

FACTORS LEADING TO POST-OPERATIVE LEAKS FOLLOWING BOWEL ANASTOMOSIS IN A TERTIARY CARE HOSPITAL: A PROSPECTIVE STUDY

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ABSTRACT

BACKGROUND

The goal of enteric anastomosis is to prevent leakage, to promote healing, to preserve bowel length, and to prevent stricture formation. An effective anastomosis requires adequate mobilization, perfusion, apposition, and inversion of the mucosal edges into the bowel lumen.

METHODS

After taking the institutional ethical committee approval for the study, the study was conducted at SVRRGG Hospital (a tertiary care centre of about 950 bed size), Tirupati. All patients were above 18 years and were admitted for undergoing gastrointestinal anastomoses electively. Patients who underwent gastrointestinal anastomoses as an emergency procedure in SVRRGG Hospital, Dept. of General Surgery, Tirupati from October 2017 to September 2018 were included in this study.

RESULTS

Out of the 60 cases in this study, 49 cases were done electively, and 11 cases were done on an emergency basis. The overall leak rate was 11.7%. The p-value is more than the significance level 0.05; the difference in leak rate between elective and emergency cases is not significant.

CONCLUSIONS

This study is an attempt to evaluate various factors involved in bowel anastomotic leaks, various presentations of anastomotic leaks, and morbidity and mortality associated with them. With the observations and analysis, we concluded that various preoperative factors like haemoglobin %, nutritional status, serum albumin levels, intraoperative factors like degree of contamination, type of anastomosis and pathology involved have significant impact on outcome of bowel anastomosis.

KEYWORDS

Bowel Anastomosis, Post-Operative Leaks, Haemoglobin, Albumin, Laparotomy.

HOW TO CITE THIS ARTICLE: Penugonda A, Budamala S, Sunil MV, et al. Factors leading to post-operative leaks following bowel anastomosis in a tertiary care hospital: a prospective study. J. Evid. Based Med. Healthc. 2019; 6(25), 1736-1741. DOI: 10.18410/jebmh/2019/353

BACKGROUND

The goal of enteric anastomosis is to prevent leakage, to promote healing, to preserve bowel length, and to prevent stricture formation. An effective anastomosis requires adequate mobilization, perfusion, apposition, and inversion of the mucosal edges into the bowel lumen.

Lot of controversies about anastomotic technique, much has been written and only little is resolved; stapled versus sutured, single layer versus double layer, type of suture material, and impact of diversion are all open controversies.

Healing depends on the approximation of collagen-containing submucosal layer. Inadequate perfusion and (or) or tension across the anastomosis may cause early leakage or late stricture formation.

Anastomotic leak is a potentially disastrous complication, ranging from a contained self-limited event to sepsis and abdominal catastrophe. Investigations into the frequency of leaks after stapled versus sewn anastomoses are contradictory; the available data support the superiority of each and of neither, possibly reflecting the difference in patient populations.

Financial or Other, Competing Interest: None.

Submission 04-06-2019, Peer Review 08-06-2019,

Acceptance 19-06-2019, Published 24-06-2019.

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DOI: 10.18410/jebmh/2019/353



The ideal intestinal anastomosis is the one which does not leak, for leaks represent a dreaded and potentially deadly disaster. In addition, the anastomosis should not obstruct, allowing normal function of the gastrointestinal tract within a few days of construction. Many types of anastomosis are practiced: end-to-end, end-to side or side-to-side; single- versus double-layered, interrupted versus continuous, using absorbable versus non-absorbable and braided versus monofilament suture materials

Aim of the Study

To determine the factors leading to post-operative leaks following various types of gastrointestinal surgeries involving different kinds of anastomoses.

Objectives

1. To determine the causative role of parameters such as pre-operative Haemoglobin, Serum Albumin, Indication for surgery, Type of anastomoses, and postoperative management of anastomotic leaks.
2. To determine the morbidity and mortality variation between patients with anastomotic leaks and patients without leak.
3. To study the various presentations of anastomotic leak in the patient group.

METHODS

After taking the institutional ethical committee approval for the study.

Study Area

SVRRGG Hospital (a tertiary care centre of about 950 bed size), Tirupati.

Study Population

All Patients belonging to age group above 18 years admitted for undergoing gastrointestinal anastomoses electively and those patients who underwent gastrointestinal anastomoses as an emergency procedure in SVRRGG Hospital, Dept. Of general surgery, Tirupati from October 2017 to September 2018 were included in this study.

Sample Size

60. All cases patients who satisfied to the inclusion criteria were admitted and included in the study.

Study Type

Prospective study.

Inclusion Criteria

- Single or multiple gastrointestinal anastomoses done as part of operative procedure with intestine as part of at least one anastomoses.
- All patients who had postoperative anastomotic leak irrespective of duration since surgery.
- Patients who survived the surgery beyond the third postoperative day if the patient had no evidence of anastomotic leak.

- Patients with feeding jejunostomy, feeding gastrostomy or nasojejun tube placed intraoperatively to provide for postoperative nutrition.

Exclusion Criteria

- Patients with a protective intestinal stoma proximal to the site of anastomosis.
- Patients who absconded or left against medical advice prior to surgery or after surgery if they had no leak.
- Loop ileostomy or loop colostomy reversal done without complete stomal dismantling.
- Patients whose surgeries involved intestinal anastomosis to pancreatic duct or extrahepatic biliary apparatus.

Determinants

Various determinants like age, sex, pre-operative haemoglobin, serum albumin, indication for surgery, degree of contamination, type of anastomoses, and their causative role in postoperative leaks, various presentations of anastomotic leaks and their morbidities and mortalities are evaluated in this study.

Methodology

After taking informed consent of all patients who are eligible for the study based on inclusion and exclusion criteria, undergoing elective surgery and emergency surgery had preoperative haemoglobin, serum albumin, blood urea, serum creatinine and serum electrolyte levels checked. Serum bilirubin levels, amylase levels and prothrombin time were tested in patients selectively. Bleeding time and clotting time were checked in all elective admissions. A chest x-ray and electrocardiogram was done in all patients in the study group preoperatively. Further cardiac work up was done if deemed necessary. Ultrasonogram, endoscopy, CT scan, MRI, tissue biopsy etc were done preoperatively based on the needs of an individual patient. Co-morbid conditions such as hypertension and diabetes were brought under control prior to surgery in patients who were electively admitted.

All preoperative blood investigations might have been done more than once and the values taken for the study are those which were available closest to the date of surgery. In elective cases, preoperative bowel preparation was done. Preoperative antibiotic was given in all patients. Similar postoperative blood investigations were employed based on the needs of an individual patient. Postoperative abdominal ultrasonography was done in patients with suspicious distension, leak detected in drain, prolonged ileus, enterocutaneous fistula etc., Other postoperative complications, such as pneumonia, were investigated if suspected. Biopsy reports of specimens sent for histopathological examination were collected. All patients who were discharged were done so only after they were completely stabilized. A postoperative blood investigation might have been done more than once. Hence, the lowest postoperative hemoglobin, serum albumin and serum electrolyte values and the highest blood urea, serum

creatinine, serum bilirubin and serum amylase values were taken for study. Postoperative antibiotics were given in all patients and nil per oral was maintained as per surgical requirement. Most patients received preoperative, intraoperative, postoperative blood transfusions as per indication.

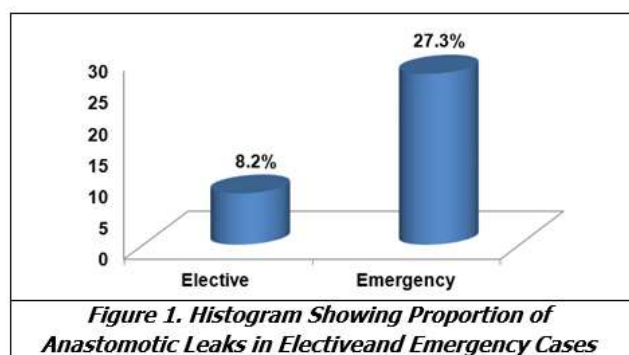
All cases were done by laparotomy. No cases done laparoscopically were available for study.

Statistical Analysis

The data analysis was done using statistical software IBM SPSS version 20. The qualitative data was represented using frequency and crosstabs with graphical representation. The difference in proportion of leak was analysed using Two-sample Proportion Test. The quantitative data was represented using descriptive statistics like mean, standard deviation and range with graphical representation. The difference in fall between leak and no leak was analysed using Repeated Measure Analysis. The level of significance was taken as 5%, so the p-value is less than 0.05 was taken as significant.

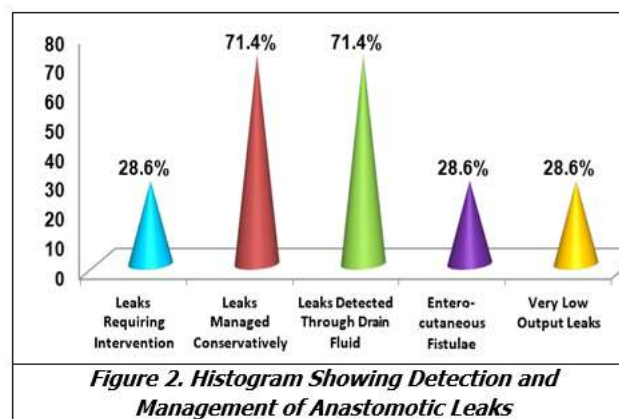
RESULTS

Out of the 60 cases in this study, 49 cases were done electively, and 11 cases were done on an emergency basis. The overall leak rate was 11.7%. The p-value is more than the significance level 0.05; the difference in leak rate between elective and emergency cases is not significant.

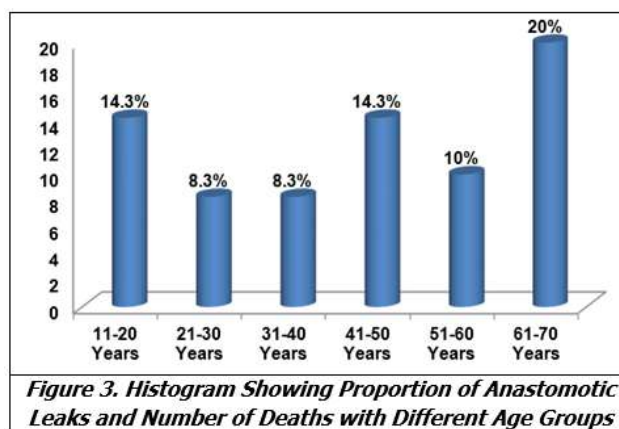


Out of the 7 cases in which leaks occurred, 5 were managed conservatively with the leak resolving completely after conservative management. Among these 7 cases there were 2 enterocutaneous fistulae one of which at the time of discharge had an output of less than 5 ml of serous fluid per day and the other was an esophago-jejunal anastomosis which healed completely by secondary intention.

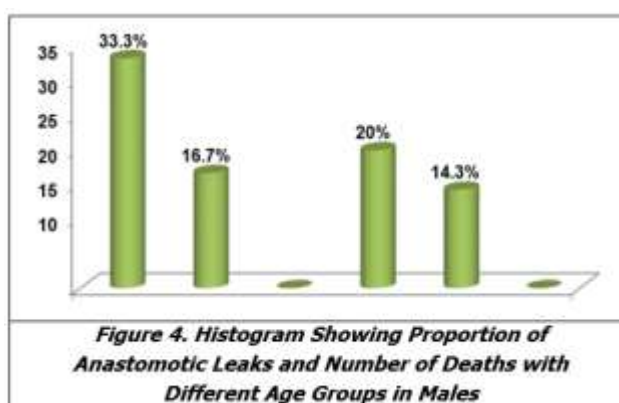
The 2 patients who had intervention were re-operated and an end ileostomy was done in both of them. One of these patients succumbed to sepsis and the other had a successful stoma dismantling 5 months later.



The ages of patients in this study ranged from 18-70 years. The average age of a patient was 40.23 years. The highest leak rate was found in the age group 61-70 years. The average age in patients with leak was 43.43 years with range 15-70 and the average age in patients with no leak was 39.81 years with range 13-65. Most number of deaths (3 of 4) was occurred in the age group 51-70 years.

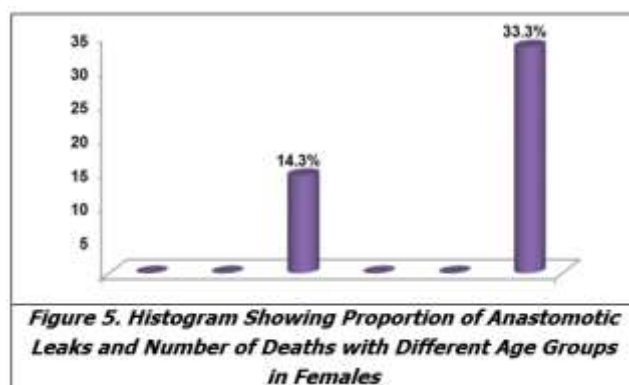


Of the 60 cases studied, 33 were male. The ages of male patients ranged from 14-65 years. The average age of a male patient was 42.06 years. The highest leak rate was found in the age group 11-20 years among males. The average age in male patients with leak was 38.90 years with range 15-60 years and the average age in male patients with no leak was 42.46 years with range 14-65 years.

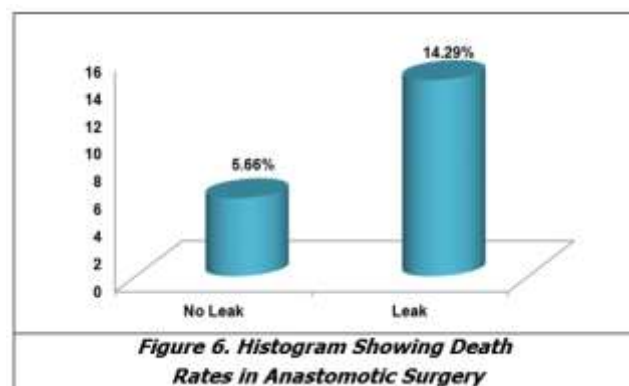


Of the 60 cases studied, 27 (45.0%) were male. The ages of female patients ranged from 18-70 years. The

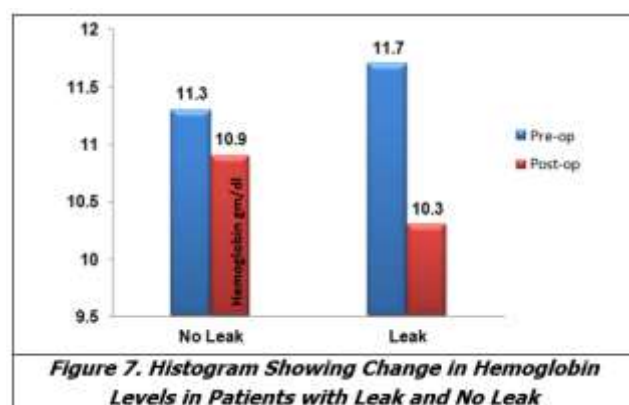
average age of a female patients was 38.01 years. The highest leak rate was found in the age group 61-70 years. The average age in female patients with leak was 52.50 years with range 35-70 years and the average age in female patients with no leak was 36.84 years with range 13-65 years.



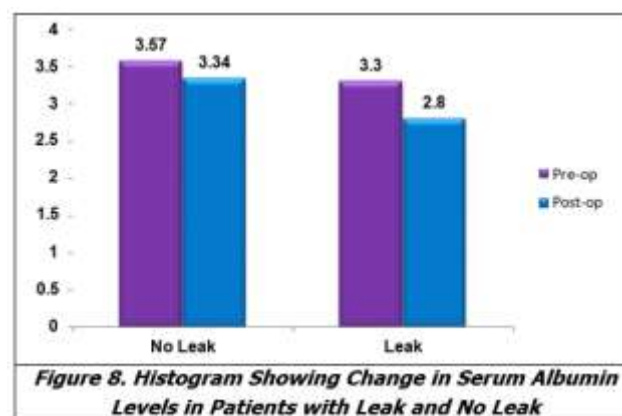
The overall death rate was 6.67% in anastomotic surgery. There was increased death rate in patients with anastomotic leak (14.29%) compared to patients with no leak (5.66%).



In the 53 cases of no leak, the mean difference between pre and post-operative haemoglobin levels are shown in the graph. The p-value is less than the significance level 0.05; the fall in haemoglobin level between patients with leak and patients with no leak is significantly different. The fall in haemoglobin level was significantly higher in leak (1.4) compared to no leak (0.4) indicating loss of blood directly proportional to chances of leaks.



In the 53 cases of no leak, the mean pre-operative serum albumin level was 3.57 g/dl and the mean post-operative serum albumin level was 3.30 g/dl in post-operative. Similarly, in the 7 cases of leak, the mean pre-operative serum albumin level was 3.34 g/dl and the mean post-operative serum albumin level was 2.80 g/dl in post-operative. The p-value is less than the significance level 0.05; the fall in serum albumin level between patients with leak and patients with no leak is significantly different. The fall in serum albumin level was significantly higher in patients with leak (0.54) compared to patients with no leak (0.27) indicating loss of blood directly proportional to chances of leaks.



Type of Anastomosis	Patients with No Leak	Patients with Leak	Total Patients	% Leak
Colocolic	8	1	9	11.1%
Colorectal	4	0	4	0.0%
Ileocolic	13	3	15	20.0%
Oesophagojejunal	1	1	2	50.0%
Jejunocolic	5	0	5	0.0%
Jejunojejunal	12	0	12	0.0%
Duodenojejunal	1	0	1	0.0%
Ileo-ileal	10	0	10	0.0%
Gastrojejunal	16	0	16	0.0%
Jejunioileal	0	1	1	100.0%
Duodeno-duodenal	0	1	1	100.0%
Ileoanal	1	0	1	0.0%

Table 1. Leak Rates According to Types of Anastomosis

	Patients with No Leak	Patients with Leak	Total Patients	Leak %
Malignancy	15	1	16	6.3%
Chronic Non-specific Inflammation	13	2	15	13.3%
Typhoid	1	1	2	50.0%
Tuberculosis	4	0	4	0.0%
Inflammatory Bowel Disease	3	1	4	25.0%
Small Bowel Gangrene due to SMA Thrombosis	1	1	2	50.0%
Post Traumatic Bowel Injury	4	1	5	20.0%

Table 2. Leaks Rates According to the Pathology

DISCUSSION

During the study period 60 gastrointestinal anastomotic surgeries were evaluated. This study was done to signify the various factors involved in causing postoperative leaks in patients undergoing a variety of anastomoses, various presentations of leaks, and morbidity, mortality variations in patients with leak and without them. There were both commonly done surgeries such as gastrojejunostomies as well as uncommon surgeries such as a duodenoduodenostomy with an ileo-transverse anastomosis included in the study. The intraoperative and extra operative factors will be discussed separately. Due to the similarity between the various preoperative and postoperative factors, they will be discussed together as peri-operative factors.

Preoperative and Post-Operative Variables

Indication and Pathology

In this study, out of 16 patients who underwent surgery for malignancy, only 1 patient's specimen had resection margin positive for malignancy and he had a leak. The leak rate in patients who underwent surgery for malignancy was 6.25%. Gastrointestinal stromal tumour was seen in 4 of the 16 patients with malignancy and none of them had a postoperative anastomotic leak. The remaining patients had adenocarcinoma. Among these patients with malignancy, one patient had gross metastasis with ascites and died on the fourth post-operative day.

Out of 15 patients with Chronic nonspecific inflammation as histopathology, 2 patients had leak with leak rate of 13.3%, the commonest type occurring following acid peptic disease leading to stenotic lesions.¹ Stenotic lesions were also seen in 2 patients with Crohn's disease. Out of 4 patients with inflammatory bowel disease, one patient had leak, the incidence of anastomotic leak was 25%. The anastomotic leak rate for Crohn's disease was not significantly different from that shown in the study done by Resegotti et al, in which the rate was 14% for hand sewn anastomoses.²

Hemoglobin

In the 53 cases of no leak, the mean pre-operative hemoglobin level was 11.3 gm/dl and the mean post-operative hemoglobin level was 10.9 gm/dl. Similarly, in the 7 cases of leak, the mean pre-operative hemoglobin level was 11.7 gm/dl and the mean post-operative hemoglobin level was 10.3 gm/dl. The p-value is less than the significance level 0.05; the fall in hemoglobin level between patients with leak and patients with no leak is significantly different. The fall in hemoglobin level was significantly higher in leak (1.4) compared to no leak (0.4).

This finding may suggest insufficient tissue oxygenation as compared to the preoperative status and the inability of tissues to adapt to the new conditions in patients who had leaks. It should also be noted that a causal relationship cannot be proved this way as lowered hemoglobin may as well be an effect of the leak, as intraoperative blood loss and transfusion replacements have not been scrutinized in this study.

Albumin

In the 53 cases of no leak, the mean pre-operative serum albumin level was

3.57 gm/dl and the mean post-operative serum albumin level was 3.30 gm/dl in post-operative. Similarly, in the 7 cases of leak, the mean pre-operative serum albumin level was 3.34 gm/dl and the mean post-operative serum albumin level was

2.80 gm/dl in post-operative. The p-value is less than the significance level 0.05; the fall in serum albumin level between patients with leak and patients with no leak is significantly different. The fall in serum albumin level was significantly higher in patients with leak (0.54) compared to patients with no leak (0.27). In this situation also, it is difficult to determine the cause-effect relationship.

Morbidity and Mortality

In patients with no leak, 2 (3.77%) cases of rise in serum creatinine are reported in pre-op and 2 cases (3.77%) are reported in post-op. In patients with leak, none is reported in pre-op and 3 (42.8%) cases of rise in serum creatinine are reported in post-op. It is clear that the post-op rise in serum creatinine is significantly higher ($p < 0.05$) in patients with leak (42.8%) than in patients with no leak (3.77%). The p-value is less than the significance level 0.05; the difference in proportion of rise in serum creatinine between patients with no leak and with leak is statistically significant.

Hence the patients with leak required more aggressive postoperative management to impede the progression of acute renal failure, and they had to stay in hospital for longer durations which indicates increased morbidity in patients with leak.

The overall death rate was 6.67% in anastomotic surgery. There was increased death rate in patients with anastomotic leak (14.29%) compared to patients with no leak (5.66%). However, the p-value is greater than the significance value 0.05; the difference in death rate between patients with no leak and patients with leak is not statistically significant. This was not significantly different from the studies of Docherty et al³ and Hymen et al.⁴ The only patient under 60 years of age in this study who died in the postoperative period, had an anastomotic leak. Most number of deaths (3 of 4) was occurred in the age group 51-70 years, indicating that increased age carries increased mortality in anastomotic surgery, irrespective of presence or absence of leak.

Presentations and Management of Anastomotic Leaks

Leaks were most commonly detected by altered drain fluid (71.4%), followed by wound inspection Enterocutaneous fistula in (28.6%).^{5,6} In cases with clinical suspicion of leak, an ultrasonogram of the abdomen and pelvis was done. No additional leaks were detected by ultrasonography.

Out of the 7 cases in which leaks occurred, 5 were managed conservatively (71.4%), with the leak resolving completely after conservative management. Among these 7 cases there were 2 enterocutaneous fistulae one of which at

the time of discharge had an output of less than 5 ml of serous fluid per day and the other was a cervical esophago-colic anastomosis which healed completely by secondary intension.

The 2 patients who had intervention were re-operated and an end ileostomy was done in both of them. One of these patients succumbed to sepsis and the other had a successful stoma dismantling 5 months later.

CONCLUSIONS

This study is an attempt to evaluate various factors involved in bowel anastomotic leaks, various presentations of anastomotic leaks, and morbidity and mortality associated with them. With the observations and analysis, we concluded that various preoperative factors like haemoglobin%, nutritional status, serum albumin levels, intraoperative factors like degree of contamination, type of anastomosis and pathology involved have significant impact on outcome of bowel anastomosis.

Multiple causative factors in each single patient undergoing gastrointestinal anastomotic surgery should be assessed for the risk of anastomotic dehiscence preoperatively so that correctable parameters can be managed, and a protective stoma may be planned. In feasible surgeries, a distal feeding tube should be placed if anastomotic leak is deemed likely, for example, in a colonic pull through, so that the nutrition of the patient is better maintained. Anastomotic leak is a dreaded postoperative complication following all types of gastrointestinal anastomosis with a broad spectrum of presentations ranging from localized intra-abdominal collection/abscess if the leak is controlled, or as enterocutaneous fistula, or as frank peritonitis when the leak is uncontrolled, which carries a higher morbidity and mortality.

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