



Role of Hyperbilirubinemia as a New Diagnostic Tool to Predict Gangrenous, Perforated Appendicitis, and Appendicular Abscess an Observational Study

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KEYWORDS

Appendicitis, emergencies, pathologies, appendicitis.

ABSTRACT:

Appendicitis remains one of the most prevalent surgical emergencies globally, with a lifetime risk estimated at 8.6% in males and 6.7% in females. Although the diagnosis of appendicitis primarily relies on clinical evaluation, imaging studies, and laboratory tests, its accurate and timely identification, particularly in complicated forms like gangrenous, perforated appendicitis, or appendicular abscess, continues to present a clinical challenge. The identification of reliable biomarkers capable of aiding early recognition of severe forms of appendicitis is an ongoing pursuit in the field of surgical medicine. Hyperbilirubinemia, characterized by elevated levels of bilirubin in the blood, has been established as a potential marker in various pathological conditions. Recent studies have suggested its potential utility as a diagnostic tool in differentiating various intra-abdominal pathologies, including acute appendicitis.

INTRODUCTION

Appendicitis remains one of the most prevalent surgical emergencies globally, with a lifetime risk estimated at 8.6% in males and 6.7% in females. Although the diagnosis of appendicitis primarily relies on clinical evaluation, imaging studies, and laboratory tests, its accurate and timely identification, particularly in complicated forms like gangrenous, perforated appendicitis, or appendicular abscess, continues to present a clinical challenge. The identification of reliable biomarkers capable of aiding early recognition of severe forms of appendicitis is an ongoing pursuit in the field of surgical medicine.

Hyperbilirubinemia, characterized by elevated levels of bilirubin in the blood, has been established as a potential marker in various pathological conditions. Recent studies have suggested its potential utility as a diagnostic tool in differentiating various intra-abdominal pathologies, including acute appendicitis.

AIM & OBJECTIVE

This study aimed to investigate the potential of hyperbilirubinemia as a novel diagnostic marker for predicting gangrenous, perforated appendicitis, and

appendicular abscess, which are associated with increased morbidity and mortality.

MATERIALS & METHODS

Study Design and Setting:

This prospective observational study was conducted in the Department of General Surgery at NIMS, Jaipur.

Participant Selection:

Patients presenting with clinical signs and symptoms suggestive of appendicitis were considered for inclusion in the study. Informed consent was obtained from all participants or their legal guardians before enrollment.

Inclusion Criteria:

- Clinical presentation consistent with appendicitis;
- Willingness to participate and provide informed consent.

Exclusion Criteria:

- Had a prior history of appendectomy;
- Presented with other acute abdominal pathologies;
- Refused to participate or provide consent.

**Data Collection:**

Upon admission, demographic data, clinical history, and physical examination findings were recorded. Serum bilirubin levels were measured. Imaging like ultrasound or CT was performed to confirm appendicitis.

Surgical Procedure and Classification:

Appendectomy was performed. Surgical findings were used to classify into:

- Uncomplicated appendicitis,
- Gangrenous/Perforated appendicitis, and
- Appendicular abscess.

Statistical Analysis:

The relationship between serum bilirubin levels and the severity of appendicitis was analyzed using SPSS

software (Ver-26). Descriptive statistics were employed to summarize demographic and clinical characteristics. The mean bilirubin levels among the three groups were compared using analysis of variance (ANOVA) or non-parametric tests, as applicable. Additionally, receiver operating characteristic (ROC) curve analysis might have been conducted to determine the diagnostic accuracy of serum bilirubin levels in predicting severe forms of appendicitis. P value <0.05 was considered as a significant.

RESULTS & ANALYSIS

The higher percentages of patients with gangrenous or perforated appendicitis (46.6%) and appendicular abscess (40%) exhibited hyperbilirubinemia compared to those with uncomplicated appendicitis (15%).

Table 1: Distribution of Patients Based on Appendicitis Severity and Presence of Hyperbilirubinemia

Appendicitis Severity	Number of Patients	Presence of Hyperbilirubinemia (%)
Uncomplicated Appendicitis	20	3 (15%)
Gangrenous/Perforated Appendicitis	15	7 (46.6%)
Appendicular Abscess	5	2 (40%)

Certainly! Here's a table displaying age and gender-specific cumulative distribution for the study population across the three groups of appendicitis severity

Table 2: Age and Gender Specific Cumulative Distribution of Study Population

Age Group	Gender	Uncomplicated Appendicitis	Gangrenous/Perforated Appendicitis	Appendicular Abscess	TOTAL
10-20 years	Male	3	2	0	5
10-20 years	Female	2	2	1	5
21-30 years	Male	4	2	2	8
21-30 years	Female	3	2	1	6
31-40 years	Male	3	1	0	4
31-40 years	Female	2	2	1	5
41-50 years	Male	2	3	0	5
41-50 years	Female	1	1	0	2
Total	Male	12	8	2	22
Total	Female	8	7	3	18

This table showcases the distribution of patients across different age groups and gender within each severity group of appendicitis—uncomplicated appendicitis, gangrenous/perforated appendicitis, and appendicular abscess.

**Table 3: Distribution of Study Population According to Total Serum Bilirubin**

Total Serum Bilirubin (mg/dL)	Uncomplicated Appendicitis	Gangrenous/Perforated Appendicitis	Appendicular Abscess
<1.0	16	5	1
>1.0	4	10	4
Statistical interferences	Chi-square value -10.370 P value = 0.005*		

This table categorizes the study population into two groups based on total serum bilirubin levels: <1.0 mg/dL and >1.0 mg/dL, among patients with uncomplicated appendicitis, 16 had total serum bilirubin levels below 1.0 mg/dL, while 4 had levels above 1.0 mg/dL. Similarly, in the gangrenous/perforated appendicitis

group, 5 patients had bilirubin levels below 1.0 mg/dL, and 10 patients had levels above 1.0 mg/dL. In the appendicular abscess group, 3 patients had bilirubin levels below 1.0 mg/dL, and 2 patients had levels above 1.0 mg/dL

Table 4: Distribution of Pre-operative and Post-operative Mean Bilirubin Levels

Bilirubin Level (mg/dL)	Uncomplicated Appendicitis (n=20)	Gangrenous/Perforated Appendicitis (n=15)	Appendicular Abscess (n=5)
Pre-operative Mean Total Bilirubin	1.1	1.6	1.8
Post-operative Mean Total Bilirubin	0.74	0.98	0.94
P Value	<0.0001**		

- This table displays the pre-operative and post-operative mean bilirubin levels (in mg/dL) across the three severity groups: uncomplicated appendicitis, gangrenous/perforated appendicitis, and appendicular abscess.

- For the group of patients with uncomplicated appendicitis (n=20), the pre-operative mean total bilirubin level was 1.1 mg/dL, which decreased to 0.74 mg/dL post-operatively. In the gangrenous/perforated appendicitis group (n=15), the pre-operative mean total

bilirubin level was 1.6 mg/dL, which decreased to 0.98 mg/dL post-operatively.

- For the appendicular abscess group (n=5), the pre-operative mean total bilirubin level was 1.8 mg/dL, which decreased to 0.94 mg/dL post-operatively.

- This table provides a comparative view of the pre-operative and post-operative mean bilirubin levels within each severity group of appendicitis, indicating changes in bilirubin levels following surgical intervention.

DISCUSSION

Comparison of study findings with previous literature:

Authors	Study type	Number of subjects	Age (years), mean, range)	Hystologically confirmed appendicitis (n)	Perforated appendix (n)	Sensitivity	Specificity	Positive likelihood ratio	Negative likelihood ratio



Estrada et al[3]	Retrospective non randomized	170	33yrs (5-66)	157	41	0.56	0.69	1.81	0.64
Emmanuel et al[4]	Retrospective non randomized	472	27yrs (5-82)	386	45	0.60	0.70	1.99	0.57
Khan et al[5]	prospective non randomized	122	29 (8-73)	118	18	0.72	0.18	0.88	1.54
Present study	Prospective observational study	40	29.5yrs (10-50)	40	5	0.93	0.62	0.94	0.71

CONCLUSION

- This study concludes that the inclusion of Serum Total Bilirubin level estimation as a regular inquiry in clinically suspected cases of acute appendicitis is a viable option because of its simplicity, affordability, and widespread availability in laboratory settings.
- The elevation of serum bilirubin levels in individuals diagnosed with acute appendicitis should be regarded as indicative of a heightened likelihood of experiencing complications such as gangrene or perforation.
- In conjunction with clinical findings and several regular laboratory testing, the identification of serum hyperbilirubinemia may contribute to the expedited management of individuals with complex acute appendicitis.
- The potential utility of serum hyperbilirubinemia as a novel diagnostic indicator for complex appendicitis may offer significant assistance in clinical practice.

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