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Original article:

Tzanaki's Score Vs Modified Alvarado's Score in diagnosing acute appendicitis: A Comparative study in a tertiary care hospital

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Abstract

A prospective non randomized observational study has been done in the department of general surgery SKIMS Medical College Bemina Srinagar/SKIMS Soura in emergency department. The study included 200 patients admitted with the clinical suspension of acute appendicitis and have undergone emergency appendectomy.

All these patients have undergone general physical examination, Base Line Investigations which includes CBC with total and differential leukocyte count, KFT, LFT, ECG, Chest X-Ray and imaging studies like abdominal Ultrasonography as part of the assessment.USG has been done using 5 MHz linear transducer. Well established Ultrasonography criteria has been applied to differentiate an acutely inflamed appendix from a normal one. Those with radiologists opinion of findings suggestive of acute appendicitis has been taken as USG positive and given points in Tzanaki's Score accordingly. Patients have been scored according to modified Alvarado Score as well as Tzanaki's Score prior to surgery. The defined scoring system was correlated intra-operatively with the patients findings. Final diagnosis has been confirmed by Histopathological examination of the specimen by the pathologist.

Introduction:

The appendix is a blind muscular tube derived from midgut. In the sixth week of human embryonic development, the appendix and cecum appear as out pouching from the caudal limb of the midgut [(1,2).] The base of the appendix can be located by following the longitudinally oriented taeniae coli to their confluence on the cecum. The tip of the appendix can be located anywhere in the right lower quadrant of the abdomen, pelvis, or retro peritoneum. In the adult, the average length of the appendix is 6 to 9 cm; however, it can vary in length from <1 to >30 cm. The outer diameter varies between 3 and 8 mm, whereas the luminal diameter varies between 1 and 3 mm. It is now well recognized that the appendix is an immunologic organ that actively participates in the secretion of immunoglobulin's, particularly in the appendix may function as a reservoir to recolonize the colon with healthy bacteria. One retrospective study demonstrated that prior appendectomy may have an inverse relationship to recurrent Clostridium difficile infections immunoglobulin [(3).]

The term "appendicitis" was described by Reginald Fitzin 1886[4].Acute appendicitis is one of the most common causes of abdominal surgical emergencies with a lifetime prevalence of approximately 1 in 7 worldwide [5] .It has been estimated that approximately 6% of the population will suffer from acute appendicitis during their lifetime; therefore, much effort has been directed toward early diagnosis and intervention[6,7]. In the classic presentation, the patient describes the pain as beginning in the periumbilical or epigastric region and then migrating to right iliac fossa. This is associated with fever, anorexia, nausea, and vomiting. This "classic" symptomatology only occurs in 50-60% of cases making the diagnosis difficult.[8]

Acute appendicitis is the most frequent cause of peritonitis in patients hospitalized at general surgery departments. Despite growing accuracy of diagnostic methods, the level of diagnostic errors has remained around 20-30%for many years[9].Additionally, in women aged 12-40 years the percentage of unnecessary laparotomies may reach even 45.6% [10]. The use of scoring systems in AA diagnosis is not a new concept. More than ten such systems have been developed since the beginning of the 1980s to present these include Alvarado,Fenyo, Eskelinen, Ohman, Tzankis, and RIPASA etc.[11-17.] A negative appendectomy rate of 20-40% has been reported in the literature and many surgeons advocate early surgical intervention for the treatment of acute appendicitis to avoid perforation, accepting a negative appendectomy rate of about15-20%.[30]The modified Alvarado score has been shown by recent studies to be easy, simple and cheap diagnostic tool for supporting the diagnosis of acute appendicitis (Table 1). A score of 1-4 there is low likelihood of Appendicitis. They are kept under observation or discharged. In patients with equivocal score (5-6) abdominal USG or contrast enhanced CT further reduces the rate of negative appendectomy. A score of 7 or more is strongly predictive of acute appendicitis. The sensitivity and specificity of Alvarado score ranges from 70-90% and 87-92% respectively. [18,19]

Modified Alvarado Scoring System	
Symptoms	**Score**
Migratory right iliac fossa pain	1
Nausea/Vomiting	1
Anorexia	1
Signs	
Tenderness in right iliac fossa	2
Rebound tenderness in right iliac fossa	1
Elevated temperature	1
Laboratory findings	
Leukocytosis	2
Total	**9**

Tzanakis score is a combination of clinical evaluation, ultrasonography, and inflammatory markers. There are altogether four variables and 15 points (Table 2) and a score of 8 or more diagnoses acute appendicitis requiring surgery. Its sensitivity, specificity, and diagnostic accuracy are 95.4%, 97.4%, and 96.5% respectively. Tzanakis scoring system can be used as an effective modality in the establishment of accuracy in diagnosis of acute

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appendicitis. The only limitation is observer bias which may vary the results. Our study compares the efficacy of modified Alvarado score and tzanakis score in diagnosing acute appendicitis

TZANAKI'S SCORING SYSTEM	
Feature	**Score**
Right lower abdominal tenderness	4
Right lower abdominal rebound tenderness	3
Total Leukocyte count > 12000/dl	2
Ultrasonography suggestive of Acute Appendicitis	6
Total	**15**

Materials and methods:

A prospective non randomized observational study has been done in the department of general surgery SKIMS Medical College Bemina Srinagar/SKIMS Soura in emergency department. The study included 200 patients admitted with the clinical suspension of acute appendicitis and have undergone emergency appendectomy.

All these patients have undergone general physical examination, Base Line Investigations which includes CBC with total and differential leukocyte count, KFT, LFT, ECG, Chest X-Ray and imaging studies like abdominal Ultrasonography as part of the assessment.USG has been done using 5 MHz linear transducer. Well established Ultrasonography criteria has been applied to differentiate an acutely inflamed appendix from a normal one. Those with radiologists opinion of findings suggestive of acute appendicitis has been taken as USG positive and given points in Tzanaki's Score accordingly. Patients have been scored according to modified Alvarado Score as well as Tzanaki's Score prior to surgery. The defined scoring system was correlated intra-operatively with the patients findings. Final diagnosis has been confirmed by Histopathological examination of the specimen by the pathologist.

Observations and results :

Out of 200 patients 124 were males and 76 females, the M:F ratio is 1.6:1.

Table showing Sex distribution

	Frequency	Percentage
Male	124	62
Female	76	38

Age Distribution

The study consists of 124 males and 76 females, the mean age of patients was 25 years ranging from 4 to 65 years .majority of cases (n=64,39 males and 25 females) were in 2nd to 3rd decade which means out of 200 patients 32% were in the age group of 21-30 years which includes 19.5% males and 12.5% females; followed by 40 patients (25 males, 15 females) in 3rd to 4th decade of life. Among these 3 patients were more than 60 years(2 males ,1 female).

Chief Complaints:

The main complaint with which the patients presented was pain abdomen (95%), 63% of patients also had anorexia, fever was present in 54% of patients, nausea/vomiting was present in 46%, dysuria was present in 5% of patients.

Operative Findings:

The main operative findings was inflamed appendix in 88% of patients.86% had reactionary fluid present ,74.5% had retrocaecal appendix, 25.5% had pelvic appendix.9% of patients had perforation of appendix.

On the basis of tzanakis scoring system, out of 200 patients who underwent appendectomy, 159 patients were found to be true positive which was confirmed by histopathology.4 patients having score greater or equal to 8 were false positive. Among 37 patients with score less than 8;5 were false negative. Acute appendicitis was significantly high (p - value < 0.001) in patients with Tzanaki's score ≥ 8. The sensitivity and specificity of TSS in diagnosing acute appendicitis was 96.9% and 88.8% respectively. The positive predictive valve, negative predictive valve and diagnostic accuracy were 97.5, 86.4 and 95.5 respectively

Tzanaki's Scoring and Histopathology:

Appendicitis			
Eligible for appendectomy	Yes	No	Total
Yes	159(TP)	4(FP)	163
No	5(FN)	32(TN)	37
total	164	36	200

TP = true positive,FP = false positive,TN =true negative,FN=false negative

The negative appendectomy rate as per tzanakis score is 15.9%. it is more common in females (18.4%) than in males (13.4%)

On the basis of modified Alvarado scoring system, out of 200 patients who underwent appendectomy, the number of true positive cases were found to be 150 who were confirmed by histopathological examination. 6 patients scored 7 or more were false positive among 44 patients with score less than 7, 34 cases were true negative Acute appendicitis was significantly high (p - value < 0.001) in patients with modified Alvarado score ≥ 7. The sensitivity and specificity of modified Alvarado scoring system in diagnosing acute appendicitis was 93.7% and 85% respectively. the positive predictive valve ,negative predictive valve and diagnostic accuracy were 96.1%, 77.2% and 92% respectively:

Modified Alvarado Score and Histopathology:

	Appendicitis		
Eligible For Appendectomy	Yes	No	Total
Yes	150(TP)	6(FP)	156
No	10(FN)	34(TN)	44
Total	160	40	200

TP = true positive,FP = false positive,TN =true negative,FN=false negative

The negative appendectomy rate as per modified Alvarado score is 18.7%. it is more common in females (21.6%) than in males (15.8%)

On the basis of USG with findings suggestive of acute appendicitis , out of 200 patients who underwent appendectomy, the number of true positive cases were found to be 153 who were confirmed by histopathological examination.4 cases were false positive. out of 43 cases who didn't show features of acute appendicitis on USG, 24 patients had appendicitis on histopathological examination. The sensitivity and specificity of ultrasonography in diagnosing acute appendicitis was 86.4% and 82.6% respectively. The positive predictive value, negative predictive value and diagnostic accuracy were 97.4%, 44.2% and 86% respectively .

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Ultrasonography and histopathology

	Appendicitis		
Eligible For Appendectomy	Yes	No	Total
Yes	153(TP)	4(FP)	157
No	24(FN)	19(TN)	43
Total	177	23	200

TP = true positive, FP = false positive, TN =true negative, FN=false negative.

Intra-operative image of acute appendicitis with perforation near tip

Discussion:

Acute appendicitis is one of the most common surgical conditions encountered in clinical practice and sometimes it is very challenging to diagnose. If the diagnosis is delayed, there are chances of appendicular lump formation, appendicular perforation, peritonitis etc with increase in morbidity and mortality. A negative appendicectomy rate of 15% to 20% has been accepted in past at the cost of preventing appendicular perforation.There are complications

associated with negative appendicectomy like wound infection, development of hernia, mechanical ileus usually caused by adhesions, significant hospital stay etc, though the mortality is low[20].hence it is imperative that negative appendicectomy rate should be lowered as much as possible. In resource poor settings where **CT** and MRI is not readily available, clinical examination, biochemical tests and USG is a good option to decrease negative appendicectomy rates.

Our study included 200 patients out of which 124 were male and 76 were females. Majority of patients were in the age group of 21 to 30 years(32% of patients). Mean age of patients was 25 years.

The main complaint with which the patients presented was pain abdomen(95%), 63% of patients also had anorexia, fever was present in 54% of patients, nausea/vomiting was present in 46%, dysuria was present in 5% of patients.

The main operative findings was inflammed appendix in 88% of patients.86% had reactionary fluid present ,74.5% had retrocaecal appendix, 25.5% had pelvic appendix.9% of patients had perforation of appendix.

The sensitivity and specificity of tzanakis scoring system in diagnosing acute appendicitis was 96.9% and 88.8% respectively. The positive predictive valve , negative predictive valve and diagnostic accuracy were 97.5%, 86.4% and 95.5% respectively. In our study the sensitivity is comparable to the study of Tzanaki's et al [20](sensitivity 95.4% and specificity97.4%). The specificity is lower compared to Tzanaki's et al in our study. This is possibly due to USG being done by many radiologists which increases the observer bias. In our study the sensitivity and specificity is better than studies done by Sigdel GS et al (sensitivity 91.4%and specificity 66.6%). They said that low specificity was due to low sensitivity of USG (63.8%) due to individual bias.

The sensitivity and specificity of modified Alvarado scoring system in diagnosing acute appendicitis in our study was 93.7% and 85% respectively. the positive predictive value , negative predictive value and diagnostic accuracy were 96.1%, 77.2% and 92 respectively. As per our study tzanakis score is better than MAS .our study results are comparable to other studies done by shashikala v et al, malla BR[21] et al, Harsha BK et al. The better sensitivity and specificity of tzanakis as compared to MAS in diagnosing of acute appendicitis is due to the introduction of US imaging in tzanakis score, which is an objective and accurate tool in diagnosing intraabdominal pathology and with addition of clinical and haematological data it increases the accuracy of intended diagnosis.

The negative appendectomy rate as per tzanakis score in our study is 15.9%. It is more common in females (18.4%) than in males (13.4%). The results are in acceptable range and comparable to sigdel et al. The negative appendectomy rate as per modified Alvarado score is 18.7%. it is also more common in females (21.6%) than in males (15.8%).The increased percentage of negative appendicectomy rates in females is due to more possible alternate diagnosis due to various pelvic pathologies. Negative appendectomy rate is less in Tzanakis score compared to modified Alvarado score.

Conclusion:

Ultrasound examination is operator dependent and has variable levels of sensitivity (44-100%) and specificity (47-100%). Ultrasound features suggestive of acute appendicitis include aperistaltic , non-compressible, dilated appendix (>6mm outer diameter), appendicolith, distinct appendiceal wall layers, echogenic prominent pericaecal and periappendiceal fat, periappendiceal fluid collection, target appearance(axial section) etc. The sensitivity and specificity of Ultrasonography in diagnosing acute appendicitis in our study was 86.4% and 82.6% respectively. the

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positive predictive valve ,negative predictive valve and diagnostic accuracy were 97.4%, 44.2% and 86 respectively. The results in our study are comparable to studies done by Skanne et al sensitivity (78%) and specificity (92%) ; Alkhayl KA et al sensitivity (83.7%) and specificity (95.9%); Tauro LF et al sensitivity (91.3%) and specificity (88.1%).USG examination in isolation is less sensitive and specific as compared to tzanakis score . The addition of clinical and haematological data in tzanakis score can explain the difference.

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