

TZANAKIS SCORE AS DIAGNOSTIC TOOL FOR ACUTE APPENDICITIS

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ABSTRACT

Objective: To determine the usefulness of Tzanakis score in the diagnosis of acute appendicitis using histopathology as gold standard.

Study Design: Cross-sectional validation study.

Place and Duration of Study: Department of General Surgery Combined Military Hospital Bahawalpur, from January 2015 to December 2015.

Material and Methods: A total of 158 patients were included in this study. Tzanakis score was assessed for each patient on presentation in emergency department. Open appendectomy was performed in all patients and respected appendicular specimens were sent for histopathological examination. Sensitivity analysis was done by using two by two tables.

Results: Out of 158 patients, 117 (74.1%) were male while remaining 41 (25.9%) were female with mean age of 27.5 ± 9.1 years. Sensitivity of Tzanakis score in diagnosing acute appendicitis was 91.9%, specificity 85.1%, positive predictive value 93.6%, negative predictive value 81.6%, and diagnostic accuracy was 89.9%.

Conclusion: Tzanakis score at a cut-off total score of 8 is a very useful tool to diagnose appendicitis

Keywords: Acute appendicitis, histopathology, score, ultrasonography.

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INTRODUCTION

Acute abdomen has remained a great challenge to surgeons and is full of surprises even in today's era of modern technology. Acute appendicitis remains the most common cause of acute abdomen worldwide¹. Appendectomy is the most commonly performed operation worldwide, life time risk of appendectomy being 12% for males and 25% for females². Despite advances in diagnosis, acute appendicitis still shows morbidity of approximately 10% and mortality of approximately 1-5%³. According to available statistics, one out of every five cases of appendicitis is misdiagnosed whereas negative appendectomy rate is 15%-40% in patients presenting to emergency department⁴. Diagnostic accuracy in case of acute appendicitis should always be high because negative appendectomy carries a significant post-operative morbidity⁵. At

present there is no single perfect diagnostic test for acute appendicitis⁶.

About 20-33% of the patients having acute appendicitis present with atypical clinical and laboratory findings, requiring the use of some imaging modality to help solve the diagnostic dilemma⁷. Abdominal ultrasonography is the most commonly used imaging modality in our setup for this purpose. Ultrasonography is an inexpensive, readily available and noninvasive method with an accuracy rate of upto 71%-90% for the diagnosis of acute appendicitis⁸. Similarly a number of scoring systems have also been devised to help in the diagnosis of appendicitis. Alvarado and the modified Alvarado scores are the two most commonly used scoring systems but these systems are mainly dependent upon clinical evaluation and white blood cell count alone and do not employ any radiological investigation which can definitely increase the diagnostic accuracy in case of acute appendicitis. Ultrasound is also a very helpful modality to diagnose acute appendicitis. It is non-invasive, easily available and cost-effective, useful in

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ruling out other causes of acute abdomen and can accomplish more than CT scans but it is operator dependent. Diagnostic accuracy of a scoring system can be significantly increased by adding ultrasound in it. We conducted this study to access the effectiveness of Tzanakis score in diagnosing acute appendicitis in our setup which is a combination of physical examination, laboratory evaluation of inflammatory marker in the form of raised total leukocyte count and radiological visualization of inflamed appendix with ultrasonography. No such study has been carried out in our set up in past.

Tzanakis scoring system is a unique scoring system in the sense that it also involves ultrasonography along with clinical evaluation (right lower abdominal tenderness and rebound tenderness) and laboratory test (total leukocyte count estimation) for evaluation of acute appendicitis. We conducted this study to detect the efficacy of Tzanakis scoring system in diagnosing acute appendicitis in our set up.

MATERIAL AND METHODS

This cross-sectional validation study was carried out at Combined Military Hospital, Bahawalpur from 1st January 2015 to 31st December 2015. Life time incidence of acute appendicitis is 50%, so anticipated population proportion (p) was 0.5, confidence level was 95% and absolute precision required (d) was 0.08, so calculated sample size was 158 with the help of WHO sample size calculator by using consecutive non probability sampling. Both male and female patients between 10 to 50 years of age who presented with right iliac fossa (RIF) pain of less than 3 days duration suspected to have acute appendicitis and who had undergone emergency appendectomy as the primary procedure were included in the study. Patients presenting with non-RIF pain, pregnant, patients having appendicular mass or appendicular abscess and patients who underwent incidental appendectomy were excluded from the study.

All the patients were initially assessed by adequate history, thorough examination and

investigations (total leukocyte count, urine examination and ultrasound of abdomen) were done. Other investigations such as those required for evaluation of fitness for general anesthesia were also carried out. The clinical diagnosis of acute appendicitis was made; the elements of Tzanakis score were recorded in every patient on presentation and the sum was calculated later so as it played no role in the management of patients. It consists of four parameters with a total score of 15 including presence of right lower abdomen tenderness (4 points), rebound tenderness (3 points), total leukocyte count $>12,000/\text{mm}^3$ (2 points) and positive findings of acute appendicitis on ultrasonography as presence of thick walled/non-compressible tubular structure with or without peri-appendicular fluid in RIF (6 points). Patients having score greater than 8 were placed in high probability group. Informed written consent was obtained for surgery from participants. Pre-operatively, the patients were kept nil by mouth for 6 hours, received intravenous fluids/antibiotics and analgesics. Appendectomy was performed via Grid iron or Lanz incision and appendectomies, resected appendix was sent for histopathological examination.

All the data collected through the proforma were entered into the Statistical Package for Social Sciences (SPSS) version 18.0 and analyzed. Mean and standard deviation was used for quantitative data like age while frequency and percentage were calculated for qualitative data like gender. Tzanakis score was applied to each patient's data and 2 x 2 table was used to determine sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy.

RESULTS

A total of 158 patients were included in this study, during the period of 1 year from January 2015 to December 2015. Regarding age distribution, 101 patients (63.9%) were between 11-30 years of age, 57 patients (36.1%) were between 31-50 years of age. Age ranged from

12–50 years, mean ± SD was calculated as 27.5 ± 9.1 years. Out of 158 patients, 117 (74.1%) were males while remaining 41 patients (25.9%) were females. Positive cases of acute appendicitis on histopathology were 111 and Tzanakis score diagnosed 109 cases of acute appendicitis. True positive were 102, false positive 7, false negative 9, and true negative were 40 (table-I). Sensitivity of Tzanakis score in diagnosing acute appendicitis was 91.9%, specificity 85.1%, positive predictive value 93.6%, negative

because of the geographical variations¹². That is the reason none of these scoring systems in alone can be employed with surety in diagnosing acute appendicitis.

A total of 158 patients were recruited in our study. A total of 101 patients (63.9%) out of a total of 158 patients were in 2nd and 3rd decade of life, which is in accordance to other study conducted by Ramachandra et al¹³. Male preponderance (n=117, 74.1%) in our study was comparable with a study conducted by Saaq and colleagues¹⁴.

Table-I: Comparisons of Tzanakis score and histopathology using 2x2 table (n=158).

		Histopathology of appendix		
		Inflamed appendix	Normal appendix	Total
Tzanakis Score	> 8	True Positive (a) (102)	False Positive (b) (07)	109
	≤ 8	False Negative (c) (09)	True Negative (d) (40)	49
	Total	111	47	158

Table-II: Statistical analysis of Tzanakis score.

Statistical Parameter		Results
Sensitivity	$a/a + c \times 100$	91.9%
Specificity	$d/b + d \times 100$	85.1%
Positive Predictive Value	$a/a + b \times 100$	93.6%
Negative Predictive Value	$d/c + d \times 100$	81.6%
Diagnostic Accuracy	$a+d/ a+b+c+d \times 100$	89.9%

predictive value 81.6% and diagnostic accuracy was 89.9% (table-II). Receiver operating characteristic (ROC) curve was drawn showing good diagnostic accuracy of Tzanakis score for acute appendicitis (figure).

DISCUSSION

Acute appendicitis is the most commonly performed surgical procedure with emergency appendectomy making upto 10% of all emergency abdominal surgeries¹⁰. Atypical clinical presentations impose diagnostic dilemmas which have led to devise different scoring systems, imaging modalities, laparoscopy and laboratory tests to help in making the diagnosis. Most commonly used Alvarado scoring system is in clinical practices since 1986¹¹. However various studies report different diagnostic accuracies of this and other scoring systems. This difference in the diagnostic accuracy of these scoring systems could be

Statistical analysis revealed that Tzanakis score has 91.9% sensitivity and 85.1% specificity in diagnosing acute appendicitis. It also has positive predictive value of 93.6%, negative predictive value of 81.6% and diagnostic accuracy of 89.9% for diagnosing acute appendicitis.

Tzanakis et al have reported that its scoring system had sensitivity and specificity of 95.4% and 97.4% respectively¹⁵. As per our study,

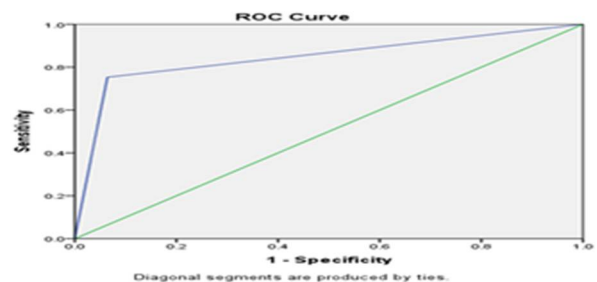


Figure: Receiver operating characteristic (ROC) curve (n=158).

Area under the curve is 0.846 (standard error=0.031, CI=0.784, 0.906)

sensitivity of Tzanakis scoring system was 91.9% which is comparable to Tzanakis et al. However, specificity of Tzanakis score in our study was low as compared to that described by Tzanakis et al. In another comparative study between Tzanakis and Alvarado score conducted by Malla BR and colleagues revealed that sensitivity of Tzanakis score for diagnosing acute appendicitis was 86.9% which is comparable with the finding of our study¹⁶. However, they found that specificity of Tzanakis score was much lower (75%) because of the low sensitivity of ultrasound (68%) due to varying experience level of ultrasonologists who were involved in the study. Sensitivity of ultrasound in our study was found to be 81.9% which is in accordance to finding in a study conducted by Debnath Jand colleagues¹⁷.

In our study, 70.3% of cases (n=111) were confirmed positive on histopathology, giving the overall negative appendectomy rate of 29.7% which is in concordance with report of 33.1%¹⁸ but in contrast with 14.7%¹⁹ reported in other studies. The reason for this negative appendectomy rate could be that all patients in our study were managed by surgical intervention keeping open appendectomy and histopathology of resected specimens as gold standard and conservative nonoperative management was not done in any patient. However, on application of Tzanakis score at a cut off value of 8, this negative appendectomy rate decreased to 4.4% (07 out of 158).

Alvarado score is the most commonly used scoring system in our set up. Khan et al showed in a study that Alvarado scoring system had sensitivity and specificity of 59% and 23%, respectively²⁰, which are lower than sensitivity and specificity of Tzanakis score in our study. In another recent study conducted by Memon ZA and colleagues showed that sensitivity and specificity of Alvarado score was 93.5% and 80.6% respectively, Positive and negative predictive values were 92.3% and 83.3% respectively, and diagnostic accuracy was 89.8%²¹, these results are comparable to our study. Although the overall negative

appendectomy rate almost remains the same in both studies. Gender wise analysis of negative appendectomy rate in our study showed that it was much lower in female patients (10.8%) as compared to male patients (18.9%) which is in contrast with the above mentioned study. This is due to the fact that use of ultrasound in female patients is very helpful in ruling out other gynecologically related differential diagnoses such as adnexal pathologies which can mimic appendicitis and impose diagnostic difficulties, thus reducing the negative appendectomies in female patients.

Use of ultrasound as diagnostic aid in appendicitis has its own limitations. It is operator dependent and patient related factors such as obesity and distended gut loops in lower abdomen may influence the results. In our study we experienced similar limitations in total four patients in which ultrasound was not diagnostic due to non-visualization of appendix. Out of these four patients, distended gut loops were present in three patients and one patient was obese.

Thus, in an accident and emergency setting, the casualty medical officer can make a definitive decision upon seeing patients with right lower abdominal pain by applying Tzanakis score and referring those with score greater than 8 to surgical team for admission and further management.

CONCLUSION

We conclude that Tzanakis score at a cut-off total score of 8 is a useful and quite accurate tool to diagnose patients with acute appendicitis.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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