Diagnostic Accuracy of Total Leucocyte Count and Ultrasound in the Diagnosis of Acute Appendicitis

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Abstract

Background: To compare the diagnostic accuracy of Total Leucocyte Count (TLC) with Ultrasound (USG) abdomen and pelvis in diagnosis of acute appendicitis.

Methods: In this cross sectional study 100 patients, with clinical diagnosis of acute appendicitis, were included. In histopathologically diagnosed cases, TLC and ultrasound (USG) abdomen and pelvis findings were compared. Chi Square test was used to find correlation.

Results: The mean age was 30.17 years. The sensitivity, specificity, positive predictive and the negative predictive value of total leukocyte count was 87.5 %, 78.6%, 91.3% and 71.0%, respectively. The sensitivity, specificity, positive predictive and the negative predictive value of USG abdomen and pelvis was 44%,89.3%,91.4% and 38.5%, respectively.

Conclusion: TLC has more sensitivity and diagnostic accuracy in acute appendicitis in comparison to USG abdomen and pelvis. As diagnosis in acute appendicitis is more clinical, hence it can be used alone to enhance diagnostic accuracy.

Key Words: Appendicitis, Total Leukocyte Count, ultrasound

Introduction

Acute appendicitis is the most common cause of emergency surgery with a life time risk of almost 7%. The accuracy of clinical examination is 70% to 87%. The risk of negative appendicectomy can be raised more than 20%, without the help of any diagnostic tool. Factors which may lead to misdiagnosis include atypical clinical presentations, inflammatory and non-inflammatory conditions especially in females of child bearing age group, situs inversus, midgut malrotation and patients in the extremes of age.1-6

TLC is a commonly performed test in the diagnosis of acute appendicitis. It is readily available and cheap investigation having sensitivity 83.3%, specificity 62.1% and positive predictive value of 92%. The TLC count usually remains over 10,000 per mm in 80% of cases. Serial measurements in suspected cases may increase the specificity. However, the diagnostic accuracy increases when used in combination with CRP. 7-11

Beside TLC, USG of the abdomen and pelvis is a commonly used radiological procedure, especially in female patients. Graded compression technique is helpful. An outer diameter of greater than 6mm, non-compressibility, lack of peristalsis or peri-appendiceal fluid characterizes an inflamed appendix. It is a non-invasive procedure, which is extremely helpful in female patients, having sensitivity 89% and specificity 100% respectively. An outer diameter of 6 mm or more is the best radiological finding. Normal appendix can be visualized in 72% of patients without appendicitis. An inflamed appendix cannot be visualized in 25-40% of cases. The probe pressure also causes discomfort/pain in few patients.12-16

Patients and Methods

This cross sectional study was carried out at General Surgery Department, Combined Military Hospital, Rawalpindi, from 30 Jan 2008 to 30 Jan 2009. All the patients with clinical diagnosis of acute appendicitis were included in the study. All the patients underwent complete blood count, urine routine examination and USG of the abdomen and pelvis. Appendicectomy was performed in all patients. Patient’s particulars, investigations (TLC and USG) results, surgical findings and histopathology report of appendix were recorded accordingly.

Chi-Square Test was used to find correlation between TLC, USG abdomen/pelvis and histopathology of appendix at 5% level of significance. A p-value of less than 0.05 was considered significant. To determine sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of TLC and USG abdomen/pelvis, 2 x 2 tables were used while keeping histopathology of Appendix as gold standard.

Results

The mean age and standard deviation for appendicitis was 30.17 and 13.50 and for TLC was 11.3 and 3.2 respectively. Total leukocyte count was elevated in 69 patients as a value of 10 x 10⁹ /cmm or more. Among these, 63 patients were having a positive
Histopathology. Contrarily, TLC was normal or below 10 x 10^9 /cmm in 31 patients. The Sensitivity of TLC was 87.5%, specificity 78.6%, positive predictive value 91.3% and negative predictive value 71.0% (Table 1 & 2). Negative appendicectomy rate was 30%.

Table 1: Accuracy of TLC in diagnosis of acute appendicitis

<table>
<thead>
<tr>
<th>Histopathology of Appendix</th>
<th>TLC Level</th>
<th>Calculation based upon 2 x 2 table</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflamed appendix</td>
<td>Elevated</td>
<td>a / a +c x 100</td>
<td>87.5</td>
</tr>
<tr>
<td>Normal appendix</td>
<td>Normal</td>
<td>d / b + d x 100</td>
<td>78.3</td>
</tr>
</tbody>
</table>

Table 2: Diagnostic accuracy of TLC

<table>
<thead>
<tr>
<th>Diagnostic Accuracy</th>
<th>Calculation based upon 2 x 2 table</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>a / a +c x 100</td>
<td>87.5</td>
</tr>
<tr>
<td>Specificity</td>
<td>d / b + d x 100</td>
<td>78.3</td>
</tr>
<tr>
<td>Positive Predictive Value</td>
<td>a / a + b x 100</td>
<td>91.3</td>
</tr>
<tr>
<td>Negative Predictive Value</td>
<td>d / c + d x 100</td>
<td>71.0</td>
</tr>
<tr>
<td>Diagnostic Efficacy</td>
<td>a + d / a + b + c + d x 100</td>
<td>57.0</td>
</tr>
</tbody>
</table>

Table 3: Accuracy of USG in diagnosis of acute appendicitis

<table>
<thead>
<tr>
<th>Histopathology of Appendix</th>
<th>USG abd/pelvis</th>
<th>Calculation based upon 2 x 2 table</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflamed appendix</td>
<td>Elevated</td>
<td>a / a +c x 100</td>
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</tr>
</tbody>
</table>

Discussion

A high degree of diagnostic accuracy is required to reduce negative appendicectomies. Studies revealed a rate of 15-20% for negative appendicectomies. Clinical acumen is considered a better judge in cases of acute appendicitis. Trainee doctors' predilection to practice also leads to an increased ratio of negative appendicectomies. Worm infestation, reactive hyperplasia and ectopic pregnancy in females can all mislead the diagnosis. Even a normal histopathological study can not be an unusual happening. 10-16

Enhancement of diagnostic yield is claimed by utilizing adjunct diagnostic tools. The commonly employed in this regard are total leucocyte count, CRP levels and USG abdomen and pelvis. As compared to ultrasound abdomen and pelvis, studies yielded better sensitivity and specificity for TLC. TLC is an easily performed test and is better standardized. On USG even the normal appendix is not visualized in almost 25-28% of cases. It is not as readily available as TLC. It is operator dependent and results vary from person to person depending upon the expertise of the radiologist. Patient factors like obesity, gas filled gut loops in front of the appendix and amount of inflammatory fluid around the appendix are pitfalls towards its diagnostic accuracy. Appendicitis is an emergency which can present any time or moment, 24
hours a day. That too leads to problems as availability of radiologist, proficient enough, is difficult to be ensured all the day long. 16-18

Conclusions
1. The diagnosis of acute appendicitis is clinical, but adjunct diagnostic modalities are worth utilizing.
2. Use of TLC in combination with other tests e.g. CRP, will improve diagnostic accuracy in acute appendicitis.
3. Use of ultrasound is suggested in complicated cases, especially in childbearing age females.

References
1. Wijesuriya LI. Imaging as an aid to the diagnosis of acute appendicitis. Malaysian Family Physician. 2007; 2(3)106-09