

ORIGINAL RESEARCH

Evaluation Of Alvarado Score And CRP In Diagnosis Of Acute Appendicitis And Correlation With Histopathological Examination

Vinay Sagar Cheeti¹, P. Mallikarjun², D.Venkateshwar Rao³

ABSTRACT

Introduction: Acute appendicitis is the most common surgical emergency in children and adolescents. Despite its frequency, the diagnosis of appendicitis is sometimes difficult. Study was aimed to correlate the Alvarado Score and C reactive protein in diagnosing (preoperatively) acute appendicitis with post-operative histopathological reports.

Materials and Methods: Patients who present with symptoms & signs of acute appendicitis and underwent an emergency Appendectomy for a period of 1 year, Total 100 cases who underwent appendectomy operation. Patients are divided into 2 groups according to Alvarado Score as Group A include patients with scores of less than 7, Group-B those patients with score 7 – 10 underwent appendectomy.

Results: In the present study the average age was 23.62 years out of 100 patients 45 belonged to the age group between 20 and 29 years. In the present study the sensitivity was 93.75%, specificity was 61.12%, positive predictive value was 81.08% and negative predictive value was 84.66% and the total negative appendectomy rate was 26%. In our study, the sensitivity of CRP was 86.48% and specificity was 84.61%. positive predictive value was 94.11% and negative predictive value was 68.75%.

Conclusion: Alvarado score and CRP are more sensitive in diagnosing acute appendicitis in comparing with histopathology.

Keywords: Acute appendicitis, Alvarado Score, C reactive protein, Histopathology.

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INTRODUCTION

The vermiform appendix is considered, by most, to be a vestigial Organ; its importance in surgery results only from its propensity for inflammation, which results in the clinical syndrome known as acute appendicitis. Notwithstanding advances in modern radiographic imaging and diagnostic laboratory investigations, the diagnosis of appendicitis remains essentially clinical, requiring a mixture of observation, clinical acumen and surgical science.¹ The overall lifetime risk of developing appendicitis is estimated to be of 7% with the highest frequency occurring at ages from 10 to 30 years.² Its incidence is 1.5-1.9/1000 in male and female population.³ Surgery for acute appendicitis is the most frequent operation performed (10% of all emergency abdominal operations).^{4,5} Routine history and physical examination still remains the most practical diagnostic modalities.⁶ Absolute diagnosis, of course, is only possible at operation and on histopathological examination of specimen.⁷

It is impractical to have a definitive preoperative diagnosis by gold standard, histopathology, which leads to an appreciable rate of negative appendectomy as reported in the world literature varying from 20-40% with its associated morbidity of around 10%, some surgeons even accept a negative appendectomy rate of 20%.⁸ In order to reduce the negative appendectomy rates, various scoring systems have been developed for supporting the diagnosis of acute appendicitis.^{9,8} Alvarado scoring system is one of them and is purely based on history, clinical examination and few laboratory tests and is very easy to apply.¹⁰

Similarly, CRP is a laboratory investigation used for diagnosis of appendicitis. Decision making in cases of acute appendicitis poses a clinical challenge especially in developing countries where advanced radiological investigations do not appear cost effective and so clinical parameters remain the mainstay of diagnosis.¹¹ It has been claimed that diagnostic aids can drastically reduce the number of appendectomies in patients without appendicitis, the number of perforation and the time spent in the hospital.¹² These aids include laparoscopy scoring

system, USG, CT (Computed tomography) scans, MRI (Magnetic Resonance Imaging), which are available in different settings and have different advantages and disadvantages. However, routine history and clinical examination both remain the most effective and practical diagnostic modalities.¹³ Hence we study to evaluate the sensitivity of Alvarado scoring system and C reactive protein in the diagnosis of acute appendicitis and correlate the Alvarado Score and C reactive protein in diagnosing (preoperatively) acute appendicitis with post-operative histopathological reports.

MATERIAL AND METHODS

Present study is done in General surgery department at Osmania general hospital Hyderabad, during the period of July 2012 to September 2014. Total 100 cases who underwent appendectomy operation. Patients presenting to the outpatient department. The cases were taken up for study on admission after obtaining written consent and after explaining them the nature of operation, type of anaesthesia and the study being done. There was no recruitment of any volunteers, additional nursing or bio medical staff for this study; also there was no interference in the normal duty pattern of the hospital staff.

Inclusion Criteria

1. It includes the patients who presented with symptoms and signs of acute appendicitis.
2. Both male and female patients.

Exclusion Criteria

1. Age below 10 year, both female and male
2. Diabetes mellitus,
3. Immuno-compromised patients ,
4. Pregnant patients ,
5. Patients with Appendicular mass .

All included patients are admitted and are initially subjected for detailed history taking, clinical examination and investigations (as required). Following which they were evaluated using the Alvarado scoring. Then the total score is calculated for each patient and based on the results, patients are divided into two groups.

Group A: Those patients with scores of less than 7 were not considered for surgery unless there were compelling reasons otherwise. If after 24 hour of observation, regardless of score, who were thought, on clinical grounds, to require Appendectomy, it was performed.

Group-B: Those patients with score 7 – 10 underwent appendectomy

SYSTEM SYMPTOM	SCORE
1.Migratory RIF Pain	1
2.Anorexia	1
3.Nausea & Vomiting	1
SIGN	
1. Tenderness Over RIF	2
2. Rebound Tenderness RIF	1
3. Elevated Temperature	1
LAB FINDINGS	
1. Leucocytosis	2
2. Shift to Left	1
TOTAL	10

Alvarado score is dynamic and patient score can increase or decrease on reassessment.

Pain around the umbilicus or upper abdomen, later shifted to right lower quadrant was taken as migratory RIF pain. The laboratory finding of leucocytosis is defined as a white cell count in excess of 10x10⁹/lit (10,000/mm³). Elevated temperature is taken as a temperature of more than 100°F . Diagnosis of acute appendicitis is confirmed by operative findings and histopathological assessment of the appendectomy specimen. one or more of the following is observed. Neutrophilic infiltration of all the coats of appendix. Necrosis of mucosa leading to mucosal ulcers, Perforated appendix Final data was collected in a specially designed proforma filled in for each patient. Finally the reliability of Alvarado scoring system is assessed by calculating Negative Appendectomy rate (the proportion of operated patients having normal appendix removed) and positive predictive value (the proportion of patients with a positive test result who actually have the disease).

C reactive protein was also done in all cases by latex (slide) agglutination method. CRP value more than 6 µg/ml was considered to be positive .

RESULTS

From total number in our sample 100 patients were included in the final data analysis

In the present study the average age was 23.62 years with the range of age of participants between 12 to 50 years. Out of the 100 patients, 45 belonged to the age group between 20 and 29.(Table-1)

In group A males if the Alvarado score is above 7 then the sensitivity of Alvarado score was 95.23%.

In females if the Alvarado score is above 7 then the sensitivity of Alvarado score was 90.90%.

Out of 100 cases 64 of them have Alvarado score above 7. If the Alvarado score is above 7 then the sensitivity of Alvarado score was 93.75%. (Table-2)

In Group B males if the Alvarado score is below 7, then the sensitivity of Alvarado score was 38.46%.

In females if the Alvarado score is below 7, then the sensitivity of Alvarado score was 40.00%.

Out of 100 cases 36 of them have Alvarado score below 7. If the Alvarado score is below 7, then the sensitivity of Alvarado score was 38.88% (Table-2).

Right iliac fossa pain was a consistent symptom in all the patients irrespective of age. Followed by migratory pain and rebound tenderness which was elicited in almost 93 and 90 percent of the cases respectively. Shift to left of neutrophil count was seen in only 9% of the cases.

Out of the 100 cases, 74 cases were confirmed histologically as appendicitis. Out of these 74 cases, 58 cases had inflamed appendix, 9 were perforated appendix and remaining 7 had gangrenous appendix. (figure-1) Remaining 24 cases which are negative for appendix histopathologically had other diagnosis like ovarian cyst, salpingitis, mesenteric lymphadenopathy or meckel's diverticulum. 14 cases had no pathology (Table-3).

Out of 100 cases considered in the study, 68 cases were positive for C reactive protein, out of which, 64 patients were proved as acute appendicitis histopathologically. 32 cases were negative for C reactive protein and out of which, only ten cases had acute appendicitis proven histopathologically. (Table-4 and Figure-2). Sensitivity of CRP was 86.48% and specificity was 84.61%. positive predictive value was 94.11% and negative predictive value was 68.75%.

DISCUSSION

This study was to evaluate the sensitivity of Alvarado scoring system and C-Reactive protein in the diagnosis of acute appendicitis, to reduce the rate of negative appendectomy and to reduce the direct complications of acute appendicitis due to misdiagnosis and delay in surgery. Cases of acute appendicitis poses a clinical challenge especially in developing countries where advanced radiological investigations do not appear cost effective and so clinical parameters remain the mainstay of diagnosis.¹⁴ Through history and clinical examination still remains the mainstay for the diagnosis, but misdiagnosis and negative appendectomy still do occur at quite a high rate. It is the surgeon who has to decide the best management and in a cost effective manner. The decision to operate or not is very important as surgical intervention in acute appendicitis is not without the risk of morbidity and mortality. Even though, a negative appendectomy has a negligible mortality and morbidity of around 10%.¹⁵ In the present study the average age was 23.62 years with the range of age of participants between 12 to 50

years. In a study conducted by S.Bramachari et al¹⁶ showed that the mean age of their study was about 29.12 years with range of age between 13 – 68 years. A study conducted by N.Baidya et al¹⁵ suggested 26.3 years as the average age with a range of their age between 16 to 72 years.

In the study conducted by Subhajeet et al¹⁷, the average age of the subjects was 25.8 years and the range of the age of the participants was 9 to 57 years. The average, in almost all the studies belong to similar age group and the most common age group was 21 to 30 years similar to the study conducted. Hence there is no major difference between the studies as far as age groups are concerned. It highlights the common age group of incidence of acute appendicitis.

In the present study, out of 100 patients, 68 were male and 32 were female. The male to female ratio was 2.1:1.5. In a study conducted by S.Bramachari et al¹⁶ showed that out of 200 patients, the males accounted for 112 (56%) of the cases and females accounted for 88 (44%) of the cases. The male to female ratio in this study was 1.27:1 In a study conducted by N.Baidya et al¹⁵ showed that out of 231 patients, the males accounted for 141 (61%) of the cases and females accounted for 90 (39%) of the cases. The male to female ratio in this study was 1.56:1. In a study conducted by Subhajeet et al¹⁷ showed that out of 155 patients, the males accounted for 83 (53.5%) of the cases and females accounted for 72 (46.5%) of the cases. The male to female ratio in this study was 1.15:1. Studies show that it is seen that males are more affected by appendicitis as females have got many gynaecological diagnosis to be excluded.

Age in Years	No.of Patients	Percentage
Less than 15	10	10%
15 – 19	24	24%
20-29	45	45%
30-39	14	14%
40-49	6	6%
Above 50	1	1%
Total	100	100%

Table-1: Distribution of Patients with Age Group (Years)

In our study 74 cases were diagnosed acute appendicitis histopathologically In the study conducted by Subhajeet et al¹⁷ there were 80 cases of histologically positive acute appendicitis. In the present study the sensitivity was 93.75%, specificity was 61.12%, positive predictive value was 81.08% and negative predictive value was 84.66%. Study by Subhajeet et al¹⁷ the sensitivity was 94.2% and

Gender	No. of patients with alv.score >7	Acute appendicitis	Normal appendix	sensitivity
GROUP A Alvarado Score <7				
Male	26	10	16	38.46%
Female	10	4	6	40.00%
Total	36	14	22	38.88%
GROUP B Alvarado Score >7				
Male	42	40	2	95.23%
Female	22	20	2	90.90%
Total	64	60	4	93.75%

Table-2: Sensitivity to Alvarado Score 7

specificity was 70%. Positive predictive value was 86.9% and negative predictive value was 69.8%. In the study by Yasser Abdeldaim et al¹⁸ the sensitivity was 95%, positive predictive value was 89% and negative predictive value was 85.5%. In the study by S.Crnogorac et al¹⁹ the sensitivity was 87% and specificity was 60%. All the studies are comparable as all the studies have almost similar sensitivity ranging from 89% to 95%. Specificity was lower when compared to sensitivity and ranged between 60 to 70 percent in all the studies. Similarly positive predictive value and negative predictive value are also comparable and almost similar in all the studies.

Findings	No. of Patients	Percentage
Inflammation	58	58%
Perforation	9	9%
Gangrenous	7	7%
Ovarian cyst	5	5%
Salpingitis	3	3%
Mesenteric lymphadenopathy	4	4%
Meckels diverticulum	0	0%
No pathology	14	14%

Table-3: Post-Operative Histopathology Findings

CRP	Acute appendicitis	Normal appendix	Total
Positive	64	4	68
Negative	10	22	32
Total	74	26	100

Table-4: C Reactive Protein in patients

In the present study in males the sensitivity was 95.23%, specificity was 61.54%, positive predictive value was 80% and negative predictive value was 88.8%. In the present study in females the sensitivity was 90.90%, specificity was 60%, positive predictive value was 83.33% and negative predictive value was 75%. In the study by Subhajeet et al¹⁷ in males, the sensitivity was 89% and specificity was 62.5%. Positive predictive value was 81.6% and negative predictive value was 62.8%.

In the study by Subhajeet et al¹⁷ in females, the sensitivity was 89% and specificity was 30.9%, positive predictive value was 93% and negative predictive value was 30.9%. In the study by Yasser Abdeldaim et al¹⁸ in males, the sensitivity was 96%, positive predictive value was 96% and negative predictive value was 92%. In the study by Yasser Abdeldaim et al¹⁸ in females, the sensitivity was 65%, positive predictive value was 77% and negative predictive value was 77%. In all the studies all the parameters are comparable to each other and are almost similar.

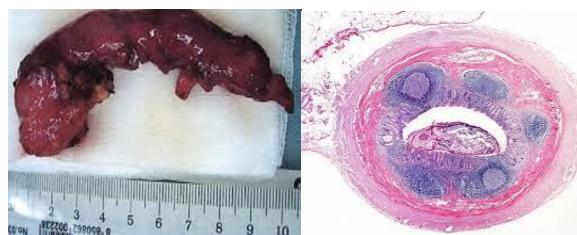


Figure-1: Inflamed appendectomy specimen; **Figure-2:** Histopathology of an inflamed appendix

In the present study, in males, the negative appendectomy rate was 26.47% and in females, was 25% and the total negative appendectomy rate was 26%. Negative appendectomy rate in Subhajeet et al¹⁷, in males, was 18.3% and in females, was 6.9% and the overall percentage was 13%. This high negative appendectomy rate in our study when compared to Subhajeet et al¹⁷ is because of removal of some normal appendices is bound to lower the rate of perforation and consequently mortality. Literature shows that if negative appendectomy rate is less than 10 to 15 percent then the surgeon is operating on very few patients, thus increasing the risk of complications. Many of the studies in our literature show a negative appendectomy rate of 20 to 40%.²⁰ In our study, the sensitivity of CRP was 86.48% and specificity was 84.61%. positive predictive value was 94.11% and negative predictive value was 68.75%. In the study by Gewurz H et al,²¹ the sensitivity of CRP was 93.5% and specificity was 80%. In the study by S.Afsar et al,²² the sensitivity of CRP was 93.6% and

specificity was 86.6%.positive predictive value was 96.7% and negative predictive value was 76.5%. In the study by I. Khan et al,²³ the sensitivity of CRP was 75.6%, specificity was 83.7% and positive predictive value was 96%. In all the studies, all the parameters are comparable to each other and are almost similar.

CONCLUSIONS

Alvarado score is having a good diagnostic accuracy when compared with post-operative histopathological report, it improves the diagnostic accuracy and consequently reduces negative exploration and complication rate when assessed early in emergency. Thus Alvarado score is a practical, reliable and easy score. CRP estimation is very sensitive in diagnosing acute appendicitis due to its rapid raise in serum following inflammation, CRP was positive in 68% of the cases and sensitivity was 86.48%. Alvarado score and CRP are more sensitive in diagnosing acute appendicitis in comparing with histopathology. Thus Alvarado score is a practical, reliable and easy score. It can be helpful for safe and accurate decision making in patient with appendicitis. It also categorizes the patients for observation.

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