e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(9); 341-349

Original Research Article

Comparative Analysis: Tzanakis Score Vs Modified Alvarado Score For Acute Appendicitis Diagnosis

Kanulla Koteswara Rao[1], Gutta Santhan Harsha[2], K. Suhas Chaitanya[3], N. Naga Mohan[4]

[1]Resident, Department of General Surgery, NMC, Nellore
[2]Assistant Professor, Department of General Surgery, NMC, Nellore
[3]Professor, Department of General Surgery, NMC, Nellore
[4]Senior Resident, Department of General Surgery, NMC, Nellore

Received: 01-06-2026 / Revised: 15-07-2026 / Accepted: 21-08-2026
Corresponding author: Dr. Kanulla Koteswara Rao
Conflict of interest: Nil

Abstract

Background: Acute appendicitis is one of the most common surgical emergencies, but its diagnosis can be challenging because of variations in clinical presentation and overlap with other causes of right iliac fossa pain. Diagnostic scoring systems such as the Modified Alvarado and Tzanakis scores can assist in early risk stratification and surgical decision-making.

Aim: To compare the diagnostic accuracy and clinical utility of the Tzanakis score and Modified Alvarado score in the diagnosis of acute appendicitis.

Materials and Methods: This prospective hospital-based comparative study was conducted over 18 months from June 2024 to December 2025 in the Department of General Surgery, Narayana Medical College and Hospital, Nellore. A total of 100 patients with suspected acute appendicitis were included. All patients underwent detailed clinical evaluation, laboratory investigations, and ultrasonography. Both the Modified Alvarado and Tzanakis scores were calculated independently. Patients underwent appendectomy according to clinical assessment and institutional protocols. Histopathological examination of the excised appendix was considered the definitive diagnostic standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), accuracy, and area under the receiver operating characteristic curve (AUC) were compared.

Results: The mean age of the study population was 44.14 ± 16.03 years, with females comprising 55% and males 45%. Right iliac fossa tenderness was the most frequent clinical finding (91%), followed by fever (64%) and vomiting (42%). Histopathology confirmed acute appendicitis in 78% of patients, while 22% had no evidence of acute appendicitis. A Tzanakis score >8 was observed in 76% of patients, while a Modified Alvarado score >7 was observed in 72%. Both scores showed significant association with histopathological diagnosis ($p<0.001$). The Tzanakis score demonstrated a sensitivity of 93.6%, specificity of 86.4%, PPV of 96.1%, NPV of 79.2%, and accuracy of 92%. The Modified Alvarado score demonstrated a sensitivity of 91%, specificity of 95.5%, PPV of 98.6%, NPV of 75%, and accuracy of 92%. ROC analysis showed an AUC of 0.90 for Tzanakis and 0.93 for Modified Alvarado, with both being statistically significant ($p<0.001$).

Conclusion: Both the Tzanakis and Modified Alvarado scores demonstrated excellent diagnostic performance in patients with suspected acute appendicitis. The Tzanakis score showed slightly higher sensitivity, whereas the Modified Alvarado score demonstrated superior specificity and PPV. Both achieved an overall accuracy of 92%. Thus, either scoring system can be effectively used to support the diagnosis and surgical decision-making in acute appendicitis, with the choice depending on clinical requirements and availability of ultrasonography.

Keywords: Acute appendicitis; Tzanakis score; Modified Alvarado score; Diagnostic accuracy.

DOI: 10.25258/ijcpr.18.9.48

Introduction

Acute appendicitis is a prevalent surgical emergency; yet, its diagnosis remains difficult because to the variability of clinical presentation, which may overlap with different aetiologies of right iliac fossa pain. Prolonged diagnosis may result in perforation, abscess development, sepsis, extended hospitalisation, and heightened morbidity, while overdiagnosis can lead to unwarranted appendectomy and preventable surgical risk. Consequently, straightforward, dependable, and repeatable diagnostic scoring systems are essential in standard surgical practice, particularly in emergency situations that necessitate swift decision-making. The Modified Alvarado Score has been utilised as a bedside clinical instrument because to its simplicity and cost-effectiveness; nevertheless, prior validation studies indicate that its accuracy may differ among age demographics and genders, exhibiting diminished specificity in some patient populations.[1,2]

The Tzanakis score was created to enhance diagnostic efficacy by integrating clinical observations, laboratory indicators of inflammation, and ultrasonography into a cohesive organised framework. This renders it especially pertinent in contexts where CT is not readily accessible or when radiation exposure becomes a problem. The initial Tzanakis study indicated that the amalgamation of ultrasonography with clinical scoring could enhance diagnostic accuracy, and subsequent comparative studies also indicated that Tzanakis scoring might exhibit superior sensitivity, specificity, or overall diagnostic precision compared to Alvarado-based systems in specific populations. The performance of both scores has varied among institutions, patient demographics, operator proficiency in ultrasonography, and regional diagnostic protocols. The variability necessitates that direct comparison between the Tzanakis Score and Modified Alvarado Score remains therapeutically significant.[3,4] The necessity of the current investigation is in determining whether scoring method is more effective, practical, and diagnostically reliable for suspected acute appendicitis in a specific clinical context. This comparison is essential for decreasing negative appendicectomy rates, minimising missed or delayed diagnoses, directing the selective application of imaging, and facilitating cost-effective emergency care. Current recommendations acknowledge that clinical scores can assist in risk stratification and minimise superfluous imaging; nevertheless, no singular score demonstrates consistent efficacy across all contexts. Therefore, a comparison assessment of the Tzanakis Score and Modified Alvarado Score is warranted to ascertain whether instrument more effectively aids in early diagnosis and surgical decision-making within the research population.

Aim: To compare the Tzanakis and modified alvarado score for better diagnosis of acute appendicitis.

Objectives: To identify the better modality for diagnosis of acute appendicitis using Tzanakis scoring system and modified alvarado score.

Materials and Methods

This was a hospital-based clinical prospective comparison analysis aimed at evaluating the diagnostic accuracy of the Tzanakis scoring system vs the Modified Alvarado score in patients with suspected acute appendicitis. The investigation was carried out over 18 months, from June 2024 to December 2025 in 100 individuals with probable acute appendicitis in the Department of General Surgery at Narayana Medical College and Hospital in Nellore.

Inclusion Criteria: Patients exhibiting signs of probable acute appendicitis as determined by medical history and clinical assessment.

Exclusion Criteria: Patients with other diagnoses during surgery, with or without an infected appendix, appendicular mass, with generalised peritonitis.

Methodology: All patients exhibiting symptoms indicative of acute appendicitis had comprehensive history taking, clinical assessment, laboratory tests, and ultrasonographic evaluation. Following the acquisition of informed permission, suitable patients meeting the inclusion criteria were recruited for the research. Every patient underwent evaluation utilising both the Modified Alvarado score and the Tzanakis score. The Modified Alvarado score was computed utilising clinical symptoms, signs, and laboratory markers. The Tzanakis score comprised clinical symptoms, leukocytosis, and ultrasonographic results. The rating algorithms were implemented autonomously for each patient. Patients were treated in accordance with the institution's established clinical guidelines. Individuals having a clinical suspicion of acute appendicitis had appendectomy. The excised appendix material was sent for histological analysis, which constituted the definitive standard for the confirmation of acute appendicitis. The diagnostic precision of both scoring systems was assessed by juxtaposing the preoperative scores with histopathological results. The sensitivity, specificity, and predictive values of both scoring systems were evaluated and contrasted.

Statistical Analysis: The gathered data were inputted into Microsoft Excel and examined utilising suitable statistical tools. Descriptive statistics were employed to encapsulate the demographic and clinical characteristics of the research cohort. Continuous variables were represented as mean ± standard deviation, whilst categorical variables were displayed as frequency and percentage. Diagnostic accuracy metrics, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and total accuracy, were computed for both scoring systems. Comparisons of the diagnostic efficacy between the Tzanakis score and the Modified Alvarado score were conducted utilising suitable statistical methods, including the Chi-square test. A p-value below 0.05 was deemed statistically significant.

Results

Table 1: Distribution of Study Subjects Based on Age and Gender

Age	Frequency	Percentage
20-29	25	25.0
30-39	18	18.0
40-49	21	21.0
50-59	15	15.0
>=60	21	21.0
Mean Age	44.14±16.03	
Female	55	55.0
Male	45	45.0

Table 2: Distribution of Study Subjects Based On Symptoms

Symptoms	Frequency	Percentage
Fever	64	64.0
Vomiting	42	42.0
RIF Tenderness	91	91.0
Loose Stool	22	22.0
Other Symptoms	19	19.0
Co-Morbidities	**Frequency**	**Percentage**
CAD	3	3.0
Diabetes	29	29.0
HTN	20	20.0
Hypothyroidism	17	17.0

Table 3: Distribution of Study Subjects Based On Tzanakis Score, Modified Alvarado Score

TZANAKIS Score	Frequency	Percentage
<=8	24	24.0
>8	76	76.0
Modified ALVARADO Score	**Frequency**	**Percentage**
<=7	28	28.0
>7	72	72.0

Table 4: Distribution of Study Subjects Based On Hpe Report

HPE Report	Frequency	Percentage
AA	78	78.0
Negative	22	22.0
Total	100	100.0

Table 5: Association of Modified Alvarado Score and Tzanakis Score

Modified ALVARADO Score	TZANAKIS Score				Total	
	<=8		**>8**			
	N	**%**	**N**	**%**	**N**	**%**
<=7	19	79.2	9	11.8	28	28.0
>7	5	20.8	67	88.2	72	72.0
Total	24	100.0	76	100.0	100	100.0
Chi-Square value = 41.01 , P value**<0.001*** ,Inference : Is Statistically Significant						

Table 6: Association of Modified Alvarado Score and Hpe Report

Modified ALVARADO Score	HPE Report				Total	
	AA		**Negative**			
	N	**%**	**N**	**%**	**N**	**%**
<=7	7	9.0	21	95.5	28	28.0
>7	71	91.0	1	4.5	72	72.0
Total	78	100.0	22	100.0	100	100.0
Chi-Square value = 63.35 , P value**<0.001*** ,Inference : Is Statistically Significant						

Table 7: Association of Tzanakis Score and Hpe Report

TZANAKIS Score	HPE Report				Total	
	AA		Negative			
	N	%	N	%	N	%
<=8	5	6.4	19	86.4	24	24.0
>8	73	93.6	3	13.6	76	76.0
Total	78	100.0	22	100.0	100	100.0
Chi-Square value = 60.14 , P value**<0.001*** ,Inference : Is Statistically Significant						

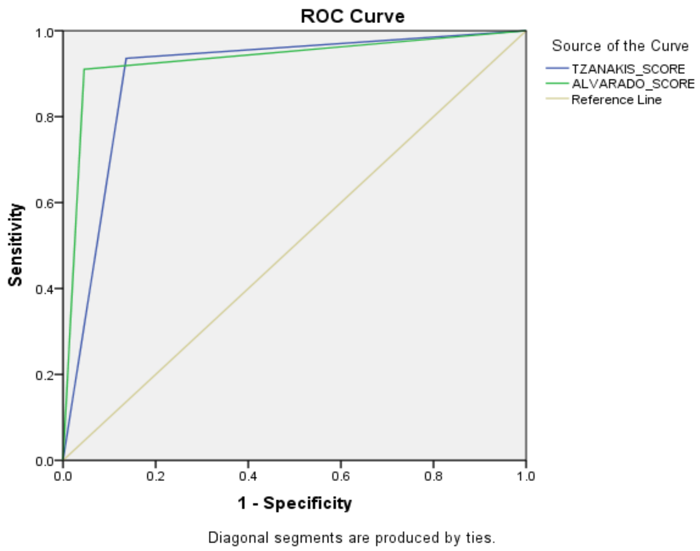

Figure 1: ROC Curve

Both scoring systems demonstrated high diagnostic performance, with AUC values of 0.90 for TZANAKIS score and 0.93 for Modified Alvarado score.

Table 8: Roc Curve Comparing Tzanakis and Modified Alvarado Scores

	TZANAKIS Score	Modified ALVARADO Score
Area Under the Curve	0.9	0.93
95% CI	0.81 to 0.99	0.87 to 0.99
P Value	**<0.001***	**<0.001***
Cut Off Value	8	7
Sensitivity	93.6%	91%
Specificity	86.4%	95.5%
PPV	96.1%	98.6%
NPV	79.2%	75%
Accuracy	92%	92%

Discussion

Our study assessed 100 patients with suspected acute appendicitis, comparing the diagnostic efficacy of the Tzanakis score and the Modified Alvarado score against histology, the established gold standard. Histopathological analysis verified acute appendicitis in 78% of instances, indicating a negative appendectomy rate of 22% within the surgical population. This exceeds the negative appendectomy rates documented in various comparative Tzanakis-versus-Alvarado studies, such as those by Sigdel et al. (6%) and Malla et al. (8%), yet remains within the wider spectrum outlined in appendicitis literature, where negative appendectomy rates have historically fluctuated significantly among institutions and patient demographics. This distinction is significant as it contextualises our findings within a more demanding diagnostic setting, rendering the elevated performance of both measures, especially their robust positive predictive values, clinically relevant.[4,5]

The Tzanakis score integrates ultrasonography with clinical and laboratory data, while the Modified Alvarado score largely depends on symptoms, signs, and leukocytosis. This conceptual distinction elucidates why Tzanakis frequently demonstrates heightened sensitivity in some comparison analyses, but Alvarado or Modified Alvarado may exhibit superior simplicity and, in particular cohorts, enhanced specificity.[3,6]

Our findings indicated that both systems exhibited excellent performance, with AUC values of 0.90 for Tzanakis and 0.93 for Modified Alvarado, and an identical total accuracy of 92%. The data demonstrate that, within our sample, both instruments exhibited significant discriminative ability and closely aligned with the performance anticipated from robust bedside diagnostic procedures. Notably, our data indicated a marginal ROC advantage for Modified Alvarado, although subsequent aggregated evidence has predominantly supported Tzanakis. This renders our study pertinent as it indicates that local disease spectrum, ultrasonography quality, patient demographics, and threshold selection can significantly affect the performance of different scores in practice.[6,7]

Age distribution and comparison with published studies: The predominant age group in our research was 20–29 years, including 25% of patients, with a mean age of 44.14 ± 16.03 years. This trend somewhat aligns with the established propensity for appendicitis to concentrate among younger persons; nonetheless, our mean age is distinctly greater than that reported in several previous studies. Nshuti et al. observed a mean age of 26 years in adults with acute appendicitis, but a recent comparative research in India by BL et al. indicated a mean age of 30.97 ± 13.44 years. The elevated mean age in our study may suggest a more extensive inclusion of middle-aged and elderly patients, a variable that might complicate diagnosis due to the diminished reliability of traditional symptom patterns and the broader differential diagnosis in older individuals.[7]

Gender distribution and sex-related diagnostic implications: Females comprised 55% of the study population, whilst men represented 45%. This little female predominance contrasts with many reported appendicitis cohorts, in which males were more prevalent. Nshuti et al. documented a male-to-female ratio of 1.6:1, and several Alvarado-based validation tests similarly noted male preponderance. This distinction is significant since diagnostic scoring systems, particularly those developed from Alvarado, have traditionally exhibited less specificity in women owing to gynaecologic and pelvic conditions that might resemble appendicitis.[8]

The systematic study by Ohle et al. also indicated that the Alvarado score often overestimates the likelihood of appendicitis in women across various risk categories. In this perspective, the remarkable specificity of Modified Alvarado in our study (95.5%) is significant and implies that, within our environment, meticulous clinical assessment and possibly more stringent criteria for surgery may have mitigated the typical sex-related constraints. Our findings thus align well with the wider literature and suggest that Modified Alvarado can maintain robust performance even in a female-dominant sample when utilised appropriately.[1,9]

Clinical symptom profile: fever, vomiting, and right iliac fossa tenderness: Fever was observed in 64% of our patients. This exceeds the 15% incidence reported by Nshuti et al. in an adult appendicitis cohort, suggesting that our patients may have arrived at a more inflammatory stage or that fever was more meticulously recorded in our context. The high frequency of fever in our population certainly improved the efficacy of the Modified Alvarado score, since it is a significant factor in both Alvarado-derived systems. The findings further substantiate that our research sample comprised a significant percentage of clinically evident instances rather than just ambiguous appearances.[8]

Vomiting occurred in 42% of patients in our study, which is lower than the frequency reported in certain classical appendicitis literature. Nshuti et al. reported that 73% of adults had vomiting, but literature reviews indicate that nausea or vomiting are prevalent but not universally seen symptoms of typical appendicitis presentations. The reduced incidence of vomiting in our study underscores a crucial concept in the diagnosis of appendicitis: no one symptom possesses enough sensitivity or specificity in isolation. The true significance of diagnostic scores is in the integration of many moderately informative factors into a practical probability estimate.[8]

Tenderness in the right iliac fossa was observed in 91% of our patients, establishing it as the predominant clinical symptom in our group. This aligns well with the literature, since discomfort in the right lower quadrant or right iliac fossa is the most dependable bedside indicator of acute appendicitis. Nshuti et al. documented right iliac fossa pain in 95% of patients, and routine clinical evaluations persist in highlighting localised tenderness, percussion pain, guarding, and rebound as critical differentiators. The elevated occurrence of this symptom in our population certainly significantly influenced the efficacy of both ratings, since right iliac fossa tenderness has considerable importance in both the Tzanakis and Modified Alvarado frameworks.[8]

Loose stools, other symptoms, and diagnostic ambiguity: Loose stools were observed in 22% of our patients, while other related symptoms were noted in 19%. While these symptoms are not central to conventional appendicitis scoring systems, they hold clinical significance since they may obscure the diagnosis by indicating infective gastroenteritis, pelvic disease, or nonspecific enteritis. The presence of overlapping symptoms in almost 20% of our population underscores that the diagnosis of appendicitis in standard practice is seldom reliant on a conventional presentation. This underscores the significance of systematic grading in contrast to just subjective perception.[10,11]

Pain in the right iliac fossa may result from several differential diagnoses, especially in women and elderly individuals. Analyses of right iliac fossa discomfort emphasise that ailments other than appendicitis can closely mimic the illness, particularly when the appendix is not distinctly visualised or when symptoms are unusual. In this context, the significant correlation of both our scoring systems with histology is heartening, since it indicates that the scores maintained their robustness despite the interference caused by overlapping symptoms and potential imitators.[12]

Co-morbidities and their possible influence on clinical scoring: Our population had a substantial prevalence of co-morbidities, with diabetes affecting 29%, hypertension 20%, hypothyroidism 17%, coronary artery disease 3%, and 31% presenting without any co-morbid conditions. These characteristics are not explicitly incorporated in either Tzanakis or Modified Alvarado scoring systems. Nonetheless, they retain significance since they can affect pain perception, inflammatory response, clinical imaging thresholds, and surgical decision-making. Diabetes and old age may obscure or modify traditional inflammatory presentations, hence rendering composite ratings more meaningful than singular clinical assessments.[11]

Distribution of Tzanakis and Modified Alvarado scores in our cohort: Seventy-six percent of patients exhibited a Tzanakis score over 8, whereas seventy-two percent displayed a Modified Alvarado score surpassing 7. The distributions closely correspond to the histopathology-positive rate of 78%, indicating that both scoring methods accurately categorised the majority of genuine appendicitis patients into high-probability classifications. The proximity of these proportions to our HPE-validated appendicitis rate suggests early evidence of effective calibration in our sample.[6]

Tzanakis's performance in our investigation aligns well with the initial description by Tzanakis et al., who established a cut-off of 8 and found exceptional diagnosis accuracy utilising a model that integrated ultrasonography, right lower quadrant discomfort, rebound tenderness, and leukocytosis. Subsequent comparative analyses corroborated this trend. Sigdel et al. reported a Tzanakis sensitivity of 91.48% and an accuracy of 90%, whereas Malla et al. reported a sensitivity of 86.9% and a specificity of 75.0%. Our study shown a sensitivity of 93.6%, specificity of 86.4%, positive predictive value of 96.1%, and an accuracy of 92%, which is at least equivalent to, and in certain aspects superior to, previous investigations.[3,4,5]

In the Modified Alvarado scoring system, our high-score distribution aligns with existing research, indicating that scores of 7 or higher typically reflect a robust clinical suspicion. Kanumba& al. demonstrated elevated diagnostic efficacy for the Modified Alvarado system within their Tanzanian cohort, whereas Memon et al. indicated a sensitivity of 93.5%, specificity of 80.6%, positive predictive value of 92.3%, negative predictive value of 83.3%, and overall accuracy of 89.8% for the Alvarado score.

Correlation between Tzanakis and Modified Alvarado scores: In our investigation, the correlation between Modified Alvarado and Tzanakis scores was extremely significant (chi-square 41.01, $p<0.001$). The majority of individuals with a Modified Alvarado score over 7 also had a Tzanakis score more than 8, indicating significant agreement between the two assessment methods. This discovery is anticipated but significant, as both techniques encompass overlapping biological and clinical aspects of appendicitis, such as localised discomfort and inflammatory response. The significant correlation suggests that both ratings were detecting a comparable high-risk clinical profile.[6]

Nevertheless, the discordant subgroup in our analysis is also enlightening. A limited cohort of patients had reduced Modified Alvarado scores and elevated Tzanakis scores, or conversely. This probably indicates the supplementary function of ultrasonography within the Tzanakis framework. When imaging results are favourable, Tzanakis may elevate patients with an incomplete symptom cluster. In contrast, robust clinical and laboratory evidence may sustain a high Modified Alvarado score despite inconclusive ultrasound results. This interaction elucidates why both systems might be complementing rather than mutually incompatible in practice.[3]

Histopathology correlation and implications for negative appendectomy: The most compelling evidence in our research derives from histopathologic connection. A modified Alvarado score greater than 7 was significantly correlated with HPE-confirmed appendicitis, as 71 out of 72 individuals with high scores had acute appendicitis, with just one negative instance seen. Tzanakis>8 was correlated with HPE positive in 73 out of 76 instances, with just three negative results. Both relationships were statistically significant, affirming that score rise indicated actual illness existence rather than simple clinical suspicion.[6,7]

The PPV numbers are particularly notable from a clinical perspective. The Modified Alvarado PPV was 98.6%, while the Tzanakis PPV was 96.1%. These data indicate that a patient above the surgical threshold by any score, especially Modified Alvarado in our sample, had a significantly high likelihood of genuine appendicitis on histological examination. This is comparable to Malla et al., who documented positive predictive values (PPVs) of 97.5% for Tzanakis and 97.2% for Alvarado, as well as Memon et al., who recorded a PPV of 92.3% for Alvarado. Consequently, our research endorses the use of both ratings to mitigate unwarranted surgical interventions, while indicating that the Modified Alvarado score may have been particularly efficacious in decreasing false-positive surgical determinations in our context.[5]

The 22% rate of negative appendectomies in our overall sample underscores that histopathologic negativity can still arise despite good scoring performance. This seeming contradiction presumably indicates that our dataset comprised operated patients rather than all individuals with suspected appendicitis. In this approach, the operated low-score or equivocal-score subgroup may exacerbate the overall unfavourable appendectomy rate. Literature indicates that case selection and operational thresholds significantly affect final histopathological distributions, even when the scoring method has high performance.

Diagnostic performance metrics: sensitivity, specificity, PPV, NPV, and accuracy: The sensitivity of our Tzanakis method, at 93.6%, exceeded the 91% sensitivity of the Modified Alvarado score. This pattern corresponds to a substantial corpus of comparative literature. Sigdel et al. reported a sensitivity of 91.48% for Tzanakis compared to 81.91% for Alvarado, whereas Awan et al.'s latest meta-analysis indicated a pooled sensitivity of 0.86 for Tzanakis vs 0.67 for Alvarado.

The probable explanation is structural: Tzanakis utilises ultrasonography, which provides objective anatomical validation to the bedside evaluation and aids in identifying clinically subtle or unusual instances.[4,6]

Conversely, our Modified Alvarado specificity of 95.5% surpassed the Tzanakis specificity of 86.4%. This data is comprehensible and aligns with the current meta-analysis, which determined that Tzanakis had superior sensitivity and AUC overall, but Alvarado demonstrated slightly enhanced specificity. BL et al. also noted that Tzanakis had greater sensitivity, although Alvarado demonstrated superior specificity in their 2024 Indian cohort. Consequently, our findings align with the overarching pattern that Tzanakis may excel in identifying real positives, but Modified Alvarado may be more effective in ruling out false positives in specific contexts.[7]

The positive predictive values (PPV) for both systems were notably elevated, especially for the Modified Alvarado, which recorded 98.6% compared to 96.1%. In a surgical emergency when a delayed diagnosis may lead to perforation, yet overdiagnosis results in unwarranted appendectomy, such positive predictive values are clinically significant. They propose that once patients exceed the surgical thresholds in our context, the post-test chance of genuine appendicitis is quite high. This observation aligns well with previous Alvarado research, including Memon et al., as well as with comparative Tzanakis series, such as Malla et al.[5,13]

The NPV values for both systems were inferior to the PPV, recorded at 79.2% for Tzanakis and 75% for Modified Alvarado. This is unsurprising. Most appendicitis scoring methods are more effective at detecting high-probability cases than at securely ruling out the condition across all subgroups. Ohle et al. demonstrated that the Alvarado score serves more effectively as a rule-out instrument at a lower threshold of 5 than as a rule-in instrument at 7. The WSES-aligned evidence synthesis also indicates that clinical ratings assist in identifying low-risk individuals, while they are not perfect. Consequently, our NPVs suggest that low or borderline scores should not be solely relied upon to negate the possibility of appendicitis while clinical suspicion remains.[14]

ROC analysis and comparison with published AUCs: ROC analysis in our study revealed AUCs of 0.90 for Tzanakis and 0.93 for Modified Alvarado, both of which are very significant. The AUCs demonstrate exceptional discriminatory capability. Their strength surpasses that shown in the recent 2024 research by BL et al., which found an AUC of 0.670 for Tzanakis and 0.598 for Alvarado, with no significant difference observed between the two. The elevated AUCs may indicate superior case selection, distinct clinical phenotypes, more uniform ultrasonography interpretation, or an alternative threshold for operational decision-making.[15]

Notably, our ROC values diverge from the aggregated meta-analytic trend. Awan et al. obtained a combined AUC of 0.9261 for Tzanakis, concluding that Tzanakis typically surpassed Alvarado in diagnostic odds ratio and sensitivity. In our investigation, Modified Alvarado marginally surpassed Tzanakis in terms of AUC. This disparity is not a contradiction but rather a reminder that aggregated evidence represents average performance across varied contexts, while individual institutions may yield different outcomes based on imaging proficiency, the incidence of appendicitis, and the demographic composition of the study population in terms of sex and age.[6] How our findings fit with historical and contemporary evidence: The first Tzanakis study was predicated on the assumption that including ultrasonography with clinical and laboratory factors enhances preoperative diagnosis. Our findings robustly endorse that idea, as evidenced by the elevated sensitivity, positive predictive value, and area under the curve attained by the Tzanakis score. Subsequent comparison analyses by Sigdel et al. and Malla et al. similarly determined that Tzanakis was superior to Alvarado in identifying acute appendicitis. The current 2024 meta-analysis again favoured Tzanakis, particularly for sensitivity and AUC. Our work corroborates the literature by displaying good Tzanakis performance, however it does not establish definitive advantage over Modified Alvarado.[7]

Our findings align with contemporary guideline-based perspectives. Recent evidence evaluations and debates associated with WSES highlight that clinical ratings are beneficial for risk stratification, minimising wasteful imaging in low-risk patients, and aiding decision-making; nonetheless, they should not supplant prudent clinical judgement and selected imaging practices. Specifically, Alvarado is mostly beneficial for triage and likelihood assessment rather than serving as an independent surgical directive for all patients. Our research endorses this balanced perspective: both scores exhibited robust diagnostic capabilities; nonetheless, histopathology remained the conclusive benchmark, necessitating personalised assessment for patients with ambiguous or low results.

The most equitable reading is that the two systems are complementing rather than conflicting absolutes. A high Modified Alvarado score can provide considerable clinical confidence, whereas Tzanakis can provide imaging-based corroboration in cases of lingering ambiguity. In facilities equipped with high-quality ultrasonography, Tzanakis may enhance sensitivity. In environments where swift bedside decision-making is critical, Modified Alvarado may provide exceptional specificity. Our research endorses the utilisation of any score within a systematic appendicitis protocol, with histopathology maintained as the definitive standard.[16,17,18] A significant aspect of our study is the 22% rate of histopathological negativity. This exceeds the results of numerous comparative score investigations; nonetheless, it does not diminish the robust performance of the scores. It indicates that our study may have encompassed a more diagnostically diverse surgical population. The broader literature indicates that negative appendectomy rates fluctuate based on patient sex, age, imaging accessibility, local surgical criteria, and the definition of negative appendectomy. Consequently, our histopathologic negativity rate need to be seen as indicative of actual surgical decision-making rather than as evidence undermining the efficacy of the rating methods.[19,20]

Overall synthesis: Collectively, our results indicate that both the Tzanakis score and the Modified Alvarado score are extremely useful diagnostic instruments for acute appendicitis when evaluated against histology. Tzanakis exhibited marginally enhanced sensitivity, although Modified Alvarado attained superior specificity and positive predictive value (PPV). Both exhibited same overall accuracy and outstanding AUC values. These findings align substantially with worldwide research; however, our analysis notably revealed a marginal ROC advantage for Modified Alvarado, despite the predominance of females in the population and recent pooled data favoring Tzanakis overall.

Conclusion

This study suggests that the Tzanakis score and the Modified Alvarado score are both extremely useful diagnostic measures for acute appendicitis. Both attained an equivalent overall accuracy of 92% and shown exceptional association with histological results.

The Tzanakis score shown marginally greater sensitivity, rendering it effective for detecting actual positive cases, while the Modified Alvarado score had enhanced specificity and positive predictive value, so proving particularly advantageous for minimising false-positive diagnoses. Ultimately, neither rating method was noticeably inferior, nor both may be regarded as beneficial in standard surgical practice. The Tzanakis score is advantageous when dependable ultrasonography is accessible and diagnostic sensitivity is crucial, but the Modified Alvarado score is more pragmatic in situations necessitating swift bedside evaluation and elevated specificity. Consequently, both methods may serve as complimentary instruments to enhance diagnostic certainty and facilitate prompt surgical decision-making in patients with suspected acute appendicitis.

References

1. Kalan M, Talbot D, Cunliffe WJ, Rich AJ. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: a prospective study. Ann R Coll Surg Engl. 1994;76(6):418–9.
2. Macklin CP, Radcliffe GS, Merei JM, Stringer MD. A prospective evaluation of the modified Alvarado score for acute appendicitis in

children. Ann R Coll Surg Engl. 1997; 79(3):203–5.
3. Tzanakis NE, Efstathiou SP, Danulidis K, Rallis GE, Tsioulos DI, Chatzivasiliou A, et al. A new approach to accurate diagnosis of acute appendicitis. World J Surg. 2005;29(9):1151–6, discussion 1157.
4. Sigdel GS, Lakhey PJ, Mishra PR. Tzanakis score vs. Alvarado score in acute appendicitis. JNMA J Nepal Med Assoc. 2010;49(178):96–9.
5. Malla BR, Batajoo H. Comparison of Tzanakis score vs Alvarado score in the effective diagnosis of acute appendicitis. Kathmandu Univ Med J (KUMJ). 2014;12(45):48–50.
6. Awan AR, Khan ZU, Saleem H, Iqbal H, Ahmad W, Khan AR, et al. A comparison of the accuracy of Tzanakis and Alvarado Score in the diagnosis of acute appendicitis: A systematic review and meta-analysis. Surgeon. 2024;22(5):e164–70.
7. Bl YBP, Mehra B, Ghoshal S, Dubhashi SP. Diagnostic Efficacy Study Comparing Tzanakis Scoring System With Alvarado Scoring System in Effective Diagnosis of Acute Appendicitis. Cureus. 2024;16(4):e58018.
8. Nshuti R, Kruger D, Luvhengo TE. Clinical presentation of acute appendicitis in adults at the Chris Hani Baragwanath academic hospital. Int J Emerg Med. 2014;7(1):12.
9. Ohle R, O'Reilly F, O'Brien KK, Fahey T, Dimitrov BD. The Alvarado score for predicting acute appendicitis: a systematic review. BMC Med. 2011;9:139.
10. Goudie A. Right Iliac Fossa Pain other than Appendicitis: A Pictorial Review. J Med Ultrasound. 2023;31(1):8–12.
11. Podda M, Pisanu A, Sartelli M, Coccolini F, Damaskos D, Augustin G, et al. Diagnosis of acute appendicitis based on clinical scores: is it a myth or reality? Acta Biomed. 2021; 92(4):e2021231.
12. Echevarria† S, Rauf† F, Hussain† N, Zaka H, Farwa U e, Ahsan N, et al. Typical and Atypical Presentations of Appendicitis and Their Implications for Diagnosis and Treatment: A Literature Review. Cureus. 15(4):e37024.
13. Memon ZA, Irfan S, Fatima K, Iqbal MS, Sami W. Acute appendicitis: diagnostic accuracy of Alvarado scoring system. Asian J Surg. 2013;36(4):144–9.
14. Fugazzola P, Ceresoli M, Agnoletti V, Agresta F, Amato B, Carcoforo P, et al. The SIFIPAC/WSES/SICG/SIMEU guidelines for diagnosis and treatment of acute appendicitis in the elderly (2019 edition). World J Emerg Surg. 2020;15:19.
15. Al-wageeh S, Alyhari QA, Ahmed F, Altam A, Alshehari G, Badheeb M. Evaluating the Diagnostic Accuracy of the Alvarado Score and Abdominal Ultrasound for Acute Appendicitis: A Retrospective Single-Center Study. Open Access Emerg Med. 2024; 16:159–66.
16. Mariadason JG, Wang WN, Wallack MK, Belmonte A, Matari H. Negative appendicectomy rate as a quality metric in the management of appendicitis: impact of computed tomography, Alvarado score and the definition of negative appendicectomy. Ann R Coll Surg Engl. 2012;94(6):395–401.
17. Favara G, Maugeri A, Barchitta M, Ventura A, Basile G, Agodi A. Comparison of RIPASA and ALVARADO scores for risk assessment of acute appendicitis: A systematic review and meta-analysis. PLoS One. 2022; 17(9):e0275427.
18. Chong CF, Thien A, Mackie AJ, Tin AS, Tripathi S, Ahmad MA, et al. Comparison of RIPASA and Alvarado scores for the diagnosis of acute appendicitis. Singapore Med J. 2011;52(5):340–5.
19. Inteti K, Shaik MR, Ganapa P, Gandi PS. A Comparison of the Alvarado Score and the Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) Score in the Diagnosis of Acute Appendicitis: A Prospective Cohort Study. Cureus. 2024;16(8):e68041.
20. Noureldin K, Hatim Ali AA, Issa M, Shah H, Ayantunde B, Ayantunde A. Negative Appendicectomy Rate: Incidence and Predictors. Cureus. 14(1):e21489.