

A Hospital Based Prospective Study to Evaluate the Diagnostic Efficacy of Serum CRP Levels in Clinically Diagnosed Cases of Acute Appendicitis Confirmed by HPR

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Abstract

Background: Acute appendicitis is one of the most common surgical emergencies and the most common source of infection in community-acquired intra-abdominal infections. Several prospective studies have shown that, in adults who have had symptoms for longer than 24 h, a normal CRP level has a negative predictive value of 97-100% for appendicitis. The aim of this study was to analyze the role of C-reactive protein (CRP) in improving the accuracy of diagnosis of acute appendicitis and to compare it with the histopathology findings. **Materials & Methods:** A hospital based prospective study done on 30 operated patients suspected of acute appendicitis in department of general surgery at district hospital Dholpur, Rajasthan, India during one year period. The normal CRP level in our laboratory is 0–6 mg/L. Levels above 6 mg/L were considered as being above normal. Macroscopic assessment was made from the operation. Appendectomy and a histopathology examination were performed on all patients. Gross description was compared with histopathology results and then correlated with CRP. **Results:** Out of 30 patients, 9 were classified as an inflamed appendicitis, 10 patients were shown to have suppurative appendicitis, 5 gangrenous, 4 perforated, and two necrotizing. Overall in the inflammation and suppurative groups (group A), the CRP was normal in 6 out of 19 patients. Complicated appendicitis included gangrenous, perforated and necrotizing (group B). CRP was normal in none of patients. **Conclusion:** We found that elevated serum CRP levels support the surgeon's clinical diagnosis. We recommend CRP measurement as a routine laboratory test in patients with suspected diagnosis of acute appendicitis.

Keywords: CRP, Appendicitis, Inflammation, Histopathology.

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Introduction

Acute appendicitis is one of the most common surgical emergencies and the most common source of infection in community-acquired intra-abdominal infections[1,2]. Its diagnosis is usually made depending on the presenting history, clinical evaluation, and physical examination[3]. Similarly in young children, signs and symptoms are non-specific, due to the wide range of causes and the inability to retell an accurate history. Therefore, appendicitis is a challenging diagnosis to make. Although clinical acumen remains the most important diagnostic tool in acute appendicitis, clinicians often rely on blood tests to support and improve the accuracy of diagnosis. The value of C-reactive protein (CRP) is very helpful in planning the management. It is vital in reducing the negative appendectomy rates, currently in one recent audit study 20.6%[4].

CRP is a non-specific inflammatory marker that is used routinely in many hospitals as an aid in the diagnosis of patients with an acute abdomen.⁵ An acute phase protein is produced in the liver. Normal serum concentration is less than 10 mg/l 8–12 hours after infection or trauma; the increase of acute phase protein in liver the CRP is more important in clinical practice. Production of CRP is controlled by Interleukin6 and in a few minutes increases from 10 to 1,000 times. CRP is increased in infections, inflammatory arthritis, autoimmune disorders, neoplasia, pregnancy, and aging[5,6].

CRP levels of greater than 1 mg/dL are commonly reported in patients with appendicitis, but very high levels of CRP in patients with appendicitis indicate gangrenous, perforation or suppurative evolution of the disease, especially if it is associated with leukocytosis and neutrophilia. However, CRP normalization occurs 12 h after onset of

symptoms. Several prospective studies have shown that, in adults who have had symptoms for longer than 24 h, a normal CRP level has a negative predictive value of 97-100% for appendicitis[7,8]. The aim of this study was to analyze the role of C-reactive protein (CRP) in improving the accuracy of diagnosis of acute appendicitis and to compare it with the histopathology findings.

Materials & Methods

A hospital based prospective study done on 30 operated patients suspected of acute appendicitis in department of general surgery at district hospital Dholpur, Rajasthan, India during one year period.

Methods

Clinical signs of acute appendicitis determined by the surgeon and the duration of the symptoms were documented on admission. The clinical signs included direct tenderness in the right lower quadrant, percussion and rebound tenderness, localized rigidity, and diffuse rigidity of the abdominal wall. At least one clinical sign had to be present in order to consider the patient positive for clinical signs. In all operated patients, in-hospital observation time until the surgical procedure was performed was recorded. The surgeons were aware of the routine laboratory and ultrasound findings.

Blood samples for routine laboratory tests (white blood cell count, differential count), and C-reactive protein were obtained on admission. The C-reactive protein concentration was quantified by a Latex agglutination slide test for the qualitative and semi-quantitative determination in Non-diluted serum (Humatex, Wiesbaden, Germany). For semi-quantitative determination, serum dilutions were prepared with the 0.9% sodium chloride, according to the instructions of the manufacturers. Each dilution was tested according to the qualitative procedure described above until no further agglutination was observed. The serum CRP concentration was then estimated by multiplying the dilution factor from the last dilution with visible agglutination (2, 4, 8, 16, 32) by the detection limit (6 mg/l).

The normal CRP level in our laboratory is 0–6 mg/L. Levels above 6 mg/L were considered as being above normal.

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Macroscopic assessment was made from the operation. Appendectomy and a histopathology examination were performed on all patients. Gross description was compared with histopathology results and then correlated with CRP.

Results

Out of 30 patients, 9 were classified as an inflamed appendicitis, 10 patients were shown to have suppurative appendicitis, 5 gangrenous, 4 perforated, and two necrotizing (table 1). Overall, in the inflammation and suppurative groups (group A), the CRP was normal in 6 out of 19 patients. Complicated appendicitis included gangrenous, perforated and necrotizing (group B). CRP was normal in none of patients.

Table 1: Percentage of the prevalence of different types of appendicitis

Types of appendicitis	No. of patients (N=30)	Percentage
Inflamed appendicitis	9	30%
Suppurative appendicitis	10	33.33%
Gangrenous	5	16.66%
Perforated	4	13.33%
Necrotizing	2	6.66%

Table 2: The level of CRP among different types of appendicitis

Level of CRP	Group A	Group B
Normal CRP	6	0
Abnormal CRP	13	11
Total	19	11
Sensitivity	68.42%	100%
Specificity	31.57%	0%
TPR	54.16%	45.83%

Discussion

The positive CRP is more accurate than the WBC and neutrophil counts and combined together it further improves diagnostic accuracy[5]. Multiple studies have examined the sensitivity of CRP level alone for the diagnosis of appendicitis in patients selected to undergo appendectomy. In a double-blind study Asfar et al. (2000)[9] reported a sensitivity and specificity of CRP as 86.6% and 93.6%, respectively. They concluded that a normal CRP value probably indicates a normal non-inflamed appendix. Erkassap (2000)[10] in a positive study on 102 patients reported that sensitivity and specificity of the CRP were 96% and 78%, respectively; the positive predictive value was 100%. Gurleyik et al[11] noted a CRP sensitivity of 96.6% in 87 of 90 patients with histologically proven disease. Similarly, Shakhathreh[12] found a CRP sensitivity of 95.5% in 85 of 89 patients with histologically proven appendicitis. Group A means inflammatory and suppurative; total patients were 19 and out of these 6 CRP values were negative, which in this group shows the sensitivity of 68.42%. Group B includes gangrenous, perforated, and necrotizing, and the sensitivity is 100% in our study. Group B patients have significantly higher mean CRP levels compared to group A patients (55.6 vs. 146 mg/L) in our study. CRP value of 55.6 mg/l is the level for simple inflammation and suppurative group. Value above this cut-off in our patients was highly predictive of complicated appendicitis. Many studies have shown different levels to predict complicated appendicitis[13]. In complicated cohort of these patients significant rise in reactive proteins should be significantly taken in to account before deciding for conservative treatment in complicated group[14]. Reactive protein cut-off generated in this study can be utilized in deciding the conservative management for simple appendicitis and surgical treatment for complicated appendicitis[15]. In our study, the CRP values corresponds to the series with high percentage of complicated appendicitis, which is typical for rural hospitals and dysfunctional healthcare systems. But, the consistence of CRP level with the severity of appendicitis was reported by the other authors as well[16].

Conclusion

We concluded that very high CRP may be related to necrotizing appendicitis, while CRP above 40 mg/L may suggest suppurative or inflammatory appendicitis. We found that elevated serum CRP levels support the surgeon's clinical diagnosis. We recommend CRP measurement as a routine laboratory test in patients with suspected diagnosis of acute appendicitis.

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