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## RESEARCH ARTICLE

### CORRELATION BETWEEN TOTAL LEUKOCYTE COUNT (TLC), C REACTIVE PROTEIN (CRP), LACTATE DEHYDROGENASE (LDH) AND ULTRASONOGRAPHIC FINDINGS WITH PER-OPERATIVE FINDINGS IN CASES OF ACUTE APPENDICITIS

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##### Key Words:

**CRP:** C reactive protein,  
**HPE:** Histopathological Examination,  
**LDH:** Lactate Dehydrogenase,  
**TLC:** Total Leucocyte Count,  
**USG:** Ultrasonography.

#### ABSTRACT

**Background and Objectives:** Acute appendicitis is most common surgical emergency and Appendicectomy for same is a common procedure. The rate of negative appendicectomies remains high despite several technical advancements. The study aims to compare few investigations like Total leucocyte count (TLC), C-reactive protein (CRP), Lactate dehydrogenase (LDH) and Ultrasonographic (USG) with per-op findings. Histopathologic examination (HPE) report will be taken as confirmatory test. The need to study is to find out which is the most sensitive and specific investigation that can help us improve our diagnosis of acute appendicitis. **Methods:** The study was conducted in 100 consecutive patients of Acute Appendicitis at an Armed Forces Tertiary Care Hospital. Total leucocyte count (TLC), C-reactive protein (CRP), Lactate dehydrogenase (LDH) and Ultrasonographic (USG) findings were noted preoperatively. Per-operative findings were noted in all the patients. Histopathologic examination (HPE) of appendicectomy specimen was done in all cases. All investigations and USG findings were compared with per-operative findings and with HPE findings. **Results:** CRP has highest sensitivity and specificity (90%, 80%) followed by, USG (87.5%, 90%), WBC count (78.75%, 80%) and LDH (77.5%, 80%). When all the four tests are combined the sensitivity, specificity, positive predictive value and predictive value of negative test increased significantly (100%, 80%, 95.23%, 100% respectively). When all the four tests were negative, appendicitis could be safely ruled out and surgery could be avoided. **Conclusion:** With all the four tests were negative, appendicitis was ruled out and surgery was avoided thereby decreasing the rate of negative appendicectomy to 09%. TLC, CRP, LDH, USG should be used as aids in diagnosis of appendicitis. However no investigation can undermine the importance of clinical judgment. Good history and examination still remains the most valued tools in cases of acute appendicitis.

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## INTRODUCTION

Acute appendicitis is most common cause of right iliac fossa pain and one of the most common cause of surgical emergencies (Harold, 1997). Its diagnosis is established by surgeon's clinical impression depending upon presenting history, clinical evaluation and laboratory tests. Acute appendicitis with protean manifestations may stimulate almost any other acute abdominal condition and in turn may be mimicked by a variety of conditions (Brown, 2000). It is estimated that accuracy of clinical diagnosis of acute appendicitis is 76-92 % (John, 1993). Appendicectomy for suspected acute appendicitis is a common procedure. The rate of normal appendices unnecessarily removed remains high (15-30%) (O' Connel, 2004) despite several technical advancements.

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On the other hand a delayed diagnosis may lead to perforation and peritonitis. Perforation may occur in up to 35% of cases (Borushok *et al.*). So, traditionally surgeons have accepted a higher incidence of unnecessary appendicectomies in order to decrease the incidence of perforation. This approach is being questioned in today's era of evidence based medicine. High rate of negative explorations for appendicitis is burden not only faced by surgeon but patients and society as a whole (Shakhatresh, 2000). The study aims to compare few investigations like Total leucocyte count (TLC), C-reactive protein (CRP), Lactate dehydrogenase (LDH) and Ultrasonographic (USG) with per-op findings.

#### Aims and Objectives

- 1) To determine specificity, sensitivity, predictive value of positive test and predictive value of negative test of CRP, TLC, LDH, USG in diagnosing acute appendicitis.
- 2) To interpret the efficacy of combining all the investigation in same patients

- ) To interpret how these investigations can be used effectively to improve diagnosis and decision making of acute appendicitis and hence reduce negative appendicectomies.

## MATERIALS AND METHODS

The study was performed on 100 cases of Acute Appendicitis and those subjected for emergency appendicectomy in an Armed Forces Tertiary Care Hospital over a span of 01 year.

**Inclusion criteria:** All patients irrespective of age and sex diagnosed clinically to have Acute Appendicitis and subjected to emergency Appendicectomy.

### Exclusion criteria

- ) Patients with co-morbid conditions.  
 ) Patients managed conservatively.  
 ) Patients admitted for interval appendicectomy following recurrent appendicitis or appendicular mass previously treated conservatively.  
 ) Concomitant conditions where CRP/Leukocyte count/LDH is elevated in acute appendicitis patients with associated diseases like Rheumatoid arthritis, SLE, Glomerular nephritis, Gout, Inflammatory bowel disease or Pancreatitis.

The diagnosis of acute appendicitis was made based on clinical signs and symptoms. Patients were subjected to routine investigations and pre anaesthetic work up as per the hospital protocol. CRP, Total leukocyte count and LDH was done in all cases. TLC count of more than 10,000 cells/mm<sup>3</sup> was considered positive. CRP more than 6 mg/dl was considered to be positive. LDH more than 490mg/dl was considered positive. Ultrasonography of abdomen was done in all the cases to confirm diagnosis and rule out other causes of pain abdomen. After obtaining consent, patient was operated, Per-operative findings were noted and the specimen was sent for histopathological examination. The histopathology report was considered as the final diagnosis. The patients were meticulously monitored in the post operative period for any complications and were followed as outpatient cases for 02 months

## RESULTS

- ) Out of 100 patients, 70 (70%) were males and 30 (30%) are females, so male predominance was present in the study. The common age group of the study was 20 – 29 years followed by less than 20 years.  
 ) Clinical diagnosis was found to be correct in 80% of cases and hence the rate of negative laparotomies for acute appendicitis in our study was 20%.  
 ) Out of 20 patient who were HPE negative 12 (60%) were females and 8 (40%) were males.  
 ) The specificity, sensitivity, predictive value of positive test and predictive value of negative test of CRP, TLC, LDH, USG and there accuracy in diagnosing acute appendicitis is as shown in Figure 1.

It was observed that none of the cases of acute appendicitis had all the four tests within normal limits. The predictive value of negative test in our study is 100 % i.e. if all four tests are negative acute appendicitis can be excluded. Also combining

the tests increases the sensitivity, specificity and predictive value of positive tests. The significance of association of combining the tests and their role in diagnosing acute appendicitis is found to be very high.

## DISCUSSION

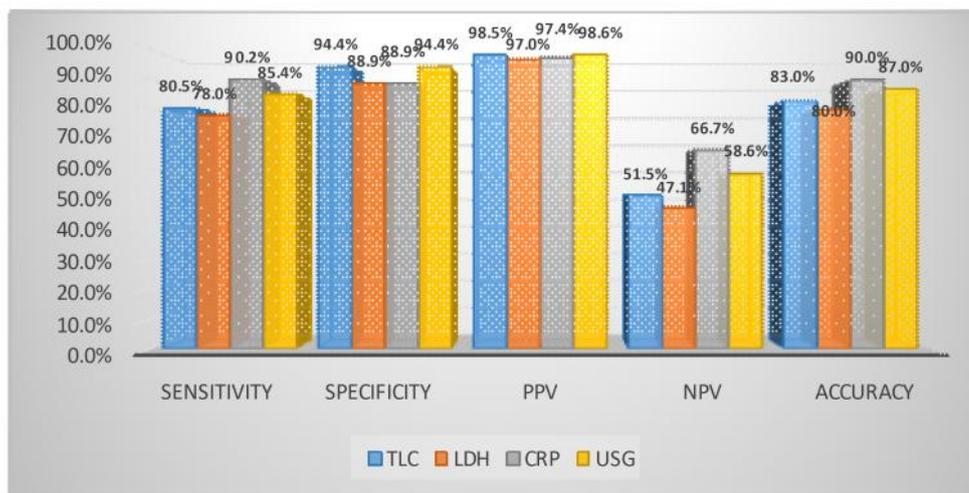
Acute appendicitis is most common condition which is diagnosed clinically with an accuracy of 76-92 % and the rate of appendicectomy for normal appendix is high (15-30%). To avoid negative explorations a variety of test and radiographic methods are available which have been evaluated in the study.

**TLC count:** Polymorphic leucocytosis as an important feature for diagnosing acute appendicitis. 80- 85% patients with acute appendicitis will have a total WBC count of over 10,000/cu mm (English, 1977; Bolton, 1975). Neutrophilia of > 75% will occur in 78% patients (Bolton, 1975). However, TLC is raised in 20-70% of patients with other causes of acute right iliac fossa pain. Leucocytosis increases with the duration of the disease process, but even a perforated appendix may present with a normal TLC. Although a raised white cell count is highly sensitive test for acute appendicitis, it is rendered almost useless due to its low specificity and it has little diagnostic value. The TLC count when done individually distinguishes normal appendix from uncomplicated acute appendicitis. But does not distinguish uncomplicated from complicated appendicitis. In our study association of TLC count and acute appendicitis is significant.

**LDH:** Lactate Dehydrogenase (LDH) is a hydrogen transfer enzyme that catalyzes oxidation of Lactate to pyruvate. Acute appendicitis associated cell damage and that associated with its complications is bound to raise LDH levels. However there is paucity of studies on LDH in cases of acute appendicitis. In our study the association is found to be significant.

**C-REACTIVE PROTEIN:** Many reports have investigated the value of CRP in improving the diagnostic accuracy of acute appendicitis with conflicting results. A meta-analysis of 22 published articles concluded that CRP is a test of medium accuracy in diagnosing acute appendicitis (Thimsen, 1989). Our study proves the adjunct value of serum CRP estimation in suspected cases of acute appendicitis. In this study, none of the cases with appendicular perforation or abscess formation had normal CRP. The test becomes positive if symptoms are present for more than 12 hours. And were also found to increase with an advancing stage of the appendiceal inflammation found at operation and the length of pre-operative phase of illness.

**USG Abdomen:** It is done in every case of pain abdomen to identify the patient with acute appendicitis and to identify an alternative explanation for their right lower quadrant pain (Stephanie, 2005; Puylaert, 1993; Clive A Barrtan, 1994). It is an accurate, safe and reliable method to minimize negative appendicectomies and perforation rate. The study by Zoller *et al.* (1996) states that negative laparotomies could be decreased by 7% and possible differential diagnosis could be either confirmed or ruled out by using ultrasound. David *et al.* in his study stated that USG Abdomen and pelvis is safe, and useful investigation, but in his study 24% patients with normal USG had acute appendicitis; therefore they state that USG Abdomen cannot be relied on to completely exclude the diagnosis. Our study showed high association between USG as a diagnostic tool for acute appendicitis.



**Figure 1. The specificity, sensitivity, predictive value of positive test and predictive value of negative test of CRP, TLC,LDH, USG and there accuracy in diagnosing acute appendicitis**

The significance of association of combining the tests and their role in diagnosing acute appendicitis is found to be very high.

### Conclusion

CRP has highest sensitivity and specificity (90%, 80%) followed by, USG (87.5%, 90%), WBC count (78.75%, 80%) and LDH (77.5%, 80%). When all the four tests are combined the sensitivity, specificity, positive predictive value and predictive value of negative test increased significantly (100%, 80%, 95.23%, 100% respectively). When all the four tests were negative, appendicitis could be safely ruled out and surgery could be deferred in those patients thereby decreasing the rate of negative appendicectomies to 09%. However history and clinical examination by a skilled practitioner still remains indispensable in diagnosing acute appendicitis. All the above tests can be kept in diagnostic workup of the surgeon to aid the clinical diagnosis.

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