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ORIGINAL ARTICLE

A Comparison between the Diagnostic Accuracy of Alvarado and Tzanaki Scoring Systems in Acute Appendicitis

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ABSTRACT

Aim: To find out how accurate the Alvarado and Tzanaki scoring systems are in diagnosing acute appendicitis taking histopathology as gold standard.

Methods: A cross-sectional prospective study was conducted from August 2019 to July 2020 at Department of General Surgery, Pakistan Institute of Medical Sciences Islamabad. Sixty patients were included, all of whom had appendectomies after a clinical diagnosis of acute appendicitis. Samples were submitted for histopathology, which was used as the gold standard for the definitive diagnosis of acute appendicitis. The specificity, sensitivity, positive predictive value (PPV), negative predictive value (NPV), diagnostic accuracy and negative appendectomy rate of Alvarado and Tzanaki scoring systems was calculated using SPSS version 23.

Results: The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of Alvarado score at optimal cut-off threshold of ≥7.0, were calculated as 74%, 55%, 90%, 27% and 71.66% respectively. The cut-off threshold point of Tzanaki score was set at more than 8, which yielded a 94.11% sensitivity and an 88.88% specificity. The positive predictive value was 99.95% and the negative predictive value was 72.72%. The Alvarado and Tzanaki scoring systems had negative appendectomy rates of 9.5% and 2.04%, respectively.

Conclusion: The Tzanaki scoring system has a better diagnostic accuracy for acute appendicitis as compared to the Alvarado score.

Keywords: Acute appendicitis, Alvarado score, Tzanaki score

INTRODUCTION

Acute appendicitis, the major cause of abdominal pain that necessitates surgery, is also the most common surgical condition seen in emergency rooms around the world. Its incidence has been reported to be highest in adolescents and young adults. Although appendicectomy is one of the most commonly performed surgical procedure, with a life time risk of 8.6% in men and 6.7% in women, it remains a diagnostic dilemma with the rate of diagnostic problems and hence negative appendectomies reaching as high as 20-33% and 30% respectively.[1,2]

The diagnosis of appendicitis is primarily a clinical. Recently, this process of diagnosis has been upgraded in rapidity and accuracy by the frequent use of ultrasonography and computed tomography scan. Despite the accuracy of radiological investigations in diagnosing appendicitis, their variable accessibility and high expenses, make their routine use difficult specially in developing countries.[3] The need to limit the number of negative appendectomies has accelerated the process of proper diagnosis and care, resulting in the development of numerous clinical scoring systems. Of the most popular one is the Alvarado scoring system, which, amongst the Asian population has unfortunately shown to have a low accuracy with its positive predictive value, sensitivity and specificity reportedly being 89%, 54% and 75% respectively.[4,5] Other scorings have also been developed, such as the modified Alvarado score, Fenyo-Lindberg score, Lintula score, Eskelinen score, Teicher score, RIPASA score, Christian score and Tzanaki score.

Clinical examination, Ultrasonography, and inflammatory indicators are used in the Tzanakis scoring system. By the application of this reliable Ultrasound-based score for diagnosing acute appendicitis, the process of decision making has improved, especially in developing countries lagging in resources.[6,7] In a recent study done in Pakistan, its sensitivity, specificity and overall diagnostic score was determined to be 99%, 91% and 95% respectively[8] indicating that it to be an accurate modality for diagnosing of acute appendicitis and preventing a negative laparotomy in this region of the world.[9] However, a prospective study done in 2019 in India concluded that Tzanaki score is considering better diagnostic scoring system than Alvarado score for acute appendicitis[10].

In this study Tzanaki and Alvarado scoring systems were compared in diagnosing acute appendicitis taking histopathology as gold standard. Such comparative study has not yet been conducted in Pakistan.

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PATIENTS AND METHODS

This was a prospective, comparative, cross-sectional study conducted at Department of General Surgery, Pakistan Institute of Medical Sciences Islamabad from August 2019 to June 2020. All patients of both gender and aged between 13 to 55 years with a clinical diagnosis of acute appendicitis undergoing emergency appendectomy were included in the study. All patients with appendicular mass, suspected of appendicular tumor, with a past surgical history of appendectomy and with signs of generalized peritonitis were excluded. Ethical approval was sought from ethical review board of the hospital before collecting data for the study. An informed written consent in English or Urdu was sought from the patient prior to including him/her in the study.

The patients were subjected for appendicectomy based on clinical judgement by an experienced surgeon, irrespective of their Tzanaki and Alvarado scores. Each patient was assessed using the Alvarado and Tzanaki scoring systems, which were reported in the pro forma, after acquiring appropriate history, physical, and laboratory findings. By taking histopathology as the gold standard for the diagnosis of acute appendicitis; sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were assessed and compared for both the scoring systems following data analysis. The presence of polymorphonuclear leukocytes across the thickness of the appendix wall was used to make a histological diagnosis of acute appendicitis. Histological diagnosis of acute appendicitis was based on the demonstration of polymorphonuclear leukocytes throughout the thickness of the appendix wall.

SPSS 23 and Microsoft Excel 2013 were used for analysis of all the data. Descriptive analysis was done and percentages were collected for each group.

RESULTS

The study included 60 patients of acute appendicitis who were admitted in the General Surgery Department. There were 34 males and 26 females i.e., 56.7% and 43.3% respectively. The mean age of patient was 25.48±9.8 years. Twenty four (40%) patients were in the age group 21-30 years, followed by <20 years the age group as being the most common age group. (Fig. 1). As per Alvarado scoring system, patients having Alvarado score of more than 7 were diagnosed as acute appendicitis. Forty two patients i.e., 70% were diagnosed as acute appendicitis according to Alvarado score. Forty nine patients i.e., 81.66% were diagnosed as acute appendicitis according to Tzanaki scoring system i.e., Tzanaki score >8. Histopathological evidence of appendicitis was found in 85% of the patients.

Of the 42 patients, diagnosed with acute appendicitis by Alvarado scoring, 38 patients had evidence of appendicitis proved by histopathology. Appendicitis was falsely diagnosed in four patients. In contrast, 13 of the 18 individuals who were not diagnosed with appendicitis using this grading system had histological evidence of appendicitis. The Alvarado score has a sensitivity and specificity of 74% and 55 percent in detecting acute appendicitis, respectively, with a positive predictive value of 90 percent and a negative predictive value of 27 percent. The accuracy of the diagnosis and the absence of appendicitis on histology were 71.66% and 9.5%.

According to the Tzanaki score, 49 patients were diagnosed with appendicitis, 48 of whom had histological evidence of appendicitis, and only one patient was misdiagnosed as having appendicitis. In contrast, three of the 11 individuals who were identified as not having appendicitis had histological evidence of appendicitis. The sensitivity, specificity, positive predictive value and negative predictive value of Tzanaki scoring system was found to be 94.11%, 88.88%, 97.95%, and 72.72% respectively. Diagnostic accuracy of Tzanaki score is 93.33% whereas negative appendectomy rate was 2.04%.

Among the 18 patients with Alvarado score <7, 10 patients had Tzanaki score more than 8, with 10 of them having histopathological evidence of appendicitis. Whereas 8 patients had Tzanaki score <8, of which 3 patients had histopathologically proven appendicitis and 5 had normal appendices.

Figure 1: Age and sex distribution.

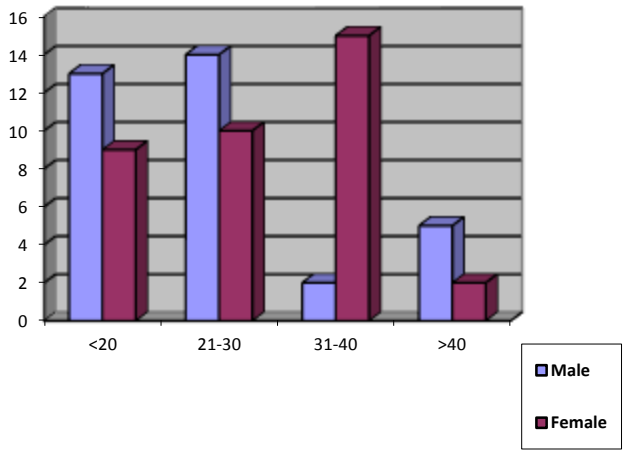

Table 1: Alvarado score and histological diagnosis

Tzanaki score	Acute appendicitis	Normal	n
<7	13	5	18
≥7	38	4	42
Total	51	9	60

Table 2: Tzanaki score and histological diagnosis

Tzanaki score	Acute appendicitis	Normal	n
≤8	3	8	11
>8	48	1	49
Total	51	9	60

Table 3: Cross tabulation of Alvarado score <7 with Tzanaki score

Tzanaki score	Acute appendicitis	Normal	n
≤8	6	5	11
>8	7	0	7
Total	13	5	18

DISCUSSION

Acute appendicitis despite being the most common surgical emergency, still poses diagnostic challenges to the surgeon. Various lab parameters, and radiological investigations have been used to aid in its diagnosis. Numerous scoring systems e.g., RIPASA, Alvarado, Tzanaki, have also been introduced to enhance the process of its diagnosis and hence reduce complications. The most widely used is the Alvarado scoring system, which, as reported by Singh et al. has a sensitivity of 94.59%, Specificity of 66.67% and positive and negative predictive values of 97.22% and 50% respectively. The accuracy of the scoring system being 92.5%[11] Tzanaki et al proposed a scoring system based on clinical and laboratory evaluations as well as Ultrasound imaging. The Tzanaki scoring system was found to be superior in diagnosing acute appendicitis, with a sensitivity of 95.4 percent, specificity of 97.4 percent, and diagnostic accuracy of 96.5 percent.[12] Ultrasonography, in experienced hands has a high accuracy in diagnosing appendicitis and hence reducing negative appendectomy rate[13,14].

We compared the Tzanaki and Alvarado scores in the diagnosis of acute appendicitis in 60 individuals in this study. The mean age of patients was 25.48±9.8 years with male preponderance being observed at 56.7%, which is comparable to other studies. [15,16] In our study, 70% of the patients had an Alvarado score greater than or equal to 7 and 81.66% had a Tzanaki score more than 8, whereas 85% of the patients had histopathological evidence of appendicitis.

In a study by Memon et al in the past, reported the sensitivity and specificity of the Alvarado scoring system to be 93.5% and 80.6 percent, respectively, with positive and negative predictive values of 92.% and 83.3%[17] Whereas the sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of the Alvarado score were all 74%, 55%, 90% and 27% and 71.66% respectively in our investigation. The low specificity is due to the high rate of false positive results. These results are comparable to those reported by Sidgel et al [18]

Lakshminarasimhaiah et al. in a prospective study reported the diagnostic accuracy of Tzanaki score to be 85%.[19] As per our study, Tzanaki scoring system had the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of 94.11%, 88.88%, 97.95%, 72.72%, and 93.33% respectively, which is comparable to corresponding values of Tzanaki score reported by Tzanaki et al and Naz et al[12,20]. The high specificity may be due to the higher sensitivity of Ultrasound due to trained sonographers.

In the past, a higher negative appendectomy rate of 15%-25% has been considered acceptable at the cost of preventing complications. The overall negative appendectomy rate in our study was 15%. The negative appendectomy rate following the application of Alvarado scoring system was 9.5%, which is much higher than that reported in a local study done in Pakistan in the past.[21] Whereas, using Tzanaki scoring system, a much lower rate of negative appendectomies (2.04%) was observed.

CONCLUSION

The Tzanaki grading system is a straightforward method for determining the severity of acute appendicitis.
In terms of sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy, it outperforms the Alvarado scoring system, with far lower negative appendectomy rates.
Conflict of interest: None

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