

Colorectal Disease

Position Statements on
Malignant Large Bowel Obstruction
and Anal Fistula

These position statements were presented at the annual scientific meeting of the Association of Coloproctology of Great Britain and Ireland in Gateshead, July 2006



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Contents

Position Statements

- 1 The Management of Malignant Large Bowel Obstruction: ACPGBI Position Statement
P. J. Finan, S. Campbell, R. Verma, J. MacFie, M. Gatt, M. C. Parker, R. Bhardwaj, N. R. Hall
- 18 The Treatment of Anal Fistula: ACPGBI Position Statement
J. G. Williams, P. A Farrands, A. B. Williams, B. A. Taylor, P. J. Lunniss, P. M. Sagar, J. S. Varma, B. D. George

Cover image: Transverse section through a rectal cancer.

The Management of Malignant Large Bowel Obstruction: ACPGBI Position Statement

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Introduction

Malignant large bowel obstruction occurs in up to 20% of patients with colorectal cancer and carries an appreciable morbidity and mortality [1–3]. Twenty-five per cent of all post-operative deaths following surgery for colorectal cancer occur in those who present initially with obstruction [4]. Patients with obstruction are often elderly with associated co-morbidities and the therapeutic options are varied. This position statement sets out to examine the current literature on this condition and to provide an evidence base upon which practitioners can advise individual management of these patients.

The Position Statement is presented in sections dealing with detailed aspects of pathology, diagnosis and treat-

ment. The evidence is briefly summarized in a question, where relevant, under the heading 'Findings' and this is followed, where relevant, by 'Recommendation'.

Methodology

Organized searches of the Cochrane Database, MEDLINE and EM-BASE were performed using keywords relevant to each section of this Position Statement. Searches were limited predominantly to English language articles. Additional publications were retrieved from the references cited in articles identified from the primary search of the literature. All evidence was classified according to an accepted hierarchy of evidence and recommendations graded A–C on the basis of the level of associated evidence and/or noted as Good Practice and/or part of NICE/SIGN recommendation or Rapid Technology Appraisal (Table 1) [5,6]. The four main sections addressed within this statement are diagnosis (SC, RV), non-surgical management (MCP, RB), optimization of the patient (JM, MG) and surgical management (NRH).

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Table 1 Grading scheme for assessing submitted evidence. All evidence was classified according to an accepted hierarchy of evidence that was originally adapted from the US Agency for Healthcare Policy and Research Classification. Recommendations were then graded A–D on the basis of the level of associated evidence and/or noted as a Good Practice and/or as part of NICE/SIGN recommendation or Rapid Technology Appraisal.

Level of evidence		Grade of recommendation	
I	Evidence obtained from a single randomized controlled trial or from a systematic review or meta-analysis of randomized controlled trials	A	Evidence of type I or consistent findings from multiple studies of type IIa, IIb or III
IIa	Evidence obtained from at least one well-designed controlled study without randomization	B	Evidence of type IIa, IIb or III and generally consistent findings
IIb	Evidence obtained from at least one other well-designed quasi-experimental study	C	Evidence of type IIa, IIb or III but inconsistent findings
III	Evidence obtained from well-designed nonexperimental descriptive studies, such as comparative studies, correlation studies and case studies	D	Little or no systemic evidence
IV	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities, case reports	GP	Recommended good practice based on the clinical experience of the expert group and other professionals*

Adapted from ref. nos [5] and [6].

*Previous experience and the literature in this area suggests that given the relative lack of evidence for many healthcare procedures, expert opinion and professional consensus are likely to be an important part of this process.

A. Diagnosis

Findings

The addition of a contrast study to the plain radiograph improves the diagnostic accuracy in suspected large bowel obstruction (Level III).

Recommendation

Single contrast studies should be used in patients with suspected large bowel obstruction as it confirms the diagnosis and defines the level obstruction (Grade B).

Whilst the clinical picture and confirmatory plain abdominal radiographs may make the diagnosis, additional information as to confirmation of, and site of, the obstruction can be obtained from single contrast studies [7–9]. The principle role of this procedure is to exclude patients with intestinal pseudo-obstruction and confirm the site of obstruction. Where the suspicion, based on the plain radiographs, was of a mechanical obstruction, confirmation was achieved in only 60–63% of patients [8,9], the remainder showing free flow of the contrast to the caecum. One study noted three missed non-obstructing carcinomas after further investigation when the initial single contrast study had shown free flow to the caecum [9]. When the clinical diagnosis was of colonic pseudo-obstruction then the contrast study was confirmatory in 83% of patients in two studies [8,9], although obstructing

lesions were found in two patients in each study. A later study [7] confirmed the improved sensitivity and specificity of a contrast enema (96% and 98%) over plain radiographs (84% and 72%). Although a contrast enema aids in the diagnosis of mechanical obstruction there are some limitations. The patients have to be relatively mobile and retain the contrast. No comment can be made on the viability of the proximal distended bowel and in confirmed cases there is no information on the extent of the primary lesion or of distant metastases.

Findings

CT scanning provides further information over and above plain and contrast radiographs in patients with suspected malignant large bowel obstruction (Level III).

Recommendation

CT scanning, if available, should be used in patients with suspected large bowel obstruction and should avoid the necessity for single contrast studies. More evidence within the literature is needed (Grade D).

The CT diagnosis of mechanical large bowel obstruction is based on dilated colon proximal to a transition point and collapsed colon distal to this site. CT scanning can confirm the diagnosis of colonic obstruction and pseudo-obstruction in over 90% of patients [10,11]. In one study correct localization of

the site of obstruction was achieved in 44 of 47 patients [11]. This same study also compared a contrast study with CT scanning in a subgroup of patients and found CT scanning to be more sensitive, more accurate and to have a better negative-predictive value. The ability to detect mass lesions and associated pathology allows CT scanning to distinguish colorectal cancer from other causes of mechanical large bowel obstruction, e.g. colonic volvulus [12]. Three-dimensional reformatting of images may be of help in difficult cases [13]. The additional advantage of CT scanning is the detection, at an early stage, of metastatic disease.

Although poorly reported in the literature, multi-detector CT scanners have the potential to provide even greater diagnostic accuracy in the assessment of large bowel obstruction. They provide improved spatial resolution and multi-planar image assessment [14]. It seems likely that improvements in scanning hardware and software will improve the diagnosis of large bowel obstruction in the future.

Findings

Colonoscopy may be of value in diagnosing the cause of large bowel obstruction but its main role is as part of a therapeutic option (Level III).

Although colonoscopy may be used to identify the level of obstruction, it is often not possible to traverse the obstructing lesion. Biopsies may be obtained but the role of colonoscopy in the initial diagnosis of malignant large bowel obstruction is limited. One recent report describes the use of a trans-anal drainage tube inserted using the colonoscope in the acutely obstructed patient with successful decompression in 96% of the 54 patients studied [15]. If successfully reproduced in other centres this offers some hope for converting the urgent case into an elective problem.

B. Non-surgical management

Findings

The introduction of self-expanding metallic stents (SEMS) can convert an emergency/urgent situation into an elective one (Level III).

Recommendation

If available, and in the absence of signs of perforation, peritonitis, or closed loop obstruction, the insertion of a self-expanding metallic stent should be considered (Grade B).

The non-surgical management of large bowel obstruction was, until recently, limited to efforts at intraluminal recanalisation using laser or thermal energy. The introduction of SEMS in patients with malignant large bowel obstruction has gained enormous popularity although randomized trials are lacking. Two recent reviews of the literature have provided remarkably similar conclusions with technical and clinical success rates of 94% and 91% [16] and 92% and 88% [17] respectively. The procedure seems safe with a perforation rate of 3–4%. The main complications are migration of the stent (10–11%) and re-obstruction (7–10%). Stent placement was more likely to fail if it involved a colonic flexure and was considered unsuitable for low rectal lesions where stents had a tendency to dislodge and also cause distressing local symptoms. There is little experience of stenting malignant strictures proximal to the splenic flexure (< 4% in one recent review) [16]. The main reason for this is that emergency surgery for obstruction of the right colon carries the same mortality as that for elective surgery as shown in the Large Bowel Cancer Project [1].

The initial success of this technique would indicate that acute obstruction can be alleviated and the insertion of SEMS allows subsequent surgery to be performed electively. It is important that this technique is introduced in a planned way using a multi-disciplinary team approach. Patients with advanced disease or who prove medically unfit for excisional surgery may be suitably palliated with SEMS (*Levels III and IV*).

One trial, reported by Saida *et al.* [18], compared 44 patients undergoing SEMS placement following elective surgery with a historical control group of 40 patients undergoing emergency surgery alone (*Level III*). The emergency group were selected from patients operated on between 1986 and 1996 and the SEMS group were treated between 1993 and 2001. Wound infection rates were higher in the emergency surgery group (14% *vs* 2%) as were anastomotic leak rates (11% *vs* 3%) but importantly 3- and 5-year survival rates were equivalent (50% *vs* 48% and 44% *vs* 40% accordingly). These data, although non-randomized, suggest that SEMS placement followed by surgery has no long-term detrimental oncological effect on outcomes. Nevertheless, controlled prospective randomized trials are lacking. There is currently a prospective multicentre randomized trial comparing immediate surgery with insertion of a stent and delayed surgery. This trial is designed to answer the relevant questions regarding immediate and long-term mortality rates (both overall and cancer-specific survival) together with associated morbidity figures and stoma formation rates. Those

wishing to join this trial are invited to view the website (<http://www.crstrial.com>) from which all relevant information can be downloaded.

Findings

Metallic stent insertion provides a cost-effective alternative to stoma creation or resection for patients with inoperable colonic malignancy (Level II).

Recommendation

SEMS offers the most appropriate palliative treatment for patients with uncomplicated malignant left-sided large bowel obstruction (Grade B).

Xinopoulos *et al.* reported a study of 30 patients randomized to undergo SEMS insertion or creation of a proximal stoma in patients with inoperable malignant obstruction [19]. Costs of the two procedures were similar. SEMS insertion, successful in 14/15 (93%), resulted in a shorter hospital stay. Tumour ingrowth into the stent occurred in six patients but none required re-stenting. One stent was expelled and all patients died without evidence of obstruction. A further comparative non-randomized study in 44 patients with incurable obstructing colorectal cancer concluded that SEMS provided an acceptable alternative to open surgery [20], as did a similar study in 61 patients [21]. This study by Law *et al.* [21] reported a much reduced requirement for ICU facilities in the stented group, a shorter hospital stay and a lower requirement for a stoma (Level III). Covered stents may prevent tumour ingrowth [22] but may be difficult to deploy endoscopically.

Cost analyses of the use of SEMS are limited. In the UK an analysis by Osman *et al.* [23] demonstrated that the cost of stenting with subsequent resection compared favourably with a Hartmann's procedure followed by reversal (Level III). Similar comparisons with a single-stage procedure were not made. A further paper [24], calculating the cost-effectiveness of two competing strategies in a hypothetical patient with acute colonic obstruction, concluded that the use of SEMS resulted in 23% fewer operative procedures per patient. There was an 83% reduction in stoma requirement and a lower procedure-related mortality (5% vs 11%).

Findings

Other modalities of non-surgical management may be of value following relief of acute obstruction but have little role in achieving this primary goal (Level IV).

Recommendation

Local therapies may be used if available but remain purely palliative (Grade C).

Laser photocoagulation of colorectal malignancies in the palliative setting has been advocated as a major alternative to surgery. Its primary role has been to treat bleeding and sub-acutely obstructing tumours. More recently it has been used as an adjunct to those patients who have insertion of a SEMS. The largest study of this modality is that of Gevers [25] (Level IV). This retrospective study of 219 patients collected over a 9-year period reported relief of symptoms in 198. More treatments were needed for obstructing and circumferential tumours. There were five deaths from laser ablation.

Cryosurgery has been used in the palliative treatment of rectal carcinoma. Relief of local symptoms, particularly rectal bleeding and mucous discharge was achieved in 62% of patients, moderate palliation in 16% and no improvement in the remaining 22% [26] (Level IV). These techniques may be of use, particularly for lower tumours, and may be more commonly used once the acute obstruction has been relieved.

C. Peri-operative management

Findings

The metabolic response to surgery is enhanced and prolonged in patients presenting with acute intestinal obstruction (Level I). Theoretically, therefore, any interventions which modulate and attenuate this response may be associated with improved outcomes (Level IIb).

Recommendation

Multi-modal optimization strategies should be employed in patients with malignant large bowel obstruction where the obstruction has been relieved preoperatively (Grade A).

Several aspects of multimodal optimization can be applied to those patients requiring urgent surgery with malignant large bowel obstruction (Grade GP).

Several studies confirm the three- to fourfold increase in mortality when patients present acutely with colorectal cancer when compared with an elective situation [1,3,4]. The ACPGBI report on colorectal cancer [27] also identified the importance of ASA grading on subsequent 30-day mortality. Time spent on the adequate resuscitation of patients presenting acutely is governed by their clinical condition and particularly concerns that there may be over the

viability of the proximally distended colon. Decompression either by means of a proximal stoma or with stenting increases the time available for appropriate optimization of the patient.

There is now good evidence from prospective randomized studies demonstrating that optimization strategies (enhanced recovery protocols) are associated with significant benefits to patients undergoing colorectal surgery [28–32]. These act by encouraging earlier return of gut function [33] (*Level I*), attenuating the surgical stress response [32] (*Level IIb*), accelerating recovery [31] (*Level I*), decreasing complications [28,31,32] (*Level II*) and shortening hospitalization [28,31] (*Level I*), all without compromising patient safety [31] (*Level I*). In so doing, optimization may also have the benefit of reducing health costs [31,32] (*Level III*). The following 10-point multimodal programme incorporating pre-, per- and postoperative treatment strategies has been shown to be of benefit in patients undergoing elective colorectal surgery.

Pre-operative factors

1. Before operation patients should be provided with both verbal and written information about the operative procedure and rehabilitation programme [34–37].
2. Pre- and probiotics should be administered for 7–14 days before surgery [38–40]. The prebiotic recommended is oligofructose 15 g daily and the probiotic Trevis® (Chr. Hansen, Horsholm, Denmark) in a dose of one capsule three times a day.
3. Patients should not receive bowel preparation [41–44]. Patients may have a phosphate enema on the morning of surgery and routinely patients undergo a washout following completion of the anastomosis.
4. Patients should be admitted the day before surgery and allowed a normal diet up to and including the evening meal [45]. A drink containing 100 g of carbohydrate (Maxijul® 500 Super Soluble; SHS International Ltd, Liverpool, UK) in 400 ml water to be administered at 22:00 hours the evening before surgery and 50 g of the same carbohydrate in 400 ml water at 3–4 h before operation. Other carbohydrate preparations are equally appropriate [46].

Per-operative factors

5. During anaesthesia 80% oxygen should be administered [47–51]. Opiate analgesics should be avoided [52–55]. Induction is carried out with fentanyl, propofol and atracurium. Intermittent positive pressure ventilation with 80% oxygen, sevoflurane (1.0–1.2 MAC), and nitrogen is given with incremental atracurium.

6. All patients should receive an epidural anaesthetic sited between T7 and L1 [56,57]. An initial bolus of 15–20 ml 0.25% bupivacaine is then followed by a continuous epidural infusion (0.15% bupivacaine + fentanyl 2 µg/ml).
7. Transverse incisions should be used where possible [58–61]. While being of sufficient length to allow the procedure to be performed safely, incisions should be kept as small as possible. A recent Cochrane review noted that transverse incisions may be less painful and have less impact on pulmonary function but in the acute patient there may still be a need for a midline incision, particularly if the cause of the acute condition is unclear [62].

Post-operative factors

8. Free fluids on the day of operation [45], a light diet on day 1 and a full diet by day 2 [63–65] should represent achievable targets. Epidural infusions should be continued postoperatively with an aim to remove the epidural catheter 24–36 h after surgery. Analgesia should be provided with paracetamol 1 g four times daily and/or ibuprofen 400 mg three times daily as required. Opiate sparing should be practiced and morphine 5–10 mg should only be used as rescue analgesia [52–55].
9. Active mobilization programmes with a physiotherapist are preferable. Patients should receive a structured mobilization programme [29] that entails sitting out of bed for 20 min on the day of surgery, walking the length of the ward on the first post-operative day and further daily mobilization according to patient tolerance.
10. Intra-operative placement of drains [66] and post-operative nasogastric tubes [67,68] should be avoided. Urinary catheters are to be removed on day 2, providing epidurals have been discontinued.

Clearly, some of these interventions may not be possible in the acutely ill (pre-operative information, probiotics), and may be deemed inappropriate in emergency anaesthesia (carbohydrate loading, epidurals). They may not suit individual surgeons preference (type of incision, lack of bowel preparation). The principles of optimization should, however, be considered in all patients. Additional measures, known to be of proven benefit in the acutely ill (although not specifically those with colonic obstruction), include glycaemic control maintaining blood sugars no greater than 6 mmol/l with exogenous insulin (*Level I*) and precise fluid resuscitation using oesophageal Doppler measurements pre- and post-operatively to optimize cardiac output and avoid splanchnic hypoperfusion (*Level I*).

It is increasingly being recognized that preservation of intestinal barrier function obviates a cytokine-generated SIRS type response (*Level IIb*). This barrier function is compromised in emergency patients with obstruction as manifested by significant increases in the prevalence of bacterial translocation (*Level IIb*). It would seem reasonable to infer from this that endeavours should be made to reduce operating times, extent of bowel handling and overuse of opiates, all of which impinge on barrier function (*Level III*).

Finally, avoidance of an anastomosis may ensure an earlier return of adequate gut function which is an independent factor associated with enhanced recovery.

D. Surgical management

Despite efforts to convert an emergency or urgent clinical situation into a more elective one, there are various reasons why surgical management of the acutely obstructed colon remains necessary. Although the insertion of a metallic stent has been shown to be of benefit, the technique may not be available or possible. There may also be concerns as to the viability of the proximal colon either detected clinically or on CT scanning. Therefore surgical procedures, of which there are a variety, remain a major component of the management of this condition.

Acute large bowel obstruction presents a challenge to any surgeon. Distended unprepared bowel, dehydration, advanced disease and frequent need for surgery out of hours are all factors which predispose to complications. The 'ideal' operation is the one that would be chosen in the elective setting, namely resection and primary anastomosis. Whilst this is common practice for right-sided tumours, it has traditionally been perceived as too risky where the obstruction is more distal. However, even for left-sided lesions, the standard surgical teaching of a three-stage approach (defunctioning colostomy, then resection with anastomosis and finally stoma closure) has been challenged over the last three decades. Primary resection and anastomosis is now considered by many to be the surgical treatment of choice for all cases wherever the tumour is situated [69–74]. In support of this a number of studies have demonstrated that primary anastomosis for left-sided obstructing malignancies are at least as safe as for right-sided obstructions (Table 2) [1,75–77].

Although it seems standard surgical practice for obstructing lesions of the right colon to be managed with a resection and primary anastomosis, a recent national audit of large bowel obstruction noted that the increased mortality observed in emergency/urgent cases applied to right-sided lesions as well as left-sided obstruction [78]. The problems encountered with stent-

Table 2 Studies comparing primary resection and anastomosis in acute left and right colonic obstruction.

Author	Year	Type of study	Total in trial	Left colon			Right colon			Comments
				n	Mortality (%)	Leak rate (%)	n	Mortality (%)	Leak rate (%)	
Fielding <i>et al.</i> [75]	1979	Prospective review – multicentre	174 patients with obstructing cancers	22	14	Not stated	54	19	Not stated	Not all resections were followed by anastomosis
Phillips <i>et al.</i> [1]	1985	Prospective review – multicentre	713 with obstructing cancer	73	22	18	179	33	10	
Lee <i>et al.</i> [76]	2001	Retrospective review – single centre	243 with obstructing cancers – 136 left sided, 107 right sided	101	9	7	96	7	5	
Hsu [77]	2005	Retrospective review – single surgeon	214	134	0	2.2	80	10	2.5	Includes a few benign cases

ing of right-sided lesions and the poor alternative options for decompression for any length of time would indicate that primary resection will continue to be the accepted surgical procedure for these lesions.

The controversy in surgery, therefore, centres around the treatment of malignant left-sided large bowel obstruction (MLLBO). Here we examine the evidence for and against the various procedures available and put forward some guidelines for the surgical management of a patient with acute MLLBO.

Single or staged procedure?

Findings

Mortality of staged procedures is similar to one-stage procedure (Level III).

Hospital stay after staged procedures is longer than for single-stage operations (Level III).

Single-stage procedures carry a low mortality and morbidity rate and are safe under favourable circumstances (Level III).

Recommendation

Primary resection and anastomosis is the preferred option for uncomplicated malignant left-sided large bowel obstruction (Grade A).

Planned two- or three-stage procedures remain acceptable management strategies, but are currently out of vogue (Grade GP).

The first major report to question the dogma of staged resection came from the Large Bowel Cancer Project (LBCP) [75]. Fielding *et al.* reported a mortality of 35% for staged resections but only 14% for primary resection (Table 3) [1,75,79–87]. A later report from the same study, however, demonstrated a similar mortality for the two groups and found a high leak rate of 18% for immediate anastomosis [1]. Both showed that length of stay was about twice as long for staged procedures. Whilst the LBCP was a large multicentre study with prospectively gathered data, it was not randomized. The only randomized trial, by Kronborg *et al.* [83], compared three-stage with two-stage procedures in 121 patients, most of whom had cancer as the cause of their obstruction. They found a similar mortality in the two groups (13% and 12%) but noted that only 6% of patients having a three-staged procedure ended up with a permanent stoma compared with 28% of those having a Hartmann's procedure as the first operation. There was no third group undergoing a single-stage operation. On this basis one would have to recommend a three-stage over a two-stage procedure.

Whilst staged procedures have gone out of fashion, they should not be withdrawn from the surgical manual completely. A large and recent series of tube caecostomy as the first of a two- or three-staged procedure has been reported by Perrier *et al.* [88]. One hundred and thirteen patients with MLLBO were treated by initial decompression via a caecostomy which could be fashioned under local anaesthetic if required. The mortality after this was 13% and no patients died from subsequent surgery. All 98 surviving patients underwent a second procedure after a mean of 17 days with only 11 requiring a palliative procedure.

Most of the other published studies [79–82,84–87] have found a reduced or similar mortality and low anastomotic leak rates for primary resection. They, like others [89,90], also found that after staged procedures there was a high proportion of patients ending up with a permanent stoma (Table 3). It should be noted that staged procedures confer morbidity and mortality risks during the second/third admissions and inevitably the overall hospital stay is longer than after primary anastomosis.

These latter studies all suffer from potential selection bias. Surgeons will naturally choose to perform a primary resection and anastomosis on the fitter patients and will reserve staged procedures for those who are unsuitable for anastomosis. Consequently the results of staged procedures are bound to appear worse. Bias is reduced if all patients are treated in the same manner. A Cochrane report investigating primary or staged resection for MLLBO failed to find any studies worthy of inclusion in the review. It concluded that there was no evidence to recommend one procedure over the other and felt it unlikely that a large enough trial could be performed in an appropriately timed manner [91].

A number of authors have adopted a policy for primary resection and anastomosis for all patients presenting with MLLBO and are able to demonstrate acceptably low mortality and anastomotic leak rates (see below and Table 4 [92–94], Table 5 [95–102] and Table 6 [103–116]) suggesting that one-stage procedures are safe.

Segmental or subtotal colectomy?

Findings

Subtotal colectomy and segmental resection are equally safe where there is a choice of procedure (Level I).

Recommendation

The choice of subtotal (STC) or segmental colectomy (SC) should be decided on the following features of the case.

Table 3 Studies comparing staged with primary resection (where possible, specific data relating to left colonic malignancies has been abstracted).

Author	Year	Type of study	Total in trial	Primary resection group						
				Surgery performed	n	Mortality (%)	Leak rate (%)	Hospital stay (days)	Operating time (min)	
Fielding <i>et al.</i> [75]	1979	Prospective review – multicentre	53 left colon of 137 resectable tumours of 174 patients	Primary resection with or without anastomosis	22	14				
Phillips <i>et al.</i> [1]	1985	Prospective review – multicentre	210 left colon of 731 obstructed of 4583	Primary resection with or without anastomosis	136	22	18	20 (all cancer sites not just left colon)		
de Almeida <i>et al.</i> [79]	1991	Retrospective review – single centre	49 MLBO	Subtotal colectomy	11	9		9		
Gandrup <i>et al.</i> [80]	1992	Retrospective review – single centre	157 obstructed cancers, 130 in left colon	Primary resection (only five had primary anastomosis)	23	13				
Sjodahl <i>et al.</i> [81]	1992	Retrospective review – single centre	115 patients with malignant LBO (R and L) 14 of 72 left-sided tumours irresectable – so 58 in total	Primary resection	18	6		19		
Kressner <i>et al.</i> [82]	1994	Retrospective review – single centre	39 emergencies – only 21 had cancer of 101 consecutive patients with left colon cancer	SC with (17) or without (5) OTL	22	5	0	11		192
Kronborg [83]	1995	Prospective randomized trial – single centre	121	Transverse colostomy then second stage resection and anastomosis then closure stoma	47	13	3.4			
Maher <i>et al.</i> [84]	1996	Retrospective review – single centre	28 obstructing left colons	Primary resection and OTL	14	0	0	19		200
Zorcolo <i>et al.</i> [85]	2002	Retrospective review – single centre	121 obstructed of 323	Primary resection	93	6	4.3	38 stayed > 16 days		
de Aguilar-Nascimento <i>et al.</i> [86]	2002	Retrospective review – single centre	23	One-stage resection + OTL or subtotal and IRA	14	0	7	8		
Meyer <i>et al.</i> [87]	2004	Prospective review – multicentre	8825 left colon cancers, uncertain how many emergencies with curative intent – at least 553	Segmental colectomy – curative intent	340	9				
Meyer <i>et al.</i> [87]	2004	Prospective review – multicentre	8825 left colon cancers, uncertain how many emergencies with palliative intent – at least 133	Segmental colectomy – palliative intent	18	39				

- *Caecal ischaemia/perforation or serosal tear – favour STC.*
- *Synchronous lesions – favour STC.*
- *Rectal anastomosis – favour SC.*
- *Known pre-existing continence disturbance – favour SC.*
- *Surgeon preference if no other directing influences (Grade A).*

Three prospective studies, one of which was randomized, have compared SC with or without on table lavage (OTL) to subtotal colectomy (STC) [92–94] (Table 4). The SCOTIA trial randomized 91 patients. Its simple design and clear message are welcome. It found that SC and STC were equally safe in terms of mortality and anastomotic leakage. Hospital stay was the same. The main difference was that of bowel function, in that subtotal colectomy resulted in a more frequent bowel action and need for constipating agents compared with a limited resection. Bowel function improved over time but

remained significantly different between the two groups at 4 months.

The results, correctly analysed on an ‘intention to treat’ basis, unexpectedly revealed a significantly higher rate of eventual stoma formation in the subtotal colectomy group (seven of 47 patients *vs* one of 44 patients). Five of the seven patients in the STC group had a Hartmann’s procedure at the first operation (at the surgeon’s discretion) and were never reversed. It is unclear how to interpret this finding and it is likely that this was a random occurrence not related to the procedure.

The SCOTIA group favoured SC over subtotal colectomy where there is a realistic choice of procedures. There are circumstances in which one or other procedure was recommended and these will be discussed later.

The other two studies had very similar findings. Nyam *et al.* [93] had very low mortality and morbidity in both groups and there was no significant difference in stool frequency at 6 months. Torralba’s study [94],

Staged resection group											
Complications		Permanent stoma rate in survivors (%)	Surgery performed	n	Mortality (%)	Hospital stay (days)	Operating time (min)	Complications		Permanent stoma rate in survivors (%)	Comments
Total (%)	Wound infection (%)							Overall (%)	Wound infection (%)		
			Staged resection	31	35						
			Staged resection	74	20	40 (all cancer sites)					
			Staged resection	20	10	21					Abstract only – Portuguese
			Initial caecostomy or transverse colostomy	53	2						
			Staged procedure	40		41					
	0		Hartmann's	17	12	17 – plus 18 after reversal	150		0	40	
53		6	Hartmann's – but seven had primary anastomosis with coloshield	63 (57 with cancer)	12				67	28, P = 0.05	
	7	0	Hartmann's	14	0	19	110		14	43	
	5		Staged procedure	24	25	13 stayed > 16 days			16		
29			Staged resection	9	22	15			67		Abstract only – Portuguese
43			Hartmann's – curative	213	7.5				106		
			Hartmann's – palliative	55	33						

however, found an increased rate of wound infection and anastomotic leakage (although reported as 'minor') in the SC group and recommended subtotal colectomy except where the anastomosis is very low.

Subtotal or total colectomy?

Findings

Subtotal colectomy results in increased frequency of defaecation but most patients do not require long-term anti-diarrhoeal medication (Level I).

There are numerous studies from different units in which subtotal or total colectomy is standard policy. These reports give an indication of the safety of the procedure but because there is still some selection bias the details of patients included and excluded are crucial to their interpretation. Subtotal colectomy was first reported in obstructing cancer by Klatt *et al.* in 1981 [117] and other studies have revealed mortality rates of between 0% and 11%, anastomotic leak rates between 0% and 10% and wound infections in 3–26% of patients

[95–102]. Most mention functional results and many patients have increased bowel frequency often requiring constipating agents in the initial weeks after surgery. By 2–6 months the mean frequency of defaecation is three per 24 h but there is a range from 1 to 4. There is some evidence that stool function is worse for total colectomy (ileorectal anastomosis) compared with higher anastomoses [98,100]. However, none of the reports suggests that continence is an issue. Another proposal is that the length of ileum resected affects bowel function. Brief *et al.* [99] found that five of eight patients with frequent defaecation had more than 10 cm of ileum resected but in those with fewer than three bowel movements a day only 3 had more than 10 cm of ileum removed.

Segmental colectomy and on table lavage

Findings

In segmental colectomy the morbidity and mortality is not significantly different whether on table lavage is

Table 4 Studies comparing subtotal colectomy with segmental colectomy.

Author	Year	Type of study	Subtotal colectomy										Segmental colectomy									
			Total in trial	n	Mortality (%)	Leak rate (%)	Hospital stay (days)	Operating time (min)	Wound infection rate (%)	Permanent stoma rate in survivors (%)	Stool frequency	n	Mortality (%)	Leak rate (%)	Hospital stay (days)	Operating time (min)	Wound infection rate (%)	Permanent stoma rate in survivors (%)	Stool frequency	Comments		
SCOTIA [92]	1995	Prospective randomized trial - multicentre	91	47	13	8.5	12	130	4	15	60% < 3 per day at 4 months	44*	11	5	11	140	7	2	89% < 3 per day at 4 months	Only 85% got treatment intended		
Niam <i>et al.</i> [93]	1996	Prospective non-randomized study - single centre	103	44	5	0	14	125	4		Three per day at 6 months	59	2	2	128	2			Two per day at 6 months			
Torralls <i>et al.</i> [94]	1998	Prospective non-randomized study - single centre	66	35	9	0	16	182	0		Two 'disabling diarrhoea'	31*	3	16	227	23	Not stated		Leaks described as 'minor'			

*On table lavage used.

performed or not, but lavage adds to the operating time (Level I).

On table lavage and manual decompression would appear to be equally effective in patients with left-sided colonic obstruction (Level I).

Recommendation

If segmental colectomy is performed the use of on table lavage is at the discretion of the surgeon, but is not essential (Grade A).

One of the reasons why a three-staged procedure used to be dogma was the belief that bowel preparation was essential for a safe anastomosis [118,119]. The introduction of intra-operative colonic irrigation was the first step towards recreating the ideal situation for an anastomosis. This was first reported by Muir in 1968 [120], but is usually attributed to Dudley [121]. Lavage may be performed antegradely via an ileotomy or through the stump of an amputated appendix. Retrograde lavage has been more recently described with a closed irrigation and collection system (Retrowash; Intermark Medical Interventions Ltd, Bromley, Kent, UK). There is increasing impetus to avoid bowel preparation in elective surgery with a realization that it may do more harm than good [122] and consequently the need for lavage in the emergency situation has also been questioned.

Papers documenting the use of SC with or without OTL show the majority of authors favouring OTL [103-111], with fewer using decompression alone [112-114]. Most papers report mortality of 3-7%, anastomotic leak of 0-8% and wound infection of 0-20%. Only two studies have compared decompression alone with OTL. The prospective randomized trial found no significant differences in outcome between the two groups [116]. The only significant difference in the other study was that of operating time with OTL taking 25 min longer [115]. In this report, however, different surgeons employed each technique so the difference could be accounted for by surgeon speed more than operation performed. Both papers concluded that decompression is as safe as OTL.

Overall, however, it seems likely that OTL adds 25-45 min of operating time [104,109,110,115,116] whereas decompression alone is usually more rapid, taking only 12 min [113].

There are no reports suggesting that primary anastomosis should routinely be covered by a defunctioning loop stoma nor is any guidance given about circumstances that would merit diversion. It appears safe to avoid a stoma altogether.

Table 5 Studies of subtotal colectomy (where possible, specific data relating to left colonic malignancies has been abstracted).

Author	Year	Type of study	Total in study	Inclusions	Exclusions (number of patients if stated)	Number of patients undergoing STC	Mortality rate (%)	Leak rate (%)	Hospital stay (days)	Wound infection rate (%)	Bowel function	Comments
Morgan <i>et al.</i> [95]	1985	Retrospective	16	MLLBO treated by STC	Not stated	16	11	0	Not stated	Not stated	1-3 per day	
Slors <i>et al.</i> [96]	1988	Retrospective	14	LBO - 10 of 14 had cancer	Not stated	14	7	7	24	7	2-4 per day at 1 year	
Wilson and Gollock [97]	1989	Prospective non-randomized	18	Consecutive MLLBO	Not stated	18	11	0	15	17	1-3 per day at 6 months	
Stephenson <i>et al.</i> [98]	1990	Retrospective	60	MLLBO	No resection (11)	31	3	0	17	3	2-4 per day at 2 months	Only 23 obstructed out of group of 72
Brief <i>et al.</i> [99]	1991	Retrospective	72	Cancers treated by STC		72	3	0	21	3	38/62 patients had 0-3 per day; only 8 had 5 or more per day at 2 months	
Amaud and Bergamaschi [100]	1994	Retrospective	118	MLLBO selected for good operative risk, resectable, ischaemic caecum, possible synchronous lesions, skilled surgeon		44	7		16	Not stated	Two per day after STC, three per day after TC at 6 months	28 STC, 16 TC
Reemst <i>et al.</i> [101]	1998	Retrospective	37	Consecutive MLLBO	Peritoneal contamination (1), inexperienced surgeon (8), poor pelvic floor (4), irresectable (4)	20	0	5	15	Not stated	Three per day at 6 weeks	
Perez-Diaz <i>et al.</i> [102]	1999	Retrospective	178	Consecutive MLLBO	Widely metastatic disease, no comorbidities, poor sphincter, rectal cancer	70	4	10	20	26	Two per day at discharge	

STC, subtotal colectomy; TC, total colectomy; LBO, large bowel obstruction; MLLBO, malignant left-sided LBO.

Table 6 Studies of segmental colectomy with or without on table lavage, including two studies comparing the two methods.

Author	Year	Type of study	Total in study	Inclusions	Exclusions (number of patients if stated)	Surgery performed	n	Mortality rate (%)	Leak rate (%)	Hospital stay (days)	Operating time (min)	Wound infection rate (%)	Anastomosis type	Comments
Pollock <i>et al.</i> [103]	1987	Retrospective	44	LLBO (including 18 patients in whom the prep bowel prep failed because of partial obstruction) Patients undergoing SC and OTL for LLBO		SC with OTL	44	16	0	12		34	HS in 31, rest stapled	35 / 44 were cancers
Konishi <i>et al.</i> [104]	1988	Retrospective	25			SC with OTL	25	4	4			Not stated	6 stapled; 19 HS	21 / 25 had cancer
Danne [105]	1991	Retrospective	50	All cases treated by OTL	Elective cases (34)	SC with OTL	16	0	0	17	178	6	Mostly HS	2 / 16 were benign
Tan <i>et al.</i> [106]	1991	Retrospective	23	MLLBO	Not stated	SC with OTL	23	9	4	17	150	30	HS	
Allen-Mersh [107]	1993	Prospective non-randomized	60	All patients with obstruction or infection of left colon treated by single surgeon	Patients treated by other surgeons	SC with OTL	15	7	0	24		20	HS	9 / 15 were obstructed; malignant proportion not stated
Law <i>et al.</i> [108]	1995	Prospective non-randomized	44	All patients with MLLBO	Tumour too low (4), advanced disease (2), dual pathology (1), technical problems (2)	SC with OTL	35	6	3	18	220	14		
Biondo <i>et al.</i> [109]	1997	Retrospective	212	MLLBO or peritonitis	Peritonitis (32), unstable or high-risk patient (47), steroids (10), caecal damage (29), irresectable tumour (31)	SC with OTL	37	5	8	16		5		Data for 37 with MLLBO abstracted from 63 in study
Fofoni <i>et al.</i> [110]	1998	Retrospective	61	All patients with LLBO	None	SC with OTL	61	3	0	11		5	HS 42, stapled 19	48 / 61 had left-sided cancer
Chiappa <i>et al.</i> [111]	2000	Retrospective	50	MLLBO	Faecal peritonitis (4), poor-risk patient (2), irresectable tumour (5)	SC with OTL	39	3	5	16		8		
Dorudi <i>et al.</i> [112]	1990	Retrospective	18	MLLBO	None	SC without OTL	18	6	0	11		0	HS	
Naraysingh <i>et al.</i> [113]	1999	Prospective non-randomized	58	Consecutive unselected series of MLLBO	None	SC without OTL	58	2	2	10		Not stated	HS	
Paritt <i>et al.</i> [114]	2005	Retrospective	73	All patients with LLBO or perforation	Haemodynamic instability (3), ASA 4 (16), unresectable tumour (8), other (2)	SC without OTL	25	0	8	11		Not stated	Stapled	Data for 25 with MLLBO abstracted from 44 in study
Nyam <i>et al.</i> [115]	1996	Retrospective	Not stated	All patients with obstructing MLLBO	Extended right or total colectomy	Decompression (surgeon A)	27	0	0	14	115*	0	Not stated	
Lam <i>et al.</i> [116]	2005	Prospective randomized trial	60	All patients with obstructing MLLBO	Synchronous tumours, caecal damage, sepsis or hypotension (7)	OTL (surgeons B and C) Decompression OTL	32 28 25	3 7 4	3 8 0	14 10 9	140* 120 145	3 16 13	Stapled	

* P < 0.05.

SC, segmental colectomy; OTL, on table lavage; LLBO, left-sided large bowel obstruction; MLLBO, malignant LLBO; HS, hand sewn.

Special situations

Recommendation

Metastatic disease to the liver alone is not in itself a contraindication to resection and primary anastomosis (Grade GP).

Where there is faecal peritonitis, shock, severe sepsis, ASA IV patient or widespread peritoneal malignancy, a Hartmann's procedure should be performed because of the increased risks of primary anastomosis (Grade GP).

Not all patients presenting with malignant left-sided colonic obstruction are suitable for primary resection and anastomosis. About 10–15% may have irresectable disease at presentation and a further 30% may have other adverse factors which dictate the choice of surgery [98,101,108,109,111,114]. Patients undergoing emergency surgery are more likely to be dehydrated, septic and suffer from cardiovascular instability. It is common surgical sense not to perform an anastomosis in adverse situations. Faecal peritonitis, hypotension, requirement for inotropic support and post-operative intensive care are all good reasons to avoid primary anastomosis. Most surgeons would still recommend resection of the primary tumour if possible. A Hartmann's procedure is the most appropriate option. Patients in whom an emergency Hartmann's procedure is performed have a high chance of having no further procedure and hence will be left with a permanent end stoma [82–84,89].

In patients with pre-existing impaired continence it is sensible to avoid a low anastomosis or a near total colectomy with ileorectal anastomosis. If SC is an option then that would be preferable to the alternative of a Hartmann's procedure. Serosal tears or ischaemia of the right colon are features which would favour the use of a subtotal rather than SC. Serosal tears can be repaired and a SC performed in such circumstances but this probably exposes the patient to unnecessary risk.

Perioperative mortality is increased in older patients with obstruction compared with younger patients and those undergoing elective surgery [3,78,123]. In a multivariate logistical regression analysis, however, age was not found to be a contributing factor whereas ASA grade, proximal colonic damage and preoperative renal failure were significantly prognostic [73]. Poon *et al.* [124] specifically compared primary resection with anastomosis in MLLBO in a large cohort of patients above ($n = 57$) and below ($n = 59$) the age of 70 years. They found that resectability, mortality and leak rates remained low and were not significantly different in the elderly group.

More advanced disease carries a higher mortality [125] but several authors have stated that metastases confined to the liver should not be considered to be a contraindication to primary anastomosis [69,102]. In patients with diffuse malignancy, especially within the peritoneal cavity, a stoma is probably more appropriate.

Other comments

Recommendation

Emergency surgery for acute obstruction should be performed by an experienced surgeon who is able to perform all the available procedures (Grade C).

Individual units should submit their results of surgery for malignant large bowel obstruction for regional or national audit and the mortality data should be risk adjusted (Grade GP).

Few would argue that surgery for acute large bowel obstruction should ideally be treated by specialist colorectal teams just as in the elective setting. Frequently, however, this is not possible because of surgical urgency or lack of availability of a colorectal surgeon. Although there is historical evidence that results are improved with consultant or specialist involvement [75,123,126–128], the recent audit of The Association of Coloproctology of Great Britain and Ireland [78] failed to show any difference in mortality either between Specialist Registrars and Consultants or between members and non-members of the Association.

There is an increasing interest in risk stratification in patients undergoing colorectal surgery. Various methods including Bayesian analysis [3,78] and P-POSSUM scoring [129] have been assessed. By application of such methods in individual clinical settings it is possible to give accurate information to patients prior to their emergency surgery. The hope for the future is that prediction of risk may be useful in guiding the surgeon in decision-making regarding the choice of procedure to be performed. As yet there are no prospective studies published on this topic.

The choice of surgery for acute malignant left-sided large bowel obstruction can be guided by evidence from the literature as outlined above. Although there are many reports on this topic, very few are prospective and only a few are randomized. The potential for selection bias is large and almost all authors promote their particular strategy as the most appropriate. There is still plenty of room for decision-making in the operating theatre and the recommendations listed above should act as guidance rather than as dogma. There are usually a number of acceptable alternatives and the surgeon

should do what he or she feels is sensible in that particular situation.

Conflicts of interest

None declared.

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The Treatment of Anal Fistula: ACPGBI Position Statement

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Introduction

Anal fistula is common. It usually causes pain and discharge of pus from the external opening which may be continuous or intermittent. These symptoms should not be underestimated. They often cause great discomfort and can make the patient's life a misery.

Assessment requires an understanding of the pathological anatomy. This is achieved by digital examination and, in complex cases, by imaging using ultrasound or magnetic resonance imaging (MRI) or both. The key to successful treatment is to eradicate the primary track. In most patients this is carried out by laying open the fistula (fistulotomy), an operation which has been performed since mediaeval times as described by John of Arderne in the 14th century. Where it is deemed that fistulotomy may lead to a disturbance of continence, other procedures are available. These include the use of a seton, advancement flap procedures or attempts to occlude the fistula track by biological

substances. Anal sepsis can arise in association with Crohn's disease, human immunodeficiency virus (HIV) infection, ileoanal pouch anastomosis, malignancy and tuberculosis.

Methodology

This Position Statement is based on the evidence obtained from an extensive review of the literature. Organized searches of the Cochrane Database, Pub Med, MEDLINE and EM-BASE were performed using keywords relevant to each section of this Position Statement. Searches were limited to English language articles with a few exceptions. Additional publications were retrieved from the references cited in articles identified from the primary search of the literature. Relevant papers were retrieved and studied by members of the writing committee and incorporated into this review. All evidence was classified according to an accepted hierarchy of evidence and recommendations graded A to C on the basis of the level of associated evidence and/or noted as Good Practice and/or part of NICE/SIGN recommendation or Rapid Technology Appraisal (Table 1) [1].

The Position Statement is presented in sections dealing with detailed aspects of pathology, diagnosis and treat-

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Table 1 Levels of evidence and grades of recommendation.

Level of evidence		Grade of evidence	
I	Evidence obtained from a single randomized controlled trial or from a systematic review or meta-analysis of randomized controlled trials	A	Evidence of type I or consistent findings from multiple studies of type IIa, IIb or III
IIa	Evidence obtained from at least one well-designed controlled study without randomization	B	Evidence of type IIa, IIb or III and generally consistent findings
IIb	Evidence obtained from at least one other well-designed quasi-experimental study	C	Evidence of type IIa IIb or III but inconsistent findings
III	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies	D	Little or no systematic evidence
IV	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities, case reports	GP	Recommended good practice based on the clinical experience of the expert group and other professionals*

Adapted from Eccles M, Mason J[1] and NHS Executive. Clinical Guidelines: Using Clinical Guidelines to Improve Patient Care within the NHS, London: 1996.

*Previous experience and the literature in this area suggests that given the relative lack of evidence for many healthcare procedures, expert opinion and professional consensus are likely to be an important part of this process.

ment. The evidence is briefly summarized in a question, where relevant, under the heading 'Findings' and this is followed, where relevant, by a 'Recommendation'.

Aetiology

Findings

Non-specific anal fistulas arise as a consequence of infection developing in an anal gland lying within the intersphincteric space (level III).

Recommendations

Not relevant.

Anorectal sepsis may present acutely as an abscess or chronically as a fistula. A fistula consists of a primary track which passes from the internal opening in the anal canal to the external opening in the perineum. In more complex cases secondary tracks may branch from the primary track. They usually extend into the upper part of the ischioanal fossa but, uncommonly, they can also involve the supralelevator region.

In the majority of cases, the cause is not immediately apparent and the sepsis is classified as being nonspecific, idiopathic or cryptoglandular in origin. In a small proportion of cases, however, sepsis arises as a complication of specific diseases including Crohn's disease [2], tuberculosis [3], HIV infection and hidradenitis suppurativa [4], as well as other rare conditions such as lymphogranuloma venereum [5],

sacrococcygeal teratoma [6], rectal duplication [7] and perianal actinomycosis [8]. Other causes include trauma, foreign bodies and a rectal cancer causing infection usually secondary to perforation. A submucosal anal fistula may develop as a result of bridging of the edges of an anal fissure.

Although early theories on the aetiology of anal sepsis assumed that infection entered the anal tissues through a fissure or other wound in the anal canal, this is now thought to be unlikely as operations on the anal canal or injections into it rarely result in formation of a fistula [9,10]. The only practical aetiological theory is infection of an anal gland situated in the intersphincteric space. It is not known, however, what initiates this process.

Anal glands

The presence of glands within the submucosa and internal sphincter was recognized in 1880 by Hermann and Desfosses [11], who suggested that, if infected, they might be a cause of anal fistula. Further support for this view was provided by Lockhart-Mummery [12] and Gordon-Watson and Dodd [13]. Parks [10] performed a detailed study on 44 anorectal specimens obtained postmortem or following surgical resection. Serial sections were performed in different planes. Glands were found in all specimens, usually numbering 6–10. Each gland discharged into an anal crypt. In two-thirds of specimens one or more gland branches entered the sphincter and in half the cases glandular tissue crossed the internal sphincter to end in the intersphincteric space. Seow-Choen and Ho [14] performed a similar study and

confirmed Parks' findings on the number of glands and demonstrated a reasonably even distribution around the anal canal, with a slight predominance posteriorly. In this study only 8% of glands were observed to reach the internal sphincter and 8% the longitudinal muscle. Lillius [15] studied a large number of anal specimens and concluded that intramuscular glands were not found in all people, but did note a higher incidence of glands in males than in females. Other authors have shown a wide variation in the anatomy and distribution of anal glands and their associated ducts [16,17] with many reporting a preponderance of ducts in the posterior anal canal [16,18,19], possibly explaining the high frequency of the internal opening lying in the midline posteriorly.

The role of the anal glands is not known. They are mucin secreting [10], but the secretion appears to be of different composition to the mucin secreted by the rectal mucosa [20]. Further studies have shown that the anal glands are dissimilar to those involved in scent production and thus they are not vestigial remnants of sexual scent glands [21].

Evidence supporting anal glands in the aetiology of anal sepsis

Gordon-Watson and Dodd [13] reported three patients with anal sepsis, where glandular epithelium was encountered in the abscess cavity or fistula. Eisenhammer [22,23] thought all nonspecific anal sepsis was a consequence of sepsis arising in a gland within the anal muscles: spontaneous drainage into the anal canal being prevented by occlusion of the connecting duct. Parks [10] examined the contents of the intersphincteric space of 30 patients presenting with anal fistula. In eight a cystic cavity containing pus and debris was encountered. In a further 13 patients, anal gland epithelium was found lining the intersphincteric abscess or part of the fistula. Thus in 70% of cases the anal glands appeared to be directly involved in the aetiology of sepsis. In a similar study, however, Goligher *et al.* [24] only encountered an intersphincteric abscess in eight of 28 patients with an acute anal abscess and in 18 of 32 patients with an anal fistula. It is possible that the intersphincteric exploration was performed in an area which was not the origin of the sepsis, particularly in the acute cases where a track was not obvious. Furthermore, histological studies to look for anal glandular epithelium were not undertaken. Bacteriological investigation was not included in this study and it is likely that a proportion of the patients with acute abscess had a simple cutaneous infection such as an infected hair follicle.

Further indirect evidence for the role of anal glands in the intersphincteric space in the aetiology of anal fistula comes from a study by Lunniss and Phillips [25].

Twenty-two patients with acute anal sepsis underwent incision and drainage coupled with exploration of the intersphincteric space. In ten patients, there was no evidence of sepsis in the intersphincteric space. None of these went on to form an anal fistula, in contrast to 12 patients where intersphincteric sepsis was found, all of whom developed a fistula.

Although current understanding places infection of an anal gland in the intersphincteric space as the initiating event in anal sepsis, an acute abscess confined to the intersphincteric space is rare and in most patients with an acute abscess the infection points some distance from the intersphincteric space.

Spread from an infected intersphincteric gland can occur in three directions. The first is downward to form a perianal abscess at the anal margin in the acute stage and an intersphincteric fistula in the chronic phase. The second is laterally, penetrating the external sphincter [26,27] to form an ischio-rectal abscess in the acute stage or a trans-sphincteric fistula in the chronic phase. The third and more rarely, is infection spreading upwards, either to form a pelvic abscess in the supralelevator space or a high intramuscular abscess, depending on the relationship of the infected gland to the longitudinal muscle [22,28]. Infection may spread circumferentially in either the intersphincteric space, ischio-rectal fossa or supralelevator space to form a so-called horseshoe extension.

Microbiological and histological studies [29,30] have shown a wide spectrum of organisms in the fistula track, similar to an acute abscess. If, however, a fistula is thought to be perpetuated by chronic sepsis, the number of organisms found is much lower than might be expected. An alternative explanation for persistence of a fistula track following acute anal gland infection could be partial epithelialization, as described in 13 of 18 fistula tracks studied by Lunniss *et al.* [30]. This result suggests that epithelialization of the track might be more important aetiologically than chronic infection.

Classification

Findings

The four types of fistula encountered are inter, trans, supra and extrasphincteric (level III).

Recommendations

Anal fistulas should be classified on the basis of the relationship between the primary fistula track and the anal sphincter muscles (grade B).

Correct treatment of an anal fistula requires a detailed understanding of the pathological anatomy with reference to the pelvic floor and anal sphincter.

Among the earlier anatomical studies, Goodsall and Miles [31] described three types of fistula; the complete fistula, the blind external fistula and the blind internal fistula. These were further subdivided into subcutaneous, submuscular and submucosal. Shortly after, Milligan and Morgan [32,33] modified this classification into low if the main track lay below and anorectal if the main track lay above the anorectal ring. Thompson [34] used the relationship of the fistula to the puborectalis to divide fistulas into simple and complex. Steltzner [35] described three groups of fistula: intersphincteric, where the track lay between the internal and external sphincters, trans-sphincteric, where it passed through the external sphincter into the ischio-rectal fossa and extrasphincteric, where it passed directly from the rectum through the levator muscle outside the sphincter complex to the exterior. Further refinement came from the work of Eisenhammer [22,23] who stressed the probable role of the anal glands within the intersphincteric space.

Parks *et al.* [36] in a study of 400 consecutive patients combined the anatomical features with the cryptoglandular theory to develop a classification of anal fistula which is now generally used. Superficial fistulas were excluded as they were thought not to arise from the anal gland. Four different types of fistula were identified including intersphincteric, trans-sphincteric, suprasphincteric and extrasphincteric. The intersphincteric fistula (45%) was the most common and was subdivided into four different types: (1) simple fistula with no secondary track(s), (2) with a high blind track, (3) with a high track opening into the rectum and (4) with a high track leading to a pelvic extension but with no perineal opening.

The second commonest was the trans-sphincteric fistula (30%), in which the track passed through the external sphincter at a varying level. These were further subdivided into uncomplicated fistulas and those with a high blind secondary track.

The third, the suprasphincteric fistula (20%) passed upwards in the intersphincteric plane before looping over the puborectalis muscle to penetrate the levator ani muscle thus entering the ischio-rectal fossa to exit through the perianal skin.

The fourth was the extrasphincteric fistula (5%), which passed directly from the rectum to the perianal skin, passing outside the sphincter complex altogether. This type is now recognized not to be of cryptoglandular origin but rather to intra-abdominal pathology or trauma.

Another less selected series of fistulas from St Mark's Hospital [37] reported an incidence of 66% intersphinc-

teric, 26% trans-sphincteric, 4% suprasphincteric and 4% extrasphincteric. The distinction between a high trans-sphincteric fistula and a suprasphincteric fistula can be difficult, and this may account, in part, for the difference in incidence of this type of fistula between the two St Mark's series. Vasilevsky and Gordon [38] reported a low incidence of suprasphincteric fistula (1.3%) with intersphincteric (41.9%) and trans-sphincteric fistula (53.1%) accounting for the majority.

Eisenhammer [39] in refining his classification recognized three main types of abscess of cryptoglandular origin including low, high intermuscular (intersphincteric), and intermuscular-trans-sphincteric-ischio-rectal. In Parks' classification, these would correspond to the intersphincteric, intersphincteric with high extension into the pelvis and trans-sphincteric. Eisenhammer felt that suprasphincteric and extrasphincteric fistulas were not of cryptoglandular origin, but were iatrogenic arising as a consequence of inappropriate drainage of an acute abscess. He thought that other types of abscess had a noncryptoglandular origin including supralelevator, submucous, ischio-rectal foreign-body abscess, mucocutaneous or marginal abscess and subcutaneous or perianal abscess. It is, however, hard to see how a trans-sphincteric ischio-rectal abscess and an ischio-rectal foreign-body abscess can be differentiated from each other. Similarly, the difference between a low intermuscular abscess pointing at the anal verge and a subcutaneous or perianal abscess is also unclear.

In summary of the various classifications of anal fistula, the one described by Parks *et al.* [36] is the one most widely used in clinical practice.

Clinical assessment

Findings

Anal fistulas should be classified on the basis of the relationship between the primary fistula track and the anal sphincter muscles (grade B).

Recommendations

Useful information can be obtained by clinical assessment including digital examination (grade B).

The history should identify any symptoms which may suggest associated intestinal pathology and previous events that might compromise anal sphincter function such as previous anal surgery and obstetric trauma.

Inspection of the anus will reveal the external opening and perhaps a scar from previous surgery. The position of the external opening is informative. If it is near the anal

canal a superficial or intersphincteric track is likely. If it lies at 2–3 cm from the anus, the fistula is likely to be trans-sphincteric, suprasphincteric or extrasphincteric.

Palpation of the skin between the external opening and the anal canal with a lubricated finger may reveal induration because of the underlying track. It may be possible to determine its direction whether anterior or posterior, thus indicating the likely site of the internal opening.

Digital examination may identify the internal opening and the presence of secondary tracks. Identification of the internal opening is the key to management. In a prospective study of 33 patients which compared digital examination with ultrasound, there was no significant difference in the two methods in correctly identifying the site of the internal opening (approximately 80% accuracy). Ultrasound was, however, less able than digital examination to find secondary tracks owing to difficulty in establishing acoustic contact with the intestinal wall in the region of the anorectal junction [40]. Buchanan *et al.* [41] compared the accuracy of digital rectal examination, anal endosonography and MRI in the preoperative assessment of anal fistula. One hundred and eight patients with anal fistula were studied prospectively by nine experienced clinicians of more than 9 years consultant practice and 10 senior registrars trained by the consultants. There was a significant linear trend ($P < 0.001$) in the proportion of fistula tracks correctly classified with each modality. Clinical examination correctly identified the anatomy of the fistula in 66 (61%), endosonography in 87 (81%) and MRI in 97 (90%). A similar result was found for the correct anatomical classification of abscess ($P < 0.001$), horseshoe extension ($P = 0.003$) and the internal opening ($P < 0.001$). These findings are consistent with previous work [40,42–50] and clearly indicate the limitations of clinical assessment alone in the management of anal fistula. Nevertheless, the digital examination is an essential part of the assessment and is adequate in most patients with a simple fistula. In those with a more complex fistula, it should be interpreted in the light of imaging, particularly MRI.

Goodsall's rule

Goodsall and Miles [31] stated that a fistula with an external opening anterior to a line drawn transversely through the centre of the anal orifice will follow a radial course directly to the dentate line. A fistula with an external opening posterior to this line will curve posteriorly to enter the crypt in the midline. Goodsall's rule is not applicable in all cases as various factors including associated intestinal disease may confound it [51].

The accuracy of Goodsall's rule was studied by Cirocco and Reilly [52] who analysed retrospectively 155 men and 61 women undergoing surgery for anal fistula over a 7-year period. Ninety per cent (87% men, 97% women) of 124 patients with an external opening posterior to the transverse anal line conformed with Goodsall's rule but only 49% (57% men, 31% women) of the 92 patients with an external opening anterior to the transverse anal line did so. Of the latter, 71% (62% men, 90% women) the track entered the anal canal in the midline. Overall in 81% the fistula passed to the midline, 51% posteriorly and 30% anteriorly. The authors concluded that Goodsall's rule was accurate when applied to a fistula with an external opening posterior to the transverse anal line but not to one with an opening lying anterior to it.

Gunawardhana and Deen [53] compared the predictive accuracy of Goodsall's rule by identifying the internal opening after injection of hydrogen peroxide through the external opening. Thirty-four (97%) of 35 internal openings were found of which 20 were in accordance with Goodsall's rule (positive predictive value 59%). The predictive accuracy was greater for anterior external openings, with 13 (72%) of 18 anterior fistulas obeying the rule, compared with six (35%) of 17 posterior external openings. For recurrent fistulas, the accuracy of Goodsall's rule was less with only seven of 17 fistulas conforming to the rule giving a predictive value of 41%.

Coremans *et al.* [54] studied 110 male and 72 female patients. Sixty-three had Crohn's disease. Fistulas with an anterior external opening occurred more frequently in patients with Crohn's disease and in females ($P < 0.003$). Fistulas with a posterior external opening occurred more frequently in men and in those without Crohn's disease ($P < 0.003$). Overall, the accuracy of Goodsall's rule was not affected by the diagnosis of Crohn's disease.

The data indicate that Goodsall's rule is accurate in patients with an opening posterior to the transverse anal line but is less reliable when it is anterior.

Anal manometry

Findings

Anal canal pressures are related to anal continence (level III).

Recommendations

Anorectal manometry may have a selective role in the management of an anal fistula, guiding the use of sphincter preserving surgery (grade B).

Consideration of the results of anal manometry has been shown to improve the outcome following surgery in selected patients. Sainio and Husa [55] studied 31 adult consecutive patients undergoing surgery for anal fistula. Anal manometry was performed preoperatively and at 7 months after surgery. Resting anal pressure was significantly reduced in the distal 3 cm of the anal canal postoperatively. Voluntary sphincter contraction was less affected, suggesting that the internal anal sphincter is especially at risk in fistula surgery. Maximal squeeze pressure and maximal contractile power were significantly reduced after division of the external anal sphincter, especially in women. Pressures were lower in women compared with men, particularly after surgery and defective control was associated with a reduced squeeze pressure.

Sainio [56] subsequently reported the results of manometry in 199 adults 9 years after laying open. Resting anal and voluntary contraction pressures were significantly reduced in 67 patients who had defective anal control, with voluntary contraction being lower in women than men. The type of fistula significantly influenced both resting and maximal squeeze pressures. Patients who had been treated for a high intersphincteric fistula had low pressures and a high incidence of incontinence ($P = 0.001$).

In a nonrandomized prospective study by Pescatori *et al.* [57], 96 patients who underwent manometry before and after operation were compared with a control group of 36 patients who did not. The recurrence rate was 3% in the group who underwent anal manometry and 13% in the control group. Postoperative soiling occurred in 14% in the manometry group compared with 31% in the control group. Division of the internal sphincter led to a reduction in resting tone (mean resting pressure pre and postoperatively 56 ± 22 and 47 ± 15 mmHg; maximal squeeze pressures pre and postoperatively 114 ± 30 and 85 ± 28 mmHg). Continence after treatment of trans-sphincteric and suprasphincteric fistulas in the patients who had manometry were better due to the greater use of sphincter preserving techniques.

It appears that preoperative anorectal manometry can influence the functional outcome following surgery by guiding appropriate use of sphincter preserving techniques [57–67].

Imaging

Various imaging techniques have been used in the investigation of anal fistula. They include contrast fistulography, anal ultrasound, MRI and computerized tomography (CT). Anal ultrasound may be carried out with or without three-dimensional reconstruction and with or without ultrasound contrast. MRI has been

used with pelvic-phased array coil, endoanal receiver coil with or without intravenous contrast.

Fistulography

Findings

Fistulography is little used in clinical practice (level III).

Recommendations

Fistulography has a very limited role in the assessment of cryptogenic anorectal sepsis (grade B).

Fistulography involves the injection of a water soluble contrast medium into the external opening to visualize the track. This technique is seldom used in modern clinical practice. While the primary track is demonstrated, secondary extensions may not fill and the complexity of the fistula may be underestimated. Furthermore, it is not possible on fistulography to determine the relationship between the track and the anorectal junction. Thus, the distinction between sepsis above or below the levator plate is not possible. Fistulography gives little information on the site and level of any internal opening, being correct in only 25% of cases [68].

The limited reports of fistulography suggest that it is correct in only 16% of cases [68], with a false-positive rate of 10%. In certain patients, however, especially those with either inflammatory bowel disease or an extrasphincteric fistula, fistulography may be helpful in up to 48% of cases [69,70] as it can show the direct communication with the intestine above the levator. Thus, a fistulogram in a patient presenting with an extrasphincteric fistula may be diagnostic by showing, for example, entry of contrast into the sigmoid colon affected by diverticular disease.

Computerized tomography

Findings

Computerized tomography offers little in the assessment of anal fistula, other than to determine the extent of intestinal inflammation in inflammatory bowel disease, for example in the terminal ileum (level III).

Recommendations

Thin-slice spiral CT may be helpful when MRI is either not available or is contraindicated (level of evidence: grade C).

Differentiation by CT between local quiescent disease with fibrosis and active disease is poor, especially when

compared with MRI. Prospective comparison of CT with rectal ultrasound showed the latter to be superior [71]. CT can be helpful in inflammatory bowel disease to assess the extent of rectal inflammation [72]. Multiplanar imaging using spiral CT and intravenous contrast may be helpful in imaging the local features of a fistula in cases where MRI is either not available or is poorly tolerated [73].

Anal endosonography

Findings

Endoanal ultrasound has an established role in the assessment of anal fistula (level IIa).

Recommendations

Anal endosonography (ultrasound) may be the first line investigation for patients with an anal fistula suspected to be complex. Patients with recurrent fistula may benefit from anal endosonography, but MRI will also be required (grade A).

Anal ultrasound described by Bartram revolutionized the assessment of anal sepsis [44]. In early studies using a 7 MHz probe fistulas could be classified correctly in 63–87% of cases when compared with the intra-operative surgical assessment [74,75]. Abscesses were detected in up to 100% of cases [74] and anal ultrasound was able to differentiate simple from complex anal sepsis [43,75,76].

The injection of hydrogen peroxide into the external opening acts as an ultrasonic contrast medium by the production of hyper-reflective gas bubbles [77]. It has been suggested that this increases the detection rate and accuracy of the assessment of horseshoe extensions [78]. The technique increased the accuracy from 68–98% [48]. Hydrogen peroxide enhancement also appears to reduce the misinterpretation of a simple fistula as being more complex [79]. The results of ultrasound have improved with the introduction of higher frequency transducers (10 MHz) combined with peroxide enhancement [80,81]. Other ultrasonic contrast agents (Levovist[®], Schering AG, Berlin, Germany) have been used [82], but have not been widely adopted because of the low cost and easy availability of peroxide and the lack of added benefit of more expensive agents.

An early study showed that anal ultrasound was poor at identifying the location of the internal opening being correct in less than one-third of cases [40], although the accuracy increased to 70% when the criteria for identifying the internal opening were redefined. More recent work has, however, shown that with experience this rises

to 93% [83]. The correct assessment of the internal opening is dependent upon the criteria used for ultrasonic identification [84,85]. Peroxide enhancement may increase the detection of the internal opening leading to a correct identification in over 80% of cases [81,86,87]. Detection of the persistence of an internal opening by anal ultrasound after antitumour necrosis factor alpha (TNF α) treatment for perianal sepsis in Crohn's disease may predict recurrence [88].

Anal ultrasound has been further developed to enable volume data acquisition and subsequent multiplanar imaging of the anal canal [89,90]. When this technique is used by enthusiasts to assess anal sepsis an accuracy of over 80% [86,87] similar to endocoil MRI can be achieved. The use of hydrogen peroxide may have some additional benefit to that of multiplanar ultrasound [91].

Endoanal ultrasound has two major drawbacks. First, it has a relatively limited field of view with images only having good spatial resolution for a distance of about 2 cm beyond the anal probe. Secondly, the differentiation between supralelevator and high infra-levator sepsis is also poor [42].

Magnetic resonance imaging

Findings

Magnetic resonance imaging is an accurate method of imaging anal fistula (level 1).

Recommendations

Magnetic resonance imaging should be considered in any primary fistula deemed after clinical or endosonographic assessment to be complex. It should also be considered in patients with recurrent anal fistula (grade A).

Magnetic resonance imaging is now the gold standard for the assessment of anal sepsis because of its ability to differentiate sepsis and granulation tissue from the sphincter muscles [73]. Early reports of MRI in anal Crohn's disease [92] were followed by its application to patients with non-Crohn's anorectal sepsis [93,94]. An early study showed very high concordance rates of MRI with the findings on examination under anaesthetic (EUA) as follows: 86% for primary track, 91% for secondary tracks and 97% for horseshoe extensions [93]. More significantly there was only a small discrepancy between the MRI findings and those on EUA (9%), the MRI predicted recurrence of sepsis. MRI was more accurate than clinical assessment in detecting previously missed secondary extensions and in the correct assessment of the level of the fistula with respect to the sphincter [95].

Magnetic resonance imaging has been refined by the introduction of endocoil receivers. These greatly increase the tissue resolution in close proximity to the anal canal, providing superior anatomical detail [96,97]. The MRI appearances have been validated by subsequent EUA [98,99]. Endocoils have, however, a limited field of view (2–3 cm from the coil) [100], so fistulous extensions beyond this range can be missed [101,102]. When extensive sepsis or supralelevator sepsis is suspected, a pelvic-phased array coil is more accurate [103,104].

Whether a pelvic-phased array or endoreceiver coil is used, there are variations in technique between the sequences used to obtain images and the use of contrast agents. Rectal gadolinium-diethylenetriamine penta-acetic acid (DTPA) may help to identify tracks but its value in this respect is limited [105]. Direct injection of saline into the track [102] has also been described but neither this nor gadolinium have been widely adopted. Intravenous gadolinium-DTPA has however been used to provide dynamic contrast enhanced MRI [106,107]. This helps to differentiate between healed tracks and those with active inflammation.

Spencer *et al.* [107] have directly compared sequences to determine which is the most helpful. T1-weighted sequence scans show anatomical detail with sinuses and fistula tracks seen as hypointense structures. T2-weighted scans provide better signal differentiation between active disease and fibrosis from inactive tracks. Short tau inversion recovery (STIR) sequences are considered by many to be superior to T1- or T2-weighted scans for the detection and delineation of sepsis [105,108,109]. They suppress the signal from fat in the ischioanal fossa thus highlighting sepsis [105]. It has been suggested that STIR sequence scanning may not be able to detect small abscesses that are seen on dynamic contrast enhancement (DCE), MRI with T2-weighted axial images [106,107], but they may be better for the detection of internal openings, especially when combined with endoanal receiver coils [108]. An alternative to STIR sequence scanning is the use of T2-weighted scans with spectral fat saturation inversion recovery (SPIR). When these two techniques are compared, however, there appears to be no advantage for SPIR and sphincter detail is better with STIR [110].

The slice orientation is crucial, irrespective of the sequences used to obtain images [73,111]. An initial T2-weighted sagittal scan should be obtained to orientate the pelvis so that further axial and coronal scans can be performed perpendicular and parallel to the long axis of the anal canal. The most useful planes are axial and coronal [73,102,112,113]; scans orientated in the sagittal plane are of limited value unless anovaginal fistulation is present [114,115].

There is a learning curve for the interpretation of MRI, with an increase in correct interpretation of up to 50% with experience [113]. Whilst initial agreement in scan interpretation is acceptable (K_a value 0.7 good agreement) [108], this can improve to K_a value 0.92 with a short period of directed training [116].

The most valuable use of MRI is in the assessment of recurrence. Where sepsis not found on EUA persisted, its presence and site were predicted by the preoperative MRI scan [46,94,117]. The MRI classification of fistulas into simple and complex enabled the chance of recurrence to be predicted much more accurately than by EUA alone (positive predictive value 73% *vs* 57%) [117,118]. When the surgeon took the result of the MRI into account when carrying out the surgery, the recurrence rate for complex fistulas was 16%, compared with 57% when the MRI scan was not referred to [119].

It has been suggested that the preoperative MRI assessment will alter the surgical treatment in up to 10% of fistulas treated for the first time [120] and in 21% of a mixed population of first and second operations and patients with Crohn's disease [42]. This has led to the suggestion that MRI should be the reference standard for anorectal sepsis rather than EUA.

Magnetic resonance imaging is not always well tolerated or always available. When compared with anal endosonography, it is time consuming and more expensive. Comparison of ultrasound and MRI showed good concordance with the surgical findings. For intersphincteric sepsis they were equally accurate, but MRI was superior for transsphincteric sepsis. MRI also benefited from multiplanar assessment [113]. Subsequent studies suggested that MRI was superior to anal ultrasound with concordances with surgery for ultrasound and MRI of 80% and 90% respectively [41,46,113,121,122]. Ultrasound may be better at locating the internal opening than non-endocoil MRI [41], but it does have the disadvantage of not being technically possible in the presence of anal canal stenosis [47]. There are difficulties in differentiating old tracks from new sepsis, and acoustic shadowing can lead to an erroneous diagnosis of intersphincteric sepsis as being trans-sphincteric [123]. The role of anal ultrasound in assessing rectovaginal fistula is uncertain. Some authorities report equal accuracy with MRI (endocoil) [122], but others suggest that ultrasound is of little value other than to demonstrate an associated sphincter defect [124].

Summary

The majority of fistulas need no investigation and can be treated with surgery with a good expectation of cure. Primary cases suspected to be complex should have an anal ultrasound scan and if features of complex fistulation

or secondary extension are present then an MRI should be requested. All recurrent fistulas, except those which are obviously simple on clinical examination or anal ultrasound, should have an MRI.

Endocoil MRI is not obligatory. Indeed many authors suggest that equivalent or superior images may be obtained with body or pelvic-phased array coils. Sequences should probably include T1 images to give sphincter anatomy detail and images with either fat suppression (STIR, SPIR) or DCE, MRI. A T2 scout sagittal scan in the midcoronal position will allow orientation to the long axis of the anal canal and not to the axis of the body. Axial and coronal scans are of most value although sagittal images are useful in cases of vaginal fistulation.

Treatment

Surgery is the mainstay of treatment. Its aims are to cure the fistula while at the same time preserving anal sphincter function. Various approaches are used indicating that there is no ideal procedure applicable to every patient. A fistula can vary in complexity from being low, involving only a small proportion of the anal sphincter, to complex, with multiple tracks involving more of the anal sphincter. The surgeon should be able to identify the degree of complexity of the fistula and plan surgery accordingly. Complex fistulas should be treated by a surgeon with experience particularly when they are associated with Crohn's disease (*level of evidence: level IV, grade GP*).

Fistulotomy

Findings

Division of the external sphincter muscle can lead to impairment of continence, which is more likely, the higher the primary fistula track (level III).

Recommendations

Division of the external sphincter should always be undertaken with caution, taking account of the sex of the patient, the position of the fistula, previous surgery and associated diseases (grade C).

Fistulotomy has been used for many hundreds of years. It involves laying open the whole track from the internal to the external openings [125]. The more proximal the track crosses the sphincter, the greater will be the resulting functional deficit.

There is great variation in the reported results regarding recurrence (0–21%) [126,127], and incontinence (0–82%) [126,128].

Extent of muscle division

While most authorities would accept that the levator ani and the external sphincter are continuous, a recent anatomical study has suggested a definite plane between puborectalis and the external sphincter [129]. As, however, division of > 30–50% of the external sphincter probably results in a significant functional deficit [130], this anatomic finding is of little relevance to management. Preoperative imaging by MRI has shown that 50% of transphincteric tracks pass obliquely upwards from the internal opening to the ischioanal fossa, indicating in these cases that more sphincter will be divided by fistulotomy than is suggested by the level of the internal opening [131]. This finding supports a clinical study which suggested that impaired continence following fistulotomy occurred in 82% of patients with a high internal opening, and even in cases with a low internal opening a continence disturbance was present in 44% [9]. A retrospective review of 312 patients also suggested that a high internal opening was significantly associated with 'minor continence disorder' [132].

A study comparing preoperative MRI aimed to assess the amount of sphincter involved by the fistula track with postoperative continence has not been performed.

It is often difficult to compare different studies. Thus one retrospective review of 110 patients which demonstrated that the amount of sphincter divided (< 25% *vs* > 25%) was the only factor which correlated significantly with postoperative continence, then stated that the extent of sphincter division was determined by the subjective method of 'estimation by palpation' [133]. Another retrospective study of 84 patients who underwent fistulotomy with marsupialization reported recurrence in 4.7% and flatus incontinence in 3.5%. It was concluded that division of three quarters of the sphincter did not increase rates of incontinence [134]. Supra and extrasphincteric fistulas were only seen after previous surgery in a retrospective study of 227 patients, (recurrence 2%; incontinence 4%) with the implication that such fistulas are iatrogenic. Another interpretation is that a complex fistula is associated with a high risk of recurrence [135].

Impairment of continence is, however, not only related to the extent of muscle division. In a study of 624 patients who had undergone surgery of various types, female sex, anterior anatomy and associated conditions such as Crohn's disease were also found to be important [136].

Although the available data are confusing, they indicate that division of more than 30% of the external sphincter should be undertaken with considerable caution particularly in females, anterior fistulas, and where the fistula is associated with Crohn's disease. Treatment

in these circumstances should be undertaken by an experienced surgeon. MRI will assist in the assessment of the pathological anatomy and possibly the extent of muscle division that would be involved by a fistulotomy.

Fistulotomy in acute anorectal sepsis

Findings

Immediate fistulotomy is associated with a lower recurrence rate than simple incision and drainage (level I).

Recommendations

Immediate fistulotomy should be undertaken only in patients in whom the internal opening can be found, and the fistula is 'simple' (grade A).

A meta-analysis of five randomized, controlled trials (RCTs) comparing drainage alone with drainage plus fistulotomy (when a fistula was identifiable), demonstrated a significant reduction (83%) in the rate of recurrent fistula formation [relative risk (RR) 0.17; $P < 0.001$] with immediate fistulotomy but no significant difference in the risk of incontinence (RR = 2.46; $P = 0.140$) [137]. While there was 'no conclusive evidence if either treatment is better in the treatment of anorectal abscess/fistula, a reduction in recurrence of 83% seems more than adequate justification for immediate fistulotomy at the time of abscess drainage in certain situations.

An RCT involving 200 patients with abscess and a 'low' fistula showed that after immediate fistulotomy for low fistula, 5% recurred compared with 29% after drainage only, with a continence disturbance rate of only 2.8% [138]. Another RCT of 52 patients with anal abscess reached the same conclusion with persistence of the fistula in no case, compared with 25% after drainage only [126]. The same unit suggested that drainage alone 'puts only a few patients at risk of recurrence' based on the results of a similar RCT in which recurrence occurred in no case after immediate fistulotomy compared with 14.3% after drainage alone [139].

The argument against immediate fistulotomy is based not only on the increased risk of impaired continence, but also on the fact that some individuals would have unnecessary surgery. Thus in a retrospective study of 117 patients with an anorectal abscess treated by drainage alone, there was an overall recurrence rate of 47% (37% fistula formation; 10% recurrent abscess) showing that fistulotomy, if undertaken, would have resulted in unnecessary surgery in over 50% of patients [140]. A similar conclusion was reached by Schouten and van Vroonhoven [141].

Another RCT adopted a slightly different approach by the randomization of patients to incision and drainage alone (18 patients) and incision and drainage followed by fistulotomy 3 days later (20 patients). Recurrence was similar in the two groups, with continence disturbance and prolonged wound healing being more common after fistulotomy. Based on this observation immediate fistulotomy was recommended only for patients with recurrent sepsis [142]. In addition, in a prospective non-randomized study of immediate fistulotomy applied only to patients in whom an internal opening could be found, there was a higher rate of recurrent sepsis (13%) compared with simple drainage only (11%). It was therefore suggested that all abscesses should be treated by simple drainage only [143]. It should be noted, however, that this is the only report in the literature with this result. All other retrospective series confirm an advantage for immediate fistulotomy in terms of recurrence. For example, in a series of 158 patients, recurrence was 4% after immediate fistulotomy compared with 34% after drainage alone [144], in larger series of 1023 patients these rates were 3.7% and 34.7% respectively [145] and in another study of 101 patients they were 0% and 16% [146].

Ischiorectal abscess

This conclusion may not be applicable to ischiorectal abscess as it is usually associated with a trans-sphincteric fistula. In a retrospective series of 80 patients with ischiorectal abscess 38 (47.5%) were treated by drainage and immediate fistulotomy with persisting sepsis in 21% compared with 44% after drainage alone [127]. In another retrospective study of 72 patients with acute abscess these rates were 7% and 33% but 55% of the recurrences after immediate drainage occurred in the subgroup of patients with ischiorectal abscess [147]. The authors therefore advised against immediate fistulotomy in cases of ischiorectal abscess or trans-sphincteric fistula.

Conclusion

The available data indicate that immediate fistulotomy at the time of drainage should be advised in patients in whom the internal opening can be found and where the fistula is submucosal or intersphincteric. Abscesses associated with a more complicated fistula should be simply drained and subsequent surgery reserved for patients who develop continuing or further sepsis or fistula.

A retrospective study of a series of 32 patients with an acute abscess and an associated complicated fistula reported a primary healing in 78% after partial fistulotomy and insertion of a seton with no muscle division at all

[148]. This should be considered as an alternative surgical approach. Again, the experience of the surgeon is crucial to the outcome judged by recurrence rates and continence.

Fistulotomy vs fistulectomy

Findings

Fistulectomy results in longer healing times and higher rates of impaired continence than fistulotomy (level I).

Recommendations

The fistula track should be laid open rather than excised (grade A).

This question has been addressed by one RCT, which randomized 47 patients to laying open (traditional fistulotomy) or excision (fistulectomy). Although recurrence was similar in the two groups, fistulectomy resulted in a larger wound, with a longer healing time and a higher rate of continence disturbance [149]. Another RCT compared radiofrequency fistulectomy with traditional diathermy fistulotomy in 20 patients. Immediate postoperative pain was less after fistulectomy and healing times were shorter. Whether this is a reflection of the surgical technique used is unknown [150]. In a retrospective series of 133 patients, of whom 80 had undergone fistulectomy, early recurrence was only seen in the 33 patients who had had a fistulotomy, although the possible reasons for this were not clear [151].

Marsupialization

Findings

Marsupialization after fistulotomy is associated with a significantly shorter healing time (level I).

Recommendations

The wound edges of the laid open fistula track should be marsupialized to aid healing (grade A).

Marsupialization of the fistulotomy wound has been shown in a randomized trial of 46 patients to result in smaller wounds and less bleeding compared with wounds that are not marsupialized [152]. Healing time was studied in a controlled trial which included 103 patients with an uncomplicated inter or trans-sphincteric fistula randomized to fistulotomy alone or fistulotomy with marsupialization. The healing time was reduced and anal squeeze pressure was higher after marsupialization [153].

Of a series of 624 patients, 300 underwent fistulotomy with marsupialization. Overall recurrence occurred in 8%, but it was not possible to determine the effectiveness of the marsupialization [136].

There is scope for a well-conducted trial of marsupialization as part of the surgical treatment of fistula. At present it is favoured by some surgeons based on personal experience and preference.

Fistulotomy in the 'complex' fistula

Findings

There may be a limited role for fistulotomy with immediate sphincter reconstruction in the management of 'complex' fistulas (level III).

Recommendations

No clear guidelines are available.

A series of 35 patients undergoing fistulotomy with primary sphincter reconstruction for 'complex' anal fistula (high trans-sphincteric in 86%; the remainder were supra or extrasphincteric) was studied prospectively. Preoperatively incontinence was present in 31.4% and most patients had had previous surgery. Recurrence occurred in 6% and continence was improved after operation. Anal canal pressures improved postoperatively in the incontinent patients and no patient who was continent preoperatively was worse after surgery [65]. This approach to a difficult clinical problem is interesting and novel, although the suggestion that primary healing can be achieved in 78% of patients with a 'complex' fistula treated by partial fistulotomy and temporary seton placement is also worthy of further consideration in this situation, particularly as the risk to continence of this approach is theoretically small [147].

Seton techniques

A seton (Latin *seta*, a bristle) is part of the armamentarium available to the surgeon. It is used when the risk to continence of a one-stage fistulotomy is thought to be too great.

Seton techniques can be classified into those aimed to cut the sphincter muscle (tight) and those intended not to do so (loose). The aims of a loose seton are as follows:

- 1 to achieve long-term drainage of the fistula to prevent acute septic exacerbations but with no curative intent. There are very little data on the outcome although the medium term follow-up of 11 patients treated in this way [154] demonstrated success in eight (73%);

Table 2 Results of published studies of loose seton used as definitive strategy for anal fistula.

Author	Year	Study type	n	Classification	Preoperative continence assessment	Technique	Recurrence / persistence (%)	Minor incontinence (%)	Major incontinence (%)	follow-up months (range)
Thomson and Ross [155]	1989	Retrospective	34	High trans (25 with secondary extensions, 8 recurrent)	No	Partial internal sphincterotomy Loose 0-nylon seton across denuded EAS Seton removed after adequate healing around it (38 days [1-125])	44	17	0	55 (20-159)
Kennedy and Zegarra [148]	1990	Retrospective	32	30 high trans/ 2 supra	No	Partial internal sphincterotomy Loose 1-silk seton across denuded EAS	22	58	4	39 (21-90)
Williams <i>et al.</i> [156]	1991	Retrospective	14	High trans- and supra sphincteric	No	Seton removed after healing around seton (7 weeks [2-17]) Partial internal sphincterotomy Loose silk or fine plastic feeding tube seton across EAS Seton removed when otherwise healed	14	36	8	24 (4-60)
Lentner and Weinert [157]	1996	Retrospective	79	Intersphincteric/ low trans	Yes	Loose seton simply passed along track and allowed to migrate distally with time (n = 19) or residual track laid open	16	1	0	16
Balogh [158]	1998	Retrospective	14	Recurrent extrasphincteric	?	Fistulectomy with no sphincter division Fenestrated catheter segment tied loosely around track Wound irrigated through the catheter	10	0	0	?
Joy and Williams [154]	2002	Retrospective	12	High trans/ suprasphincteric	Yes	Catheter removed after 7-10 days Loose silastic seton passed across muscular component of fistula (no sphincter division) Seton removed once all healed	25	8	0	19 (9-54)
Buchanan <i>et al.</i> [159]	2004	Retrospective	14	High trans/ suprasphincteric	Yes	Review of 14 contactable patients treated at least 10 years earlier by Thomson technique (Lunniss and Thomson, 1996 [184])	79	?	?	142 (125-153)

EAS, External anal sphincter

Table 3 Results of published studies of loose seton used as part of staged fistulotomy for anal fistula.

Author	Year	Study type	n	Classification	Preoperative continence assessment	Technique	Recurrence/persistence (%)	Minor incontinence (%)	Major incontinence (%)	follow-up months (range)
Parks and Stitz [160]	1976	Retrospective	80	23 trans 57 supra	No	Partial internal sphincterectomy Division of lower 1/3 to 1/2 EAS Loose braided nylon seton across upper sphincter After 3 months If healed, seton removed (15/23 trans; 35/57 supra) If not healed, seton enclosed muscle divided	9	17 39	0 0	> 12
Ramanujan et al. [161]	1983	Retrospective	45	Suprasphincteric (but possibly trans)	No	Proximal sphincter (IAS, EAS, puborectalis) divided Loose seton across distal EAS Distal sphincterotomy at 8 weeks (3-18)	2	1	0	?
Kuypers [162]	1984	Retrospective	10	Extrasphincteric to secondary trans	Yes	Partial internal sphincterectomy Transphincteric component laid open Loose seton through extrasphincteric extension Seton enclosed muscle divided at > 3 months	0	60	10	6-30
Thomson and Ross [155]	1989	Retrospective	19	Trans-sphincteric 13 with supralelevator or horse-shoe extension		Internal sphincterotomy Loose seton across EAS Because of persistence, seton enclosed muscle divided at 19 weeks (1-56)	0	56	31	16 (1-47)
Faith et al. [163]	1990	Retrospective	7	5 suprasphincteric 2 extra (arising from trans)	Yes	IAS and EAS divided to dentate line Loose seton across upper sphincter End colostomy > 3/12, seton tightened twice or thrice weekly until cut through Colostomy closed	0	0	0	9-69
Williams et al. [156]	1991	Retrospective	24	High trans- and suprasphincteric	No	Internal sphincterotomy Loose seton across EAS Enclosed EAS divided 4-8 weeks later	8	54	4	24 (4-60)

Table 3 Continued.

Author	Year	Study type	n	Classification	Preoperative continence assessment	Technique	Recurrence/persistence (%)	Minor incontinence (%)	Major incontinence (%)	follow-up months (range)
Pearl <i>et al.</i> [164]	1993	Retrospective	89	complex	No	IAS and proximal EAS division Loose seton across distal EAS	3	?	4	23
Van Tets and Kuipers [165]	1995	Retrospective	34	18 trans-16 extra	Yes	Distal EAS divided 6–8 weeks later IAS and distal EAS divided Seton across upper EAS	13	56	42	?
Garcia-Aguilar <i>et al.</i> [166]	1998	Retrospective	47	39 high trans 3 supra 5 extra	No	Enclosed muscle divided at 3 months IAS divided, 2-silk loose seton Residual track laid open after at least 6 weeks	8	50	24	33

IAS, Internal anal sphincter.

- 2 to allow any secondary track(s) to heal around the seton lying along the primary track before definitive surgery is subsequently undertaken. Eradication of acute sepsis and secondary extensions before definitive surgery is logical, but there are no data available specifically addressing this question;
- 3 to cure a trans-sphincteric fistula without division of either the internal or external sphincter. Data on this approach are given in Table 2 [148,154–159];
- 4 as part of a staged fistulotomy, in which the sphincter is divided in stages, the seton being used to allow healing of the divided sphincter segment before further division (Table 3) [155,156,160–166];
- 5 to cure a trans-sphincteric fistula without external sphincter division;
- 6 to permit slow division of the enclosed muscle, despite being loose.

A cutting seton (Table 4) [61,66,154,156,166–183] gradually severs the enclosed muscle with the aim of achieving cure of the fistula with minimal continence disturbance. One type of cutting seton, the Ksharasootra, divides the muscle by its chemical properties, rather than tension, but as such setons are not licenced for use in the UK, they will not be considered further.

The loose seton as part of a staged fistulotomy strategy

Findings and recommendations

A loose seton can be used as part of a staged fistulotomy strategy in complex fistulas (level III, grade B).

In 1976, Parks and Stitz published [160] the results of a personal series of ‘high’ fistula treated at St Mark’s Hospital. Of 158 patients, 80 had a high trans-sphincteric or suprasphincteric track in whom fistulotomy was deemed to have an unacceptable risk of incontinence. These were treated by drainage of the source of the sepsis by internal sphincterectomy to open the intersphincteric space. This was followed by division of the lower third to half of the external sphincter, after which a braided nylon seton was loosely inserted around the remaining track. The rationale of the seton was to prevent premature healing with pocketing of any high secondary track or extension, and to give time for fibrosis to occur. After a few months, if all secondary tracks had healed, the seton was removed in the anticipation that the remaining primary track would then close. This strategy was successful in 15 of 23 trans-sphincteric and 35 of 57 suprasphincteric fistulas. If a high track or extension persisted, the remaining primary track enclosed by the

Table 4 Results in published studies of cutting seton as treatment for anal fistula.

Author	Year	Study type	n	Classification	Preoperative continence assessment	Prior division of IAS	Seton material	Time to cut through weeks (range)	Recurrence/persistence (%)	Minor incontinence (%)	Major incontinence (%)	follow-up months (range)
Hanley [167]	1978	Retrospective	35	Anterior low trans-± abscess	No	No	Rubber band tightened every 3-4 weeks	?	?	?	?	?
Culp [168]	1984	Retrospective	20	High trans- or supra-sphincteric	No	No	Penrose drain tied with silk	2 (1-9)	0	15	0	> 24
Held <i>et al.</i> [169]	1986	Retrospective	9	Trans-sphincteric 7 acute	No	No	Rubber band tightened every 2 weeks	7	0	0	0	36 (3-120)
Christensen <i>et al.</i> [170]	1986	Retrospective	21	High trans-sphincteric	No	No	? type tightened every second day	1 (<1-2)	0	29	43	96 (24-168)
Misra and Kapur [171]	1988	Retrospective	59	38 intersphincteric 16 trans 2 supra	No	No	Braided stainless steel wire, tightened weekly	4 (<1-7)	4	0	0	22 (11-37)
Ustymoski <i>et al.</i> [172]	1990	Retrospective	11	Trans-sphincteric horseshoe	No	No	Rubber band tightened weekly	7 (2-17)	18	?	?	48 (8-144)
Williams <i>et al.</i> [156]	1991	Retrospective	13	? abscess fistulae	No	Yes	Elastic band or silk tightened 'as necessary'	16 (8-6)	0	54	7	24 (4-60)
Olmo <i>et al.</i> [173]	1994	Retrospective	12	5 trans-7 suprasphincteric	No	No	5 silk setons, sequentially tied weekly	3 (2-5)	0	25	0	6-24
Graf <i>et al.</i> [61]	1995	Retrospective	25	High trans-	No	Yes	0/0 braided polyester, tightened again at 1 month (9) or tissue divided (16)	?	8	44	12	46 (3-94)
McCourtney and Finlay [174]	1996	Retrospective	22	1 Inter 16 trans 5 supra	No	No	1/0 Silk, replaced monthly as necessary	20 (4-76)	4	0	0	> 12
Walisch <i>et al.</i> [175]	1997	Retrospective	20	High trans	No	No	2 x 0 silk, the second tied at 4 weeks	8	0	0	0	24
Hamalainen, and Sainio [176]	1997	Retrospective	35	25 high trans 5 low trans 3 extra	Yes	Distal sphincter cut in 10	Non-absorbable braided suture 0/0, tightened every 1-2 weeks	12 (3-23)	8	64	6	70 (28-184)
García-Aguilar <i>et al.</i> [166]	1998	Retrospective	12	11 trans 1 supra	No	Yes	Rubber band, tightened every 2 weeks after acute sepsis resolved	16 (8-36)	6	67	25	27
Dziki and Bartos [177]	1998	Retrospective	33	22 high trans 4 supra 7 extra	?	Yes	Rubber band, tightened with thread every week	12 (0-22)	0	34	38	16 (4-22)
Isbister and Al Sanai [178]	2001	Retrospective	47	16 high trans 11 low trans	Yes	No	1-Silk, tightened every 2-3 weeks	?	2	36	11	13
Joy and Williams [154]	2002	Retrospective	17	Trans (not high)	Yes	Yes	Snug silastic, tightened with haemorrhoid bands	20	6	50	20	19 (9-54)
Durgan <i>et al.</i> [179]	2002	?Prospective	10	extra	?	Yes and EAS up to dentate line	4 or 5, 1-silk setons tightened sequentially every 10 days	?	0	20	0	3-108
Thearopol <i>et al.</i> [180]	2002	Retrospective	41	? ?	Yes	No	0-prolene x 2: one loose, the other tight; patient asked to pull on this daily	9 (4-62)	2	?	0	4 (0.5-17)

Table 4 Continued.

Author	Year	Study type	n	Classification	Preoperative continence assessment	Prior division of IAS	Seton material	Time to cut through weeks (range)	Recurrence/persistence (%)	Minor incontinence (%)	Major incontinence (%)	Follow-up months (range)
Zbar <i>et al.</i> [181]	2003	Prospective, randomised (conventional vs. IAS preserving)	34	18 high trans 16 high trans	Yes Yes	No - seton around EAS only No - seton via EAS and IAS	0-Nylon tightened every 2 weeks	14 12	11 6	6 13	0 0	13 (6-30) 12 (5-28)
Hamel <i>et al.</i> [182]	2004	Retrospective	12	trans	No	No	2-0 Nonabsorbable braided, repaced and tightened every 2 weeks	?	0	0	0	?
Pescatori <i>et al.</i> [66]	2004	Retrospective	17	Mid/high trans	Yes	Yes	Minneapolis technique (Goldberg)	?	?	6	12	22 (5-89)
Mentes <i>et al.</i> [183]	2004	Prospective	20	6 ant trans (women) 14 high trans	Yes	No	Double-stranded elastic	< 3 (1-4)	5	20	0	12 (6-24)

seton was divided. This was necessary in 38% of patients. The results of this form of treatment were not identified individually, but for the whole series persistence and recurrence occurred in 7% and 9%. Of 68 patients available for assessment of continence, 17% of those in whom the seton was simply removed experienced difficulty in holding flatus and/or soiling compared with 39% of those who required laying open of the track.

The experience of Cook County Hospital, Chicago in the management of suprasphincteric fistula was reported in 1983 [161]. A suprasphincteric track was present in 45 patients. These were treated by an initial division of the cephalad sphincter (deep external anal sphincter, puborectalis and internal anal sphincter) and a loose seton was placed around the remaining distal sphincter. When the wounds were deemed to have healed with adequate fibrosis around the seton, the remaining track was laid open at an average 7.6 weeks after the first stage. The authors reported a single recurrence, and only one patient had persistent flatus incontinence. A second series from the same institution [164] reported the outcome of this method in 65 patients with a complex fistula and 24 women with an anterior fistula. There were three recurrences and only one patient developed major incontinence as defined by the need for pads. On the basis of these results, the authors suggested that a strategy of staged fistulotomy was preferable to the cutting seton method (see below).

Kuypers [162] reported the outcome of seton staged fistulotomy similar to that described by Parks and Stitz in ten patients with a trans-sphincteric fistula with a secondary extension into the rectum (i.e. extrasphincteric) [160]. Again, the importance of the seton to allow sufficient fibrosis to form, preventing muscle retraction after the second stage was stressed. All the fistulas healed, six patients developed slight soiling and the patient with the rectal secondary opening (5 cm above the dentate line) became incontinent. In another series of 34 patients (16 extrasphincteric; 18 trans-sphincteric), all but two extrasphincteric fistulas healed, but only 41% had normal continence postoperatively [165]. The authors felt that the two-stage method carried no benefit when compared with one-stage fistulotomy in their hands. Fasth *et al.* [163] used a variation of the Parks technique in seven patients with a supra or extrasphincteric fistula. A colostomy was added to the treatment and the loose seton was tightened after 3 months until it had cut through. The colostomy was closed after healing. There were no recurrences, and five patients retained normal continence, making the point that delayed fistulotomy with complete division of the anorectal ring can be achieved without detriment to continence.

Thomson and Ross [155] used a seton to treat 34 patients with a high trans-sphincteric fistula in an attempt to preserve the sphincter whenever possible (see below). An internal sphincterotomy was performed and the primary track was loosely encircled by a nylon seton. Failure owing to persistent local sepsis or failure of healing following removal of the seton occurred in 19 (66%) patients who then underwent laying open of the track. Conversely 15 (44%) did not require any further surgery. Sixteen of the 19 patients requiring laying open were assessed postoperatively. Nine were incontinent to solid stool and 10 to liquid stool or flatus. These results were significantly worse than in the patients in whom no division of the external sphincter had been carried out.

Garcia-Aguilar *et al.* [166] reported the outcome of 47 patients with high trans-sphincteric (39), suprasphincteric (3) or extrasphincteric (5) fistulas treated by two-stage fistulotomy, a loose seton being left in place for at least 6 weeks before the second stage of laying open the track. There were four recurrences, but 31 patients had imperfect control postoperatively 12 of whom were incontinent to stool. The frequency and degree of incontinence were, however, no different from those observed in a smaller cohort of 12 patients with similar fistulas treated by the cutting seton method.

Williams *et al.* [156] reviewed the experience of seton usage at the University of Minnesota over a 6-year period. Of 24 patients with a cryptoglandular high fistula treated by the two-stage seton technique, there were two recurrences, one with major incontinence. Minor incontinence was reported by 54% of patients.

The loose seton as a therapeutic strategy in its own right

Findings and recommendations

The loose seton can be used as a therapeutic strategy in its own right (level III, grade B).

It is evident from the work of Parks and Stitz [160] that some patients with a high fistula can be treated successfully without recourse to further sphincter division if effective eradication of intersphincteric space sepsis is achieved and if wounds around the seton heal leaving only the primary track.

In their series of 34 patients with a high trans-sphincteric fistula described above, Thomson and Ross [155] reported successful closure of the fistula in 44% simply by removing the seton at around 5 weeks after insertion, combined with drainage of the intersphincteric space. In those who failed, the primary track was laid

open (see above). In the patients in whom the technique was successful, 10 of 12 whose function was assessed postoperatively were fully continent, and no patient suffered incontinence to stool. This contrasted significantly with the function of those treated by laying open (see previous section).

Kennedy and Zegarra [148] used the same strategy in 32 patients with a high trans- or suprasphincteric fistula, and achieved healing in 25 (78%) without any division of the external sphincter. They observed slower healing rates for posterior than for anterior fistulas. Only 38% of those in whom the method was successful reported no change in continence postoperatively, although none was incontinent to formed stool.

Of 14 patients reported from the University of Minnesota treated similarly, two recurred and there was a 36% incidence of postoperative minor incontinence (one patient had temporary major incontinence) [156].

Despite the generally accepted importance of the need for eradication of intersphincteric space sepsis as necessary for healing, Joy and Williams [154] reported healing in eight of 12 patients treated by loose seton in whom neither sphincter was divided. Similarly Lentner and Weinart [157] treated 108 patients with an intersphincteric or a low trans-sphincteric fistula in the outpatient setting by insertion of a loose seton through the primary track. The seton was left to migrate out spontaneously, or if the track became sufficiently superficial an outpatient fistulotomy was performed if the patient so wished. There was one recurrence in the 19 in whom the seton spontaneously worked itself out, and no reported case of incontinence.

The results of surgery depend on the accuracy and duration of follow-up. This is illustrated by Buchanan *et al.* [159] who followed for a minimum of 10 years, 20 patients who had been reported as successes by Thomson and Ross [184]. Of the 13 of the 20 who had healed in the short term, only four were still healed at 10 or more years indicating that the loose seton method has a high recurrence rate over time.

The cutting (tight) seton

Findings and recommendations

A cutting seton can be used to treat trans-sphincteric fistula (level III, grade B).

As with all seton techniques the cutting seton has been mainly used when the risk to continence of a one-stage fistulotomy is felt to be high. One of the earlier reports [167] used a rubber band seton for treating an acute anterior abscess with an associated fistula in

women. The abscess was drained through an incision made away from the midline and an elastic seton was then passed loosely around the fistula track via a separate incision made in the midline. After resolution of the abscess, the seton was tightened every 3–4 weeks until it had cut through. A similar method was adopted for established chronic anterolateral fistulas. Hanley claimed success in 35 patients with good functional results (not detailed). Culp [168] reported similar success in 20 patients with a complex fistula in whom the seton, in the form of a rubber Penrose drain cut through after an average of 13.6 days. Again continence was not compromised.

The results of more recent studies are summarized in Table 4. Using a variety of seton materials and varying methods and frequency of seton tightening (when necessary), recurrence or persistence rates of 0–18% were reported. Disturbance of fine control was common, however, and in seven studies major incontinence in over 10% of patients was reported. Christensen *et al.* [170] reported complete cure of the fistula but a high rate of incontinence (62%) at least 2 years postoperatively in 21 patients treated for a high trans-sphincteric fistula. They attributed this to the postoperative anal deformity that resulted after division of the sphincter by the seton, rather than to weakness which, judged by manometry, was not markedly different from controls, apart from a lower squeeze pressure in women.

Garcia-Aguilar *et al.* [166] compared the results following the cutting seton technique with two-stage seton fistulotomy in a retrospective nonrandomized study. There was no statistical difference between the treatments regarding cure of the fistula, incontinence or patient satisfaction. One prospective randomized study [181] comparing internal anal sphincter preservation *vs* division of the internal sphincter by the cutting seton has been performed. The recurrence rates were 2/18 and 1/16 respectively and there was also no difference in continence or anal canal pressures. The number of patients in the study were, however, too small to determine whether internal sphincter preservation was advantageous.

Advancement flap procedures

Most low fistulas can be managed by fistulotomy, track debridement, use of a draining or cutting seton or fibrin glue. More complex fistulas may not be suitable for these treatments and in selected patients an advancement flap procedure may be used. The technique should be considered in patients in whom fistulotomy would result in likely compromise of continence. An advancement flap may also be used to close a rectovaginal and rectourethral fistula. As the lumen is the high pressure side of an anal

fistula, the flap technique is effective as it brings a layer of healthy tissue to the internal opening.

Advancement flaps can be taken from the rectum (transanal advancement flap) or from the perianal skin (cutaneous advancement flap). A further development of the latter, the transanal sleeve advancement flap (TSAF), can also be used.

Transanal advancement flap procedure

Findings

The success rate of transanal advancement flap is the order of 70% (level IV).

Recommendations

Transanal advancement flap can be used to treat an anal fistula where simple fistulotomy is thought likely to result in impaired continence (grade B).

The transanal rectal advancement flap procedure

The transanal rectal advancement flap procedure has several advantages over other treatments. Division of the sphincter is avoided with less risk of impairment of continence, defects of the contour of the anal canal such as a keyhole deformity are avoided and healing is quicker than after fistulotomy. Additional procedures can be incorporated into the operation such as sphincteroplasty without the need for a protective colostomy. Failure of the repair does not usually lead to worse symptoms, although the internal sphincter at the level of the anorectal junction will have been disrupted to a certain extent and the anal canal will be somewhat more rigid as a result of scar tissue. This could result in functional impairment.

Relative contraindications to the transanal rectal advancement flap procedure [185] include:

- 1 the presence of proctitis especially in patients with Crohn's disease;
- 2 undrained sepsis and/or persisting secondary tracks;
- 3 rectovaginal fistula with a diameter > 3 cm;
- 4 malignant or radiation-related fistula;
- 5 fistula of < 4 weeks duration;
- 6 stricture of the anorectum;
- 7 severe sphincter defect;
- 8 severe perianal scarring because of previous fistula surgery.

Technique

Several basic surgical principles should be adhered to. First, the anatomy of the fistula must be defined

accurately. Careful haemostasis is required to avoid a haematoma below the flap. A broad-based flap should be raised with adequate blood supply. Tension on the suture line must be avoided. Debridement or excision of the fistula should be followed by a layered closure. Acute perianal sepsis should be allowed to resolve before a flap procedure is attempted. Patients should receive mechanical bowel preparation and preoperative antibiotics. Formation of a temporary diverting stoma should be considered at the end of the operation, especially if there is concern about its technical aspects. This possibility must be discussed with the patient in advance.

The urinary bladder is catheterized and the patient placed in the lithotomy or prone jack-knife position. The perineum including the vagina and anal canal is prepared with antiseptic solution.

Preparation of the flap

Sutures or the Lone-Star retractor are used to evert the anal orifice. A solution of normal saline and adrenaline (1/200 000) is injected into the submucosa to develop the plane. A semicircular flap is used most commonly as this avoids ischaemia at the corners. The majority of authors describe a U-shaped flap while a minority use an inverted U-shaped flap. The flap consists of mucosa, submucosa and some circular muscle. It is raised from the level of the dentate line over a distance of 4–5 cm proximally to avoid tension on the suture line. A partial thickness excision of the internal sphincter does not adversely affect continence but adds strength to the flap. Further advancement can be gained by excising Burrow's triangles of skin from the adjacent base [186]. The base of the flap should be approximately twice the width of its length.

Placement of the flap

The fistula track is cored out and the resulting internal defect is closed with absorbable sutures. The rectal flap is

advanced to the dentate line and sutured with absorbable sutures. The external wound can be drained, packed loosely or left open.

The cutaneous advancement flap procedure

Findings

The cutaneous advancement flap procedure has a similar success rate. The theoretical risk of ectropion is avoided [186–189] (level IV).

Recommendations

The cutaneous advancement flap procedure is an alternative to rectal advancement flap repair of a high fistula (grade B).

Technique

A V-shaped incision is made in the perianal skin with its base made to include the internal opening and the external opening lying at its lateral edge. The flap is mobilized by undermining the underlying fat to allow advancement without tension. The track is cored out with excision of the internal and external openings. The flap is then advanced proximally and sutured to the anal mucosa lying above the internal opening. One side of the flap is left open to permit drainage.

The transanal sleeve advancement flap procedure

The TSAF takes the concept of flap advancement one step further by mobilising the circumference of the anal canal. It has been used for a subgroup of patients with severe complex fistulas associated with Crohn's disease [190].

Table 5 Results of advancement flap repair of anal fistula.

Author	Number	Type	Crohn's	FU*	Healing	Recurrence	Incontinence
Ozuner [185]	101	RA	47%	31 (1–79)	94%	29%	NS
Jun [187]	40	AC	0%	17 (6–24)	95%	2.5%	0%
Miller [191]	25	RA	0%	14 (3–60)	80%	0%	0%
Ortiz [192]	103	RA	0%	12	93%	7%	8%
Makowiec [193]	32	RA	100%	19.5	89%	30%	3%
Sonoda [194]	99	RA	44%	17 (0.4–67)	64%	36%	NS
Amin [187]	18	AC	0%	19 (3–60)	83%	11%	0%
Del Pino [188]	11	AC	27%	1–10	72%	28%	NS
Nelson [189]	65	AC	NS	NS	NS	20%	NS
Lewis [195]	8	RA	75%	2–24	75%	25%	12.5%

RA, recto-anal advancement flap; AC, anocutaneous advancement flap; NS, not stated.

*Median follow-up in months (range).

Technique

The technique is similar to the transanal flap procedure described above but in addition a 90–100% circumferential incision is made at or just below the dentate line to create a sleeve of the full thickness of the bowel wall. This is then mobilized proximally into the supralevator space until sufficient mobility is achieved to allow the flap to be advanced distally into the anal canal without tension. Its distal edge is then sutured to the anal canal epithelium below the level of the internal opening with absorbable sutures. This technique may offer an alternative in selected patients with fistulation in Crohn's disease without proctitis for whom the only alternative is proctectomy with permanent stoma.

Postoperative management of flap procedures

There is no consensus on the role of antidiarrhoeal agents or antibiotics in the early postoperative period. Normal anal wound management should be carried out. It may be advisable to perform a digital examination and anoscopy at 10–14 days to check the suture line. If, however, there is no clinical indication for this, it should not be done. The main cause of flap failure is inadequate blood supply. This can be assessed clinically by means of observation of colour and capillary blanching and refill on gentle pressure applied to the perianal skin [186].

Results advancement flap procedures

It is difficult to compare published series as there is often great variation in the type and complexity of fistula. Long-term follow-up is essential to assess recurrence accurately. The results of published series are shown in Table 5 [185–189,191–195].

Advancement flap procedures are safe. They are effective in around 70% of patients. The functional results are good with minimal or no disturbance of continence. They are suitable for anorectal and rectovaginal fistulas in patients with and without Crohn's disease.

Fibrin glue

Findings

Simple anal fistulas may be treated by track debridement and fibrin glue injection (level III, grade B).

Recommendations

Complex anal fistulas may be treated by track debridement and fibrin glue injection (level III, grade B).

Fibrin glue was first used in surgery at the beginning of the last century [196,197]. Since then there have been over 2000 publications on its use for the closure of fistulas affecting many parts of the body including cerebrospinal, trachoesophageal, bronchopleural, chyloous, upper gastrointestinal, pancreatic, proximal colorectal and urological but with variable success.

Fibrin glue as a treatment for anal fistula was first used in the early 1980s [198,199] with reported success rates of around 50% of patients followed over a variable period. In the early 1990s more reports appeared [200] and following the licencing of commercial fibrin glues in 1998, its use increased greatly.

Rationale

Fibrin glue is an activated mixture of a solution containing fibrinogen, factor XIII, fibronectin and aprotinin. Factor XIIIa also cross-links with fibrin and fibronectin which are present in the sealant mixture which then cross-link with collagen in the surrounding tissue [201]. When applied to anal fistula the fibrin clot seals the track and stimulates the migration, proliferation and activation of fibroblasts. Via the bridging action of fibronectin it serves as a matrix for ingrowing fibroblasts and pluripotent endothelial cells [202] which take on the function of normal repair-promoting cells after fibrin degradation. Plasmin, activated from plasminogen in the surrounding tissue causes eventual lysis of the fibrin clot. This process is estimated to occur in 1–2 weeks. Collagen synthesis by fibroblasts then follows. Initially, therefore, the fistula is simply rendered quiescent by the sealing action of the fibrin clot but the longer-term outcome is determined by the action of the ingrowing fibroblasts as the fibrin degrades. Failure in this process leads to recurrence of the fistula.

Results

There are 18 studies in the literature including two RCTs [203,204] and 13 prospective non-randomized [200, 205–214] trials. The remaining three were retrospective [215–217]. Healing rates ranging from 60% to 70% have been reported [203,205,209,210,212,214,216]. Risk factors for failure include Crohn's disease, rectovaginal fistula, HIV infection and a short fistula track.

Most studies have used commercially available fibrin glue products (Tisseel, Viguard and Beriplast). Two used autologous fibrin alone and two a combination of commercial and autologous preparations. There was no difference in the healing rates according to the type of fibrin preparation employed. Thus Cintron *et al.* [205] in

comparing Tisseel, Viguard and autologous glue preparations in 79 fistulas found no difference in the healing rates.

Several studies have compared healing rates of simple and complex fistulas although the definition of complex is somewhat arbitrary because of lack of a standardized classification. Healing rates vary from 14% to 60% [205,212,214] with success reported in more than 50% in a recent multicentre prospective study [216]. Continence rates have not been reported.

While early studies have reported high rates of cure [210,214], the long-term results have been less successful, with reported recurrence rates of up to 100% [202]. The factors responsible for this include the variability of study design, the duration and accuracy of follow-up, mixed indications for surgery and lack of uniformity of operative technique. Assessment of fibrin glue should include MRI after treatment which can identify any residual sepsis. This has been found to correlate to early failure or delayed recurrence [202,218]. Thus Buchanan *et al.* [212] treated 22 patients with fibrin glue with initial success in 77%. By 16 months, however, only three (14%) remained healed. Failure was predicted by evidence of persistent sepsis in the track on a posttreatment MRI scan. Thus any study of fibrin glue (or the fibrin plug; see below) should include MRI as part of the assessment.

Fibrin plug

The fibrin plug, made from lyophilized porcine intestinal collagen, is a recent development designed to occlude the track of the fistula from the internal to the external opening [219].

At present there are insufficient available data to assess the efficacy of this technique. A small, nonrandomized study reported healing in 13 of 15 patients compared with four of 10 patients treated by fibrin glue [219]. Healing appears to be maintained with longer follow-up. Thus the same group reported healing in 83% of 46 patients treated by fibrin plug insertion followed for a median of 12 months [220].

Management of specific fistulas

Crohn's disease

Anal sepsis in Crohn's disease was first described by Penner and Crohn [221] in 1938 and in greater detail by Morson and Lockhart-Mummery [222] in 1959. Approximately one-third of patients with Crohn's disease have an anal fistula [223] and this association may be linked to a genetic predisposition [224]. Anal fistula in

Crohn's disease commonly occurs with other anal pathology including oedematous skin tags, fissure, ulceration or stricture and is more likely to occur when proctitis is present [223]. The fistula may predate the presentation of intestinal Crohn's disease [225]. In general, high fistulas and those associated with severe proctitis or an anorectal stricture tend to have a worse prognosis [223].

Assessment

Investigation should include colonoscopy and contrast radiology of the small intestine. Assessment of the anal fistula involves clinical examination in the awake patient and also under anaesthetic if necessary. MRI should be requested in patients with a complex fistula [71].

Treatment

The management falls into in four parts:

- 1 emergency treatment: incision and drainage of an abscess;
- 2 stabilization: insertion of a seton and optimization of medical therapy;
- 3 attempts at healing: medical therapy including anti-TNF-alpha (infliximab, remicade) or surgery, including fistulotomy or flap procedures or a combination of both;
- 4 proctectomy: if the above treatments fail.

Emergency treatment

Findings and recommendation

Suppurating anal infection in Crohn's disease should be controlled by adequate surgical drainage (level IV, grade GP).

The commonest surgical procedure for perianal Crohn's disease is incision of an abscess [225,226] which should be accompanied by the administration of a broad spectrum antibiotic particularly if the patient shows signs of systemic sepsis or has diabetes or is immunosuppressed. The use of intra-operative endoanal ultrasound to detect collections which are not clinically evident has been described [47].

Stabilization

Findings and recommendations

Complex sepsis may require insertion of a loose seton and occasionally a defunctioning stoma may be necessary (level IV, grade GP).

Stabilization is an attempt to prevent or diminish sepsis after the acute phase has been treated. This may

be effected by the placement of a loose seton around the primary track [156,164,227–229]. If there is extensive perianal disease and seton drainage is not practical then a stoma should be advised [230–233]. Antibiotics, including metronidazole and ciprofloxacin should be used in both the acute and stabilization phases.

Attempts at healing

Findings

Anti-TNF-alpha therapy (infliximab) has been demonstrated to be superior to placebo in achieving a reduction in the number of draining fistulas [234,235] (level I).

Recommendations

Any medical or surgical attempt to heal Crohn's anal fistulas should only be undertaken once the patient is stable, with minimal residual perianal sepsis and good nutritional status. Asymptomatic or minimally symptomatic Crohn's anal fistulas should not be treated (grade GP).

Medical treatment

Immunosuppressants

Immunosuppressants include azathioprine and its metabolite 6-mercaptopurine (6-MP). Both inhibit DNA synthesis by preventing purine synthesis resulting in impaired T-cell proliferation. In a study of patients with Crohn's disease and anal fistula by Present *et al.* [236], 6-MP (1.5 mg/kg) resulted in complete closure of 31% of fistulas compared with 6% in the placebo group. Several other studies have confirmed the efficacy of azathioprine in healing anal fistulas in Crohn's disease [237–240]. Other immunosuppressants including methotrexate, cyclosporin A, mycophenolate mofetil and tacrolimus have been reported to heal some anal fistulas in Crohn's disease [223].

Biological agents

Elevated levels of TNF α are found in Crohn's disease. In an early study, Present *et al.* [234] reported that three infusions of infliximab, (5 or 10 mg/kg, at weeks 0, 2 and 6) led to a 46% complete closure of perianal fistulas. The median length of time the fistulas remained closed was 12 weeks with a higher response rate to 5 mg/kg compared with 10 mg/kg. It is important to understand, however, that the fistula recurred in every case. Similar results using infliximab and a completely humanized antibody (CDP571), have been reported [235,241]. All studies of infliximab show that despite a clinical response the fistula still persists [242,243]. Favourable results with maintenance

infliximab have been reported in the ACCENT II trial [244]. The present conclusion from all trials treating anal fistula in Crohn's disease is that biological treatments do not cure the condition.

Surgery

Findings

Active proctocolitis is a contraindication to any local surgical procedure aimed to treat fistula (level IV).

Recommendations

Low fistulas in the absence of proctitis may be treated by fistulotomy provided medical therapy has been optimized. Patients should be warned about the risk of slow wound healing (level grade GP). Complex fistulas may be palliated by long-term seton drainage. Attempted healing by surgical treatment should only be considered after optimization of medical therapy and usually after a trial of anti-TNF-alpha therapy. Endorectal or cutaneous advancement flaps may be successful (grade GP).

Surgical treatment includes fistulotomy, either as a primary procedure or following staged seton drainage, flap procedures and interposition grafts. The choice of treatment depends on whether the fistula is low or high.

Fistulotomy

Morrison *et al.* [245] reported healing after fistulotomy in 30 of 32 patients. Most had a low fistula and healing was more likely in the absence of proctitis. Similarly Levien *et al.* [246] reported complete healing or minimal symptoms in 37 of 47 patients following fistulotomy. Scott *et al.* [247] reported similar success rates between fistulotomy and seton treatment of 81% and 85%. Platell *et al.* [248] reported healing in 91% following treatment for low perianal Crohn's fistulas with the majority (75%), having a fistulotomy. In contrast, eight patients with a high or complex fistula were treated by seton drainage with healing occurring in three but three patients required proctocolectomy. A similar result for low fistulas was also reported by Fuhrman and Larach [249]. Of 41 fistulas in 33 patients with Crohn's disease, Williams *et al.* [250] reported healing in 73% at 3 months with no deterioration in continence in 26. In contrast in a series of 23 patients with a high complex fistula treated by partial laying open and seton drainage three required proctocolectomy [156,250]. Several groups have also reported a poorer outcome following treatment of a high fistula [225,251]. Nordgren *et al.* [252] found that involvement of the large

bowel by Crohn's disease was a poor prognostic factor for healing irrespective of the level of the internal opening. The evidence indicates that fistulotomy is acceptable for low fistulas in the absence of proctitis.

Advancement flap procedures

Makowiec *et al.* [193] reported their experience of rectal advancement flap procedures in 32 patients with perianal Crohn's disease, of whom 20 had a trans-sphincteric fistula. The initial healing rate was 89% but 7 (58%) of 12 patients with an anovaginal fistula and four (20%) of 20 with a trans-sphincteric fistula had a recurrence during subsequent follow-up. Joo *et al.* [253] reported comparable healing rates for rectovaginal and perianal fistula of 75% and 64% respectively in patients with perianal Crohn's disease. Hyman [254] also reported an initial healing rate of 71% but in the long term 50% recurred. Factors associated with flap failure include Crohn's colitis [38] and active small bowel disease [253] and also proctitis [255]. Various other flap repairs have been described in small case series [189,190,256–258]. In general there is a high rate of failure of flap repair in patients with Crohn's disease [194,259].

A recent report has shown promising results for the treatment of Crohn's anal fistulas using the fistula plug. Healing occurred in 16 (80%) of 20 patients but success was less in fistulas with multiple tracks [260].

Combined medical and surgical treatment

Topstad *et al.* [261] reported a combined approach with seton placement, infliximab and maintenance azathioprine or methotrexate, which was effective in fistula healing in over two-thirds of patients.

Proctectomy

Failure to control fistulating anal Crohn's disease by any of the above methods may require rectal excision with a permanent stoma. There are no trials dealing with the indications, timing or technique of proctectomy. Proponents of a preliminary defunctioning stoma argue that this allows improvement of perianal sepsis, nutritional status and psychological adjustment before committing the patient to a permanent stoma. An intersphincteric dissection of the anal canal is recommended, although in cases of extensive anal destruction, fistulation and induration, this is often theoretical rather than practical advice. Tracks extending to an external opening after removal of the rectum may be treated by placement of a seton thereby avoiding a large perineal wound. This may be extremely slow to heal and can be a source of considerable morbidity. There are no objective data supporting primary reconstructive myocutaneous flaps although the use of these has been reported.

Ileoanal pouch-vaginal fistula

Findings and recommendations

Pouch-vaginal fistula (PVF) should be treated in centres with experience of revisional pouch surgery. Initial management should include the control of sepsis and a review of the available histology should be undertaken to exclude the diagnosis of Crohn's disease. Patients should undergo defunctioning by an ileostomy. This is usually necessary to treat the incontinence. A fistula arising from an ileoanal anastomosis lying within the anal canal should be treated by a local endoanal or transvaginal procedure. A high PVF, which usually arises from a stapled ileoanal anastomosis should be treated by abdominoanal pouch advancement (level IV, grade GP).

Ileoanal PVF was first described by Wong *et al.* [262] and occurs after pouch surgery in about 5–10% of female patients [263]. The incidence continues with the passage of time. The main risk factors include pelvic sepsis in the early postoperative period, indeterminate colitis and Crohn's disease usually unrecognized at the time of the original restorative proctectomy. PVF usually originates from the ileoanal anastomosis following pelvic sepsis and anastomotic dehiscence. Less commonly, the fistula enters the anal lumen at the level of the crypt and is assumed to be the result of cryptoglandular infection.

Treatment

For therapeutic purposes PVF may be classified as high or low, depending on the relationship of the fistula to the anal sphincter. This will determine whether a pouch advancement procedure or an attempt at local closure should be advised.

Initial management should be to control sepsis and to review available histology to reconsider the diagnosis of Crohn's disease. In almost all cases a stoma should be established to relieve the symptoms. After any acute inflammation has settled, an attempt at closure should be made. Where feasible, an abdomino-anal pouch advancement should be carried out as the results are better than with local closure (see below). Where the ileoanal anastomosis is too distal for advancement, a local procedure is the only technique available to the surgeon. No comparative trials have been carried out.

Results of surgery

There are two reports in the literature of case series of over 50 patients [264,265]. In these, successful closure was achieved in around 60% over a 5-year period of follow-up

Table 6 Treatment options for specific fistulas.

Fistula type	Suitable primary treatment	Suitable secondary treatment
Low intersphincteric*	Fistulotomy	Fibrin glue ^b Loose seton Cutting seton ^a
High intersphincteric*	Fistulotomy Fibrin glue	Loose seton Tight seton ^a
Low trans-sphincteric†	Fistulotomy Cutting seton	Fibrin glue ^c Advancement flap ^{c,f} Loose seton
High trans-sphincteric†	Fibrin glue ^c Advancement flap ^{c,f} Loose seton	Staged cutting seton ^d Fistulotomy ^{d,c,g}
Suprasphincteric	Loose seton	Advancement flap ^{c,f} Fibrin glue ^c

*Arbitrary definition of high intersphincteric fistula: passes deep to > 50% of length of internal sphincter muscle.

†Arbitrary definition of high trans-sphincteric fistula: passes deep to > 30% of external sphincter muscle.

^aAvoid sphincter division in presence of impaired anal control or regular loose motions.

^bNot suitable if fistula track is short

^cRisk of key hole deformity and persistent leakage if fistula in midline

^dAvoid sphincter division in anterior fistula in female

^eConsider settling active sepsis with loose seton prior to definitive treatment

^fFeasibility of advancement flap depends on degree of rigidity in anal canal

^gFistulotomy for high fistula requires careful consideration of the likelihood of sphincter impairment, based on previous surgery, sex of patient and underlying bowel function

although repeat repair was required in some cases to achieve this. Patients whose diagnosis was changed to Crohn's disease fail without exception [265].

Seton drainage has been used to control associated sepsis but is not a definitive long-term treatment. Fistulotomy may be considered for low fistulas, although the reported results are poor [265–267]. Success of local advancement flap procedures carried out via the transanal or transvaginal routes is around 50% [265–270]. Small case series in the literature report reasonable results with interposition muscle flaps [265,271,272].

Transabdominal pouch advancement of the pouch is applicable to fistulas located at a sufficient distance above the anal canal to allow the ileoanal anastomosis to be constructed well below the level of the fistula. Usually these patients have had a stapled ileoanal anastomosis lying above the anorectal junction. The published data show that successful closure is more likely to occur in such cases after pouch advancement than after an attempt at local perineal closure. Reported rates of success following pouch advancement procedures are around 80% [273–275]. Although this is a major procedure and more traumatic than closure via the perineum, the improved results make this, the procedure of choice, when technically possible. There is little information on

endoanal perineal advancement of the ileoanal anastomosis.

In summary, PVF should be treated by abdominoanal advancement of the ileoanal anastomosis when there is sufficient anorectum distal to the anastomosis to perform an anastomosis below the level of the fistula. A perineal attempt should be reserved for patients in whom advancement is not possible. In practice, patients who have had a stapled ileoanal anastomosis are suitable for the former. Those who have had a manual anastomosis within the anal canal will usually require an attempt at local closure.

Malignancy

Findings and recommendations

A policy of biopsy of all longstanding anal fistulas or a fistula with any unusual characteristics is recommended. If positive for cancer, multidisciplinary management for malignancy should be followed (level IV, grade GP).

Anal or low rectal carcinoma may occasionally present with a perianal abscess or fistula because of direct tumour extension. It is also well documented that longstanding

anal fistula may be complicated by malignancy, particularly when associated with Crohn's disease [276–284]. Ky *et al.* [277] reported seven patients with carcinoma associated with anorectal fistula in a population of about 1000 patients with Crohn's disease followed over a 14-year period, giving an incidence of 0.7%. Four were squamous cell and three adenocarcinoma. Cases reports and small case series also report a mixture of squamous cell and adenocarcinoma of the anorectum in association with Crohn's disease [276–284]. It is not clear how many arise in a longstanding fistula and how many originate in the large bowel as a consequence of the increased risk of malignancy associated with Crohn's disease [285]. Malignancy may rarely arise in a longstanding non-Crohn's fistula and tends to be mucinous adenocarcinoma in type [286–289].

There are also sporadic case reports of seeding of carcinoma in an anal fistula track from a proximal colonic adenocarcinoma [290,291]. The diagnosis of malignancy associated with a longstanding fistula, particularly in association with Crohn's disease is difficult. Most reports in the literature comment on considerable delay in diagnosis.

Treatment follows the conventional lines of management of anal or low rectal malignancy. Careful preoperative staging and multidisciplinary team discussion is mandatory. Colonoscopy is recommended to exclude a proximal tumour which may have seeded to the anal fistula or a synchronous adenocarcinoma.

HIV infection

Findings and recommendations

Patients with fistula should be thoroughly assessed under anaesthetic and appropriate biopsies taken. Associated sexually transmitted diseases should be identified using the expertise of the genitourinary physician. Patients with early disease may usually be treated in the same manner as non-HIV patients, particularly with the availability of highly active antiretroviral therapy (HAART). Patients with advanced disease should be treated minimally, for example by drainage of abscesses through small incisions and the use of a seton (level IV, grade GP).

It is estimated that there are about 24 000–81 000 adults infected with HIV living in the UK. This represents 0.1–0.3% of the adult population between the ages of 15 and 49 years. The prevalence has increased gradually since the late 1990s probably due to the increased transmission of HIV in homosexual and bisexual men and of migration of infected heterosexual men and women from sub-Saharan Africa. The number of cases of AIDS and related

deaths has, however, declined since the introduction of HAART. In 2002, there were reports of 753 new cases of AIDS and 390 deaths in the UK [290–292].

Anorectal pathology is common in HIV patients. Approximately one-third will present with an anal lesion at some stage during the illness, of which about half will require surgery [293,294]. Barrett *et al.* [295] reported that anal fistula accounted for 34% of anorectal pathology in the HIV population.

The management of anal fistula in HIV patients includes:

- 1 precise assessment of anorectal pathology;
- 2 assessment for other sexually transmitted diseases;
- 3 assessment of the stage of HIV/AIDS and overall prognosis;
- 4 HIV/AIDS infection control measures.

Up to two-thirds of HIV patients with anorectal symptoms will have more than one pathology [295]. Furthermore, patients are at increased risk of cancer particularly anal squamous carcinoma, lymphoma and Kaposi's sarcoma [296,297]. EUA with biopsy of any suspicious lesion is required.

There are several classifications of HIV/AIDS. In early disease there is minimal disturbance of immunological function and wound healing, whereas in late disease immune function is significantly disturbed with increased morbidity and delayed wound healing. Several reports suggest that a low CD4 count is associated with delayed wound healing [296,297]. With the improved results associated with HAART, the use of the CD4 count alone is no longer a guide to decide between minimal or conventional surgery for anal fistula. Symptomatic fistulas in early stage disease may be treated by conventional fistulotomy with a reasonable expectation of healing [298]. Patients with late disease should be treated minimally, with drainage of abscesses using small incisions and seton drains if appropriate.

Tuberculosis

Findings and recommendations

Treatment involves drainage of perianal sepsis and appropriate medical antituberculosis treatment [299,300] (level IV, grade GP).

Tuberculosis of the anorectal region is rare. There are two different clinical types. First, patients with active pulmonary disease may develop anal ulceration [301]. The diagnosis is usually suspected in a patient with active chest disease. It may be confirmed by demonstrating the presence of acid-fast bacilli in smears or biopsy material from the ulcer. Secondly, anorectal tuberculosis may

present as a complex fistula, often associated with a rectal stricture. This occurs in patients with a past history of tuberculosis but without active pulmonary disease [3,299,300]. The diagnosis may be suspected in immunocompromised patients and in those from parts of the world where tuberculosis is common [302]. Treatment involves drainage of perianal sepsis and medical antituberculosis treatment.

Conclusions

Successful treatment of anal fistula requires understanding of the pathological anatomy. There is an extensive literature on the subject accrued over many years. This includes data on the success of the various treatments and the prevalence of continence disturbance. Despite this, however, some questions are unanswered and for this reason treatment decisions should be based on clinical judgment through knowledge and experience, while taking the available data into account.

Although fistulas can be grouped into various categories based on the classification, the mode of presentation and the level of the internal opening, it is not possible to be prescriptive on the management of each type of fistula. Broad guidelines for treatment, with comments are given in Table 6.

Conflicts of interest

None declared.

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