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Comparison of Sensitivity and Specificity of Alvarado Score and Tzanakis Score in Enforcement of Acute Appendicitis Diagnosis

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KEYWORDS

Acute appendicitis, Alvarado, Tzanakis, sensitivity, specificity

ABSTRACT

Appendicitis is inflammation of the appendix that occurs due to fecalitis, fibrosis, foreign bodies, or neoplasia. Based on WHO data in 2014, appendicitis is ranked 8th as the cause of death and is expected to continue to increase in the upcoming years. In the Southeast Asian region, the incidence of acute appendicitis is found in almost all Southeast Asian countries. Indonesia with a prevalence of 0.05% ranks first as the country with the highest incidence of acute appendicitis. Appendicitis has clinical manifestations in the form of visceral pain that is felt around the umbilicus, which within a few hours will move to the right under McBurney's point, fever, nausea, and vomiting as the result of infection. Difficulties in diagnosing acute appendicitis arise especially in pediatric patients, the elderly, and women of reproductive age because the symptoms they cause often overlap with other conditions.

INTRODUCTION

Appendicitis is inflammation of the appendix that occurs due to feccalitis, fibrosis, foreign bodies, or neoplasia. Based on WHO (World Health Organization) data in 2014, appendicitis is ranked 8th as a cause of death and is expected to continue to increase in the coming years.(Baresti & Rahmanto, 2017a; Miladina Zahra, 2023; Son et al., n.d.)

Based on research in different countries, the incidence of appendicitis in different countries varies. The incidence of appendicitis in western countries has largely stabilized. Based on data from the United States, the incidence of appendicitis of 8.6% occurs in men and 6.7% in women, with the highest rate occurring in the age range of 20 to 30 years. This condition is different from the incidence of appendicitis in developing countries such as Asia, the Middle East, and Africa which are increasing. In the regional region of Southeast Asia, the incidence of acute appendicitis is found in almost all Southeast Asian countries. Indonesia with a prevalence of 0.05% ranks first as the country with the highest incidence of acute appendicitis, followed by the Philippines (0.022%) and Vietnam (0.02%).(Mariati, Julyani, Shamsu, & Sa'diyah, 2022; Palguna, Sueta, & Mahadeva, 2022)(Nurhuda, Rosmaini, Siana, Ivan, & Arma, 2022; Suprayitno, Dear Person, & Ruchimat, 2020)

Appendicitis has clinical manifestations in the form of visceral pain felt around the umbilicus, which within a few hours will move to the right below McBurney's point, fever, and nausea vomiting as a result of infection. Difficulties in establishing the diagnosis of acute appendicitis arise mainly in pediatric patients, the elderly, and women of productive age, because the symptoms caused are uncertain and often overlap with other conditions, such as acute meceironic adenitis, cecum diverticulisis, Chron's disease, ovarian cysts, and acute gastroenteritis.(Alfisahrinie, Wibowo, Noor, Tedjowitono, & Aflanie, 2021; Baresti & Rahmanto, 2017b; De Kluyver, 2000)(Marjaya & Pasaribu, 2019; Philip, 1994; Somov, 2018)

Currently, many screening methods have been found to support the diagnosis of acute appendicitis, including the Alvarado Score system and the Tzanakis Score. The Alvarado score is a simple scoring system that is inexpensive and easy to apply to help diagnose acute appendicitis, consisting of 10 scoring items based on symptoms and clinical signs and laboratory examinations. Meanwhile, the Tzanakis Score is a unique scoring system that involves the results of ultrasound examinations along with clinical evaluations and laboratory tests for the evaluation of acute appendicitis. The Alvarado score is an easy screening method because it only looks at clinical symptoms and the results of patient laboratory tests, so it is faster and more practical because it does not rely on radiological examinations that are not always available 24 hours. However, there are weaknesses in this scoring system where sometimes subjective symptoms such as anorexia and nausea, vomiting and physical examination cannot be assessed in less operative patients, such as pediatric patients. Meanwhile, on the Tzanakis score, diagnostics are also supported by the results of ultrasound examination which can provide a more definite picture of the patient's condition. However, camping is also found in ultrasound examination where there can be differences in the interpretation results of ultrasound images. (Mardianto, Kartiko, & Utami, 2019; Mariyanti, Khalik, & Badrudin, 2016)(Ptri & Gustomo, 2018)

Research conducted by Elhosseiny et. al obtained the sensitivity and specificity of Alvarado's score of 65.22% and 100%, while the study conducted by Mustafa et al obtained the sensitivity and specificity of Alvarado's score of 60.9% and 89.9%. Meanwhile, research conducted by Malla Br and Batajoo H on the Tzanakis score system obtained sensitivity and specificity scores of 86.9% and 75.0%.8 Another study conducted by Arun Kumar et al on the Tzanakis score system gave sensitivity and specificity scores of 95.4% and 97.4%.9 Based on the data of the studies above, sensitivity and specificity results were obtained by Alvarado and Tzanakis scores that were high enough to diagnose appendicitis. However, there are still quite a lot of differences in results so that researchers are interested in conducting a similar study at Semen Padang Hospital, Padang, West Sumatra. In establishing the diagnosis at Semen Padang Hospital, it does not use scoring techniques and emphasizes more on the experience of the clinician on duty, so that the application of scoring in this study will not bring bias and will help in the establishment of further diagnoses.

METHOD

This study is an analytical study conducted retrospectively and cross-sectionally to determine the sensitivity and specificity of Alvarado and Tzanakis scores in the diagnosis of acute appendicitis at Semen Padang Hospital 2017-2019. Samples were taken from 184 patients with a diagnosis of appendicitis and had the results of lab examinations and ultrasound.

RESULTS AND DISCUSSION

The samples obtained in this study were all Semen Padang Hospital patients who had complaints of abdominal pain in the lower right quadrant region throughout 2017-2019. Data collection was carried out during the period January 2022 to October 2022 from the medical records of Semen Padang Hospital patients.

From a total of 184 patients, the number of male and female patients was 63 (34.2%) and 121 (65.8%), which can be concluded that the number of female patients is more than the number of male patients. Patients are spread in the age range of 18-67 years, with the average age of patients (SD) is 28.11 10.45 (men = 31.41 11.65 and women = 26.40 9.36).++++

Of the total 111 patients with a diagnosis of acute appendicitis discharge, the number of male and female patients was 38 (20.7%) and 73 (39.7%) respectively. The age range of patients was 18-67 years, with the average age (SD) was 28.61 11.13 (men = 32.16 11.93 and women = 26.77 10.29).++++

The Alvarado score is a scoring system that combines parameters in the form of 3 clinical symptoms (iliac fossa tenderness moving to the right, anorexia, nausea vomiting), 3 clinical signs (fever, tenderness and rebound tenderness in the right iliac fossa) and 2 laboratory test results

(leukocytosis and neutrophils shift to the left) which are typical signs of appendix inflammation. Each of these parameters has a score with a total accumulated score of 15.

Meanwhile, the Tzanakis score is a scoring system that combines clinical findings in the form of tenderness and rebound tenderness in the lower right quadrant abdomen, ultrasound examination results and laboratory tests in the form of leukocyte levels >12,000/mm3 to establish the diagnosis of acute appendicitis. The demographic distribution of Tzanakis score data is presented in the following table.

From this study, it was found that the sensitivity and specificity values of Alvarado's scores were 69% (95% CI = 60-70%) and 97% (95% CI = 94-100%), with accuracy, positive predictive values and negative predictive values respectively were 79.8%, 97.4%, and 67%. Meanwhile, the Tzanakis score has sensitivity and specificity values of 89% (95% CI = 85-95%) and 80% (95% CI = 70-89%) with accuracy, positive predictive value and negative prediction value respectively are 85.3%, 86.8%, and 82.9%.

Based on the curve and table above, we get the area under the curve (hereinafter referred to as AUC) Alvarado score and Tzanakis score respectively 0.829 and 0.843. The results show that the AUC scores on both scoring systems are statistically significant, so it can be argued that the Alvarado score and the Tzanakis score are effective screening tools.

Table 1. Characteristics of Research Subjects

Demographics	Sum
Gender	
Man	63 (34,2%)
Woman	121 (65,8%)
Age Range (Years)	18 – 67
Average Age of Elementary School (Years)±	
Man	31,41 11,65±
Woman	26,40 9,36±
Diagnosis Home	
Acute appendicitis	111 (60,3%)
Not Acute Appendicitis	73 (39,7%)
Acute appendicitis	
Man	38 (34,2%)
Woman	73 (65,7%)
Age Range	18 – 67
Average Age of Elementary School (Years)±	28,61 11,13±

Table 2. Demographic Distribution of Alvarado Scores

Demographics	Sum
Iliac fossa tenderness moves to the right	160 (87%)
Right iliac fossa tenderness	184 (100%)
Rebound tenderness	180 (97,8%)

Fever	33 (17,9%)
Leukocytosis	120 (65,2%)
Shift to the left neutrophil	93 (50,5%)
Anorexia	22 (12%)
Nausea, vomiting	71 (38,6%)
Leukocyte count value	
< 5,000/^{mm3}	7 (3,8%)
5,000 – 10,000/^{mm3}	56 (30,4%)
> 10,000/^{mm3}	121 (65,8%)

Table 3. Demographic Distribution of Tzanakis Scores

Demographics	Sum
Right lower quadrant abdominal pain	184 (100%)
Rebound tenderness	180 (97,8%)
Leukocytes > 12,000 / mm^3	74 (40,2%)
Ultrasound examination	
Suspect acute appendicitis	87 (47,3%)
Not acute appendicitis	97 (52,7%)

Table 4. Comparison of Alvarado's Score Results with Final Diagnosis

	Acute appendicitis	Not Acute Appendicitis
Positive	76	2
Negative	35	71

Table 5. Comparison of Tzanakis Score Results with Final Diagnosis

	Acute appendicitis	Not Acute Appendicitis
Positive	99	15
Negative	12	58

Table 6. Comparison of Alvarado Score with Tzanakis Score

	Alvarado Score	Tzanakis Score
Sensitivity	69% (95% CI = 60-70%)	89% (95% CI = 85-95%)
Specificity	97% (95% CI = 94-100%)	80% (95% CI = 70-89%)

Accuracy	79,8%	85,3%
Positive Predictive Value	97,4%	86,8%
Negative Forecasting Value	67%	82,9%

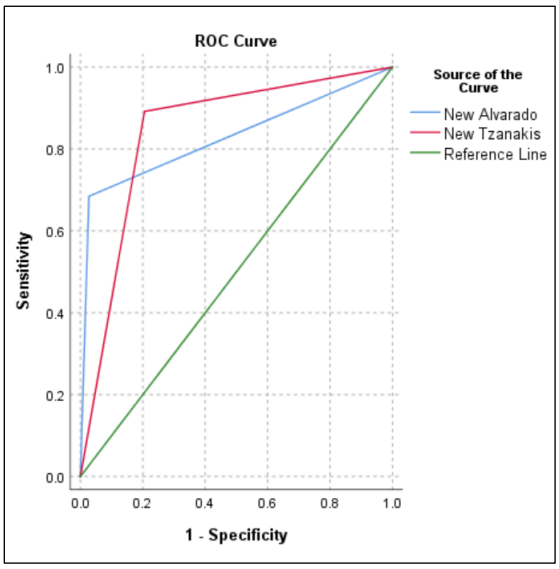

Figure 1. *Receiver operating characteristic* (ROC) curve (n = 184)

CONCLUSION

In the 2017-2019 period, there were 111 cases of acute appendicitis with more female patients than male patients. All patients had complaints of lower right abdominal pain, 97% of patients had rebound tenderness, 87% of patients had tenderness in the right iliac fossa that moved, 65% had an increase in leukocytes (> 10,000 / mm3), 50% of patients had a change in the composition of leukocyte cells towards younger cells (shift to the left), 38% of patients complained of nausea vomiting, 17% had a rise in body temperature and 12% had a decrease in appetite.

Alvarado's score is more specific than Tzanakis' score while Tzanakis' score is more sensitive than Alvarado's.

The implications of the results of this study can be done as follows. The Alvarado score has a higher specificity and consists of a physical examination and a simple lab examination, which can help clinicians in first-level health facilities to prove the patient is not acute appendicitis with the reference that patients with a score of 5-6 may have appendicitis, where patients can go home and come back if they feel symptoms again, then patients with a score of 7-8 are most likely to have appendicitis, While a score of 9-10 means that the patient must have appendicitis. Thus, appendicitis screening has started from first-level health facilities. Meanwhile, a Tzanakis score with high sensitivity can help confirm the diagnosis of acute appendicitis provided that there is an ultrasound examination in addition to physical and laboratory examinations.

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