

Evaluation of Tzanakis Scoring System in the Diagnosis of Acute Appendicitis: A Prospective Study

Sulaiman AT¹, Adewunmi OL¹, Nganjiwa US¹, Gali BM¹, Naaya HU¹

ABSTRACT

Background: Acute appendicitis is a common cause of acute abdominal emergencies. Tzanakis scoring system is a combination of clinical evaluation, ultrasonography and laboratory findings, used in the diagnosis of acute appendicitis.

Objective: was to evaluate the probabilistic prediction of Tzanakis scoring system in the preoperative diagnosis of acute appendicitis and compare its accuracy with histopathological examination (HPE).

Methods: A prospective observational study designed to analyze those patients who presented with clinical suspicion of acute appendicitis, admitted to accident and emergency unit of University of Maiduguri Teaching Hospital (UMTH) during the study period. After complete clinical examination, radiological and laboratory investigations Tzanakis score was calculated, and patients underwent appendectomy irrespective of the Tzanakis score and HPE results were analyzed.

Results: Out of the 115 appendectomies performed during the study period, 110 were eligible for the study based on the inclusion criteria. The sensitivity and specificity of Tzanakis score was 70.8% and 71.4% respectively. The overall diagnostic accuracy was 70.9% with positive predictive value of 94.4% and negative predictive value of 26.3%. The negative appendectomy rate was 5.6%.

Conclusions: Tzanakis scoring system is an effective diagnostic tool in the establishment of diagnosis of acute appendicitis, but the limitation is that the score involves the use of ultrasonography which is observer dependent and subsequently makes the score vary from one location to another.

Key words: Acute appendicitis, Sensitivity, Specificity, Tzanakis scoring system, Negative appendectomy

¹Department of Surgery, University of Maiduguri Teaching Hospital, Maiduguri, Borno State, Nigeria.

Corresponding Author:

Sulaiman AT
Department of Surgery, University of Maiduguri
Teaching Hospital, Maiduguri, Borno State, Nigeria.
drsalt@yahoo.com

Received: 10th December 2025

Accepted: 20th February 2026

Published online: 30th June 2026

Introduction

Appendicitis is defined as the inflammation of the inner lining of the vermiform appendix which extends to its other parts causing pain that increases with the degree of inflammation.¹ It is one of the most common causes of

acute abdominal surgical emergencies in daily practice.²

Based on the symptoms, appendicitis can be acute or chronic,³ and sometimes it is recurrent.

The accuracy of clinical diagnosis of acute appendicitis is approximately 70 to 87% and errors are common resulting in occurrence of perforation and negative appendectomies.⁴ To enhance the diagnostic accuracy and reduce negative appendectomy rates, various scoring systems have been developed, including Tzanakis Score *etc.*⁵ Tzanakis scoring system was designed to reduce the negative appendectomy rate without increasing morbidity and mortality. This present study aimed to evaluate the usefulness of this scoring system in patients with a provisional diagnosis of acute appendicitis in a federal teaching hospital.

Methods

Over a 12-month period, 110 out of 115 patients seen within the study period at the emergency unit of University of Maiduguri Teaching Hospital (UMTH)

Access this article online

QuickResponse Code



website: www.bornomedicaljournal.com

DOI: 10.31173/bomj.bomj_2533_23



with clinical suspicion of acute uncomplicated appendicitis and required surgery were evaluated. Patients 18 years or above who gave written consent to participate were recruited in the study. The study excluded individuals with recurrent appendicitis, appendicular mass, appendicular abscess, previous surgery, peritonitis, and pregnancy.

A thorough clinical history and examination, radiologic, and laboratory investigations were done for all the patients. Abdominopelvic Ultrasound scan was carried out by a dedicated radiologist. Blood sample taken for total and differential leucocyte count, routine urine analysis and pregnancy test (female participants only) were carried out. Detailed history, physical examination findings and investigation reports were recorded on a preformed Proforma.

The scoring system, as described by Tzanakis, has four parameters and a total of 15 points. Two clinical signs, one laboratory finding and one radiological test (Table 1). A score of 8 or more, diagnoses acute appendicitis,

while a score of less than 8 is not likely to be appendicitis.³ The laboratory finding of leucocytosis is defined as a white cell count more than 12×10^9 /litre. Ultrasound findings considered positive for acute appendicitis included presence of any four or more of the following:⁶

- i. Aperistaltic non compressible blind ended sausage shaped structure arising from the base of the cecum.
- ii. distinct appendiceal wall layers.
- iii. an appendiceal outer diameter greater than 6mm.
- iv. a target appearance of the appendix.
- v. peri-appendicular fluid collection; and
- vi. echogenic prominent peri-cecal fat.

The decision to proceed with appendectomy surgery was made based on clinical judgment alone irrespective of the Tzanakis score.

Table 1: Tzanakis Scoring System

FEATURE	SCORE
Right lower abdominal tenderness	4
Right lower abdominal rebound tenderness	3
Total leucocyte count > 12000/dl	2
Ultrasonographic features suggestive of acute appendicitis	6
Total	15

All patients underwent appendectomy, with intraoperative findings documented. The excised appendix was fixed in 10% formalin and sent for histopathology using H&E staining. Histological results were recorded, and the final diagnosis of acute appendicitis was confirmed by histology.

Ethical approval for the study was approved by the institutional ethics committee of the UMTH.

Statistical analysis

Statistical Analyses were carried out using Statistical Package for the Social Sciences Software (SPSS)

Program for Windows® 10 version 22.0. Armonk, NY: IBM Corp. Descriptive statistics used for nominal variables like gender, white blood cell (WBC) counts, Ultrasonography scan (USS) features and ordinal variables like Tzanakis Score included proportions, rates, and ratios. While the numerical variables like age and temperature were analysed using mean, median and standard deviations. Frequency tables and charts were used as appropriate.

Associations between categorical variables were assessed using Chi square test. The level of



Evaluation of Tzanakis Scoring System in the Diagnosis of Acute Appendicitis

significance was set at $p < 0.05$ and 95% confidence intervals. Binary classification metrics, such as diagnostic accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), were computed from a two-by-two table dataset called the confusion matrix.

A total of 110 patients who underwent emergency appendectomy were recruited for the study. There were 58 (52.7%) males than 52 (47.3%) females, with M:F ratio of 1.1:1. Mean age of the study participants was 25.9 ± 7.6 years ranged 18 to 45 years (Table 2).

RESULTS

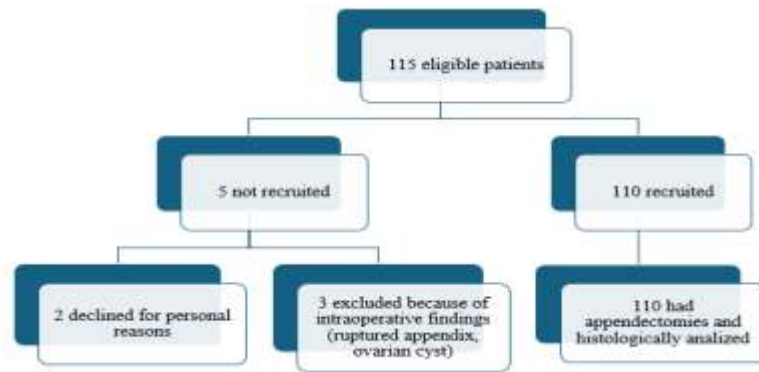


Fig 1: Recruitment flow chart

Table2: Demographic and Socioeconomic characteristics of patients (n=110)

Variables	Frequency (%)
Age (Years)	
≤ 20	36 (32.7)
20 - 30	44 (40.0)
31 - 40	24 (10.9)
>40	6 (5.5)
Sex	
Male	58 (52.7)
Female	52 (47.3)
Socioeconomic status	
Low income	18 (16.4)
Middle income	90 (81.8)
High Income	2 (1.8)

Abdominal pain was found in all 110 (100%) patients. Pain was in periumbilical region in 88 (80%) of the patients, right lower quadrant in 20 (18.2%) and non-localized in 2 (1.8%). Abdominal pain migrated to the right iliac fossa in 100 (90.9%) of the patients, while it was non migratory in the rest. One hundred and four

(94.5%) patients had nausea, 74 (67.3%) vomiting, 98 (89.1%) anorexia and 60 (54.5%) fever. Other symptoms included diarrhea, constipation, dysuria, and urgency which were present in 16 (14.5%), 10 (9.1%), 32 (29.1%), and 12 (10.9%) patients respectively.

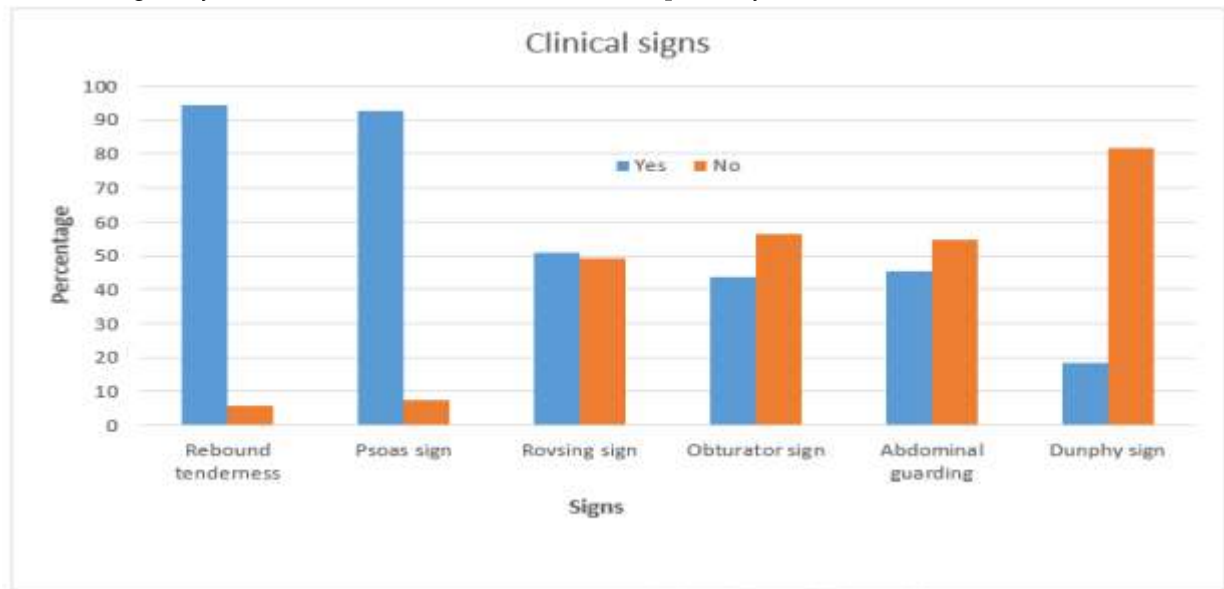


Fig 2: Clinical signs

Physical signs were right iliac fossa tenderness and rebound tenderness in 110 (100%) and 104

(94.5%) respectively. Psoas sign in 102 (92.7%) patients, Rovsing's sign in 56 (50.9%) and obturator sign in 48 (43.6%), figure 2, and Tzanakis score parameters, table 3.

Table 3: Distribution of Tzanakis Score parameters

Parameter	Frequency (%)
Right lower abdominal tenderness	
Present	110 (100)
Rebound tenderness	
Present	104 (94.5)
Absent	6 (5.5)
Total white blood cell counts	
$\geq 12,000/\text{mm}^3$	28 (25.5)
$< 12,000/\text{mm}^3$	82 (74.5)
Abdominal ultrasound scan	
Positive	60 (54.5)
Negative	50 (45.5)

Evaluation of Tzanakis Scoring System in the Diagnosis of Acute Appendicitis

In this study, none of the 110 participants had Tzanakis score less than 3. Scores of 4-15 have respective frequencies and percentages as shown in Table 4.

Table 4: Tzanakis score distribution of patients

Tzanakis score	Frequency	Percentage (%)
4	4	3.6
7	34	30.9
9	12	10.9
10	2	1.8
13	42	38.2
15	16	14.5

The mean score for Tzanakis Score was 10.6 ± 3.3 , acute appendicitis, Table 5. The Tzanakis scores of patients with negative appendectomy were 8, 8, 9 and 10. (65.5%) patients had a high-risk score of (8-15) while 38 (34.5%) had a low-risk score (1-7) for diagnosis of

Table 5: Relating diagnostic scoring system to histopathological diagnosis of acute appendicitis (N=110)

Histopathological diagnosis	Tzanakis score		P-value
	†High risk	*Low risk	
Positive	68	28	0.041
Negative	4	10	

* Low risk: 1-7

† High risk: 8-15

All histopathologically confirmed appendicitis were categorized as positive, whereas all other findings were categorized as negative. The negative appendectomy rate (NAR) was calculated as the ratio of all negative results to the total number of appendectomies performed.

The sensitivity and specificity of Tzanakis scoring system were 70.8% and 71.4% respectively. The Positive Predictive Value (PPV) and the Negative

Predictive Value (NPV), for Tzanakis Score were 94.4% and 26.3% respectively. The diagnostic accuracy of Tzanakis Score was 70.9% and negative appendectomy rate was 5.6% (Table 6).

The overall rate of negative appendectomy in this study was 12.7% (1.8% male, 10.9% female). But using Tzanakis scoring systems, the rate was significantly lower at 5.6%



Table 6: Sensitivity, specificity, PPV, NPV, accuracy and NAR of Tzanakis scoring systems in predicting acute appendicitis

Tzanakis scoring system	Percentage (%)
Sensitivity	70.8
Specificity	71.4
PPV	94.4
NPV	26.3
Accuracy	70.9
NAR	5.6

PPV: Positive predictive value; NPV: Negative predictive value; NAR: Negative appendectomy rate

Discussion

In the past, the clinical diagnosis of acute appendicitis alone yielded a high negative appendectomy rate of 15% to 30%.⁷ Negative appendectomy is associated with prolonged hospital stay and increased cost of health care. The use of Tzanakis scoring system has been reported to enhance accuracy of diagnosis of AA and reduces negative appendectomy rate.⁸ This study evaluated the usefulness of Tzanakis scoring system in this regard in our setting.

Appendicitis is a disease that affects individuals of any age; however, it is peaked at second and third decades of life.⁹ In this study, we found similar preponderance of AA in 80 (72.7%) patients in 2nd to 3rd decades of life. In a similar study on modified Alvarado Score, Kanumba *et al.*¹⁰ found that the average age of the study population was 29.64 ± 12.97 years. Our study showed the participants had a mean age of 25.9 ± 7.6 years and a male: female ratio of 1:1.1, which is consistent with prior findings in Nigeria.^{11,12} We also found more 6 (5.5%) older males above 40 years of age presenting with acute appendicitis than females. The reason for this is not known but may be due to reduced incidence of AA in older females.

The sensitivity of ultrasonography as a component of Tzanakis score in this study was 50%, which is lower compared to other studies which had shown the sensitivity rate of 73%-84.7%.¹³⁻¹⁶ Orr *et al.*¹³ and Pacharn *et al.*¹⁴ reported high NPV for USS and emphasized the need for USS to be employed as screening tool in the evaluation of suspected acute

appendicitis. Tzanakis *et al.*⁸ established that USS in experienced hands improve the diagnostic yield of appendicitis, which may be the reason why USS is one of the parameters of the scoring system.

The sensitivity, specificity and diagnostic accuracy of Tzanakis scoring system was 95.4%, 97.4% and 96.5% respectively according to the author of the scoring system, Tzanakis in his study.⁸ The positive predictive value and negative predictive value were 97.5% and 33.3% respectively. In this study, the sensitivity and specificity of Tzanakis score at cut off ≥ 8 in the diagnosis of acute appendicitis was 70.8% and 71.4% respectively. The overall diagnostic accuracy was 70.9% with positive predictive value of 94.4% and negative predictive value of 26.3%. Similar values were reported in other studies.^{17,18}

Negative appendectomy rate was relatively high in our hospital, 15.9% from previous study.¹⁹ The negative appendectomy (NA) rate in this study was 12.7%. On the other hand, Tzanakis scores yielded lower rate of negative appendectomy rate of 5.6%. Using Tzanakis Scores, Makor *et al.*⁶ found similar rate of 3% in Uganda using a cutoff point of ≥ 13 instead of 8 used in this study.

In general, the Tzanakis scoring system provides a quick, safe, and effective way to diagnose acute appendicitis. It helps prevent surgical delays and has the potential to lower the rate of negative appendectomy in our environment.





Fig 3: Intraoperative picture of inflamed appendix with adhesion at the tip

The limitation of the study includes the fact that Tzanakis scoring system uses ultrasonography as part of its diagnostic parameters which is observer dependent and may affect the score in different Hospitals. The practice of self-medication of antibiotics and analgesics at home, which is rampant in our setting, may mask some of the clinical signs used in the Tzanakis score. This may affect its accuracy and other indices. This study has its strength in being a prospective study with proper evaluation and inclusion of all necessary information.

Conclusion

Acute appendicitis is a very common surgical emergency. Good clinical judgment combined with a good scoring system can help to lower the negative appendectomy rate. The Tzanakis scoring system can be used effectively to improve accuracy in the diagnosis of acute appendicitis. The only limitation is observer bias in the ultrasonography which may affect the results.

Funding: No funding sources

Conflict of interest: None declared

References

1. Lakshminarasimhaiah AKS, A. L. N, M. S. Evaluation of Tzanakis scoring system in acute appendicitis: a prospective study. *International Surgery Journal*. 2017;4(10):3338–43.
2. Richmond B. The appendix. In: Townsend CM, Beauchamp RD, Evers BM, Mattox KL, editors. *Sabiston textbook of surgery: The biologic basis of modern surgical practice*. 20th ed. Philadelphia: Elsevier; 2017. p. 1296–308.
3. Sigdel G, Lakhey P, Misra P. Tzanakis Score vs Alvarado Score in acute appendicitis. *Journal of Nepal Medical Association*. 2010;49(178):96–9.
4. Kumar U, Pandit G, Khichy PS, Sharma PRS. A comparative study on Alvarado scoring Vs Tzanakis score system in diagnosis of acute appendicitis. *Journal of Dental and Medical Sciences*. 2020;19(1):26–9.
5. Lintula H, Kokki H, Pulkkinen J, Kettunen R, Gröhn O, Eskelinen M. Diagnostic score in acute appendicitis. validation of a diagnostic score (Lintula score) for adults with suspected appendicitis. *Langenbeck's Archives of Surgery*. 2010;395(5):495–500.
6. Makor A, Jombwe J, Galukande M, Elobu AE. Diagnostic accuracy of the Tzanakis Score for acute appendicitis in a resource-limited setting: a tertiary hospital-based survey. *East and Central African Journal of Surgery*. 2018;23(3):100–3.
7. Sammalkorpi HE, Mentula P, Leppäniemi A. A new adult appendicitis score improves diagnostic accuracy of acute appendicitis - a prospective study. *BMC Gastroenterology*. 2014;14(1):1–7.
8. Tzanakis NE, Efstathiou SP, Danulidis K, Rallis GE, Tsioulos DI, Chatzivasilou A, et al. A new approach to accurate diagnosis of acute appendicitis. *World Journal of Surgery*. 2005;29(9):1151–6.
9. Alatise O, Ogunweide T. Acute appendicitis: incidence and management in Nigeria. *Journal of the Obafemi Awolowo University Medical Student's Association (IFEMED)*. 2008;14(1):66–70.
10. Kanumba ES, Mabula JB, Rambau P, Chalya PL. Modified Alvarado scoring system as a

- diagnostic tool for acute appendicitis at Bugando Medical Centre, Mwanza, Tanzania. *BMC Surgery*. 2011;11(1):1-5.
11. Oguntola A, Adeoti M, Oyemolade T. Appendicitis: trends in incidence, age, sex, and seasonal variations in South-Western Nigeria. *Annals of African Medicine*. 2010;9(4):213-7.
 12. Afuwape O, Ayandipo O, Soneye O, Fakoya A. Pattern of presentation and outcome of management of acute appendicitis: a 10-year experience. *Journal of Clinical Sciences*. 2018;15(4):171-5.
 13. Orr RK, Porter D, Hartman D. Ultrasonography to evaluate adults for appendicitis: decision making based on meta-analysis and probabilistic reasoning. *Academic Emergency Medicine*. 1995;2(7):644-50.
 14. Preeyacha Pacharn, MD, Jun Ying, PhD, Leann E. Linam, MD, Alan S. Brody, MD, Diane S. Babcock M, Objective. Sonography in the evaluation of acute appendicitis. *American Institute of Ultrasound in Medicine*. 2010;29(5):1749-55.
 15. Rajbhandari AP, Dhakal N, Koirala R, Shrestha ML. Comparision of ultrasonographic diagnosis with 'Tzanakis' Score in acute appendicitis. *Journal of Society of Surgeons of Nepal*. 2016;19(1):9-12.
 16. 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.
 17. Malla B, Batajoo H. Comparison of Tzanakis Score vs Alvarado Score in the effective diagnosis of acute appendicitis. *Kathmandu University Medical Journal*. 2014;12(1):48-50.
 18. J GM, G S, K C. Alvarado vs Tzanakis score- better score for appendicitis. *IOSR Journal of Dental and Medical Sciences*. 2019;18(2):65-6.
 19. Ali N, Aliyu S. Appendicitis and its surgical management experience at the University of Maiduguri Teaching Hospital Nigeria. *Nigerian journal of medicine: journal of the National Association of Resident Doctors of Nigeria*. 2012;21(2):223-6

Cite this Article as: Sulaiman AT, Adewunmi OL, Nganjiwa US, Gali BM, Naaya HU. Evaluation of Tzanakis Scoring System in the Diagnosis of Acute Appendicitis: A Prospective Study. *Bo Med J* 2026; 23 (1):52-59 **Source of Support:** Nil, **Conflict of Interest:** None declared

