

A Prospective Study Comparing Alvarado Score and Tzanakis Score in Diagnosis of Acute Appendicitis

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Abstract

Background: One in seven people may get acute appendicitis at some point in their lives, making it one of the most common abdominal surgery emergencies. The lifetime risk is 6.7% for women and 8.6% for males; it is lowest at both extremes of age and highest in the twenties and thirties. A clinical examination can be between 70 to 87% accurate in identifying acute appendicitis. In cases of acute appendicitis, many surgeons advocate for immediate surgical surgery to prevent perforation, even if it means accepting a negative appendectomy rate of 15-20%. The purpose of this research was to evaluate the accuracy of the Alvarado scoring system vs the Tzanaki scoring system for identifying cases of acute appendicitis.

Methodology: Our tertiary care facility hosted this cross-sectional, prospective, non-randomized investigation. Participants had to be experiencing pain in the right lower abdomen. The appropriate history, physical, and laboratory tests were performed. Patients had open appendectomy after being scored with the Alvarado and Tzanakis systems. The pathologist's histology findings formed the basis of the final diagnosis. Both scoring methods were evaluated and compared based on their sensitivity, specificity, PPV, NPV, and diagnostic accuracy.

Results: There were a total of 100 participants in this study. Tzanakis scores of 8 or higher were present in 84 individuals. The Alvarado score was 7 or above for 82% of the patients. In 85 percent of cases, appendicitis was confirmed by a histological analysis.

The Tzanakis score was as follows: 97% sensitivity, 93% specificity, 98.81% positive predictive value, 87.50% negative predictive value, and 97% accuracy.

Sensitivity = 94.12%, specificity = 86.67%, PPV = 97.56%, NPV = 72.22 %, accuracy = 93%; Alvarado score.

Conclusion: According to the results of this research, the Tzanakis scoring system is more sensitive, specific, and diagnostically accurate than the Alvarado scoring system. Therefore, Tzanaki's score is a useful tool for making a correct diagnosis of acute appendicitis and decreasing the number of unnecessary appendectomy procedures.

Keywords: Acute Appendicitis, Alvarado score, Tzanakis score.

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Introduction

There's excellent justification for the analogy between the stomach and Pandora's box. Diseases of the abdomen are a source of great clinical interest because of the vast number of viscera and other anatomical components that it comprises. In many diseases and disorders manifesting as abdominal pain, a thorough examination of the abdomen and clinical correlation is one of the most essential diagnostic tools and constitutes the cornerstone of care. The necessity of a thorough clinical examination still cannot be overstated, despite the many diagnostic tools available today. [1]

One in seven people may get acute appendicitis at some point in their lives, making it one of the most common abdominal surgery emergencies. There is a 6.7% lifetime risk in women and an 8.6% risk in men, with the highest rates occurring in one's twenties and thirties and decreasing with age. [2]

The accuracy of clinical examination in diagnosing acute appendicitis is 70 to 87% [3,4]. Abdominal pain is the most typical sign. Typically, the patient will report pain in the periumbilical or epigastric area that spreads to the right iliac fossa. Symptoms include high body temperature, loss of appetite, nausea, and vomiting. Twenty percent to thirty-three percent of people with acute appendicitis have unusual signs, making clinical diagnosis challenging for both doctors and patients. [5,6] Acute appendicitis can present clinically in a wide range of ways, depending on factors such as the patient's age, appendix position, and the severity of the inflammatory response. Misdiagnosis of acute appendicitis occurs in 1

out of 5 cases due to varying clinical presentations, and appendectomy rates range from 15% to 40% due to this problem. [7] In cases of acute appendicitis, many surgeons advocate for immediate surgical surgery to prevent perforation, even if it means accepting a negative appendectomy rate of 15-20%.

Normal appendix removal is expensive for patients and the healthcare system as a whole. Perforation and subsequent peritonitis are complications that might arise from a delayed or incorrect diagnosis and subsequent surgical intervention.

Therefore, several clinical scoring systems have been created throughout the years [8] due to the need of early and correct diagnosis and the realization that clinical evaluation is the best and most accurate diagnostic technique for appendicitis.

Acute appendicitis can be diagnosed with the help of the Alvarado Score, a quick, simple, and inexpensive diagnostic tool [9]. Another grading method that incorporates clinical assessment, inflammatory markers, and ultrasonography is the Tzanakis score [10].

Our research intends to evaluate how well the Alvarado Scoring system and the Tzanakis Scoring system detect acute appendicitis.

Materials and Methods

A tertiary care center conducted this prospective, non-randomized observational study. The research project was given the green light by the local ethics committee. Each participant in the study provided written informed consent before they were enrolled.

One hundred patients diagnosed with acute appendicitis and subjected to emergency open appendectomy between January 2021 and January 2022 were analyzed in this study.

At check-in, we got Tzanakis and Alvarado scores. Histopathological evaluation (HPE) is performed on surgical specimens after surgery.

Histopathological findings are used as the gold standard for diagnosing acute appendicitis.

Alvarado scoring:

- Migratory abdominal pain-1
- Anorexia-1
- Nausea-1
- Rebound tenderness-1
- Leucocytosis-2
- Shift of white blood cell count to left-1
- Elevated temperature-1
- Tenderness in right lower quadrant-2

Total-10

1-4---discharge

5-6---observation

7-10---surgery

Tzanakis scoring:

- Tenderness in the lower right abdomen area = 4 pts.
- Three points of discomfort upon rebounding.
- Two points are awarded based on laboratory results for white blood cell count of over 12,000.

Result

- A positive ultrasonography diagnosis of appendicitis is worth 6 points.
- fifteen, all in the 8+ range-A surgical diagnosis of acute appendicitis

Inclusion Criteria

- Everyone who has symptoms that suggest they have acute appendicitis.
- At least 12 years old.
- Providing one's written, fully-informed consent.

Exclusion Criteria

- Constant discomfort for more than five days.
- Younger than 12 years of age.
- Right iliac fossa trauma in the past.
- Patients with a history of abdominal operations.
- Individuals experiencing issues in the urinary tract.
- Appendicular complications such as perforation, abscess, tumor, and other abnormalities are present.
- Peritonitis Characteristics.
- Symptoms of a bowel blockage.
- Those who refuse surgical intervention.
- Expectant mothers.

The P value was determined by using a paired t-test, and the cut off for significance was set at 0.05. SPSS, a statistical tool, version 21 was used for the calculations.

Table 1: Sex

	No of cases
Female	38
Male	62
Total	100

Males (62%) were more likely than females (38%) to experience acute appendicitis.

Table 2: Age

Age Group (years)	No. of Patients	Percentage (%)
11-30	72	72
31-50	22	22
>50	6	6
TOTAL	100	100

Acute appendicitis is a disease of the young, typically affecting those between the ages of 11 and 30, and then those between the ages of 31 and 50.

The average age of our patients was 26.28, and the SD was ± 11.58 .

Table 3: Alvarado score

	SEX		Total
	F	M	
< 7	8	10	18
≥ 7	30	52	82
Total	38	62	100

18 patients (10 men and 8 females) had an Alvarado score of 7, as seen in the table. Thirty-two women and fifty-two men received a score of seven or higher.

The male population had a higher Alvarado majority than the female population.

Table 4: Tzanakis score

	SEX		Total
	F	M	
<8	7	9	16
≥ 8	31	51	84
Total	38	62	100

16 patients (9 men and 7 females) had a Tzanakis score of less than 8, as seen in the table. Eighty-four individuals (31 women and 51 men) scored an 8 or higher. The male population had a higher mean Tzanakis score than the female population.

Table 5: Alvarado Score

	HPERREPORT	
	Acute Appendicitis	Normal
$\leq (n=82)$	80%	2%
Less than 7 (n=18)	5%	13%
Total (n=100)	85%	15%

Post Operative Correlation with HPE Report

According to Alvarado score, 82 patients were diagnosed to have appendicitis. Out of these 82, 80 patients had evidence of appendicitis histopathologically, 2 patients were falsely diagnosed to have appendicitis by Alvarado scoring system. Alvarado ruled out appendicitis in 18 cases, but histopathology confirmed the diagnosis in 5.

Table 6: Tzanakis score- Post operative Correlation with HPE Report

	HPEREPORT	
	Acute Appendicitis	Normal
More than 8(n=84)	83%	1%
Less than 8(n=16)	2%	14%
Total(n=100)	85%	15%

Eighty-four people were determined to have appendicitis using the Tzanakis score. Tzanakis rating indicated that 83 of these 84 patients actually had appendicitis, while 1 was incorrectly diagnosed with appendicitis. Tzanakis ruled out appendicitis in 16 cases, however a histopathology review found that 2 of those patients actually did have the condition.

Our research showed that the Alvarado Score had a positive predictive value of 97.56%, a negative predictive value of 72.22%, a sensitivity of 94.12%, and a specificity of 86.67%.

Tzanakis score had a positive predictive value of 98.81% and a negative predictive value of 87.50%, with a sensitivity and specificity of 97.65% and 93.33%, respectively. Alvarado score diagnostic accuracy was 93%, whereas Tzanakis score accuracy was 97%.

Discussion

One of the most frequent reasons for a surgical emergency is acute appendicitis. Although appendicitis is commonly diagnosed clinically, it is always challenging for a surgeon to accurately rule out other reasons that may resemble appendicitis, leading to a high negative appendectomy rate [11].

Non-invasive scoring methods, such as the Alvarado and Tzanakis scoring system, have improved over the years, making it easier to make a diagnosis and reducing the likelihood of unneeded surgeries for these patients. Although it has its flaws, the Alvarado system is the more popular of the two. However, the Tzanakis scoring method is preferred over Alvarado's since it incorporates clinical examination, laboratory assistance, and

ultrasound to make a definitive diagnosis of acute appendicitis. Using a sample size of 100 patients, the present study contrasted the Alvarado and Tzanakis scoring systems and analyzed the correlation between the intra-operative observations and the post-operative HPE reports to arrive at a definitive diagnosis.

The preponderance of males in our study population is consistent with that of other studies [12,13]. The average age of our patients was 26.28, and their standard deviation was 11.58, both of which are in line with the results found in the aforementioned worldwide literature. In terms of sensitivity, Alvarado scored 94.12%, while Tzanakis scored 97.65%; in terms of specificity, Alvarado scored 86.7%, while Tzanakis scored 93.33%. Similarly, Alvarado's positive predictive value was 97.56%, while Tzanakis' was 98.81%. Alvarado and Tzanakis had a negative predictive value of 72.22 and 87.50 percent, respectively.

Our study's sensitivity (93.33%) and overall diagnostic accuracy (90%), as well as those of another study [14,15], are comparable; however, our study's specificity (93.33%) is better than that of the other study's (66.66%).

Tzanakis *et al.* [16] found that the scoring method was 95.4% sensitive and 97.4% specific. We found similar results in our investigation, with a sensitivity of 97.65% and a specificity of 93.11%. The sensitivity and specificity reported by Sigdel GS *et al.* [17] were 91.48 and 66.86 percent. They explained that the low specificity of USG (63.82%) was attributable to individual bias. The sensitivity and specificity [18] of ultrasound examinations range from 75% to 90% and 86% to 100%,

respectively, and are highly operator-dependent.

Similar to our results, Sigdel GS *et al.* found a positive and negative predictive value of 97.27% and 33.33 percent, respectively. The elimination of radiological observer bias in our study is another factor contributing to the significant negative predictive value [17].

The Alvarado score has a sensitivity of 98.8% and a specificity of 93.3%, according to research by Harsha BK *et al.* [19]. They also claimed an NPV of 83.3% and a PPV of 89.3%, whereas the actual figures were 97.56% and 72.22%. Our study's PPV is higher than that of Harsha BK *et al.*'s 45 because we used a larger sample size. Our study's sensitivity of the Alvarado score (94.1%) is little lower than that reported by Harsha BK *et al.* (95.9%), but the difference is not statistically significant. Our 15% negative appendectomy rate is comparable to the 15-25% reported by Raja *et al.* and Joshi *et al.* [20,21]. In order to prevent perforation, many surgeons recommend immediate surgical surgery for cases of acute appendicitis.

Women actually had a higher rate of appendectomy complications than men did. High probabilities of alternative diagnosis in females of reproductive age group account for the disparity.

Conclusion

One common surgical emergency is acute appendicitis. Negative appendectomy rates can be lowered with careful clinical judgment, supported by research and a valid scoring system. We found that the Tzanakis score outperformed the Alvarado score in terms of sensitivity and specificity.

In addition, when compared to the Alvarado score, the Tzanakis score showed superior diagnostic accuracy. As a result, the Tzanakis score can be used to make an appendicitis diagnosis, and in the future, unnecessary appendectomies can be avoided. The results of this research show that the Tzanakis scoring

system is a useful tool for assessing the precision of a diagnosis of acute appendicitis.

References

1. Hamilton Bailey's Emergency Surgeries, 12th Ed, 1995; 438-451.
2. Stewart B, Khanduri P, McCord C, *et al.* Global disease burden of conditions requiring emergency surgery. *Br J Surg.* 2014; 101: e9-22.
3. John H, Neff U, Kelemen M. Appendicitis diagnosis today: clinical and ultrasound deduction. *World J Surg.* 1993; 17:243-9.
4. Saidi RF, Ghasemi M Role of Alvarado score in diagnosis and treatment of suspected acute appendicitis. *Am J Emerg Med.* 2000; 18:230-1.
5. Lewis FR, Holcroft JW, Boey J, Dunphy JE, Appendicitis: A critical review of diagnosis and treatment of suspended acute appendicitis. *Am J Emerg Med.* 2000; 18:230-1.
6. Berry J Jr, Malt RA. Appendicitis near its centenary. *Ann surgery.* 1984; 200:567-75.
7. Fenyo G, Lindberg G, Blind P, Enochsson L, Oberg A. Diagnostic decision support in suspected acute appendicitis: validation of a simplified scoring system. *Eur J Surg Med.* 1997; 11: 831-8.
8. Evaluation of modified Alvarado score in the diagnosis of suspected acute appendicitis. *Menoufia Medical Journal.* 2015; 28(1):17.
9. Alvarado, A. A practical score for the early diagnosis of acute appendicitis *Annals of Emergency Medicine.* 1986; 15(5), 557-564.
10. Malla B, Batajoo H. Comparison of Tzanakis Score vs Alvarado Score in the Effective diagnosis of acute Appendicitis. *Kathmandu Univ Med J.* 2014; 45(1):48-50.
11. Lui CD, Mcfadden DW. Acute abdomen and appendix. *Surgery: Scientific Principles and Practice.* Edited by: Greenfield LJ, Mulholland MW, Zelenock GB, Oldham KT, Lillemoe KD. Philadelphia: Lippincott-Raven; 1997; 1246-1261.

12. Sahm M, Pross M, Lippert H. Acute appendicitis-changes in epidemiology, diagnosis and therapy. *Zentralblatt fur Chirurgie*. 2011;136(1):18-24.
13. Malik A A, Mir M F, Khurshid S U, Wani I, Dagga R. Modified Alvarado Score Versus Tzanakis Score for Diagnosing Acute Appendicitis in Changing Clinical Practice. *Int J Clin Muhammad Mansoor Iqbal et al. ISRA Medical Journal*. Jan - Feb 2018;10(1): 43 *Exp Med*. 2016; 2(5):90- 93
14. Shashikala V, Hegde H, Victor AJ. Comparative study of Tzanakis score vs Alvarado score in the effective diagnosis of acute appendicitis. *Int J of Biomed & Adv Res*. 2016;7(9):418-20.
15. Sigdel G, Lakhey P, Misra P. Tzanakis Score vs Alvarado in Acute Appendicitis. *J Nepal Med Assoc*. 2010;49(178):96-9.
16. Tzanakis NE, Efstathiou SP, Danulidis K, *et al*. A new Approach to Accurate Diagnosis of Acute Appendicitis. *World J Surg*. 2005; 29:1151-1156.
17. Sigdel GS, Lakhey PJ, Mishra PR. Tzanakis score Vs. Alvarado score in acute appendicitis. *JNMA J Nepal Med Assoc*. 2010; 49:96-99.
18. Yu SH, Kim CB, Park JW, *et al*. Ultrasonography in the diagnosis of appendicitis: evaluation by meta-analysis. *Korean journal of Radiology*. 2005; 6:267.
19. Harsha BK, Bhaskaran A, Prasad CSBR, Basavarajappa M, Ambikavathy M, Vasanth Kumar G. Evaluation of Modified Alvarado Score in the diagnosis of acute appendicitis and its correlation with ultrasonography and histopathology. *J Clin Biomed Sci*. 2011; 1: 149-1.
20. Raja A, Wright C, Sodickson A. Negative Appendectomy Rate in the Era of CT: An 18-year Perspective. *Radiol*. 2010; 256(2): 460-5.
21. Joshi MK, Joshi R, Alam SE, Agarwal S, Kumar S. Negative Appendectomy: an Audit of Resident Performed Surgery. How Can Its Incidence Be Minimized? *Indian J Surg*. 2014;77(3):913-7.