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BRIEF ARTICLE

Anterior resection for rectal carcinoma - risk factors for anastomotic leaks and strictures

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Abstract

AIM: To determine the incidence and factors responsible for anastomotic leaks and stricture following anterior resection (AR) and its subsequent management.

METHODS: Retrospective analysis of data from 108 patients with rectal carcinoma who underwent AR or low anterior resection (LAR) to identify the various preoperative, operative, and post operative factors that might have influence on anastomotic leaks and strictures.

RESULTS: There were 68 males and 40 females with an average of 47 years (range 21-75 years). The median distance of the tumor from the anal verge was 8 cm (range 3-15 cm). Sixty (55.6%) patients underwent handsewn anastomosis and 48 (44.4%) were stapled. The median operating time was 3.5 h (range 2.0-7.5 h). Sixteen (14.6%) patients had an anastomotic leak. Among these, 11 patients required re-exploration and five were managed expectantly. The anastomotic leak rate was similar in patients with and without diverting stoma (8/60, 13.4% with stoma and 8/48; 16.7% without stoma). In 15 (13.9%) patients, resection margins were positive for malignancy. Nineteen (17.6%) patients developed anastomotic strictures at a median duration of 8 mo (range 3-20 mo). Among these, 15 patients were successfully managed with per-anal dilatation. On multivariate analysis, advance age (> 60 years) was the only risk factor for anastomotic leak (P = 0.004). On the other hand, anastomotic leak (P = 0.00), mucin positive tumor (P = 0.021), and lower rectal growth (P = 0.011) were found as risk factors for the development of an anastomotic stricture.

CONCLUSION: Advance age is a risk factor for an anastomotic leak. An anastomotic leak, a mucin-secreting tumor, and lower rectal growth predispose patients to develop anastomotic strictures.

Key words: Rectal carcinoma; Anterior resection; Anastomotic leak; Stricture

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INTRODUCTION

Anterior resection (AR), especially low anterior resection (LAR), for rectal carcinoma and colorectal anastomosis is a technical challenge to surgeons. The introduction of circular stapling devices has made more and more LARs technically feasible. The two most serious complications following AR/LAR, anastomotic leaks and stenosis, are causes of concern because these affect the long-term outcome and quality of life. The incidence of these complications has been variably reported in the literature because of the different definitions used. The objective of this study is to determine the incidence of anastomotic leaks and anastomotic strictures following AR/LAR, the factors responsible for these complications, and to define their management.

MATERIALS AND METHODS

Between January 1989 and December 2008, 280 patients were operated on for rectal carcinoma in the department of Surgical Gastroenterology, a tertiary level referral hospital in Northern India. One hundred and eight of these patients underwent AR/LAR. For the purpose of the study, information was collected both from medical records and a computerized database. Colonoscopy or sigmoidoscopy was performed on all patients to localize the lesion and for tissue sampling for histopathology. A barium enema was administered to some patients to assess the proximal colon for synchronous lesions in cases where a colonoscopy was either incomplete or could not be performed for technical reasons. Chest X-rays were performed on all patients to rule out lung secondaries. Contrast enhanced computed tomography (CECT) was performed to determine the extent of the tumor, to assess lymph nodes, and to detect liver secondaries. Neoadjuvant chemoradiotherapy was given to patients with unresectable T4 lesions (infiltration to adjacent organs) for downstaging. Routine hemogram, liver function, and renal function tests were ordered as part of the pre- operative work up. All patients received mechanical bowel preparation with Polyethylene Glycol (PEG) solution the day before the planned procedure. Prophylactic antibiotics were administered at the time of induction. Antibiotics were continued for 5 d postoperatively. The procedures were performed either by consultants or registrars. The decision to perform hand-sewn *vs* stapled anastomosis (CDH, Ethicon, Johnson and Johnson, Illinois, USA), and the decision to add a proximal diverting stoma (either a loop ileostomy or a loop colostomy) were taken by the operating surgeon on a case-to-case basis. Suction drains were routinely left in the pelvis, near the anastomosis, in all patients and were removed when the drainage was serous in nature and the amount less than 50 mL/d. A contrast study was performed in patients with clinical suspicion of a leak.

An anastomotic leak is defined as either evidence of feculent drainage or a leak demonstrated on contrast imaging. An anastomotic stricture is defined as anastomotic narrowing that does not allowing the passage of the distal inter- phalangeal joint of the index finger, or narrowing causing difficulty in the evacuation of stool. Patients with T3, T4 disease and/or lymph node positive disease, and/or positive histological margins received chemoradiation as an adjuvant treatment. The diverting stoma was closed after 8-12 wk when a contrast study revealed no anastomotic leak or stricture.

Various clinical, tumor related, and intra-operative factors, which might influence the development of leaks (Table 1) and strictures (Table 2), were analyzed. Univariate analysis was done using Pearson's χ^2 test, Fishers exact test, or Student's *t* test. Multivariate analysis was done

Table 1 Factors analyzed for their significance in anastomotic leaks

Factor	Leak (*n* = 16)	No leak (*n* = 92)	*P* value (univariate analysis)
Age (more than 60 yr)	7	13	0.01[1]
Male sex	11	57	0.78
Distance of the tumor from anal verge (mean, cm)	8.2	8.9	0.5
Pre- operative hemoglobin (mean, g/dL)	10	10.2	0.6
Pre- operative serum albumin (mean, g/dL)	3.6	3.5	0.4
Stapled anastomosis	6	42	0.59
Doughnut incomplete	3	2	0.032
Duration of surgery (mean, h)	1.9	2.8	0.28
Blood loss (mean, mL)	157	168	0.9
Diverting stoma	8	52	0.78
R0 resection	12	65	1
Positive resection margin	2	13	1
Mucin secreting tumour	5	28	1

[1]Factors found to be significant.

Table 2 Factors analyzed for their significance in anastomotic strictures

Factor	Stricture (*n* = 19)	No stricture (*n* = 89)	*P* value (univariate analysis)
Age (more than 60 yr)	3	17	1
Male sex	15	53	0.126
Distance from anal verge (mean, cm)	6.6	9.3	0.011[1]
Pre-operative hemoglobin (mean, gm/dL)	10.7	10.1	0.23
Pre-operative serum albumin (mean, gm/dL)	3.5	3.5	0.92
Stapled anastomosis	11	37	0.21
Doughnut incomplete	2	3	0.63
Duration of surgery (mean, h)	2.25	2.76	0.43
Blood loss (mean, mL)	177	164	0.86
Diverting stoma	11	49	1
R0 resection	15	62	0.57
Positive resection margin	2	13	0.1
Anastomotic leak	8	8	0.001[1]
Mucin secreting tumour	10	23	0.029[1]

[1]Factors found to be significant.

using the binary logistic regression method. SPSS 15 software was used for the analysis. Significance was calculated at the 95% CI and P value < 0.05.

RESULTS

Among 108 patients who underwent AR/LAR, there were 60 males and 48 females with a median age of 47 years (range 21 to 75 years). The median distance of the tumor from the anal verge was 8 cm (range 3-15 cm). The tumor was situated within 5 cm from the anal verge in 30 patients, between 5 and 10 cm in 46 patients, and above 10 cm in 32 patients. Endoscopic biopsy revealed adenocarcinoma in 100 and adenoma with dysplasia in four. The biopsy was inconclusive in remaining four patients. No patient had lung metastasis on X-ray chest. Based on pre-operative staging, five patients received neo-adjuvant treatment.

LAR (anastomosis below the level of the peritoneal reflection) was performed in 93 patients (86%). Fifteen patients (14%) underwent anterior resection (anastomosis above the level of the peritoneal reflection). Sixty patients (55.6%) underwent hand-sewn anastomosis and 48 (44.4%) had stapled anastomosis. The median distance of the tumor from the anal verge in the hand sewn anastomosis group was 10.2 cm (range 4-15 cm) and it was 6 cm (range 3-15 cm) in the stapled group. Twenty-nine anastomoses were performed using CDH29, ten with CDH31, and three with CDH33. In the remaining six patients, no information regarding the size of the stapler was available. Information regarding anastomotic doughnuts was available in 39 patients. Doughnuts were complete in 34 patients and incomplete in five. Diverting stomas were created in 60 patients (55.6%); 33 (69%) with stapled anastomosis and 27 (45%) with hand-sewn anastomosis. The median duration of operation was 3.5 h (range 2.0-7.5 h). Final histopathology revealed adenocarcinoma in all patients. Resection margins were positive for malignancy in 15 (13.9%) patients. Seven patients with stapled anastomosis and eight with hand-sewn anastomosis had positive resection margins. The resections were R0 (no microscopic or gross residual disease) in 77 patients (71.3%) and R1/R2 (microscopic/macroscopic residual disease left) in 31 (28.7%) patients. Nineteen patients (17.6%) had evidence of distant metastases at operation (liver in 13, peritoneal in three, and both liver and peritoneal in three).

Fifty Six patients (51.8%) had post operative complications. Major complications included wound infection (n = 27, 25%), intra-abdominal bleed (n = 4, 3.7%), anastomotic leak (n = 16, 14.6%), anastomotic stricture (n = 19, 17.6%), and intestinal obstruction (n = 16, 14.6%). Of the 16 patients who had anastomotic leaks, eight had diverting stoma. Overall, 18 patients (16.7%) required re- exploration for the management of post-operative complications. Eleven patients with anastomotic leaks required re-exploration, and in seven of these, diverting stomas were created at second surgery. The remaining five patients with leaks were managed expectantly. There were two (1.85 %) postoperative deaths (one due to an intra-abdominal bleed and the other due to pneumonitis). Local pelvic recurrence developed in eight patients during the follow up (follow up duration: 1-15 years). Nineteen (17.6%) patients presented with anastomotic strictures at a median duration of 8 mo (range 3-20 mo) after surgery. Biopsy from these strictures revealed no evidence of malignancy in any of them. Seven of these strictures were managed with dilatation using Hegar's dilators under general anesthesia. In others, the dilatations were carried out on an outpatient basis. The median number of dilatation required was 1 (1-4). Diverting stomas were closed in all patients, except for four who had severe fibrotic strictures and did not respond to dilatations even after multiple sessions.

Table 3 Significant factors determined by multivariate analysis

Factors	P value	Odds ratio
Factors affecting anastomotic leak		
Advance age (> 60 yr)	0.004	7.23
Factors affecting anastomotic stricture		
Anastomotic leak	0.000	13.6
Distance of growth from anal verge	0.011	6.5
Mucin secreting tumor	0.021	5.3

Advanced age (greater than 60 years) and incomplete doughnuts were found to be significant risks for anastomotic leaks on univariate analysis (Table 1). However, age was the only significant risk factor for anastomotic leaks on multivariate analysis (Table 3). On the other hand, increased distance of the tumor from the anal verge, a mucin secreting tumor, and an anastomotic leak were the factors found significant for the development of stricture, both on uni- and multivariate analysis (Tables 2 and 3).

DISCUSSION

Incidence of anastomotic leaks following AR/LAR has been reported to be 3%-21%[1-7]. Various patient-related, tumor-related, and technique-related factors have been enumerated as predisposing factors for anastomotic leaks. Male sex has been reported to be one such factor because of their unfavorable pelvic anatomy[1,2]. No significant difference in the number of leaks between males and females was observed in our study.

Distance of the tumor from the anal verge and the position of the anastomosis were found to be associated with the development of anastomotic leaks[2-4]. The reported higher incidence of leaks as the anastomosis becomes lower may be because of the increasing technical difficulty and ischemia of the distal end. In our series, distance of the tumor from the anal verge was not associated with leaks on univariate analysis. A leak rate of 3%-18% following stapled anastomosis in AR has been reported by various authors[1,2,5,6]. Law *et al*[1] and Rullier *et al*[2] demonstrated a higher leak rate following stapled anastomosis compared to hand-sewn. They attributed

this to the difficulty of the cases undergoing stapled anastomosis. A systematic review of nine randomized controlled trials could not find any significant difference in leak rates between the two groups[8]. The leak rates of 16.7% for stapled anastomosis and 12.5% for hand-sewn anastomosis in our study were comparable to the published series[8]. The high leak rates in our study may reflect the experience of operating surgeons (both trainee and consultants). We assume that, as the number of patients and experience increase, the leak rate will decrease.

Although the use of a protective stoma has not been shown to decrease the overall anastomotic leak rate, it reduces the rate of re-operation and postoperative mortality in the event of a leak[9,10]. In the present series, creation of a protective stoma did not reduce the anastomotic leak rate. The majority of authors recommend a selective policy in providing covering stoma after AR/LAR, reserving it for patients with high risk for of leaks (anastomosis within 5 cm from the anal verge, male gender, and incomplete doughnut)[4,7,11].

Although anastomotic leak and positive resection margin were implicated as factors promoting recurrence after AR[12,13], the relation between the leak and a positive resection margin is not well studied. A positive resection margin was not a significant risk factor for anastomotic leak in our patients.

Over all, the anastomotic stricture rate after hand-sewn anastomosis varies from 5%-9%[14]. The incidence of strictures after hand-sewn anastomosis that necessitated treatment, was 0.6% in Goligher's experience[15]. The low stricture rate in Goligher's series compared to recent experience could be due to the lower number tumors close to the anal verge. Today, as more and more low rectal tumors are being submitted for LAR and ultra low AR, the stricture rate may also show a similar increase. Stricture rates of up to 20% have been reported[16]. Some animal studies have suggested that healing by scarring of the of the exposed seromuscular layer with poor epithelial bridging might explain the significant incidence of strictures following stapled anastomosis[17]. A meta-analysis of 13 randomized controlled trials showed increased stricture rates following stapled anastomosis compared to hand-sewn[18]. In our series, 22.9% developed strictures after stapled anastomosis, which is higher than the 13.3% developed after hand-sewn anastomosis; however, it was not statistically significant. Waxmann *et al*[19], in a review of 10 series, reported 6% incidence of strictures with stapled anastomosis. They also noticed a reduced stricture rate with Russian staples, which deliver a single row of staples, compared to the new generation staples, which deliver two rows of staples. The size of the stapler has also some bearing on the stricture rate, according to some published series. Miller *et al*[20], in their report of 103 patients with stapled anastomosis, had a 4 % stricture rate, and the strictures were more common when a 28 mm diameter stapler was used as compared to one of 31 mm.

The high incidence of anastomotic leaks (14.6%) was another reason for the high stricture rate (17.6%), because a leak predisposes the patient to intense inflammation and scarring. The stricture rate will therefore invariably increase.

The need for permanent stoma because of anastomotic stricture has been variably reported (1%-9%)[21-23]. Although the incidence of anastomotic stricture was high in our series (17.6%), it is noteworthy that 15/19 (78.9%) strictures were successfully managed by per-anal dilatations. The incidence of anastomotic leaks and strictures are bound to be high in a teaching hospital where there will always be an influx of new trainees.

In conclusion, in our study, advance age was the only factor significantly associated with anastomotic leaks. On the other hand, anastomotic leaks, an aggressive tumor (mucin secreting), and growth in the lower rectum were predisposing factors for development of anastomotic strictures.

COMMENTS

Background

Two major complications of anterior resection (AR) and Low AR, anastomotic leaks and anastomotic strictures, were analyzed retrospectively. The effects of various factors that can lead to anastomotic leaks and anastomotic strictures were analyzed.

Research frontiers

Neoadjuvant Chemotherapy is under evaluation for locally advance tumors. Intersphincteric resections are under evaluation for patients with lower rectal tumors.

Innovations and breakthroughs

Introduction of total mesorectal excision was a major achievement in the development of surgery for lower rectal growth, leading to significant decreases in the complications rate and a significant decrease in local recurrence. Development of end-to-end staplers was also a significant breakthrough, which made anastomosis possible in the lower rectum, thus facilitating sphincter preservation.

Applications

As advance age is a significant risk factor for anastomotic leaks, so attention to detail is important while performing surgery on elderly patients. Similarly, special precautions are needed while performing anastomosis on low-lying growths, and mucin positive tumors; these patients should be operated on only by an experienced surgeon.

Peer review

This is a good paper, but the study is over a period of 20 years, and changes may have happened regarding management.

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