Original article doi:10.1111/j.1463-1318.2007.01417.x

The management and outcome of anastomotic leaks in colorectal surgery

A. A. Khan*, J. M. D. Wheeler†, C. Cunningham‡, B. George‡, M. Kettlewell‡ and N. J. McC. Mortensen§

*St Thomas' Hospital, London, UK, †Cheltenham General Hospital, Cheltenham, UK, ‡Department of Colorectal Surgery, John Radcliffe Hospital, Oxford, UK and §Department of Colorectal Surgery, John Radcliffe Hospital, Oxford, UK

Received 3 May 2007; accepted 20 August 2007

Abstract

Purpose Anastomotic leaks in colorectal surgery are associated with significant morbidity and mortality and may result in poor functional and oncological outcomes. Diagnostic difficulties may delay identification and appropriate management of leaks. The aim of this study was to look at the diagnosis, clinical management and outcomes of anastamotic leaks in our department.

Method A retrospective audit and case note review of all patients who underwent the formation of a colorectal anastomosis between January 1996 and December 2002 (n = 1421) was performed. An anastomotic leak was defined as sepsis identified to have arisen from an anastomosis that subsequently required surgery, radiological drainage or intravenous antibiotics. Forty-one patients (25 male, 16 female) with a median age of 60 years (range 7–89 years) were identified as having suffered an anastomotic leak.

Results The median time to diagnosis of an anastomotic leak following surgery was 7 days (range 3–29). At re-operation, 21 patients (51%) underwent formation of a stoma, and any who required the anastomosis to be formally taken down have been left with a 'permanent' stoma. Currently only four of 12 patients (33%) who required a stoma for an anastomotic leak following anterior resection have undergone stoma reversal. Eleven of 16 patients (69%) who had received a stoma following another colorectal procedure had undergone stoma reversal. The mortality associated with an anastamotic leak in this series was 5% (n = 2).

Conclusion Although anastomotic leaks following colorectal surgery are associated with significant morbidity and stoma formation, early and aggressive management should result in a low overall mortality. If an anastomosis is taken down following an anastomotic leak after anterior resection, this will usually result in a 'permanent' stoma.

Keywords anastomosis, leak, stoma, anterior resection

Introduction

A healthy anastomosis requires well-vascularized ends of bowel to be secured together in a tension-free manner. The reported incidence of 'clinically significant' leaks following gastrointestinal anastomosis formation varies depending on the location of the anastomosis (anterior resection: 12.0–15.3% [1,2]; all resections: 4.3–13.0% [3–6]). In part, these variations are due to differences in the definition of an anastomotic leak [7] and whether it is defined on clinical or radiological grounds. In practice it is the clinical manifestations of anastomotic leakage that drive the urgency of surgical management.

Consequently, we chose to define an anastomotic leak as sepsis identified as arising from an anastomosis that required subsequent intervention: surgical, radiological or medical.

Risk factors can be broadly divided into two groups: patient specific and procedure specific. Examples of the former include smoking, steroid use and nutritional status [8].

Anastomotic leaks adversely affect the morbidity and mortality of postoperative patients, may result in a poorer prognosis for functional outcome and increase the risk of permanent stoma formation. More recent evidence [9] suggests that patients undergoing curative anterior

Correspondence to: Mr J. M. D. Wheeler, Consultant Colorectal Surgeon, Cheltenham General Hospital, Sandford Road, Cheltenham, GL53 7AN, UK. E-mail: aadilakhan@gmail.com

Disclaimers: None declared
Presentations: Poster presentation, American Society of Colorectal Surgeons, Dallas 2004

resection, with subsequent anastomotic leakage, may have a higher risk of local tumour recurrence, which in turn is an independent risk factor for anastomotic leakage.

The diagnosis of anastomotic leaks may require the use of radiology (USS or CT) or contrast studies, but in a subset of patients the decision to re-operate may be made on clinical grounds alone. The aim of this study was to investigate how anastomotic leaks are diagnosed and managed in our department, and the stoma status of patients at follow-up who had undergone re-operation for an anastomotic leak.

Method

A retrospective audit of all patients who underwent the formation of a colorectal anastomosis (under the care of CC, BG, MK and NJM), both elective and emergency, between January 1996 and December 2002 at the John Radcliffe Hospital (Oxford) was performed (n = 1421). Patients were identified from a prospectively entered computerized database of emergency and elective colorectal procedures performed in our hospital. Case notes of patients documented to have had an anastomotic leak, and of those patients in whom anastomotic leak was suspected (for example, because of prolonged ileus postoperatively) were reviewed. We used a standardized proforma to identify demographic, clinical, physiological and surgical criteria. For the purposes of this study, an anastomotic leak was defined as sepsis identified to have arisen from an anastomosis that subsequently required surgery, radiological drainage or intravenous antibiotics. With regard to patients undergoing strictureplasty (three anastomotic leaks of 43 procedures), we accede that strictureplasty is not strictly a colorectal procedure, and that often more than one anastomosis is formed. We, therefore, report figures both inclusive and exclusive of the strictureplasty cohort (Tables 2 and 5).

Forty-one patients (37 without strictureplasty) were identified (male = 25, female = 16) with a median age of 60 years (range 7–89 years) who had suffered an anastomotic leak. The median follow-up time was 46 months (range 15–84).

The diagnoses of the patients who suffered anastomotic leaks are listed in Table 1 and the surgical procedures performed, with procedure-specific leak rates, are listed in Table 2. Twelve patients had undergone the formation of a defunctioning stoma prior to their elective anterior resections. Nine of 17 anterior resections, who subsequently leaked, had been defunctioned in addition to 2 of 2 J-pouch procedures and 1 of 1 reversal of Hartmanns.

Possible sources of selection bias for our study include patients who may have re-presented to other units with their leaks.

Table 1 Primary diagnoses of patients undergoing colorectal surgical procedures with subsequent anastamotic leaks.

Diagnosis	*n*
Cancer of colon	5
Cancer of rectum	17
Inflammatory bowel disease	10
Diverticular disease	3
Other*	5
Total	40

*Obstetric pelvic floor repair, chronic constipation, fistula-in-ano, adenoma of rectum, appendix abscess.

Results

Diagnosis of anastomotic leaks

The median time to diagnosis of anastomotic leak was 7 days (range 3–29). Clinical features at the time of diagnosis were a median temperature of 37.8°C (95% CI 37.5–38.0; range 36.4–39.5), a median heart rate of 100 bpm (95% CI 94–106; range 70–140) and a median blood pressure of 120 mmHg (95% CI 110–129; range 55–210). Six patients (two anterior resection, two reversal of ileostomy, one reversal of colostomy, one strictureplasty) (15%) were diagnosed and taken to theatre on clinical grounds alone. Thirty-five patients required further investigation prior to the diagnosis of anastomotic leak being made (Table 3).

Management of anastomotic leaks

Three patients (7.3%) were treated with a course of intravenous antibiotics only. Eight patients (19.5%) underwent radiological drainage of a postoperative collection and 30 patients (70.8%) underwent re-operation.

The median time to re-operation after diagnosis of an anastomotic leak was 0 days (mean = 0.7 days; range 0–12). At re-operation, 22 patients (53%) underwent stoma formation only including one who underwent a Hartmann's procedure. Of the 22 patients with stoma formation at re-operation, 15 (68.2%) had the anastomosis taken down and seven (31.8%) had the anastomosis defunctioned. Other surgical procedures performed at re-operation are listed in Table 4.

Outcomes after anastomotic leaks

There were two deaths (5%) as a consequence of anastomotic leaks. This included an 89-year-old male who had undergone a low anterior resection without being defunctioned, and a 64-year-old male who had

Table 2 Frequency of colorectal surgical procedures and cumulative procedure specific leak rates between 1996 and 2002.

	Number of leaks	Total no. procedures (1996–2002)	Leak rate (%)	Mortality
Anterior resection	14	290	5	2 (0.69%)
AR with pouch	3	39	8	
Ileoanal pouch	2	102	2	
Reversal of Hartmanns	1	44	2	
Sigmoid colectomy	1	120	1	
L hemicolectomy	1	54	2	
R hemicolectomy	4	254	2	
Ileocaecal resection	4	98	4	
Strictureplasty	3	43	7	
Colostomy closure	2	40	5	
Ileostomy closure	5	217	2	
Total	40	1301	3.07	2 (0.15%)
	37*	1258*	2.94*	

*Strictureplasty patients excluded.

Table 3 Frequency and modality of investigations requested for suspected anastomotic leaks.

Without investigation	Primary procedure	CT	CT/ EUA	CT/ contrast	EUA	Contrast	USS
	Sigmoid C	1					
	R hemicolectomy	4					
	L hemicolectomy	1					
2	Ant Res	3	2	3	4	3	
1	Colostomy	1					
2	Ileostomy	3					
	J pouch	1				1	
	Ileocaecal	3					1
	R Hartmanns					1	
1	Strictureplasty	2					
Total		19	2	3	4	5	1

Table 4 Frequency of procedures performed at re-operation for anastomotic leaks.

Re-operation procedures	*n*
Defunctioning of anastamosis	7
Anastamosis taken down	15
Drainage of abscess	3
Excision enterocutaneous fistula	2
Left hemicolectomy	1
Strictureplasty	1
Small bowel resection	1
Total	30

undergone a low anterior resection with a defunctioning ileostomy.

Patients who underwent anterior resection had a fivefold increase in the odds [OR = 5.0 (95% CI 1.5–152) of developing anastomotic leakage (χ^2 = 7.0; df = 5; P = 0.0082), compared with patients who underwent other colorectal procedures.

Long-term outcomes from leaks following anterior resection

Of the 17 anterior resections who had a leak (14 AR, 3 AR with pouch formation) performed in our series, nine (52.9%) had undergone perioperative defunctioning with stoma formation. In this group, five required the anastomosis to be taken down and four did not. Three of the four patients (Fig. 1) who did not have their anastomosis taken down underwent subsequent stoma reversal. Of the eight patients that were not defunctioned at initial surgery two underwent defunctioning stoma formation at re-operation, and one had the anastomosis taken down. One of the two defunctioned patients had their stoma reversed at a later date.

Table 5 Frequency of stoma formation at re-operation, by procedure, and procedure-specific stoma closure rates.

Operation	Number of patients	Preop defunctioning	Subsequent stoma formation	Closed
Anterior resection	17	9	3	4 (33%)
Sigmoid C	1			0
RHC	4		4	1 (25%)
LHC	1		1	1 (100%)
Colostomy	2		1	0
Ileostomy	5		1	1 (100%)
J pouch	2	2		2 (100%)
Ileocaecal	4		3	3 (100%)
Hartmanns	1	1		1 (100%)
Strictureplasty	3		2	1 (50%)
Total	40	12	15	14 (52.0%)
	37*	12*	13*	13 (52.0%)*
	20†	3†	10†	10 (76.9%)†

*Strictureplasty patients excluded.
†Anterior resection and strictureplasty patients excluded.

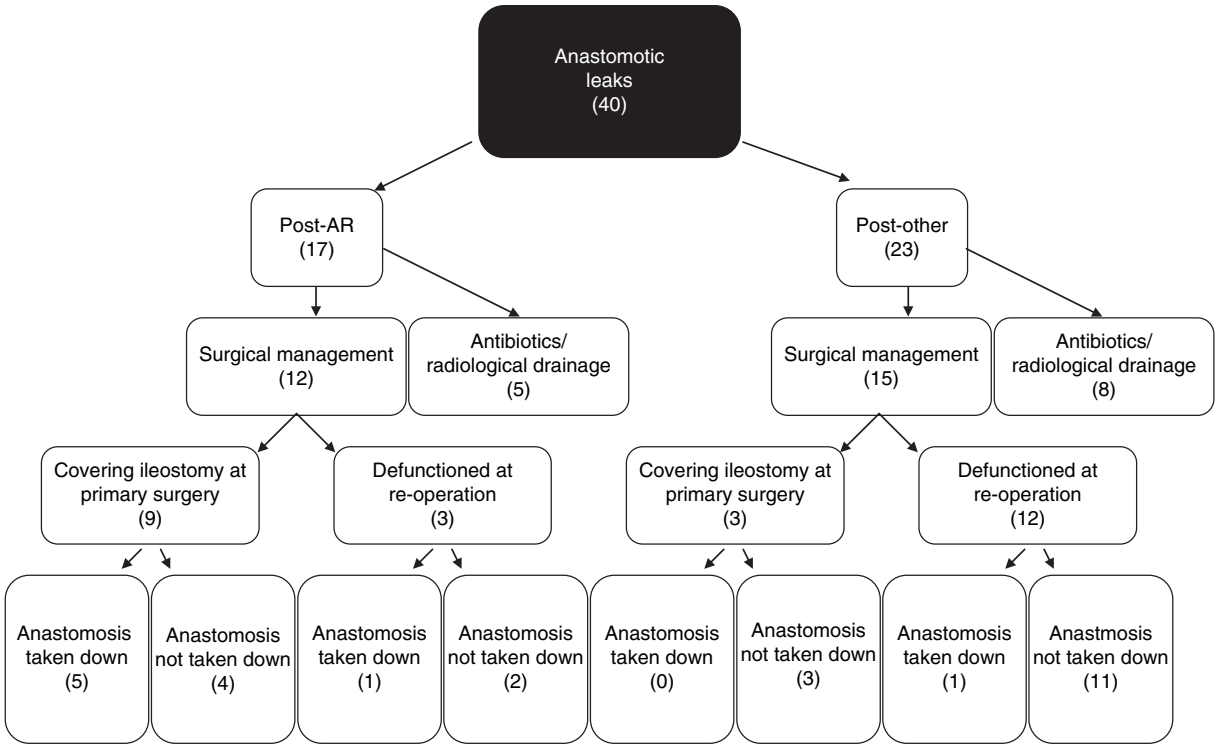

Figure 1 Schematic of surgical patient outcomes in patients who had an anastomotic leak.

The overall stoma reversal rate for those patients who leaked and were taken to theatre after anterior resection was 33% (n = 4). Six patients had their anastomoses taken down and were left with 'permanent' stomas (OR = 5.0; 95%CI 1.5–152; RR = 8.0; 95% CI 1.1–57.9; n = 6).

A flow chart representing outcomes in patients who experienced anastomotic leaks following anterior resection is depicted in Fig. 1.

Outcomes from leaks following other colorectal procedures

These are listed in Table 2. Of the 24 patients who leaked following a surgical procedure, 16 patients had undergone defunctioning either perioperatively (n = 3) or at re-operation (n = 13). Of this group (n = 16), 11 (68.8%) have undergone subsequent stoma reversal.

There were three anastomotic leaks following strictureplasty procedures all of which required re-operation. One patient was re-operated on clinical grounds alone and required a laparotomy with defunctioning ileostomy formation. The other two patients had CT scans prior to being re-operated. In one of the two patients direct closure of the anastomosis was performed, whilst the other required a defunctioning ileostomy.

Stoma outcomes following anastomotic leaks, after other colorectal procedures are shown in Table 5. Of a total 28 stoma formations, 21 (75%) were ultimately reversed. The median time to reversal was 9.75 months (range 4–19 months). The seven (25%) unreversed stomas were formed when a leaking anastomosis was formally taken down.

Discussion

This retrospective case review aimed to audit the diagnosis, management and outcomes of anastomotic leaks occurring in our department. For the purposes of this study we chose to define an anastomotic leak as sepsis arising from an anastomosis, which subsequently required surgery, radiological drainage or intravenous antibiotics.

Our analysis shows that the majority of patients (85%) who experienced an anastomotic leak had undergone investigation, either radiological or examination under anaesthetic (EUA), prior to the diagnosis being made. Conversely, 15% of patients were diagnosed on clinical grounds alone. Anastomotic leakage manifests as a spectrum of clinical presentations [3] from outright peritonism, to cardiac arrhythmias (for example, atrial fibrillation) and lower respiratory tract infections. In addition, some anastomotic leaks are manifest only radiologically, in an asymptomatic patient. In both instances, making the diagnosis of anastomotic leakage can prove difficult.

Sixty-eight per cent of patients who had a stoma formed at re-operation had the anastomosis taken down and were left with a 'permanent stoma'. Our analysis also suggests that leaks following anterior resection are more likely to end in permanent stoma formation than leaks occurring after other colorectal procedures.

Previous studies looking at the diagnosis of anastomotic leaks [10] concluded that significant clinical indicators of leakage were: fever (> 38°C) on day 2, absence of bowel action on day 4, diarrhoea before day 7, > 400 ml of fluid in the abdominal drain by day 3, renal failure on day 3 and leucocytosis on day 7. In our study base, the median time of leak diagnosis was not until 7 days postoperatively, and our findings also support the significance of a fever (median temperature 37.8°C) at this time.

The commonest investigations performed were a CT scan (41.5%), gastrografin enema (14.6%) and EUA (12.2%). Other authors [10,11] have demonstrated that CT scanning with rectal contrast was superior to contrast enemas in the diagnosis of anastomotic leaks following large bowel resections, and was also better at diagnosing intra-abdominal and pelvic abscesses.

Leak rates are higher following anterior resection [1], and are incrementally greater for low anterior resections. Multivariate analysis of leaks following stapled, rectal anastomoses has shown that an anastomosis height below 7 cm is significantly associated with a higher leak rate [12,13].

The finding presented in this paper that leaks following anterior resection have a higher probability of permanent stoma formation would be consistent with existing knowledge [14]. Of note, we observed a leak rate of 2% following ileostomy closure.

Although much of the literature on anastomotic leaks examines aetiology, there is comparatively less information on outcomes following leaks. As alluded to previously, this is due in part to the differing ways in which an anastomotic leak is defined. Mileski *et al.* [15] reported that the formation of end colostomy at re-operation in leaks following low anterior resections conferred a survival benefit over anastomotic repair with proximal defunctioning. Moreover, other long-term sequelae of anastomotic leaks include stricture formation, recurrence of cancer and poor anorectal function [16]. From our series, 75% of patients with a stoma formed at re-operation were reversed within a year following formation.

Our mortality rate (5%) compares favourably with mortality rates reported in the literature (6.25–18.3%) [17–19]. This can be attributed in part to close collaboration with, anaesthetic and intensive care facilities and ease of access to emergency theatres in our hospital, allowing for the provision of pre-emptive surgical care.

This paper reports on the diagnosis, management and stoma outcomes for patients who experienced an anastomotic leak in our department. Despite the significant morbidity and stoma formation that is associated with anastomotic leaks, early and aggressive management should result in a low overall mortality.

Funding

None declared.

References

1 Rullier E, Laurent C, Garrelon JL *et al.* Risk factors for anastomotic leakage after resection of rectal cancer. *Br J Surg* 1998; **85:** 355–8.

2 Tuson JR, Everett WG. A retrospective study of colostomies, leaks and strictures after colorectal anastomosis. *Int J Colorectal Dis* 1990; **5:** 44–8.
3 Alves A, Panis Y, Trancart D *et al.* Factors associated with clinically significant anastomotic leakage after large bowel resection: multivariate analysis of 707 patients. *World J Surg* 2002; **26:** 499–502.
4 Fielding LP, Stewart-Brown S, Blesovsky L, Kearney G. Anastomotic integrity after operations for large-bowel cancer: a multicentre study. *Br Med J* 1980; **281:** 411–4.
5 Sugerman HJ, Sugerman EL, Meador JG *et al.* Ileal pouch anal anastomosis without ileal diversion. *Ann Surg* 2000; **232:** 530–41.
6 Remzi FH, Fazio VW, Gorgun E *et al.* The outcome after restorative proctocolectomy with or without defunctioning ileostomy. *Dis Col Rectum* 2006; **49:** 470–7.
7 Bruce J, Krukowski ZH, Al-Khairy G, Russell EM, Park KGM. Systematic review of the definition and measurement of anastomotic leak after gastrointestinal surgery. *Br J Surg* 2001; **88:** 1157–68.
8 Makela JT, Kiviniemi H, Laitinen S. Risk factors for anastomotic leakage after left sided colorectal resection with rectal anastomosis. *Dis Colon Rectum* 2003; **46:** 653–60.
9 Bell SW, Walker KG, Rickard JFX, Sinclair G, Dent OF, Chapius BH, Bokey EL. Anastomotic leakage after curative anterior resection results in a higher prevalence of local recurrence. *Br J Surg* 2003; **90:** 1261–6.
10 Alves A, Panis Y, Pocard M *et al.* Management of anastomotic leakage after nondiverted large bowel resection. *J Am Coll Surg* 1999; **189:** 554–9.
11 Lim M, Akhtar S, Sasapu K *et al.* Clinical and subclinical leaks after low colorectal anastomosis: a clinical and radiologic study. *Dis Colon Rectum* 2006; **49:** 1611–9.
12 Vignali A, Fazio VW, Lavery IC *et al.* Factors associated with the occurrence of leaks in stapled rectal anastomoses: a review of 1014 patients. *J Am Coll Surg* 1997; **185:** 185–6.
13 Meade B, Moran B. Reducing the incidence and managing the consequences of anastomotic leakage after rectal resection. *Acta Chir Iugosl* 2004; **51:** 19–23.
14 Bailey CM, Wheeler JM, Birks M, Farouk R. The incidence and causes of permanent stoma after anterior resection. *Colorectal Dis* 2003; **5:** 331–4.
15 Mileski WJ, Joehi RJ, Rege RV, Nahrwold DL. Treatment of anastomotic leakage following low anterior colon resection. *Arch Surg* 1988; **123:** 968–71.
16 Chambers WM, Mortensen NJ. Postoperative leakage and abscess formation after colorectal surgery. *Best Pract Res Clin Gastroenterol* 2004; **18:** 865–80.
17 Brannagan G, Finnis D, Wessex Colorectal Cancer Audit Working Group. Prognosis after anastomotic leakage in colorectal surgery. *Dis Col Rectum* 2005; **48:** 1021–6.
18 Pakkastie TE, Luukkonen PE, Jarvinen HJ. Anastomotic leakage after anterior resection of the rectum. *Eur J Surg* 1994; **160:** 293–7.
19 Mealy K, Burke P, Hyland J. Anterior resection without a defunctioning colostomy: questions of safety. *Br J Surg* 1992; **79:** 305–7.