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Anastomotic Leak in Bowel Surgery - Factors Influencing It

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A B S T R A C T

Background: Anastomotic leakage remains one of the most critical complications following gastrointestinal surgical procedures, often resulting in significant morbidity and mortality. Multiple variables—preoperative, intraoperative, and postoperative—can influence the risk of such leaks.

Objective: To identify and analyze potential risk factors contributing to anastomotic leakage in bowel surgeries.

Methods: This prospective study included 60 patients who underwent bowel resection with anastomosis at Gauhati Medical College and Hospital between March 1, 2021, and June 30, 2022.

Results: Out of 60 patients, 15 (25%) developed an anastomotic leak, while 45 (75%) did not. Significant factors associated with leaks included male gender, lower preoperative serum albumin (mean: 2.9 g/dL, $p = 0.01$), emergency surgical procedures, intraoperative hypotension, and higher units of blood transfusion.

Conclusion: Key contributors to anastomotic leakage in this cohort were male gender, hypoalbuminemia (≤2.9 g/dL), intraoperative hypotension, and blood transfusion requirements. These variables should be critically assessed when planning bowel anastomosis to minimize complications.

Keywords: Anastomotic leakage, Hypoalbuminemia, Emergency surgery, Blood transfusion, Hypotension.

INTRODUCTION

Anastomotic leaks following bowel surgery pose a significant clinical challenge due to their association with increased postoperative complications and healthcare burden. The term "anastomosis" originates from the Greek word *anastomoein*, meaning “to provide with a mouth.”

Despite extensive studies, no single universally accepted definition exists for anastomotic leaks. Between 1993 and 1999, a review of 97 studies found 56 varying definitions. A more recent standardized definition describes it as a failure of anastomotic integrity, leading to communication between intra- and extraluminal compartments at the anastomotic site, regardless of surgical technique (1).

A variety of factors—both patient- and procedure-related—have been implicated in increasing the risk of these leaks.

AIMS AND OBJECTIVES

This study aims to identify and evaluate preoperative, intraoperative, and postoperative parameters influencing the occurrence of anastomotic leaks. Specific variables examined include age, gender, BMI, serum albumin, hemoglobin levels, surgical urgency, duration, intraoperative hypotension, and need for blood transfusions.

MATERIALS AND METHODS

A total of 60 patients undergoing bowel resection with primary anastomosis in the Department of Surgery at Gauhati Medical College and Hospital from March 1, 2021, to June 30, 2022, were enrolled. Exclusion criteria included pediatric patients, prior pelvic irradiation, and history of enteric diversion.

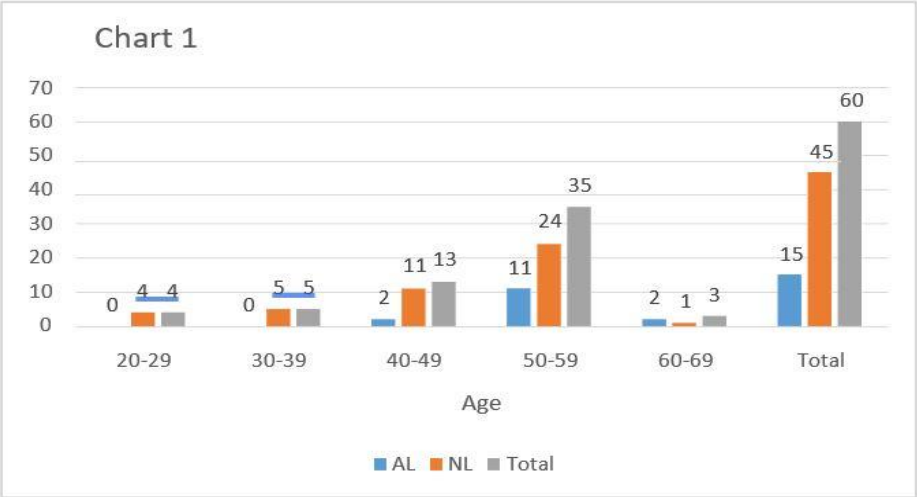
Data were obtained from patient records and included clinical findings, laboratory investigations, intraoperative notes, and postoperative observations. Anastomoses were performed in an end-to-end two-layer technique. Leak detection was based on drainage of feculent material or wound discharge. Univariate analysis was conducted, with $p < 0.05$ considered statistically significant.

RESULTS AND OBSERVATIONS

- **Incidence of Leak:** 15 of 60 patients (25%) developed an anastomotic leak.
- **Age Distribution:** Leaks were most common in patients aged 50–59 years.
- **Gender:** Male patients showed a higher incidence of leaks (26.5%) compared to females (18.1%).
- **Surgical Setting:** All leaks occurred in emergency procedures. None were noted in elective surgeries.
- **BMI:** Mean BMI was nearly identical between groups (23.75 in AL vs. 23.72 in NL).
- **Serum Albumin:** Lower preoperative albumin levels were significantly associated with leaks (mean 2.97 g/dL in AL group vs. 3.87 g/dL in NL group, $p = 0.01$).
- **Hemoglobin Levels:** The mean hemoglobin level was 11.06 g/dL in the AL group vs. 11.97 g/dL in the NL group, not statistically significant.
- **Blood Transfusion:** 32% of those who received transfusions developed leaks. Increased number of transfused units correlated with higher risk.
- **Surgery Duration:** Mean duration was 213.06 minutes in the AL group vs. 204.8 minutes in the NL group.
- **Intraoperative Hypotension:** 42% of patients with intraoperative hypotension developed leaks, a statistically significant finding.

Table: 1

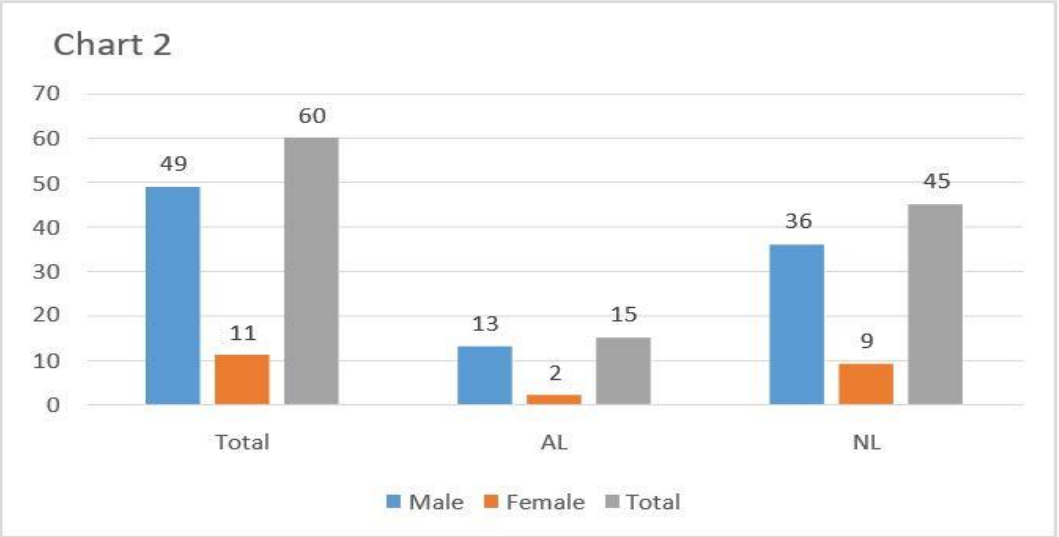
Age	20-29	30-39	40-49	50-59	60-69	Total
AL	0	0	2	11	2	15
NL	4	5	11	24	1	45
Total	4	5	13	35	3	60



Mean age for AL and NL is 53.6 and 47.5 respectively. GENDER:

Table: 2

	Total	AL	NL
Male	49	13	36
Female	11	2	9
Total	60	15	45



SETTING OF SURGERY was decided based on clinical condition of the patients and informed consent from the patients/ patients' attenders.

Table: 3

	Total	**AL**	**NL**
Emergency	54	15	39
Elective	6	0	6
Total	60	15	45

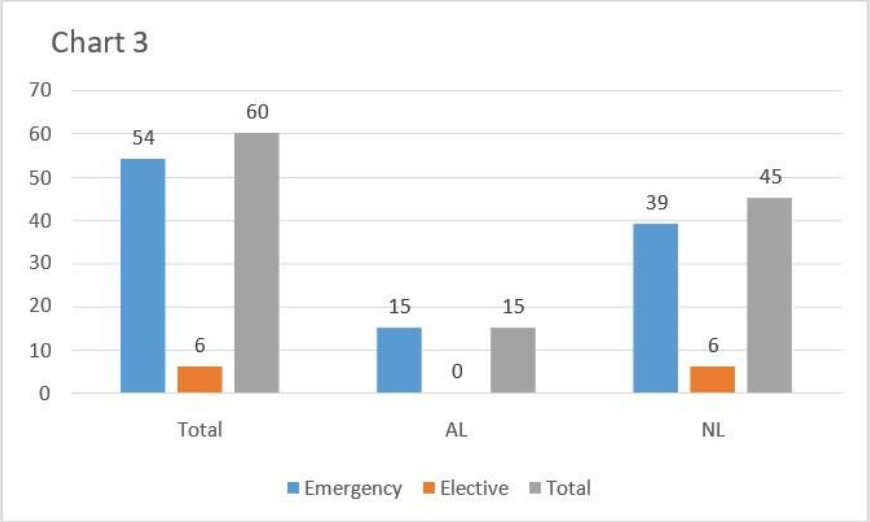
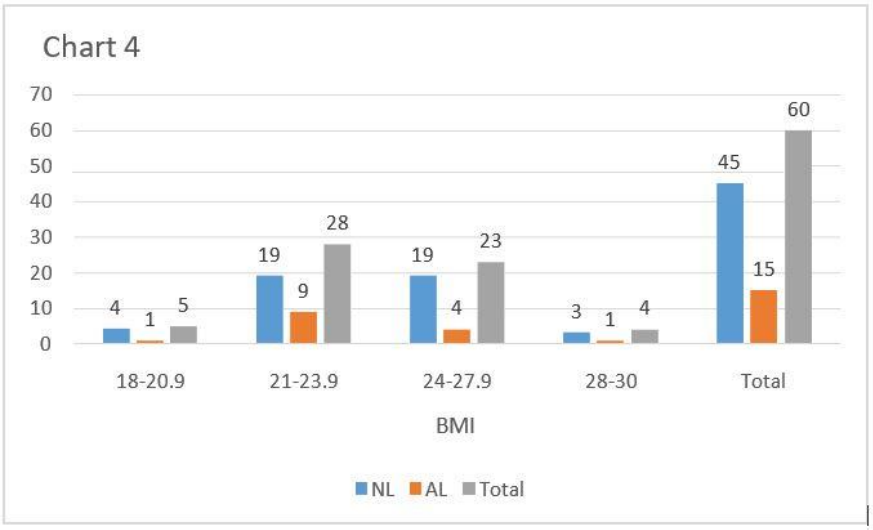


Table: 4

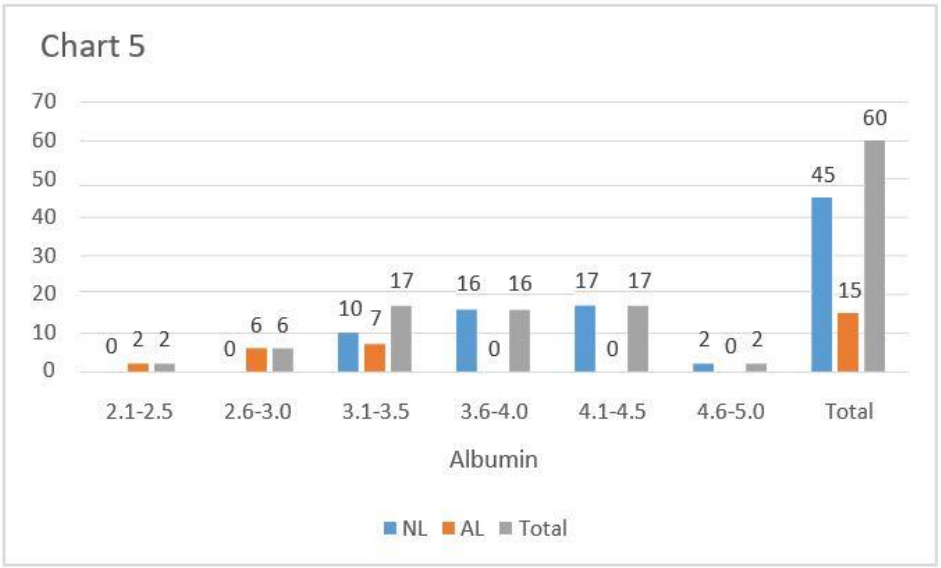
BMI	**18-20.9**	**21-23.9**	**24-27.9**	**28-30**	**Total**
NL	**4**	**19**	**19**	**3**	**45**
AL	**1**	**9**	**4**	**1**	**15**
Total	**5**	**28**	**23**	**4**	**60**



ALBUMIN:

Table: 5

Albumin	2.1-2.5	2.6-3.0	3.1-3.5	3.6-4.0	4.1-4.5	4.6-5.0	Total
NL	0	0	10	16	17	2	45
AL	2	6	7	0	0	0	15
Total	2	6	17	16	17	2	60

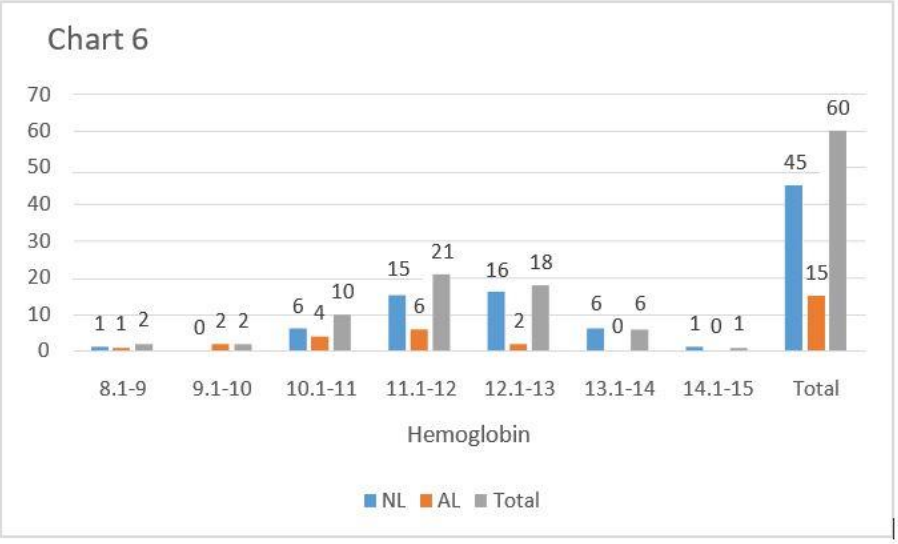


Mean S. Albumin of AL and NL is 2.97 and 3.87 respectively.

HEMOGLOBIN:

Table: 6

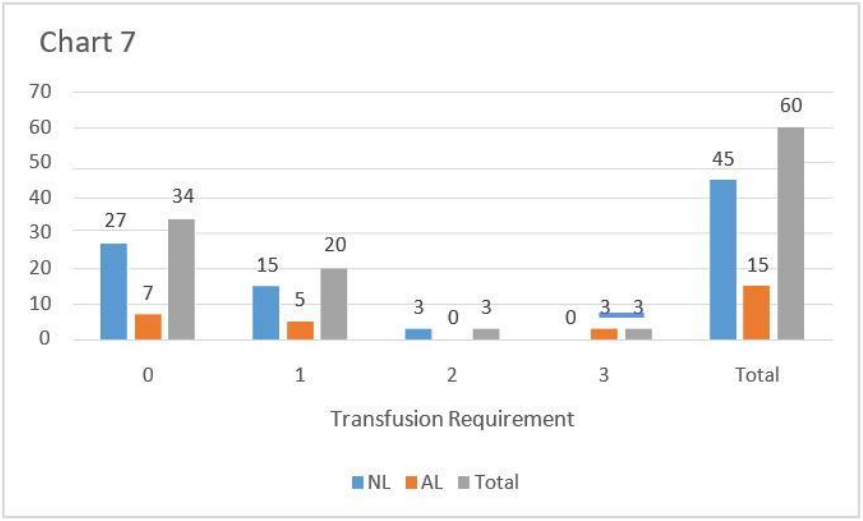
	8.1-9	9.1-10	10.1-11	11.1-12	12.1-13	13.1-14	14.1-15	Total
NL	1	0	6	15	16	6	1	45
AL	1	2	4	6	2	0	0	15
Total	2	2	10	21	18	6	1	60



Mean Hemoglobin of AL and NL is 11.97 and 11.06 respectively. Number of blood transfused:

Table: 7

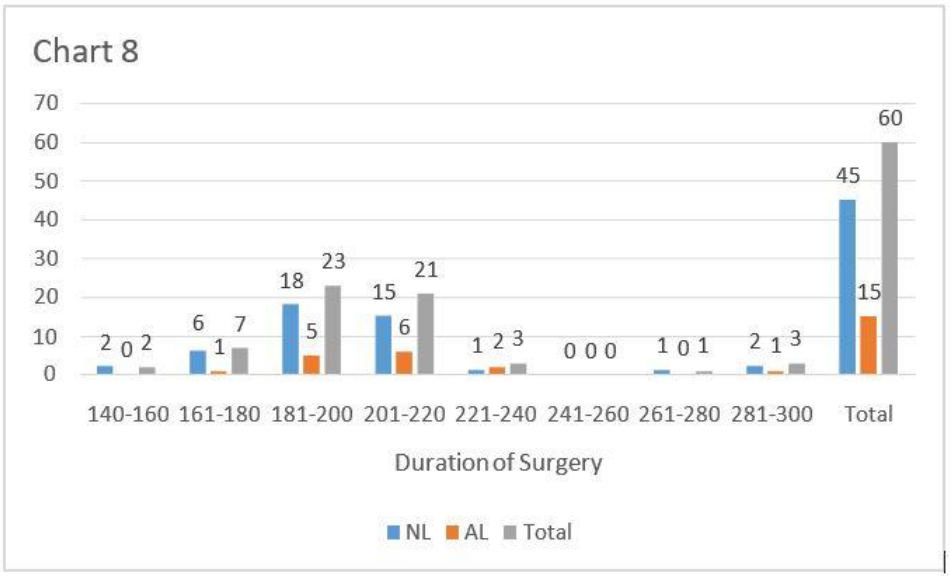
	0	1	2	3	Total
NL	**27**	**15**	**3**	**0**	**45**
AL	**7**	**5**	**0**	**3**	**15**
Total	**34**	**20**	**3**	**3**	**60**



DURATION OF SURGERY: Number of minutes from beginning of surgery to end as per operative records in case sheet.

Table: 8

	NL	AL	Total
140-160	2	0	2
161-180	6	1	7
181-200	18	5	23
201-220	15	6	21
221-240	1	2	3
241-260	0	0	0
261-280	1	0	1
281-300	2	1	3
Total	45	15	60

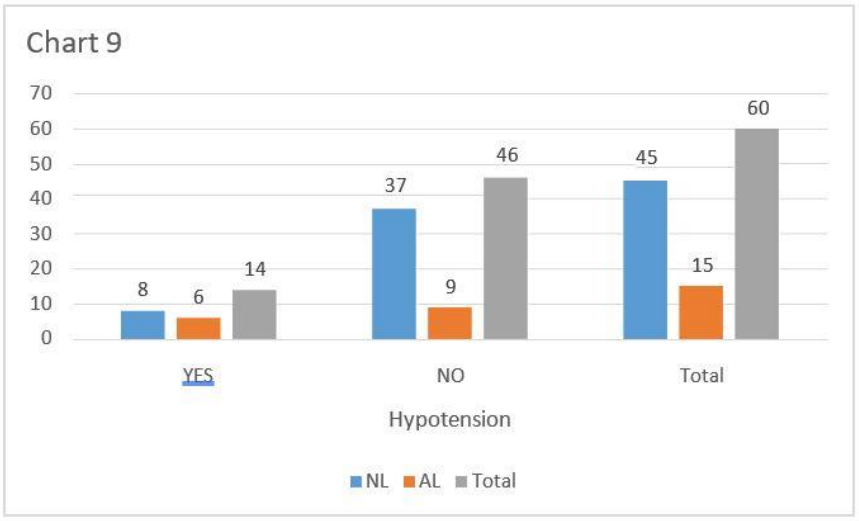


Mean duration of AL and NL is 204.8 and 213.06 mins respectively.

HYPOTENSION: measured as systolic blood pressure less than 90mm of Hg and diastolic blood pressure less than 60mm of Hg.

Table: 9

Hypotension	YES	NO	Total
NL	8	37	45
AL	6	9	15
Total	14	46	60



DISCUSSION

Anastomotic leakage following bowel surgery is a complex, multifactorial complication that contributes significantly to postoperative morbidity and mortality, as supported by numerous previous studies. Understanding the contributing risk factors is crucial to implementing effective preventative strategies.

In the present study involving 60 patients, the leak rate was observed to be 25% (15 patients). **Age** showed some correlation with leak incidence, as most cases were noted in individuals in their sixth decade of life. However, this was not statistically significant (p = 0.2), likely because a large proportion (about 50%) of the overall patient population also fell within this age range. This contrasts with findings from Parthasarathy M et al. (2), who reported a higher risk in younger patients; however, our younger demographic was limited to only 8%, possibly influencing this discrepancy.

Gender appeared to be a notable risk factor, with a higher incidence of leakage in male patients (26%) compared to females (18%). These findings are in line with those of Ba et al. (3), who attributed such differences to lower perfusion pressures in males, potentially affecting anastomotic healing.

Obesity, though often implicated in increased leak risk, was not significant in our study due to the absence of obese patients. The mean BMI in both groups was approximately 23, indicating a leaner cohort. Previous research by Biondo S et al. (4) has highlighted obesity as a contributing factor, but this could not be assessed here due to the sample profile.

Serum albumin levels demonstrated a strong association with anastomotic integrity. A preoperative albumin level below 2.9 g/dL was significantly related to higher leak rates ($p = 0.01$). This reinforces findings by Golub R et al. (5) and Jina et al. (6), who also emphasized the role of nutritional status in tissue healing and anastomotic strength.

Hemoglobin concentration, though clinically important for tissue oxygenation and healing, did not emerge as a significant predictor in our dataset. This is in contrast to prior work, such as that by Choudhury et al. (7), likely due to limitations in sample size within our study.

Leak rates were notably higher in patients undergoing **emergency procedures** compared to elective surgeries. This observation aligns with studies like that of Al-Doghan et al. (8), which suggest that suboptimal preoperative preparation in emergency cases may compromise surgical outcomes.

Operative duration is another variable often linked to postoperative complications. While studies such as that by Suding et al. (9) have shown that prolonged surgery increases leak risk, our study did not find a statistically significant association ($p = 0.3$), possibly due to minimal variation in operative times.

Intraoperative hypotension was strongly linked to leak development in our patients. Nearly 42% of individuals who experienced low blood pressure during surgery developed a leak, underscoring the importance of maintaining stable hemodynamics. This finding is consistent with the work of Farghaly et al. (10), who reported similar outcomes.

Lastly, the **requirement for blood transfusion** in the postoperative period was significantly associated with higher leak rates. In our study, 45% of the cohort received transfusions, and 32% of these individuals developed leaks. An increasing number of transfused units correlated with higher leak risk. This relationship has been supported by Tadros et al. (11), who suggested that transfusions may compromise immune function—particularly T-lymphocyte and macrophage activity—thereby hindering tissue repair and anastomotic healing.

CONCLUSION

This study identifies male sex, hypoalbuminemia (≤2.9 g/dL), intraoperative hypotension, and blood transfusion as major contributors to anastomotic leaks. Close preoperative assessment and intraoperative monitoring of these parameters can aid in minimizing postoperative complications and improving outcomes in bowel surgery.

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