



Original Research Article

Diagnostic accuracy of Tzanakis scoring in Acute appendicitis

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Abstract: Background: Acute appendicitis is a prominent emergency that calls for immediate surgical intervention throughout the world. Its clinical diagnosis still poses a challenge, particularly in lower-middle-income countries like Pakistan. The Tzanakis score, with components of clinical, laboratory, and ultrasonographic findings, has become a popular diagnostic tool in recent times. This study highlights the effectiveness of the Tzanakis score in the diagnosis of acute appendicitis in a tertiary care hospital in Pakistan. **Methods:** A prospective observational study was conducted from April to July 2025, including 114 patients with suspected acute appendicitis. The Tzanakis score was then calculated based on right lower quadrant tenderness, rebound tenderness, leukocytosis, and ultrasound findings. A score ≥ 8 was considered positive. All patients underwent appendectomy, with histopathological examination (HPE) serving as the gold standard. Diagnostic findings, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy, were calculated. **Results:** The mean age of participants was 28.38 ± 13.48 years, with a male predominance (69.3%). On HPE acute appendicitis was confirmed in 59.6% of cases, while 34.2% of appendices were reported normal. The Tzanakis score demonstrated a sensitivity of 88% but a very low specificity of 7.69%. The PPV was 64.71%, the NPV was 25%, and the overall diagnostic accuracy was 60.53%. **Conclusion:** The Tzanakis score showed high sensitivity, making it a useful tool for ruling out acute appendicitis. Its exceptionally low specificity and overall accuracy in this setting suggest limited dependability, contributing possibly to radiological mishandling or misinterpretation. Taking in consideration of our scarcity of resources, there is a need to have a credible scoring system to support decision-making. The score is sensitive but should not be the sole basis for diagnosis to prevent unnecessary appendectomies.

Keywords: cute appendicitis; Tzanakis score; Diagnostic accuracy; Sensitivity and specificity; Ultrasound; Appendectomy.

INTRODUCTION

Acute appendicitis is the leading cause of surgical emergencies throughout the world, with the prevalence of 1 in 7 individuals being affected, also with a male-to-female predominance of about 1.2-1.3:1. It presents in most cases with a classic lower abdominal pain associated with or without

symptoms like vomiting, nausea, anorexia, and fever. (1) Most cases of acute appendicitis are clinically diagnosed, even though we now have access to revolutionary diagnostic modalities. Atypical presentation of the disease, however, is challenging and might need added expertise of a surgeon along with appropriate labwork and imagings. The high

incidence of negative appendectomies (20–40%) highlights how important it is to devise an effective scoring system to enhance diagnostic accuracy and minimize unnecessary surgeries. (2) There are various scoring systems that have been used to aid in the diagnosis of appendicitis, which include the Alvarado score, Appendicitis Inflammatory Response (AIR) score, Pediatric Appendicitis Score (PAS), RIPASA score, and, lastly, the highlight of our study, which is the Tzanakis score.

The Tzanakis scoring system, proposed by Nikolas E. Tzanakis in 2005, combines four key elements of assessment, which are awarded different points: right lower quadrant tenderness (4 points), rebound tenderness (3 points), leukocytosis $>12,000/\text{mm}^3$ (2 points), and positive ultrasound findings (6 points). A score ≥ 8 is highly predictive of acute appendicitis, with reported sensitivity and specificity of 95.4% and 97.4%, respectively. (3).

Pakistan, being a lower-middle-income country (LMIC), faces particular challenges concerning infrastructure and the scarcity of quick diagnostic procedures. Especially, the multi-disciplinary tertiary care hospitals that receive the majority of critical patients via referrals from other secondary care setups or because of the unaffordability of the masses. The physicians and surgeons have to rely solely on clinical knowledge to help diagnose acute cases requiring urgent care. The scoring system, like the Tzanakis score, has proved to be an efficient alternative in comparison to the other scoring systems because of its cost-effectiveness and early and superior diagnostic accuracy, particularly in reducing negative appendectomy rates. (4)

This study seeks to analyze the effectiveness of the Tzanakis score in diagnosing acute appendicitis within a tertiary care hospital setting. The primary objective is to determine its sensitivity, specificity, and overall diagnostic accuracy in accurately predicting acute appendicitis. By corroborating its performance in clinical practice, we aim to generate evidence supporting its broader use and foreshadowing of clinical promise, especially in regions like Pakistan, where access to specialized imaging and diagnostic platforms is limited.

Methods

This prospective observational study was conducted in the Department of General Surgery of Civil Hospital located in Karachi, Pakistan, from April 15th, 2025, to July 15th, 2025. A total of 200 cases were studied after the ethical approval from the Institutional Review Board of Dow University of Health Sciences. Male and female patients, aged 10 to 60 years, presenting with a clinical diagnosis of suspected acute appendicitis, who subsequently underwent surgical intervention and consented to participate, were included in the study. Patients with an appendicular lump or mass, appendicular abscess, generalized peritonitis, blunt abdominal trauma, or pregnancy were excluded.

Data were collected using a structured proforma, recording demographic details, presenting complaints, laboratory results (total leukocyte count), and ultrasonographic findings. The Tzanakis score was calculated for each patient based on four parameters: right lower quadrant tenderness (4 points), rebound tenderness (3 points), leukocytosis $>12,000/\text{mm}^3$ (2 points), and positive ultrasound findings (6 points). A score ≥ 8 was considered indicative of acute appendicitis, demanding surgical intervention. The diagnosis of acute appendicitis was assessed using the Tzanakis scoring system, as originally described by Tzanakis et al. (2005). (3) This scoring system consolidates clinical findings with laboratory results and ultrasonographic evidence to produce a cumulative and pertinent score for diagnostic prediction.

All patients underwent appendectomy, and the resected specimens were submitted for histopathological examination (HPE). A negative appendectomy was defined as the absence of histological evidence of inflammation on HPE. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy were determined using standard statistical procedures. Data were analyzed with SPSS software (version 26), and a p-value of less than 0.05 was considered to indicate statistical significance.

RESULTS

A total of 114 patients were assessed in this study. There were 68% of patients with appendicitis were seen in between 12–30 years. The mean age of the study population was 28.38 ± 13.48 years (Table 1). Out of them, 69.3% of patients were males and 30.7% patients were female (Table 2) and right iliac fossa tenderness was present in 96.5% cases. Rebound tenderness was present in 21% of cases. The total leucocyte count is an important component in the diagnosis of appendicitis. In our present study, it was raised in 59% of cases. According to ultrasound findings, 98 patients had Positive USG for acute appendicitis and 16 patients had negative USG for acute appendicitis (Table 3). Out of 114 patients, 102 patients had Tzanaki's score more than 8, and 12 patients had less than 8. All 114 patients, clinically diagnosed as cases of acute appendicitis in the study were histopathologically examined, 68 cases were acute appendicitis, 07 were chronic appendicitis and 39 were normal (Table 4). In our study, sensitivity, specificity, negative predictive value, and positive predictive value are 88%,

7.69%, 64.71%, and 25%, the overall diagnostic accuracy of Tzanaki's score is 60.53% (Table 6). Present study has a Sensitivity and positive predictive value and diagnostic accuracy which is comparable with original Tzanaki's scoring system with specificity at a lesser side. But sensitivity is better than many existing scoring systems (Table 7).

Table 1: Age Distribution

Age	Number	Percentage
>40	20	17.5
<40	94	82.5
Total	114	100

Table 2: Sex Distribution

Sex	Number	Percentage
Male	79	69.3
Female	35	30.7
Total	114	100

Table 3: Sensitivity and specificity of USG finding and HPE finding of Tzanaki's score

Positive USG for Acute Appendicitis	HPE	
	Appendicitis	No Appendicitis
Negative	11	5
Positive	64	34
Total	75	39
Chi Square	0.072	
22P value	0.788	
Significance	Not Significant	

Table 4: Histopathological diagnosis wise distribution of frequency

HPE Report	Number	Percentage
Normal	39	34.2
Acute Appendicitis	68	59.6
Chronic Appendicitis	7	6.1
Total	114	100

Table 5: Comparison of Tzanaki's scoring diagnosis with histopathological diagnosis.

Tzanaki's Score		HPE		Tzanaki's Score
		Appendicitis	No Appendicitis	
> 8	Count	9	3	12
	% within Score_MoreThan8	75.0%	25.0%	100.0%
	% within HPE	12.0%	7.7%	10.5%
<8	Count	66	36	102
	% within Score_MoreThan8	64.7%	35.3%	100.0%
	% within HPE	88.0%	92.3%	89.5%
Total	Count	75	39	114
	% within Score_MoreThan8	65.8%	34.2%	100.0%
	% within HPE	100.0%	100.0%	100.0%
Chi- Square	0.506			
P value	0.477			
Significance	Not significant			

Table 6: Diagnostic indices for Tzanaki's score.

		95% CI
Sensitivity	88	78.44-94.36
Specificity	7.69	1.62-20.87
Positive Predictive Value	64.71	61.84-67.47
Negative Predictive Value	25	8.73-53.73
Accuracy	60.53	50.94-69.55

Table 7: Comparison of present study with other scoring system

Scoring System	Sensitivity	Specificity	PPV	NPV
Alvarado	73-90	87-92	-	-
Ripasa	88	67	93	53
Tzanaki's	95.4	97.4	-	-
Present Study	88	7.69	64.71	25

DISCUSSION

Acute appendicitis stands as the most common surgical emergency worldwide. While the exact etiology remains a mystery, it could be attributed to an obstructive cause, which would eventually cause significant necrosis and/or rupture. (5) The age group profoundly affected includes ages of 10 and 20 years. Although common in this group, it may also affect other age groups. There also exists a slight male predominance with a male-to-female ratio of 1.4:1, while the lifetime risk is estimated somewhere between 7-8%. (6) The presentation of a patient with suspected acute appendicitis usually includes abdominal pain associated with vomiting, fever, or anorexia. Despite appendicitis being a common presentation in healthcare setups, it continues to pose a challenge for surgeons who must weigh the serious consequences of complications such as perforation against the risks of unnecessary surgery and negative appendectomy. (7) It is also important to take into consideration the additional burden that the developing countries, like Pakistan, face because of a paucity of resources. Although surmountable, this influences decision-making and calls for a well-rounded and familiar diagnostic system. Our study calculated Tzanaki's scoring system in 114 patients in a multidisciplinary, tertiary care setup, demonstrating a high sensitivity of 88% but a notably low specificity of 7.69%, positive predictive value (PPV) of 64.71%, negative predictive value (NPV) of 25%, and an overall diagnostic accuracy of 60.53%. (Table 6)

Our study observes a high sensitivity of Tzanaki's score as its strength and is in accordance with various other comparable articles. The study of Tadvi et al. (2024) gives a sensitivity of 86.36% for the Tzanakis score, phenomenally surpassing the Alvarado score's 43.93% in their cohort. (8) Likewise, Kumar et al. (2024) found a Tzanaki's sensitivity of 87.27%, (9) while Prabhu et al. (2024) reported 87%. (10) A

higher diagnostic performance, with 98% sensitivity, 75% specificity, 100% PPV, and 99% NPV, was the outcome of Patel et al (2025) establishing an advantage to the Modified Alvarado Score in diagnosing acute appendicitis. (11) A coinciding pattern exists among these studies, that is, an amalgamation of ultrasound findings, presenting clinical signs, and lab parameters, which allows us to identify true positive scenarios while ensuring patient well-being and minimizing avoidable surgical procedures.

The true limitation of the Tzanakis scoring system seems to lie in its dependence on ultrasonographic findings. Our study shows a specificity of only 7.69%, in stark contrast with the 97.4% specificity reported in the original paper. (3) This nudges us in the direction of taking into consideration that ultrasounds are dependent on human handling, which makes it a glaring variable. The diagnostic accuracy of an ultrasound depends greatly on the radiologist's expertise. (10) In our study, the poor specificity reduced the overall reliability of the Tzanakis score. It sheds light on the precarious situation of underfunded and resource-constrained countries. Similar challenges have been highlighted in resource-limited hospitals, where the lack of imaging modalities and prompt lab work hinders diagnostic accuracy, making clinical scores alone insufficient to identify complicated appendicitis. (12)

Our analysis also shows that 34.2% of the surgically removed appendices were histologically normal (Table 4), suggesting a high negative appendectomy rate (NAR), which is a prominent concern. Similar findings have been noted in other related literature. Tadvi et al. (2024) reported that 28.06% of their specimens were not actually true cases of acute appendicitis. (8) Another study by Kumar et al. (2024) reports a certain prevalence of negative appendectomy rates among females, a finding our

data corroborates, as 30.7% of our cohort were female. (9)

In essence, our findings testify that the Tzanakis score is highly sensitive and effective for ruling out appendicitis despite low scores. Our data suggests that the poor sensitivity makes the Tzanakis score inconsistent and may potentially lead to untoward outcomes. This is in accordance with studies that reiterate that scoring systems on their own are not always reliable and accurate. (12)

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