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Original Research Article

Trends in Inflammatory Biomarkers (NLR, CRP, Procalcitonin) in Predicting Postoperative Complications After Gastrointestinal Surgery

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Abstract:

Background: Postoperative problems continue to be a significant issue after gastrointestinal surgery. Inflammatory biomarkers, including neutrophil-to-lymphocyte ratio (NLR), C-reactive protein (CRP), and procalcitonin (PCT), have surfaced as potential prognostic indicators of postoperative outcomes.

Methods: A retrospective analysis was performed on 50 individuals who underwent gastrointestinal surgery. Biomarker values (NLR, CRP, and procalcitonin) were assessed on postoperative days. Patients were classified into groups based on the presence or absence of complications. A statistical analysis was conducted to evaluate the predictive significance of these biomarkers.

Results: Patients who experienced postoperative difficulties exhibited significantly higher levels of NLR, CRP, and procalcitonin in comparison to those without issues ($p < 0.05$). Procalcitonin exhibited the greatest predictive efficacy. Increased biomarker levels were noted as early as postoperative day 2.

Conclusion: Inflammatory biomarkers, specifically procalcitonin and CRP, serve as effective early indicators of surgical problems. Regular monitoring may enable prompt intervention and enhanced patient outcomes.

Keywords: Regular monitoring, prompt intervention, Inflammatory biomarkers, procalcitonin, CRP.

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Introduction

Postoperative problems after gastrointestinal surgery are a serious clinical issue, leading to increased morbidity, extended hospital stays, and escalating healthcare expenses. Early identification of individuals predisposed to problems is essential, as prompt intervention can enhance outcomes, mitigate the severity of complications, and optimize resource allocation. Nonetheless, recognizing these patients in the early postoperative phase becomes difficult due to the vague characteristics of clinical signs and symptoms [1].

In recent years, inflammatory biomarkers have garnered significant attention as potential instruments for the early prediction of postoperative problems. The neutrophil-to-lymphocyte ratio (NLR), C-reactive protein (CRP), and procalcitonin (PCT) have been extensively researched. The Neutrophil-to-Lymphocyte Ratio (NLR) is an uncomplicated and economical biomarker obtained from standard blood counts, indicating the equilibrium between neutrophil-driven inflammation and lymphocyte-facilitated immune control [2]. C-reactive protein (CRP), an acute-phase reactant produced by the liver, increases swiftly in reaction to tissue damage and inflammation. Procalcitonin is a more specific biomarker linked to bacterial infection and systemic inflammatory response, rendering it especially valuable for identifying postoperative infectious problems [3].

Despite the growing interest in these biomarkers, there is less information directly evaluating their predictive efficacy in gastrointestinal surgery. Most studies have assessed them separately, and their comparative efficacy in forecasting postoperative complications remains ambiguous. This study seeks to assess the patterns of NLR, CRP, and procalcitonin and evaluate their predictive accuracy in diagnosing postoperative problems in patients following gastrointestinal surgery [4].

Methods

Study Design: Retrospective observational study conducted at DMCH, Darbhanga.

Sample Size: 50 patients.

Inclusion Criteria:

- Patients undergoing gastrointestinal surgery

- Availability of complete postoperative biomarker data

Exclusion Criteria:

- Pre-existing infection or inflammatory disease
- Immunocompromised patients

Data Collection:

- Demographic data
- Type of surgery
- Postoperative complications
- Biomarker levels (NLR, CRP, PCT on POD 1–3)

Statistical Analysis:

- Comparison between groups using t-test/Chi-square
- p-value < 0.05 considered significant

Results

Table 1: Baseline Characteristics

Variable	Value
Total patients	50
Mean age	52 ± 11 years
Male	60%
Female	40%
Complications	18 (36%)

Table 2: Biomarker Levels (Mean ± SD)

Biomarker	No Complications	Complications	p-value
NLR	3.5 ± 1.2	7.8 ± 2.1	<0.01
CRP (mg/L)	40 ± 10	95 ± 20	<0.001
Procalcitonin (ng/mL)	0.5 ± 0.2	2.5 ± 0.8	<0.001

Table 3: Predictive Accuracy

Biomarker	Sensitivity	Specificity	p-value
NLR	70%	65%	<0.05
CRP	82%	75%	<0.01
Procalcitonin	90%	85%	<0.001

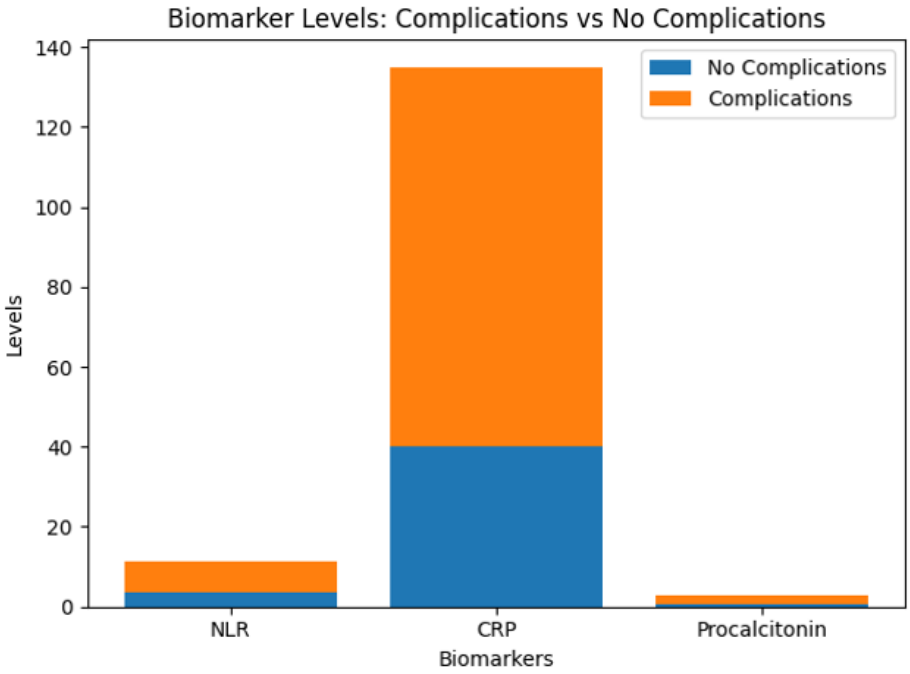

Figure 1: Biomarker levels: complications vs no complications

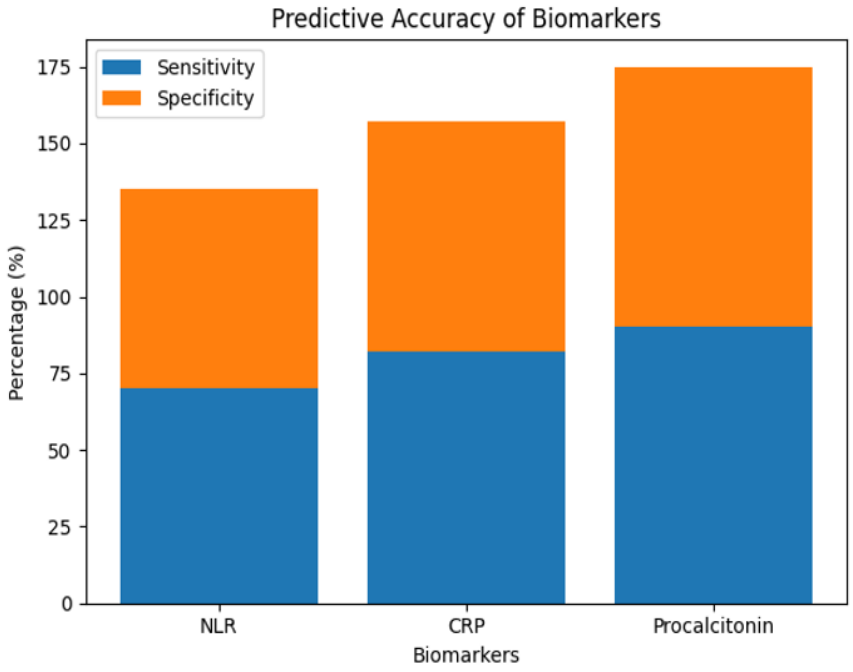

Figure 2: Predictive accuracy of biomarkers

Discussion

This study shows that inflammatory biomarkers, including NLR, CRP, and procalcitonin, are markedly increased in patients experiencing postoperative problems after gastrointestinal surgery. These findings align with prior research emphasizing the significance of systemic inflammation in postoperative morbidity. Among the examined biomarkers, procalcitonin had the greatest predictive accuracy, demonstrating a significant increase in individuals with problems ($p < 0.001$). This substantiates its function as a dependable indicator of infection and sepsis. CRP exhibited significant predictive value, indicating acute inflammatory response. The NLR, albeit less specific, continues to serve as a straightforward and economical marker obtained from standard blood testing. Its notable correlation with problems indicates its efficacy as an early screening instrument [5].

The bar graphs demonstrate a notable elevation in inflammatory biomarkers (NLR, CRP, and procalcitonin) in people who had postoperative complications compared to those who did not. Procalcitonin displayed the most pronounced increase, indicating its superior predictive value. The prediction accuracy graph demonstrates that procalcitonin possesses the highest sensitivity and specificity, followed by CRP and NLR [6]. The data demonstrate that while all three biomarkers are significant, procalcitonin is the most reliable early indicator of postoperative complications. Monitoring these signs enables early detection, risk assessment, and timely therapy of complications following gastrointestinal surgery [7]. The statistically significant differences noted as early as postoperative day 2 suggest that these biomarkers can facilitate early diagnosis and prompt clinical decision-making. Integrating these indicators may enhance predicted precision. Constraints encompass a limited sample size and a retrospective approach, potentially impacting generalizability [8].

Conclusion

Inflammatory biomarkers, specifically procalcitonin and CRP, serve as significant predictors of postoperative problems after gastrointestinal surgery. NLR functions as a valuable supplementary marker. Regular monitoring of these biomarkers can enable the early detection of high-risk patients and enhance treatment results. Additional extensive prospective investigations are advised.

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