Original Article

VALIDITY OF TOTAL LEUCOCYTES COUNT AND NEUTROPHIL COUNT (DIFFERENTIAL LEUCOCYTES COUNT) IN DIAGNOSING SUSPECTED ACUTE APPENDICITIS

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ABSTRACT

Objective: To compare the diagnostic accuracy of Total Leucocytes Count (TLC) with Neutrophil count; Differential Leucocytes Count (DLC) in diagnosing cases of suspected acute appendicitis.

Study design: Validation study.

Place & duration of the study: Department of Surgery, Combined Military Hospital (CMH) Rawalpindi, from April 2008 to October 2008.

Method: A total of 100 patients of Pain right iliac fossae who underwent appendicectomy were included. Detailed history of all the patients was taken for pain in right lower abdomen, its severity, its nature, relieving or provoking factors. Clinical examination was done in detail. Total and Differential Leucocytes Count was done. Every patient's appendix was examined grossly after appendicectomy for evidence of appendicitis. Diagnostic measures of TLC and DLC were calculated by standard formulas.

Results: Sensitivity and specificity of TLC is 86.9% and 81.25% respectively and that of DLC is 82% and 68.75% respectively. Accuracy was 86% for TLC and 80% for DLC.

Conclusion: TLC is more sensitive, specific and accurate test as compared to DLC and it should be used as diagnostic aid for suspected acute appendicitis cases.

Keywords: Acute appendicitis, Total Leukocyte count (TLC), Differential Leukocyte Count (DLC)

INTRODUCTION

Acute appendicitis is the most commonly encountered surgical emergency with a life time prevalence of one in seven[1]. Acute Appendicitis is the most frequent cause of persistent and progressive abdominal pain for all ages[2], accounting for 10% of all abdominal surgeries[3] and one third of all pediatrics hospital admissions with acute abdominal pain[4]. It is very important to differentiate between acute appendicitis and other causes of acute abdominal pain, as undue delay can result in an increased incidence of complications[5]. A number of conditions compete with the diagnosis of acute appendicitis for the pain in the right iliac fossa; common differential diagnosis being ureteric colic, perforated duodenal ulcer in males, and salpingitis, pyelonephritis and ectopic pregnancy in females[6].

Diagnosis of acute appendicitis is made primarily on the basis of the history and the physical findings, with additional assistance from laboratory investigations. Although most patients with acute appendicitis can easily be diagnosed, for many of them the signs and symptoms are variable and a firm diagnosis can be difficult. This is particularly true when the appendix is in the retrocecal or the retroileal position. The diagnosis is mainly clinical but because of myriad presentation and is correct in up to 80% of the patients[7]. As the consequences of missed diagnosis are dire, the common surgical practice has been to operate on doubtful cases rather than to wait and see till the diagnosis is certain.

The percentage of appendectomies performed where the appendix is subsequently found to be normal varies between 15% and 30%[8,9] and postoperative complications can occur in up to 50% of these patients[10]. The removal of normal appendix is not a benign procedure and negative appendicectomy carries a definitive morbidity[11].

Clinical judgment still remains the important diagnostic tool for acute

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appendicitis[12]. Various methods and scoring systems have been devised to diagnose acute appendicitis including serum Lactate Dehydrogenase levels, C-Reactive Proteins, Erythrocyte Sedimentation Rate, Blood Total Leucocytes Count and Differential Leucocytes Count levels. WCC and C-reactive protein can be helpful in the diagnosis, when measured together as this increases their positive predictive value[13,14].

Total Leukocyte count (TLC) is one of the helpful investigations in diagnosis of acute appendicitis. Leukocytes count>11,000 is usually present in patients with acute, uncomplicated appendicitis and is often accompanied by a moderate polymorphonuclear / redominance[15]. Differential leukocyte count is another investigation which can be helpful for diagnosis. DLC is mainly based on neutrophils count and neutrophils > 80% means there is some problem.

Our aim was to find out a test which is noninvasive, inexpensive and readily available which is highly sensitive, specific and accurate. Therefore this study was carried out to compare the diagnostic accuracy of Total Leucocytes Count with Neutrophil count (Differential Leucocytes Count) in diagnosing cases of suspected acute appendicitis.

PATIENTS AND METHODS

This validation study was carried out from April to October 2008 at the department of surgery, Combined Military Hospital (CMH) Rawalpindi, Pakistan

Inclusion Criteria

All clinically diagnosed cases of acute appendicitis undergoing appendicectomy of any age and both males and females.

Exclusion Criteria

Any patient already in immunosuppressive state or drugs, patients having fever or diabetes.

Data Collection Procedure

Total 100 patients were included in the study using non-probability convenience sampling. After detailed history, and clinical examination 100 patients of acute appendicitis, fulfilling the inclusion criteria were selected. Detailed history of the patients was taken for pain in right lower abdomen, its severity, its nature, relieving or provoking factors. Laboratory tests i.e. TLC and DLC were carried out in all the patients. Appendicectomy was performed in all the patients under general anesthesia through Lanz or grid iron incision. All the patients had their appendices examined grossly after appendicectomy for evidence of appendicitis. Wound was closed in layers by interrupted sutures. Subcutaneous tissue was approximated by chromic and skin was closed by Proline. Wound was kept dressed for 48 hours with first dry dressing. Dressing was changed on 2nd post-op day and wound examined for swelling, redness and discharge. Patients were discharged on 2nd post op day if there was no erythema, swelling or discharge from wound. Stitches were removed on first follow up visit on 9th post-op day. All information was filled in a Proforma containing details of name, age and gender.

Data Analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 15. Mean and standard deviation were calculated for age, TLC and DLC. Frequency and percentages were calculated for gender, presenting symptoms, normal and raised TLC and DLC. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy were calculated using the 2×2 table for TLC and Neutrophils (DLC) separately taking gross appearance as gold standard (Red edematous appendics).

RESULTS

A total of 100 patients were included, 32 (32%) patients were males. Male to female ratio was 1: 2. The age distribution ranged from 5–50 years (Mean25.54±11.6). Mean age was 25.54 years (SD = 11.6). Most of the patients belonged to the second and third decade of life.

All the patients had tender right half of abdomen to variable degree of pressure. The site of tenderness was variable but in majority

(92%), it was in the right iliac fossa. Rebound tenderness was present in 82% of all patients.

All the patients were assessed and operated within 12 hours of admission. The decision to operate was made on the basis of history and clinical examination. The operative findings were recorded in each case. Out of 100 patients, appendices were found inflamed in 84 (84%) patients and normal in 16 (16%) patients. The negative appendicectomy rate is 16%.

In every patient TLC was done which ranged from 4500 to 17,400/mm^3. Mean TLC was 12,813/mm3 (SD=3063.59). A patient having TLC > 11,000 was considered as positive for appendicitis. In 24 (24%) patients TLC<11,000/mm^3 and in 76 (76%) patients TLC >11,000 mm^3.

When the results of TLC were compared with gross appearance we observed that in 86 of 84 inflamed appendicitis TLC picked up 73 (TP) as inflamed while 11 (FN) cases were misdiagnosed as non-inflamed. Similarly out of 16 non-inflamed cases TLC picked up 13 (TN) cases correctly but 3 (FP) cases were wrongly diagnosed as inflamed.

Differential leukocyte count (DLC) was also carried out in every case. We based our diagnosis on neutrophils count. Neutrophils ranged from 65% to 95%. Average percentage neutrophils was 82.22% (SD=7.298). A patient having neutrophils >80% was considered as positive for appendicitis. In our study 75 (75%) patients had neutrophils > 80% and 25 (25%) patients had neutrophils < 80%.

Comparison of the results of DLC with gross appearance revealed that in 80 patients the diagnosis of DLC was correct while in 20 patients the diagnosis was incorrect. Out of 84 patients the diagnosis of TLC was correct while in 14 patients the diagnosis was incorrect. Out of 84 inflamed appendicitis DLC picked up 69 (TP) as inflamed while 15 (FN) cases were

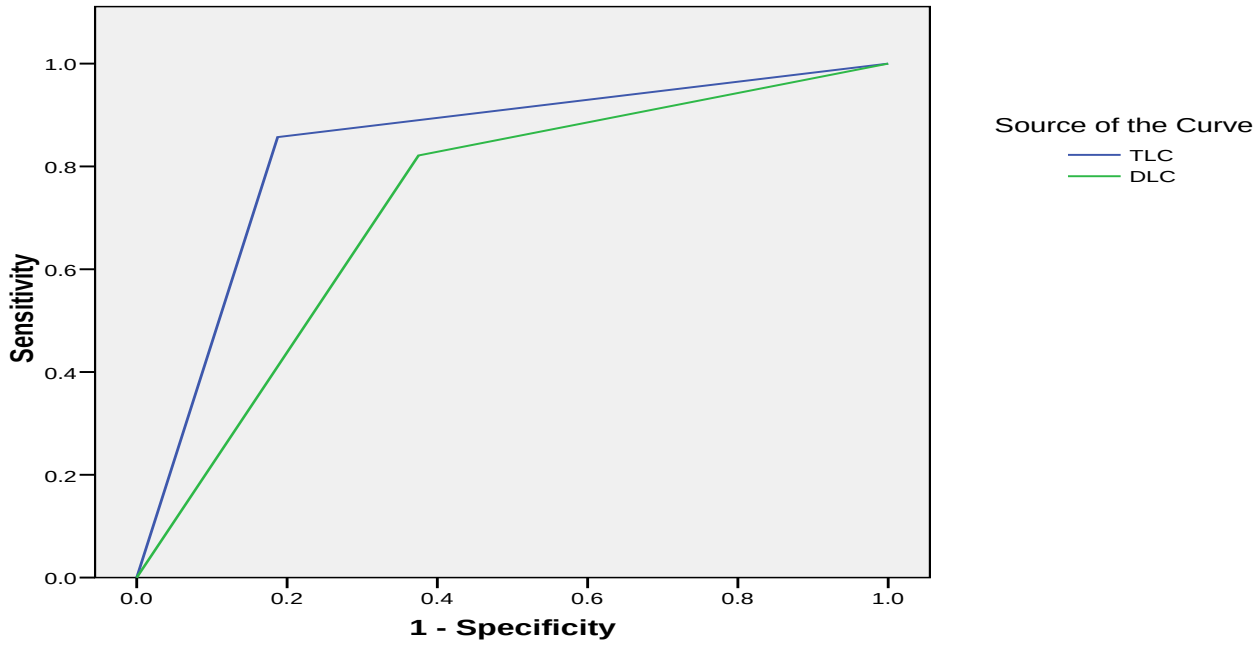

Table: Diagnostic measures of TLC and DLC

	TLC	DLC
Sensitivity	86.9%	82%
Specificity	81.25%	68.75%
Positive Predictive Value (PPV)	96%	93%
Negative Predictive Value (NPV)	54.17%	42.3%
Accuracy	86%	80%
Area Under Curve (AUC)	0.841	0.692

misdiagnosed as non-inflamed. Similarly out of 16 non-inflamed cases DLC picked up 11 (TN) cases correctly but 5 (FP) cases were wrongly diagnosed as inflamed. Diagnostic measures & ROC for TLC and DLC were given in table & figure.

DISCUSSION

Acute appendicitis is the most common surgical condition encountered in emergency room. Because of common occurrence of symptoms mimicking acute appendicitis, the diagnosis of acute appendicitis is a dilemma for surgeons. Between 15% and 30% of all these patients who are suspected of having acute appendicitis undergo surgery that demonstrate neither appendicitis nor any other surgically correctable disease[16]. Thirty percent of the patients with documented appendicitis have an atypical presentation and 30% of patients with probable appendicitis will have an alternative diagnosis[17]. Paulson et al agreed that although history taking and physical examination remains the diagnostic cornerstone in patients presenting with RIF pain, not all patients will have a classical presentation and further diagnostic investigations are indicated[18].

In the present study, we emphasized on the importance of laboratory findings i.e. TLC and DLC in making a confident diagnosis of acute appendicitis.

The incidence of acute appendicitis is variable in both sexes. Male to female ratio in the present study was approximately 1:2. In one study[19] male to female ratio was 1.18:1. Gulzar et al[20] in a study of 160 patients noted a male to female ratio of 1.6:1. Guraya et al in a series of 232 patients observed a 2.3:1 ratio. It can be seen from the given statistics, that there are no set patterns for incidence of the disease in both sexes and it is highly variable. The exact cause of male preponderance in most studies is not known.

Acute appendicitis has many clinical symptoms such as anorexia, abdominal pain, nausea, vomiting, urinary symptoms etc. Pain was the most important presenting symptom and was present in all the patients of our study. This is similar to the study[20] who reported lower abdominal pain in all cases of appendicitis. In our study, pain in right iliac fossa was observed in 62% patients. In the literature, the migration or shifting of pain to right iliac fossa is variable and is found in 30-64% of the patients[21]. In our study it was noted in 42% patients.

The total leukocyte count is widely used to aid the diagnosis of acute appendicitis. Various studies[10,22] have reported that 80% to 85% patients with acute appendicitis will have a total leukocyte count of over 11,000/mm^3. The present study shows that 76 % cases had TLC>11,000/mm^3 which is higher than the findings of a series that reported a raised TLC>11,000/mm^3 in only 49% of 354 patients[22]. A raised TLC is regarded as a sensitive test for acute appendicitis but is not diagnostic because of its relatively low specificity and does not add much to the management in patients with un doubtful clinical findings[23]. The sensitivity (86.9%) and specificity (81.25%) of the raised white cell count in the present study correlated with a study which showed sensitivity 88.7% and 70% specificity[22]. In a series 20 of patients of acute appendicitis, sensitivity and specificity of leucocyte count was 76.5% and 73.7%. Thus although raised white cell count may be highly sensitive test for acute appendicitis, it has low specificity and has little diagnostic value. Even a perforated appendics may be associated with a normal white cell count[22]. In the present study 11% patients with gangrenous or perforated appendics had a TLC of less than 11,000/mm^3. So in those cases where the white cell count varies with clinical signs, the clinical judgment should be considered more reliable.

Neutrophil count (Differential leukocyte count)has been evaluated in many studies and was found helpful in increasing the diagnostic accuracy in patients with suspected acute appendicitis. In present study 75% patients had neutrophils >80%. Our results were in accordance with other studies[22]. The sensitivity (82%) and specificity (68.75%) of the raised neutrophils in the present study were almost similar to other studies[9]. Neutrophilia has high sensitivity but it is a less specific test. A patient

with perforated appendix may have normal neutrophils count. In our present study 15% patients with gangrenous or perforated appendix had neutrophils of less than 80%. So the clinical judgment should be considered more reliable than Neutrophil count (DLC).

The negative exploration rate of 16% in the present study is consistent with the figure of 5.4-30% mentioned in various studies[22,23]. This may be due to the fact that preoperative clinical judgment and the decision to operate was made by the senior surgeons. In operated cases the diagnostic accuracy of 84% is also consistent with the figure of 59-97% mentioned in the literature[19, 20].

CONCLUSION

The diagnosis of acute appendicitis can be made confidently with proper history and thorough physical examination along with laboratory investigations. TLC is proved to be more sensitive, specific and accurate test as compared to DLC and it should be used as diagnostic aid for suspected acute appendicitis cases. TLC and DLC although not the diagnostic criteria for acute appendicitis but still are helpful investigations in decision making regarding appendicitis especially in doubtful cases and circumstances when senior surgical staff are not available in odd hours.

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