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A retrospective study of colostomies, leaks and strictures after colorectal anastomosis

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Abstract. A review was undertaken of 360 patients undergoing elective left-sided colonic or rectal resections with primary anastomosis, under the care of one surgeon, over a nineteen year period. The incidence, aetiology and management of anastomotic leaks and strictures was studied and the role of proximal diverting colostomy considered. Perioperative mortality was 2.7%. The incidence of anastomotic leaks was 24.4%. Leaks were more common when anastomoses were low, were sutured or were constructed by trainees. Strictures developed in 5.8%. Local recurrence of tumour was the cause of 25% of these strictures. Anastomotic leakage was the principal cause of benign strictures; those developing in association with leaks were more likely to require surgical intervention. There was no evidence that delay in colostomy closure contributed to the development of benign anastomotic strictures. It was not possible to determine whether the presence of a colostomy affected the incidence of leaks but the local effects of such leaks were mitigated in patients with colostomies. Where a minor leak had occurred it was not necessary to wait for complete anastomotic healing before closing the colostomy. After major leaks, colostomy closure before complete healing was associated with further anastomotic problems in 16.0% of cases.

Introduction

A review was undertaken of 360 patients undergoing elective left sided colonic or rectal resections with primary anastomosis under the care of one surgeon (WGE) during the period 1969–1987. The purpose was to determine the incidence and aetiology of anastomotic leaks and strictures, to review the management of these complications and to address two particular issues: (1) When is it safe to close a colostomy in a patient who has had an anastomotic leak; is it necessary to wait until there is complete healing of the anastomosis? (2) Does delay in closure of colostomies result in an increased incidence of anastomotic strictures?

Patients and methods

Information was obtained on 360 patients whose ages ranged from 23 to 93 years (mean 64.6 yr). 182 were male and 178 female. Most operations were performed for neoplasms of the colon or rectum (290–80.5%) or diverticular disease (65–18.1%). Pre-operative preparation and operative technique are described elsewhere [1]. Anastomoses were sutured, using a single layer of interrupted inverting Supramid sutures (A. W. Showell, Surgicraft Ltd), or stapled using the non-disposable EEA instrument (Autosuture). Of the 360 anastomoses 271 were sutured and 89 were stapled. From 1979 cases were entered into a prospective trial comparing hand suture and stapling techniques [1]. This became the principal factor determining the technique chosen for individual cases.

Anastomoses were marked with Cushing's clips for identification on subsequent radiographs. Anastomoses were classified as "low" when the rectum was divided below the pelvic peritoneal reflection. Of 360 anastomoses, 119 were low. A proximal diverting right transverse loop colostomy was fashioned in all 18 cases with coloanal anastomoses. Other indications included inadequate bowel preparation, gross faecal contamination, cases where the anastomosis could not be adequately inspected or where there was particular difficulty in constructing the anastomosis, and stapled anastomoses where doughnuts were incomplete.

Patients were monitored for clinical evidence of anastomotic leakage, which was considered to be present if any of the following was observed: post-operative pyrexia or septicaemia with abdominal tenderness; evidence of an intraperitoneal abscess on pelvic examination or ultrasound; development of faecal fistula from wound, drain tract or vagina; discharge of pus per rectum or via drain tract; necessity of a further laparotomy for peritonitis; anastomotic defect palpable or visible at sigmoidoscopy.

On the 9th or 10th post-operative day a limited contrast enema was performed to determine integrity of the anastomosis. Where present, colostomies were closed at the earliest opportunity after a satisfactory contrast enema examination. The radiographs were reviewed, and leaks classified as "major" where contrast escaped freely into the peritoneal cavity and "minor" where the escape was localised. If there was evidence of a major leak closure was usually delayed until subsequent contrast studies showed healing or limitation of the extent of the leak.

Anastomotic strictures were considered significant if at any stage during follow-up a 15 mm sigmoidoscope could not be passed through the anastomosis. All were within sigmoidoscopic range.

The chi-squared test with Yates' correction was used to determine the statistical significance of the observations. Probabilities of <0.05 were accepted as significant.

Results

There were 9 early deaths, a hospital mortality of 2.5%. Three were related to septicaemia associated with anastomotic leaks.

Proximal diverting colostomies were fashioned for all 18 coloanal anastomoses. The incidence of colostomy formation in the remainder was 29.8%, and was greater for low (68.3%) than for high (13.7%) anastomoses.

Clinically apparent leaks from the primary anastomosis affected 55 cases (15.3%). Post-operative contrast enemas disclosed 33 additional leaks – a combined incidence of 24.4%. Age, sex and pathological diagnosis exerted no discernable effect on the incidence of leaks. Factors which significantly influenced the incidence of anastomotic leaks are considered in Table 1. Coloanal anastomoses were excluded from those figures in Table 1 pertaining to the effect of seniority of surgeon and anastomotic technique on the incidence of leaks as all were sutured by the consultant. Both stapled and sutured groups were well matched for age, sex, pathological diagnosis and level of anastomosis.

Management of anastomotic leaks: 50 of the 88 cases that leaked had proximal diverting colostomies. All 50 were managed conservatively; closure of the colostomy was delayed if there was clinical evidence of sepsis, or a major leak was detected radiologically. Closure was effected when a subsequent contrast enema showed either complete healing of the anastomosis or localisation of the abscess cavity. Two of the 50 cases died as a result of sepsis related to leakage. Non-malignant strictures developed in 4 of the 50 cases, 2 of which required late surgical intervention.

Thirty-eight of the 88 cases with leaks did not have a colostomy formed at the time of anastomosis. In this group 8 cases (21.0%) required early re-operation for faecal contamination – drainage and formation of a diverting colostomy in 6, and Hartmann's procedure in 2. One of the 8 died as a result of sepsis. Non-malignant strictures developed in 6 of the 38 cases (15.8%). Late surgical intervention was required in 6 cases – in 5 of these for strictures.

Anastomotic strictures: We detected 20 strictures, an incidence of 5.6%. These were caused by either cicatrization or local recurrence of malignancy.

There were 15 non-malignant strictures (4.2%). Of the possible aetiological factors examined, age, sex, pathological diagnosis, level of anastomosis, anastomotic technique, seniority of surgeon, presence of a diverting colostomy and the extent of a leak where one had occurred were all found to exert no statistically significant effect. The development of an anastomotic leak was the single factor which was found to significantly affect the incidence of such strictures. Strictures developed in 10 of 88 cases with leaks (11.4%) and 5 of 272 cases with no leak (1.8% – $p<0.001$). In 5 cases the stricture was an asymptomatic sigmoidoscopic finding and no intervention was required. In 10 cases the stricture either caused obstructive symptoms or required treatment before closure of a proximal colostomy. Dilatation was performed in five cases. Five tight fibrous strictures required resection or stricturoplasty.

Table 1. Factors affecting the incidence of anastomotic leakage

			Leak incidence		
			Number	%	
Level of anastomosis	High		42/241	17.4	$p<0.001$
	Low excluding coloanal		35/101	34.7	
	Coloanal		11/18	61.1	
Anastomotic technique	Sutured		66/253	26.1	$p<0.01$
	Stapled		11/89	12.4	
Surgical experience	Consultant:	Stapled	7/67	10.4	$p>0.05$
		Sutured	48/216	22.1	
	Registrar:	Stapled	4/22	18.2	$p<0.05$
		Sutured	18/37	48.6	

Eight of the 10 non-malignant strictures occurring in association with leaks required surgical intervention (resection in 3, per-anal stricturoplasty in 1 and dilatation in 4). Of the five strictures developing in the absence of a leak, one sutured anastomosis was resected; of three stapled anastomoses in this group, one was easily dilated by the passage of a colonoscope and the other two were observed to dilate spontaneously.

Data pertaining to the effect of timing of colostomy closure on the incidence of non-malignant anastomotic strictures are presented in Table 2. The term "delay" in colostomy closure was applied to closure after the 28th day. Where there was no anastomotic leak, delay in colostomy closure was not associated with an increased incidence of strictures. Our results do not provide support for the hypothesis that the presence of a proximal diverting colostomy predisposes to the development of an anastomotic stricture.

Timing of colostomy closure after anastomotic leaks: In 18 cases the colostomy was closed early (mean 18.7 days) despite a minor leak (Table 2). These leaks were subclinical. In 8 further cases closure was delayed (mean 78.6 days) until there was radiographic evidence of complete anastomotic healing. No further local complications occurred in any of these 26 cases. In 25 cases closure of the colostomy was delayed (mean 127.5 days) until there was radiographic evidence of partial but incomplete healing, with limitation of extent of the leak. Six non-malignant strictures developed in this group. Three developed early and were managed by dilatation before colostomy closure. Three cases developed symptomatic strictures late, after colostomy closure. Two were managed by dilatation, while the third required resection.

Malignant strictures: local malignant recurrence occurred in 15 cases (5.3%) and caused a stricture in 5 of these. The management of this complication is beyond the scope of this article.

Table 2. The effect of leaks, colostomies and the timing of colostomy closure on the incidence of non-malignant strictures

		Stricture incidence	Management	Results
Colostomy 126 cases	Anastomotic leak (56 cases)	12.5%	18 cases closed early despite minor leak	No strictures
			8 cases closure delayed until radiographic evidence of complete anastomotic healing	No strictures
			25 cases closed when there was incomplete healing	6 strictures (3 early and 3 late)
			5 cases not closed	1 stricture .
	No anastomotic leak (70 cases)	2.9%	53 cases closed early	2 strictures
			16 cases closure delayed	No strictures
			1 peri-operative death	
No colostomy 234 cases	Anastomotic leak (32 cases)	9.4%	–	3 strictures
	No anastomotic leak (202 cases)	1.5%	–	3 strictures

Discussion

A particular feature of this series is the assessment of all anastomoses by contrast radiography. In other series where a post-operative contrast enema was performed [2–11] the incidence of leaks ranges from 5.7% to 51.0%. Whilst the combined incidence of leaks in our series appears high in comparison with some reports [11–15], these results are matched by those of the senior author [1, 16]. We report the results of all elective left-sided colonic anastomoses during a 19 year period which perhaps reflect more accurately the experience of a single surgical firm.

Three factors significantly affected the incidence of leaks: the level of the anastomosis, the method of its construction and the degree of experience of the surgeon.

An increased incidence of leaks from low anastomoses is well recognised [1–6, 11, 15–19] and was reflected in our results. One of the main difficulties encountered with anastomoses in this situation is disparity between colon and rectum; the diameter of the rectum may be up to three times that of the proximal colon. When a sutured anastomosis is performed in these circumstances it may be impossible to avoid gaps between sutures. When performing a stapled anastomosis difficulty may be experienced gathering the rectum into the purse-string suture so that the knife blade cuts through the rectum eccentrically giving an incomplete doughnut. Where there is gross disparity there is much to be said for closing the rectum with a linear stapler before completing the anastomosis with the EEA instrument or, if hand suturing, forming a side to end anastomosis [20].

The method of construction of the anastomosis did not significantly affect the incidence of leaks when the procedure was performed by the consultant. This is in accordance with other reports [1, 5, 21]. Where anastomoses were stapled, seniority and experience of the surgeon did not affect the incidence of leaks. However, the overall incidence of anastomotic leaks was significantly greater where anastomoses were fashioned by registrars, and for registrars the incidence of leaks was significantly greater for sutured than for stapled anastomoses. Where leakage occurs it is likely that one of the basic principles of anastomosis (an adequate blood supply, avoidance of tension and contamination, and construction of an air-tight anastomosis) has been violated. The increased incidence of leaks from anastomoses constructed by registrars supports this contention and highlights the importance of supervision. After introduction of the stapler cases were entered into a prospective trial, trainees were more closely supervised, and the incidence of leaks no longer varied significantly with seniority or technique [1].

Conservative management of leaks in cases with a covering colostomy was successful in most instances (92.0%), the presence of a colostomy making it easier to resist a further operation for contamination. However, the 2 deaths amongst 50 cases managed this way underline the need for careful case selection, with timely surgical intervention when indicated. In the absence of a colostomy, conservative management of leaks was successful in a smaller proportion of cases (65.0%). Early surgery for contamination was necessary in 21.1%, and late intervention for anastomotic problems – principally non-malignant strictures – was required in 15.8%. We therefore conclude that diverting colostomies mitigate the local and systemic effects of leaks, as suggested by others [3, 12], although any advantage must be weighed against the morbidity and mortality of colostomy closure. We do not agree with the contention [12] that a proximal diverting colostomy should be formed in all cases where a clinically apparent leak has occurred.

We found that it was not necessary to await complete healing of a minor leak before closing a colostomy. In

contrast, after major leaks further anastomotic problems may be anticipated if the colostomy is closed before healing is complete.

The sensitivity of our criteria for determining which anastomoses should be considered at high risk of leakage and protected by a colostomy was 41.7%, and the specificity 84.2%. Assuming that the presence of a colostomy does not make an anastomosis less likely to leak, these criteria seem poor indicators of outcome of an anastomosis, which have resulted in unnecessary colostomies in 19.4% of our 360 cases. Furthermore, our experience indicates that the majority of anastomotic leaks may be managed without formation of a colostomy. Certain groups at particular risk can be identified where a colostomy should be considered: coloanal anastomoses; low sutured anastomoses performed by registrars; and cases where there is gross contamination or inadequate bowel preparation.

Anastomotic leakage was the only statistically significant aetiological factor in the development of non-malignant anastomotic strictures and was related to fibrosis associated with healing and contracture of the associated abscess cavity [9]. Non-malignant strictures developing in the absence of leakage may be attributable to compromise of the vascular supply of the proximal colon. With stapled anastomoses ischaemia may be the consequence of excessive clearance of the bowel wall before application of the purse-string suture [22, 23]. Crushing of the bowel between anvil and cartridge may also be a factor, as may cicatrisation during healing by second intention of the linear ulcer formed in the gap between mucosal surfaces which is produced by the action of the stapler [24]. Furthermore, a diaphragm-like stenosis may result from the inversion produced by stapling devices [25], especially where smaller sized cartridges are used [26].

We found no evidence that proximal diverting colostomies cause non-malignant strictures. Whilst strictures were more common amongst cases with colostomies, the incidence of leaks was also higher in this selected group.

Many strategies have been employed in the management of non-malignant anastomotic strictures. Such strictures are often asymptomatic, and probably dilate spontaneously with the passage of faeces [2, 4]. Others require dilatation, particularly where a proximal diverting colostomy is to be closed.

We found that strictures developing in the presence of anastomotic leakage were more likely to require surgical intervention than those occurring without leaks. Where a leak culminated in stricture formation there was often extensive fibrosis and contracture. This was in contrast to strictures affecting intact anastomoses which were commonly short diaphragm-like lesions, particularly where the stapler was used to construct the anastomosis. In all cases where a stricture was dilated we found that a single dilatation was sufficient.

Antonsen [27] suggested that symptoms of stenosis in patients without evidence of anastomotic leakage were usually explained by local recurrence. However, in our experience such stenoses were more commonly caused by non-malignant cicatrisation. It is clear that the prognosis for patients with malignant strictures is poor, irrespective of the treatment selected. Death was in all our cases caused by disseminated malignancy rather than local complications.

In conclusion, we report the combined results achieved by a surgical firm and highlight the continuing problem of anastomotic leakage and its sequelae, in spite of modern suturing and stapling techniques. We question the place of the diverting proximal colostomy for left-sided colorectal anastomoses and consider the need for refinement of the indications for diversion.

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