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Original Research Article

A Prospective, Observational Study to Determine the Role of C - reactive protein (CRP) in the Preoperative Workup and Diagnosis of Acute Appendicitis

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Abstract:

Background: Acute appendicitis is a common surgical emergency that requires prompt diagnosis and treatment. Inflammatory markers play a crucial role in the preoperative workup and diagnosis of acute appendicitis. This study aims to evaluate the efficacy of C-reactive protein (CRP) as an inflammatory marker in the diagnosis of acute appendicitis.

Materials and Methods: This prospective, clinical study was conducted at the Department of Surgery, ESIC Medical College & Hospital, Bihta, from January 2023 to June 2023. A total of 82 patients, admitted through emergency with suspected acute appendicitis, were included in the study. Preoperative blood samples were collected to measure CRP levels. The diagnosis of acute appendicitis was confirmed by histopathological examination post-appendectomy. Statistical analysis was performed to correlate CRP levels with the histopathological findings.

Results: Out of the 82 patients, 65 (79.3%) had elevated CRP levels (>10 mg/L) at the time of admission. The histopathological examination confirmed acute appendicitis in 68 (82.9%) patients. Among these, 60 patients (88.2%) had elevated CRP levels. The sensitivity and specificity of CRP in diagnosing acute appendicitis were found to be 88.2% and 66.7%, respectively. The positive predictive value (PPV) and negative predictive value (NPV) were 92.3% and 55.6%, respectively.

Conclusion: CRP is a valuable inflammatory marker in the preoperative diagnosis of acute appendicitis. Elevated CRP levels are significantly associated with acute appendicitis, providing a reliable diagnostic tool in emergency settings. However, CRP should be used in conjunction with clinical evaluation and other diagnostic modalities to improve accuracy.

Keywords: Acute appendicitis, C-reactive protein, inflammatory markers, diagnosis, preoperative workup, emergency surgery.

Introduction

Acute appendicitis is one of the most common surgical emergencies, often requiring prompt diagnosis and intervention to prevent complications such as perforation and peritonitis. Despite advancements in diagnostic imaging techniques, the diagnosis of acute appendicitis remains challenging, particularly in atypical presentations [1].

Traditionally, the diagnosis has relied on clinical evaluation, including symptoms and physical examination findings, supported by imaging studies such as ultrasound and computed tomography (CT) scans [2]. However, these methods have limitations, including variable sensitivity and specificity, potential radiation exposure, and accessibility issues in resource-limited settings [3].

Inflammatory markers, such as C-reactive protein (CRP), white blood cell (WBC) count, and procalcitonin, have been increasingly utilized to aid in the diagnosis of acute appendicitis. Among these markers, CRP has gained prominence due to its rapid response to inflammatory stimuli and its ability to provide quantitative data that correlates with the severity of inflammation [4]. Elevated CRP levels have been associated with a higher likelihood of acute appendicitis and can serve as an adjunct to clinical and imaging findings [5].

Several studies have investigated the role of CRP in the diagnosis of acute appendicitis, demonstrating its potential utility in improving diagnostic accuracy. For instance, a study by Andersson et al. reported that combining CRP levels with clinical

assessment significantly improved the diagnostic accuracy for acute appendicitis [6]. Another study by Asfar et al. highlighted that CRP levels, in conjunction with other inflammatory markers, could effectively differentiate between uncomplicated and complicated appendicitis [7].

This study aims to evaluate the efficacy of CRP as an inflammatory marker in the preoperative diagnosis of acute appendicitis. By analyzing CRP levels in patients with suspected acute appendicitis admitted through emergency, we seek to determine the sensitivity, specificity, and predictive values of CRP in diagnosing this condition. The findings of this study could contribute to the optimization of diagnostic protocols for acute appendicitis, particularly in settings where advanced imaging modalities are not readily available.

Materials and Methods

Study Design and Duration: This prospective, clinical study was conducted over a six-month period from January 2023 to June 2023.

Study Location: The study was carried out at the Department of Surgery, ESIC Medical College & Hospital, Bihta.

Study Population: The study included a total of 82 patients who were admitted through emergency services with suspected acute appendicitis. All patients were evaluated and included based on the following inclusion and exclusion criteria:

Inclusion Criteria:

1. Patients of all ages and genders presenting with clinical signs and symptoms suggestive of acute appendicitis.
2. Patients who consented to participate in the study.

Exclusion Criteria:

1. Patients with a history of chronic inflammatory diseases.
2. Patients who had received antibiotics or anti-inflammatory drugs prior to admission.
3. Pregnant women.

Data Collection: Upon admission, a detailed clinical history was taken, and a physical examination was performed for each patient. Preoperative blood samples were collected to measure the levels of C-reactive protein (CRP) using a high-sensitivity assay. The CRP levels were recorded and analyzed.

Diagnostic Procedures: In addition to laboratory investigations, all patients underwent imaging studies, including ultrasound and/or computed tomography (CT) scan, to support the clinical diagnosis of acute appendicitis.

Surgical Intervention and Histopathological Examination: Patients with a clinical and imaging diagnosis of acute appendicitis underwent an appendectomy. The resected appendices were sent for histopathological examination to confirm the diagnosis of acute appendicitis. The histopathological results were considered the gold standard for diagnosing acute appendicitis.

Statistical Analysis: The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of CRP in diagnosing acute appendicitis were calculated using histopathological confirmation as the reference standard. Statistical analysis was performed using SPSS software version 25.0 (IBM Corp., Armonk, NY, USA). The correlation between CRP levels and histopathological findings was assessed using the Chi-square test. A p-value of <0.05 was considered statistically significant.

Results

A total of 82 patients were included in the study, with a mean age of 34.5 years (range 12-68 years). The gender distribution was 45 males (54.9%) and 37 females (45.1%). The clinical and demographic characteristics of the patients are summarized in Table 1.

Table 1: Clinical and Demographic Characteristics of Patients

Characteristic	Value
Number of patients	82
Mean age (years)	34.5
Age range (years)	12-68
Gender distribution	45 males (54.9%)
	37 females (45.1%)

Preoperative CRP levels were measured for all patients. The mean CRP level was 22.5 mg/L (range 5-85 mg/L). Elevated CRP levels (>10 mg/L) were observed in 65 patients (79.3%). Table 2 provides a summary of CRP levels and their correlation with histopathological findings.

Table 2: CRP Levels and Histopathological Findings

CRP Level (mg/L)	Number of Patients	Histopathologically Confirmed Appendicitis	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
<10	17	8	88.2	66.7	92.3	55.6
>10	65	60				

Histopathological examination confirmed acute appendicitis in 68 patients (82.9%). Among these patients, 60 (88.2%) had elevated CRP levels (>10 mg/L), while 8 patients (11.8%) had CRP levels <10 mg/L. The diagnostic performance of CRP in detecting acute appendicitis is detailed in Table 3.

Table 3: Diagnostic Performance of CRP in Acute Appendicitis

Diagnostic Parameter	Value (%)
Sensitivity	88.2
Specificity	66.7
Positive Predictive Value	92.3
Negative Predictive Value	55.6

Statistical analysis revealed a significant correlation between elevated CRP levels and histopathologically confirmed acute appendicitis ($p<0.05$). The data suggest that CRP is a valuable marker for the preoperative diagnosis of acute appendicitis, particularly when combined with clinical evaluation and imaging studies.

The overall findings highlight the potential of CRP to improve diagnostic accuracy for acute appendicitis in emergency settings.

Discussion

The diagnosis of acute appendicitis continues to pose a significant clinical challenge despite advances in diagnostic modalities. This study aimed to evaluate the efficacy of C-reactive protein (CRP) as an inflammatory marker in the preoperative diagnosis of acute appendicitis. Our results demonstrate that elevated CRP levels correlate significantly with histopathologically confirmed cases of acute appendicitis, suggesting its utility as a diagnostic adjunct.

Previous studies have highlighted the role of inflammatory markers in diagnosing acute appendicitis. CRP, an acute-phase reactant, is produced by the liver in response to inflammation and has been widely studied in this context [1]. Our findings are consistent with those of Andersson et al., who reported that combining CRP with clinical assessment significantly enhances diagnostic accuracy [2]. In our study, the sensitivity and specificity of CRP were 88.2% and 66.7%, respectively, which align with the reported values in the literature [3].

The positive predictive value (PPV) and negative predictive value (NPV) of CRP in our study were 92.3% and 55.6%, respectively. These findings are comparable to those reported by Grönroos et al., who found a PPV of 91% and an NPV of 54% for CRP in diagnosing acute appendicitis [4]. The high PPV suggests that elevated CRP levels strongly indicate the presence of acute appendicitis, making it a useful marker for decision-making in emergency settings.

However, the relatively lower specificity and NPV indicate that CRP alone should not be solely relied upon for diagnosis. As noted by Birnbaum and Wilson, the diagnostic approach to acute appendicitis should be multimodal, incorporating clinical assessment, imaging studies, and laboratory markers [5]. The addition of CRP to this diagnostic algorithm can enhance the overall accuracy and reduce the rate of negative appendectomies.

One limitation of our study is the relatively small sample size, which may affect the generalizability of the findings. Additionally, we did not compare CRP with other inflammatory markers, such as white blood cell (WBC) count or procalcitonin, which could provide a more comprehensive understanding of its diagnostic utility. Future studies with larger cohorts and comparative analyses of multiple markers are warranted to validate and extend our findings.

Conclusion

In conclusion, our study supports the use of CRP as a valuable inflammatory marker in the preoperative diagnosis of acute appendicitis. Elevated CRP levels are significantly associated with acute appendicitis, providing a reliable diagnostic tool when used alongside clinical evaluation and imaging studies. Incorporating CRP measurement into the diagnostic workup can improve accuracy and aid in timely decision-making in emergency surgical settings.

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