

## Association of Total Leucocyte Count and Acute Appendicitis Among Young Patients Undergoing Emergency Appendectomy

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### ABSTRACT

**Objective:** To study the association of total leucocyte count and acute appendicitis among young patients undergoing emergency appendectomy.

**Study Design:** Comparative cross-sectional study.

**Place and Duration of Study:** Department of Surgery, Combined Military Hospital, Quetta Pakistan, from Mar to Oct 2021.

**Methodology:** The study included one hundred patients diagnosed with acute appendicitis by a consultant surgeon undergoing an emergency appendectomy. The total leucocyte count was calculated for all the patients at the time of diagnosis. The treating surgeon confirmed acute appendicitis findings based on gross examination of the appendix at the time of surgery. The presence of acute appendicitis and other factors was associated with raised total leucocyte count in all the patients.

**Results:** Out of 100 patients diagnosed with acute appendicitis, 59 were male, while 41 were female. The mean age of the study participants was  $28.33 \pm 3.673$  years. On gross examination, 79 had a confirmed diagnosis of acute appendicitis, while 21 did not have an inflamed appendix. 85 had raised total leucocyte count, while 15 patients had total leucocyte count in the normal range. Statistical analysis revealed that acute appendicitis on gross examination and raised C-reactive protein had a statistically significant correlation with raised total leucocyte count ( $p$ -value: 0.001).

**Conclusion:** Total leucocyte count was significantly raised in patients who had confirmation of inflammation of the appendix at gross examination during the surgery. Raised total leucocyte count and C reactive protein should be given more weightage in diagnosing acute appendicitis and planning for an emergency appendectomy.

**Keywords:** Acute appendicitis; Association, Total leucocyte count.

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### INTRODUCTION

Acute appendicitis is one of the most commonly encountered surgical emergencies worldwide.<sup>1</sup> Emergency appendectomy has been the bread and butter of surgeons across the globe.<sup>2</sup> There is no exact clinical, laboratory or radiological parameter that could confirm the diagnosis of acute appendicitis.<sup>3</sup> It is usually a combination of all parameters and clinical judgment of the treating physician, which could ascertain the diagnosis and the patient is considered for emergency surgery. Several haematological indices have been used to prioritize patients for various surgical emergencies.<sup>4</sup> Parameters related to leukocyte count have been important in the diagnostic and prognostic workup of acute appendicitis, renal colic, peptic ulcer disease, acute pancreatitis, ruptured ovarian cyst, chronic obstructive airway disease, septic conditions, cerebral haemorrhage, metastatic diseases and even COVID-19.<sup>5,6</sup> Raised TLC count has been part of

routine MANTRLES criteria but still many patients with raised TLC have normal appendix on gross examination. The neutrophils to lymphocytes ratio has been correlated with the severity of appendicitis in various groups of populations.<sup>7,8</sup>

Emergency appendectomy could be a lifesaving procedure for the patients. However, surgeons and health services still emphasize correct diagnosis before surgical intervention and prefer using non-interventional modalities for accurate diagnosis.<sup>9</sup> Statistics suggest that acute appendicitis is a commonly encountered surgical emergency in Pakistan.<sup>10</sup> Limited local data has been available regarding the use of haematological parameters for diagnosing this condition. Therefore, we planned this study to look for the association of total leucocyte count and acute appendicitis among young patients undergoing emergency appendectomy at our tertiary care surgical unit.

### METHODOLOGY

The comparative cross-sectional study was conducted at the Department of Surgery, Combined

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Military Hospital, Quetta Pakistan, from March to October 2021 after approval from Ethical Review Committee (Letter number: CMH QTA-IRB/036). WHO sample size calculator was used to calculate the sample size for this study with population proportion of raised TLC in acute appendicitis as 75%.<sup>11</sup> Non-probability consecutive sampling was done to recruit the patients for this study.

**Inclusion Criteria:** Patients of either gender, aged of 18-35 years presented with symptoms of acute appendicitis and were diagnosed and operated on at the surgical unit by the consultant surgeon were excluded.

**Exclusion Criteria:** Patients with a past or current history of any abdominal surgery, patients with any recent viral illness, autoimmune disorder or haematological or lymphoid malignancy were excluded from the study. Patients with comorbid sepsis or suspected appendicular abscess on ultrasound were also excluded.

Patients diagnosed with acute appendicitis based on clinical and laboratory findings were included in the study. They underwent basic laboratory investigations, including the full blood count. Total leucocyte count was performed as part of routine investigations, and the range used was  $4.5-11 \times 10^9/L$ .<sup>12</sup> Confirmation of acute appendicitis was made based on gross examination by a consultant surgeon at the time of surgery.<sup>13</sup> The analysis did not include cases considered suspicious and sent for histopathology.

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The *p*-value of ≤0.05 was considered statistically significant

**RESULTS**

Out of 100 operated patients with a clinical diagnosis of acute appendicitis, 59 were male, while 41 were female. The mean age of the study participants was 28.33±3.673 years. On gross examination, 79 had a confirmed diagnosis of acute appendicitis, while 21 did not have an inflamed appendix (Table-I). 85 had raised total leucocyte count, while 15 patients had total leucocyte count in the normal range. Out of 100 patients included in the study, 20 patients had normal C-reactive protein levels, while 80 had raised levels of C-reactive proteins. It was revealed that the presence of acute appendicitis on gross examination (*p*-

value<0.001) and raised C-reactive protein had a statistically significant association with raised total leucocyte count (*p*-value<0.01). In contrast, age (*p*-value-0.093) and gender (*p*-value-0.211) had no such association established in our study with raised total leucocyte count (Table-II).

**Table-I: Characteristics of Study Participants (n=100)**

Study Parameters	n (%)
<b>Age (years)</b>	
Mean±SD	28.33±3.673
Range (min-max)	19 years-35 years
<b>Gender</b>	
Male	59(59%)
Female	41(41%)
<b>Acute appendicitis at gross examination</b>	
No	21(21%)
Yes	79(79%)
<b>Raised total leucocyte count</b>	
No	15(15%)
Yes	85(85%)
<b>C-reactive protein</b>	
<5	20 (20%)
>5	80 (80%)

**Table-II: Association of Acute Appendicitis and other factors with Raised Total Leucocyte Count (n=100)**

Factors	Normal Leucocyte Count	Raised Total Leucocyte Count	<i>p</i> -value
<b>Age</b>			
<30 years	08(53.3%)	64(75.3%)	0.093
30-35 years	07(46.7%)	21(25.7%)	
<b>Gender</b>			
Male	11(73.3%)	48(56.5%)	0.211
Female	04(26.7%)	37(43.5%)	
<b>C-reactive protein</b>			
<5	08(53.3%)	12(14.1%)	0.001
>5	07(46.7%)	73(85.9%)	
<b>Appendicitis at gross examination</b>			
No	09(60%)	12(14.1%)	<0.001
Yes	06(40%)	73(85.9%)	

**DISCUSSION**

Acute appendicitis is a common surgical condition across the globe. Pakistan is no exception to this. Many patients, especially young ones, suffer from acute appendicitis each year.<sup>13,14</sup> It would be of utmost importance if clinicians find a reliable, cost-effective and widely available biomarker that could predict this condition's certainty at the time of presentation. This would enable them to prioritize the patient for definitive management and clear the diagnostic ambiguities. Various haematological indices have been in practice for this purpose, but still, there is ongoing

research on this aspect. We, therefore, planned this study intending to study the association of total leucocyte count and acute appendicitis among young patients undergoing an emergency appendectomy

Xharra *et al.*<sup>15</sup> concluded that all these parameters correlated with acute appendicitis, but combining these three tests significantly increases the accuracy. We did not study the histopathology of the appendix, but the finding of acute appendicitis on gross examination was statistically significantly related to raised TLC and raised CRP. Yu *et al.*<sup>16</sup> in 2013 aimed to evaluate the diagnostic value of pro-calcitonin, C-reactive protein (CRP) and white blood cell count (WBC) in uncomplicated or complicated appendicitis utilizing a systematic review and meta-analysis. They came up with the findings that raised WBC count, and CRP predict complicated appendicitis. Our results aligned with their meta-analysis; both parameters were associated with acute appendicitis on gross examination. Virmani *et al.*<sup>17</sup> studied the role of various biomarkers in acute appendicitis. They concluded that an NLR >4.8, TLC >13,500 cells/mm<sup>3</sup>, percentage lymphocyte count <14.8% and percentage neutrophil count >75% were found to be associated with complicated appendicitis. We did not study other parameters, but raised TLC and CRP strongly predicted acute appendicitis. Acharya *et al.*<sup>18</sup> conducted a systematic review and cost-benefit trade-off analysis to evaluate the clinical utility of individual biomarkers in diagnosing appendicitis and appraise the quality of these studies. They came up with the findings that traditional biomarkers such as white cell count were found to have a moderate diagnostic accuracy but lower costs in the diagnosis of acute appendicitis. We generated the same findings from our data set as CRP and raised TLC were cost-effective and authentic biomarkers for diagnosing acute appendicitis.

### CONCLUSION

Total leucocyte count was significantly raised in patients who had confirmation of inflammation of the appendix at gross examination during the surgery. Raised total leucocyte and C reactive protein should be given more weightage in diagnosing acute appendicitis and planning for an emergency appendectomy. Association of total leucocyte count and acute appendicitis among young patients undergoing emergency appendectomy.

**Conflict of Interest:** None.

### Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

ZS: & MSA: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

TM: & MZ: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

SI: & MZ: Concept, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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