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Original Research Article

A study to assess the role of raised total leucocyte count in diagnosis of acute appendicitis

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ABSTRACT

Introduction: Total Leucocyte Count (TLC) is an easily available and commonly performed investigation and studies have reported various degrees of leucocytosis in patients with acute appendicitis. This study was performed with the aim to assess the diagnostic validity of raised TLC count in acute appendicitis.
Methods: This was a cross sectional study conducted from 2013 to 2015, in the Department of General Surgery, Indira Gandhi Medical College, Shimla. A clinical diagnosis of acute appendicitis was made based on detailed history taking, clinical examination, and laboratory investigations including TLC count. 50 patients with acute appendicitis were enrolled in the study by convenience sampling, after taking a written, informed consent. Appendicectomy specimen were sent for histopathological examination (HPE).
Results: The mean age of the patients was 26.48 ± 12.28 years. 29 (58%) patients were male, and 21 (42%) were female. The negative appendicectomy rate in the present study was 14%. 7 (14%) were normal appendices, 31 (62%) inflamed appendices, 4 (8%) perforated appendices, and 8 (16%) gangrenous appendices as per HPE report. In our study, there were 12 (24%) cases of complicated appendicitis i.e., 8 (16%) cases of gangrenous appendicitis and 4 (8%) cases of perforated appendicitis). TLC had a sensitivity 76.74%, specificity 51.14%, positive predictive value 91.66%, and negative predictive value 28.57%.
Conclusion: In our study, TLC was found to have low sensitivity and specificity for acute appendicitis. Hence, used alone, TLC may not be diagnostic of acute appendicitis. However, used in conjunction with other laboratory parameters, it will lead to improvement of diagnostic accuracy.

Keywords: Total leucocyte count, Acute appendicitis, Sensitivity, Specificity, Predictive value

INTRODUCTION

Acute appendicitis often poses a diagnostic dilemma to the operating surgeon because of the multiple aetiologies of acute abdomen and the varied clinical presentation among different categories of patients. Total leucocyte count (TLC) is a useful investigation in diagnosing acute appendicitis. It is an indirect marker of inflammation and bacterial infection. Patients with acute, uncomplicated appendicitis usually present with a total leucocyte count ranging from 10,000 to 18,000.[1] Reports show the finding of an elevated white blood cell (WBC) count, resulting from the associated inflammatory response in 70-90% of patients with acute appendicitis.[2] Besides, it is an easily available, inexpensive test, done routinely in almost all laboratories round the clock.

The present study was performed to determine the sensitivity, specificity, positive and negative predictive value of TLC in the diagnosis of acute appendicitis. For this, the TLC values were correlated with histopathology findings of appendicectomy specimens in clinically diagnosed cases of acute appendicitis.

METHODS

The present study was a cross sectional study conducted in the Department of General Surgery, Indira Gandhi Medical College, Shimla, from January 2012 to June 2013. Study participants were recruited by convenience sampling and included 50 patients who were clinically diagnosed as having acute appendicitis and were to be managed by emergency appendicectomy. Inclusion criteria included patients more than 10 years of age, diagnosed clinically to have acute appendicitis and subjected for appendicectomy in IGMC Shimla. Patients who had associated co-morbidities, or were being managed conservatively, were excluded from the study. Patients with rheumatoid arthritis, Systemic erythematosus (SLE), tuberculosis (TB), gout, inflammatory bowel disease (IBD), glomerular nephritis etc, where TLC count is raised, were also excluded from the study.

A clinical diagnosis of acute appendicitis was made based on detailed history taking, clinical examination, and laboratory investigations including TLC count. Appendicectomy specimen were sent for histopathological examination (HPE).

TLC was done in all patients by three-part automatic analyser (MS- 9). About 3 ml of blood sample was sent in Ethylenediaminetetraacetic (EDTA) containing tubes for TLC estimation. No special preparation of the patient was required prior to sample collection by approved techniques. In case of delay, samples were stored at 2-8 degrees centigrade for maximum period of 12 hours. TLC count >10,000 cells/cubic mm was considered positive.

Patients with a strong suspicion of acute appendicitis were advised emergency appendicectomy. After obtaining informed consent, the patients were operated, operative findings noted, drain was kept in perforated appendix cases and the appendicectomy specimens were sent for HPE. The histopathology reports suggestive of appendicitis, were considered as a final diagnosis. Among the patients who were positive on HPE, those who also had raised TLC i.e. >10,000 cells per cubic mm, were considered true positive, while those patients in whom TLC was not raised were considered false negative. Among those negative on histopathology, those with raised TLC were considered as false positive, while those in whom TLC was not raised were considered as true negative. Sensitivity, specificity, and positive and negative predictive value of TLC in diagnosis of acute appendicitis were calculated.

Consent and ethical issues

The Institutional ethics committee clearance was obtained prior to undertaking the study. Written Informed consent of the study participants was taken, and confidentiality of study participants was ensured.

Statistical analysis

The data collected was entered in and analyzed using the Statistical package for the social sciences (SPSS) statistical software (version 16.0). Quantitative variables were expressed as mean ± standard deviation (SD), while qualitative variables were expressed as proportions. The sensitivity, specificity, positive and negative predictive value of TLC for the diagnosis of acute appendicitis were calculated.

RESULTS

This present study was a cross sectional study. 50 patients with a clinical diagnosis of acute appendicitis, who were posted for emergency appendicectomy, were enrolled in the study after taking a written, informed consent. All the 50 patients were subjected to TLC count, to evaluate its role in diagnosing a case of acute appendicitis. The following observations were made in the study.

Age and sex distribution of study subjects

The mean age of the patients was 26.48±12.28 years. 29 (58%) patients were male, and 21 (42%) were female. (Figure 1)

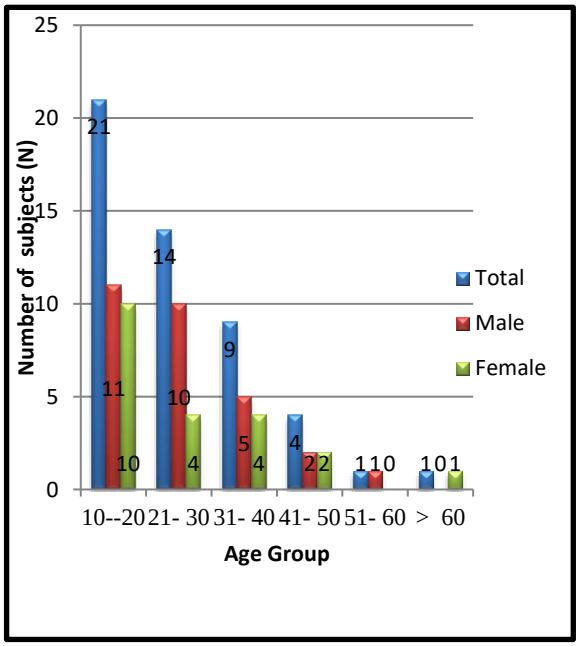

Figure 1: Distribution of study subjects by age and sex.

Distribution of types of appendices per histopathology examination (HPE)

The negative appendicectomy rate in the present study was 14%, with 7 out of the 50 appendicectomy specimens being reported negative on histopathology for acute appendicitis (Figure 2). Among the appendicectomy specimens, 7 (14%) were normal, 31 (62%) inflamed

appendices, 4 (8%) perforated appendices, and 8 (16%) gangrenous appendices as per HPE report. Hence, in our study there were 12 (24%) cases of complicated appendicitis i.e. 8 (16%) cases of gangrenous appendicitis and 4 (8%) cases of perforated appendicitis). The results are shown in figure 3.

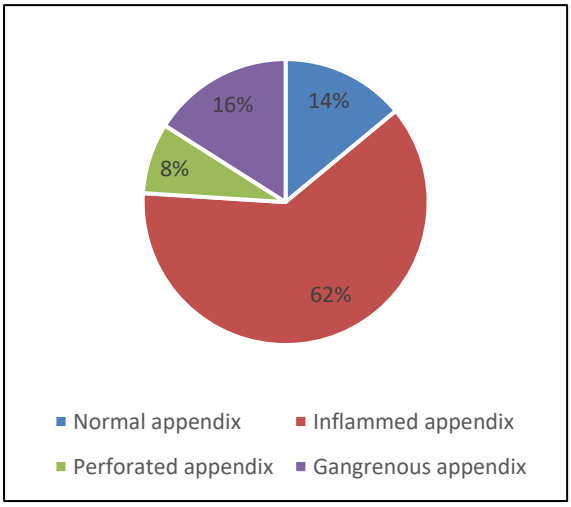

Figure 2: Distribution of types of appendices on HPE.

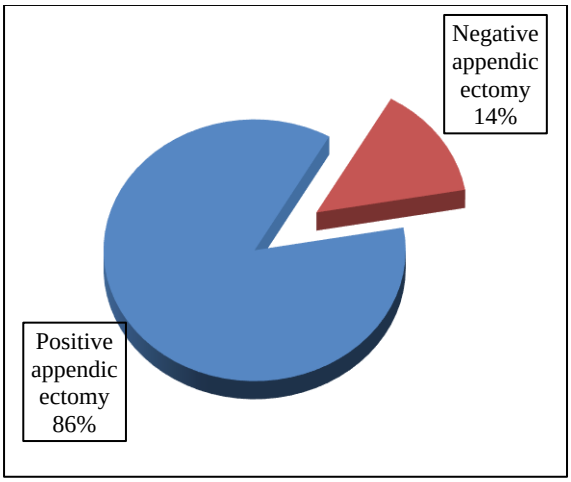

Figure 3: Distribution of positive versus negative appendicectomy rate.

Evaluation of the role of TLC in the diagnosis of acute appendicitis by correlation with HPE

TLC was raised in 36 patients (72%) out of the total sample of 50 cases. Of these, 33 (66%) cases were positive for appendicitis on HPE (true positive), and 3 (6%) were negative on HPE (false positive). Out of the 14 (28%) cases in whom TLC was not raised, in 4(8%) cases HPE was negative (true negative), and in 10 (20%) cases HPE was positive (false negative). The findings are depicted in figure 4.

Out of 50 cases who were enrolled in this study, the neutrophil count was elevated (>75%) in 38 cases (76%). Among the 43 patients who were positive on histopathology, the neutrophil count was raised in 35 cases (81%).

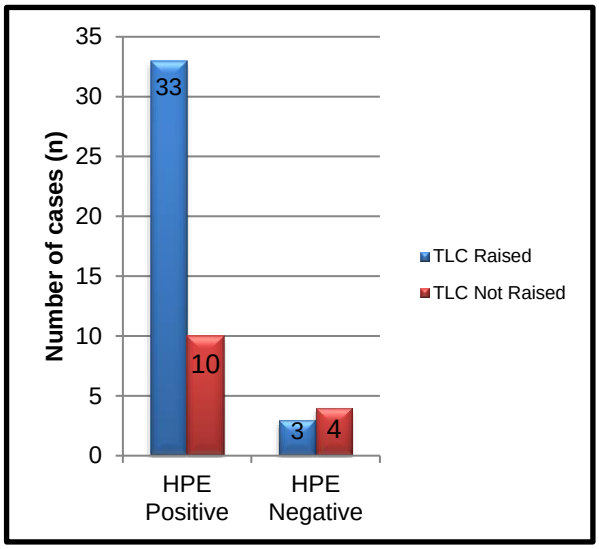

Figure 4: Role of TLC in diagnosis of Acute appendicitis.

Table 1: Role of TLC in diagnosis of acute appendicitis.

TLC Result	HPE positive	HPE negative	Total
TLC positive	33 (true positive)	3 (false positive)	36
TLC negative	10 (false negative)	4 (true negative)	14
Total	43	7	50

Pearson $\chi 2=3.429$; df = 1, p value= 0.064

Table 2: Sensitivity, specificity, positive and negative predictive value of TLC.

Characteristics	%
Sensitivity	76.74
Specificity	57.14
Predictive value of positive test	91.66
Predictive value of negative test	28.57

DISCUSSION

The TLC is commonly used to aid the diagnosis of acute appendicitis. Initial de-margination of peripheral WBC's caused by catecholamine and cytokine release accounts for leucocytosis in most patients with acute appendicitis.[3] Reports show the finding of an elevated WBC count, resulting from the associated inflammatory response in 70-90% of patients with acute appendicitis.[4] Various studies have reported that 70% to 90% patients with acute appendicitis will have total leucocyte count over 10,000/mm^3.[3] In 1992, Izbicki et al conducted a study and found that a mean TLC of less than 8×109/L was significantly more common in patients who did not have

acute appendicitis.[5] According to the authors, a WBC count of more than 11×109 /L could significantly differentiate patients with acute appendicitis from patient without acute appendicitis. In our study the TLC was raised in 33 (76.7%) patients with acute appendicitis. The sensitivity, specificity, predictive value of positive test and predictive value of negative test of TLC in our study is 76.74%, 57.14%, 91.66%, and 28.57% respectively. Our results are in accordance with other studies as shown in Table 3.

Table 3: Comparison of role of TLC in diagnosis of acute appendicitis with other studies.

Previous studies	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Hussain et al[10]	52	41.6	74	27	
Dawood Kamal[11]	53.95	75	87	34	59
WM West et al[12]	60	69.2	69.23	60	64.2
Nasir Ali et al [13]	74.4	72.7	90.6	44.4	74
Kamran H. et al[6]	76.5	73.7	92.5	42.42	76
Salamat Khan[14]	77	50	97.8	7.4	76.22
Present study	76.7	57.1	91.6	28.5	74

A raised TLC is regarded as a sensitive test for acute appendicitis but not diagnostic, because of its relatively low specificity. According to Haider Kamran et al, even though a raised TLC is not diagnostic of acute appendicitis, but it still has an important role in clinical decision making.[6] According to the authors, if TLC is raised in doubtful cases and there is no radiological investigation available, then appendicectomy should be done. If the TLC is normal in doubtful cases, then appendicectomy should be avoided. Lateef AU et al, reported a raised WBC count in 79.6% patients with acute appendicitis.[7] According to them, leucocyte count is an important diagnostic criterion for the diagnosis of acute appendicitis and if it is normal, patient should be further investigated by ultrasonography or diagnostic laparoscopy. According to Guraya et al, TLC reflects the severity of disease in acute appendicitis.[3] When integrated with the clinical findings, TLC augments the diagnostic accuracy. In our study, neutrophilia was present in 38 (76%) cases out of 50, and of these 38 cases, 35 (81%) were confirmed as acute appendicitis on histopathology examination. Guraya et al reported neutrophilia in 123 (53%) cases, of which 116 (94%) were reported to have appendicitis.[3]

When TLC and neutrophil count are taken together, less than 4% cases with acute appendicitis will have normal value. According to Marchand et al neutrophil count >75% is 81-84% sensitive in the diagnosis of acute appendicitis.[8] According to Doraiswamy et al, neutrophil count is particularly useful in diagnosis of acute appendicitis in children.[9]

CONCLUSION

Acute appendicitis is a common surgical emergency with an essentially clinical diagnosis. TLC is a simple lab investigation which is cheap and easily available. A raised TLC is a sensitive test for acute appendicitis but has relatively low specificity. The sensitivity, specificity, predictive value of positive test and predictive value of negative test of TLC in our study was 76.74%, 57.14%, 91.66% and 28.57% respectively. The negative appendicectomy rate was 14%. TLC alone may not be diagnostic of acute appendicitis, however used in conjunction with other clinical and laboratory markers, it will lead to improvement of diagnostic accuracy.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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