

Original Research Article

A comparative study of appendicitis inflammatory response score and Tzanakis score for diagnosing patients with acute appendicitis

Sumanjali Sreeram*, Abhishek Thunga, Sushma Reddy Palla, Sri Vidya Ratakonda

Department of General Surgery, Mamata Medical College and Hospital, Khammam, Telangana, India

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*Correspondence:

Dr. Sumanjali Sreeram,

E-mail: sumanjalisreeram1279@gmail.com

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ABSTRACT

Background: Accurate diagnosis of acute appendicitis remains challenging, and negative appendectomy rates remain significant when decision-making is based on clinical suspicion alone. Clinical scoring systems combine symptoms, signs, laboratory parameters and imaging to improve diagnostic accuracy. This study aimed to compare the diagnostic performance of the Appendicitis Inflammatory Response (AIR) score and the Tzanakis score in suspected acute appendicitis.

Methods: This prospective comparative study was conducted in the Department of General Surgery, Mamata General Hospital, Khammam, for 2 years. 94 patients above 16 years of age with clinically suspected acute appendicitis were included. All patients were evaluated using both AIR and Tzanakis scoring systems. Histopathological examination (HPE) of the resected appendix was considered the gold standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy were calculated for both scoring systems.

Results: The mean age was 33.2 ± 14.87 years; males constituted 55.3% (M:F=1.2:1). On histopathological examination, out of 94 patients 80(85.1%) had acute appendicitis, 4 (4.3%) had follicular hyperplasia, and 10 (10.6%) had normal appendix. With cutoff >8 , Tzanakis score showed sensitivity 98.8%, specificity 78.6%, PPV 96.3%, NPV 91.7%, and diagnostic accuracy 95.7%. With cutoff >8 , AIR score showed sensitivity 67.5%, specificity 71.4%, PPV 93.1%, NPV 27.8%, and diagnostic accuracy 68.1%.

Conclusions: The Tzanakis score demonstrated higher diagnostic accuracy than the AIR score. The inclusion of ultrasonography improves reliability, making it a practical and effective tool for clinical decision-making, particularly in resource-limited settings.

Keywords: Acute appendicitis, Appendicitis inflammatory response score, Diagnostic accuracy, Histopathology, Tzanakis score

INTRODUCTION

Appendicitis is defined as inflammation of the appendix. It was first coined by "Reginald Heber Fitz" from Boston who identified it as the common cause of right lower quadrant pain. Appendectomy was first performed by Lawson Tait in England.¹ Acute appendicitis (AA) stands out among the most widely recognized reasons for acute abdomen. This condition warrants quick health care and treatment.² A negative appendectomy rate of up to 17.5% is noted in India following appendectomy based

on clinical suspicion. This necessitates accurate diagnosis before performing appendectomy.³ Imaging studies such as ultrasonography and computed tomography are operator dependent. The diagnostic accuracy of acute appendicitis can be improved by combining clinical examination, laboratory parameters, and imaging techniques into a clinical scoring system. Clinical scoring systems like the Appendicitis Inflammatory Response (AIR) score, ALVARADO score, RIPASA score, TZANAKIS score, pediatric appendicitis score, etc. are being deployed to clinically diagnose acute appendicitis.³

The Alvarado score is the most well-known and best-performing in validation studies, but it has some drawbacks.⁴ The recently introduced appendicitis inflammatory response (AIR) score was designed to overcome these drawbacks. Tzanakis and his coworkers published a simplified system with four variables and a total score of 15 for the diagnosis of acute appendicitis which is termed as Tzanakis scoring system.⁵ Tzanakis scoring system is a unique scoring system in the sense that it includes ultrasonography with clinical evaluation (right lower abdominal tenderness and rebound tenderness) and laboratory parameters (total leukocyte count estimation) for evaluating acute appendicitis. The present study was undertaken to compare the diagnostic accuracy of the Appendicitis Inflammatory Response (AIR) score and Tzanakis score in patients with suspected acute appendicitis.

METHODS

This study was conducted in the Department of Surgery, Mamata General Hospital and Medical College, Khammam, over a period of 02 years. The study was conducted among a study population of 94 patients; all patients were evaluated using both AIR and Tzanakis scoring systems. These patients were included in this study with their written informed consent after a full explanation of the study protocol. The study was conducted with the prior approval of the Ethical Committee of the institution. The following inclusion and exclusion criteria were considered for the study.

Inclusion criteria

Patients willing to undergo appendicectomy after the diagnosis of acute appendicitis based on clinical assessment, patients above 16 years of age, irrespective of sex, and patients willing to participate in the study were included.

Exclusion criteria

Pregnant women, patients with right iliac fossa mass, patients with previous history of pelvic inflammatory disease, and patients not willing to participate in the study were excluded.

Clinically suspected cases of acute appendicitis, admitted in the surgical wards of Mamata General Hospital, are included in the study after obtaining consent for the same. Detailed history, and clinical findings, along with relevant investigations like hematological examination, biochemical parameters as required, ultrasound of the abdomen, etc. were recorded in the proforma for individual patients. Each patient was scored using both the appendicitis inflammatory response score and Tzanakis scoring systems. A score of >8 was taken as a high probability of acute appendicitis for the Tzanakis scoring system and a score of >8 for the appendicitis inflammatory response score. The decision on

appendicectomy was solely based on the concerned surgeon's clinical judgment after taking into consideration all the clinical findings, laboratory, and radiological investigations. The diagnosis was recorded in the concerned proforma for the respective patients. Histopathological findings of the excised appendix were recorded in the respective proforma, for correlation with the pre-and post-operative diagnosis as well as with both scores. The outcomes were recorded and analyzed at the end of the study using statistical package for social science (SPSS).

RESULTS

Out of 94 patients, 17 were aged <20 years, 57 were between 20 and 39 years, 12 were between 40 and 59 years and 8 were aged ≥ 60 years. The mean age in the present study was 33.2 ± 14.87 years. The majority were aged between 20-39 years (60.6%) (Table 1).

Table 1: Distribution of patients by age.

Age in years	Frequency	Percentage
<20	17	18.1
20-39	57	60.6
40-59	12	12.8
≥ 60	8	8.5
Total	94	100
Mean$\pm$SD	33.2 ± 14.87	

The male-to-female ratio (M:F) was 1.2:1. Among 94 subjects, 30 presented with vomiting; 86 subjects had pain in RIF, rebound tenderness and tenderness were present in 35 and 86 subjects, respectively and 7 subjects were febrile (Figure 1).

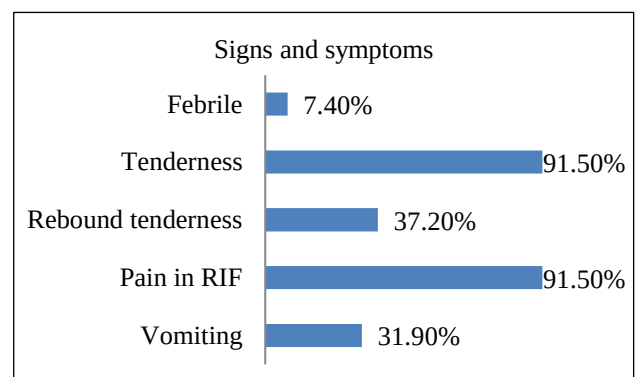
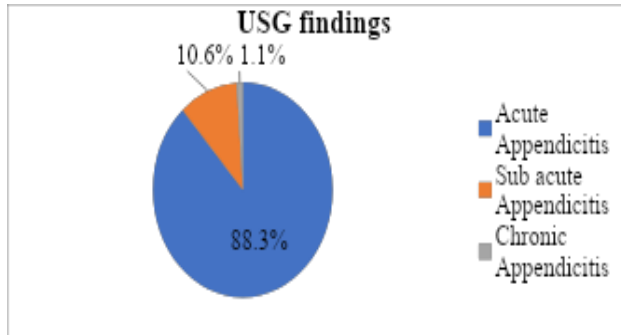


Figure 1: Distribution of patients according to signs and symptoms.

The mean WBC count was 11510.6 ± 3973.18 , the mean percentage of polymorphonuclear leucocytes was $74.5 \pm 10.22\%$ and CRP was elevated in 7 subjects. USG showed acute appendicitis in 83 subjects and sub-acute and chronic appendicitis in 10 and 1 subject respectively (Table 2 and Figure 2).

Table 2: Distribution of subjects according to lab parameters.

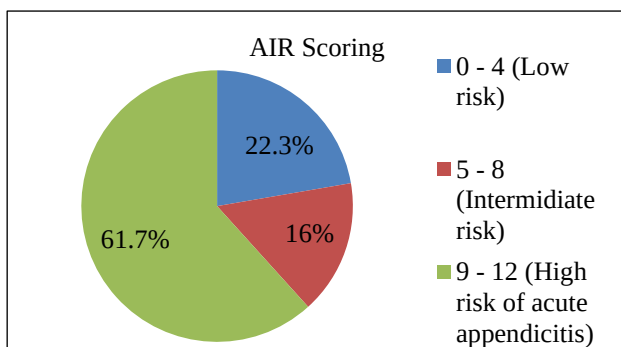
Lab parameters	Frequency/ Mean	Percentage/ SD
WBC count	11510.6	3973.18
Polymorphonuclear leucocytes	74.5	10.22
Elevated CRP	7	7.4

**Figure 2: Distribution of subjects according to USG findings.**

Histopathological examination was done in all cases, and the reporting was done under the groups as acute appendicitis, normal, and follicular hyperplasia. Out of 94 patients, in the majority (80 subjects), HPE reporting was given as acute appendicitis, 4 subjects had follicular hyperplasia, and 10 subjects had a normal appendix (Table 3).

Table 3: Distribution of subjects according to histopathological findings.

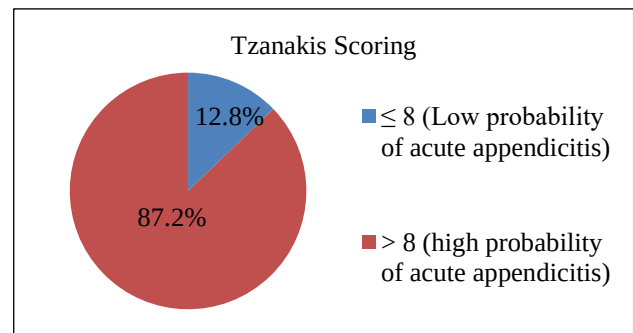
Histopathological findings	Frequency	Percent
Acute appendicitis	80	85.1
Follicular hyperplasia	4	4.3
Normal appendix	10	10.6
Total	94	100

**Figure 3: Distribution of AIR scoring.**

In the AIRS a score of 0-4 was unlikely to have a diagnosis of acute appendicitis, a score of 5-8 was considered an intermediate group, and a score above 8

was a high probability of appendicitis. Among 94 patients in this study 21 (22.3%) patients had scores in the range of 0-4, 15 (16%) patients had scores in the range of 5-8, suggestive of probable appendicitis, 58 (61.7%) patients had score in the range 9-12 (Figure 3).

In the Tzanakis scoring a score below 8 was of low probability of acute appendicitis and a score above 8 was of high probability of acute appendicitis. Among 94 patients in this study, 12 (12.8%) patients had scores in the range of 0-8, suggestive of a low probability of acute appendicitis, and 82 (87.2%) patients had scores above 8, suggestive of a high probability of acute appendicitis (Figure 4).

**Figure 4: Pie chart showing the distribution of the Tzanakis scoring system.**

With a cutoff value of greater than ≤8 for the Tzanakis score, the sensitivity was 98.8% and specificity was 78.6% with a positive and negative predictive value of 96.3% and 91.7% respectively. The diagnostic accuracy was 95.7%. With a cutoff value of greater than >8 for the AIR score, the sensitivity and specificity were 67.5% and 71.4% respectively with a positive and negative predictive value of 93.1% and 27.8% respectively. The diagnostic accuracy was 68.1% (Table 4).

Table 4: Analysis of AIR scoring and Tzanakis scoring system.

Test variable	Tzanakis scoring system >8, %	AIR score > 8, %
Sensitivity	98.8	67.5
Specificity	78.6	71.4
Positive predictive value	96.3	93.1
Negative predictive value	91.7	27.8
Diagnostic accuracy	95.7	68.1

DISCUSSION

Acute appendicitis remains one of the most common surgical emergencies worldwide, with a lifetime risk of approximately 7%. Despite advances in diagnostic imaging and laboratory investigations, establishing an

accurate diagnosis continues to be challenging, particularly in young females, elderly patients, and those presenting atypically. Misdiagnosis may result either in negative appendectomy or delayed surgery with increased risk of perforation and sepsis. Therefore, clinical scoring systems have gained importance, especially in resource-limited settings. In the studies conducted by Sharma et al and Korkut et al consisting of 100 patients and 74 patients respectively, the majority of patients belonged to the age group of 18-40 years, comparable to the age structure of this study.^{2,7} In the present study, the most common clinical presentations were right iliac fossa (RIF) pain (91.5%), tenderness (91.5%), rebound tenderness (37.2%), and vomiting (31.9%). These findings are consistent with those reported by Korkut et al and Lakshminarasimhaiah et al.^{7,5} The mean total leukocyte count in the present study was $11,510.6 \pm 3,973.18$ cells/mm³, while the mean percentage of polymorphonuclear leukocytes was $74.5 \pm 10.22\%$. Elevated C-reactive protein (CRP) levels were observed in seven patients. These results are comparable to those reported by Korkut et al and Malik et al.^{7,6} Ultrasonography (USG) findings revealed acute appendicitis in 88.3% of patients, whereas subacute and chronic appendicitis were identified in 10.6% and 1.1% of patients, respectively. These observations are in agreement with the findings of Korkut et al and Lakshminarasimhaiah et al.^{7,5} Lakshminarasimhaiah et al. reported that 15% of patients had Tzanakis scores of 4-6, 5.5% had scores of 7-9, 57.5% had scores of 10-12, and 22% had scores of 13-15.⁵ These findings are comparable to those observed in the present study. In the present study, 12 patients (12.8%) had Tzanakis scores ranging from 0 to 8, while 82 patients (87.2%) had scores greater than 8. These results are comparable to those reported by Malik et al.⁶ In the present study, with a cutoff value of greater than 8 for the Tzanakis score, the sensitivity was 98.8% and specificity was 78.6% with a positive and negative predictive value of 96.3% and 91.7% respectively. The diagnostic accuracy was 95.7%. With a cutoff value of greater than 8 for the AIR score, the sensitivity and specificity were 67.5% and 71.4% respectively with a positive and negative predictive value of 93.1% and 27.8% respectively. The diagnostic accuracy was 68.1%, which is comparable to the study conducted by Lakshminarasimhaiah et al.⁵

CONCLUSION

The diagnosis of patients with suspected acute appendicitis is still challenging. The results of this study

conclude that the Tzanakis score is a superior diagnostic tool to the AIR score, outperforming it with higher sensitivity and specificity. The overall diagnostic accuracy of the Tzanakis score is higher when compared to the AIR score. Thus, the Tzanakis score could better help identify patients who require surgery.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Seal A. Appendicitis: a historical review. *Can J Surg* 1981;24(4):427-433.
2. Sharma D, Koujalagi RS. A comparative study to assess the efficacy of Tzanakis score and Alvarado score for effective diagnosis of patients with acute appendicitis at a tertiary care center in North Karnataka: a one-year prospective analytical study. *Int Surg J*. 2020;7(6):1742-5.
3. Jose T, Rajesh PS. Appendicitis inflammatory response score in comparison to Alvarado score in acute appendicitis. *Surg J (N Y)*. 2021;7(3):e127-e131.
4. de Castro SMM, Ünlü Ç, Steller EP, van Wagenveld BA, Vrouenraets BC. Evaluation of the appendicitis inflammatory response score for patients with acute appendicitis. *World J Surg*. 2012;36(7):1540-5.
5. Lakshminarasimhaiah AKS, Nagaraja AL, Srinivasaiah M. Evaluation of Tzanakis scoring system in acute appendicitis: a prospective study. *Int Surg J*. 2017;4(10):3338-43.
6. Malik AA, Mir MF, Khurshid SU, Wani I, Dagga R. Modified Alvarado score versus Tzanakis score for diagnosing acute appendicitis in changing clinical practice. *Int J Clin Exp Med Sci*. 2016;2(5):90-3.
7. Korkut M, Bedel C, Karancı Y, Avcı A, Duyan M. Accuracy of Alvarado, Eskelinen, Ohmann, RIPASA and Tzanakis scores in diagnosis of acute appendicitis; a cross-sectional study. *Arch Acad Emerg Med*. 2020;8(1):e20.

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