Original Research Article

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Evaluation of Tzanakis scoring system in acute appendicitis: a prospective study

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ABSTRACT

Background: Tzanakis scoring system is a combination of clinical evaluation, ultrasonography and laboratory marker of inflammatory response, used as accuracy of diagnosis of acute appendicitis. Objective of this study was to evaluate the predictability of Tzanakis scoring system in preoperative diagnosis of acute appendicitis and compare its accuracy with histopathological examination (HPE).

Methods: A prospective non-randomized study was designed to study those patients who suspected clinically as acute appendicitis, admitting to Department of General Surgery, ESIC-MC PGIMSR, Bangalore between November 2013 to July 2015. After complete clinical examination, radiological and laboratory investigations Tzanakis score was calculated and patients with score 8 or >8 underwent appendicectomy and HPE results were analyzed.

Results: Out of 218 participants, 200 patients underwent emergency appendicectomy and were selected for the study. The sensitivity and specificity of Tzanakis score was 85.49% and 71.43% respectively. The overall diagnostic accuracy was 85% with positive predictive value of 98.80% and negative value of 15.15%.

Conclusions: Tzanakis scoring system is an effective modality in the establishment of accuracy in diagnosis of acute appendicitis, but the limitation is observer bias which may vary the scoring system.

Keywords: Acute appendicitis, Sensitivity, Specificity, Tzanakis scoring system

INTRODUCTION

Appendicitis is inflammation of the inner lining of the vermiform appendix at the right lower quadrant of the abdomen which extends to its other parts with pain which increases with degree of inflammation. Based on the symptoms appendicitis can be acute and chronic. Sometimes it is recurrent. Acute appendicitis is the most common cause of acute abdomen surgery during childhood (reported 1 - 8% of children presented in paediatric emergency with acute abdominal pain).

The accuracy of diagnosis of acute appendicitis is approximately 70 to 87% and errors are common resulting in occurrence of perforation 20% and negative

appendicectomy 2% to 30%.⁴ In 2005, Tzanakis and coworkers published a simplified system with four variables and total score of 15 for diagnosis of appendicitis which is termed as Tzanakis scoring system.⁵ This is a combination of clinical evaluation, ultrasonography and laboratory marker of inflammatory response. In this study, authors were aimed to evaluate the predictability of Tzanakis scoring system in preoperative diagnosis of acute appendicitis and compare its accuracy with histopathological examination (HPE).

METHODS

A prospective non-randomized study was designed to study those patients who suspected clinically as acute appendicitis, admitting to Department of General Surgery, ESIC-MC PGIMSR, Bangalore between November 2013 to July 2015. Permission of institutional ethical committee was taken prior to the study.

Patients with the clinical diagnosis of acute appendicitis and undergoing surgery and willing to participate in the study were included in this study. Those patients having generalized peritonitis, appendicular abscess, appendicular lump/mass, blunt trauma abdomen, recurrent appendicitis and pregnancy were excluded from the study. Out of 218 participants assessed for this study, 200 patients underwent emergency appendicectomy and were selected for the study. Written informed consent was taken from the patients who fell into the inclusion criteria of the study.

After complete clinical examination, radiological and laboratory investigations Tzanakis score was calculated and patients with score 8 or >8 underwent appendicectomy and HPE results were analyzed. Initial evaluation of patients was conducted. Ultrasound of abdomen and pelvis, total and differential leucocyte count, routine microscopic examination of the urine and other necessary investigation were carried out. Detailed history, physical examination findings and investigation report were recorded on a preformed Performa. The diagnosis of acute appendicitis was done on the basis of clinical judgment. Subsequently Tzanakis scoring was done and recorded. Even when the new score was less than 8, if clinical suspension was high patient were subjected for appendectomy.

Tzanakis scoring:5

- Presence of right lower abdominal tenderness= 4 points
- Rebound tenderness = 3 points
- Laboratory findings: presence of white blood cells greater than 12,000 in the blood = 2 points
- Ultrasound finding: presence of positive ultrasound scan findings of appendicitis = 6 points.

Total-15 ponits; >8: Diagnostic of acute appendicitis requiring surgery.

Total leucocyte count above 12000/µl was considered raised count in Tzanakis scoring system. The intraoperative findings were recorded and the removed appendix was sent in a 10% formalin containing jar for histological examination. Hematoxylin and eosin stain was used for the staining purpose. When there was focal collection of neutrophil within the lumen and lamina propria, appearance of neutrophills at the base of the crypts adjacent to small defect in the epithelium along with focal erosion, ulceration, cryptitis and crypt abscess extending up to submucosa diagnosis of acute appendicitis was made. When there was extensive neutrophilic infiltrate extending deep in to or through the appendical wall along the fibrinous purulent coating of

the serosa, histological diagnosis of acute suppurative appendicitis was made. If the mucosa was absent, the wall was necrotic and thrombosed vessels were present it was diagnosed as gangrenous appendicitis.

Histological reports were followed up and recorded in the preformed performa sheet. The final diagnosis of acute appendicitis was based on histological diagnosis.

Statistical analysis

Data was analysed using Microsoft excel 2013 and SPSS version 16. Frequencies, percentages, mean with standard deviation and p values were calculated. Significance of the results was tested by using the independent T- test, chi-square test and Fisher's Exact Test. Measures of binary classifications (i.e., sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), diagnostic accuracy) were calculated from confusion matrix, a two by two table dataset. The 'p' value of less than 0.05 was regarded as significant.

RESULTS

Two hundred eighteen patients with clinical diagnosis of acute appendicitis were assessed for their eligibility from July 2013 to June 2014. Out of them 12 patients refused to participate in the study and 6 patients had alternative diagnosis during surgery (3 salpingitis, 2 patients with ovarian cyst and meckeles diverticulum). Finally a total of 200 patients underwent emergency appendicectomy and were selected for study.

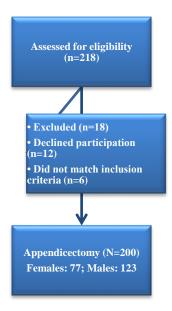


Figure 1: Sample selection as per eligibility.

The study group consisted of 77 females and 123 males. The mean age of patients was 27.88±12.24 years with ranging from 5-70 years (Table 1 and Figure 2). Majority of cases (n=80; 30 females, 50 males) were occurring in second to third decade of life followed by 54 patients (21

females and 33 males) were in third to fourth decade. Among the patients only two male patients were having more than 60 years.

Table 1: Demographic data.

Total no. of patients	200
Female : Male	1:1.6
Mean age in years	27.81±11.06

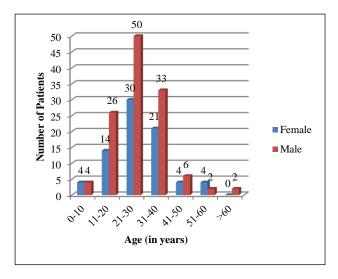


Figure 2: Age-wise distribution of sex.

Patients had acute appendicitis, subacute and chronic appendicitis accounting to 85%, 0.5% and 11% of the total patients respectively. The results are shown in Table 2.

In this study of 200, none had Tzanakis score less than 3, in score between 4-6, 7-9, 10-12 and 13-15 patients had histological evidence of acute appendicitis were 30, 11, 115, 44 respectively (Table 3). Out of 200 patients 15%

(30) had score between 4 and 6, 5.5% (11) had score between 7 and 9, majority 57.5% (115) were between score 10 to 12 and 22% had score more than 13.

Table 2: Histological diagnosis wise distribution of frequency.

Histological diagnosis	Frequency	Percentage	p-value
Normal	7	3.5	
Sub-acute appendicitis	1	0.5	
Chronic appendicitis	22	11.0	0.000
AA	170	85.0	
Total	200	100.0	

Tzanakis scores in acute appendicitis, acute on chronic (A on C) appendicitis and chronic appendicitis group is presented in Table 4. The minimum Tzanakis score in acute appendicitis (AA) group was 4 and maximum was 15 with a mean score of 10.24, while the mean score for acute gangrenous appendicitis (AGA) group was 12.58, mean score for acute suppurative appendicitis (ASA) group was 13.03, for chronic appendicitis (CA) it was 8.95 and for normal histopathological group it was 6.43 with a significant p value.

Table 3: Tzanakis score-wise distribution of patients.

Tzanakis Score	Frequency	Percentage (%)
0-3	0	0.0
4-6	30	15.0
7-9	11	5.5
10-12	115	57.5
13-15	44	22.0
Total	200	100

Table 4: HPE wise Tzanakis mean score distribution of patients.

HPE	N	Minimum	Maximum	Mean	Std. Deviation	F-value (p-value)
A ON C	7	4	12	9.71	2.690	
AA	99	4	15	10.24	2.308	
AGA	26	7	15	12.58	2.194	
ASA	31	9	15	13.03	1.663	10.18 (0.000)
CA	22	4	13	8.95	3.429	10.18 (0.000)
N	7	4	12	6.43	3.359	
RA	7	6	13	9.86	2.854	
SAA	1	-	-	10.00	0.00	
Total	200			10.67	2.853	

N- Normal HPE; AA- acute appendicitis; ASA- acute suppurative appendicitis; AGA- acute gangrenous appendicitis; A ON C- acute on chronic appendicitis; CA- chronic appendicitis; RA- reccurent appendicitis.

Table 5 shows definite association between Tzanakis score and histopathological outcome with significant p value. The highest numbers of patients (115; 57.5%)

among the study participants were having 10-12 scores followed by 13-15 (44; 22%).

Table 5: Comparison of Tzanakis score according to subtypes of HPE.

Tzanakis Score	HPE								Total	D volvo
A O	A ON C	AA	AGA	ASA	CA	N	RA	SAA	10tai	P-value
0-3	0	0	0	0	0	0	0	0	0	
4-6	1	16	0	0	7	4	2	0	30	
7-9	0	2	4	2	2	1	0	0	11	0.005
10-12	6	79	5	7	11	2	4	1	115	
13-15	0	2	17	22	2	0	1	0	44	
Total	7	99	26	31	22	7	7	1	200	

N- Normal HPE; AA- acute appendicitis; ASA- acute suppurative appendicitis; AGA- acute gangrenous appendicitis; A ON C- acute on chronic appendicitis; CA- chronic appendicitis; RA- reccurent appendicitis.

Table 6: HPE-wise distribution of score with cut off 8.

Tzanakis Score	HPE	HPE				
	N	SAA	CA	UA	Total	
<8	5	0	8	20	33	
≥8	2	1	14	150	167	
Total	7	1	22	170	200	

N- Normal HPE; CA- chronic appendicitis.

Table 7: Cross tabulation of HPE and Tzanakis score.

Tzanakis score	HPE diagnosis	HPE diagnosis		Vanna Valua (n valua)	
	Positive	Negative	Total	Kappa Value (p-value)	
Positive	165	2	167	0.204	
Negative	28	5	33	0.204 (0.000)	
Total	193	7	200	(0.000)	

Table 8: Diagnostic indices for Tzanakis score.

Index	New score (%)	95% CI
Sensitivity	85.49	79.72%-90.14%
Specificity	71.43	29.04%-96.33%
Positive predictive value	98.80	95.74%-99.85%
Negative predictive value	15.15	5.11%-31.90%
Diagnostic accuracy	85	80.05%-89.95%

Comparison of diagnosis of HPE and the scoring system is presented in Table 6. Kappa value was significant which shows there is agreement between the two variables that is preoperative Tzanakis score with actual histopathological report.

Diagnostic indices for Tzanakis score is given in Table 8. The sensitivity and specificity of Tzanakis score ≥ 8 in diagnosis of AA was 85.49% and 71.43% respectively. The overall diagnostic accuracy was 85% with positive predictive value of 98.80% and negative value of 15.15%.

DISCUSSION

Even though acute appendicitis is one of the most common surgical conditions encountered in clinical practice sometimes it is challenging task for the surgeon to diagnose. There always exists fear of negative appendicectomy and also fear of appendicular perforation if diagnosis is delayed and so the morbidity and mortality. A higher negative appendectomy rate of 15% to 25% has been accepted in the past in the cost of preventing appendicular perforation.⁶

Negative appendicectomy is not devoid of complications, though the mortality is low, it can be associated with the mortality of 10 to 15%. Negative appendicectomy is associated with significant hospital stay. Hence, negative appendicectomy should be lowered as low as possible.⁶

Gallego et al reported the incidence of appendicitis in 2nd and 4th decade of life was 52%.⁷ We found incidence of acute AA, in 80 patients (40%) patients in 2nd to 3rd decade and 27% in 3rd to 4th decade which is similar to the reported results. Sharma et al also reported similar findings in their studies. They found mean study population was 24.81±11.69 years with sex ratio (male:female) 1.13:1.8 In this study we found, the mean age of study participants was 27.81±11.06 years with sex ration (m:f) 1.6:1 which is comparable with the previous reports.

Along with clinical examination, various laboratory parameters of inflammation (TLC, CRP), USG, CT and laparoscopy are used to establish an accurate diagnosis of acute appendicitis. Numerous scoring systems have been developed to aid in preoperative diagnosis of acute appendicitis viz. Alvarado and modified Alvarado score is being used worldwide.⁴ The Tzanakis scoring system found to be superior to the previously formulated scoring

systems. This scoring system has the sensitivity, specificity and diagnostic accuracy was 95.4%, 97.4% and 96.5% respectively. The sensitivity and specificity of Tzanakis score \geq in diagnosis of acute appendicitis in this study was 85.49% and 71.43% respectively. The overall diagnostic accuracy was 85% with positive predictive value of 98.80% and negative value of 15.15%.

Negative appendectomy rate was low in our institute and the current study has also supported this fact. Previously the negative appendectomy rate was ten percent whereas this study has shown a negative appendectomy rate of six percent. Majority of our patients have delayed presentation which increases rate of positive clinical findings as well as laboratory parameters for AA. This has probably led to more accurate preoperative diagnosis and hence the lower rate of negative appendectomy in our setup.

Present study has a sensitivity and positive predictive value and diagnostic accuracy which is comparable with the original Tzanakis scoring system with specificity at a lesser side. But sensitivity and specificity is better than many existing scoring systems as shown in the table.

Table 7. Co	IIIDAI ISOH OL	DI ESCHI SIHU	v will dille	scoring systems.
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No.	Scoring system	Sensitivity	Specificity	PPV	NPV
1	Alvarado	73-90	87-92	-	-
3	Ripasa ¹⁰	88	67	93	53
4	Tzanakis	95.4	97.4	-	-
5	Present study	85.49	71.43	98.8	15.15



Figure 3: Inflammed appendix with gangrenous changes at the base.

Sigdel et al, reported, for a sample size of 100 patients with sensitivity, specificity and overall diagnostic accuracy were 91.48%, 66.66% and 90% respectively. 10,11



Figure 4: Inflamed appendix with enlarged tip.

And another study by Malla BR et al for a sample size of 200 patients with sensitivity, specificity, positive predictive value and negative predictive value 86.9%, 75.0%, 97.5% and 33% respectively.¹²



Figure 5: Intraoperative picture showing inflammed appendix.

This study had some limitations. Both clinical and ultrasonographic evaluations were done by different residents, allowing place for interobserver differences in findings. Similarly, the histological examination of the appendix was also done by different pathologists, in which opinion might differ, especially with regard to grading of severity of inflammation of the appendix.

CONCLUSION

Acute appendicitis is a common surgical emergency. Good clinical judgment aided by investigation scoring system can help to reduce the negative appendectomy rate. Tzanakis scoring system can be used as an effective modality in the establishment of accuracy in diagnosis of acute appendicitis. The only limitation is observer bias which may vary the results.

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Ethical approval: The study was approved by the

institutional ethics committee

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