

Salvage surgery after restorative proctocolectomy

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Background and method: Restorative proctocolectomy is now the elective surgical procedure of choice for most patients with ulcerative colitis or familial adenomatous polyposis. Complications may lead to failure, defined as removal of the reservoir with establishment of a permanent ileostomy or long-term diversion. Failure may be avoided for some patients by salvage surgery. The causes of failure are identified in this article and the procedures adopted to treat them are defined; a review of the literature was carried out to determine the effectiveness of the procedures.

Results: Failure after restorative proctocolectomy results from complications, which may occur indefinitely during follow-up to a cumulative rate of about 15 per cent at 10–15 years. Sepsis accounts for over 50 per cent of these complications. Abdominal salvage procedures are successful in 20 to over 80 per cent of patients but the rate of salvage is dependent on the duration of follow-up, which might explain this variance. Local procedures are successful in 50–60 per cent of patients with pouch–vaginal fistula. Poor function accounts for about 30 per cent of failures. Abdominal salvage for outlet obstruction and low pouch capacitance results in satisfactory or acceptable function in up to 70 per cent of patients. There is no effective surgical salvage for pouchitis.

Conclusion: Salvage surgery must be discussed carefully with the patient, who should be made aware of the possible complications and the prospect of success, which is less than that in the general population of patients undergoing ileoanal pouch surgery.

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Introduction

In 1947 Ravitch and Sabiston¹ described mucosal proctectomy with straight ileoanal anastomosis with the aim of preserving the sphincter mechanism and faecal continence in patients undergoing surgery for ulcerative colitis and familial adenomatous polyposis (FAP). However, this operation was often followed by a high stool frequency with urgency^{2–5} owing to low capacitance of the neorectum.

In the late 1960s Kock⁶ developed the continent ileostomy and showed that it could function satisfactorily in humans. Parks and Nicholls⁷ subsequently combined this with endoanal anastomosis to create the present form of reconstruction. Restorative proctocolectomy with an ileal reservoir is now the elective surgical procedure of choice for most patients with ulcerative colitis and selected patients with FAP^{8–18}. It has also been applied to some patients with functional bowel disease^{17,19,20}.

There have been refinements in operative technique and postoperative management during the past two decades^{21–27}. Functional results, complications and failure rates are well documented^{28–33}. Most patients have a satisfactory outcome, but failure occurs in up to 17 per cent of patients followed for 5 years or more^{29,30,34–41} (Table 1). The failure rate increases with the duration and completeness of follow-up³⁵. Failure may occur early, within the first postoperative year, or at any time thereafter (Fig. 1). The cumulative failure rate was 14 per cent at 15 years in a series of 631 patients followed for a median of 85 (range 2–288) months⁴². Age does not appear to be an absolute contraindication to pouch surgery and is not associated with an increased incidence of failure⁴³.

Salvage surgery

In this review salvage surgery is defined as surgery aimed at avoiding failure, as evidenced by excision of the pouch or

Table 1 Failure after restorative proctocolectomy

Reference	Year	Total no. of patients	Follow-up (months)	Pouch excision	Permanent defunction	Overall failure (%)
Gemlo <i>et al.</i> ⁴⁷	1992	253	> 12	—	—	9.9
Setti Carraro <i>et al.</i> ^{34*}	1994	110	63–173 (99.3)	12	4	14.5
Fazio <i>et al.</i> ⁴⁴	1995	1005	1–125 (35)	34	11	4.5
Foley <i>et al.</i> ³⁸	1995	460	—	7	9	3.5
MacRae <i>et al.</i> ³⁹	1997	551	> 30	49	9	10.5
Korsgen and Keighley ⁴⁰	1997	180	> 24	23	8	17.2
Meagher <i>et al.</i> ^{35*}	1998	1310	24–180 (77)	84	50	10
Tulchinsky and Nicholls ^{42*}	2001	634	36–288 (85)	41	20	9.7

Values in parentheses are means. *Patients with ulcerative colitis only.

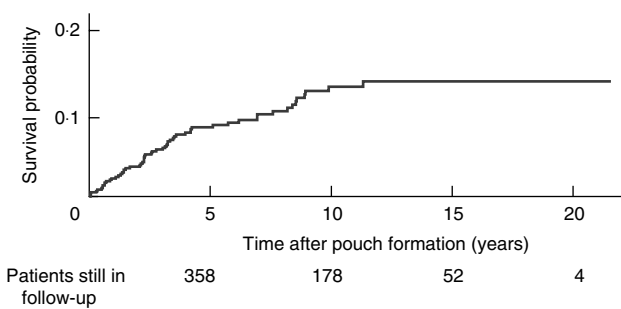


Fig. 1 Kaplan–Meier life-table analysis of failure in 631 patients⁴²

Table 2 Causes of failure (excision of pouch or indefinite defunctioning)

Sepsis
Acute
Chronic
Pelvic sepsis
Fistulation
Poor function
Mechanical outlet obstruction
Ileoanal anastomotic stenosis
Long efferent limb
Retained rectum
Sphincter dysfunction
Small-volume reservoir
Mucosal inflammation
Pouchitis
Neoplastic transformation

indefinite defunctioning. There are four causes of failure (Table 2): acute and chronic sepsis, poor function for mechanical or functional reasons, mucosal inflammation (including pouchitis and retained rectal mucosa) and neoplastic transformation. Of these, sepsis is the most common being responsible for over 50 per cent of all failures (Table 3). The term salvage also denotes procedures intended to avoid the loss of anal function. Neoplastic

Table 3 Sepsis as a cause of failure

Reference	Year	Failure	Sepsis
Setti Carraro <i>et al.</i> ³⁴	1994	16	8 (50.0)
Meagher <i>et al.</i> ³⁵	1998	70†	40 (57.1)
Foley <i>et al.</i> ³⁸	1995	16	12 (75.0)
MacRae <i>et al.</i> ³⁹	1997	58	36 (64)*
Tulchinsky and Nicholls ⁴²	2001	61	32 (52.5)
Galandiuk <i>et al.</i> ⁶⁵	1990	114	59 (51.8)

Values in parentheses are percentage of all failures. *Eleven with Crohn’s disease. †Estimate.

transformation is not an indication for salvage surgery in this sense and is not considered in this review.

Various factors to be considered when advising a salvage procedure include feasibility of success, magnitude of operation, overall duration of treatment and the patient’s wishes. Counselling is essential and the patient must be given a realistic appraisal of the prospect of a successful outcome. The potential morbidity of removal of the reservoir resulting in a permanent ileostomy should also be discussed, including the possibility of a high-output ileostomy, pelvic nerve damage and an unhealed perineal wound.

Sepsis

Reported rates of pelvic sepsis after restorative proctocolectomy range between 3 and 25 per cent^{11,33–35,44–55}. This variance may be explained partially by differences in definition. For example, some authors may record any septic complication, however minor, whereas others confine the definition of pelvic sepsis to the need for reoperation including laparotomy. Sepsis, usually pelvic, accounts for half or more of all failures^{39,42,44} and its incidence appears to decrease as surgical experience increases^{35,53,56,57}. Patients who develop sepsis in the early

postoperative period have a higher likelihood of subsequent failure. In a series of 706 patients that included 494 with colitis 131 developed sepsis. There was a cumulative failure rate of 19.6 per cent at 3 years rising to 39.2 per cent at 10 years. The failure rate was significantly greater when the site of sepsis involved the anal sphincter than when it was located more proximally (5-year failure rate 50.1 and 29.2 per cent respectively)⁵⁸.

Pelvic sepsis may present in the immediate postoperative period or it may be delayed, manifesting as abscess formation (usually presacral) or fistulation, often with a history of an anastomotic complication. In one study of fistulation it occurred at a median of 7 months following closure of a defunctioning ileostomy⁵⁹.

Early sepsis

Symptoms of early pelvic sepsis include fever, anal pain, tenesmus, and discharge of pus or secondary haemorrhage through the anus. The diagnosis is established by digital examination (under anaesthesia if necessary), combined with imaging, including contrast pouchography, computed tomography (CT) and magnetic resonance imaging (MRI).

In a proportion of patients the condition resolves spontaneously. Others need operative endoanal, or imaging-guided percutaneous, drainage. If drainage of the cavity is unsatisfactory, an attempt should be made to deroof the abscess and curette the cavity through the anus, creating a large communication between the abscess and the reservoir. Sometimes several local procedures are needed to eradicate sepsis. Rarely an abdominal approach is needed. When sepsis is severe enough to warrant a laparotomy, pouch excision is common and closure of the ileostomy is infrequent. In one report of the treatment and outcome of 30 patients who developed significant acute intra-abdominal or pelvic sepsis, 13 responded to local procedures. No pouch was excised in these patients and the ileostomy closure rate of 92 per cent (12 of 13) was similar to that of those who did not have sepsis. Of the 17 patients who required laparotomy to control sepsis, seven subsequently lost the pouch and in only five was it possible to close the ileostomy. The conclusion is that reoperation carries a poor prognosis as it is often followed by ultimate failure⁵³.

When anastomotic disruption is the cause of pelvic sepsis, after drainage and curettage, a transanal repair of the anastomosis or advancement of the ileum and resuturing of the ileoanal anastomosis has been advocated. In a report of 24 patients who had an ileoanal anastomotic complication, 19 were found to have partial anastomotic disruption. Of these, 15 were diagnosed between 7 and 90 days after

surgery and before ileostomy closure. Seven were treated by resuturing of the anastomotic defect and counterdrainage, with success in three. Seven others underwent a pouch advancement flap procedure, with success in five. Thus, over a follow-up of 1–22 months successful salvage was achieved in eight of the 15 patients⁶⁰.

It is clear, however, that severe acute pelvic sepsis with extensive anastomotic breakdown results in a high failure rate, despite attempts at salvage. In a report by Heuschen *et al.*⁵⁸, only 16.8 per cent of the 131 patients with sepsis could be managed conservatively, the rest requiring some form of surgical procedure. However, patients with early postoperative sepsis were not distinguished from those in whom sepsis developed during subsequent follow-up, although there was no significant difference in failure rate when salvage surgery was undertaken within or beyond 6 months of restorative proctocolectomy. As might be expected, failure was related to the magnitude of the procedure, 6.1 per cent after minor intervention (33 patients) compared with 47.3 per cent after major surgery (74 patients).

Severe acute pelvic sepsis with extensive anastomotic breakdown occurs in 5–15 per cent of patients and results in early failure in around 30 per cent, despite adequate drainage. Attempts at salvage by direct suture may work for some patients. The occurrence of early sepsis renders the patient at increased risk of subsequent failure compared with the total population.

Delayed sepsis

Abdominal and pelvic sepsis

Delayed abdominal or pelvic sepsis presents as abscess formation with or without fistulation. MRI using short-tau inversion recovery (STIR) settings may make the diagnosis in some patients in whom clinical examination, contrast radiography or CT has not been successful. When sepsis is limited, there is a good chance of healing provided that drainage is adequate. If resolution does not occur, there are two surgical options – excision of the pouch or an attempt at salvage, usually via an abdominal approach. There is a considerable variation in the reported outcome of abdominal salvage surgery (*Table 4*).

In one study abdominal revision was successful in five of eight patients with fistulation or abscess⁶¹ and in another in two of four⁶². Similar results were also obtained in a third study of eight patients with complicated pelvic sepsis; four had abdominal revision, with success in three, and four required conversion to a permanent ileostomy despite repeated local surgery⁵⁵.

A much higher rate of success was reported in a series of 35 patients with chronic sepsis, either abscess or

Table 4 Abdominal revision for sepsis

Reference	Year	No. of patients	Deaths	Follow-up (months)	Failure
Galandiuk <i>et al.</i> ⁶⁵	1990	29	0	1–98 (47)	17
Poggioli <i>et al.</i> ⁵⁵	1993	8	0	> 24	5
Cohen <i>et al.</i> ⁶⁴	1998	24	0	7–97 (35)	4
Sagar <i>et al.</i> ⁶²	1996	4	0	12–120 (60)	2
Korsgen <i>et al.</i> ¹²⁰	1996	4	0	7–48	2
Paye <i>et al.</i> ⁵⁸	1996	10	0	—	6
Ogunbiyi <i>et al.</i> ⁶¹	1997	8	0	6–84 (34)	3
Fazio <i>et al.</i> ⁶³	1998	22 UC 10 CD	0	6–105 (18)	1 4
Heuschen <i>et al.</i> ⁵⁸	2002	74	0	31–96 (51)	35

Values in parentheses are means. UC, ulcerative colitis; CD, Crohn's disease.

fistulation⁶³, including 22 with ulcerative colitis, ten with Crohn's disease, one with indeterminate colitis and two with FAP; 29 had leakage from the ileoanal anastomosis and four from the upper pouch. Overall a pelvic abscess was present in 25 patients, and ten had a vaginal and 12 a perineal fistula. All underwent abdominal revision with detachment of the ileoanal anastomosis, curettage of any chronic abscess cavity with drainage and/or repair of fistula, and reanastomosis. The median interval between the first operation and revision was 24 months. At a median follow-up of 18 (range 6–105) months, 30 had preserved anal function. Twenty-one of the 22 patients with ulcerative colitis retained anal function but the functional outcome was not satisfactory in all cases. The median frequency of defaecation per 24 h was 9.6, but the range was considerable, from 4 to 35. Urgency was common, and was constantly present in 4 patients and intermittent in 14. The quality of life was reported as good or excellent by 17 patients and fair or poor by 13. Despite disappointing function in some patients, it is clear that major surgical revision can result in worthwhile salvage in many.

Similarly, in a report of 24 patients who underwent salvage abdominal surgery after multiple local procedures had failed, salvage was achieved in 20⁶⁴. The mean time from ileostomy closure to revision was 35 (range 7–97) months and success was defined as an intact pouch after ileostomy closure provided that there had been no further complications for at least 6 months. In 18 such patients the median frequency was 5.2 (range 3–8) bowel movements per day and 1.5 (range 0–3) at night. Continence was normal in 13 of these 18 patients during the day and in nine at night.

Others, however, have reported poorer results. In a series of 114 patients who underwent reoperation after pouch surgery, 29 had procedures for intra-abdominal sepsis⁶⁵.

These included drainage of abscess (three patients), diverting ileostomy (18), revision of the pouch (six) and primary closure of fistula (four). Of the 29 patients, 17 still had an ileostomy at the time of assessment and in ten the pouch had been removed. Only ten had satisfactory anal function. The authors showed, importantly, that failure continues with the passage of time; at 2 years 34 procedures had failed and at 5 years the probability of remaining free of pouch excision was 75 per cent.

A similar experience was reported in 131 patients who developed early sepsis of a total of 706 who had restorative proctocolectomy for ulcerative colitis (494) and polyposis (212)⁵⁸. The occurrence of early sepsis conferred a higher chance of cumulative failure compared with that in patients who did not develop early sepsis. Furthermore, failure after attempted salvage rose from 20 per cent at 3 years to 40 per cent at 10 years. Of the 131 patients followed for 51 (interquartile range 31–96) months, sepsis was due to fistulation in 76 per cent, anastomotic separation in 15 per cent and abscess formation alongside the pouch in 10 per cent. The authors classified the site of fistulation into three levels: level I (upper pouch) in 19 per cent, level II (lower pouch, rectal cuff) in 31 per cent and level III (ileoanal anastomosis) in 50 per cent. Sepsis was treated conservatively in 24 (18 per cent), by minor surgery in 33 (25 per cent) and by major surgery in 74 (56 per cent). As might be expected, the failure rate was higher after major (47 per cent) than after minor (6 per cent) surgery. Overall, failure was related to sepsis at level III, the presence of a pouch–vaginal fistula (43 per cent), an original diagnosis of ulcerative colitis and the number of salvage procedures. It was also cumulative with time, even after salvage intervention.

The literature is at present not clear on the effectiveness of salvage surgery when chronic sepsis is treated by abdominal operation. As shown in *Table 4*, there is great variability in success rates. To some extent this may be explained by variation in the severity of sepsis, its location in relation to the anastomosis, and the operation used. The duration of follow-up is also an important factor, as failure after salvage continues steadily with time. Success is less likely if the sepsis is near the sphincter.

Fistulation to the vagina

The reported incidence of pouch–vaginal fistula ranges from 2.6 to 16 per cent, and depends on the accuracy and duration of follow-up^{32,44,48,59,60,66–70}. Since first reported in 1985⁷¹, its incidence may have increased^{59,67}. It has been suggested that the complication is more likely in patients with ulcerative colitis than in those with FAP^{68,72}, but others have not found this to be the case⁵⁹. The patient

complains of a vaginal discharge and clinical examination usually demonstrates the fistula. Occasionally, it is only detected by radiological contrast enema (pouchogram). It is important to exclude pouch–vaginal fistula by careful examination under anaesthetic of the vagina as well as the anal canal, before closing the defunctioning ileostomy.

The fistula may present early, before ileostomy closure, or afterwards. In a series of 22 patients, it developed in five before and in 17 at a median interval of 7 (range 1–144) months after closure^{59,73}, perhaps owing to subclinical pelvic sepsis. Patients in the former group have a better prognosis, with spontaneous healing in some^{59,70}.

The internal opening is usually located at the ileoanal anastomosis, but less often it may arise at the dentate line, perhaps as a form of cryptoglandular sepsis. In a series of 17 patients, the internal opening was found at the anastomosis in 15 and at the dentate line in two⁵⁹. In a larger series of 59 patients, the internal opening was at the anastomosis in 37 and at the dentate line in 14⁶⁶. Causative factors may include injury to the vagina or rectovaginal septum during the rectal dissection^{66,67,69} or anastomotic dehiscence with pelvic sepsis^{59,60,67}. The latter is probably the major predisposing factor as pelvic sepsis rates are significantly higher in patients with pouch–vaginal fistula than in those without^{29,59,70,74}. Crohn's disease has been reported to be more common in patients with fistula^{67,70,74–76}, but in a series of 22 patients with this complication only one had proven Crohn's disease after review of all histopathological material⁵⁹.

A survey of colorectal surgeons from 11 hospitals in the USA and Canada reported 21 pouch–vaginal fistulas (6.9 per cent) in a total of 304 patients who underwent restorative proctocolectomy⁷⁰. Five further patients were referred from elsewhere. Of these 26 patients, the original diagnosis was ulcerative colitis in 23 patients, indeterminate

colitis in two and FAP in one. There were 27 fistulas among the 26 patients. The fistula appeared before closure of the ileostomy at a mean of 11 weeks in eight patients and at an interval from closure of 35 weeks in the remaining 19. Twenty-five were recognized clinically; two that were asymptomatic were discovered on routine pouchography.

Management depends on the severity of symptoms. When these are minimal and acceptable to the patient, no action or the placement of a seton may be all that is necessary. There are no published data on the long-term effectiveness of seton drainage, although *Table 5* shows success in all four patients in one study⁶⁷. In those with a clinically significant degree of incontinence, a diverting ileostomy should be established if not already present. On defunctioning, sepsis is drained with or without placement of a seton suture and, once it has settled, repair is indicated. The seton technique is the preferred option when the origin of the fistula is cryptoglandular, but there is no information on the longer-term outcome of this approach.

Simple defunctioning does not appear to be sufficient in itself; in a series of 21 patients, no instance of closure occurred in the six patients who had an ileostomy only⁶⁸. The surgical options are divided into abdominal and local procedures. The former includes abdominoanal revision with advancement of the ileoanal anastomosis, and the latter fistulectomy with or without sphincter repair, endoanal advancement flap repair, and endovaginal or transvaginal repair. The height of the ileoanal anastomosis is the essential feature that influences the choice.

For a stapled anastomosis at or above the anorectal junction, an abdominoanal procedure should be chosen as there is sufficient distance to advance the anastomosis distally below the fistula. The reservoir is dissected from the surrounding pelvic structures down to the anastomosis. This is divided, the track excised and the defect in the vagina

Table 5 Successful closure of pouch–vaginal fistula

Reference	Year	Endoanal ileal advancement flap	Transvaginal	Transabdominal	Seton	Fistulectomy	Perineal direct repair
Wexner <i>et al.</i> ⁷⁰	1989	5 of 12	3 of 11	1 of 1	0 of 2	1 of 16	
Groom <i>et al.</i> ⁵⁹	1993	0 of 3	1 of 1			0 of 1	1 of 5
Keighley and Grobler ⁶⁷	1993		1 of 1	1 of 1	4 of 4	1 of 1	
O'Kelly <i>et al.</i> ⁶⁹	1994		5 of 7				
Paye <i>et al.</i> ⁶⁸	1996			4 of 5			
Lee <i>et al.</i> ⁷⁴	1997	10 of 20	0 of 1	1 of 1	0 of 1		
Ozuner <i>et al.</i> ⁶⁶	1997	15 of 24					
Cohen <i>et al.</i> ⁶⁴	1998			5 of 7			
Burke <i>et al.</i> ⁸⁰	2001		11 of 14				
Zinicola and Nicholls ⁷⁷	2003			9 of 11			
Total		30 of 59	21 of 35	21 of 26	4 of 7	2 of 18	1 of 5

Values are number of successful procedures as a proportion of total number of procedures.

repaired. Any retained rectum is removed and, after a mucosectomy, a manual endoanal anastomosis is performed thereby advancing the pouch distally. *Table 5* shows success in 21 of 26 patients treated by this technique^{64,67,68,70,74,77}.

For a fistula arising from an ileoanal anastomosis lying within the anal canal or just above the sphincter, abdominal advancement of the anastomosis is impractical as there is not sufficient distal anal canal length to be clear of the fistula. A local procedure is necessary in such circumstances and various approaches have been used. Fistulectomy and direct perineal repair appear to give poor results (*Table 5*). The use of muscle flap procedures has been reported, but the long-term results are unknown. Two patients who had a gracilis muscle repair had no recurrence 3 months after ileostomy closure⁷⁸, and four treated by transposition of the rectus abdominis muscle were without recurrence at between 6 and 30 months⁷⁹.

Most surgeons have used either an endoanal ileal advancement flap procedure^{59,66,70,74} or a transvaginal closure technique^{65,80}. The former has a success rate of 50–8 per cent, with closure reported in 30 of 59 cases^{59,66,70,74} (*Table 5*). Transvaginal repair may have advantages over the endoanal technique as it allows a direct approach to the fistula, avoiding possible sphincter damage. In one study the use of an endovaginal advancement flap was successful in five of seven patients at a mean follow-up of 26 (range 14–72) months⁶⁵. Function was satisfactory and no fistula had recurred. In another study a direct approach through the posterior vaginal wall, with repair of the internal opening in the bowel followed by closure of the vaginal wound, was successful in 11 of 14 patients at a median follow-up 18 (range 6–60) months, with repeated procedures being required in five of the 11⁸⁰. The frequency of defaecation ranged from 2 to 10 bowel actions per 24 h with no incidence of faecal incontinence. Combining the results of several studies of transvaginal repair suggests that successful closure was achieved in 21 of 35 patients^{59,65,67,70,74,80}.

Pouch–vaginal fistula from an anastomosis at or above the anorectal junction should be approached abdominally. In one series of 57 patients undergoing major abdominal revision, 21 had a pouch–vaginal fistula; 14 of them had successful abdominal revision, with two of the seven failures subsequently salvaged by a repeat procedure⁸¹. In another combined series of 60 women with pouch–vaginal fistula, 46 patients were treated by transanal closure, six by abdominal revision and five by pouch excision. Initial healing occurred in 20 patients, with 11 more successes after further surgery, yielding an overall success rate of 52 per cent. Pouch failure occurred in 13 (22 per cent) and persistent fistula in 16 (27 per cent)⁸².

Fistula arising from an anastomosis within the anal canal should be treated by either endoanal or transvaginal repair. Higher fistulas should be considered for abdominal revision. Abdominal salvage is achieved in 80 per cent and perineal salvage in from 50 to 60 per cent.

Poor function

Function varies from day to day, and the patient's own perception is probably the most important factor in its identification. Most patients with poor function have a stool frequency of 10 evacuations per 24 h or more, often associated with the passage of small-volume stool. There may also be urgency, incontinence and difficulty in evacuation. An assessment of the extent to which these impair quality of life should be made. Time may affect pouch function. In a prospective study of patients over 12 years there was no change in bowel frequency, although there was an increase in major day continence in 18 per cent and improvement in 1 per cent of patients. Most patients had stable function over the 12 years⁴¹.

Differential diagnosis

Dysfunction accounts for 20–40 per cent of failures^{38,39,42,47,65}. The causes are given in *Table 2*. The diagnosis is made on clinical examination combined with investigations, including pouchoscopy with mucosal biopsy, contrast pouchography, physiological tests of sphincter function, and estimation of reservoir capacity. Pouchitis is often invoked as the cause of poor function, but a degree of acute inflammation in a mucosal biopsy is often seen and this may not necessarily be the reason. Frequently more than one lesion coexists. For example, stenosis of the ileoanal anastomosis, chronic abscess and retained rectum may all occur in the same patient.

Mechanical outlet obstruction

The causes of mechanical outlet obstruction include stricture of the ileoanal anastomosis, long efferent limb of an S-reservoir reconstruction, and a retained rectum with ileorectal anastomosis. Examination and contrast radiology may show evidence of obstruction either at the level of the ileoanal anastomosis or in the distal part of the reservoir. In some patients, outlet obstruction may not be associated with evidence of mechanical narrowing; it is then presumed to be due to a functional disorder of unknown aetiology. Surgery is not indicated in these patients. The symptoms are typical and almost diagnostic. The patient experiences difficulty in evacuation with the characteristic frequent

passage of small volumes of stool. Frequency may be as high as 20–30 defaecations per 24 h with the expulsion of no more than a few millilitres of stool on each occasion. Such symptoms are an indication for further investigation (see above).

Ileoanal anastomotic stricture

Narrowing of the ileoanal anastomosis requiring at least one dilatation under anaesthesia has been reported in 4–40 per cent of patients^{29,32,46,48,65,83–86}. Factors leading to fibrosis include pelvic sepsis and anastomotic tension causing separation^{48,62,84,87}, although no statistical difference has been shown in the incidence of stenosis in patients who develop septic complications compared with those who do not⁸⁶. Stenosis may be more common in those with ulcerative colitis than in those with FAP^{65,83,84}, and also after a stapled anastomosis, particularly when an instrument with a small head has been used⁸⁴. In a series of 266 patients, stenosis occurred in 14.2 and 39.6 per cent respectively after manual and stapled anastomosis⁸⁶.

The severity of the stricture is assessed by digital examination to determine the diameter, longitudinal length and the extent of surrounding induration. Contrast radiology is used to assess the length and the degree of dilatation of the proximal bowel. An apparent stricture may be noted when digital examination is carried out for the first time after operation. This is often due to lateral adhesions across the anastomosis creating a web effect, which is easily divided by gentle passage of the finger.

In one study 35 of 50 patients with stenosis were treated by dilatation, including 26 with and nine without general anaesthesia⁸⁶. Repeated dilatations were necessary in the former group. The stenosis persisted in 37 of the 50 patients and in only 13 did it resolve. In another study, 42 patients who developed a stricture of 982 undergoing restorative proctocolectomy were followed up for 31 (range 1–98) months⁶⁵. All underwent dilatation under anaesthetic, with recurrence in 25 and failure in seven. In 23 patients who required repeated dilatation function was satisfactory and in 11 it was poor. Thus reasonable function was achieved by dilatation in about half the patients. The incidence of stenosis in another series was 39 of 102 patients, of whom 16 were considered to have severe stenosis that required a median of eight dilatations during a 12-month period⁸⁴. Dilatation failed in only one of these patients; in the remaining 15, function was no different from that in patients without stricture.

If symptoms of outflow obstruction persist despite dilatation, surgery may be indicated depending on their severity. In some patients with a tight but short stricture a posterior stricturotomy may be successful, although there

are no published data on the results. This operation runs the risk of sepsis and haemorrhage, and should be carried out under direct vision by means of electrocoagulation. A transanal approach involving excision of the stricture and advancement of the pouch distally has been described in three patients with stricture, two of whom had a simultaneous vaginal fistula. At follow-up of 3–11 months all had satisfactory function⁸⁸.

The endoanal approach is difficult; for patients who are unsuitable for this or who do not respond to dilatation, the available options include removal of the reservoir with the establishment of a permanent ileostomy or a major salvage procedure. Removal has been reported to be necessary in 2.5–15 per cent of patients with stricture^{48,65,83,84,86}. Abdominal salvage involves mobilization of the reservoir from the pelvis, followed by excision of the stenosis and reanastomosis of the apex of the reservoir to the distal anal canal. It is usually necessary to perform a mucosectomy to achieve this^{63,87}. Technical details of importance include the need to dissect close to the reservoir to avoid damage to pelvic structures, including autonomic nerves, and removal of as much of the fibrosis as possible in the area of stricturing. Any associated chronic abscess cavity should be curetted and the operation covered by a defunctioning ileostomy.

There is sparse information in the literature on the outcome of major abdominal surgery for stricture (*Table 6*). In one study, of 23 patients who underwent abdominal salvage for various reasons, the indication was an anastomotic complication in three, all of whom had a successful result⁶². In another study, five patients treated for stricture were followed for a minimum of 6 months⁸⁷. The median frequency of defaecation fell from 17 (10–26) to 6 (4–24) after operation with a successful outcome in four.

Long efferent limb

The S reservoir of Parks and Nicholls⁷ and the isoperistaltic reconstruction of Fonkalsrud and Bustorff-Silva⁸⁹ both involved the creation of an efferent limb of terminal ileum which formed the proximal side of the ileoanal anastomosis. Neither reconstruction is common today. With a limb of up to 8 cm in length in the early years of the S reservoir, over 50 per cent of patients were unable to evacuate spontaneously and needed to catheterize the pouch through the anus to do so⁹⁰. Contrast radiological studies showed outflow obstruction that was roughly proportional to the length of the limb⁹⁰. Accordingly this was shortened to 2 cm, resulting in spontaneous evacuation in around 90 per cent of patients^{24,91}.

The need for catheterization was usually accepted by patients as a reasonable price to pay for avoiding an

Table 6 Abdominal revision for mechanical outlet obstruction

Reference	Year	n	Deaths	Follow-up (months)	Failure	Good function	Poor function
Efferent limb							
Liljeqvist and Lindquist ⁹³	1985	7	0	—	2	5	2
Nicholls and Gilbert ⁹²	1990	6	0	—	0	4	2
Sagar <i>et al.</i> ⁶²	1996	9	0	12–120 (60)	2	7	—
Herbst <i>et al.</i> ⁸⁷	1996	8	0	> 6	1	4	3
Ogunbiyi <i>et al.</i> ⁶¹	1997	2	0	> 6	0	2	—
Stricture							
Sagar <i>et al.</i> ⁶²	1996	3	—	> 12	0	3	0
Herbst <i>et al.</i> ⁸⁷	1996	5	0	> 6	0	4	1
Ogunbiyi <i>et al.</i> ⁶¹	1997	4	—	> 6	1	3	—
Retained rectum							
Sagar <i>et al.</i> ⁶²	1996	1	0	> 12	0	1	0
Herbst <i>et al.</i> ⁸⁷	1996	2	0	> 6	0	2	0
Tulchinsky <i>et al.</i> ¹⁰⁹	2001	22	0	4–14 (22)	5	15	2

Values in parentheses are means.

ileostomy, but some were unable to tolerate the situation. Further surgery has some prospect of improving matters for such patients, with restoration of spontaneous evacuation. It may be possible to remove the problematic segment endoanally, but this is technically possible in less than 30 per cent of patients^{89,92}. In most, an abdominoanal salvage procedure is required. The technique is similar to that described for stricture. The pouch is mobilized and the ileoanal anastomosis detached. The efferent limb is excised and a new anastomosis is constructed manually between the pouch and anal canal. The results are summarized in *Table 6*. Of a total of 26 patients, failure occurred in five and improved function, including conversion from catheterization to spontaneous evacuation, in 18^{61,62,87,92–94}.

Retained rectum

The aim of restorative proctocolectomy is to remove all disease-prone mucosa. The original technique therefore included a mucosectomy of the upper anal canal with an anastomosis just above the dentate line. With the introduction of stapling techniques into pouch surgery²⁶, the anastomosis usually came to lie more proximal at, or above, the level of the anorectal junction. Some degree of inflammation in biopsies taken from the anal columnar epithelium is common^{95–107}. This may be severe enough to cause symptoms in 2–15 per cent of patients^{103–105,108}. In a series of 217 patients who had a stapled anastomosis, 48 (22.1 per cent) had evidence of persisting inflamed mucosa distal to the anastomosis¹⁰³. Of these 32 were symptomatic and 28 needed treatment.

The symptoms of retained inflamed mucosa are those of proctitis, including bleeding, burning and urgency^{109,110}. Disordered evacuation with the frequent passage of small

amounts of stool may also occur, and patients are at continuing risk of neoplastic transformation¹¹¹. Such a diagnosis may be made on digital palpation, which assesses the anastomosis above the level of the anorectal junction, and is confirmed by contrast radiology and endoscopy with biopsies taken from above and below the anastomosis.

Treatment with local steroids may relieve the symptoms but is unlikely to be a satisfactory long-term solution. In patients with unacceptable function despite medical treatment, surgery is indicated^{62,99,108,109}. If there is a short strip of persisting inflamed mucosa it may be possible to remove it via an endoanal approach⁹⁹. In most patients, however, a combined abdominoanal approach is necessary, with removal of the retained rectal stump followed by mucosectomy of the anal stump and a manual ileoanal anastomosis.

Initial reports of one⁶² and two⁸⁷ patients with satisfactory outcome were promising. In a larger series of 22 patients followed for a median of 22.5 (range 4–114) months, failure with excision of the reservoir occurred in five. Seventeen patients had anal function and in these the median 24-h frequency before and after surgery was 12 (range 4–20) and 6 (range 3–12) respectively¹⁰⁹. Median night-time frequency fell from 4 (range 0–8) to 0.5 (range 0–4). Fifteen of the 17 patients reported subjective improvement in the quality of life, giving an overall success rate of 15 of 22.

Retained rectum is a specific cause of dysfunction and is remediable in most circumstances. It should, however, be avoidable by ensuring that the anastomosis is at or below the anorectal junction at the initial operation. This may sometimes be difficult using stapling techniques; the surgeon should be able to perform a manual anastomosis in this eventuality. The failure rate of over 30 per cent

after attempted salvage surgery for this complication is greater than that reported in general series of restorative proctocolectomy.

Small-volume reservoir

A compliant pouch of good volume appears to be a factor determining function; there is an inverse relationship between the maximum tolerated volume of the reservoir and frequency of defaecation^{110,112–115}. Patients with a small-capacity reservoir have high stool frequency, sometimes with urge incontinence. The original 'straight' ileoanal anastomosis reconstruction¹ is an extreme example of this. The diagnosis is made by contrast radiology to give a direct image of the size of the reservoir, and by balloon volumetry which gives a measure of urge and maximum tolerated volume.

If medical treatment fails to reduce unacceptable stool frequency, a reservoir augmentation procedure should be considered using an abdominal approach. It may be possible to add a loop of immediately proximal ileum to the upper part of the reservoir. When this is not technically possible, it is necessary to mobilize the reservoir entirely, including detachment of the ileoanal anastomosis, to allow a complete remodelling. In a report of five patients with functional failure due to low pouch capacity whose reservoir was converted to a W pouch, mean 24-h and nocturnal stool frequency fell from 13.8 and 3.0 to 5.8 and 0.3 respectively after augmentation¹¹⁵.

Sphincter dysfunction

Some degree of anal discharge occurs in up to 30 per cent of patients but faecal incontinence due to poor sphincter function is less common, with a reported frequency of less than 5 per cent^{34,44,61}. Preoperative assessment of the sphincter may avoid some failures by appropriate patient selection¹¹⁶. Previous anal surgery is not, however, necessarily a contraindication to the operation^{117,118}. In patients with postoperative incontinence, the nature of the sphincter lesion should be determined by clinical examination, anorectal physiological testing and anal ultrasonography^{96,119,120}.

There is little information in the literature on the results of salvage surgery for an incompetent sphincter. One study reported two patients who underwent sphincter repair, both with a satisfactory outcome¹¹⁹. Unsatisfactory results were obtained in a series of 11 patients who underwent sphincter reconstruction. Only four retained the reservoir and seven required a permanent ileostomy (unpublished data). The prospect of salvage surgery for sphincter dysfunction appears to be poor.

Mucosal disease

The creation of an ileoanal reservoir leads to mucosal changes whether the operation is done for ulcerative colitis or FAP. These include villous atrophy and the infiltration of chronic inflammatory cells to a varying degree. Acute inflammation leading to symptoms is almost entirely confined to patients with ulcerative colitis^{72,121,122}. The reported incidence of pouchitis ranges from 9 to more than 50 per cent^{32,44,121–127} and increases with the duration of follow-up^{128–130}. However, it is recorded as the main cause of failure in only 7–15 per cent of patients^{29,34,42,44}.

The clinical features of pouchitis are similar to those of colitis and treatment is medical. The recently reported use of probiotics as maintenance treatment offers some hope for those with chronic unremitting pouchitis¹³¹, but surgery appears to have no useful role. Defunctioning does not influence the degree of inflammation in the reservoir mucosa, as demonstrated by poor results in three of a group of 28 patients with pouchitis who were treated by a loop ileostomy. In one the ileostomy was subsequently closed and further attacks of pouchitis occurred¹³². Surgical revision with construction of a new reservoir also results in recurrent pouchitis and up to 5 per cent of patients with chronic unremitting pouchitis have undergone excision of the reservoir^{29,34,42,133,134}.

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