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ORIGINAL RESEARCH

A Clinical study of Acute Appendicitis and Evaluating Alvadro scoring in Diagnosis and Treatment

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ABSTRACT

Background: Acute appendicitis is a common surgical emergency, and timely diagnosis is crucial to prevent complications. The Alvarado scoring system is a widely used clinical tool designed to aid in the diagnosis and management of suspected cases. **Objectives:** To assess the clinical presentation of acute appendicitis and evaluate the diagnostic accuracy of the Alvarado scoring system in correlation with histopathological findings. **Methods:** A prospective observational study was conducted on 75 patients presenting with symptoms suggestive of acute appendicitis. Clinical evaluation, Alvarado scoring, imaging studies, and surgical outcomes were recorded. The correlation between Alvarado score and histopathology was statistically analyzed using the chi-square test. Diagnostic parameters including sensitivity, specificity, predictive values, and overall accuracy were calculated. **Results:** The majority of patients were males (60%) and aged between 31–40 years. Surgery was performed in 82.7% of cases. A significant association was observed between Alvarado score and histopathological findings ($p = 0.03$). An Alvarado score >7 showed a sensitivity of 69.35%, specificity of 61.54%, and a high positive predictive value of 89.58%, with an overall diagnostic accuracy of 68%. Wound infection was the most common complication (24%), while 69.3% had no postoperative issues. **Conclusion:** The Alvarado scoring system is a valuable, simple, and cost-effective tool in diagnosing acute appendicitis. It has high diagnostic utility when the score is >7 but limited ability to rule out the disease when the score is low. Combined with clinical assessment, it can enhance decision-making and improve outcomes.

Keywords: Acute Appendicitis, Alvarado Score, Clinical Diagnosis, Histopathology, Abdominal Pain

INTRODUCTION

Acute appendicitis is one of the most common causes of acute abdominal pain requiring emergency surgical intervention worldwide. It is estimated that approximately 5–7% of the global population develops appendicitis during their lifetime, with the highest incidence observed in the second and third decades of life [1]. Despite advancements in diagnostic imaging and surgical techniques, early and accurate diagnosis remains a challenge due to the variable presentation of appendicitis. Delayed diagnosis can lead to complications such as perforation, peritonitis, and sepsis, increasing morbidity and healthcare costs [2].

The Alvarado scoring system, first introduced in 1986, is a widely used clinical tool designed to improve the diagnostic accuracy of acute appendicitis by integrating clinical signs, symptoms, and laboratory findings [3]. The score assigns weighted values to parameters such as migration of pain, anorexia, nausea or vomiting, tenderness in the right iliac fossa, rebound pain, fever, leukocytosis, and left shift in neutrophils [4]. Studies suggest that a high Alvarado score (≥7) correlates well with the need for surgical intervention, whereas lower scores indicate a need for further observation or imaging [5]. However, the accuracy of this scoring system varies across different populations and clinical settings, necessitating continuous validation and assessment of its predictive value.

This study aims to evaluate the clinical presentation, diagnostic accuracy of the Alvarado scoring system,

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and its role in guiding treatment decisions in cases of acute appendicitis. By assessing the sensitivity, specificity, and predictive value of the score, we seek to determine its reliability as a diagnostic tool and its potential to reduce unnecessary appendectomies and associated complications.

MATERIALS AND METHOD

This prospective observational study was conducted at Department of Surgery, Government Medical college, (Singareni Institute of Medical Sciences) Ramagundam in a tertiary care hospital, over a period of one year. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all patients or their legal guardians before participation.

Study Population

The study included 75 patients presenting to the emergency department with suspected acute appendicitis. The inclusion and exclusion criteria were as follows:

Inclusion Criteria

- Patients aged ≥12 years presenting with acute right lower quadrant pain suspected to be acute appendicitis.
- Patients willing to provide informed consent for participation in the study.

Exclusion Criteria

- Patients with a history of prior appendectomy.
- Patients with alternative diagnoses such as mesenteric adenitis, gynecological disorders, or urinary tract infections.
- Patients with generalized peritonitis or hemodynamic instability requiring immediate surgical intervention without further evaluation.

Clinical Assessment and Alvarado Scoring

Each patient underwent a detailed clinical evaluation, including history, physical examination, and laboratory investigations. The Alvarado scoring system was applied to all patients based on the following parameters:

Parameter	Score
Migration of pain	1
Anorexia	1
Nausea or vomiting	1
Tenderness in right iliac fossa	2
Rebound tenderness	1
Elevated temperature (>37.3°C)	1
Leukocytosis (>10,000/mm³)	2
Left shift of neutrophils (>75%)	1
Total Score: 10	

Patients were categorized based on their Alvarado score:

- **Score 1–4**: Unlikely appendicitis, observation or alternative diagnosis considered.
- **Score 5–6**: Equivocal, further imaging (ultrasonography or CT) advised.
- **Score ≥7**: Probable appendicitis, surgical intervention considered.

Diagnostic Imaging and Laboratory Investigations

Patients with an equivocal Alvarado score (5–6) underwent further diagnostic imaging, including abdominal ultrasonography (USG) and/or contrast-enhanced computed tomography (CECT) for confirmation. Laboratory tests, including complete blood count (CBC) and C-reactive protein (CRP), were performed for all patients.

Surgical Intervention and Histopathological Correlation

Patients diagnosed with acute appendicitis underwent appendectomy either by open or laparoscopic technique. Resected appendix specimens were sent for histopathological examination (HPE) to confirm the diagnosis.

Outcome Measures

The following parameters were assessed:

- Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the Alvarado score.
- Accuracy of clinical diagnosis compared with histopathological findings.
- Rate of negative appendectomies (i.e., cases where histopathology did not confirm appendicitis).
- Complications associated with appendicitis or surgical intervention.

Statistical Analysis

Data were analyzed using SPSS version 25. Continuous variables were presented as mean ± standard deviation (SD), and categorical variables were expressed as frequencies and percentages. The diagnostic accuracy of the Alvarado score was assessed using receiver operating characteristic (ROC) curve analysis. A p-value <0.05 was considered statistically significant.

OBSERVATION AND RESULTS

Table 1: Distribution of demographic profile among study population

Parameter	Frequency	Percentage
Age		
< 20 Years	16	21.3
21-30 Years	14	18.7

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31 - 40 Years	19	25.3
41 - 50 Years	13	17.3
> 50 Years	13	17.3
Gender		
Male	45	60
Female	30	40
Diagnosis		
Equivocal	27	36
Probable Appendicitis	25	33.3
Unlikely Appendicitis	23	30.7
Imaging Done		
Yes	27	36
No	48	64
Surgery Done		
Yes	62	82.7
No	13	17.3

This table presents the baseline characteristics of the 75 patients included in the study. The age distribution shows that the majority of patients were between 31 to 40 years (25.3%), followed by those less than 20 years (21.3%). Equal proportions (17.3%) were observed in the 41–50 years and >50 years age groups. The study had a male predominance (60%) compared to females (40%). Regarding the clinical diagnosis, 36% were classified as equivocal appendicitis, 33.3% as probable, and 30.7% as unlikely appendicitis. Imaging studies were performed in 36% of patients, while 64% did not undergo any imaging. Notably, 82.7% of the study population underwent surgery, while the remaining 17.3% were managed conservatively.

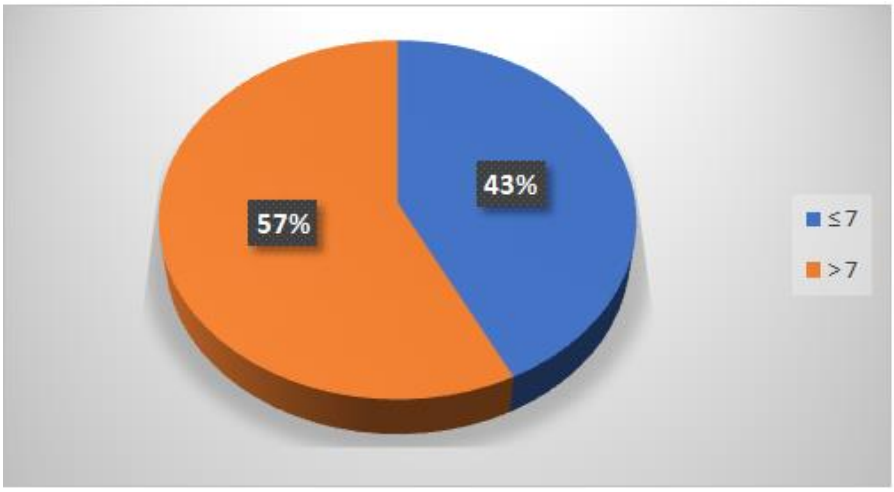

Figure1: Distribution of Alvarado score among study population

Table 2 : Distribution of Alvarado score among study population

Alvarado Score	Histopathology Report		Chi-square	p-value
	Positive	Negative		
≤ 7	19(25.30%)	8(17.30%)	5.336	0.03
> 7	43(57.30%)	5(6.67%)		
Total	62(82.7%)	13(17.3%)		

This table assesses the relationship between the Alvarado score and histopathological findings post-appendectomy. Among patients with a score ≤7, 19 had a positive histopathology, and 8 had negative findings, while among those with a score >7, 43 had positive histopathology, and only 5 had negative findings. A Chi-square test value of 5.336 with a p-value of 0.03 indicates a statistically significant association between Alvarado score and histopathology results, supporting the clinical utility of the score in diagnosing appendicitis.

Table 3: Diagnostic parameters for Alvarado score > 7 based on Histopathology

Diagnostic Parameters	Value	95% CI
Sensitivity	69.35%	56.35% to 80.44%

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Specificity	61.54%	31.58% to 86.14%
Positive Predictive Value (*)	89.58%	80.92% to 94.58%
Negative Predictive Value (*)	29.63%	19.23% to 42.68%
Accuracy (*)	68.00%	56.22% to 78.31%

This table evaluates the diagnostic performance of an Alvarado score >7. The sensitivity was 69.35%, indicating the score correctly identified a majority of true appendicitis cases. The specificity was 61.54%, meaning it correctly ruled out some of the non-appendicitis cases. The positive predictive value (PPV) was high at 89.58%, suggesting that patients with a score >7 are very likely to have appendicitis. However, the negative predictive value (NPV) was low (29.63%), indicating that a score ≤7 does not reliably exclude the disease. The overall diagnostic accuracy was 68%, reflecting moderate effectiveness of the scoring system.

Table 4: Distribution of complication among study population

Complications	Frequency	Percent
Ileus	2	2.7
Peritonitis	3	4
Wound Infection	18	24
None	52	69.3
Total	75	100

This table outlines the post-treatment complications observed in the study group. The most common complication was wound infection (24%), followed by peritonitis (4%) and ileus (2.7%). However, a majority of the patients (69.3%) experienced no complications, indicating a favorable overall outcome for most individuals in the cohort. This distribution also highlights areas where postoperative care and surgical hygiene could be improved to reduce wound infections.

DISCUSSION

In the present study, 75 patients with suspected acute appendicitis were evaluated clinically and categorized using the Alvarado scoring system. The demographic profile revealed a male predominance (60%) and the most affected age group being 31–40 years (25.3%), which is consistent with findings from other Indian studies. For instance, Sharma et al. reported maximum incidence in the third decade of life, with a male-to-female ratio of approximately 2:1, mirroring our findings [6].

A significant proportion of cases in the current study (36%) were classified as having equivocal appendicitis, which often poses a diagnostic dilemma. A majority (82.7%) of patients underwent surgical intervention, suggesting a strong clinical tendency toward early surgical management, even in cases with diagnostic uncertainty. This approach aligns with that of Goyal et al., who emphasized prompt surgical management in suspected appendicitis to reduce complications such as perforation and peritonitis [7].

The Alvarado score served as a reliable clinical tool in the present study. The cutoff score of >7 was associated with a statistically significant correlation with positive histopathological findings (Chi-square = 5.336, p = 0.03). Among those with scores >7, 89.58% had confirmed appendicitis on histopathology, highlighting a high positive predictive value. These results are comparable to studies by Kalan et al. and others, where the Alvarado score demonstrated good predictive utility, especially at higher cutoffs [8].

However, the negative predictive value in our study was low (29.63%), indicating that a score ≤7 may not be sufficient to rule out appendicitis, especially in equivocal cases. This limitation is consistent with the observations of Khanna et al., who suggested that while a high Alvarado score strongly supports the diagnosis, lower scores should prompt further imaging or observation rather than outright exclusion [9].

In terms of diagnostic performance, our findings showed a sensitivity of 69.35% and specificity of 61.54%, with an overall diagnostic accuracy of 68%. These results are moderately consistent with other Indian data. For example, a study by Chandrasekhar et al. reported a slightly higher sensitivity (76%) and specificity (65%) using similar cutoffs, reinforcing the clinical value of the scoring system while acknowledging its limitations [10].

Complications noted postoperatively included wound infections (24%), peritonitis (4%), and ileus (2.7%). The relatively high rate of wound infection is notable and may reflect the need for improved perioperative antisepsis or surgical technique. Most patients (69.3%) had no complications, supporting the overall safety and effectiveness of timely surgical management. These trends align with those reported by Rao et al., where wound infection was the most frequent postoperative issue in appendectomy patients [11].

Overall, our findings underscore the Alvarado score as a practical and cost-effective clinical tool for guiding diagnosis and management of suspected acute appendicitis, particularly in resource-limited settings. However, caution must be exercised in low-scoring patients, where adjunct imaging or close clinical observation is warranted.

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CONCLUSION

The Alvarado score proved to be a useful clinical tool in diagnosing acute appendicitis, showing a significant correlation with histopathological findings ($p = 0.03$). A score >7 demonstrated high sensitivity and positive predictive value, supporting its role in guiding surgical decisions. However, its low negative predictive value suggests it should not be solely relied upon to rule out appendicitis. Despite moderate diagnostic accuracy, the score remains effective, especially in settings with limited resources. Most patients had favorable outcomes, though wound infection was the most common complication.

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Conflict of Interest: None

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