



LEUCOCYTOSIS AS A DIAGNOSTIC TOOL IN ACUTE APPENDICITIS FOR BORDERLINE (5-6) AND PROBABLE DIAGNOSIS (7-8) MANTRELS SCORES

Jan Mohammad Rather*¹., Sobia Manzoor²., Adil pervais shah³ and Ajaz Ahmad Rather⁴

¹Department of General and Minimal Invasive Surgery, Skims

²Department of Anaesthesia and Critical care, Skims

^{3,4}Department of General Surgery, Skims medical college

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ABSTRACT

Background: Acute appendicitis constitutes the most common cause of non-traumatic acute abdomen in the world. Patients with borderline MANTRELS score of 5-6 require a CT abdomen to finally clinch the diagnosis. CT availability may not always be possible in resource limited centres and third world countries leading to difficulty in diagnosis.

Methods: An analytical study was conducted to find out the diagnostic accuracy of leukocytosis in predicting acute appendicitis in patients undergoing emergency appendectomy who have borderline MANTRELS scores of 5-6 and 7-8 (probable appendicitis). The degree of inflammation of the resected specimens was grossly assessed and graded into acute appendicitis, complicated appendicitis (such as gangrene, perforation, and abscess) and normal or negative appendix. The operative findings were correlated with leukocyte counts using 2 x 2 tables.

Results: Out of 100 appendectomies, with exclusion of the negative appendectomies there were 70% patients with elevated leukocyte count. The overall sensitivity, specificity, positive predictive value and negative predictive value of elevated leukocyte counts for inflamed appendix were 84.33%, 70.5%, 93.33%, and 48% respectively.

Conclusions: We conclude that leucocytosis is helpful in the diagnosis of acute appendicitis especially in patients with Alvarado scores in the middle range, 5-8, and can be used as a useful diagnostic tool in limited resource centres and third world countries with reasonable accuracy.

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INTRODUCTION

Acute appendicitis constitutes the most common cause of non-traumatic acute abdomen both in the developed as well as developing countries. Clinically, the patient may present with non-specific vague abdominal pain or the typical findings of right iliac fossa pain, tenderness and rebound tenderness. One out of every five cases of appendicitis is misdiagnosed whereas a normal appendix is found in 15%-40% of patients who undergo an emergency appendectomy.^{1,2} Classically acute appendicitis is diagnosed using the Alvarado score (MANTRELS score) with a maximum score of 10. Patients with borderline score of 5-6 require a CT abdomen to finally clinch the diagnosis. CT availability may not always be possible in limited resource settings or third world countries hence the need of making the diagnosis within the available resources. Elevated leukocyte count is one of the most helpful investigations in diagnosing acute appendicitis. It is not overtly

expensive to the patient, and does not require any sophisticated equipments or technical expertise. Moreover, the results of this investigation can be obtained promptly allowing the surgeon to establish diagnosis immediately and thereby avoiding unwanted explorations and preventing complications (perforation, abscess). It has been reported to be significantly predictive of inflamed appendix in patients with provisional diagnosis of acute appendicitis.³⁻⁵

MATERIALS AND METHODS

The present study was carried out to evaluate the usefulness of elevated leukocyte count in complementing the clinical diagnosis of acute appendicitis by determining the sensitivity, specificity, positive predictive and negative predictive values of elevated leukocyte counts for inflamed appendix. The study included patients with clinically borderline MANTRELS score (5-6) and probable diagnosis of MANTRELS score 7-8. It was conducted at the Department of Surgery, SKIMS, India, from May 2015 to April 2017. Adult patients of either gender, over the age of 16 years, who underwent appendectomy in emergency, were included. Exclusion criteria were patients

*Corresponding author: Jan Mohammad Rather

Department of General and Minimal Invasive Surgery, Skims

who underwent incidental appendectomy, those who received management for appendicular mass and higher scores of 9-10. The patients were initially assessed by adequate history, thorough examination and investigations (total and differential leukocyte counts, urine examination, ultrasound of abdomen in women of child bearing age, and other investigations such as those required for evaluation of fitness for general anaesthesia, where indicated). Leukocyte count of over 10,000/mm³ was considered elevated. The clinical diagnosis of acute appendicitis was made. Pre-operatively, the patients were kept nil by mouth for 6 hours, received intravenous fluids / antibiotics, and analgesics. Appendectomy was performed via Grid iron or Lanz incision. The degree of inflammation of the resected specimens was grossly assessed and graded into acute inflammation, complicated appendicitis (such as gangrene, perforation, abscess) and normal appendix. Patients with normal appendix were assessed intra-operatively for any other possible cause of the condition. Operative findings were noted and confirmed on histopathology. The data were collected through proforma which included the demographic profile of the patients, MANTRELS score on admission, total leukocyte counts, peroperative findings and histopathology reports of the surgical resection specimens. The data were subjected to statistical analysis to determine any correlation between total leukocyte count and grade of inflammation of the appendix. The data were analysed through Statistical Package for Social Sciences (SPSS) version 11 and various descriptive statistics. 2 x 2 table was employed to determine sensitivity, specificity, positive predictive value and negative predictive value. Chi-square test was used to compare percentages and a p-value of less than 0.05 was considered statistically significant.

RESULTS

Out of a total of 100 patients, 62 were males while 38 were females. The age range was 16-65 years, with a mean of 24.53 ± 6.54 years. Most of the patients were young and less than 30 years of age. There were 16% (n = 16) negative appendectomies. Out of these, 11 patients were females and 5 were

Males. 70% patients (n = 70) operated for appendicitis presented with elevated leukocyte count. The acute appendicitis patients with elevated leukocyte counts were further stratified into those who had uncomplicated acute appendicitis (n = 61) and those with complicated acute appendicitis (n = 9). Leukocyte count was found to be elevated in significantly greater number of patients (p < 0.001) with uncomplicated acute appendicitis, however, the elevated leukocyte counts were statistically insignificant among the subset of patients with complicated acute appendicitis. (p = 0.66). Among the negative appendectomy subset of patients, the leukocyte counts were < 10,000/mm³ in significantly greater number of patients (n=12) with a p value of < 0.0001. (Table 1)

Table 1 Leucocyte counts among patients of operated appendicitis (n=100)

Specimen Histopathology	Leucocytosis	
	>10000/mm ³	<10000/mm ³
Acute appendicitis	56	14
Complicated appendicitis	9	4
Normal appendix	5	12
Total	70	30

Overall, the range of leukocyte counts was 4,000/mm³ to 24,000/mm³ with a mean of 13,162.24 ± 4,513.20/mm³. Over all 75 patients with elevated leukocyte counts (range 10,010/mm³ - 24,000/mm³ with a value mean of 13,945.15/mm³ ± 2,456.20/mm³. Similarly 25 patients presented with < 10,000/mm³ leukocyte counts, ranging from 4,000/mm³ - 9800/mm³ with a mean of 7,343.7/mm³ ± 1,518.65/mm³. The overall sensitivity, specificity, positive predictive value and negative predictive value of elevated leukocyte counts for inflamed appendix were 84.33%, 70.5%, 93.33%, and 48% respectively (Table II)

DISCUSSION

Acute appendicitis often presents with a characteristic set of symptoms and signs in young and otherwise fit individuals, however, atypical presentations are not uncommon. Women in child bearing age constitute the most challenging group where the diagnostic accuracy of leukocyte count as well as ultrasonographic examination is low. Diagnostic laparoscopy is now being increasingly recommended and practiced in this group of patients to address the diagnostic dilemmas. Hence, stratification of the patients into either those requiring emergent surgery or those who may be initially observed is not always straightforward. These diagnostic dilemmas have led to devise and validate various scoring systems, imaging modalities, laparoscopy and laboratory tests.⁶

In this study, acute appendicitis was more frequent among young males than females, in conformity with published literature.^{1,3} Elevated leukocyte count was found in 70% patients with macroscopically confirmed acute appendicitis. Different studies have reported variable frequencies of leukocyte count elevation in their patients with acute appendicitis. Lateef *et al.* and Ahmed *et al.* have reported elevated leukocyte counts in 79.6% and 57.53% of their patients with acute appendicitis.^{7,8} De Carvalho *et al.* found elevated leukocyte counts in 80% patients during the first 24 hours of acute appendicitis.⁵ Grönroos has reported consistently altered leukocyte counts in acute appendicitis and advocated it as a guide for decision making in children and elderly patients.⁹ Elevated leukocyte count was highly sensitive (84.33%) for diagnosing acute appendicitis. This finding is in conformity with De Carvalho *et al.*, And Kamran *et al.* who have reported sensitivity of elevated leukocyte count for acute appendicitis as 88.7%, and 76.5% respectively.^{5,10} Thus, an elevated leukocyte count can be regarded as a sensitive test for acute appendicitis provided appropriate clinical assessment compliments it. The specificity of leukocyte count for acute appendicitis was found to be lower (70.5%). De Carvalho *et al.* have reported an even lower specificity of only 20%.⁵ Owing to the low specificity, leukocyte count may not help much in the management of patients with doubtful clinical findings. The same accounts for the significant number of negative appendectomies observed in this study. Because of the inherent problem of low specificity, leukocyte count may mislead the diagnosis at times. Several of our patients with acutely inflamed complicated appendix had a normal leukocyte count (13).

Table 2 Leucocyte counts and operative diagnosis among the operated patients (n=100)

Operative diagnosis	leucocytosis		Total
	>10000/mm ³	<10000/mm ³	
yes	70	13	83
no	5	12	17

Specificity – 70.5%
Positive Predictive Value – 93.33%
Negative Predictive Value – 48%

Similar observations have been reported by other published studies also.¹⁰ In this study, we evaluated the diagnostic accuracy of only leukocytosis and acute appendicitis, however, some studies have evaluated the relationship between combined leukocytosis and CRP and have reported elevated levels of these two as more sensitive than elevated levels of either of these two parameters alone. Hence the combine role of these parameters in the diagnosis needs further studies.^{1,4} We conclude that leucocytosis is helpful in the diagnosis of acute appendicitis especially in patients with Alvarado scores in the middle range, 5-8, and can b used a useful diagnostic tool in limited resource centres and third world countries with reasonable accuracy.

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