

Original article

A study of C - Reactive protein is an marker for acute appendicitis

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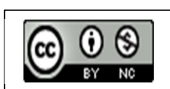
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Abstract

Background - Acute appendicitis is the commonest cause of acute abdominal pain requiring surgery. Emergency appendectomy done for suspected cases of acute appendicitis is a common procedure. The rate of negative appendicectomies remains high despite various techniques and investigations used to diagnose acute appendicitis. The objective of this study is to evaluate the value of C reactive protein in patients operated for clinical suspicion of acute appendicitis.

Methods - The present study conducted in 75 patients who were clinically diagnosed as acute appendicitis and posted for appendectomy in General Surgery Department of Meenakshi Medical College, Kanchipuram during the period from 1st January 2023 to October 31st 2023. Preoperatively blood for C Reactive protein was done. All patients were subjected to histopathological examination postoperatively which was taken as gold standard. CRP results were correlated with histopathological reports to evaluate their role in diagnosis of acute appendicitis.

Results and Conclusion - In present study, CRP has highest sensitivity and specificity (90%, 80%). It was observed that negative appendicitis could be safely ruled out and surgery can be deferred in these patients. It would reduce the rate of negative appendicectomies. CRP is found to significantly increase the diagnostic accuracy. When CRP is negative acute appendicitis is very unlikely and surgery can be safely deferred in these patients thereby reducing the negative appendectomy rates.

Key Words: CRP; Acute appendicitis; Histopathological report

Introduction

Acute appendicitis is one of the most common causes of right lower abdomen pain and is one of the most common cause of surgical emergencies.¹ Diagnosis of acute appendicitis is established by clinical impression depending on presenting history, clinical evaluation and laboratory tests.² Acute appendicitis may mimic any other acute abdominal conditions and can also be mimicked by variety of conditions.³ The accuracy of clinical diagnosis of acute appendicitis is found to be between 76% and 92%.⁴ While Appendectomy for suspected acute appendicitis is a common procedure, the rate of normal appendices being unnecessarily removed remains high (15%-30%).⁵ A normal appendix at

appendectomy represents a misdiagnosis, but a delayed diagnosis of appendicitis may lead to perforation and peritonitis. Perforation may occur in up to 35% of cases.⁶

In order to decrease the incidence of perforation surgeons have accepted a higher rate of unnecessary appendicectomies. The high rate of negative explorations for appendicitis is a burden faced not only by the general surgeon.⁷ Goal of surgical treatment is the removal of an inflamed appendix before it perforates and to attain a minimal number of negative appendicectomies.⁸ Appendicitis is one of the common causes of right iliac fossa pain. Report suggest that 6% of populations have risk of suffering

from appendicitis during their lifetime. While the mortality from appendicitis has dropped from 26% to less than 1% with the discovery of antibiotics and early surgical intervention.⁹ The morbidity rate of appendicular perforation ranges from 17% to 40%. Perforation rates are higher in the elderly and children.¹⁰

Acute appendicitis can become a perforated appendicitis requiring laparotomy if diagnosis is delayed and it can lead to potential complications like intra-abdominal abscesses, wound infection and even death.¹¹ Negative laparotomy rate ranges from 15% to 35% and is associated with significant morbidity.¹² The negative laparotomy rate is significantly higher in young women (up to 45%) because of prevalence of pelvic inflammatory disease (PID) and other common obstetrical and gynecological disorders.¹³ To conclude acute appendicitis may simulate many other acute abdominal conditions and despite intensive research, the diagnosis of acute appendicitis still remains a challenge and the exact diagnosis is important for proper management.

This study aims to find if CRP is specific and sensitive to the diagnosis of acute appendicitis. This would be done by comparing it with HPE report. The need for the study is to find if CRP is most accurate and sensitive investigation to improve diagnosis of appendicitis and if it's helpful in decision making and hence decrease negative and unnecessary appendectomies. We would also like to know whether a normal CRP would exclude the presence of acute appendicitis.

Materials and Methods

It was hospital based observational study. According to Indian Council of Medical Research rules (Ref No. MMCH&RI/IEC003/2023), the protocol was authorized by the Institution Committee of Ethics in Human Research, which is part of Meenakshi Medical College Hospital & Research Institute. After being informed, every patient signed a written informed permission form to take part in the research. This study was done on 100 patients who have been clinically diagnosed as a case of Acute Appendicitis and who were posted for appendectomy in General Surgery department of Meenakshi Medical College and Research Institute Hospital, during the Period from 1 January 2023 to 30 January 2024. All patients

above the age of 16 years admitted with complaints of acute abdominal pain with clinical signs and symptoms of acute appendicitis and confirmed by tissue diagnosis. Detailed history was recorded in all patients. In female patients obstetric history was noted. Clinical diagnosis of acute appendicitis was done based on clinical symptoms of pain, migration, vomiting, fever and clinical signs of peritoneal inflammation like right iliac fossa tenderness, rebound tenderness and guarding. Vital signs were recorded.

Once acute appendicitis was suspected, patient was subjected to routine investigations. Urine microscopy, CRP, Total leucocyte count, differential count, X-ray chest and ECG was done in all cases. Elderly patients were subjected to further investigations as part of pre-anaesthetic work up. WBC count of more than 10,000 cells/mm was considered positive and neutrophil count of more than 75% was considered positive.

CRP more than 6 mg/dl was considered to be positive. Ultrasonography of abdomen was done in most of the cases to confirm diagnosis and to rule out other causes of pain abdomen. Patients with suspicion of acute appendicitis were advised appendectomy. After obtaining consent, patient was operated, and the appendectomy specimen 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. The histopathologically negative cases in the same group were considered as false positives. The histopathologically positive cases among CRP negative group were considered false negatives. The histopathologically negative cases in the same group were considered as true negatives.

Statistical analysis

Data was entered in to Microsoft excel data sheet and was analyzed using EPI info 7 version software. Categorical data was presented in the form of frequencies and proportions. Bar charts and pie diagrams was used to represent graphically. Chi-square test was the test of significance. Continuous data was represented in the form of Mean and Standard deviation. Sensitivity, Specificity, Positive predictive value, Negative predictive value, Diagnostic accuracy and Kappa agreement were

computed to find the effectiveness of CRP in diagnosing Appendicitis. p value <0.05 was

considered as statistically significant.

Results

Table 1 shows that the Mean age of the subjects presenting with appendicitis was 33.8 ± 10.99 yrs. Majority of them were in the age group 20 to 25 yrs and least no of cases were observed in 46 to 50 yrs.

Table 1. Age distribution of appendicitis patients

Age	Frequency	Percentage
20 to 25 years	28	28.0
26 to 30 years	19	19.0
31 to 35 years	18	18.0
36 to 40 years	8	8.0
41 to 45 years	13	13.0
46 to 50 years	5	5.0
>50 years	9	9.0
Total	100	100.0

Table 2. Represents that the sex wise distribution of acute appendicitis patients. Male were 52% and Females were 48 acute appendicitis patients present in this study.

Table 2. Sex distribution of appendicitis patients

Sex	Frequency	Percentage
Female	48	48.0
Male	52	52.0
Total	100	100.0

Figure 1. indicates that the study 100% had pain abdomen, 57% had Migrating pain, 51% had vomiting and 40% had Fever.

Fig.1. Symptoms in appendicitis patients

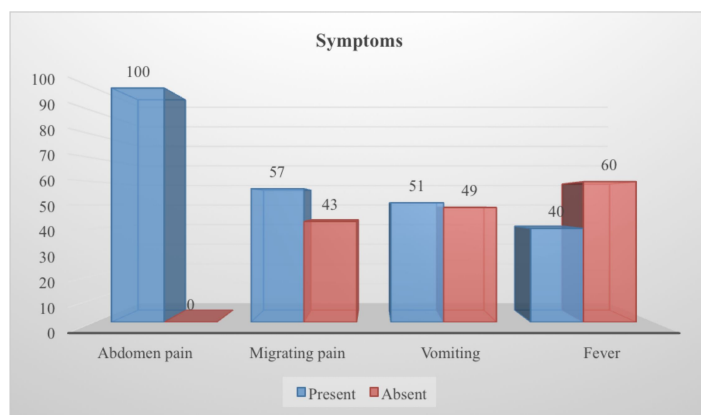
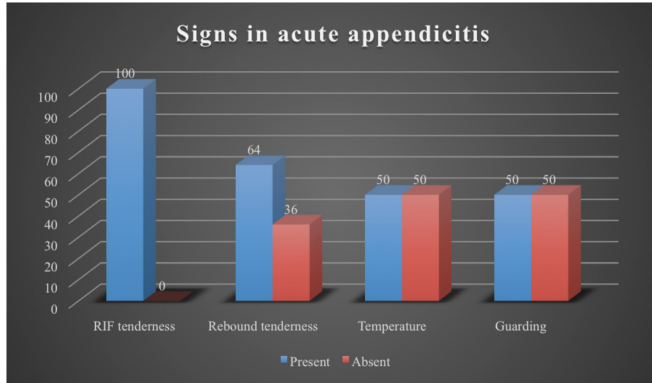


Figure 2 shows that the study 100% had RIF tenderness, 64% had Rebound tenderness, 50% had Raised temperature and 50% had Guarding.

Figure.2. Signs in acute appendicitis



Association between CRP and total Count in acute appendicitis

Table.3 In the study it was observed that there was significant association between CRP and Total count. CRP levels and total count were significantly (P <0.001) increased in acute appendicitis patients (89.6%) when compared with normal control subjects (10.4 %).

Table 3. Association between CRP and total Count in acute appendicitis

Particulars		Total Count		Total	Significance
		Normal	Abnormal		
CRP	Normal	17	7	24	P <0.001
	Increased	16	60		
Total		33	67	100	

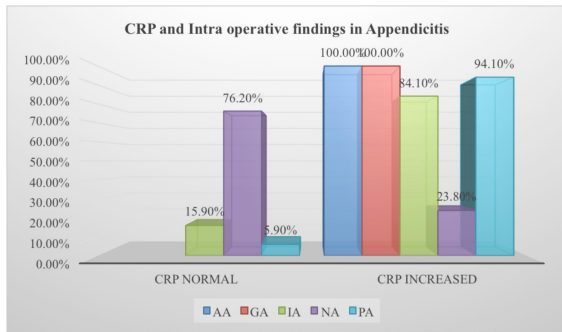
Association between CRP and DLC count in acute appendicitis

Table 4. It was observed that there was significant association between CRP and DLC in appendicitis patients. CRP was increased in 89% of Patients with increase in DLC count.

Particulars		DLC-N%		Total	Significance
		Normal	Abnormal		
CRP	Normal	17	7	24	P <0.001
	Increased	17	59		
Total		34	66	100	

Association between CRP and Intra operative findings in Appendicitis

Figure 3 observed that that CRP was increased 100% in AA, GA and PA. 84.1% increase in IA group. This observation was statistically significant.



AA- Acute appendicitis, GA – gangrenous appendicitis, IA- Inflamed appendicitis, NA- Necrotic appendicitis, PA- perforated appendicitis.

Association between CRP and Histopathology findings in Appendicitis

Table 5 showed that CRP was increased 100% in GA and PA. 88.9% increase in AA group. This observation was statistically significant.

Particulars		HPE				Total	Significance
		AA	GA	NA	PA		
CRP	Normal	7	0	16	1	24	P<0.0001
	Raised	41	29	4	2	76	
Total		48	29	20	3	100	

Diagnostic accuracy of CRP with respect to Histopathology findings in Appendicitis

Table 6. shows that the diagnostic accuracy of histopathology finding and serum CRP levels. The CRP levels were significantly associated with histopathology images in acute appendicitis patients.

Particulars	Percentage
Sensitivity	90%
Specificity	80%
Positive Predictive Value	94.74%
Negative Predictive value	66.67%
Diagnostic accuracy	88%
Cohen`s kappa	0.6512

Discussion:

Out of 100 patients, 52 (52%) were males and 48 (48%) are females. The Mean age of the subjects presenting with appendicitis was 33.8 ± 10.99 yrs. Majority of them were in the age group 20 to 25 yrs and least no of cases were observed in 46 to 50 yrs. Clinical diagnosis was found to be correct in 79% of patients and the rate of negative laprotomies for acute appendicitis in our study is 21 %. This observation is close to the observation of 19.2% in a study by Sengupta G et al¹⁴ showed in their study group of 125 patients which was confirmed by pathological diagnosis.

In the study 100% had Right Iliac Forsa (RIF) tenderness, 64% had Rebound tenderness, 50% had Raised temperature and 50% had Guarding. In the study 100% had pain abdomen, 7% had migrating pain, 51% had vomiting and 40% had fever. Various studies have investigated the value of CRP in improving the diagnostic accuracy of acute appendicitis with conflicting results. A multivariate analysis by Sengupta G et al showed CRP measurement can improve the accuracy of diagnosing acute appendicitis.

An observational study by Choudhary et al.¹⁵ was observed in a study group of 537 patients found that in acute appendicitis the CRP values are always elevated in cases of gangrenous and perforated appendicitis. Pablo Ortega et al in study group of 134 patients found that C reactive protein increased with the severity of appendicitis and predicted accurately perforation showing the highest accuracy among inflammatory markers.

In our study, serum CRP estimation in diagnosis of acute appendicitis yielded a sensitivity of 90%, specificity of 80%, positive predictive value of 94%, and predictive value of negative test 66%. It was observed that CRP was increased 100% in GA and PA.

According to Shakhathreh¹⁶, Kumar, et al¹⁷ while CRP measurement is a valuable tool in diagnosing acute appendicitis, it should not replace the clinical judgment of a surgeon. The accuracy of CRP was found to be significantly higher when combined with an abnormal total blood count. Anderson¹⁸ conducted a prospective study on 420 patients with a borderline diagnosis of appendicitis and concluded that WBC and neutrophil count are better indicators for further examinations. In our study, out of 100 patients with acute appendicitis, 33 had normal CRP and total count levels (33%). The mean CRP values in patients with simple acute appendicitis were significantly higher than in those with a normal appendix ($p < 0.001$). However, CRP measurement or leukocyte count alone cannot completely prevent a negative appendectomy.¹⁹ 88.9% increase in AA group. This observation was statistically significant. It was observed that there was significant association between CRP and DLC in appendicitis patients. CRP was increased in 89% of Patients with increase in DLC count. An Intra operative finding was observed that CRP was increased 100% in AA, GA and PA. 84.1% increase in IA group. This observation was statistically significant. Among 89.9% of appendicitis patients CRP was raised and was normal in 76.2% of normal individuals. This observation was statistically significant. Among 90.1% of appendicitis patients CRP was raised and was normal in 80% of normal

individuals. This observation was statistically significant.

There are in use different clinical classification for the acute appendicitis, but, since the correlation of CRP values with histopathology findings were studied, we used the classification that combines the gross appearance of the appendix with pathologic stage. Actually, the non-surgical initial management of acute appendicitis with catarrhalis changes (inflammation within the mucous membrane), or phlegmonous changes (inflammation in all layers) has been shown to be safe and effective.²⁰

Numerous research works have examined the histopathological results of the CRP value association associated with appendicitis. Gurleyik et al.'s investigation found that 87 out of 90 individuals with histologically confirmed illness had a CRP sensitivity of 96.6%.²¹ Shakhathreh discovered that 85 out of 89 patients with histologically confirmed appendicitis had a CRP sensitivity of 95.5%.¹⁶ Asfar et al. found that 78 patients having appendicectomies had a CRP sensitivity of 93.6%.²²

Our results, compared from other studies, clearly mentioned that CRP contributes to a more accurate prediction of the severity of acute appendicitis. However, we believe that CRP is not a specific test for appendicitis. Therefore, before making a diagnostic decision and determining the appropriate treatment, clinicians should rely on a comprehensive interpretation that includes their clinical experience, patient history, and available diagnostic tools such as laboratory tests, ultrasonography, and computed tomography. Ultimately, combining laboratory tests with imaging techniques remains essential for diagnosing acute appendicitis and ruling out other causes of acute abdominal pain

Conclusion

C reactive protein is a helpful marker in the management of patients with suspected acute appendicitis. When elevated C-reactive protein supports the surgeon's clinical diagnosis of acute appendicitis. Its found that C-reactive protein can be used to diagnose acute appendicitis and its use has reduced complication rate and avoid negative laparotomies.

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