

Serum C-Reactive Protein A Helpful Marker in Diagnosis of Acute Appendicitis

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ABSTRACT

Objective: evaluate the diagnostic accuracy of serum C-reactive protein levels in acute appendicitis (AA)

Methodology: Two hundred suspicious cases of AA presenting with pain in right iliac fossa in addition to nausea/vomiting, direct tenderness in right iliac fossa of either gender in adult population were included. Intravenous blood sample was drawn for CRP evaluation. Appendectomy was performed in all these cases, and histopathological examination was done to confirm presence/absence of AA. Both the reports were evaluated and AA was considered positive if CRP levels are >6 µg/dl. A 2x2 table was drawn to analyze diagnostic accuracy of CRP.

Results: The mean age was 27.11±10.42 years, 80.5% (n=161) cases were diagnosed as acute appendicitis on histopathology. The diagnostic accuracy of serum C-Reactive Protein levels shows 81.63% for sensitivity, 73.58% for specificity, 89.55% had positive predictive value, 50.09% negative predictive value while 79.50% had accuracy rate.

Conclusion: serum C-reactive protein levels is a useful marker for diagnosing acute appendicitis and may be used in rural areas where USG and CT scan facility is not available.

Keywords: Acute appendicitis, diagnosis, serum C-reactive protein, diagnostic accuracy

INTRODUCTION

Acute appendicitis(AA) in adults is the common medical complaint with higher rate of misdiagnosis.¹ It is reported as 2nd commonest malpractice condition in pediatric population and 3rd in adult.²⁻³ It is reported as 7% lifetime risk requiring surgical treatment.⁴⁻⁵ The annual reported incidence of this disease is around 13 per 100,000 cases, however, the rate of misdiagnoses is 3.8 to 15% in pediatrics and 5.9 to 23.5% for adult population.⁶⁻¹⁰

Lumen obstruction is a potential factor of this condition. As the inflammatory process becomes severe, obstruction rate also increases. Though, obstruction is commonly implicated, however, not identified always. Previously, it is revealed that increased intraluminal pressure is found in one-third non-perforated appendix patients.¹¹

The classical symptoms may help in straightforward diagnosis whereas atypical presentations may delay in accurate diagnosis and initiation of treatment.¹² In most of the cases, the diagnosis becomes challenging even in most experienced hands. Primary complaint in patients with acute appendicitis is abdominal pain.¹² Still, the clinical diagnosis of AA is difficult. Previous estimations reveal diagnostic accuracy falls between 70-85%¹³ of the cases and even more than 40% of the cases are hospitalized but actual have no appendicitis.¹⁴ Misdiagnosis is responsible for delay in surgery leading to perforation¹⁵⁻¹⁶ and wound related complications in negative appendectomy.¹⁴

Various approaches are introduced for improved diagnosis to reduce complication rate. Imaging techniques¹⁷ particularly CT and abdominal ultrasound are highly sensitive i.e. 90%.¹⁸ However, these medical facilities and quality staff may increase the healthcare cost.¹⁹⁻²⁰

C-reactive protein (CRP), an inflammatory marker, is a protein that is generated in the blood. As previously stated, its level in the body grows during the inflammatory process. As a result, it is recognised as one of the acute-phase reactant proteins that can be employed in illness diagnosis and prognosis. It attempts to interact with phospho-choline, which is present on the cell surface of both dead and near-dead cells in the inflammatory region, once it is created in the blood. Its interaction with phospho-choline triggers the complement cascade via the C1Q complex.

A considerable increase in CRP levels in the blood serum can aid to diagnose an inflammatory process or rule out any inflammatory disease morbidity. CRP binding has also been demonstrated with phospho-choline on the cell surface of different

bacteria, injured cells, and macrophages. This feature of CRP helps in the elimination of necrotic and apoptotic cells.

CRP in the blood is classified as an acute reactant protein, which means that its level rises sharply in the presence of inflammation anywhere in the body. When inflammation develops, macrophages and fat cells create cytokines such as IL-6. CRP rises in correlation with cytokine production. CRP binds to necrotic and apoptotic cells, directing macrophages to assault these cells as well as bacterial cells (process call opsonization). CRP also plays a role in the development of innate immunity, which serves as an early defensive system against pathogens.

Being acute phase protein C-reactive protein(CRP) is relied-on by various surgeons while diagnosing acute appendicitis. However, no conclusive data available suggesting its use while diagnosing acute appendicitis.¹³

The aim of this study was to evaluate the diagnostic accuracy of serum CRP levels for the confirmation of AA. The significance of this study is that local data is variant, which needs another study to be conducted so that the variation may be clarified according to our local population based study.

METHODOLOGY

Two hundred suspicious cases of AA presenting with pain in right iliac fossa in addition to nausea/vomiting, direct tenderness in right iliac fossa of either gender in adult population were included, and those having immuno-compromised status or suffering from other acute inflammatory conditions like tuberculosis, enteric fever, preexisting disease and pregnant females were excluded from this trial. An intravenous blood sample was obtained from all suspicious AA patients for CRP evaluation and sent to the hospital lab. Appendectomy was performed in all these cases, and histopathological examination was done to confirm presence/absence of AA. Both the reports were evaluated and AA was considered positive if CRP levels are >6 µg/dl. A 2x2 table was drawn to analyze diagnostic accuracy of CRP. We used SPSS-19 for data analysis and evaluation.

RESULTS

In this study age distribution shows 62%(n=124) were between 18-40 years and 38%(n=76) were between 41-60 years of age, mean age was 27.11±10.42 years. Gender distribution shows that 52%(n=104) were male and 48%(n=96) were females. Frequency of appendicitis on histopathology was 80.5%(n=161) whereas

19.5%(n=39) had no findings of the morbidity. (Table No. 1) The diagnostic accuracy of serum C-Reactive Protein levels for the diagnosis of acute appendicitis was calculated, it shows 81.63% for sensitivity, 73.58% for specificity, 89.55% had positive predictive value, 50.09% negative predictive value while 79.50% had accuracy rate. (Table No. 2)

Table 1: (n=200)

Variable		No. of patients	%
Age(in years)	18-40	124	62
	41-60	76	38
Gender	Male	104	52
	Female	96	48
Appendicitis on histopathology	Yes	161	80.5
	No	39	19.5

Table 2: Diagnostic Accuracy (n=200)

Serum C-reactive protein levels	Histopathology for AA	
	Present (Appendicitis)	Absent (Appendicitis)
Appendicitis Present	TP(a) 120(60%)	FP(b) 14(7%)
Appendicitis Absent	False negative(d) 27(13.5%)	True negative(c) 39(19.5%)

Sensitivity = 81.63%, Specificity = 73.58%, PPV=89.55%
NPV = 59.09%, Accuracy rate = 79.50%

DISCUSSION

The aim of this study was to evaluate the diagnostic accuracy of serum CRP levels for the confirmation of AA. The significance of this study is that local data is variant, which needs another study to be conducted so that the variation may be clarified according to our local population based study.

In this study mean age was 27.11+10.42 years, 52%(n=104)male and 48%(n=96)females. Appendicitis on histopathology was present in 80.5%(n=161). CRP levels shows 81.63%sensitivity, 73.58% specificity, 89.55%PPV, 50.09%NPV while the accuracy rate was 79.50%.

Skibber JM and others reveal sensitivity in 85.1%, specificity in 72%, PPV in 94.7% and 83.2% accuracy rate.²¹ Their findings are consistent with this study. Another study published in JPMA reveals sensitivity in 93.6%, specificity in 86.6% and PPV in 96.7%.²² Our findings are slightly different with this study. Gurleyik E and colleagues in their study²³ revealed 96.6% sensitivity of CRP levels for prediction of AA. Similarly, Shakhtrah ad colleagues²⁴ recorded 95.5% showing a higher sensitivity rate. Erkasap and others²⁵ found 96% sensitivity of CRP included 102 adult cases presenting with RLQ pain. All these studies are in favour of using CRP level while diagnosing acute appendicitis.

Falak Sher and others²⁶ in 2019 verified our results by calculating sensitivity in 92.86%, specificity in 78.26%, PPV in 94.39%, NPV 69.23% and rate of accuracy in 90.37%. Another recent study in 2022 in India by Raheel Hussan Naqvi and colleagues evident that raised CRP levels in AA acute and this marker is helpful to reduce the risk of negative appendectomy.²⁷ Tugay Tartar and colleagues concluded that lower CRP levels are helpful to rule out acute appendicitis, however, the study was conducted in children.²⁸

There are various other studies on many other serological markers relating to detection of AA, few are efficient but we kept in mind ground realities of our available health care system, where cost and availability are the major concerns, however, we chose CRP which is widely available and highly sensitive for AA.

Finally, our results are clear regarding efficient role of CRP for diagnosing of AA, this marker is useful particularly in areas where imaging facility is limited in Pakistan.

CONCLUSION

We found serum C-reactive protein levels as a useful marker for diagnosing AA, and it may be used in rural areas where imaging facility is not available.

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