

Study of predictive value of serum C- reactive protein in diagnosis of acute appendicitis

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Abstract

Background: Acute appendicitis is a common surgical condition and the most common cause of acute surgical abdomen. Commonly used tests for diagnosis of acute appendicitis were WBC, CRP ESR and procalcitonin (PCT) levels. In present study we correlated the serum levels of CRP with the histopathology of the removed appendix, to study predictive value of serum C- reactive protein in diagnosis of acute appendicitis. **Material and Methods:** Present study was conducted in patients with possibility of acute appendicitis, underwent appendicectomy. The histopathology report was considered as the final diagnosis. CRP more than 6 mg/dl was considered to be positive. **Results:** In present study total 88 patients were included. Male to female ratio was 1.4:1, most common age group was 21-30 years (35.23%) followed by 31-40 years (27.27%). Abdominal pain (92.05%), McBurney tenderness (80.68%), vomiting (76.14%), rebound tenderness (67.05%) and fever (55.68%) were common signs and symptoms noted in present study. On histopathology examination, inflamed appendix (51.14%) was most common finding, others were gangrenous appendix (23.86%), perforated appendix (5.68%) and normal appendix (19.32%). In present study diagnostic efficacy of serum CRP was sensitivity (80%), specificity (84.62%), positive predictive value (96.77%), negative predictive value (42.31%), diagnostic accuracy (80.68%). **Conclusion.** Serum CRP estimation is useful adjunct in diagnosis of acute appendicitis along with clinical diagnosis. Serum CRP value should be interpreted in combination with clinical findings. **Keywords:** Serum CRP levels, acute appendicitis, diagnosis.

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INTRODUCTION

Acute appendicitis is a common surgical condition and the most common cause of acute surgical abdomen with a lifetime risk of 7%.¹ Early diagnosis (often based on history and clinical examination and sometimes aided by laboratory tests) and quick surgical intervention are important in acute appendicitis so as to reduce morbidity and sometimes mortality associated with complications

such as gangrene, perforation, and abscess formation.^{2,3} Though classic clinical and laboratory findings in appendicitis usually allow for prompt diagnosis and treatment. However, patients with atypical and confusing presentation, often leads to misdiagnosis. Apart from imaging techniques, various laboratory investigations are used as an adjunct for diagnosis of acute appendicitis. The most commonly used tests are white blood cell count and serum C-reactive protein (CRP) levels. Erythrocyte sedimentation rate (ESR) and procalcitonin (PCT) levels have also been used.⁴ Serum C-reactive protein (CRP) is a positive acute phase reactant synthesized by the liver and its level in the blood increases within hours in response to inflammation and infection. CRP rises in response to any tissue injury. It also increases in response to infections (bacterial and viral) and in non-infectious conditions like myocardial infarction, malignancies and rheumatic disorders.⁵ In present study we correlated the serum levels of CRP with the histopathology of the removed appendix,

to study predictive value of serum C- reactive protein in diagnosis of acute appendicitis.

MATERIAL AND METHODS

Present study was conducted in Department of Surgery, Government Doon Medical College, Dehradun, from March 2019 to February 2020. It was hospital based, observational study.

Inclusion criteria

- Patients with possibility of acute appendicitis, underwent appendicectomy and willing to participate in study.

Exclusion criteria

- Pregnancy, HIV seropositivity, patients on corticosteroid therapy, patient with inflammatory bowel diseases or sickle cell disease.
- Waiting interval appendectomy, admitted for interval appendicectomy following recurrent appendicitis or appendicular mass previously treated conservatively.
- Patients who were managed conservatively.
- Patients with co-morbid conditions where CRP/Leukocyte count/ Neutrophil count is elevated in acute appendicitis patients with associated diseases like rheumatoid arthritis, SLE, glomerular nephritis, gout

Informed consent was taken from the patient in the pre designed format. After history and clinical examination, patient underwent USG whole abdomen. Diagnosis of appendicitis was established. After that patient underwent routine blood investigations including, CRP. CRP estimation was done using diagnostic reagent kit for the in vitro detection of C-reactive protein in human serum by semi-quantitative rapid latex slide tests. After confirming diagnosis of appendicitis, patients underwent appendectomy and biopsy of appendix was sent for histopathological examination. The histopathology report was considered as the final diagnosis. The histopathologically positive cases among CRP positive group were considered true positives. CRP more than 6 mg/dl was considered to be positive. The patients were meticulously monitored in the post-operative period for any complications. All patients were followed up 3 months postoperatively. Statistical analysis was done using descriptive statistics. Data was collected, compiled using Microsoft Excel and analysed using SPSS 23.0 version

RESULTS

In present study total 88 patients were included. Male to female ratio was 1.4:1, most common age group was 21-30 years (35.23 %) followed by 31-40 years (27.27 %).

Table 1: Age and gender wise distribution

	No. of patients	Percentage
Age in years		
0-10	0	0
11-20	15	17.05
21-30	31	35.23
31-40	24	27.27
41-50	18	20.45
>50	-	-
Gender		
Male	51	57.95
Female	37	42.05

Abdominal pain (92.05 %), McBurney tenderness (80.68 %), vomiting (76.14 %), rebound tenderness (67.05 %) and fever (55.68 %) were common signs and symptoms noted in present study.

Table 2: Signs and symptoms

Signs and symptoms	No. of patients	Percentage
Abdominal pain	81	92.05
McBurney tenderness	71	80.68
Vomiting	67	76.14
Rebound tenderness	59	67.05
Fever	49	55.68
Shifting tenderness	13	14.77
Diarrhea	6	6.82

On histopathology examination, inflammed appendix (51.14 %) was most common finding, others were gangrenous appendix (23.86 %), perforated appendix (5.68 %) and normal appendix (19.32 %)

Table 3: Histopathology report

Histopathology report	No. of patients	Percentage
Inflammed appendix	45	51.14
Gangrenous appendix	21	23.86
Perforated appendix	5	5.68
Normal appendix	17	19.32

In present study diagnostic efficacy of serum CRP was sensitivity (80%), specificity (84.62%), positive predictive value (96.77%), negative predictive value (42.31%), diagnostic accuracy (80.68%).

Table 4: Correlation between CRP levels and histopathological findings

CRP level	Histopathology report		Total
	Positive	Negative	
Elevated	60	2	62
Normal	11	15	26

Table 5: Diagnostic efficacy of serum CRP

Sensitivity	80.00 %
Specificity	84.62 %
Positive predictive value	96.77 %
Negative predictive value	42.31 %
Diagnostic accuracy	80.68 %

DISCUSSION

The incidence of appendicitis seems to have risen in some Asian and African countries because of changing lifestyle and western type of food habits.⁶ The morbidity and mortality rates associated with appendicitis are greatly increased when perforation ensues, wound infection rates increases, intraabdominal abscess formation increases 15 fold and mortality may be 50 times greater.¹ Delay in diagnosis may increase morbidity and mortality in these patients, and may have significant effects on hospital resources due to increased length of stay. The diagnosis of acute appendicitis still remains problematic due to unacceptably high negative appendectomy rate in spite of the introduction of modern imaging techniques.⁷ Appendicitis commonly occurs in young adults (the highest incidence, approximately 40%, in 2nd decade of life i.e. 10–19 years and 70% of the subjects are less than 30 years old.). Acute appendicitis is relatively rare at the extreme of age.⁸ Kumari B *et al.*,⁹ noted diagnostic efficacy of serum CRP as sensitivity (94.1%), specificity (73.3%), positive predictive value (95.23%), negative predictive value (68.75%), diagnostic accuracy (91%). Mean and standard deviation of serum CRP was 41.92±26.28 with $p < 0.0001$ which is highly significant. John *et al.*¹⁰ noted that CRP is the earliest inflammatory marker whose concentration has been found to rise on repeated testing whereas leucocyte counts have been found to decrease. Shogilev *et al.*¹¹ in a review article, observed that when the best cut-off values of serum CRP to diagnose acute appendicitis was greater than 10 mg/L, the sensitivity and specificity, ranged from 65 to 83% and 59 to 73%, respectively. Choudhary SK *et al.*,¹² studied 120 patients and noted that CRP value > 6.15 mg/L has a sensitivity of 100.0% and a specificity of 54% in predicting complicated perforated or gangrenous appendicitis. The positive predictive value and negative predictive value of CRP were 100% and 61.54% respectively. The cut off level at around 6mg/dL needs to be handled carefully and a person with high CRP should undergo surgery immediately. Similar results were noted in present study. Agrawal *et al.*¹³ found a sensitivity and specificity of 74.8% and 66.7%, respectively. A much higher CRP sensitivity and specificity of 98% and 87%, respectively, was recorded by John *et al.*¹⁴ in a mixed-population study. Tarleker S *et al.*,¹⁵ studied that elevated CRP has a higher sensitivity (100%) for complications of acute appendicitis than specificity. The cut off level at around 6mg/dL needs to be handled carefully and may need much higher patient number to reach the confidant level. Yang *et al.*¹⁶ reported that WBC, CRP, and neutrophil count may assist in the diagnosis of acute appendicitis and that patients with normal values in all the three tests are highly unlikely to have appendicitis. CRP concentration increases within 8

hours of the onset of tissue injury, peaks in 24- 48 hours and remains high as long as there is continuing infection or tissue destruction. The measurement of CRP is practical, easily applicable, and cost-effective. In spite of various contrasting observations, one of the major advantages of CRP is its ease of measurement and cost-effectiveness for rural communities where CT, MRI, and laparoscopy are not available.

CONCLUSION

Diagnostic efficacy of serum CRP was sensitivity (80%), specificity (84.62%), positive predictive value (96.77%), negative predictive value (42.31%), diagnostic accuracy (80.68%). Serum CRP estimation is useful adjunct in diagnosis of acute appendicitis along with clinical diagnosis. Serum CRP value should be interpreted in combination with clinical findings.

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