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DIAGNOSTIC ACCURACY OF NEUTROPHIL-TO-LYMPHOCYTE RATIO VS SMART-LAB SCORING SYSTEM IN DIAGNOSING COMPLICATED APPENDICITIS

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Abstract

Background: Acute appendicitis is one of the most common causes of emergency abdominal surgery. Differentiating between uncomplicated and complicated appendicitis is crucial, as the latter requires urgent surgical management to prevent severe complications such as peritonitis and sepsis. Single biomarkers like the neutrophil-to-lymphocyte ratio (NLR) have been explored as diagnostic tools, but their accuracy is limited. More comprehensive scoring systems, such as SMART-LAB, may provide superior diagnostic reliability.

Objectives: To evaluate and compare the diagnostic accuracy of NLR and the SMART-LAB scoring system in distinguishing between complicated and uncomplicated appendicitis.

Methods: This cross-sectional study included 95 adult patients with acute appendicitis admitted to the Department of General Surgery, Saveetha Medical College and Hospital, Chennai, from January to December 2024. Patients with recurrent, subacute, or previously treated appendicitis were excluded. NLR values and SMART-LAB scores were calculated at admission. Intraoperative findings classified cases as uncomplicated or complicated appendicitis. ROC curve analysis was performed to determine area under the curve (AUC), cutoff values, sensitivity, and specificity for both tools.

Results: NLR showed an AUC of 0.670, with a sensitivity of 72.7% and specificity of 68.4% at a cutoff value of 5.68. The SMART-LAB scoring system demonstrated superior diagnostic accuracy, with an AUC of 0.816, sensitivity of 81.8%, and specificity of 68.4% at a cutoff of 8.

Conclusion: NLR is a simple and cost-effective biomarker for assessing appendicitis severity but demonstrates only moderate accuracy. The SMART-LAB scoring system, by integrating multiple clinical and laboratory parameters, showed significantly better diagnostic performance in distinguishing complicated from uncomplicated appendicitis. Its use in clinical practice may enhance decision-making, reduce delays in surgical intervention, and optimize healthcare outcomes.

Keywords: Acute appendicitis, Neutrophil-to-Lymphocyte Ratio, SMART-LAB scoring system, biomarkers, complicated appendicitis, diagnosis

INTRODUCTION

Acute appendicitis is a prevalent cause of sudden abdominal pain and often leads to emergency surgery. However, distinguishing between uncomplicated as well as complicated appendicitis can be challenging. Uncomplicated appendicitis involves straightforward inflammation of the appendix without severe complications like gangrene or perforation, and in select cases, it may be managed with antibiotics or delayed surgery. (1,2). Conversely, complicated appendicitis is marked by issues such as perforation, which requires prompt surgical intervention to avoid serious complications like peritonitis and sepsis.(3).

Recognizing whether a case is complicated is critical, as it informs immediate management decisions and influences long-term outcomes. Identifying complicated appendicitis quickly can ensure timely surgery and help prevent life-threatening issues. On the flip side, unnecessary surgeries for uncomplicated cases can lead to additional risks and overwhelm healthcare resources. (4,5).

Over the years, several biomarkers and scoring systems were suggested to enhance diagnostic precision. One such marker is NLR (Neutrophil-to-Lymphocyte Ratio), highlighting promising, cost-effective indicator derived from standard blood tests. An elevated NLR is associated with a systemic inflammatory response and has been studied as a possible predictor of severity in various surgical issues, including appendicitis.(6–8).

More recently, the SMART-LAB scoring system has been developed. This composite tool incorporates clinical, radiological, and laboratory variables—NLR included—to provide a more comprehensive risk assessment. Early studies indicate that the SMART-LAB system may outperform isolated indicators like the NLR in predicting complicated appendicitis, though further evidence is necessary to confirm this. (10).

Purpose of this research is to evaluate and compare diagnostic accuracy of NLR as well as SMART-LAB scoring system in distinguishing between complicated as well as uncomplicated appendicitis. Identifying a more reliable tool will facilitate timely interventions, reduce complications, and enhance healthcare efficiency.

MATERIALS AND METHODS

This cross-sectional study has been performed at Department of General Surgery, Saveetha Medical College and Hospital, Chennai, involving 95 patients with a diagnosis of acute appendicitis from January to December 2024.

Study Population

Patients aged over 18 exhibiting clinical and imaging evidence of acute appendicitis have been included in a study. Those with subacute appendicitis, prior treatment for complicated appendicitis, or recurrent appendicitis were excluded.

Data Collection

On admission, a complete blood count and routine biochemistry were performed. We calculated NLR values and determined SMART-LAB scores. After appendectomies (whether laparoscopic or open), intraoperative findings were used to categorize patients as having uncomplicated or complicated appendicitis, based on presence of issues like phlegmon, abscess, gangrene, or perforation.

Statistical Analysis

We recorded and analyzed data using SPSS version 25. ROC (Receiver Operating Characteristic) curves have been constructed to assess AUC (area under the curve), optimal cutoff values, sensitivity, and specificity for both NLR and SMART-LAB.

RESULTS

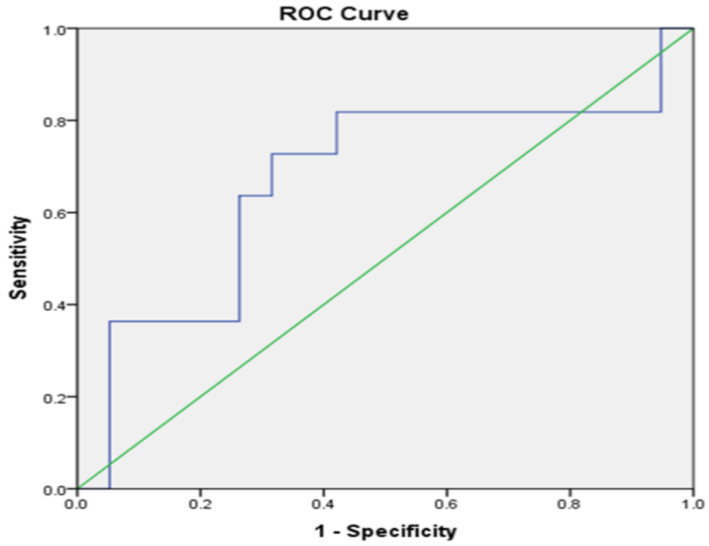

Fig 1: ROC curve for Neutrophil to Lymphocyte Ratio

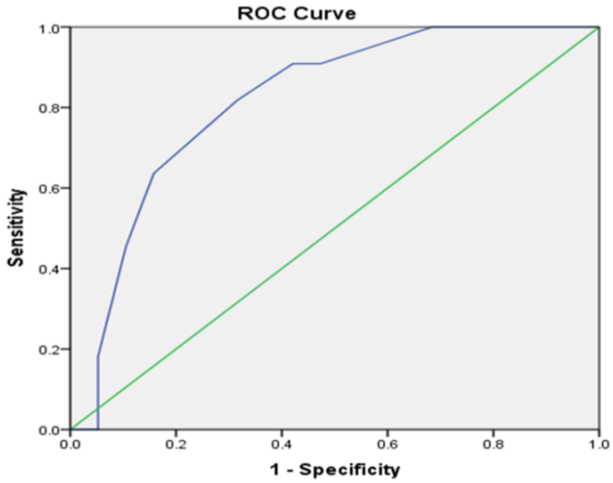

Fig 2: ROC curve for SMART-LAB Scoring System

Neutrophil to Lymphocyte Ratio

- •The AUC for Neutrophil to Lymphocyte ratio was 0.670.
- •At a cutoff value of 5.68 to differentiate between uncomplicated as well as complicated acute appendicitis, Sensitivity is 72.7% and Specificity is 68.4%.

SMART-LAB scoring system

- •AUC for SMART-LAB scoring system has been 0.816.
- •At a cutoff value of 8 to differentiate between uncomplicated as well as complicated acute appendicitis, Sensitivity is 81.8% and Specificity is 68.4%.

DISCUSSION

Accurately distinguishing between complicated as well as uncomplicated appendicitis preoperatively remains struggle. Traditional methods such as clinical exams and imaging can be unreliable, particularly with atypical presentations(11). This is why the exploration of reliable biomarkers and scoring systems is gaining traction for early risk stratification.

Our findings indicate that NLR has moderate diagnostic value (AUC 0.670) with decent sensitivity and specificity, aligning with earlier research that acknowledged its role as an inflammatory marker in appendicitis (12,13). Increase in NLR reflects an increased neutrophil response to infection and decreased lymphocyte count due to stress-mediated apoptosis, making it a proxy of systemic inflammation (14).. However, while NLR is simple and cost-effective, it alone does not have the consistent discriminative power necessary to guide surgery decisions in complicated cases effectively.

In contrast, the SMART-LAB scoring system demonstrated superior diagnostic performance (AUC 0.816). Its incorporation of multiple clinical and laboratory parameters likely accounts for its enhanced predictive accuracy compared with NLR alone. This supports evidence from recent studies suggesting that multifactorial scoring systems, such as Alvarado, AIR, and now SMART-LAB, provide more comprehensive risk assessment than single biomarkers [(5–17).

Importantly, the sensitivity of SMART-LAB (81.8%) was notably higher than NLR (72.7%), indicating its greater reliability in identifying complicated cases, which is crucial for timely surgical intervention. Both markers had similar specificity (68.4%), suggesting comparable ability to exclude uncomplicated appendicitis.

The clinical implications of these findings are significant. Use of SMART-LAB may reduce diagnostic uncertainty, prevent delays in surgery for complicated appendicitis, and avoid unnecessary interventions in uncomplicated cases. Nevertheless, its application requires further validation in larger multicentric studies to confirm generalizability and cost-effectiveness.

CONCLUSION

NLR is a useful, accessible, and inexpensive tool for assessing appendicitis severity, but its moderate diagnostic accuracy limits standalone use. The SMART-LAB scoring system, by integrating multiple parameters, provides superior diagnostic performance and is a more reliable tool in distinguishing complicated from uncomplicated appendicitis. Adoption of such scoring systems in clinical practice may enhance decision-making, improve outcomes, and optimize healthcare resources.

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