## Original Research Article

# A study of factors leading to post-operative leaks following bowel anastomosis

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**ABSTRACT**

**Background:** Intestinal anastomosis is one of the most commonly performed procedures, especially in the emergency setting and is also in the elective setting when resection is carried out for benign or malignant lesion of the gastrointestinal tract. Anastomotic leakage is a potentially disastrous complication, which can lead to sepsis and abdominal catastrophe. The aim of the study is to determine factors leading to post-operative leaks in gastrointestinal surgeries involving different kinds of anastomosis and to determine the role of parameters such as pre-operative hemoglobin, serum albumin, indication for surgery, degree of contamination, type of anastomosis, technical variations and postoperative management in anastomotic leaks. We also aim to determine the morbidity and mortality variation and to study the various presentations of anastomotic leak in the patient group as well.
**Methods:** A prospective study was conducted from December 2015 till the end of august 2017 at Prathima Institute of Medical Sciences, Karimnagar. All patients undergoing gastrointestinal anastomosis electively and as an emergency procedure were included in this study. The total number of cases studied is 60.
**Results:** Out of the 60 cases in this study, 49 cases were done electively, and 11 cases were done on an emergency basis. Anastomotic leaks occurred most in emergency cases (27.27%). Among 5 patients, (71.42%) leaks were managed conservatively and rest required intervention. There was increased death rate in patients with leak. Leaks occurred maximum in jejunoileal anastomosis. Most common organ involved was esophagus (28.57%).
**Conclusions:** Anastomotic leaks are a common complication following all types of gastrointestinal anastomosis. It is believed, hypoalbuminemia hinders anastomotic healing. Surgeries indicated in emergency situation carried increased risk of operative leaks in post-operative period.

**Keywords:** Anastomotic leak, Bowel anastomosis, Emergency, Elective, Hypoalbuminemia

## INTRODUCTION

Intestinal anastomosis is one of the most commonly performed surgical procedures, especially in the emergency setting and is also commonly performed in the elective setting when resection is carried out for benign or malignant lesion of the gastrointestinal tract.[1] Anastomotic leakage is a potentially disastrous complication, running the gamut from a contained self-limited event to sepsis and abdominal catastrophe. Leakage from an anastomosis in the gastrointestinal tract that is often associated with increased morbidity, mortality rate and adversely affect length of hospital stay and cost. The term anastomosis is derived from the Greek term anastomoein meaning "to furnish with a mouth.[1]

The prevalence of AL varies from 1% to 20% depending upon anatomical site, pre and per operative factors.

Consideration of risk factors is relevant in the decision-making process. These factors should be classified as modifiable or non-modifiable. Anastomotic leakage is the most important early complication after oesophageal anastomosis: incidences of up to 53% have been reported.[2] Anastomotic leak rates following colorectal anastomosis range from 4 to 26%. The mortality rate for an anastomotic leak in the literature typically is in the 6 to 39% range and a 10-100% rise of permanent stoma. However, a large number of patients ultimately found to have an anastomotic leak develop a more insidious presentation, often low-grade fever, prolonged ileus, or failure to thrive.

Much has been written and little resolved about anastomotic technique; although many risk factors for anastomotic failure have been described, we seldom understand exactly why a leak occurred in any individual case, making meaningful quality improvement initiatives a formidable challenge. Further, the broad array of definitions and criteria for diagnosis have made benchmarking and comparative analyses of limited utility. In actuality, there is a spectrum of postoperative infectious complications that could be considered to represent an anastomotic leak. Stapled versus sutured, single layer versus double layer, type of suture material, and impact of diversion are all open controversies. Many methods 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. Investigations into the frequency of leakage after stapled versus sewn anastomoses are contradictory; available data support the superiority of each and of neither, possibly reflecting a difference in patient population.

## METHODS

A prospective study was conducted from December 2015 till the end of august 2017 at Prathima Institute of Medical Sciences, Karimnagar. All patients undergoing gastrointestinal anastomoses electively as well as those as an emergency procedure were included in this study. The total number of cases studied is 60.

### 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
- All patients who were discharged by the treating doctor
- Patients with feeding jejunostomy, feeding gastrostomy or naos jejunal tube placed

intraoperatively to provide for post-operative nutrition

### Exclusion criteria

- Patients who died intraoperatively or those patients without leaks who did not survive beyond 3rd postoperative day
- 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
- Associated primary closure of any gastrointestinal perforation along with anastomotic surgery
- Patients whose surgeries involved intestinal anastomosis to pancreatic duct or extrahepatic biliary apparatus

All patients who underwent elective surgery and emergency surgery had preoperative hemoglobin, blood urea, serum creatinine and serum electrolyte levels checked. Serum albumin levels were tested in most of the electively admitted patients except in a few due to non-availability of reagents in the biochemistry lab. 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.

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.

## RESULTS

Out of the 60 cases in this study, 49 cases were done electively, and 11 cases were done on an emergency basis and the rate of leaks in each scenario is given in Table 1. 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 a cervical

esophago-colic anastomosis which healed completely by secondary intension.

**Table 1: Rate of anastomotic leak.**

|  | No leaks | Leaks | % of leaks |
|---|---|---|---|
| Total cases | 53 | 7 | 11.6 |
| Elective cases (49) | 45 | 4 | 8.16 |
| Emergency cases (11) | 8 | 3 | 27.27 |

The 2 patients 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.

**Table 2: Leak rates based on type of anastomosis.**

| Type of anastomosis | Total cases | Leaks | % of leaks |
|---|---|---|---|
| Colocolic | 9 | 1 | 11.11% |
| Colorectal | 4 | - |  |
| Ileocolic | 12 | 2 | 16.66% |
| Esophagocolic | 4 | 1 |  |
| Jejunocolic | 5 | - |  |
| Jejunojejunal | 16 | - |  |
| Esophagojejunal | 2 | 1 | 50% |
| Ileoileal | 9 | - |  |
| Gastrojejunal | 15 | - |  |
| Jejunoileal | 1 | 1 | 100% |
| Duodenoduodenal | 1 | 1 |  |
| Ileoanal | 1 | - |  |
| Esophagogastric | 1 | - |  |
| Duodenojejunal | 1 | - |  |

Leaks were most commonly detected by altered drain fluid, followed by wound inspection. The ages of patients in this study ranged from 13-70 years. The mean age of a patient was 40.85years. The leak rate increased with increasing age. The mean age in patients with leak was 43.42 years and for those without leak was 40.50 years.

There was a total of 33 male patients in this study with a mean age of 41.36 years (range = 14-65years). The number of female patients in this study was 27 and their mean age was 38 years (range = 13-70years). There was no statistically significant difference among the different age distributions or the sexes. There was increased death rate in patients with anastomotic leak. Not only was there increased mortality, but also increased in morbidity as indicated by the increased duration of postoperative stay in patients with anastomotic leaks. The mean hospital stays for patients without leaks, excluding the patients who deceased during hospital stay, was 16.9 days where as the mean hospital stay for patients who had postoperative leaks was 29.8 days.

The mean change in hemoglobin levels in the 53 patients without leaks was a rise in postoperative levels by 0.1L g%. Similarly, the mean change in hemoglobin levels in patients who had postoperative leaks was a fall by 1.4 g%.

**Table 3: Leak according to histopathological diagnosis.**

|  | Patients with no leaks | Patients with leak | % leak |
|---|---|---|---|
| Malignancy | 15 | 1 | 6.25 |
| Chronic non-specific inflammation | 13 | 2 | 13.3 |
| Typhoid | 1 | 1 | 50 |
| Tuberculosis | 4 | - | - |
| Inflammatory bowel disease | 3 | 1 | 25 |
| Small bowel gangrene due to small thrombosis | 1 | 1 | 100 |
| Post traumatic bowel injury | 4 | 1 | 25 |

Electrolyte imbalance was more common in patients with postoperative leaks (85.7%, p = 0.0005). Serum creatinine levels were more often increased postoperatively in patients with leaks (42.8%, p = 0.003). In patients with no anastomotic leak, pre-op mean serum albumin level was 3.57 g/dl but in those with anastomotic leak, mean value was 3.34 g/dl. post operatively, in patients with no leak, mean serum albumin level was 3.24 g/dl and in those with leak the mean level was 2.8 g/dl.

There was a total of 10 cases with stapler anastomoses. The remaining were hand sewn. There was only 1 case of leak in stapler anastomosis. Circular stapler was used in that case. Leaks based on type of anastomosis is given in Table 2.

Maximum leak occurred in Duodenal anastomosis (50%), Esophageal anastomosis (28.57%), followed by anastomosis of ileum (13.04%), colon (11.76%) and jejunum (5.26%). Leak according to histopathological diagnosis is given in Table 3.

**DISCUSSION**

Anastomotic leakage is the most serious complication specific to intestinal surgery. The definition of leak after bowel surgery usually included peritonitis (localized or generalized), fecal or purulent drainage from the wound and / or drain, presence of an abscess and fever. The uncomplicated healing of an intestinal anastomosis even after attentive technical performance from an experienced surgeon is still a challenge because the healing process is dependent on multiple physiological, biochemical, and morphological factors.

Numerous risk factors have been implicated as predisposing for anastomotic leaks. Factors that were found to correlate with an increased leakage rate were older age, anemia, prior radiation therapy, intraperitoneal infection and anatomic level of anastomosis.

This study was attempted to signify the various factors involved in causing postoperative leaks in patients undergoing a variety of anastomoses.

In present study the percentage of leak was 11.6%. In study by Cheng YT et al, it is 8.8%, study by Sultan et al it is 15% and the study done by Buchs et al, it is 3.8%.[3-5]

The reason behind the higher rate of leakage in present study were not proximally diverted while in rest of the studies patient's population was mixed i.e. proximally diverted as well as not diverted. The overall mortality rate in present study was 4/60 (6.6%). It was significantly higher in patients with anastomotic leak 1/7 (14.28%) versus 3/53 (5.66%) in patients without anastomotic leak (P <0.001). In comparison with other studies we approximate with the study of Sultan et al 4 they reported 15.79% mortality rate of their patients with anastomotic leak and high in comparison with the study of Hyman et al, they found mortality rate 5.7% of their patients, Trenchva et al the mortality rate 0.9%, and Buch et al5 the mortality rate was 12.9% of their patients with anastomotic leakage.[6,7]

The mean postoperative period for diagnosis of anastomotic leakage was an 8.5 days range (4-16 days) in present study. A study by Hyman N, found 2.7% of anastomotic leak in post-operative period. Diagnosis was made a mean of 12.7 days postoperatively.[8]

Since all of the emergency surgeries had no preparation of bowel prior to surgery, they have been considered as contaminated or dirty whereas all elective surgeries are clean contaminated surgeries as all patients had preoperative bowel preparation. Three of the 11 emergency surgeries had postoperative leaks whereas only 4 of the 49 elective surgeries had postoperative leaks. This difference, however, was not statistically significant (p = 0.09).

Irvin and Goligher, reported significant decrease in anastomotic dehiscence with use of mechanical preparation than that without mechanical bowel preparation. Burke et al have provided further evidence that question the use of bowel preparation showing no difference in outcome after colon surgery between prepared and unprepared patients.[9,10]

In 50 cases the anastomoses were hand sewn with 6 leaks where as in 10 cases the anastomoses were stapled with 1 leak. The difference was not significant (p=0.4). There was no difference in stapler and sutured anastomosis in studies done by Choy PY et al, Lustosa et al and Khan N et al.[11-13] Among 53 patients without leak 5 patients were

diabetic and among 7 patients with anastomotic leak one patient was diabetic, but this was not statistically significant (p>0.05).

Vignali A et al and Manson PN et al reported diabetes is an independent predictor for anastomotic leak.[14,15] This may be due to the fact that only 1.6% (1/60) of the patients in this study had insulin-dependent diabetes and no patient had diabetes with end-stage organ damage.

Paradoxically, the mean preoperative hemoglobin levels in patients who had postoperative leaks was higher than those who did not have leaks, however the mean change in postoperative hemoglobin value was a fall in levels by 1.4g% in patients who had postoperative leaks where as in patients who had no leak there was a rise in mean hemoglobin value, although only by 0.11g%.

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. The mean preoperative albumin levels in patients with leaks was 0.23g/dl less than patients without leaks and the mean fall in albumin levels in patients with anastomotic leaks was double than that of patients without leaks.

In this situation also, it is difficult to determine the cause-effect relationship. A study by Seshadri A, concluded serum albumin pre-operative value of 3.2g/dl or lower is risk factor for anastomotic leak.[16]

## CONCLUSION

Anastomotic leaks are a common postoperative complication following all types of gastrointestinal anastomosis usually with multiple causative factors in a single patient.

Postoperative care plays a pivotal role in all cases of anastomosis and hemoglobin levels and serum albumin levels should be monitored. It is believed, hypoalbuminemia affects anastomotic healing. It also reduces the host immune competence and makes them more vulnerable for anastomotic leakage. Patients with serum albumin <3.5 g/dl had significant greater leak. Correction of hypoalbuminemia in Pre-operative or in immediate post-operative period, helps in decreasing the rate of post-operative leak at anastomotic site.

Patients should be screened preoperatively to identify insufficient haemoglobin levels in case of iron insufficiency, optimization of haemoglobin levels is preferable. No difference in anastomotic failure rate between hand sewn and stapled techniques on an individual anastomotic level or on an individual patient level.

Not preparing the bowel appear to have resulted in increased anastomotic leak rate. Surgeries indicated in

emergency situation carried increased risk of operative leaks in post-operative period when compared to that of elective.

The most compelling of all evidence of increased morbidity in patients with postoperative leaks was the doubled duration of postoperative in patients with leaks when compared with patients who had no leaks. Also found an increased mortality rate in patients with anastomotic leak than that of in patients without leak. The incidence of leak was high in patients over 60 years of age with increased mortality irrespective of whether leak was present or not. Also, 71.45% of leaks in this study were successfully managed conservatively, proving its scope. It is mandatory to assess the risk of anastomotic dehiscence preoperatively so that correctable parameters can be managed, and a protective stoma may be planned.

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