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Original Article

Accuracy of Acute Appendicitis Prediction Using Alvarado Score and Tzanaki's Score

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Abstract

Background: Appendicitis is the most often encountered abdominal emergency on a global scale. The lifetime risk of acute appendicitis is 8.6 percent for males and 6.7 percent for women. Clinical examination is useful in diagnosing acute appendicitis in approximately 70%–87% of cases.

Objective: To study the diagnostic accuracy of Alvarado and Tzanakis score in predicting the accuracy of acute clinical appendicitis.

Methods: The study involves a prospective analysis of 50 patients with acute appendicitis. Completing relevant history, exam, and lab tests were used to capture the proforma capture both Alvarado and Tzanakis rating for patients. In addition, both scoring systems' sensitivity, specificity, positive and negative predictive values were evaluated.

Results: Among the 50 patients analyzed, Tzanakis' specificity was 100%, but HPE expected Alvarado's was 81.82 percent. The accuracies of both scores likewise differed greatly. The Tazanakis score predicted 100% accuracy, while the Alvarado score predicted 50% accuracy. In a prior study, Tazanakis scored outperformed Alvarado in predicting acute appendicitis.

Conclusion: For diagnosing acute appendicitis, Tzanakis's scoring system is a relatively appropriate scoring system to use compared with that of Alvarado.

Key words: Acute appendicitis, Alvarado score, Tzanakis score

INTRODUCTION

The Appendix (Vermiform Appendix) is a vestigial organ in humans, as it has no purposeful function. However, its propensity to inflame makes it useful in surgery. An infection that results in "Acute clinical Appendicitis". Acute appendicitis is an inflammation of the appendix due to common pathology, blockage of the lumen[1]. It causes significant stomach pain that might be localized to generalized peritonitis varies in severity. Globally, acute appendicitis accounts for over 1% of all surgical procedures. Acute appendicitis affects between 6% and 7% of people in their lifetime. Appendicitis is most common in children due to submucosal lymphoid tissue hyperplasia; however, it is uncommon in infants[2]. It can occur in the elderly. Males have an average lifetime incidence of 8.6%, while females have an average lifetime incidence of 7.2 percent. Men are 3 times more likely than women to develop this disorder before the age of 30, and the ratio tends to equalize thereafter[3].

Because of the low-fibre, high-fat diet that is assumed to be responsible in most cases, appendicitis is more common in developed countries than in underdeveloped or developing countries. In the previous two decades, the diagnosis of acute appendicitis has been exclusively clinical. However, the sensitivity in detecting acute appendicitis has grown dramatically since the advent of imaging investigations such as Ultrasonography (US) and Computed Tomography (CT)[4].

The diagnosis of acute appendicitis is still a clinical one. The most common symptom is abdominal pain. The patient describes the discomfort as starting in the

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periumbilical or epigastric region and then spreading to the right iliac fossa in the classic presentation. Fever, anorexia, nausea, and vomiting are all symptoms of this condition[5]. The clinical presentation of acute appendicitis varies greatly due to the degree of inflammatory process involvement, the location of the appendix, and the patient's age. Because of the uneven clinical presentation, one out of every five cases of acute appendicitis is misdiagnosed, with negative appendicectomy rates ranging from 15 to 40%. Furthermore, "typical" symptomatology occurs in just 50-60% of patients, making diagnosis challenging[6].

The diagnosis was made on clinical grounds in the earlier era, and patients were brought to emergency surgery to limit the morbidity and death associated with severe appendicitis. However, the rate of negative laparotomy and negative appendectomy has risen dramatically due to routine emergency laparotomy for acute appendicitis on clinical grounds[7]. According to numerous researches, the rate of negative appendectomy varies between 15% and 30%. In a Swedish study, the percentage was approximately 15%, but it was only around 13% in a North American study. The imaging research was implemented to limit the number of negative appendectomies, but even so, the rate is not well managed[8].

Difficulties with the diagnosis are particularly prevalent in extremely young, elderly, and females of reproductive age. These patients are more prone to present with an atypical appearance and a variety of other illnesses may mimic acute appendicitis[9]. Numerous physicians advise early surgical surgery in acute appendicitis to avert perforation, accepting a negative appendectomy rate of approximately 15-20%. The removal of the normal appendix imposes a financial cost on both patients and health care resources. Misdiagnosis and surgical delay can result in complications such as perforation and, ultimately, peritonitis.

There are different scoring systems for acute appendicitis. However, the best scoring method for acute appendicitis to date is the Alvarado scoring system, which integrates clinical symptoms, signs, and laboratory test values and provides a clear approach to care. The purpose of this study is to validate the diagnostic accuracy of several established scoring systems and to compare the four most vital and relevant, easily quantifiable scoring systems, namely the Alvarado, Tzanaki, RIPASA, and AIR scores[5]. There are different scoring systems for acute appendicitis. However, the best scoring method for acute appendicitis to date is the Alvarado scoring system, which integrates clinical symptoms, signs, and laboratory test values and provides a clear approach to care[10].

Aim

To study the diagnostic accuracy of Alvarado and Tzanaki in predicting the accuracy of acute clinical appendicitis.

MATERIALS AND METHODS

This prospective study was conducted in the department of general surgery at the Government medical college Pudukottai. All patients admitted with the diagnosis of acute appendicitis was included.

Inclusion Criteria

All patients diagnosed with acute appendicitis undergoing open or laparoscopic appendicectomy

Exclusion Criteria

Patients not fit or not willing for surgery, Appendicular mass

Even when both the scores were below the cut-off value, patients were subjected to appendicectomy based on clinical judgement.

Relevant history, examination and laboratory investigations are done. Patients were scored according to both Alvarado Scoring System and Tzanakis Scoring, and both were documented in the proforma. Sensitivity, specificity, positive predictive value, negative predictive value were assessed and compared for both scoring systems.

The decision to operate on the patient (versus conservative line of management) was based solely on the clinical suspicion of an experienced Surgeon who was not part of/involved in the study. Scoring was performed at every review until a decision was made from either appendicectomy or continued conservative management line. The diagnosis of acute appendicitis was confirmed by operative findings and histopathological assessment of the appendicectomy specimen. The ultimate criterion for the final diagnosis of acute appendicitis was the histological demonstration of polymorphonuclear leukocytes throughout the thickness of the appendix wall. Data were analyzed using the Pearson chi square test to calculate sensitivity, Specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), and Diagnostic Accuracy.

RESULTS

50 patients admitted to the general surgery service with a diagnosis of acute appendicitis was included. The majority of patients were in the age group between 21 to 30 years. [Figure 1] 34 patients were male and 16 patients were female. [Figure 2] 42% of patients were presented within 12 hours [Figure 3].

The position of the appendix was retrocaecal in 62% of patients. [Figure 4] 56% of patients have a Tzanakis score of more than 8. 36% of patients have Alvarado score of more than 7 [Figures 5 and 6].

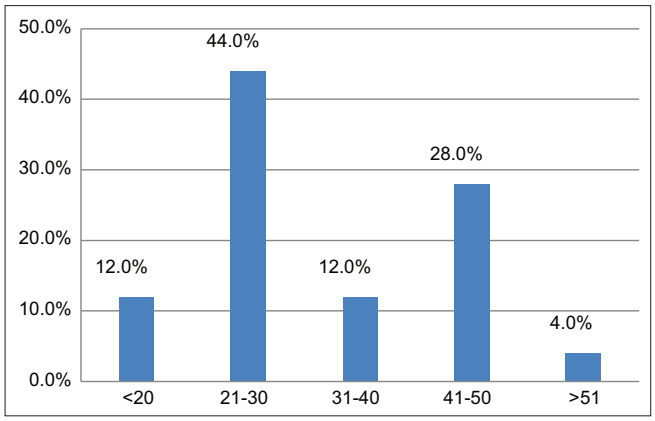

Figure 1: Age distribution

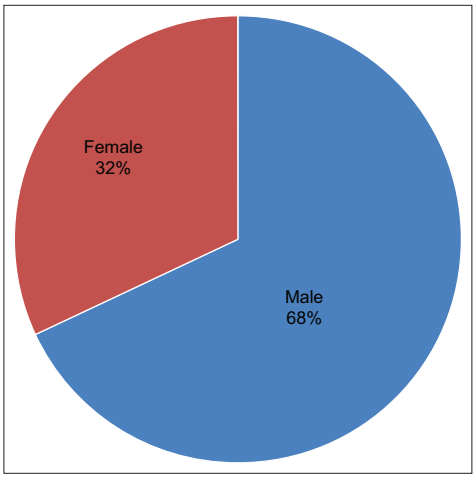

Figure 2: Gender distribution

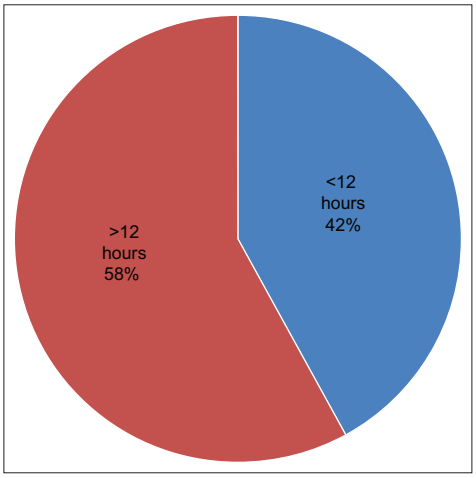

Figure 3: Time of presentation distribution

The histopathological examination has shown that 78% of patients had evidence of appendicitis [Figure 7].

The Tzanakis score had 65.52% sensitivity to correctly identify appendicitis with a confidence interval of 51.88% to 77.51%. Specificity of Tzanakis score is 100%, normal

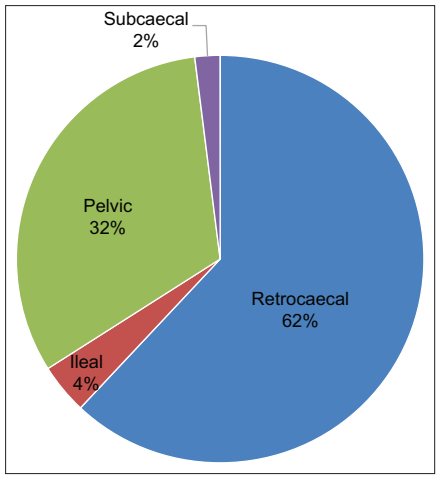

Figure 4: Position of appendix distribution

Table 1: Cross-tabulation of Tzanakis score with HPE

TZANAKIS Score	HPE		Total	P-value
	Positive	Negative		
>8	38	0	28	<0.0001
<8	20	12	22	
Total	39	11	50	

Table 2: Cross-tabulation of Alvarado score with HPE

ALVARADO Score	HPE		Total	P-value
	Positive	Negative		
>7	16	2	18	<0.0001
<7	23	9	32	
Total	39	11	50	

appendices are correctly identified with score <8 with a confidence interval of 73.54% to 100.00%. Tzanakis score had a 100% positive predictive value and having 37.50% negative predictive value. The accuracy of the Tzanakis score is 71.43%. [Table 1].

The Alvarado score indicated a sensitivity of 36.21 percent for correctly diagnosing appendicitis, with a confidence interval of 23.99 percent to 49.88 percent. Alvarado score has a specificity of 66.67 percent, while score 7 properly identifies normal appendices with a confidence interval of 34.89 percent to 90.08 percent. Alvarado score had a positive predictive value of 84% and a negative predictive value of 17.78%. Alvarado's accuracy is 41.43 percent. [Table 2].

DISCUSSION

Acute appendicitis is a common abdominal surgical disease. Since 1900, the disease's morbidity and fatality rates have

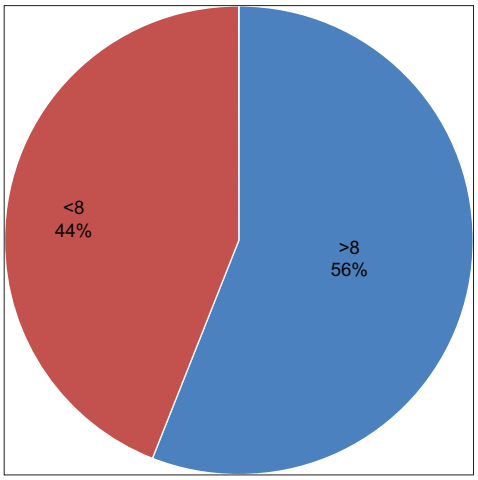

Figure 5: Tzanakis score distribution

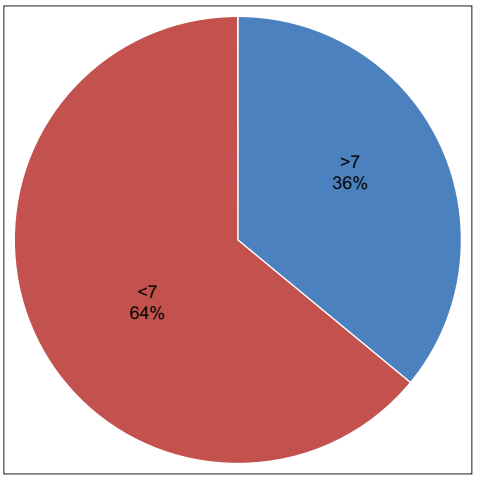

Figure 6: Alvarado score distribution

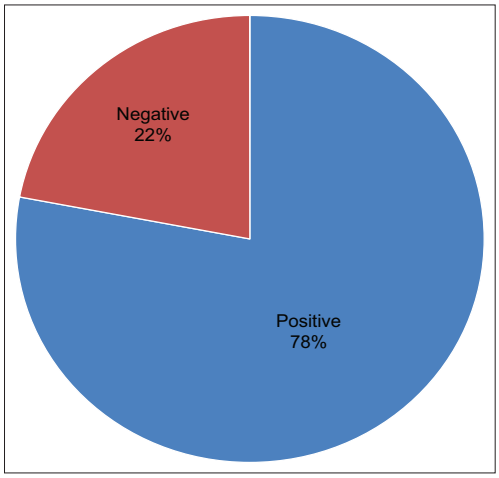

Figure 7: HPE distribution

fallen dramatically. Negative appendectomies have low mortality but a 10% morbidity rate. Many strategies have been investigated to reduce the removal of a normal appendix without increasing the perforation rate[11]. Radiological procedures, including ultrasonography and computed tomography, as well as laparoscopy, have all been studied. Many diagnostic ratings have been proposed, however, most are complex and difficult to apply in practise. The purpose of this study was to contrast Tzanaki and Alvarado in 50 appendicitis patients to develop a grading system for acute appendicitis and to determine the efficacy of these scoring systems for diagnosing acute appendicitis.

Incidence of acute appendicitis was higher in the patients below 40, with the highest prevalence occurring in those of age group 21 to 30. In addition, the predominance of occurrence in males was observed (68%). In a similar study conducted by Babu *et al.*[12], it was reported that the occurrence of acute appendicitis condition was predominant in males and documents the comparative surge in the frequency of the condition in the age group 21-30 years. A previous analysis performed by Anupriya *et al.*10 also reported a parallel statement on the existence of the condition more significantly higher in males and similar age groups. However, Sarla[13], in a likely study, has stated that age is not a limiting factor for the occurrence of acute appendicitis yet reported a higher rate of the condition among males and within a similar age group (20-30 years).

The position of the appendix is extremely variable – more than any other organ – and if it is too long, the appendix may extend to any part of the abdomen. The appendix is the only organ in the body that has no fixed anatomy[14]. The effect of the position of the appendix in relationship to acute inflammation was also determined. Appendix position in patients was found to be retrocaecal, ileal, pelvic and subcaecal. Among the four positions identified, the retrocaecal location of the appendix was found to be higher, followed by the pelvic position. Ileal as well as subcaecal appendix positions were found to be existent in very meagre numbers. In a previous study conducted by Fashina *et al.*[14], the retrocaecal appendix was dominant among 250 patients admitted for acute appendicitis. They also recorded that the length and position of appendices were not significantly different between those who had acutely inflamed and normal appendices ($P = 0.923$). This could also contribute to the majority of the appendix position being confined to the retrocaecal, even in general. Out of 377 cadavers autopsied, Souza *et al.*[15] recorded a vital number of appendix positions to the retrocaecal. Thus the length and position of the appendix might be excluded while fixing criteria for analyzing patients with acute appendicitis. Yet, further detailed analysis of the higher number of patients from various demographic locations shall be performed to substantiate this.

Tzanaki's scoring method is one of these systems; it incorporates clinical evaluation, elevated leukocyte count, and ultrasonography. There are just four variables worth

15 points, and a score of 8 or greater indicates acute appendicitis necessitating surgical treatment[16]. In our current evaluation, 56% of patients displayed Tzanaki's score of >8, while the remaining 22 patients were recorded with scores <8. In a previous study conducted by Anupriya *et al.*[10], more than half of patients recorded an optimum Tzanaki score. The overwhelming accuracy of Tzanaki's scoring method in predicting the positive diagnosis of acute appendicitis was recorded in many previous studies[5],[8],[10],[12]. In a study conducted by Sujeetha[8] also the patients admitted for acute appendicitis, most of them displayed scores above 10. Iqbal *et al.*[17] analyzed 214 appendicitis patients with Tzanaki's score and revealed the presence of scores >8 in more patients.

The Alvarado scoring system effectively detected acute appendicitis early in patients with a pre-operative clinical diagnosis of appendicitis, as established by numerous trials, and reduced the incidence of negative appendectomies without increasing morbidity or death[18]. The modified Alvarado Score is an easy, simple and cheap diagnostic tool for supporting the diagnosis of acute appendicitis. In our current observation, the scoring system using Alvarado's method revealed the presence of scores <7 in 64% of patients. However, patients with scores >7 were designated to be highly probable to be diagnosed with acute appendicitis. In previous analyses conducted in predicting acute appendicitis by the Alvarado scoring system, the predominant number of patients were recorded with scores >7, substantiating the existence of acute appendicitis with a histopathological cross examination[19].

A cross-sectional histopathological evaluation (HPE) of patients with acute appendicitis was compared with both the scoring systems. A total of 39 patients were positively diagnosed with acute appendicitis, while 11 of them were not. Hence the overall positive predictivity of acute appendicitis through HPE was recorded as 78%. In a similar study performed by Anupriya *et al.*[10], the predictivity accuracy of both scoring systems was also compared with HPEs. Our study found that out of the 50 patients, Tzanaki's scoring method, all the patients with scores>8 were confirmed with the presence of acute appendicitis. Also, 20 patients with <8 scores were also ascertained with the acute condition, thus revealing 71.79% sensitivity, 50% NPV rates, and 100% specificity and PPV. The overall analysis designates an accuracy score of Tzanaki's scoring system to fall to 78%. There was also no false diagnosis found in Tzanaki's scoring system.

In a parallel study conducted by Anupriya *et al.*[10] also, No patients were falsely diagnosed with appendicitis by the Tzanakis scoring system. Similar to our study, patients with a Tzanakis score of <8 and 12 among 32 patients analyzed were confirmed with appendicitis. However, in an investigation conducted by Iqbal, among 214 patients, HPE proven appendicitis condition was found in 89.7%, with 10.3% of them diagnosed with a normal appendix. Sensitivity, specificity, and the overall diagnostic score of Tzanaski were 99%, 91%, and 95%, respectively.

According to Alvarado score, 18 patients were diagnosed to have appendicitis through HPE. Out of these 18, 16 patients had evidence of appendicitis histopathologically, 2 patients were falsely diagnosed with appendicitis by the Alvarado scoring system. Out of the 32 patients diagnosed by Alvarado as not having appendicitis, 23 patients had evidence of appendicitis HPE. Thus revealing 41.03% sensitivity, 28.13% NPV rates, and 81.82 and 88.89% of specificity and PPV, respectively. The overall analysis designates an accuracy score of the Alvarado scoring system to fall to 50%. In Anupriya'*et al.*'s [10] study, 25 patients were diagnosed with appendicitis based on the Alvarado score. Out of these 25, 21 individuals had histological evidence of appendicitis, while four patients were misdiagnosed with appendicitis using the Alvarado grading system. Thus, of the 45 individuals Alvarado diagnosed as not having appendicitis, 27 had histological evidence of appendicitis.

Hsiao *et al.*[20] performed a retrospective analysis and discovered that the sensitivity and specificity for an Alvarado score of 7 were 60% and 61%, respectively. In their retrospective analysis, Rezak *et al.*[21] found a greater sensitivity and specificity of 92 percent and 82 percent, respectively. This study indicated that if patients with scores >7 were handled immediately by appendectomy without CT examination, CT scanning would have been reduced by 27%. Owen *et al.*[22] assessed 215 patients prospectively and discovered that Alvarado scoring had 93% and 81% sensitivity and specificity, respectively. In addition, 16 patients with an Alvarado score of less than 7 were compared to 45 patients with a Tzanakis score of greater than 8, indicating the presence of appendicitis on the histological investigation. Thus, 37 (82.2 percent) of 45 patients with an Alvarado score of less than 7 had histopathological evidence of appendicitis.

Comparing positive histological outcomes for patients with an Alvarado score of less than 7 patients with a Tzanakis score of less than 8 would reveal the better scoring system that could be adopted to predict acute appendicitis. In our present analysis, the specificity of Tzanakis score was 100%, but Alvarado was predicted as 81.82% based on HPE. There was also a huge difference in the accuracies of both scores. With the employment of the Tazanakis score, the accuracy was 100%, while the Alvarado score predicted only 50% accuracy. In a previous study also that compared both Tazanakis as well as Alvarado scores in

predicting acute appendicitis, Tazanakis score proved to be more accurate.

CONCLUSION

In conclusion, the Tzanakis score is a significantly superior diagnostic scoring system for acute appendicitis than the Alvarado score at the moment. Acute appendicitis is a frequently encountered surgical emergency. A combination of sound clinical judgement and an investigation rating system can assist lower the rate of negative appendectomy. In our study group, Tzanakis had significantly higher sensitivity, negative predictive value, and diagnostic accuracy. Thus, in remote locations or during an emergency, a swift decision on referral to an operating surgeon or observation might be made.

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