

Role of total leukocyte count in predicting complicated appendicitis in a tertiary care Hospital, Peshawar

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Abstract

Introduction: Appendicitis is one the acute abdominal diseases presented usually as a surgical emergency. About 11.6 million people affected due to appendicitis reported in 2015 worldwide and about 50,000 deaths occurred due to appendicitis and its complications in the same year. The diagnosis of appendicitis is usually very difficult for both the surgeons and physicians and it presents differently depending upon the location of appendix and its clinical manifestations. Appendicitis is usually diagnosed on the basis of history of abdominal pain, clinical, radiological and laboratory findings. Different scoring systems are used for the diagnosis of acute appendicitis. Severity of acute appendicitis in the form of complicated and uncomplicated acute appendicitis can be predicted by different inflammatory markers. Leucocytosis is one of the components of the Alvarado scoring system used for both the diagnosis and prediction of severity of appendicitis.

Material and Methods: This was a descriptive cross sectional study conducted at Department of Surgery, PGMI Khyber Teaching Hospital, Peshawar, Pakistan from January 2020 to April 2021 for duration of one year. The sample size was 117 and consecutive non probability sampling technique was used for the sampling. All the patients presenting with acute appendicitis diagnosed on the basis of Alvarado scoring system, with age 15 to 40 years or more, were included in the study.

Results: The mean and standard deviation of age and total leukocyte count were 27.83 ± 11.09 and 14883.47 ± 4940.94 respectively. Out of 117 patients with acute appendicitis, 71 (60.7%) were male patients while 46 (39.3%) were female patients. Acute appendicitis was present 47% in the age group of 15-30 years. Out of 117 patients, 69 (59%) patients had uncomplicated acute appendicitis and 48 (41%) had complicated acute appendicitis. Out of 117 patients, 60% had Alvarado score greater than 8 while 46 (39.3%) and 11 (9.4%) patients had Alvarado score 5-8 and 1-4 respectively. Out of 117 patients, 28 (23.9%) patients had TLC less than 11,000 g/l, 36 (30.8%) had TLC 11,000-15,000 g/l, 32 (27.4%) had TLC 16,000-20,000 g/l and 21 (17.9%) had TLC greater than 20,000. There was statistically significant difference among patients with complicated and uncomplicated appendicitis and leukocytosis.

Conclusions: It is conducted that total leukocyte count can be used as a severity marker and predicts about the complicated appendicitis. The higher the total leukocyte counts, the more are the chances of complicated acute appendicitis.

Keywords: Appendicitis, total leukocyte count

Introduction:

Appendicitis is one the acute abdominal diseases presented usually as a surgical emergency.¹ About 11.6 million people affected due to appendicitis reported in 2015 worldwide and

about 50,000 deaths occurred due to appendicitis and its complications in the same year.² Appendectomy is a surgical operation by removing the appendix for the treatment of appendicitis either by open or laparoscopic approach. The

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first laparoscopic appendectomy was done by Semm in 1983.³ About 250,000 appendectomies are done in America annually.⁴

The diagnosis of appendicitis is usually very difficult for both the surgeons and physicians and it presents differently depending upon the location of appendix and its clinical manifestations. As there is no sensitive and specific test for the diagnosis of acute appendicitis therefore the prevalence of negative appendectomy rate is high ranging from 10-20%.^{5,6} The prevalence of complicated appendicitis ranges from 18.2% to 65.9%.^{7,8}

Appendicitis is usually diagnosed on the basis of history of abdominal pain, clinical, radiological and laboratory findings.⁹ Acute appendicitis typically presents with mid abdominal pain and later on shifts to the right iliac fossa. The pain varies according to the location of the appendicitis. Clinically Rovsing's sign and McBurney's signs are used for the diagnosis. Different investigations are used for the diagnosis of acute appendicitis like leukocytosis, C reactive proteins, abdominal ultrasonography and CT abdomen. Different scoring systems are used for the diagnosis of acute appendicitis. Alvarado scoring system is commonly used for the diagnosis of acute appendicitis.^{10,11}

Severity of acute appendicitis in the form of complicated and uncomplicated acute appendicitis can be predicted by different inflammatory markers.¹² Leukocytosis is one of the components of the Alvarado scoring system used for both the diagnosis and prediction of severity of appendicitis. The higher the total leukocyte count, the more are the chances of acute appendicitis and its complications.¹³ An elevated leukocyte count is a non-specific inflammatory marker predicting the severity of appendicitis.¹⁴ Sensitivity and specificity of raised leukocyte count vary from 70% to 80% and 60% to 68% respectively for the diagnosis acute appendicitis.¹⁵

The aim of this study is to determine the role of total leukocyte count in predicting the complicated acute appendicitis in a tertiary care hospital.

Material and Methods:

This was a descriptive cross sectional study conducted at Department of Surgery, PGMI Khyber Teaching Hospital Peshawar, Pakistan from January 2020 to April 2021 for duration of one year and three months. The sample size was 117, keeping 18.2%⁷ proportion of complicated appendicitis among patients with acute appendicitis, 95% confidence interval and 7% margin error using WHO sample size calculator. Consecutive non probability sampling technique was used for the sampling.

All the patients presenting with acute appendicitis diagnosed on the basis of Alvarado scoring system with age 15 to 40 years or more, were included in the study. Patients having history of abdominal pain younger than 14-years, patients with liver disease and jaundice, patients with hemolytic anemia and consequent hyperbilirubinemia, patient with other obvious infective foci, previous abdominal surgeries, known concurrent medical diseases that would have affected outcomes were excluded from this study. Exclusion criteria were strictly followed to control the confounders and to exclude bias in the study results.

After obtaining permission from hospital ethical committee and taking consent from patients were included in the study. 5ml of blood was taken from all the patients admitted in the surgical ward for appendectomy and was sent to hospital laboratory for the detection of total leukocyte count. All the patients underwent appendectomy and were labeled as complicated and uncomplicated acute appendicitis on the basis of naked eye examination by the operating surgeon. All the investigations were done in same laboratory by a technician having experience of more than five years. All the data like age, gender, Alvarado score, Total leukocyte count, type of appendicitis were recorded in a pre designed proforma.

All the data was analyzed in SPSS version 22. Mean and standard deviation was calculated for numerical variables and frequencies and percentages were calculated for qualitative variables. Chi square test for categorical variables

Table 1: Mean and standard deviation of continuous variables

	Mean	SD
Age (years)	27.83	11.09
Total Leukocyte Count (g/l)	14883.47	4940.94

Table 2: Gender distribution of patients with acute appendicitis

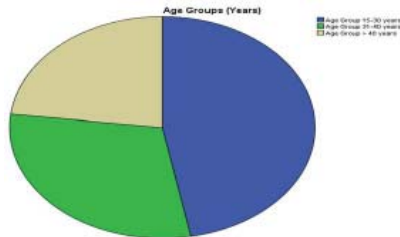
	Frequency	Percent
Male	71	60.7%
Female	46	39.3%



Graph 1: Gender

Table 3: Age group distribution

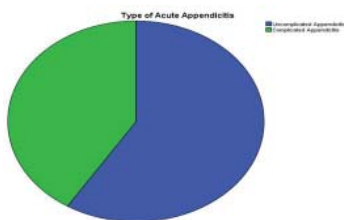
	Frequency	Percent
Age group 15-30 years	55	47.0
Age group 31-40 years	35	29.9
Age group > 40 years	27	23.1



Graph 2: Age groups

Table 4: Type of acute appendicitis

	Frequency	Percent
Uncomplicated acute appendicitis	69	59.0
Complicated acute appendicitis	48	41.0



Graph 3: Type of appendicitis

was applied with p value of < 0.05 as significant.

Results:

The mean and standard deviation of age and total leukocyte count were 27.83±11.09 and 14883.47±4940.94 respectively as shown in table 1.

Out of 117 patients with acute appendicitis, 71(60.7%) were male patients while 46(39.3%) were female patients as shown in table 2 and also shown in graph 1.

Acute appendicitis was present 47% in the age group of 15-30 years. 29.9% and 23.1% patients' were from the age groups 31-40 years and > 40 years respectively as shown in table 3 and also in graph 2.

Out of 117 patients, 69(59%) patients had uncomplicated acute appendicitis and 48(41%) had complicated acute appendicitis as shown in table 4 and also in graph 3.

Out of 117 patients, 60% had Alvarado score greater than 8 while 46(39.3%) and 11(9.4%) patients had Alvarado Score 5-8 and 1-4 respectively as shown in table 5 and also in graph 4.

Out of 117 patients, 28(23.9%) patients had TLC less than 11,000g/l, 36(30.8%) had TLC 11,000-15,000g/l, 32(27.4%) had TLC 16,000-20,000g/l and 21(17.9%) had TLC greater than 20,000 as shown in table 6 and also in graph 5.

There was not found statistically significant difference among different total leukocyte count groups and gender as shown in table 7.

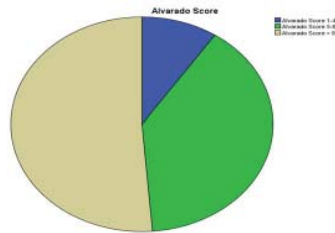
There was no statistically significant difference among different leukocyte count groups and age groups as shown in table 8.

Out of 117 patients, 23.9% patients had normal TLC and rest of the patients had high TLC as shown in table 9.

There was statistically significant difference among patients with complicated and uncomplicated appendicitis and leukocytosis as shown in table 10.

Table 5: Alvarado score

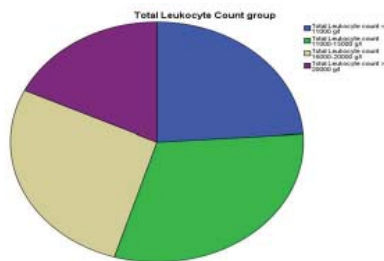
	Frequency	Percent
Alvarado Score 1-4	11	9.4
Alvarado Score 5-8	46	39.3
Alvarado Score > 8	60	51.3



Graph 4: Alvarado score

Table 6: Total Leukocyte count distribution

	Frequency	Percent
Total Leukocyte count < 11,000 g/l	28	23.9
Total Leukocyte count 11,000-15,000 g/l	36	30.8
Total Leukocyte count 16,000-20,000 g/l	32	27.4
Total Leukocyte count >20,000 g/l	21	17.9



Graph 5: Total Leukocyte count group

Table 7: Gender wise total leukocyte count distribution

	Male	Female
Total Leukocyte count < 11000 g/l	16(22.5%)	12(26.1%)
Total Leukocyte count 11000-15000 g/l	18(25.4%)	18(39.1%)
Total Leukocyte count 16000-20000 g/l	20(28.2%)	12(26.1%)
Total Leukocyte count > 20000 g/l	17(23.9%)	4(8.7%)
Asymp. Sig. (2-sided)	.137	

Table 8: Age wise distribution of total leukocyte count

	Age group 15-30 years	Age group 31-40 years	Age group > 40 years
Total Leukocyte count < 11000 g/l	12(21.8%)	9(25.7%)	7(25.9%)
Total Leukocyte count 11000-15000 g/l	21(38.2%)	8(22.9%)	7(25.9%)
Total Leukocyte count 16000-20000 g/l	14(25.5%)	13(37.1%)	5(18.5%)
Total Leukocyte count > 20000 g/l	8(14.5%)	5(14.3%)	8(29.6%)
Asymp. Sig. (2-sided)	.337		

Mean and standard deviation of continuous variables: The mean and standard deviation of age and total leukocyte count were 27.83 ± 11.09 and 14883.47 ± 4940.94 respectively as shown in table 1.

Gender distribution of patients with acute appendicitis: Out of 117 patients with acute appendicitis, 71(60.7%) were male patients while 46(39.3%) were female patients as shown in table 2 and also in graph 1.

Age group distribution: Acute appendicitis was present 47% in the age group of 15-30 years. 29.9% and 23.1% patients' were from the age groups 31-40 years and > 40 years respectively as shown in table 3 and also in graph 2.

Type of acute appendicitis: Out of 117 patients, 69(59%) patients had uncomplicated acute appendicitis and 48(41%) had complicated acute appendicitis as shown in table 4 and also in graph 3.

Alvarado score: Out of 117 patients, 60 (%) had Alvarado score greater than 8 while 46(39.3%) and 11(9.4%) patients had Alvarado Score 5-8 and 1-4 respectively as shown in table 5 and also in graph 4.

Total Leukocyte count distribution: Out of 117 patients, 28(23.9%) patients had TLC less than 11,000g/l, 36(30.8%) had TLC 11,000-15,000g/l, 32(27.4%) had TLC 16,000-20,000g/l and 21(17.9%) had TLC greater than 20,000 as shown in table 6 and also in graph 5.

Gender wise total leukocyte count distribution: There was not found statistically significant difference among different total leukocyte count groups and gender as shown in table 7.

Age wise distribution of total leukocyte count: There was no statistically significant difference among different leukocyte count groups and age groups as shown in table 8.

Out of 117 patients, 23.9% patients had normal TLC and rest of the patients had high TLC as shown in table 9.

Table 9: Type of acute appendicitis and TLC

	Uncomplicated appendicitis	Complicated appendicitis	Total
Total Leukocyte count < 11000 g/l	24	4	28 (23.9%)
Total Leukocyte count ≥ 11000 g/l	45	44	89 (76.1%)

Table 10: Type of acute appendicitis according to different TLC groups

	Uncomplicated appendicitis	Complicated ap- pendicitis
Total Leukocyte count < 11000 g/l	24(34.8%)	4(8.3%)
Total Leukocyte count 11000-15000 g/l	21(30.4%)	15(31.2%)
Total Leukocyte count 16000-20000 g/l	17(24.6%)	15(31.2%)
Total Leukocyte count > 20000 g/l	7(10.1%)	14(29.2%)
Asymp. Sig. (2-sided)	.002	

Type of acute appendicitis according to different TLC groups: There was statistically significant difference among patients with complicated and uncomplicated appendicitis and leukocytosis as shown in table 10.

Discussion:

The diagnosis of acute appendicitis is usually difficult for physicians and surgeons due to its presentation and location. A detailed history, clinical examination and laboratory investigations and radiological findings can help in the diagnosis of acute appendicitis^{6,17,18} The rate of negative appendectomy still exists and there is no sensitive or specific tool for the diagnosis of acute appendicitis. Leukocytosis is one of the components helping in the diagnosis and predicting the severity of acute appendicitis.

According to our study, out of total 117 patients, 60.7% were male and 39.3% were female. Saaqi M et al showed that 62.23% were males and 37.76% were females.¹⁹

Acute appendicitis is associated with elevated total leukocyte count. Different studies have shown elevated total leukocyte count. Ahmad QA et al showed in a study that 57.3% had elevated TLC.²⁰ Another study by Maqbool HJ et al, 79.6% patients had elevated total leukocyte count.²¹ Diogo-Filho A et al,²² suggested that 80% patients with acute appendicitis had elevated leukocyte count in 24 hours of presentation. In this study, 76.1% patients elevated Total Leukocyte Count and 23.9% had normal Total Leukocyte Count. In a study by Joseph L et al 17.5%

patients had normal Total Leukocyte Count.²³

Comparing the leukocytosis in patients with complicated and uncomplicated acute appendicitis, p-value was found statistically significant in our study. Joseph L et al²³ showed that high TLC was associated statistically significant with complicated and uncomplicated acute appendicitis.

Thus it was suggested that elevated total leukocyte count is a predictor of complicated acute appendicitis. Beltrán MA et al¹⁴ and Guraya SY et al²⁴ showed in their studies that leukocytosis was a reliable marker of severity of acute appendicitis.

Limitations: This study had relatively small sample size. Others severity markers like C reactive proteins and bilirubinemia were not addressed in this study.

Conclusion:

It is conducted that total leukocyte count can be used as a severity marker and predicts about the complicated appendicitis. The higher the total leukocyte counts, the more are the chances of complicated acute appendicitis.

Conflict of interest: None

Funding source: None

Role and contribution of authors:

Sakhawat Hussain, collected the data, references and did the initial writeup.

Naseem Khan, helped in collecting the data and also helped in introduction writing.

Mohammad Daraz Khan, helped in collecting the references and also helped in abstract writing.

Waqar Ullah, helped in collecting the data and also helped in discussion writing.

Fazli Rashid, critically review the article and made final changes.

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