



Original Article

Neutrophil-to-Lymphocyte Ratio as an Early Predictive Tool for an Anastomotic Leak in Laparoscopic Colorectal Surgeries: A Five-Year Retrospective Study from an Oncology Centre

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ABSTRACT

Background: Anastomotic leak following colorectal surgery is a serious postoperative complication that increases morbidity, mortality, and hospital stay. Early recognition can significantly improve outcomes.

Objective: This study evaluated the prognostic value of the neutrophil-to-lymphocyte ratio in predicting early postoperative anastomotic leak after laparoscopic colorectal surgery for cancer.

Materials and Methods: A retrospective cohort analysis was conducted at a tertiary oncology centre from March 2019 to March 2024 including 205 patients who underwent elective laparoscopic colorectal resection for histologically confirmed adenocarcinoma. Postoperative neutrophil-to-lymphocyte ratio values were recorded daily from postoperative day 1 to day 5. Anastomotic leak was diagnosed clinically and confirmed radiologically by computed tomography. Statistical analyses included the Mann-Whitney U test, chi-squared test, and receiver-operating characteristic (ROC) analysis.

Results: Anastomotic leak occurred in 16 patients (7.8 %), predominantly after low or ultralow anterior resections. Elevated neutrophil-to-lymphocyte ratio on postoperative days 3 and 4 was significantly associated with anastomotic leak ($p < 0.05$). ROC analysis on day 4 showed an AUC of 0.851 with 100 % sensitivity and 61.8 % specificity at a cut-off value of 6.15.

Conclusion: A postoperative neutrophil-to-lymphocyte ratio ≥ 6.15 on day 4 is a highly sensitive indicator of impending anastomotic leak. Incorporating this inexpensive biomarker into postoperative monitoring can facilitate earlier detection and intervention.

Keywords: anastomotic leak; neutrophil-to-lymphocyte ratio; colorectal cancer; laparoscopic surgery.

INTRODUCTION

Anastomotic leak following colorectal resection for malignancy remains one of the most dreaded postoperative complications, with reported incidence ranging from 2 % to 14 %.^{1,2} Mortality rates vary between 5 % and 22 %.³⁻⁵ Patients with anastomotic dehiscence frequently require re-operation or percutaneous drainage, resulting in prolonged hospitalization and increased healthcare costs.⁶⁻⁸

The neutrophil-to-lymphocyte ratio represents a convenient marker of systemic inflammation and sepsis.⁹ When an anastomotic leak occurs, peritoneal contamination triggers *Systemic Inflammatory Response Syndrome (SIRS)*, characterized by neutrophilia and lymphocytopenia.¹⁰ Multiple studies have shown that the neutrophil-to-lymphocyte ratio predicts major postoperative complications, including anastomotic leak, more accurately than isolated leukocyte counts.

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Pre- and postoperative elevations in this ratio have also been correlated with increased morbidity and poorer survival in patients with gastrointestinal malignancies.^{15–17} Xu et al. (2025) further demonstrated that both neutrophil-to-lymphocyte and platelet-to-lymphocyte ratios hold prognostic significance in colorectal cancer and in those developing anastomotic leak.¹⁸ Similarly, Yung et al. (2024) highlighted the clinical benefit of timely detection of anastomotic leak using biochemical and imaging modalities but stressed that simple, inexpensive tests such as neutrophil-to-lymphocyte ratio remain highly valuable for early screening.¹⁹

Therefore, this study aimed to evaluate postoperative neutrophil-to-lymphocyte ratio as an early predictive biomarker for anastomotic leak in patients undergoing laparoscopic colorectal resection for cancer.

Materials and Methods

Study Design:

A retrospective cohort study was performed at the Tata Medical Centre, Kolkata (January 2019 – January 2024) after institutional ethics approval. Data were obtained from prospectively maintained electronic records. Neutrophil-to-lymphocyte ratio was measured daily from postoperative day 1 to day 5. Anastomotic leak was confirmed by computed tomography when suture-line disruption, leakage of bowel contents, or abscess formation occurred with clinical symptoms such as fever or abdominal pain.

Patient Selection:

All elective laparoscopic colorectal resections for adenocarcinoma were included. From 212 initial patients, seven were excluded (two non-adenocarcinoma; five synchronous metastases). Operations were performed by colorectal specialists. Tumours ≤ 6 cm from the anal verge were classified as ultralow anterior resections. Stoma formation was at the surgeon's discretion.

Data Collected:

Demographics, tumour stage and histology, laboratory parameters (WBC, platelets, serum proteins), and neutrophil/lymphocyte counts were recorded.

Inclusion/Exclusion Criteria:

Included: laparoscopic colorectal, ileorectal, or ileocolic anastomosis (hand-sewn or stapled); completion of neoadjuvant therapy allowed.

Excluded: open or emergency cases; procedures without anastomosis (e.g., abdominoperineal resection); non-adenocarcinoma histology; synchronous metastasis; loss to follow-up.

Ethical Compliance:

Conducted in accordance with the Declaration of Helsinki and institutional policies. Informed consent was waived due to the retrospective design. All data were anonymized.

Statistical Analysis:

Continuous variables are expressed as mean $\pm$ SD or median (range). Mann-Whitney U and chi-squared/Fisher exact tests were used. Anastomotic leak was graded (A–C) per ISGRC criteria. A p value < 0.05 was considered significant. ROC curves were generated to calculate AUC, sensitivity, specificity, PPV, and NPV. Analysis used SPSS v20 and GraphPad Prism v7.

Results

Among 205 patients (52 % male; median age 61 years), overall morbidity was 37 % and 30-day mortality 0 %. Anastomotic leak occurred in 16 patients (8 %), median postoperative day 8 (range 5–9). Hospital stay was significantly longer for patients with anastomotic leak (25 vs 8 days; $p < 0.001$).

No differences were noted in neutrophil-to-lymphocyte ratio on postoperative days 1–2, whereas significant elevations appeared on days 3 and 4. ROC analysis on day 4 yielded AUC 0.851, sensitivity 100 %, specificity 61.8 %, PPV 19.23 %, and NPV 100 %.

Stoma formation occurred in 16.9 % overall, more frequent in ultralow anterior resections (25 %) than low anterior (9.5 %). Most anastomotic leaks (63 %) were grade C.

Table 1: Features related to clinical, surgical, and demographic characteristics across research groups.			
	Patients with AL (n= 189)	Patients without AL (n=16)	P value
Gender, (percentage)			0.49
Male	95 (50.5)	10 (66.7)	
Female	94 (49.5)	06 (33.3)	
Age, (percentage), years			0.60
> 60	111 (58.9)	12 (77.8)	
> 60	78 (48.1)	04 (22.2)	
Weight, mean $\pm$ SD, kilogram	75 $\pm$ 15	88 $\pm$ 13	0.01
Area, n (%)			1.00
Colon	151 (80.4)	12 (77.8)	
Right	55	5	
Transverse	88	3	
Left	8	4	
Rectum	30 (15.9)	4 (22.2)	
Superior	9	1	
Medium	14	2	
Low	7	1	
Cecum	8 (3.7)	0	
Protective ostomy, n (%)			0.47
Yes	44 (23.4)	4 (22.2)	
No	145 (76.6)	12 (77.8)	
Hospitalization, median (Days)	8 (4-14)	25 (8-48)	0.001
NLR, median (Days)			
1 st	9.50 (1.90-47)	8.98 (3.5 -23)	0.70
2 nd	6.11 (1.58-42)	7.35 (3.8-15)	0.18
3 rd	4.69 (0.86-30.66)	7.64 (2.20- 22.25)	0.02
4 th	3.92 (1.38-47)	6.15 (2.16-47)	0.03
5 th	3.88 (1.34-95)	5.00 (2.03-30)	0.15

Discussion

Postoperative elevation of the neutrophil-to-lymphocyte ratio on days 3–4 was strongly predictive of subsequent anastomotic leak, preceding clinical manifestations. The identified cut-off (6.15 on day 4) demonstrated excellent diagnostic accuracy.

These findings align with previous research showing that heightened systemic inflammation predicts anastomotic failure after colorectal resection. Malik et al. (2020), Shimazaki et al. (2021), and Hayama et al. (2015) reported similar associations. The present study adds to this literature by defining a quantitative postoperative threshold in an exclusively laparoscopic cohort.

Xu et al. (2025) highlighted that integrating multiple inflammatory markers improves predictive value, while Yung et al. (2024) demonstrated that early recognition through biochemical screening complements advanced imaging. Together, these findings underscore the practicality of incorporating routine neutrophil-to-lymphocyte ratio monitoring into enhanced-recovery pathways.

Limitations include the retrospective design and limited sample size. Elevated neutrophil-to-lymphocyte ratio may reflect non-specific inflammatory responses; thus, results should be interpreted clinically. Nonetheless, its high sensitivity and negative predictive value justify its use as an early screening tool.

Conclusion

An increased postoperative neutrophil-to-lymphocyte ratio (≥ 6.15 on day 4) is significantly associated with anastomotic leak after laparoscopic colorectal surgery. Routine monitoring of this marker may allow earlier diagnosis and improved outcomes in colorectal cancer surgery.

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