Original Article

Acute Appendicitis

C-Reactive Protein and Total Leukocyte Count in the Diagnosis of Acute Appendicitis

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ABSTRACT

Objective: The objective was to calculate the sensitivity and specificity of C reactive protein and Total leukocyte count by taking histopathological diagnosis of acute appendicitis as the gold standard.

Study Design: Observational study

Place and Duration of Study: This study was conducted in the Surgical Unit of Lady Reading Hospital, Peshawar from January 2014 to December 2014.

Materials and Methods: The study included 50 adult patients of either gender with clinical diagnosis of acute appendicitis. The patients were admitted through the emergency department. The decision to operate was made by the senior surgeon on call, on the basis of clinical features. All the cases were operated within 12 hours' of admission. Blood samples for Total leukocyte count and C-reactive protein measurement were collected from all the patients before surgery. Operative findings were recorded. Removed appendices were sent for histology. The data was entered and processed on the SPSS 16 version.

Results: The patients included 32 males and 18 females. Male to female ratio was 1.8:1. Mean age was 24 years. Frequency of negative appendicectomy was 16%. Sensitivity, specificity and positive predictive value of Total leukocyte count were 80.5%, 62.5% and 91.8% respectively. Sensitivity, specificity and positive predictive value of C-reactive protein were 85.7%, 75% and 94.5% respectively. In patients with histopathologically confirmed acute appendicitis, both the TLC and C - reactive protein were found to be statistically significant.

Conclusion: C-reactive protein and Total Leukocyte Count supplement the clinical diagnosis of acute appendicitis.

Key Words: Appendicitis, Total leukocyte count, C-reactive protein, Appendicectomy

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INTRODUCTION

Appendicitis is one of the commonest acute surgical conditions of the abdomen,[1,2] with a life time cumulative incidence of 8.6% for men and 6.7% for women.[3] The diagnosis of appendicitis is made primarily on the basis of patient's history and clinical examination.[3,4] A typical patient presents with right lower abdominal pain, nausea, vomiting and anorexia. He has tenderness, rebound tenderness and guarding in right iliac fossa. However, the clinical features are not specific for appendicitis and can mimic other acute abdominal conditions.[3,5-7] Variable position of the appendix further adds to the diagnostic difficulty. Consequently appendicitis remains a difficult diagnosis.[3, 4]

The percentage of negative appendectomies varies between 10% and 30%.[3,8,9] The reported post-operative morbidity associated with these negative explorations is 5-15%.[3,8] The overall accuracy for diagnosing acute appendicitis clinically is about 80%.[3,4] It is considerably low at extremes of age and in females of child bearing age.[3,4,6,7] It also varies according to the experience of surgeon.[3] In most cases junior surgeons and residents have to diagnose and decide whether to operate or not. Hence the diagnostic accuracy can be quite low.

Therefore, additional tests, which would improve the diagnostic accuracy and reduce the number of unnecessary operations, are needed. These investigations range from simple laboratory tests like Total Leukocyte Count (TLC), Differential Leukocyte Count (DLC), to more sophisticated and expensive radiological investigations like: helical CT scan, MRI scan and radio labelled studies.[3]

TLC is the most commonly used test. Unfortunately it is also elevated in patients with other causes of right lower quadrant pain. Many studies have suggested that it has low specificity.[3,4,6] A recently suggested test is the measurement of C- reactive protein (CRP) level in serum. However, role of CRP in the diagnosis of acute appendicitis is contoversial.[4,5,10]

In this study the sensitivity, specificity and positive predictive value of TLC and serum CRP in patients

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with clinical diagnosis of acute appendicitis were checked. The purpose of this study was to see whether simple investigations like TLC and CRP help in the diagnosis of acute appendicitis.

MATERIALS AND METHODS

An observational study was conducted in surgical unit of Lady Reading Hospital, Peshawar during the period from Jan 2014 to Dec 2014. The study included 50 patients above 12 years of age, of either gender with clinical diagnosis of acute appendicitis. The criteria for diagnosis of acute appendicitis were pain in right iliac fossa, tenderness and rebound tenderness in the same region. Patients with generalized abdominal pain, appendicular mass, patients with coexisting conditions like recent myocardial infarction, known malignancy, rheumatic disorders, respiratory tract infection were excluded from the study. Informed consent was taken from all the patients before including them in the study. All the cases were assessed by the senior surgeon on call and operated within 12 hours' of admission. The decision to operate was made on the basis of clinical features. Blood samples for TLC and CRP measurement were collected from all the patients before going to operating room. The cut-off value for TLC was $11x10^6$/L. Quantitative CRP was measured in serum by Fluorescence Polarization Immunoassay (FPIA) technology. Normal CRP level in our laboratory was less than 1.0 mg/dl. Preoperative care included intravenous fluid resuscitation and broad spectrum antibiotics. Appendicectomy was done through Gridiron muscle spitting or small transverse incision. Operative findings were recorded. Removed appendix was sent for histological examination in each case. The results were used to get the frequency of negative appendicectomy. All the data was entered on a pre-designed proforma. The proforma included: demographic detail of the patient, TLC, serum CRP level, operative and histological findings. All the data was processed on the SPSS 10 version. The results of the tests were subjected to statistical analysis using the same program. Sensitivity and specificity of TLC and CRP were calculated by taking histopathological finding as the gold standard. P value of less than 0.05 was considered as significant.

RESULTS

During the study period, a total of 50 patients were admitted through the accident and emergency department of the hospital, with the clinical diagnosis of acute appendicitis. The patients included 32 males and 18 females. Thus, males out numbered the female patients. Male to female ratio was 1.8:1. Age distribution ranged from 12-55 years with mean being 24 years. In 8 cases (16 %) appendix was found to be normal on histopathology. Out of these, 3 cases (37.5%) were males and 5 cases (62.5%) were females. Sensitivity, specificity and positive predictive value (PPV) of TLC were 80.5%, 62.5% and 91.8% respectively, as shown in table 1. Sensitivity, specificity and PPV of CRP were 85.7%, 75% and 94.5% respectively, as shown in table 2. In patients with histopathologically confirmed acute appendicitis, both the TLC and CRP were found to be significant, p=0.021 and p=0.001 respectively.

Table No.1: TLC and histopathology

Histopathological Diagnosis	TLC $<11x10^6$/L	TLC $>11x10^6$/L	Total
Acute Appendicitis	8 (FN)	34 (TP)	42
Normal Appendix	5 (TN)	3 (FP)	8
Total	13	37	50

Sensitivity= TP/TP+FN= 34/34+8= 80.5%
Specificity= TN/TN+FP= 5/5+3= 62.5%
Positive Predictive Value= TP/TP+FP= 34/34+3=91.8%
P value=0.021

Table No. 2: CRP and histopathology

Histopathological Diagnosis	Serum CRP (<1mg/dl)	Serum CRP (>1mg/dl)	Total
Acute Appendicitis	6 (FN)	36 (TP)	42
Normal Appendix	6 (TN)	2 (FP)	8
Total	13	37	50

Sensitivity= TP/TP+FN= 36/36+6= 85.7%
Specificity= TN/TN+FP= 6/6+2= 75 %
Positive Predictive Value= TP/TP+FP= 35/35+2= 94.5%
P value=0.001

DISCUSSION

Acute appendicitis is a common surgical emergency. [3] It is a disease of the young [11, 12] In this study the mean age was 24 years. This is consistent with the results reported from other studies [11, 13-15] However no age is immune, the age range in this study was from 12 years to 55 years which conforms with the findings of other studies.[11,12,16,17] Moreover, in all age groups male preponderance was noted. Male to female ratio was 1.8:1. These observations are similar to those observed in other studies.[11,12,14,16,18,19]

Accurate clinical diagnosis of acute appendicitis is difficult. Diagnosis may be delayed in some patients leading to increased risk of perforation, gangrene and abscess formation. On the other hand, removal of a normal appendix is also not uncommon. Negative appendicectomy is associated with significant morbidity.[16,20,21] According to a study by Flum et al[22] stated that negative appendicectomy is associated with a significantly longer hospital stay, higher total cost, case fatality rate and rate of infectious complications.

In this study, frequency of negative appendicectomy was 16% and most of these were females (62.5%). Except for a few reports of rate of negative appendicectomy below 10%,[12,13,23] recent studies report the rate between 10% and 30%.[11,14,16-18.,24] A study has

reported that women, patients younger than 5 years and older than 60 years have higher rate of negative appendicectomy.[22]

TLC is widely used to aid the diagnosis of acute appendicitis. Its diagnostic value varies from useful to misleading.[12,16] Many studies have been done on the diagnostic value of TLC in appendicitis with conflicting results.[12,16,25,26]

In this study, the sensitivity, specificity and PPV of TLC were 80.5%, 62.5% and 91.8% respectively. These findings are consistent with that of other studies.[12,16,18] Raised TLC is regarded as a sensitive test for acute appendicitis but is not diagnostic because of its relatively low specificity.[12,16,20] Many studies have suggested a more supportive role for TLC in the diagnosis of acute appendicitis.[27,28]

Recently attention has been focused on other inflammatory markers which can be raised in acute appendicitis. CRP is one of them. It is an acute phase protein, produced in the liver in response to tissue trauma, inflammation. Several studies have been done on the role of CRP in the diagnosis of appendicitis.[12,16-18,28,29]

In this study the sensitivity, specificity and PPV of CRP in the diagnosis of acute appendicitis were 85.7%, 75% and 94.5% respectively These figures are consistent with the results reported in other studies.[12,16-18,28,29]

Afsar et al[30] in a prospective study reported that the sensitivity, specificity and PPV of CRP were 93.6%, 86.6% and 96.7%. The author concluded that normal CRP level was unlikely to be associated with acute appendicitis. However, some authors have suggested that CRP is more effective in supporting the clinical diagnosis of acute appendicitis than in excluding it.[28,31,32] According to Shakhatreh CRP is very helpful in the diagnosis of acute appendicitis but it does not replace the clinical skills of a surgeon.[2] CRP alone is not effective in preventing negative appendicectomies.[33] Studies have reported that the frequency of negative appendicectomy can be reduced if CRP is added to other lab tests.[33,34] A prospective study done in Scotland showed that the sensitivity, specificity and PPV of CRP were 75.6%, 83.7% and 96% respectively.[16] The study also concluded that the specificity and PPV increased if TLC and CRP were used together.[16].

CONCLUSION

CRP and TLC supplement the clinical diagnosis of acute appendicitis. These tests should be used together. These are readily available and of particular value to a junior surgeon making the diagnosis of appendicitis.

Conflict of Interest: The study has no conflict of interest to declare by any author.

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