic surgery for colorectal cancer**

In recent years, there has been a great deal of interest in the use of laparoscopic surgery for the management of colorectal cancer. It is now generally agreed that in the majority of cases laparoscopic or laparoscopy-assisted surgery is feasible, although obesity is seen by many as a relative contra-indication. A number of randomised studies have been carried out and it does appear that the laparoscopic approach is associated with some advantages\textsuperscript{56}. In particular, postoperative pain appears to be reduced and one randomised study has demonstrated significantly lower postoperative pain scores\textsuperscript{57}. In addition, the recently published report of the COST multicentre randomised trial from the US demonstrated that patients assigned to laparoscopic surgery required fewer days of both parenteral and oral analgesia\textsuperscript{58}. Other advantages include reduced intra-operative blood loss, reduced duration of postoperative ileus and duration of hospital stay\textsuperscript{56}. Another theoretical advantage of laparoscopic surgery is a reduction in immunological suppression which may provide an advantage in cancer surgery. Certainly circulating levels of interleukin 1, 2 and 6, interferon gamma, and tumour necrosis factor have all been shown to be lower in patients undergoing laparoscopic surgery when compared to those undergoing open surgery\textsuperscript{59-61}, and recently there is evidence that T-lymphocytes
subsets and activation markers including CD71 and HLADR are reduced in laparoscopic surgery\textsuperscript{62}. On the other hand, in a study of 60 patients undergoing laparoscopic colorectal surgery, there was no difference from open surgery in terms of lymphocyte counts, natural killer cell counts and CRP levels\textsuperscript{63}. Thus, although there is evidence that laparoscopic surgery leads to a reduced inflammatory response and perhaps less immunosuppression, there is no clear evidence of an immunological benefit in cancer patients.

Laparoscopic colonic surgery is associated with certain complications and perhaps the most worrying is the occurrence of port site metastases which can even occur following resection of Dukes' stage A tumours\textsuperscript{64}. While there is no doubt that these metastases do occur, there are many series which are free of this complication and in a large prospective audit the rate was found to be 1.1\%\textsuperscript{65}. This compares with a 1.5\% rate of wound recurrence after open procedures\textsuperscript{66}, so that it seems that port site metastasis may not be as major a problem as was initially feared. Other complications of laparoscopic surgery include ureteric injuries and the general complications of laparoscopic surgery such as trocar injury and herniation at port sites, all of which can be almost completely avoided by a good operative technique.

In the short term, the overall aim of laparoscopic surgery is to provide a better quality of life than open surgery and the recently reported COST study has addressed this. Unfortunately, only minimal short-term quality of life advantages were found with laparoscopic surgery and the authors concluded that laparoscopic surgery for colorectal cancer should not be adopted widely until the long-term results of on-going randomised trials are available. One of the major concerns is that laparoscopic approach may compromise long-term outcomes, although the available evidence would suggest that there is no difference in lymph node yield between open and laparoscopic colorectal surgery\textsuperscript{57,67}. Ultimately, however, it is essential to be sure that the laparoscopic approach yields long-term results in terms of local and distant recurrence which is at least as good as high quality open surgery. There will be a number of years before the on-going trials are able to answer this question.

**Management of malignant obstruction**

About 15\% of all patients with colorectal cancer present as emergencies with partial or complete obstruction. When a mechanical large bowel obstruction is suspected, a water-soluble contrast enema should be undertaken to demonstrate the site of the obstruction and to exclude pseudo-obstruction, which occurs in up to 10\% of patients\textsuperscript{68}. 
Many of these patients are elderly and have pre-existing cardio-respiratory insufficiency. Careful resuscitation, with correction of fluid losses and electrolyte imbalance, is essential before surgery is undertaken. Ideally, surgery should be performed during normal working hours by senior surgical and anaesthetic staff.

It is generally accepted that most obstructing colonic tumours proximal to the descending colon are suitable for primary resection as anastomosis. In contrast, the optimum management of distal obstructing colonic tumours remains controversial. Traditionally, three approaches have been used: primary decompression followed by staged resection, primary resection with delayed anastomosis or primary resection and anastomosis.

In theory, primary decompression followed by staged resection provides a simple, life-saving operation. However, although the initial mortality is low, cumulative mortality is about 20%. Furthermore, about half of patients undergoing a staged resection fail to complete all three stages and are, therefore, left with a permanent stoma. This approach is seldom used nowadays.

Concern that failure to remove the primary tumour at the time of initial surgery might compromise long-term survival led to the introduction of primary resection with delayed anastomosis, the so-called Hartmann’s procedure. This approach achieves the dual objectives of relieving the obstruction and resecting the tumour, while avoiding the potential complications of an anastomosis performed under suboptimal conditions. Reversal of a Hartmann’s, however, is a major surgical procedure with a high complication rate. Morbidity occurs in about one-third of patients and mortality may be as high as 10%. Nevertheless, a Hartmann’s procedure remains a life-saving operation, particularly in the sick patient. In suitable patients, resection with primary anastomosis may be appropriate. This approach achieves relief of the obstruction, removal of the tumour and restoration of intestinal continuity in one procedure. In experienced hands, this approach is associated with an anastomotic leak rate of about 6% and an operative mortality of 9%.

There have been only two randomised trials. In the Danish study, Kronberg and his colleagues compared three-stage surgery with Hartmann’s procedure. There were no significant differences in the cumulative operative mortality or survival between the two groups, but the number of patients studied was small69.

In the Scotia Study, subtotal colectomy was compared with segmental resection. Mortality was similar in both groups; however, bowel function was less satisfactory in those undergoing sub-total colectomy70.

More recently, several reports have suggested that it is often possible, in patients with obstructing lesions at the recto-sigmoid junction, to temporarily relieve the obstruction using a self-expanding metallic stent prior to semi-elective surgery71,72. This approach, however, requires further evaluation.
Follow-up

Recent studies have highlighted the lack of consensus among surgeons about the value of follow-up; strategies range from a single postoperative visit to life-long surveillance.

A meta-analysis of seven non-randomised studies containing more than 3000 subjects, that compared intensive follow-up with minimal or no follow-up, did little to clarify the situation. In the intensive group, more asymptomatic recurrences were detected, more patients underwent ‘second look’ laparotomy and more patients had a second potentially curative resection. However, although there were fewer deaths in the intensive follow-up group, this did not reach significance.

Five randomised trials of intensive follow up have also been reported. None showed a significant survival advantage to more intensive follow-up. In the early studies, much of the effort was directed towards the early detection of asymptomatic loco-regional recurrence. However this was unlikely to ever be a successful approach since the majority of local recurrences are not amenable to secondary curative resection. In contrast, liver metastases are much more common. Perhaps, therefore, more emphasis should have been placed on the early detection of potentially resectable liver metastases. More recently, Schoemaker and his colleagues evaluated the addition of colonoscopy and computed tomography of the liver to standard follow-up in over 300 patients. At 5 years, fewer patients in the intensive group had died, but the result was not significant. Disappointingly, despite intensive follow-up, only one asymptomatic metachronous colon tumour was detected and only one asymptomatic patient with liver metastases might have benefited from resection was identified.

Nevertheless, despite these apparently disappointing results, recent meta-analyses of these randomised studies has shown that intensive screening is associated with better outlook.

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