

VALUE OF TOTAL LEUCOCYTE COUNT AND C-REACTIVE PROTEINS IN THE DIAGNOSIS OF ACUTE APPENDICITIS

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ABSTRACT

- Objective* To find out the predictive value of total leucocytes count and C-reactive proteins (CRP) in the diagnosis of acute appendicitis.
- Study design* Cross sectional study.
- Place & Duration of study* Surgical unit 1, Department of Surgery, Jinnah Postgraduate Medical Center Karachi, from November 2006 to April 2007.
- Patients and Methods* A total of 50 patients attending emergency department with provisional diagnosis of acute appendicitis were included. All patients were evaluated by clinical features and their total leucocytes count and C-reactive protein levels were checked and compared with histopathological report which is gold standard for the diagnosis of acute appendicitis.
- Results* Positive predictive value of total leucocyte count was 90.6% and negative predictive value was 44.4% with accuracy of diagnosis of 74%. Positive predictive value of C-reactive protein was 97.1% and negative predictive value was 62.5% with accuracy of diagnosis of 86%.
- Conclusions* The diagnosis of acute appendicitis can be made confidently with excellent history and proper examination. Total leucocyte count and C-reactive protein levels estimation can be helpful in the diagnosis of doubtful cases of right iliac fossa pain. When measured together it increases their diagnostic value.
- Key words* Acute appendicitis, Total leucocyte count, C-reactive proteins.

INTRODUCTION:

The importance of appendix in surgery is due to its propensity for inflammation that results in a clinical syndrome, known as acute appendicitis. Acute appendicitis is a common surgical condition, requiring emergency surgery. The diagnosis may be incorrect or overlooked. This error leads to an unnecessary operations or become the reason for delay.¹ Lonzeno, a professor of surgery at Helmstedt, in 1711, was the first to suggest the appendix as the likely site of inflammation and abscess formation in acute typhilitis.

Being most frequent in 2nd and 3rd decade of life, it can affect individuals of all ages and both sexes. There is no way to prevent the development of acute appendicitis. The only way to reduce the morbidity and mortality is to perform appendicectomy before the occurrence perforation or gangrene.

In spite of various investigations used to improve the accuracy of diagnosis, the rate of normal appendices removed can be as high as 15-30%.² Despite extraordinary advances in modern radiographic imaging and diagnostic laboratory investigations, the diagnosis of appendicitis remains essentially clinical requiring a mixture of observation, clinical acumen and surgical science.

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White cell count (WCC), an acute phase reactant and

C-reactive proteins (CRP) are regularly measured in patients with suspected appendicitis and may improve the accuracy of diagnosing acute appendicitis.^{3,4} Within few hours after the exposure to an acute inflammatory stimulus, there is a sharp increase in the serum concentration of C-reactive proteins in the body. The doubling time of this protein is 4-11 hours and peak levels occurs at 2-3 days.⁵

New diagnostic techniques such as peritoneal aspiration cytology, scoring and computer analysis, graded compression ultrasonography, computed tomography and laparoscopy have been introduced in recent years.^{6,7} The draw back with these techniques is the involvement of additional cost and lack of free availability. Due to these factors these modalities have not gained wide acceptance as a routine diagnostic investigation of acute appendicitis. The objective of the study was to determine the value of total leucocytes count and C-reactive proteins in the diagnosis of acute appendicitis.

METHODOLOGY:

The study was conducted in Surgical unit 1 (ward-3), Jinnah Postgraduate Medical Center Karachi, from November 2006 to April 2007. This was a cross-sectional study with non-probability, purposive sampling. It included 50 patients above 12 years of age who were diagnosed as acute appendicitis on the basis of presenting symptoms and signs. Patients with appendicular lump and age above 60 years with co-morbid such as hypertension, diabetes mellitus, tuberculosis and bleeding disorders, were excluded.

Total leukocyte count (TLC), and C-reactive proteins were measured in all patients who were planned to undergo appendectomy on clinical grounds. Routine tests including CBC, blood sugar, urine D/R, x-ray plain abdomen in erect posture and ultrasound were carried out in selected cases. Informed consent was taken. All the specimens were sent for histopathology. All relevant features were recorded on pre-designed proforma.

Data analysis was performed through SPSS version-10. Ratio (M: F) was computed to present sex distribution. Age of the patients was presented by mean ± standard deviation. Frequencies and percentages were computed for presentation of all categorical variables like patient's presenting complaints, signs/symptoms of acute appendicitis, raised total/ differential leukocyte counts, C-reactive proteins and histopathological results. Sensitivity analysis was performed to compute sensitivity, specificity, accuracy, positive and negative predictive values of C-reactive proteins and TLC in the diagnosis of acute appendicitis on the basis of histopathology as gold standard criteria.

RESULTS:

Among 50 patients operated as cases acute appendicitis, 40 (80%) were males and 10 (20%) females with a ratio of 4: 1. Mean age was 23.1 ± 7.53 years (range 13 to 45 years). In 39 clinically suspected patients the diagnosis was same on histopathology while 11 were found negative. In 13 (26%) patients on histopathology the report was acute appendicitis, 24 (48%) were acute suppurative appendicitis, 9 (18%) were lymphoid hyperplasia and 4 (8%) normal appendix.

Suspicion of acute appendicitis on C-reactive proteins was considered negative. Out of 39 confirmed cases on histopathology, 33 positive cases on C-reactive proteins were true positive yielding 84.6% sensitivity of C-reactive proteins while 6 cases were false negative. Out of 11 confirmed negative cases on histopathology, 10 negative cases on C-reactive proteins were true negative yielding 90.9% specificity of C-reactive proteins. Out of 34 positive cases on C-reactive proteins, 33 cases were true positive that revealed 97.1% positive predictive value of C-reactive proteins in the diagnosis of acute appendicitis. Out of 16 cases that were negative on C-reactive proteins, 10 cases were true negative with 62.5% negative predictive value. Overall accuracy of C-reactive protein in the diagnosis of acute appendicitis was 86% (table-I).

Table-I: Predictive Value of C-Reactive Protein in the Diagnosis Acute Appendicitis:

	Histology (Gold standard)		
	Positive	Negative	Total
Positive	33 (TP)	1 (FP)	34
Negative	6 (FN)	10 (TN)	16
Total	39	11	50

TP = True positive, FP = False positive, FN = False negative, TN = True Negative
 Sensitivity = TP/ (TP+FN)*100 = 84.6%
 Specificity = TN/ (FP+TN)*100 = 90.9%
 Positive predictive value = TP/ (TP+FP)*100 = 97.1%
 Negative predictive value = TN/ (TN+FN)*100 = 62.5%
 Accuracy = (TP + TN)/ (TP+TN+FP+FN) * 100 = 86%

Out of 39 confirmed cases on histopathology, 29 positive cases on TLC typically > 10,000 were true positive yielding 74.4% sensitivity of TLC while 10 cases were false negative. Out of 11 confirmed negative cases on histopathology, 8 negative cases on TLC were true negative yielding 72.7% specificity of TLC. Out of 32 positive cases on TLC, 29 cases were true positive that

revealed 90.6% positive predictive value of TLC in the diagnosis of acute appendicitis. Out of 18 cases that were negative on TLC, 8 cases were true negative that revealed 44.4% negative predictive value. Overall accuracy of TLC in the diagnosis of acute appendicitis was 74% (Table-II). In comparison of both diagnostic modalities, C-reactive protein has shown greater positive predictive value than TLC, however this difference of positive proportions was not statistically significant (97.1% vs. 90.6%, p=0.07).

Table-II Predictive Value of Total Leukocyte Count In The Diagnosis Acute Appendicitis			
	Histology (Gold standard)		
	Positive	Negative	Total
Positive	29 (TP)	3 (FP)	32
Negative	10 (FN)	08 (TN)	18
Total	39	11	50

TP = True positive, FP = False positive, FN = False negative, TN = True Negative
 Sensitivity = $TP / (TP+FN) * 100 = 74.4\%$
 Specificity = $TN / (FP+TN) * 100 = 72.7\%$
 Positive predictive value = $TP / (TP+FP) * 100 = 90.6\%$
 Negative predictive value = $TN / (TN+FN) * 100 = 44.4\%$
 Accuracy = $(TP + TN) / (TP+TN+FP+FN) * 100 = 74\%$

DISCUSSION:

The role of C-reactive proteins and total leucocytes count in patients with acute appendicitis has been extensively studied in adult patients with conflicting results.⁸ In this study the overall accuracy of CRP in the diagnosis of acute appendicitis was 86%. Afsar et al found positive and negative predictive value of CRP as 96.7% and 76.5% respectively and suggested that normal CRP level is not associated with acute appendicitis, which is comparable to our study.⁹ Amalesh et al found positive and negative predictive value of CRP as 88% and 48% respectively and contrary to the most of literature concluded, neither raised nor normal CRP value are helpful in the diagnosis of acute appendicitis.² Khan MN, Horng-Ren Yang and Beltrad et al in their studies also suggested the use of CRP to support the diagnosis of acute appendicitis.^{8,10,11} Wu et al went one step ahead and, proposed the addition of CRP measurement as a routine laboratory test in patients suspected of having acute appendicitis.⁷

In this study we found over accuracy of TLC in diagnosis of acute appendicitis as 74%. Yildirim et al also found

positive and negative predictive value of acute appendicitis as 92.5% and 50% which is comparable to this study.¹² He found positive and negative predictive value of CRP as 90% and 30% respectively showing superiority of TLC over CRP which is contrary to this study. Fergusson et al recommended the measurement of TLC in equivocal cases of acute appendicitis and if the count is >15000 should proceed to appendicectomy.¹³ If the TLC is <11000 then further investigation with abdominal CT should be performed. Birchley concluded that laboratory tests of the white cell count, neutrophil count and C-reactive proteins are more effective in supporting a clinical diagnosis of acute appendicitis in patients with typical clinical features than in excluding the diagnosis.¹⁴

CONSLUSIONS

The diagnosis of acute appendicitis can be made confidently with history and proper examination. Total leucocyte count and C-reactive proteins can be helpful in the diagnosis of doubtful cases of right iliac fossa pain. When measured together increases their diagnostic value with more reliable positive predictive value than negative predictive value.

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