

Correlation Between Alvarado Score with Surgical Findings in Acute Appendicitis Patients at RSUD Dr. H. Chasan Boesoirie Ternate

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Abstrak

Apendisitis akut merupakan penyebab tersering bedah darurat di dunia. Identifikasi akurat pasien yang membutuhkan pembedahan segera dibandingkan observasi aktif tidak selalu mudah dilakukan sehingga dibuat berbagai sistem skor, termasuk skor Alvarado yang memuat berbagai temuan klinis. Penundaan tindakan bedah berakibat pada progresivitas penyakit ini. Temuan operasi perforasi sebagian besar ditemukan pada skor Alvarado yang lebih tinggi. Tujuan penelitian ini untuk mengetahui hubungan skor Alvarado dengan temuan operasi pasien apendisitis akut di RSUD Dr. H. Chasan Boesoirie Ternate. Penelitian ini merupakan penelitian analitik observasional dengan rancangan *cross-sectional* menggunakan data sekunder berupa data rekam medik pasien apendisitis akut yang menjalani operasi di RSUD Dr. H. Chasan Boesoirie Ternate periode 2020-2022 yang memenuhi kriteria inklusi dan eksklusi berjumlah 49 sampel. Data yang diambil berupa usia, jenis kelamin, skor Alvarado dan temuan operasi. Sampel kemudian dianalisis secara univariat dan bivariat menggunakan uji korelasi spearman. Karakteristik pasien apendisitis akut mayoritas pada kelompok usia 17-25 tahun (46,9%), berjenis kelamin laki-laki (63,3%), kelompok skor alvarado 7-10 (55,1%) dan temuan operasi perforasi (65,3%). Berdasarkan analisis bivariat, didapatkan $p = 0,019$ ($p < 0,05$) yang berarti terdapat hubungan signifikan antara skor Alvarado dengan temuan operasi pasien apendisitis akut di RSUD Dr. H. Chasan Boesoirie Ternate.

Keywords: apendisitis akut; skor Alvarado; temuan operasi; rekam medik

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Abstract

Acute appendicitis is the most common cause of emergency surgery in the world. Patients who need immediate surgery compared to patients under active observation often difficult to identified, so several system scores have been found including Alvarado score which based on clinical findings. Delayed of surgical treatment results in the progression of this disease. Perforation were mostly found at higher Alvarado scores. This study aims to determine the correlation between the Alvarado score with surgical findings of acute appendicitis patients at RSUD Dr. H. Chasan Boesoirie Ternate. This research is an observational analytical study with a cross-sectional design using secondary data in the form of medical record data of acute appendicitis patients who underwent surgery at RSUD Dr. H. Chasan Boesoirie Ternate during 2020-2022 period who met the inclusion and exclusion criteria amounted to 49 samples. Data taken included age, gender, Alvarado score and surgical findings. The samples were then analyzed univariately and bivariately using Spearman's correlation. Characteristics of acute appendicitis patients were the majority in the age group 17-25 years (46.9%), male (63.3%), Alvarado score group 7-10 (55.1%) and surgical findings of perforation (65, 3%). Based on bivariate analysis, $p = 0.019$ ($p < 0.05$) was obtained, which means there was a significant relationship between the Alvarado score and the surgical findings of acute appendicitis patients at RSUD Dr. H. Chasan Boesoirie Ternate.

Keyword: acute appendicitis; Alvarado score; surgical findings; medical record

Introduction

Acute appendicitis is an inflammation of the vermiform appendix organ due to obstruction of the appendiceal lumen that can give local signs whether accompanied by local peritoneal stimulation or not (1). In addition, acute appendicitis is also the most common cause of acute abdomen and indication for emergency surgery in the world (2). Epidemiologically, cases of acute appendicitis increased by 38.8% of cases from 1990 to 2019 to 17.7 million cases in the world. In the same year, the incidence of acute appendicitis also increased by 11.4% incidence to 228 cases per 100,000 population in the world (3). The prevalence of acute appendicitis in Indonesia is the highest in Southeast Asia at 0.5%, followed by the Philippines. In addition, in 2016 and 2017 there was an increase in appendicitis cases in Indonesia from 65,755 patients to 75,601 patients. Based on data obtained from RSUD Dr. H. Chasan Boesoirie Ternate, appendicitis cases amounted to 53 cases in 2021. Meanwhile, in 2022 there was an increase in appendicitis cases to 58 cases (4–6). Patients with acute appendicitis often present with typical symptoms and physical findings, but accurate identification of patients who need immediate surgery compared to patients who need active observation is not always easy to do. Several scoring systems have been created to improve the sensitivity and specificity in diagnosing acute appendicitis and reduce the rate of appendectomy with negative results (7). Various score systems have been developed to standardize the diagnosis of acute appendicitis patients, namely, Alvarado score, Appendicitis Inflammatory Response Score (AIR Score), Raja Isteri Pangiran Anak Salehah Appendicitis (RIPASA Score), and other scores (8).

The first and most popular score system used in assessing acute appendicitis is the Alvarado score. This score was created by Alfredo Alvarado in 1986 which contains 8 predictive factors that are useful in diagnosing acute appendicitis. The predictive factors in question are based on symptoms, signs, and laboratory findings that are often found in patients with acute appendicitis, which consist of tenderness, pain migration, anorexia, nausea and vomiting, rebound pain, temperature rise, leukocytosis, and shift to the left. Assessment using the score has a total score of 10 with the aim of reducing appendectomy rates with negative results without increasing the risk of perforation (9). Based on the literature review on the accuracy of the Alvarado score, the mean accuracy with a sensitivity of 72.92% and specificity of 67.17% indicates that the use of this score can still be used in daily practice to

diagnose appendicitis in the Asian region. It is also a simple and inexpensive score compared to other scoring systems (10).

The only appropriate management for acute appendicitis is surgery (appendectomy) which can be performed either closed or open. Delaying surgery may result in progression of the disease (1). Appendices that are surgical findings are generally classified by surgeons based on macroscopic observation, consisting of the catarrhal stage, suppurative stage, gangrenous stage, and perforated stage (11). Various stages of appendicitis show different physical signs and symptoms (12). Previous research conducted at Muhammadiyah Palembang Hospital on the relationship between the Alvarado score and the findings of surgical outcomes in appendicitis patients found that there was a significant relationship through the chi-square test with a p-value of 0.001 ($p < 0.05$). Perforated appendicitis stages are more commonly found in higher Alvarado scores (>7) compared to patients with lower Alvarado scores (≤ 7) (13). Based on the explanation above, the formulation of the problem is whether there is a relationship between Alvarado score and surgical findings in patients with acute appendicitis at RSUD Dr. H. Chasan Boesoirie Ternate. The purpose of this study was to determine the characteristics of acute appendicitis patients at RSUD Dr. H. Chasan Boesoirie Ternate based on age, gender, alvarado score, morphological surgical findings, and the relationship between alvarado score and surgical findings in acute appendicitis patients at RSUD Dr. H. Chasan Boesoirie Ternate.

Methods

This study used an observational analytic design with a retrospective cross-sectional approach conducted at RSUD Dr. H. Chasan Boesoirie Ternate from November to December 2023. The population of this study were all acute appendicitis patients who had undergone surgery. The sample of this study were all acute appendicitis patients who had undergone surgery and were recorded in medical records at RSUD Dr. H. Chasan Boesoirie Ternate for the period 2020-2022 who met the inclusion and exclusion criteria totaling 49 samples. Samples were taken using purposive sampling technique. The inclusion criteria were patients aged ≥ 17 years, having undergone appendectomy surgery and complete medical record data according to variable needs. While the exclusion criteria were patients in pregnancy, patients with immunodeficiency diseases and patients with tumor surgery findings. The data taken came from secondary data in the form of medical record data for acute appendicitis patients at RSUD Dr. H. Chasan Boesoirie Ternate for the period 2020-2022. Data taken in the form of

age, gender, Alvarado score, and patient surgery findings. The data were then processed and analyzed with SPSS (Statistical Package for the Social Science) software. Univariate analysis was presented in the form of frequency distribution tables of sample characteristics. Meanwhile, bivariate analysis was carried out using the Spearman correlation test on SPSS to determine the relationship between Alvarado score and surgical findings in patients with acute appendicitis at RSUD Dr. H. Chasan Boesoirie Ternate for the period 2020-2022.

Research Results

Table 1. Sample characteristics

Karakteristik	n=49	%
Age (years)		
17-25	23	46,9
26-35	12	24,5
36-45	10	20,4
46-55	2	4,1
56-65	1	2,0
>65	1	2,0
Gender		
Male	31	63,3
Female	18	36,7
Alvarado scores		
1-4	7	14,3
5-6	15	30,6
7-10	27	55,1
Surgical finding based on morphological intraoperative findings		
Catarrhalis	9	18,4
Suppurative	4	8,2
Gangrenous	4	8,2
Perforated	32	65,3
Total	49	100

Based on the univariate analysis in the table above (Table 1), the distribution of characteristics of patients with acute appendicitis was highest in the age group 17-25 years as many as 23 samples (46.9%). While the group aged 26-35 years were 12 samples (24.5%), aged 36-45 years were 10 samples (20.4%), aged 46-55 years were 2 samples (4.1%), aged 56-65 years were 1 sample, and aged > 65 years were 1 sample. Based on gender, 31 samples were dominated by men (63.3%) and 18 samples were female (36.7%). Based on the Alvarado score, the most in the Alvarado score group 7-10 were 27 samples (55.1%). While 1-4 as many as 7 samples (14.3%) and 5-6 as many as 15 samples (30.6%). Based on the surgical findings, the most perforation surgical findings were 32 samples (65.3%). Meanwhile, there were 9 samples of catarrhalis (18.4%), 4 samples of suppurative (8.2%), and 4 samples of gangrenous (8.2%).

Table 2. Correlation Between Alvarado Score with Surgical Findings in Acute Appendicitis Patients

Skor Alvarado	Temuan Operasi				Total	<i>p-value</i>
	Katarhalis	Supuratif	Gangrenosa	Perforasi		
1-4	5	0	0	2	7	0,019
5-6	2	2	1	10	15	
7-10	2	2	3	20	27	
Total	9	4	4	32	49	

Based on Table 2, patients who had an alvarado score of 1-4 with catarrhalis surgical findings were 5 patients (71.4%), there were no patients with suppurative and gangrenous surgical findings and patients with perforation surgical findings were 2 patients (28.6%). In addition, patients who had an alvarado score of 5-6 with catarrhalis surgery findings were 2 patients (13.3%), suppurative surgery findings were 2 patients (13.3%), gangrenous surgery findings were 1 patient (6.7%) and perforation surgery findings were 10 patients (67.7%). Finally, patients with an alvarado score of 7-10 with catarrhalis surgery findings were 2 patients (7.4%), suppurative surgery findings were 2 patients (7.4%), gangrenous surgery findings were 3 patients (11.1%) and perforation surgery findings were 20 patients (74.4%). Based on bivariate analysis with the spearman correlation test, the *p-value* was 0.019 ($p < 0.05$) which means that there was a statistically significant relationship between the alvarado score and the surgical findings of acute appendicitis patients at RSUD Dr. H. Chasan Boesoirie Ternate.

Discussion

Based on the results of this study, the characteristics of acute appendicitis patients based on age, found the most in the age group 17-25 years, as many as 23 patients (46.9%). This is in line with research conducted at Sanglah Denpasar Central General Hospital on 110 patients with acute appendicitis, the largest group was obtained at the age of 17-25 years, as many as 38 patients (34.5%) (14). In addition, another study conducted at Undata Palu Hospital on 14 patients found the most in the age group 17-25 years as many as 7 patients (50%) (15). The incidence of appendicitis can occur in all age groups. However, the age group with the highest incidence occurs at the age of 20-30 years. Afterward, as age increases,

the incidence of appendicitis also decreases (1). In adults, the anatomy of the appendix is tubular with a lumen that narrows proximally and widens distally. Normally, the appendix secretes mucus that is channeled into the cecum from its lumen. Obstruction of this mucus flow plays a role in the pathogenesis of appendicitis. Unlike the shape of the appendix in infants, which is dilated proximally and narrowed distally, the incidence of acute appendicitis at this age tends to be lower. In the elderly, anatomical changes in the appendix become narrower, but due to the vague symptoms felt, it can be a factor in delaying diagnosis so that patients come already with complications (1).

Based on the results of this study, the characteristics of acute appendicitis patients based on gender were dominated by men, namely 31 patients (63.3%) compared to women, namely 18 patients (36.7%). This is in line with research conducted by Sarla on 69 patients with acute appendicitis, where most patients were male, namely 44 patients (63.76%) compared to 25 patients who were female (36.23%) (16). In addition, another study conducted by Aithmia, Choudhary, and Mahajan on 250 patients was also found to be mostly male, namely 190 patients (76%) (17). In general, the incidence of appendicitis in men and women is comparable. However, there are exceptions at the age of 20-30 years which are higher in men (1). Men are more at risk of appendicitis than women during their lifetime (8.6% vs. 6.7%) and more often at the age of 10-30 years with a male to female ratio of 1.4:1 (18). In addition, based on literature studies on risk factors associated with the incidence of acute appendicitis, it is found that gender is associated with the incidence of acute appendicitis. The structure of the appendix in men has more lymphoid tissue than women so that the incidence of appendicitis in men is higher. More frequent fiber consumption in women may also play a role in the low incidence of appendicitis in women. Low fiber consumption causes obstruction of the appendiceal lumen and increased growth of normal colonic flora so that appendicitis is easier to occur (19).

Based on the results of this study, the characteristics of acute appendicitis patients based on the alvarado score were most in the alvarado score group 7-10, as many as 27 patients (55.1%). This is in line with research conducted at the Gajah Mada University Academic Hospital on 173 patients with acute appendicitis, where the largest group of patients had an alvarado score ≥ 7 , as many as 124 patients (71.68%) (20). In addition, another study conducted at Mahatma Gandhi Hospital on 100 patients also found the most in the alvarado score ≥ 7 group, as many as 65 patients (65%) (21). The Alvarado score consists of clinical findings in the form of symptoms, signs, and laboratory findings that are often found

in patients with acute appendicitis with a total score of 10. Scores 7-10 can predict patients with the possibility of appendicitis as much as 93%. Meanwhile, scores 1-4 and 5-6 are 30% and 66% respectively (9). Based on a systematic review of the Alvarado score as a predictor of acute appendicitis, an Alvarado score of ≥ 7 is useful for identifying patients with a high risk of acute appendicitis who require surgical consultation or further supporting examinations. However, the accuracy of this score with a cut-off point of 7 in processing appendicitis patients who will be operated on is not very specific so that the benefit of applying this score is more to determine high-risk patients who will be treated further such as conducting supporting examinations in the form of imaging rather than as a single criterion for patients to be managed surgically. However, in low-resource settings where surgical decisions are based on clinical judgment, the Alvarado score can be an accurate and consistent triage tool to rule out appendicitis and identify high-risk patients (22). The Alvarado score was found to over-predict the diagnosis of appendicitis in women in all risk categories so the use of this score needs careful attention, especially in women because symptoms found in women such as abdominal pain do not necessarily indicate appendicitis, there are other possible diagnoses, such as pelvic inflammatory disease (PID) and other gynecological diseases (22).

Based on the results of this study, the characteristics of acute appendicitis patients based on surgical findings were most in the perforation surgery findings group, namely 32 patients (65.3%). This is in line with previous research conducted at RSUD Dr. H. Chasan Boesoirie Ternate on 47 patients with acute appendicitis found the largest group of patients with perforation surgery findings, as many as 19 patients (40.4%) (23). In addition, another study conducted in India on 237 patients also found the most in the findings of perforation surgery, namely 86 patients (36%) (24). Various factors that play a role in the occurrence of perforated appendicitis are the presence of fecalith, age, and delay in diagnosis. The incidence of perforation tends to be high in the elderly and children because in the elderly the symptoms that arise are not typical, there is a delay in getting treatment, a degenerative process that makes the lumen narrow and arteriosclerosis. Whereas, in children the thin wall of the appendix, diagnosis takes longer due to lack of cooperation, incomplete walling process due to rapid perforation and undeveloped omentum are factors that play a role in the high incidence of perforation at this age (1).

According to the results of bivariate analysis using the Spearman correlation test, the p-value was 0.019 ($p < 0.05$) which can be concluded that there is a relationship between the

Alvarado score and the surgical findings of acute appendicitis patients. These results are in line with research conducted at the Muhammadiyah Palembang Hospital on 44 patients, there are patients with Alvarado scores > 7 dominated by the findings of perforated appendicitis surgery results, namely as many as 10 patients compared to 6 patients with acute appendicitis so that the findings of perforation operations tend to have high Alvarado scores. Through the chi-square test, this study obtained a p-value of 0.001 ($p < 0.05$) which showed that there was an association between the Alvarado score and the findings of the operation (13). In addition, another study conducted at Dr. R. N. Cooper Hospital on 150 samples was dominated by Alvarado scores 8-9 as many as 85 patients (56.66%) of which 55 patients (64.7%) were patients with perforated appendicitis. There is a significant relationship between the high Alvarado score in patients with perforated appendicitis and appendicitis without perforation (p value 0.01) (25). The Alvarado score is an easy and simple score based on history taking, physical examination, and laboratory tests. The application of the Alvarado score is also an economical alternative to other costly diagnostic tools such as CT scan and MRI (26).

It should be noted that this study assessed the Alvarado score after surgery, so the decision of whether to perform surgery was not based on this score but on the patient's clinical diagnosis and supporting examinations such as ultrasound. This explains why patients with a score of 1-4 in this study were still operated on. In addition, each individual's different immune response to the acute appendicitis process is also influential in determining the Alvarado score considering that this score is determined based on the patient's clinical findings, such as in the elderly whose symptoms were vague so the score tended to be low but the operative findings had been perforated.

High Alvarado score and delayed diagnosis were the main risk factors for high incidence of perforation. 72.7% of patients with perforation presented 24 hours after symptom onset and all of these patients had an Alvarado score >7 , requiring intensive management of patients with these characteristics. In addition, the Alvarado score is useful in reducing the incidence of perforated appendicitis and its accompanying morbidity and mortality (27). In prioritizing patients for surgery, the Alvarado score can be a good indicator in assessing the severity of acute appendicitis (28).

Conclusion and Suggestion

Based on the results of this study, it is concluded that the characteristics of acute appendicitis patients were mostly experienced at the age of 17-25 years and male. Most

patients were found with Alvarado scores of 7-10 and perforation surgery findings. Statistically, there was a relationship between Alvarado score and surgical findings of acute appendicitis patients at RSUD Dr. H. Chasan Boesoirie Ternate with a p-value of 0.019 ($p < 0.05$). This study is expected to be a reference for considering a high Alvarado score as a triage tool in ruling out acute appendicitis and determining patients with a high risk of acute appendicitis.

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