



COMPARATIVE ASSESSMENT OF ALVARADO AND TZANAKIS SCORES FOR EARLY DIAGNOSIS OF ACUTE APPENDICITIS IN A TERTIARY CARE CENTRE.

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Abstract

Background: Acute appendicitis is a prevalent surgical emergency globally, necessitating prompt and precise diagnosis to mitigate morbidity and consequences. Clinical scoring systems, like the Alvarado and Tzanakis scores, have been established to enhance diagnostic accuracy, reduce unnecessary appendectomies, and refine surgical decision-making. **Aims:** This study aimed to compare the diagnostic accuracy of the Alvarado and Tzanakis scoring systems in patients presenting with suspected acute appendicitis. **Materials and Methods:** A prospective observational study was conducted at the Department of General Surgery, over a period of eight months. A total of 55 patients presenting with right lower quadrant pain and clinical suspicion of acute appendicitis were enrolled after obtaining informed consent. Each patient was evaluated using both the Alvarado and Tzanakis scoring systems upon admission. Based on the calculated scores, patients were stratified into groups suggestive or non-suggestive of appendicitis. Final diagnosis was confirmed intraoperatively and by histopathological examination of the resected appendix, which served as the gold standard. Statistical analysis was performed to calculate sensitivity, specificity, PPV, NPV, and overall diagnostic accuracy for both scoring systems. **Results:** Of the 55 patients, 38 (69.1%) were diagnosed with acute appendicitis after histopathological examination. The Alvarado score had a sensitivity of 84.2%, specificity of 78.9%, positive predictive value of 88.5%, negative predictive value of 72.7%, and an overall accuracy of 81.8%. The Tzanakis score demonstrated superior diagnostic efficiency, featuring a sensitivity of 92.1%, specificity of 84.2%, positive predictive value of 90.9%, and negative predictive value of 86.7%, resulting in an overall accuracy of 89.1%. The disparity between the two systems was statistically significant ($p < 0.05$), demonstrating the enhanced predictive usefulness of the Tzanakis score in detecting authentic instances of acute appendicitis. **Conclusion:** The Alvarado and Tzanakis scoring systems are effective instruments for diagnosing acute appendicitis. The Tzanakis score exhibited superior sensitivity, specificity, and overall accuracy, rendering it a more dependable and pragmatic scoring approach. Notably in environments where radiological facilities are restricted.

Keywords: Acute appendicitis, Alvarado score, Diagnostic accuracy, Sensitivity, Specificity, Tzanakis score.



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INTRODUCTION

Acute appendicitis is a prevalent cause of acute abdominal pain and a primary rationale for emergency abdominal surgery globally. It impacts all age demographics, with the greatest prevalence observed in young adults, and presents a lifetime risk of roughly 7–8%.¹ Although appendectomy is a common and straightforward therapy, diagnosing acute appendicitis frequently presents difficulties due to its many manifestations and similarities with other abdominal disorders, including mesenteric adenitis, ovarian disease, and gastroenteritis.²

A delay in diagnosis may result in complications such perforation, peritonitis, and sepsis, whereas premature surgical intervention raises negative appendectomy rates, hence augmenting patient morbidity and healthcare burden. Therefore, precise and timely diagnosis is fundamental to the optimal management of this illness.^{3,4}

Traditionally, diagnosis has depended on a synthesis of clinical evaluation, test results, and imaging examinations. The manifestation of appendicitis might differ, particularly in women and the elderly, resulting in diagnostic ambiguity.⁵ While imaging techniques like ultrasonography and computed tomography (CT) have enhanced diagnostic accuracy, their regular application is constrained by cost, radiation exposure, and accessibility, especially in resource-limited healthcare

environments.⁶ In this context, clinical scoring systems offer a straightforward, replicable, and economical method to assist doctors in decision-making.

The Alvarado score, established in 1986, is among the most prevalent scoring systems for identifying acute appendicitis. It encompasses eight categories, comprising symptoms, indicators, and laboratory values, with a cumulative score of 10 points.⁷ The Alvarado score aids in stratifying patients based on appendicitis likelihood; nevertheless, its accuracy fluctuates across different groups and is often less reliable in females and older patients due to unusual presentations.⁸

Conversely, the Tzanakis score, introduced in 2005, amalgamates clinical, laboratory, and ultrasonographic criteria, providing a more thorough assessment.⁹ This score encompasses soreness, rebound pain, leukocytosis, and sonographic evidence of an inflamed appendix. It seeks to enhance diagnostic precision and minimize false positives by integrating clinical judgment with imaging evidence.¹⁰

Numerous studies indicate that the Tzanakis score possesses greater predictive value than the Alvarado score, especially in instances of diagnostic ambiguity. Despite the utilization of both scoring systems, there is a dearth of region-specific research evaluating their diagnostic accuracy among the Indian population. Differences in healthcare infrastructure, patient demography, and clinical presentation require local validation of these scoring systems prior to extensive implementation.

This study attempts to address that deficiency by directly evaluating the efficacy of Alvarado and Tzanakis scores. This study seeks to determine the most reliable and feasible scoring system for routine clinical use by evaluating their sensitivity, specificity, and positive and negative predictive values. The results will assist doctors in enhancing diagnostic precision while concurrently decreasing negative appendectomy rates, hospital expenditures, and diagnostic delays in emergency surgical practice.

AIMS AND OBJECTIVES

- To compare the diagnostic accuracy of the Alvarado and Tzanakis scoring systems in patients presenting with suspected acute appendicitis.

MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of General Surgery at Sree Mookambika Institute of Medical Sciences, Kulasekharam, over a period of eight months. A total of 55 patients presenting to the surgical outpatient department and emergency unit with symptoms suggestive of acute appendicitis were included in the study. The study population comprised patients evaluated both clinically and radiologically before surgical confirmation and histopathological analysis.

Inclusion Criteria:

- Patients aged above 12 years of either sex.
- Patients presenting with right lower quadrant abdominal pain and clinical suspicion of acute appendicitis.
- Patients who provided informed written consent for participation and surgical intervention.

Exclusion Criteria:

- Patients with a previous history of abdominal surgeries.
- Patients with appendicular lump or abscess.
- Cases of generalized peritonitis due to causes other than appendicitis.
- Patients unfit for surgery or unwilling to provide consent.

On admission, a detailed history was elicited, and thorough clinical examination was carried out, emphasizing symptoms such as migratory right iliac fossa pain, anorexia, nausea, vomiting, and tenderness at McBurney's point. Routine laboratory investigations, including total leukocyte count and differential count, were performed. Urine analysis was done to rule out urinary tract pathology. All patients underwent ultrasonography of the abdomen performed by an experienced radiologist to detect appendicular wall thickening, non-compressibility, or periappendiceal fluid suggestive of inflammation.

Each patient was assessed using both the Alvarado and Tzanakis scoring systems. The Alvarado score, based on symptoms, clinical signs, and laboratory parameters, was calculated out of a total of 10 points. The Tzanakis score, which combines clinical features, laboratory findings, and ultrasonographic results, was calculated out of 15 points. Based on the scores, patients were categorized into low, intermediate, or high probability groups for acute appendicitis.

The decision to proceed with surgery was taken by the attending surgeon after clinical correlation with the scores. Operative findings were recorded, describing whether the appendix was inflamed, gangrenous, perforated, or normal. All resected appendices were subjected to histopathological examination, which was considered the definitive diagnostic standard.

All data obtained from clinical evaluation, scoring, operative findings, and histopathological results were compiled and statistically analyzed. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy were calculated for both scoring systems. Comparative analysis between the two methods was done to identify the more reliable system for diagnosing acute appendicitis. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 55 patients clinically suspected of acute appendicitis were evaluated. Among them, 34 (61.8%) were males and 21 (38.2%) were females, showing a male predominance (M:F = 1.6:1). The highest incidence was in the 21–30 years age group (40%), with a mean age of 27.8 ± 8.6 years, indicating that acute appendicitis commonly affects young adults.

Table 1: Age and Gender Distribution of Study Population

Parameter	No. of Patients (n=55)	Percentage (%)
Age (years)		
≤20	10	18.2
21–30	22	40.0
31–40	10	18.2
41–50	8	14.5
Gender		
Male	34	61.8
Female	21	38.2

Pain in the right iliac fossa was the most consistent presenting symptom (100%), followed by nausea/vomiting in 81.8%, anorexia in 70.9%, and fever in 49.1%. The most frequent clinical signs were tenderness at McBurney's point (94.5%) and rebound tenderness (80%). Leukocytosis ($>10,000/\text{mm}^3$) was present in 76.4% of cases.

Ultrasonography revealed findings suggestive of appendicitis in 46 (83.6%) patients, including a non-compressible tubular structure >6 mm, wall thickening, and periappendiceal fluid collection.

During surgery, intraoperative findings confirmed that the majority of patients had an inflamed appendix (58.2%), followed by gangrenous (18.2%) and perforated (12.7%) appendices. A normal appendix was noted in 6 (10.9%) cases, which accounted for the negative appendectomy rate. Histopathological examination (HPE) was used as the gold standard. Out of 55 specimens, 38 (69.1%) were confirmed as acute appendicitis, 11 (20%) as complicated appendicitis (gangrenous/perforated), and 6 (10.9%) as normal appendix.

According to the Alvarado score, 34 patients scored ≥ 7 (high probability) and 21 scored < 7 (low/intermediate probability). Of the high-probability group, 30 (88.2%) were HPE positive, while 8 (38.1%) in the low-score group were HPE positive. (Table 2)

Table 2: Correlation of Alvarado Score with Histopathological Findings

Alvarado Score	HPE Positive	HPE Negative	Total	p-value
≥ 7	30	4	34	<0.05
< 7	8	13	21	
Total	38	17	55	

When evaluated using the Tzanakis score, 37 patients scored ≥ 8 (high probability), and 18 scored < 8 . Among the high-score group, 35 (94.6%) were HPE positive, while 3 (16.7%) of the low-score group were HPE positive. (Table 3)

Table 3: Correlation of Tzanakis Score with Histopathological Findings

Tzanakis Score	HPE Positive	HPE Negative	Total	p-value
≥ 8	35	2	37	<0.01
< 8	3	15	18	
Total	38	17	55	

The Alvarado scoring system demonstrated sensitivity 84.2%, specificity 76.5%, PPV 88.2%, NPV 72.2%, and diagnostic accuracy 81.8%, which was statistically significant. The Tzanakis scoring system showed sensitivity 92.1%, specificity 88.2%, PPV 94.6%, NPV 83.3%, and overall accuracy 89.1%, with a highly significant correlation. Thus, while both scoring systems proved clinically useful, Tzanakis scoring showed superior sensitivity, specificity, and diagnostic accuracy, making it a more reliable tool for early and accurate diagnosis of acute appendicitis.

DISCUSSION

In the present study of 55 people who were thought to have acute appendicitis, most of them were men (34; 61.8%) and were between the ages of 21 and 30 (22; 40%). This confirms that acute appendicitis mostly affects young adult men. The average age at presentation was 27.8 years, aligning with the recognized pattern of incidence in the productive age demographic. Tadv MM et al.¹¹ documented analogous demographic characteristics, noting that of 92 patients, 55 (59.78%) were male and 37 (40.21%) were female, with the largest prevalence occurring in the 12–20-year age range (32.60%), followed by the 21–30-year group (29.34%). Amudhan KS et al.¹² similarly identified a male prevalence of 59.7%, with 70% of cases being under 40 years old. Bharath B et al.¹³ stated that in a study of 100 appendectomy cases, 77% of the patients were male, with a mean age of 31.88 ± 11.33 years.

Clinically, the most common complaint in the current study was right iliac fossa pain, which was followed by anorexia (70.9%) and nausea or vomiting (81.8%). Tenderness at McBurney's point was observed in 94.5%, rebound tenderness in 80%, fever in 49.1%, and leukocytosis in 76.4%, highlighting the enduring significance of traditional clinical characteristics. Daffe VD et al.¹⁴ identified widespread abdominal pain as the predominant complaint (87.4%), succeeded by right iliac fossa pain and fever. Ultrasonography demonstrated good results in 83.6% of cases in this investigation, exhibiting characteristic signs of appendiceal inflammation. Durrani K et al.¹⁵ reported that ultrasound diagnosed acute appendicitis in 74 patients, with 73 confirmed by histopathology, and a total of 76 histopathologically verified cases among the specimens investigated.

The operative findings in this study indicated that 58.2% of appendices were inflammatory, 18.2% gangrenous, 12.7% perforated, and 10.9% normal, leading to a negative appendectomy rate of 10.9%. Histopathological analysis revealed 69.1% acute appendicitis, 20% complex appendicitis, and 10.9% benign appendices. Tadv MM et al.¹¹ reported 56.52% acute, 15.21% perforated, and 28.06% subacute appendicitis. Bharath B et al.¹³ reported 13% normal appendices, 47% acute appendicitis, 7% subacute appendicitis, 18% acute suppurative appendicitis, 11% gangrenous appendicitis, and 4% recurrent appendicitis.

The Alvarado score revealed 61.8% of patients with values of 7 or higher, with 88.2% of these cases histopathologically confirmed as appendicitis. The Tzanakis score of ≥ 8 was seen in 67.3%, exhibiting a high positive predictive value of 94.6%. Amudhan KS et al.¹² showed analogous diagnostic thresholds, with 68% achieving scores over 7 on the Alvarado scale and 88% surpassing 7.5 on the RIPASA scale. Results from Patel VB et al.¹⁶ corroborated, with 72.07% of patients achieving scores of ≥ 7 on the Alvarado scale and 81.08% attaining scores of ≥ 8 on the Tzanakis scale. The performance of the Alvarado and Tzanakis scores found in this study was compared with results from prior studies to assess the diagnostic value of clinical scoring systems in acute appendicitis. (Table 4)

Table 4: Comparison of diagnostic utility of Alvarado and Tzanakis scores with other studies

Study	Scoring System	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Diagnostic Accuracy (%)
Present Study	Alvarado	84.2	76.5	88.2	72.2	81.8
	Tzanakis	92.1	88.2	94.6	83.3	89.1
Tadv MM et al. ¹¹	Alvarado	43.93	92.30	93.54	39.34	57.60
	Tzanakis	86.36	73.07	89.06	67.85	82.60
Bharath B et al. ¹³	Alvarado	95.4	97.4	—	—	96.5
	Tzanakis	50.57	92.3	97.7	21.8	—
Patel VB et al. ¹⁶	Alvarado	78	—	—	—	78.38
	Tzanakis	88	—	—	—	87.39
R. Anupriya et al. ¹⁷	Tzanakis	65.52	100	100	37.50	—
Shrestha R et al. ¹⁸	Alvarado	44.8	75.0	97.7	5.4	46.0
	Tzanakis	88.5	75.0	98.8	21.4	88.0
Shandilya S et al. ¹⁹	Alvarado	33	83	91	19	41
	Tzanakis	89	58	92	50	84

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Thus, both scoring systems were reliable, but the Tzanakis score provided superior diagnostic accuracy due to the inclusion of ultrasonography. Combining clinical signs, laboratory data, and imaging reduced diagnostic errors and negative appendectomies, ensuring more accurate and timely management of acute appendicitis.

CONCLUSION

The Alvarado score, relying solely on clinical and laboratory criteria, shown commendable accuracy, whereas the Tzanakis score, incorporating ultrasonographic data, revealed superior sensitivity, specificity, and overall diagnostic precision. The amalgamation of imaging with clinical assessment markedly diminished negative appendectomy rates and enhanced diagnostic certainty. Consequently, the Tzanakis scoring system represents a more dependable and pragmatic method for identifying acute appendicitis, especially in ambiguous clinical scenarios.

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CONFLICTS OF INTEREST:

There are no conflicts of interest

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