ORIGINAL ARTICLE

Factors affecting anastomotic leak after colorectal anastomosis in patients without protective stoma in tertiary care hospital

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Abstract

Objective: To determine the factors associated with clinically significant anastomotic leak in patients having undergone large intestinal anastomosis.

Method: The retrospective study at the Aga Khan University Hospital, Karachi, comprised data between January 2000 and March 2010, related to patients who underwent colorectal anastomosis. Demographic details of the patients, as well as preop, intraop and postop risk factors were recorded. Anastomotic leak was identified as per the defined criteria. Outcome of patients was recorded as postop hospital stay and mortality. Univariate and Multivariate analyses were applied to identify risk factors for anastomotic leakage.

Results: Among the total 127 patients in the study, anastomotic leak occurred in 19 (15%) patients (Group 1), while there was no clinical leak in 108 (85%) patients (Group 2). Univariate analysis showed 8 factors to be affecting the anastomotic leak: operation time (p=0.003), intraoperative blood loss (p=0.006), intraoperative blood transfusion (p=0.013), indication of surgery malignancy vs. benign (p=0.049), type of surgery elective vs. emergency (p=0.037), intraop use of vasopressor (p=0.019), segment of bowel anastomosed left side vs. right side (p=0.012), and drain placement vs. no drain placed (p=0.035). Preop immunosuppressive therapy was borderline significant (p=0.089). Multivariate analysis showed that left vs. right sided anastomosis (p=0.068), blood transfusion >2 pack cells (p=0.028), smoker vs. non-smoker (p=0.049), elective vs. emergency surgery (p=0.012) were the independent risk factors which significantly affected the outcome of bowel anastomosis. Mortality rate was 15.79% (n=3/19) in Group 1, while it was 1.85% (n=2/108) in Group 2 (p=0.02). The postop hospital stay was 15±5.44 days in Group 1, while it was 7.51±4.04 days in Group 2 (p>0.001).

Conclusion: In colorectal anastomotic surgeries temporary diversion stoma formation needs to be considered on the basis of risk factors to decrease mortality and morbidity associated with anastomotic leak.

Keywords: Anastomotic leak, Intestinal anastomosis. (JPMA 64: 166; 2014)

Introduction

Anastomotic dehiscence is one of the most dreaded complications of operations of the large intestine. Breakdown of an anastomosis results in increased morbidity and mortality and adversely affects length of stay and cost.[1] Reported rates of anastomotic dehiscence vary between 1% and 30%, although experienced colorectal surgeons often quote 3% to 6% as an acceptable overall leakage rate.[2] In literature there are many ways to prevent this anastomotic leak (AL) which include correcting the correctable risk factors preoperatively, Good anastomotic technique, using fibrin glue to seal off the anastomosis,[3,4] using intraluminal tubes which can be absorbable or nonabsorbable, using bovine myocardial strips to bury the anastomotic line[5] and by making diversion stoma. Role of fibrin glue, bovine myocardial strips and intraluminal tubes is not supported by larger trials and is also not cost-effective. Formation of diversion stoma proximal to anastomotic site is a time-tested and widely used method and also supported by literature. For example in a study[6] done in 2007 it was described that the anastomotic leak in patients with proximal diversion was 10.3% while without proximal diversion was 28% (p<0.001). But it is not "the end" as diversion stoma is also associated with morbidity of compromised quality of life for 6 weeks to 3 months after which stoma is reversed and second surgery for reversal of stoma is required and there are also some complications of stoma like prolapsed, stenosis, bleeding, necrosis, retraction of stoma, skin erosions, and disuse stricture of distal anastomosis. So the decision of making diversion stoma is not easy in each case and it should be judicious. The factors which can predict the leakage of anastomosis are debated and there is no well established set of factors when to divert the bowel and when to maintain the continuity of anastomosis. Better knowledge of risk factors for AL could help not only in the better management of these patients (i.e., by correcting well identified pre-operative risk factors for AL) but also for preventive treatment by creating a protective stoma in

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high-risk patients with an intraperitoneal or extra-peritoneal anastomosis.

Few studies have been reported in literature till now in which different factors are analysed to find their association with AL.[7-14] Most of these studies are retrospective and involved univariate analysis of data.

The aim of the current study was to determine by univariate and multivariate analyses the factors associated with clinically significant AL in patients who underwent large intestinal anastomosis (without a protective stoma).

Patients and Methods

The retrospective case-control study was done at Aga Khan University Hospital, Karachi, and comprised data of patients with colorectal anastomosis without proximal diversion operated from January 2000 to March 2010. Record of patients was extracted on the basis of International Classification of Diseases (ICD) coding system. Data was collected by using a proforma. Comorbids of patients included in the study were measured by Charlson Severity Index.[15-17] Data was analysed on SPSS 17. Descriptive Analysis of continuous variables was described by Mean±SD and that of categorical variables was expressed in frequency and percentage. Comparative analysis of continuous variables was done by student t test and that of categorical variables by Chi square test. Multivariate Analysis was done by Binary logistic regression and $p<0.05$ was considered significant. Patients were monitored for the clinical evidence of AL post-operatively, which included postoperative pyrexia or septicaemia with abdominal tenderness without any other evidence of source of infection, evidence of intraperitoneal abscess, development of faecal fistula from wound or drain, or need of another laparotomy for peritonitis. All the clinical AL were confirmed by laparotomy or a water soluble contrast anaema or follow-through study. Patients were labelled as anastomotic leak by the primary surgeon treating the patient. Subclinical anastomotic leaks were not considered because a routine contrast study was not performed after surgery. All files were reviewed by two reviewers. Data was divided into five groups. Demographic details included gender and age. Preop factors included Charlson Severity Index for comorbidity, addiction of patient, body mass index (BMI), Preop haemoglobin, albumin, blood urea nitrogen (BUN), creatinine, bowel preparation, and preoperative treatment. Indications of surgery, nature of surgery (elective or emergency), American Society of Anaesthesiology (ASA) score, operative time, blood loss during surgery, intraoperative blood transfusion, use of vasopressors, surgical technique (open or laparoscopic), anastomotic technique (hand-sewn, stapled or combined), anastomotic segment and drain placement was recorded in the operative factors group. Postop factors included nasogastric decompression, diet started on which postop day, leak found or not, if found on which postop day, how it was identified, and how it was treated. Postop hospital stay and mortality were also recorded. Outcome (AL or no AL) occurred within the same hospital admission so there was no loss to followup.

Results

The medical records of 647 patients who underwent large intestinal anastomosis during the study period were reviewed. The patients in whom resection anastomosis was done with a covering stoma or it was done outside the AKUH or there was missing medical record were excluded from the study. Of these 647 patients, 127 (19.63%) met the inclusion criteria. There were 82 (64.6%) males and 45 (35.4%) females, with an overall mean age of 52.41±16.34 years.

Indications of anastomosis of bowel included colorectal carcinomas in 82 (64%) patients, reversal in 18 (14.2%),

Table-1: Descriptive analysis of data.

Descriptive Analysis	N(%)
Bowel Preparation	
Done	94(74%)
Not Done	33(26%)
Type of anastomosis	
Stapled	81(63.8%)
Hand Sewn	44(34.6%)
Combined	02(1.6%)
Drain placement	
Placed	29(23%)
Not placed	98(77%)
Postop Nasogastric decompression	
Done	113(89%)
Not Done	14(11%)
Bowel Preparation	
Done	94(74%)
Not Done	33(26%)
Type of anastomosis	
Stapled	81(63.8%)
Hand Sewn	44(34.6%)
Combined	02(1.6%)
Drain placement	
Placed	29(23%)
Not placed	98(77%)
Postop Nasogastric decompression	
Done	113(89%)
Not Done	14(11%)

Table-2: Analysis of Continuous Variables.

Continuous variables	Group 1	Group 2	P value
AGE(years)	52.44(±13.22)	52.40(±16.87)	0.99
Charlson severity index	2.42(±2.36)	1.52(±2.089)	0.138
BMI(Kg/m^2)	23.69(±4.55)	23.04(±5.67)	0.589
PreopHb(gm/dl)	11.3(±2.55)	11.56(±2.05)	0.681
Preop Albumin	2.6(±0.74)	2.8(±0.69)	0.443
Missing data	4	32	
Preop BUN	14.18(±17.86)	12.39(±7.87)	0.681
Preop Cr	0.841(±0.27)	0.911(±0.22)	0.326
Operation time (minutes)	275.32(±98.4)	209.19(±84.65)	0.003
Blood loss(ml)	862.63(±707.43)	350.29(±284.36)	0.006
Blood transfusion(Pints)	1.63(±2.166)	0.25(±0.643)	0.013
NG placed for (days)	3.47(±1.54)	3.36(±2.36)	0.78
Diet started(days)	4.14(±1.03)	4.54(±2.1)	0.21

BMI: Body mass index. BUN: Blood urea aitrogen. NG: Nasogastric Tube.

Table-3: Analysis of Categorical Variables.

Categorical Variables	Anastomotic Leak	No anastomotic leak	p-value
Sex			0.34
Male	11	71	
Female	8	37	
Addiction			0.282
Smoker	5	14	
Alcoholic	0	2	
None	14	92	
Bowel prep			0.364
Yes	13	81	
No	6	27	
Preop Treatment			0.089
Steroids	1	0	
Chemotherapy	1	1	
Radiation	0	1	
Antituberculous	0	1	
None	17	105	
Indications of surgery			0.0419
Cancer	13	69	
IBD	1	0	
Benign Obstruction	2	5	
Diverticulitis	0	3	
Reversal	1	17	
Hernia	0	1	
Trauma	0	1	
Tuberculosis	1	7	
Typhoid	0	1	
Other	1	4	
Type of surgery			0.037
Emergency	5	9	
Elective	14	99	
ASA Level			0.274
1	4	11	
2	8	61	
3	5	32	
4	2	4	
Vasopressor			0.019
Yes	2	0	
No	17	108	
Surgical technique			0.836
Open	19	106	
Converted	0	2	
Laparoscopic	0	0	
Anastomosis			0.309
Hand Sewn	4	40	
Stapled	15	66	
Combination	0	2	
Margins of resected bowel (for cancer only)			0.9
Involved	0	1	
Clear	11	61	
Segment of Anastomosis			0.012
Right ileocolic	5	69	
Left iliocolic	2	4	
Ileosigmoid	0	3	
Right colocolic	0	2	
Left colocolic	4	15	
Colosigmoid	0	2	
Colorectal	6	12	
Ileorectal	1	0	
Ileoanal	1	1	
Drain Placement			0.035
Yes	8	21	
No	11	87	
Postop NG decompression			0.338
Yes	18	94	
No	1	13	

IBD: Inflammatory Bowel Disease. ASA: American Society of Anaestesiology. NG: Nasogastric Tube.

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benign obstruction in 7 (5.5%); tuberculosis in 8 (6.3%), diverticulitis in 3 (2.4%), trauma, typhoid perforation, inflammatory bowel disease (IBD) and obstructed hernia in 1 (0.8%) in each category. Type of surgery was elective in 113 (89%) patients and emergency in 14 (11%). Bowel preparation was done in 94 (74%) patients with colonoscopy solution and clear liquid diet prior to surgery and it was not done in 33 (26%) patients (Table-1). The intestinal anastomosis was end-to-end in case of hand-sewn and both end-to-end and side-to-side functional end anastomosis in case of stapled anastomosis depending on the site of anastomosis and surgeon's preference. All anastmosis were done by or under supervision of 14 consultant general surgeons. Hand-sewn anastomosis, performed in 44 (34.6%) patients, were done in continuous layer or interrupted stitches as preferred by the consultant surgeon, and stapled anastomosis was done in 81 (63.8%) patients by using gastrointestinal anastomosis (GIA) stapler, thoraco-abdominal (TA) stapler, Contour stapler or current circular stapler depending on consultant's preference and location of anastomosis. In 2 (1.6%) patients stapled

Table-4: Multivariate Analysis by using Binary regression.

Variables	p-value	OR (CI)
Left vs right sided anastomosis	0.068	4.2 (1.89-5.05)
Indication Malignant vs benign	0.868	1.14 (0.24-5.32)
Blood loss (<200 vs>200)	0.297	2.29 (0.42-1.74)
Blood transfusion >2 pack cells	0.028	3.6 (2.0-7.1)
Operation time <210min vs>210min	0.114	0.27 (0.55-1.37)
Smoker vs nonsmoker	0.049	0.16 (0.26-0.99)
Elective vs emergency surgery	0.012	4.03 (1.78-7.04)
Vasopressor used vs not used	0.999	1.03 (0.1-3.1)
Drain placed vs not placed	0.379	1.92 (0.44-8.33)

anastomosis was re-enforced by hand-sewing. Besides, 74(58.3%) anastomosis were right ileocolic, 6 (4.7%) were left ileocolic, 3(2.4%) were ileosigmoid, 2 (1.6%) were right colocolic, 19 (15%) were left colocolic, 18 (14.2%) were colorectal, 2 (1.6%) were colosigmoid, 2 (1.6%) were ileoanal and 1 (0.8%) was ileorectal. In 29 (22.8%) patients, there was placement of drain in the vicinity of the anastomosis, while in rest of 98(77.2%) patients, no drain was placed again on consultants' preference. Postoperatively in 113(89%) patients Nasogastric decompression was done while in 14(11%) patients it was not done. Median hospital stay of patients (follow up time) was 7 (interquartile range [IQR] 5-10) days.

Anastomotic leak was found in 19 (15%) patients (Group 1), no anastomotic leak was found in 108 (85%) (Group 2).

Univariate analysis showed 8 factors to be affecting the anastomotic leak. The continuous variables among them were Operative time (p=0.003); Blood loss (p=0.006); and Blood transfusion (p=0.013) (Table-2). Categorical variables found to be significantly affecting the outcome of anastomosis were indication of surgery (p=0.049); Type of surgery (p=0.037); intraop use of vasopressor (p=0.019), segment of bowel anastomosed (p=0.012), and drain placement (p=0.035) (Table-3). Preop immunosuppressive therapy was borderline significant (p=0.089). Certain factors which are given importance in colorectal surgery were not significant in our study for their impact on anastomotic leak they included preop bowel preparation done in 11/82 patients vs. not done in 6/33 patients (p=0.364), nasogastric decompression done in 18/112 patients vs. not done in 1/15 patients (p=0.338).

Multivariate analysis showed that Left vs. right sided anastomosis (p=0.068), Blood transfusion >2 packed cells (p=0.028), smoker vs. non-smoker (p=0.049), elective vs. emergency surgery (p=0.012) were the independent risk factors which significantly affected the outcome of bowel anastomosis (Table-4).

The overall mortality rate was 3.9% (5/127). It was significantly higher in Group 1 than group 2 i.e., 3/19 (15.79%) in Group 1 and 2/108(1.85%) in Group 2 (p=0.02). Cause of death in Group 1 was multiple organ dysfunction due to sepsis (n=2), DIC (n=1) and in Group 2 Cardiac dysfunction (n=2). Mean postop hospital stay was 8.7±5.1 days. For Group 1, it was 15±5.44 days, while for Group 2 it was 7.51±4.04 days (p>0.001).

The mean postoperative period for diagnosis of anastomotic leak was 7.68±3.30 days. In 15 (78.95%) patients, AL was identified radiologically by contrast study. In 2 (10.52%) patients, it was identified by drain output and 2 (10.52%) patients were clinically diagnosed to be having AL.

Out of the 19 patients from Group 1, 10 (52.63%) had radiological drainage of the collection, 7 (36.84%) had diverting ileostomy after another exploratory laparotomy and washout of peritoneal cavity and repair of the leak, and 2 (10.52%) patients had conservative management of the leak done. Two patients in Group 2 were reoperated other than for AL in the same admission; 1 (0.93%) each for coronary artery bypass graft (CABG) and for ureteroveginal (UV) fistula repair.

According to our study results, the rate of anastomotic leak during the study period was 15% in colorectal surgery. Besides, there was statistically significant mortality (p=0.002) and morbidity (p=0.001) associated with anastomotic leak.

Discussion

The current study showed that AL after colorectal anastomosis at AKUH was 15%. Independent risk factors which significantly affected the outcome of bowel anastomosis were intraop transfusion of >2 packed cells (p=0.028), smoking (p=0.049), emergency surgery (p=0.012), and left vs. right sided anastomosis (p=0.068).

In global literature, a retrospective study with multivariate analysis of the risk factors in intraperitoneal anastomosis showed that preop sepsis, difficulty in anastomosis, colocolic anastomosis and blood transfusions >2 packed cells were the risk factors identified in the study population (n=707).[12] The AL rate was 6% and mortality in those who leaked was 12%. Nicolas et al[13] in their prospective study with univariate analysis only in 807 patients analysed that ASA>2, operation room (OR) time>3hrs, rectal disease and BMI>25 are the risk factors associated with AL which was 3.8% with mortality rate of 12.9%. Thomas Eberl et al[14] studied 472 patients with leak

rate of 10.4% and mortality rate of 2.2% showed that risk factors associated with anastomotic leak were tumour diameter, tumour localisation and absence of protective stoma. T. Konishi et al.[18] also studied 391 cancer patients with 2.8% anastomotic leak and factors identified were use of steroids, OR time of >4hours and wound contamination. We studied 127 patients who were not proximally diverted prior to anastomosis out of total 621 colorectal anastomosis with 15% leak rate and 15.79% mortality rate associated with anastomosis. Leak rate in our patient population was higher than the rest of the studies, but the reason behind this is probably that patients included in this study were not proximally diverted while in rest of the studies patient population was mixed i.e., proximally diverted as well as not diverted. This was a retrospective study with multivariate analysis and it showed that Intraop transfusion>2 Packed Cells, Emergency surgery, Smoking and Left-sided anastomosis were the independent risk factors associated with anastomotic leak. And there is no association of anastomotic leak with preop bowel preparation and postop nasogastric decompression. In this study we included intra as well as extra peritoneal anastomosis and malignant and benign conditions were also included. We recommend that a multicentre, randomised control trial should be done to conclude the risk factors associated with anastomotic leak in colorectal surgery so that mortality and morbidity of patients can be decreased.

Conclusion

Every effort needs to be made to bring down the mortality and morbidity rates associated with anastomotic leak.

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