

Predictive factors for anastomotic leak in small bowel and large bowel anastomosis: A Multivariate analysis at K R hospital Mysore

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Abstract

Background: Intestinal anastomosis is an operative procedure to establish communication between two formerly distant parts of the intestine. The procedure restores bowel continuity after elimination of the pathological condition affecting the intestines. **Objective:** to determine the incidence of Anastomotic leak in patients undergoing intestinal resection and bowel anastomosis, to study the association between multiple predictive risk factors and Anastomotic leak and to determine the Mortality rate associated with Anastomotic Leak. **Materials and methods:** This prospective hospital-based study involved all the patients undergoing Intestinal Resection and Anastomosis due to various clinical conditions at K R Hospital attached to Mysore Medical College and Research Institute from 1st December 2018 to 31st July 2020. Total of 73 patients undergoing Small and Large bowel anastomosis for various indications were studied. **Results:** Out of 73 patients, 58 of them underwent emergency surgery and 15 of them had elective surgery. In this study 46 patients underwent small bowel anastomosis, 24 had ileocolic anastomosis and remaining 7 had large bowel anastomosis. Predictive factors significantly associated with AL were male gender, CLD, multiple comorbidities, emergent anastomoses, colonic anastomoses, preoperative leukocytosis, and intraoperative blood transfusion. The anastomotic leak incidence was 16.4%. **Conclusion:** Intestinal anastomosis carries with it considerable mortality and the morbidity. Malnourished and preoperative leukocytosis patients are at a greater risk for developing anastomotic leak, SSI, burst abdomen & mortality following bowel anastomosis.

Keywords: Intestinal anastomosis, Anastomotic Leak, Predictive factors for anastomotic leak.

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Introduction

Intestinal anastomosis is an operative procedure to establish communication between two formerly distant parts of the intestine. The procedure restores bowel continuity after elimination of the pathological condition affecting the intestines. [1] It is a major surgical procedure done in both elective and emergency surgeries. Outcome and prognosis of intestinal anastomosis depends on the number of parameters related to host, operating technique and nature of the disease. However, perioperative host factors have a significant bearing on the outcome of the surgery even with variations in surgeon's technique. Intestinal anastomosis is associated with number of complications most disastrous one being the Anastomotic Leak, resulting in peritonitis, which is associated with high morbidity and mortality. Incidence of anastomotic leak ranges from 0.5% to 30% and it can reach up to 39%. [2-5] Our knowledge of the gastrointestinal surgery has developed gradually over centuries from a mystical to scientific levels. Today, operations on GIT are among the most common surgical procedures. We have better understanding of local and systemic factors on anastomotic healing. Despite recent advances, anastomotic leak and dehiscence are still regrettably, are common surgical experience. A leaking anastomosis prolongs hospital stay and has been associated with high morbidity and mortality. Here in this dissertation, I have made an attempt to conduct a comprehensive study on bowel anastomosis and to assess the association of various risk factors involved with it through

multivariate analyses of these factors in all patients undergoing bowel anastomosis for various indications in the Department of general surgery at K R Hospital attached to Mysore Medical College and Research Institute from 1st December 2018 to 31st July 2020. The aim of this study is To determine the incidence of Anastomotic leak in patients undergoing intestinal resection and bowel anastomosis, to study the association between multiple predictive risk factors and Anastomotic leak to determine the Mortality rate associated with Anastomotic Leak.

Materials & Methods

This prospective hospital-based time bound study involved all the patients undergoing intestinal Resection and anastomosis due to various clinical conditions at K R Hospital attached to Mysore Medical College and Research Institute from 1st December 2018 to 31st July 2020.

Relevant data was collected from detailed history, clinical examination, and Investigations (Hematological and Radiological) of the patients.

Total of 73 patients undergoing Small and Large bowel anastomosis for various indications were studied.

Inclusion criteria

All the patients aged above 18 years and undergoing intestinal resection and primary anastomosis, in elective or emergency surgeries at K R Hospital attached to Mysore Medical College and Research Institute during the study period.

Exclusion Criteria

Pediatric patients aged below 12yrs.

- Patients undergoing covering stoma(diversion) as a safeguard for the anastomosis
- Patients with single perforation closed primarily.

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- patients undergoing gastrointestinal and biliary enteric anastomosis.

Methods of collection of data

A pretested proforma was used to collect relevant information. The data collected were:

- Detailed history
- Demographic data of patients including name, age, gender, and comorbid conditions
- Type of admission (elective or emergent)
- Cause of intestinal injury necessitating surgery
- Haematological investigations: Haemoglobin, Preoperative leukocytic count, Liver Function Test, Serum electrolytes
- Operative details including type of intestinal anastomosis (small intestinal or colonic), technique of anastomosis (manual or stapled; single or double layer)
- Intraoperative blood transfusion
- Time of presentation and management of AL
- Final outcome of patients with AL.

Preoperative Preparation

All the patients undergoing emergency exploratory laparotomies were stabilized hemodynamically with IV crystalloids, colloids and Ionotropes {in necessary situation} before shifting to OT.

All the patients planned for elective resection and anastomosis received mechanical bowel preparation with polyethylene glycol solution, a day before surgery.

Ryle's tube inserted, bladder catheterized and a dose of preoperative iv antibiotic (usually a third generation Cephalosporins) was administered.

Operative Data:

The technique of anastomosis differed according to surgeon's choice. Thorough peritoneal lavage given with warm saline given and

intraabdominal drains at anastomotic site as well as pelvic and sometimes at subdiaphragmatic sites kept before abdominal wall closures.

Mortality and morbidity data collection

Patients were followed up during the post-operative period till the day of discharge. Any specific complications and in hospital deaths were recorded.

Surgical site infections were defined as per CDC guidelines.

Diagnosis of anastomotic leak

AL was identified by either discharge of intestinal contents through the wounds or from abdominal drains or evident signs of peritonitis associated with fever, leukocytosis or fluid collection in abdominal ultrasonography.

Only clinically evident anastomosis was recorded. Oral contrast studies (gastrografin follow-through) were not performed. CT scan of the abdomen and pelvis with oral and intravenous contrasts are usually done to demonstrate the site of leak, which were not performed in the current study.

The intestinal fistulas were classified according to standard classification to: Low{<200ml/day}, Moderate {200-500ml} and High output fistulas{>500ml/day.}

Statistical analysis

Results were expressed as mean and standard deviation for continuous data and frequency as number and percentage. A p value of 0.05 or less was considered for statistical significance.

Results:

In this study there were 53 (72.6%) males and 20(27.4%) female patients included in the study. most of the patients were >40 years of age. 45(61.6%) out of 73 were >40 years of age, whereas 28 (38.3%) patients were < 40 years of age.

Table 1: Incidence of associated co morbidity in study population

Comorbidity	Frequency	Percentage
None	39	53.4%
DM	29	39.7%
CLD	2	2.7%
HTN	2	2.7%
DM, IHD	1	1.4%
Total	73	100.0%

58 (79.5%) of the 73 patients underwent resection and anastomosis due to emergency indication and 15 (20.5%) patients had elective indication for the surgery.

Out of 73 patients 24 patients underwent Ileo Colic Anastomosis(ICA), 7 patients had Large Bowel Anastomosis(LBA) and 42 had Small Bowel Anastomosis(SBA).

Table 2: Type of Anastomosis in study population

Type of Anastomosis	Frequency	Percentage
ICA	24	32.9%
LBA	7	9.6%
SBA	42	57.5%
Total	73	100.0%

Pre operative leucocytosis

Among 73 patients in the study group 57 (78.1%) had pre operative leucocytosis and 16 (21.9%) patients had normal leucocyte level. The presence of hypoalbuminemia is a very significant risk factor for AL in many of the studies. In our study 40 patients had Albumin

levels of < 3.5 gm /dl and 33 patients had normal albumin levels of >3.5 gm/dl.

Out of 73 patients in the study group, 12(16.4%) patients developed Anastomotic Leak post operatively.

The risk factors which increases the incidence of AL and influence the outcome of anastomosis were observed and recorded. Table 3

Table 3: Incidence of risk factors in study population

Sl No	Risk factors	No of patients	Percentage
1	Age (>40 years)	45	61.1%
2	Male gender	53	72.6%
3	Co morbidities	34	46.5%

4	Emergency surgeries	58	79.4%
5	Pre operative Leucocytosis	57	78%
6	Intra Operative Blood Transfusion	7	9.5%

The number of patients more than 40 years of age in this study is 45 (61.6%). 2 patients in this group had AL. The AL rate is 16.7% and p value is 0.160(>0.05).

The total number of male patients in this study was 53(72.6%). The rate of anastomotic leak in male patients was 75.0%(9 patients). The p value is 0.596(>0.05). There was a higher incidence of AL among male patients.

Out of 12 patients with anastomotic leak 11 patients had associated co morbidities. 7 of them were Diabetic, 2 patients had Chronic Liver Disease, 1 had Hypertension, and 1 patient had both DM and Ischemic Heart Disease. The p value obtained is 0.001(<0.05) which is statistically significant. Table 4

Table 4: Correlation between anastomotic leak and associated comorbidities

Comorbidities	Frequency	Percentage
None	1	8.3%
DM	7	58.3%
CLD	2	16.7%
HTN	1	8.3%
DM, IHD	1	8.3%
Total	12	100.0%

Out of 12 patients who had Anastomotic Leak 10 patients (83%) had emergency admission and 2 patients(17%) underwent elective resection anastomosis. p value obtained was 0.716(>0.05)

The total number of patients with anastomotic leak and pre operative leucocytosis is 10(83.0%). P value was 0.878(>0.05) which is not statistically significant.

All the 12 patients who developed AL in this study had a albumin level less than 3.5 gm/dl. 6 of them had severe hypoalbuminemia of less than 3 gm/dl.

Of the 12 patients who had AL 5 patients(41.7%) underwent Ileocolic Anastomosis, 4 patients(33.3%) had Large Bowel Anastomosis and 3 patients (25%) underwent Small Bowel Anastomosis.

Table 5: Correlation between AL and type of bowel anastomosis

Type of Bowel Anastomosis	Frequency	Percentage
ICA	5	41.7%
LBA	4	33.3%
SBA	3	25.0%
Total	12	100.0%

Out of 12 patients who had AL 5 patients received intra operative blood transfusion. p value is 0.001(<0.05) which is statistically significant.

7 out of 12 patients developed SSI postoperatively. p value is 0.009(<0.05) which is statistically significant. Incidence of SSI was found to be significantly higher in patients who had anastomotic leak.

Out of 12 patients who had AL 7 patients (58.3%) of patients developed burst abdomen as a complication. P value is 0.000(<0.005)

which is statistically significant. The rate of burst abdomen was found to be higher in patients with AL.

Outcome was good in 69(94.5%) patients out of 73 study group. 2(16.7%) patients underwent re exploration and recovered eventually. 2 patients(16.7%) succumbed to death due to complications.

Table 6: Outcome of surgery in study group

Outcome	Anastomotic Leak		Total
	Yes	No	
Good	8	61	69
Bad	2	0	2
Diversion (Reexploration)	2	0	2
Total	12	61	73

The mortality rate in the present study is 2.7% (2 patients). Among patients with AL 16.7% (2 patients), succumbed to death. P value is 0.001(<0.05) which is statistically significant.

Discussion

The rate of anastomotic leak in this study is 16.4%. The reported rate varies from 0.5 to 30 %, [1–3], and it can reach up to 39 % according to Buchs and colleagues [4]. Overall incidence of colorectal AL ranges from 1.5 to 16 % globally.

Several risk factors contribute to anastomotic leak. Patient-related factors comprise age, gender, and systemic illness as chronic liver disease, hypoalbuminemia, cardiac diseases, DM, and cancer [6,7]. 27,28 Technical factors are related to the technique and site of anastomosis, use of abdominal drains, and intraoperative blood transfusion.

Our analysis of various risk factors for AL showed a higher incidence of AL among male patients, patients >40 years of age, patients with pre existing co morbidities, emergency surgeries, patients with leucocytosis and those who received intra operative blood transfusion. Statistical significance association was found between intra operative blood transfusion, co morbidities and AL.

Although no significant difference in incidence of leak was observed among different age groups, more than two thirds of leaks in our study were in patients above 40 years. Gluszek and his colleagues [8] have mentioned that older patients are more liable to AL due to the associated comorbidities, and atherosclerosis compromising blood supply of the anastomosis.

Male patients in our report developed AL three times more than the female patients. Male gender was associated with significantly higher

incidence of colonic AL concordant with Quan et al [9] who identified male gender as a risk factor for colorectal AL due to narrow male pelvis, and hormonal differences that affect intestinal microcirculation contributing to higher risk of anastomotic failure. On the other hand, male gender was not associated with higher rates of small intestinal AL. Paul et al [10] stated that female patients has a higher rate of anastomotic leak.

Associated comorbidities, particularly multiple comorbidities, were associated with higher incidence of anastomotic disruption, coping with Alves and colleagues who found ASA >II to be a significant independent contributing factor to colorectal AL. Chronic liver diseases, DM and cardiovascular diseases were observed as important predictors for AL. Dermetriades D et al [11] in there study also recognized cardiovascular diseases and DM as significant factors associated with occurrence of AL.

Large bowel anastomoses exhibited significantly higher rates of AL than small intestinal anastomoses; this can be attributed to higher intra-luminal pressure, poorer vascularity, and higher load of bacterial flora of the large intestine compared to small bowel. Ileal anastomoses and low pelvic anastomoses were the most common sites for AL in our study, concordant with Kumar et al [12]. who reported that ileal anastomoses were the most prone for anastomotic failure.

Chronic liver disease and multiple associated comorbidities significantly predicted small intestinal AL; on the other hand, preoperative leukocytosis and intraoperative blood transfusion were highly associated with colonic AL. We could not detect remarkable difference between stapled and manual anastomoses regarding incidence of leak which copes with what Lustosa and colleagues [13] reported.

Preoperative leukocytosis and intraoperative blood transfusion were associated with higher risk of anastomotic disruption, similar to what other multivariate analysis has observed [3] Leukocytosis indicates active inflammatory process induced by intestinal leak and secondary peritonitis; thus, it can be a marker of considerable fecal contamination of the peritoneal cavity that compromise healing of the anastomosis and eventually leading to anastomotic disruption and leak. [11]

The need for intraoperative blood transfusion implies to low hemoglobin levels of patients and, thus, relative ischemia of the anastomosis that can compromise its vitality and healing. Kirchhoff and colleagues. [14] found intraoperative blood transfusion a well-established independent risk factor for complications in colorectal surgery, particularly AL.

A meta-analysis by Petrowsky H [15] concluded no significant benefit of abdominal drainage after intestinal anastomosis in reducing the incidence of AL or other complications. Similarly, rates of AL in drained and nondrained patients in our report were almost the same, denoting the questionable utility of abdominal drains. We inserted drains in more than 90 % of patients with intestinal anastomosis, not as a prophylactic measure against leak, but for early detection of the onset of AL.

The morbidity rate in our study is 45.2% which is comparable with studies by Amit nair et al. The morbidity rate in intestinal anastomotic surgeries ranges between 21% to 51.8%

Morbidity rates were high among elderly, male patients, undergoing emergency surgeries and those with hypoalbuminemia, preoperative Leucocytosis, ileo colonic anastomosis and those who received intra operative blood transfusion. Arnaud Alves et al [16] has shown significant association between morbidity and hypoalbuminemia. Gibbs et al [17] have observed among 54,125 major non cardiac surgeries that a decrease in serum albumin from concentration greater than 4.6gm/dl to lesser than 2.2gm/dl was associated with an increase in morbidity rates from 10% to 65%.

The surgical site infections in the present study is 27.4%. The rate of SSI reported in the literature ranges between 4.3% to 42.8% .

SSI was among one among the significant complications observed. The higher rates of SSI were observed with patients with associated male sex, presence of comorbidities, hypoalbuminemia and pre operative leucocytosis. Hypoalbuminemia was an independent risk factor for the development of SSI following gastrointestinal surgeries [18]

The mortality rate in the present study is 2.7%. The mortality rate in the reported literature ranges between 1.5% to 30

Mortality was observed in higher rates in patients aged >40 years, patients with pre existing comorbidities ,hypoalbuminemia, leucocytosis and in emergency surgeries. Arnaud Alves et al [3] demonstrated the association between emergency surgery and mortality in their study. Gibbs et al [17] showed an exponential increase in post operative mortality with decrease in serum albumin levels.

Conclusion

Significant incidence of AL was observed with the elderly age group, male patients and with emergency surgeries. Patients with the comorbidities are at higher risk of developing AL. Patients with the hypoalbuminaemia and pre operative Leucocytosis are with greater risk of AL. Resection and anastomosis of small bowel with large bowel anastomosis with done under emergency settings are found to be associated with AL in the current study.

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