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HYPERBILIRUBINEMIA AS A PREDICTOR OF COMPLICATED APPENDICITIS: A CROSS-SECTIONAL STUDY FROM A TERTIARY CARE CENTRE IN SOUTH INDIA

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ABSTRACT

Background: Early identification of gangrenous and perforated appendicitis remains a challenge despite advances in laboratory and imaging modalities. Hyperbilirubinemia has emerged as a potential biomarker for predicting complicated appendicitis.

Objective: To evaluate the diagnostic value of serum bilirubin in predicting gangrenous and perforated appendicitis and compare its performance with conventional inflammatory markers.

Methods: A hospital-based cross-sectional observational study was conducted in the Department of General Surgery, Sree Balaji Medical College and Hospital, Chennai, from July 2024 to August 2025. One hundred patients diagnosed with acute appendicitis and undergoing appendicectomy were included. Serum bilirubin, total leukocyte count (TLC), C-reactive protein (CRP), ultrasonography findings, operative findings, and histopathological reports were analyzed. Histopathology served as the reference standard for diagnosing complicated appendicitis.

Results: Among 100 patients, 68 had uncomplicated appendicitis, 18 had gangrenous appendicitis, and 14 had perforated appendicitis. Hyperbilirubinemia was observed in 42 patients. Elevated serum bilirubin was present in 77.8% of gangrenous appendicitis cases and 85.7% of perforated appendicitis cases. Serum bilirubin demonstrated a significant association with complicated appendicitis ($p<0.001$), outperforming TLC ($p=0.041$) and CRP ($p=0.032$). Diagnostic analysis revealed sensitivity of 81.3%, specificity of 76.5%, positive predictive value of 61.9%, negative predictive value of 89.7%, and overall accuracy of 78%. Receiver operating characteristic analysis demonstrated an area under the curve of 0.83 (95% CI: 0.74–0.92).

Conclusion: Hyperbilirubinemia is significantly associated with gangrenous and perforated appendicitis and may serve as an inexpensive and readily available adjunctive biomarker for predicting complicated disease.

KEYWORDS: Acute appendicitis; Hyperbilirubinemia; Gangrenous appendicitis; Perforated appendicitis; Serum bilirubin; Diagnostic marker

INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies worldwide and remains a frequent cause of acute abdomen requiring emergency surgery. Although advances in imaging and laboratory investigations have improved diagnostic accuracy, differentiating uncomplicated appendicitis from gangrenous or perforated appendicitis remains challenging.

Complicated appendicitis is associated with increased morbidity, prolonged hospitalization, postoperative complications, and healthcare costs. Delayed diagnosis may lead to appendiceal perforation, intra-abdominal abscess formation, generalized peritonitis, and sepsis.

Traditional diagnostic tools such as total leukocyte count, C-reactive protein, ultrasonography, computed tomography, and clinical scoring systems provide useful information but have limitations in accurately predicting disease severity. Recent evidence suggests that bacterial translocation and endotoxemia in complicated appendicitis impair hepatic bilirubin excretion, resulting in hyperbilirubinemia.

Several studies have reported a significant association between elevated serum bilirubin levels and appendiceal perforation. However, data from the Indian population remain limited. The present study was undertaken to evaluate the role of serum bilirubin as a predictor of gangrenous and perforated appendicitis and compare its diagnostic performance with commonly used laboratory markers.

MATERIALS AND METHODS

Study Design:

Cross-sectional observational study.

Study Setting:
Department of General Surgery, Sree Balaji Medical College and Hospital, Chennai, India.

Study Duration:
July 2024 to August 2025.

Sample Size:
100 patients.

Inclusion Criteria:
Patients diagnosed with acute appendicitis who underwent appendicectomy.
Exclusion Criteria:Patients younger than 13 years, previous history of jaundice, hemolytic anemia, chronic alcoholism, gastrointestinal malignancy, and HBsAg positivity.

Data Collection:
Detailed clinical examination, complete blood count, serum bilirubin, C-reactive protein, liver function tests, ultrasonography findings, operative findings, and histopathological reports were recorded.

Outcome Measure:
Complicated appendicitis was defined as gangrenous or perforated appendicitis confirmed by histopathological examination.

Statistical Analysis:
Data were analyzed using SPSS version 25. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. A p-value <0.05 was considered statistically significant.

RESULTS

The mean age of study participants was 30.8 ± 12.6 years. The majority belonged to the 21–30-year age group (36%). Male patients constituted 62% of the study population. Right iliac fossa pain was present in all patients. Associated symptoms included migratory abdominal pain (72%), nausea and vomiting (68%), anorexia (64%), and fever (54%).
Histopathological examination revealed uncomplicated appendicitis in 68 patients, gangrenous appendicitis in 18 patients, and perforated appendicitis in 14 patients. Hyperbilirubinemia was observed in 42 patients. Elevated bilirubin levels were identified in 14 of 18 gangrenous cases and 12 of 14 perforated cases. In contrast, only 16 of 68 patients with uncomplicated appendicitis had elevated bilirubin levels. Elevated serum bilirubin demonstrated a stronger association with complicated appendicitis compared with elevated TLC and CRP levels. The association was highly significant ($p<0.001$).
The sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy of serum bilirubin for predicting complicated appendicitis were 81.3%, 76.5%, 61.9%, 89.7%, and 78%, respectively. Receiver operating characteristic analysis demonstrated an area under the curve of 0.83 (95% CI: 0.74–0.92), indicating good discriminatory performance.

DISCUSSION

The present study demonstrated a significant association between hyperbilirubinemia and complicated appendicitis. Elevated bilirubin levels were substantially more common among patients with gangrenous and perforated appendicitis than among those with uncomplicated disease.
The biological basis for hyperbilirubinemia in complicated appendicitis is believed to involve bacterial endotoxemia and cytokine-mediated hepatocellular dysfunction. Endotoxins impair bile salt transport and bilirubin excretion, resulting in elevated serum bilirubin levels even in the absence of primary hepatobiliary disease.
Our findings are consistent with Chaudhary et al., who demonstrated significantly elevated bilirubin levels in gangrenous and perforated appendicitis. Similarly, Sand et al. reported nearly a threefold increase in the risk of appendiceal perforation among patients with hyperbilirubinemia. A meta-analysis by Lv et al. further confirmed a strong association between elevated bilirubin and complicated appendicitis.
The sensitivity observed in the present study (81.3%) compares favorably with previous reports and highlights the potential utility of serum bilirubin as a screening biomarker. Importantly, the high negative predictive value (89.7%) suggests that normal bilirubin levels may help exclude complicated disease.
Compared with TLC and CRP, serum bilirubin demonstrated stronger statistical significance and superior discriminatory ability. Because bilirubin estimation is inexpensive, routinely available, and rapidly obtainable, it may be particularly useful in resource-limited settings where advanced imaging is not immediately accessible.

CONCLUSION

Hyperbilirubinemia is significantly associated with gangrenous and perforated appendicitis. Serum bilirubin demonstrated good sensitivity, specificity, and diagnostic accuracy for predicting complicated appendicitis. Bilirubin estimation is inexpensive, readily available, and may serve as a valuable adjunctive marker for early identification of patients at risk of perforation.

Conflict of Interest:
None declared.

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Ethical Approval:
Approved by the Institutional Human Ethics Committee of Sree Balaji Medical College and Hospital, Chennai.

Author Contributions:
Conceptualization, data collection, analysis, manuscript preparation, and final approval by all authors.

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