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Research Article

Correlation of WBC Count and Neutrophil Percentage in Acute Appendicitis: A Prospective Study at Universal College of Medical Sciences, Bhairahawa

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Abstract:
Acute appendicitis is the most common surgical emergency of the abdomen and remains a diagnostic challenge despite advances in imaging techniques. Clinical evaluation supported by laboratory investigations, including white blood cell (WBC) count and neutrophil percentage, continues to play an important role in diagnosis. However, the diagnostic accuracy of these parameters remains variable.
This prospective study aimed to evaluate the correlation between WBC count and neutrophil percentage in the diagnosis of acute appendicitis. A total of 147 patients clinically suspected of acute appendicitis and undergoing appendectomy between January 2017 and July 2018 were included. WBC count and neutrophil percentage were measured at admission, and final diagnosis was confirmed through histopathological examination.
The sensitivity and specificity of WBC count were 72.7% and 73.3%, respectively, with positive and negative predictive values of 23.4% and 96%. Neutrophil percentage showed a sensitivity of 50.8% and specificity of 80%, with positive and negative predictive values of 15.6% and 95.7%, respectively. Histopathological confirmation of appendicitis was observed in 89.79% of cases.
The findings suggest that WBC count and neutrophil percentage are useful supportive diagnostic tools when combined with clinical evaluation. However, they should not be used as standalone diagnostic indicators due to their variable sensitivity and specificity.

Keywords: *Acute appendicitis, total leukocyte count, neutrophil percentage, diagnostic accuracy, histopathological correlation, appendectomy*

1. Introduction

Acute appendicitis was first described by Reginald Fitz in 1886 as the cause of pain in Right Iliac fossa [1]. It is the most frequent cause of persistent and progressive abdominal pain for all ages [2]. Acute appendicitis accounts for nearly 10% of abdominal surgeries and one third of paediatric hiospital admissions for acute abdomen [3]. Approximately 7.0% of the population will have appendicitis in their lifetime with the peak incidence occurring between the age of 10 and 30 years [4].
Appendicitis progresses from simple inflamed appendicitis to gangrene with subsequent perforation and abscess formation which can be localized or widespread [5]. The condition is difficult to diagnose especially if the patients present in the early stages when the classical signs and symp- toms are usually subtle [6] . There are many Different disease processes which mimic the diagnosis of acute appendicitis as there are a number of causes leading to pain in the right iliac fossa particularly in female patients.
Accurate and prompt diagnosis is essential and indispensable as this condition requires timely surgery. Delay in the diagnosis and therapeutic decision are continuing dilemmas leading to a high morbidity and mortality rate, specially when there are other associated medical diseases especially in case of kids and elderly population [7].
Abdominal pain is the most common clinical presentation in Acute Appendicitis along with other associated symptoms like Anorexia, nausea and vomiting. The classical history of periumbilical pain at beginning and later shifting to right iliac fossa is present in only 50% cases. In 70% of the cases the clinical presentation is typical and there is no difficulty in making a diagnosis. The remaining 30% have atypical clinical presentation and present a diagnostic dilemma for the surgeons especially in the extreme of age, in women of reproductive age and with abnormal position of the appendix and thus have an uncertain preoperative diagnosis leading to unnecessary laparotomy and appendicectomy [8,9].
Early recognition of the condition and prompt operation

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have been the most important factor in reducing morbidity and possible mortality, length of hospital stay, and cost of treatment [10].

Although none of the laboratory values has high sensitivity and specificity for the diagnosis of appendicitis, for a long time the main laboratory test for acute appendicitis has been the Total leucocyte (TLC) count and Neutrophil percentage . These tests have been studied extensively. These two lab markers are the most discriminating factor for appendicitis within 24 hours of the onset of pain .They are simple, cheap and results can be available in a very short time. Their practical values however remain controversial because of its considerable overlap with other inflammatory conditions mimicking acute appendicitis. Different opinions have been expressed Other additional laboratory tests that help in the diagnosis of acute appendicitis include the C-Reactive Protein (CRP) which is synthesized by hepatocytes during acute phase response to a variety of infectious or inflammatory processes[11] .

Different opinions have been expressed regarding the significance of these tests. They have been described as useful, of limited value, of no specific value or even misleadin. For a long time, the main laboratory test for acute appendicitis has been the leucocyte count. Patients with acute appendicitis often present with a raised leucocyte count,but owing to a considerable overlap with other inflammatory processes mimicking acute appendicitis, the diagnostic value of the leucocyte count remains controversial [12].

The objective of this study was to find the corelation of WBC and neutrophil count in acute appendicitis.

Materials And Method

This prospective study was conducted in the Department of Surgery, Universal College of Medical Sciences (UCMS) over the period of One Year and Five months (January 2016 to July 2017) . Informed consent was obtained from all patients. Ethical approval was obtained from institutional review board. A total number of 147 Patients with a Clinical diagnosis of acute appendicitis and those who gave writtenconsent for the study were included in the study. Patients not willing to participate and severely ill patients were not included in the study. The Sampling method used was Simple Random Sampling. A detailed Clinical History was taken and thorough Clinical Examinations were done. Relevant Investigations like Haemoglobin, Total Leucocyte Count, Differential Count, RBS, Urine examination and Ultrasonography (USG) were done in all cases. The final diagnosis of Acute Appendicitis was made on the basis of Clinical examination supported by available laboratory investigation reports. However Histopathological report was taken as gold standard for diagnosis of Acute Appendicitis.

WBC count and Differential count of all the patients were recorded along with other relevant laboratory investigation results in Windows Microsoft Excel and then statistical analysis was conducted by using statistical package for social science software (SPSS) version 20.0 for data analysis and chi square test was used for categorical data. A value of $p<0.05$ was considered statistically significant.

Total number of cases who underwent Appendectomy during this period was 147, who were taken for the study

Result And Observation

Out of total 147 patients studied, 92 cases (62.6 %) were male and 55 (37.4%) were female.

Age Distribution

The age group most commonly undergoing appendectomy was 21-40 years which was followed by 0-2 years.

The youngest operated patient was 5 years old while the oldest was 85 years old.

Table 1: Age wise distribution of the patients

S. No	Age	Number	Percentage
1.	0–20	47	31.97%
2.	21-40	69	46.93%
3.	41-60	25	17%
4.	61-80	5	3.40%
5.	81-100	1	0.68%
	Total	147	

Presentation

Out of 147 cases most common presenting complains were Periumbilical Pain and fever along with anorexia. 67 patients out of 147 patients (45.6%) presented with chief complains of Pain along with fever and anorexia. Then the second most common symptom was pain and fever. 38 patients (25.9%) presented with complains of pain and fever. Similarly 28 patients (19%) presented with complains of Pain and fever accompanied by vomiting.

Table 2: Presentation of the patients

S. No	Complaints	Number	Percentage
1.	Pain, Vomiting and Fever	28	19.05%
2.	Pain and Fever	38	25.85%
3.	Pain, Vomiting and Anorexia	2	1.36%
4.	Pain, Vomiting and Diarrhoea	6	4.08%
5.	Pain, Fever and Anorexia	67	45.58%
6.	Pain and Anorexia	4	3.04%
	Total	147	

Intraoperative Findings

The table shows the Intraoperative findings in case of Appendicitis. The most common finding was Inflamed Appendix with Healthy base. This finding was present in 100 cases. Second most common finding was found to be Gangrenous Appendix with base healthy seen in 10 cases. Least common intraoperative finding was Appendicular abscess which was present in 6 cases.

S. No	Diagnosis/Finding	Number	Percentage
1	Appendicular Abscess	6	4.08%
2	Gangrenous Appendix, Base Healthy	10	6.80%
3	Inflamed Appendix with Gangrenous Segment Impending to Perforate	7	4.76%
4	Inflamed Appendix with Peri-appendicular Collection	8	5.44%
5	Inflamed Appendix, Base Healthy	100	68.03%
	Total	**147**	**100%**

Histopathological Findings

Out of 147 patients operated for acute appendicitis, most common histopathological type was Acute Suppurative Appendicitis which was seen in 38 patients (25.9%) followed by Early Acute Appendicitis in 35 patients (23.8%) . Similarly Acute Gangrenous appendicitis was 32%. Perforation was seen in 17 cases (11.6%) and Negative appendectomy rate was 10.2% (in 15 patients).

Figure 4: Table showing Histopathological Findings

S. No	Findings	Number	Percentage
1	Acute Suppurative Appendicitis	38	25.85%
2	Early Acute Appendicitis	35	23.80%
3	Acute Gangrenous Appendicitis	32	21.77%
4	Perforation	17	11.56%
5	Others	10	6.80%
6	Normal Appendix	15	10.20%
	Total	**147**	**100%**

Negative Appendectomy and Perforation.

There were total 147 patients Operated for Acute Appendicits. On Histopathological examination, 132 cases turned out to be Appendicitis where as 15 cases were of Normal Appendix and 17 were perforated appendix.

Table 5: Negative appendectomy and perforation rate

S. No	Findings	Number	Percentage
1	Negative Appendectomy	15	10.20%
2	Perforation	17	11.65%

Sex and Negative Appendectomy

Out of 147 cases, there were 15 normal appendix among which 12 were seen in female patients and the rest were seen in male . This study shows that the chances of Negative appendectomy is higher in female compared to male.

Figure 6: Table of sex and histopathology.

		HISTOPATHOLOGY REPORT		Total
		Appendicitis	Normal Appendix	
SEX	Male	89	3	92
	female	43	12	55
Total		132	15	147

Coorelation Of Total Leucocyte Count With Histopathologically Positive And Negative Cases.

TLC was raised in 104 cases and normal in 43 cases. Appendicitis was diagnosed by histopathology in 132 cases and 15 cases had a normal appendix on histopathological examination. In the TLC raised group 96 cases had true appendicitis, and 4 cases had normal appendix on histopathological examination. Out of 132 cases of appendicitis TLC was raised in 96cases while it was normal in 36 cases. Similarly in 15 cases of normal appendix, TLC was raised in 4 cases and normal in 11 cases.

Thus Sensitivity and Specificity of TLC in diagnosing appendicitis was 72.7 % and 73.3% respectively whereas the positive and negative predictive values were 23.4% and 96% respectively .The P value was 0.001 using Fisher's exact test which shows high statistical significance.

Sensitivity = True Positive ÷(TruePositive+FalseNegative)x100%=72.7%

Specificity =True Negative÷ (True Negative+False Positive)x100%=73.3%

Positive Predictive value=23.4%

Negative Predictive Value=96%

Diagnostic Accuracy of the Test = 72%

Table 7: Correelation between TLC and Histopathologically proved appendicitis

			OUTCOME		Total
			Normal appendix	Appendicitis	
TLC	Normal	Count	11	36	43
		% within only positives	73.3%	27.3%	29.3%
	Raised	Count	4	96	104
		% within only positives	26.7%	62.7%	70.7%
Total		Count	15	132	147
		% within only positives	100.0%	100.0%	100.0%

Correlation Of Neutrophil Percentage With Histopathologically Proved Appendicitis

Neutrophil was raised in 70 cases and was normal in 77cases.In Neutrophil raised group, 67 had histopathologically proved appendicitis and 3 had normal Appendix. Out of 132 histopathologically proved appendicitis , 67 had raised neutrophil count whereas 65 had normal neutrophil count. Similary in case of Normal Appendix, 3 had raised count and 12 had normal count.

Thus Sensitivity and specificity of Neutrophil percentage in diagnosing acute appendicitis was 50.8% and 80% respectively. Similarly Negative and Positive predictive Value were 15.6% and 95.7% respectively. The P value is 0.024 using Chi square test which shows statistical significance.

Sensitivity = 50.8%

Specificity = 80%

Positive Predictive Value = 95.7%

Negative Predictive Value = 15.6%

Diagnostic Accuracy of the test = 53%

Table 8: Correlation between Neutrophil percentage and Appendicitis

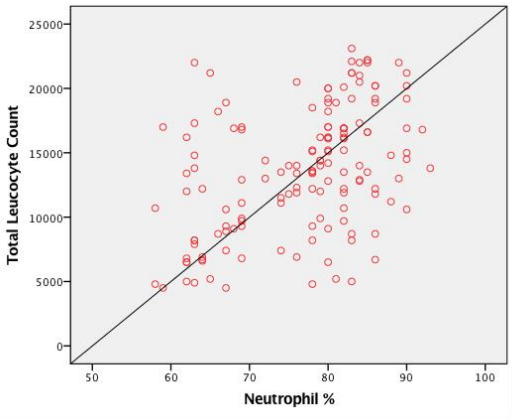
			Outcome		
			Normal Appendix	Appendicitis	Total
DLC	Normal	Count	12	65	77
		% within only positives	80%	49.2%	49.7%
	Raised	Count	3	67	70
		% within only positives	20%	50.8%	50.3%
Total		Count	15	132	147
		% within only positives	100.0%	100.0%	100.0%

Correlation Between Total Leucocyte Count And Neutrophil Percentage

It was found that, out of 147 patients studied, TLC was raised in 104cases and Neutrophil percentage was raised in 70 cases with Histopathologically positive Acute Appendicitis while TLC was normal 43 cases and Neutrophil percentage was normal in 77 cases.

There existed a perfectly positive linear relationship between two variables i.e TLC and Neutrophil. It means if one of the either increases, the other one automatically increases and if one of the two decrease, another one also decreases. The level of significance is 0.01.

Figure 1: Scatter Diagram showing positive linear Relationship



Discussion

Acute Appendicitis is the most common Acute Surgical condition of the abdomen. The diagnosis of Acute Appendicitis is difficult and remains one of the most challenging diagnostic issues in surgery even in today's modern era. The combination of history, physical examination, laboratory tests, and imaging studies are used for an accurate diagnosis of AA. The classical history of pain, beginning in the periumblical region and shifting to right lower quadrant is found in 50.0% of the patients [13]. There are many other inflammatory conditions which mimic the presentation of Acute Appendicitis which is the main cause of diagnostic confusion and hence delay in diagnosis which result in Increases mortality.

Although, appendectomy is considered to be a safe operation, it still has got associated complication such as wound infections, dehiscence, peritonitis and abdominal abscess. Therefore, there is an eager to reach an accurate diagnosis of acute appendicitis among surgeons relying on the fastest and the most cost effective diagnostic tool [14].

Many prospective studies have demonstrated that the accuracy of preoperative clinical diagnosis lies in the range of mere 70.0-78.0% thus giving a negative appendectomy rate around 20.0-25.0% on average [15].

Many vigorous attempts were made with various diagnostic modalities to reduce the negative laparotomy rate. The different modalities are based on radiological or other invasive procedures and laboratory tests to identify inflammatory markers.

In this study various variables related to Acute appendicitis were studied. In our study, out of total 147 patients studed, 62.5% were male and 37% were female which is similar to the finding in a study conducted by Jamaluddin M et.al in Karachi, Pakistan [16] and study conducted in Columbia University College of Physicians and Surgeons, New York, USA by Kharbanda et al. in Jan 2012 [17]. Among 147 patients operated , age group commonly undergoing appendectomy was 21-40 years which was followed by 1-20 years old. Mean age was 29.66 with Standard Deviation of 15.18 .

In our study we had a negative Appendectomy Rate of 10.2% which is in accordance with the rates of Negative Appendectomy of 5-15% by Buchman TG et. al . One important finding in our study was a higher percentage of Negative Appendectomy in females than in males , which tallies with the result of other studies [18].

Out of 147 patients studied, 132 patients had histopathologically positive acute appendicitis .In these 132 , Total Leucocyte Count was raised in 96 patients while in case of 15 Negative Appendectomy, WBC count was raised in 4 patients . So the Sensitivity of the test was 72.7 % and Specificity of the test was 73.3% . According to Wang et al. study [19], WBC counts had a sensitivity of 67% and a specificity of 80%. In another clinical report, the range of sensitivity and specificity of WBC in the diagnosis of AA have been reported to be 67%- 97.8% and 31.9%-80%, respectively [20]. Similarly a study conducted by Sahbaz et al, both sensitivity and specificity of leucocyte count was found low for the diagnosis of acute appendicitis, being 67.5% and 36.3%, respectively [21], which is quiet low compared to our study.

Neutrophil percentage was also used as a laboratory test for acute appendicitis. In a retrospective study, elevated neutrophil ratio has been detected as a good diagnostic marker in acute appendicitis. The sensitivity of neutrophil ratio has been 60.1% and specificity 76.9% in diagnosing acute appendicitis 24.Another study conducted by Sahbaz et.al [21] the sensitivity and specificity of neutrophil ratio was found 60.1% and 90.9%, respectively. In present study, the sensitivity of Neutrophil Precentage was found to be 50.8% and specificity was 80%.

We can neither rely wholly on TLC nor on WBC count for operative decision. Clinical judgment is still remains the best modality for diagnosis of acute appendicitis and in judging whether operating management is required or not. It seems wiser to use active observation, which should identify most patients

with non-specific pain and reserve operation for those who need it most.

Conclusion

From this study it can be concluded that there exists a positive linear relationship between TLC and neutrophil percentage, i.e. if one of the test increases, the other test also increases and vice versa. Similarly regarding correlation of TLC and neutrophil percentage in histopathologically positive acute appendicitis, they can be used as important diagnostic test combined with evaluation of physical findings.

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