



ALVARADO SCORING SYSTEM IN PREOPERATIVE DIAGNOSIS OF ACUTE APPENDICITIS - A CLINICO PATHOLOGICAL CORRELATION

Dr. Anil Raj D*

Assistant Professor, Department of General Surgery, P K Das Institute of Medical Sciences, Vaniamkulum, Palakkad, Kerala-679522, INDIA. *Corresponding Author

Dr. Sreejith P S

Assistant Professor, Department of General Surgery, P K Das Institute of Medical Sciences, Vaniamkulum, Palakkad, Kerala-679522, INDIA.

ABSTRACT

INTRODUCTION: Acute appendicitis is one of the commonest surgical emergencies. Simple appendicitis can progress to perforation, which is associated with a much higher morbidity and mortality, and surgeons have therefore been inclined to operate when the diagnosis is probable rather than wait until it is certain. Routine history and physical examination still remain most practical diagnostic modalities. Absolute diagnosis of course is only possible at operation and histopathological examination of the specimen. For this reason rate of negative appendectomy as reported in the world literature varying from 20–40% with its associated morbidity of around 10%. Surgeons have been resorting to various scoring systems to aid in diagnosis and operative decision making.

OBJECTIVES:

1) To evaluate the efficacy of Alvarado Scoring System as a pre-operative diagnostic tool in acute appendicitis, in correlation with operative and histopathological findings.

2) Role of Alvarado Scoring System in cutting down the rate of negative appendectomy without increasing morbidity and mortality.

MATERIALS: A study of 100 patients presenting with pain abdomen and diagnosed provisionally as acute appendicitis, admitted in surgical department in PK Das Institute of Medical Sciences, Kerala. Depending on individual presentation, a score was calculated for each case, from 8 values (based on Alvarado scoring system).

- Group 1 - Those patients with scores of ≥ 7 underwent Appendectomy.
- Group 2 - Those patients with scores of 5-7 who were thought on clinical grounds to require Appendectomy, it was performed.
- Group 3 - Those patients with a score of < 5 were observed and managed conservatively and reassessed.

The results of Alvarado scoring system, on table operative findings and HPE, were reviewed. Reliability of scoring system was assessed by calculating negative appendectomy rate, sensitivity and positive predictive value.

RESULTS: In the present study we had 100 cases of which 59 were males and 41 were females. Patients with score 7-10 were 77; with score 5-6 were 18 and with score < 5 were 5. A total of 95 patients with score of 7-10 and 5-6 were operated of which acute appendicitis was found in 80 patients. Patients with score < 5 were kept under observation and none of the patients required surgery. The sensitivity of Alvarado scoring system was 91.25%. The positive predictive value of scoring system was 94.8%. The negative appendectomy rate in this study was 15.78%.

CONCLUSION: The Alvarado scoring system is a fast, simple, reliable, non-invasive, repeatable and safe diagnostic modality without much extra expense and complications. It has greater sensitivity and positive predictive value in diagnosing acute appendicitis and it reduces the rate of negative appendectomy.

KEYWORDS : Appendicitis, Appendectomy, Alvarado Score

INTRODUCTION:

Acute appendicitis is one of the commonest surgical emergencies. Simple appendicitis can progress to perforation, which is associated with a much higher morbidity and mortality, and surgeons have therefore been inclined to operate when the diagnosis is probable rather than wait until it is certain.¹¹ Acute appendicitis is essentially a clinical diagnosis.¹² About 6% of the population is expected to have appendicitis in their lifetime. Routine history and physical examination still remain the most practical diagnostic modalities. Absolute diagnosis of course is only possible at operation and histopathologic examination of the specimen.

For this reason, it is impractical to have a gold standard for definitive preoperative diagnosis, 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%.¹³

Removing normal appendix is an economic burden both on patients and health resources. Misdiagnosis and delay in surgery can lead to complications like perforation and finally peritonitis.¹⁴

Scoring systems are valuable and valid for discriminating between acute appendicitis and nonspecific abdominal pain¹⁵. At present many scoring systems for the diagnosis of acute appendicitis are available. 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.¹⁶ The use of an objective scoring system such as the Alvarado system can reduce the negative appendectomy rate to 0-5%.

However, this system is not a substitute for clinical judgment and just an aid in diagnosing acute appendicitis and assist in arriving at a conclusion whether a particular case should be operated or not, so that the number of negative laparotomies will be reduced.

Our study is to evaluate the efficacy of Modified Alvarado Scoring

System as a pre-operative diagnostic tool in acute appendicitis, in correlation with operative and histopathological findings.

AIMS AND OBJECTIVES:

- To evaluate the efficacy of Alvarado Scoring System as a pre-operative diagnostic tool in acute appendicitis, in correlation with operative and histopathological findings.
- To review the Alvarado Scoring System's usefulness in cutting down the rate of negative Appendectomy without increasing morbidity and mortality

MATERIALS AND METHODS:

A prospective study of 100 Patients who present with symptoms & signs of acute appendicitis and suspected enough to warrant surgery for acute appendicitis in under the general surgery department, PK Das Institute of Medical Sciences, Vaniamkulam, Palakkad, Kerala over a period of 2 years.

Inclusion Criteria:

Patients who present with symptoms & signs of acute appendicitis who are:-

1. Patients aged 15 years and above and of either sex.
2. Patients willing for investigation and surgery.

Exclusion Criteria

1. Patients age - 14 years and below.
2. Pregnant females.
3. Appendicular mass.
4. Patient with recent history of any abdominal surgeries.

After initial assessment of patients with symptoms and signs suggestive of acute appendicitis, who met the inclusion criteria admitted and are initially subjected for detailed history taking, clinical examination and investigations like Haematological investigations, urine routine, X-ray abdomen/ chest, USG abdomen and CT scan as

required. Following which they were evaluated using the Alvarado scoring.

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

- Those patients with scores of 7-10: Probably Appendicitis.
- Those patients with scores of 5-6: May be Appendicitis.
- Those patients with scores of 1-4: Unlikely to be Appendicitis

A specially designed proforma was filled in for each patient. These proforma had general information about the patient plus eight variables based on Alvarado scoring system. Then the total score is calculated for each patient and based on the results patients are divided into three groups.

- Group 1 - Those patients with scores of \geq 7-10 underwent Appendectomy.
- Group 2- Those patients with scores of 5-7 who were thought on clinical grounds to require Appendectomy, it was performed.
- Group 3- Those patients with a score of $<$ 5 were observed and managed conservatively and reassessed.

Diagnosis of acute appendicitis is confirmed by operative findings and histopathological assessment of the Appendectomy specimen. Finally the reliability of Alvarado scoring system is assessed by calculating sensitivity, specificity, 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).

RESULTS:

Out of 100 patients, 59 (59%) were male and 41 (41%) were female. The number of patients were highest in the age group 15 to 24 years (51%) followed by 25 to 34 years (30%). The least was in the age group of 45 years and above (5%). Patients with score 7-10 were 77; with score 5-6 were 18 and with score $<$ 5 were 5. Out of 59 males, score of 7-10 were 48, score of 5-6 were 9 and 2 had score $<$ 5. Out of 41 female patients, 29 had score of 7-10, 9 had score of 5-6 and 3 had score $<$ 5. These 5 patients with score $<$ 5 did not undergo surgery and managed conservatively.

Individual features of Alvarado score

Clinical Features	Number
M- Migrating RIF pain	87
A- Anorexia	83
N- Nausea & Vomiting	79
T- Tenderness over RIF	97
R- Rebound Tenderness in RIF	73
E- Elevated Temperature	70
L- Leucocytosis	83
S- Shift to Left	40

Total of 95 patients were operated, out of which 48 were males and 29 females. 46 males having score of 7-10 had acute appendicitis, 2 patients had normal appendix. Male patients having score of 5-6 were 9, out of which 4 patients had acute appendicitis, 5 patients had normal appendix. In 29 female patients having a score 7- 10, 27 had acute appendicitis, 2 patients had normal appendix with other diseases. In 9 females with score 5-6, 3 had acute appendicitis, 6 had normal appendix with other diseases. Scores $<$ 5 score not included as they were not operated managed conservatively indicating the usefulness of Alvarado scoring system.

Results of Alvarado Score

Score	No Operated	Appendicitis on HPE	Normal Appendix on HPE
7-10	77	73	4
5-6	18	7	11

The sensitivity, specificity and positive predictive value were 91.25%, 73.3% and 94.8% respectively.

DISCUSSION:

The present study was undertaken to evaluate the usefulness of Alvarado scoring system in reducing the number of negative appendectomy and to evaluate its sensitivity & positive predictive value in the diagnosis of acute appendicitis. Our results and observations were discussed and compared with various other studies.

In this study, the males accounted for 59% and the females 41%. The number of patients were highest in the age group 15 to 24 years (51%) followed by 25 to 34 years (30%). The least was in the age group of 45 years and above (5%). Most of the patients were younger age group. This result shows that there is predominance in the younger age group and the incidence peaks around 15 to 35 years and decreases as age progressed.

Pain was the commonest presenting symptom and migratory RIF Pain has been observed in 87% all the cases in the present series. Other symptoms observed were nausea/vomiting in 79% of cases and anorexia in 83% of cases. Low grade fever was present in 70% of cases. Majority of the patients presented within 48 hrs after the onset of pain, with most of them presenting between 12-24 hrs of onset of pain. On clinical examination, tenderness at McBurney's point was the commonest sign (97%). Rebound tenderness was present in 73%. In these cases, there was presence of local peritonitis or when inflamed appendix was more anteriorly placed. On laboratory test, leucocytosis was seen in 83% of cases and leucocyte shift to left is seen in 40% of patients.

In our series when the score was more than 7 indicating strong possibility of intra-abdominal infection localized to the Right Iliac fossa, emergency surgery was performed within 6 hours. These patients were found to have badly inflamed appendix with impending perforation once again indicating the sensitivity and specificity of the scoring system. In patients in whom score was between 5 and 6 were observed for a period of 12-24 hours and re-assessed, where there was persistence of abdominal tenderness with increased WBC count appendectomy was carried out. These patients were also found to have congested and inflamed appendix.

In this study the sensitivity, specificity and positive predictive value were 91.25%, 73.3% and 94.8% respectively. The positive predictive value was 95.83% in males as compared to 93.15 in females, resulting in higher accuracy in males. The positive predictive value shown by this study is comparable with the studies done by M Kalan¹, KA Malik² and TD Owen³ who reported 87.5%, 85.3% and 87.4% respectively.

This study also revealed that Alvarado scoring system is more helpful in lowering negative appendectomy rates. In the study by Ohmann et al¹ and Arian GM⁵ the negative appendectomy rate was 14.3% and 16.1% respectively. In this study the negative appendectomy rate is 15.78% with the rate being higher in females (21.05%) than in males (12.28%). Hence in the overall, females had more negative appendectomy rate compared to males, as the other diseases like pelvic inflammatory diseases were more common in the reproductive age group. Since intraabdominal infection in females, particularly lower abdomen, can be quite confusing, it is difficult to differentiate acute appendicitis from gynaecological conditions like twisted ovarian cyst and PID, laparoscopy and abdomino-pelvic USG scan can be advised as a diagnostic tool to minimize negative appendectomy.

Comparing with Kalan et al our series also has consistent result.

Study/Sex	Number	Score $>$ 7	Appendicitis	Sensitivity
Kalan et al ¹	Male	21	15	93%
	Female	17	15	67%
Our study	Male	59	48	92%
	Female	41	29	90%

Study	Sensitivity
Kalan et al	81.6%
Denizbasi A ⁶	95.4%
Al- Hashemy et al ⁷	53.90%
Shrivatsa U K et al ⁸	92.40%
Present Study	91.25%

Increased proportion of negative appendectomy is noticed for the Alvarado Score 5-6 and significantly decreased proportion negative

appendectomy is noticed for the Alvarado Score 7-10. In our present study, usefulness of the Alvarado scoring system was demonstrated beyond doubt by reducing number of negative laparotomies especially in men. However in women the negative laparotomy was high and this can be avoided by using abdomino-pelvic USG scan and laparoscopy as a diagnostic tool.

CONCLUSION

So we conclude that the Alvarado scoring system has high sensitivity and positive predictive value of 91.25% and 94.8% respectively. Its application can reduce negative appendectomy rate which is 15.78% in our study.

In the diagnosis of acute appendicitis, the Alvarado score is a fast, simple, reliable, non-invasive, repeatable and safe diagnostic modality without extra expense and complications.

It is very handy in day care hospitals or peripheral hospitals where back up facilities like USG scan or CT scan is not available. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendectomy and thus reduces complication rates.

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