

Relationship between High Alvarado Scores and Complicate Acute Appendicitis in Acute Appendicitis Patients That Undergo Appendicectomy Surgery

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ABSTRACT

Background/aim: Alvarado score can help diagnose acute appendicitis based on predictive clinical factors and reduce the number of radiological examinations. Correct diagnosis and early surgical intervention are the best treatment to reduce morbidity, mortality and complications, with appendicectomy as the gold standard of treatment. This study aims to determine the relationship between a high Alvarado score and the occurrence of complicated acute appendicitis in acute appendicitis patients who underwent appendicectomy surgery at Sanglah General Hospital.

Methods: This study used a cross sectional design. Data observation was carried out retrospectively. The research sample in this study was selected sequentially (consecutive sampling) which involved 108 respondents who had met the inclusion criteria and there were no exclusion criteria. Data analysis in this study consisted of univariate analysis (descriptive statistics), bivariate analysis (Chi Square test) and multivariate analysis (logistic regression).

Results: Alvarado score in the complicated group obtained with a mean of 7.4 (SD: 1.2) and the non-complicated group obtained with a mean of 6.7 (SD: 1.8) with p value = 0.049. Alvarado score 7 with the occurrence of complicated appendicitis as many as 45 respondents (41.7%) and 29 respondents non-complicated (26.9%), Alvarado score <7 with complicated appendicitis status as many as 9 respondents (8.3%) and non-complicated as many as 25 respondents (23.1%).

Conclusion: There is a significant relationship between a high Alvarado score and the occurrence of complicated acute appendicitis in patients with acute appendicitis who underwent appendicectomy with a 4 times chance of complications if they have a high Alvarado score.

Keywords: Appendicitis, Alvarado score, complications, clinical symptoms

INTRODUCTION

Abdominal pain is the most frequent complaint by patients in the emergency department, one of which is due to acute appendicitis, the most frequent cause of

abdominal emergencies [1], and appendicectomy is the gold standard of treatment. Approximately 90 to 100 patients per 100.000 population experience this disease annually [2] but the presence of atypical symptoms makes diagnosis more difficult, where typical symptoms & laboratory tests may not occur in 20-33 % of cases, especially in the early stages and if there is a misdiagnosis it can lead to complications such as perforation, abscess, surgical site infection, sepsis to death.[1,3]

Correct diagnosis and early surgical intervention is the best treatment to reduce morbidity and mortality, length of stay and cost of care.[3] The role of radiological examination in diagnosis, such as Ultrasonography which has a high false positive and false negative rate.[4] While Computed Tomography is more of an option because of its higher sensitivity and specificity, but is relatively expensive and not available in various centers.[5] The definitive method for confirming the diagnosis of acute appendicitis is through histopathological examination of the appendix tissue.[6] However, the presence of clinical tests such as scoring can help establish the diagnosis of Acute Appendicitis, including the Alvarado Score, Pediatric Alvarado Score, RIPASA Score, Appendicitis Inflammatory Response Score, New Adult Appendicitis Score.[7]

The Alvarado score describes a scoring system based on eight predictive clinical factors to assist in the assessment of the diagnosis of Acute Appendicitis, with a maximum of 10 points [8], is still used in remote areas and was designed with the aim of reducing the number of radiological examinations performed. According to ROC curve analysis, the best limit value for Alvarado scoring in the diagnosis of acute appendicitis was 7. Histopathological appendicitis was found in all patients with Alvarado score >7. Acute appendicitis has a positive predictive value of 93.7 percent for the optimum cut-off value.[9] Therefore, this study was conducted to determine the relationship between a high Alvarado score

and the occurrence of complicated acute appendicitis in acute appendicitis patients who underwent appendicectomy surgery at Sanglah Hospital.

METHOD

This study used a cross-sectional design to determine the high Alvarado score associated with the occurrence of complicated acute appendicitis in acute appendicitis patients who undergo appendicectomy surgery. The research has received an ethical suitability letter from the Ethics Commission of the Research and Development Unit from the Faculty of Medicine, Udayana University/Sanglah General Hospital, followed by identification of cases, namely individuals who have been diagnosed with acute appendicitis who are histopathologically upright. Furthermore, retrospective data observation was carried out to identify the Alvarado score of the patient.

The study was conducted through observations in the Anatomical Pathological Room and patient medical records at the Medical Record Installation of Sanglah General Hospital, using secondary data derived from patient histopathological administrative data and others from patient medical records, starting in January 2019.

Samples of this study were part of an accessible population with an amount according to the minimum sample size calculation, selected in a certain way and fulfilled the requirements as a sample and meets the inclusion and exclusion criteria. The research samples were selected sequentially (consecutive sampling), namely patients diagnosed with acute appendicitis who undergo appendicectomy surgery from December 2019 until the required number of samples was met. The sample in this study were 108 people.

RESULT

This study involved 108 respondents to find out that a high Alvarado score is associated with the occurrence of complicated acute appendicitis in acute

appendicitis patients who underwent appendicectomy surgery. Characteristics based on gender obtained male sex in the complicated appendicitis group obtained 34 respondents (31.5%) and in the non-complicated group as many as 18 respondents (16.7%) while the female sex obtained data in the complicated group as many as 20 respondents (18.5%) and 36 respondents (33.3%) in the non-complicated group with p value = 0.002, which means that there is a significant difference between the complicated group and the non-complicated group (Table 1).

Characteristics based on age in the complicated appendicitis group got an

average of 27.8 (SD: 13.6) while the non-complicated appendicitis group of 54 respondents got an average of 25.8 (SD: 1.7) with p value = 0.381. Characteristics based on the Alvarado score in the complicated group were obtained with a mean of 7.4 (SD: 1.2) and the Alvarado score in the non-complicated group was obtained with a mean of 6.7 (SD: 1.8) with p value = 0.049. Characteristics based on age and Alvarado scores showed that there was no significant difference between the complicated group and the non-complicated group.

Table 1 Characteristics of Respondents Based on Age, Gender and Alvarado Score

Variable	Appendicitis Severity Status		p Nilai value
	Complicated appendicitis (n=54)	Non-complicated appendicitis (n=54)	
Age (mean, SD)	27.8 ± 13.6	25.8 ± 1.7	0.381
Gender (n,%)			
• Man	34 (31.5%)	18 (16.7%)	0.002*
• Woman	20 (18.5%)	36 (33.3%)	
Alvarado Score (mean,SD)	7.4±1.2	6.7±1.8	0.049

*p value <0.05: significantly different

Analysis to determine the relationship of each variable age, gender and Alvarado score with the occurrence of complicated

acute appendicitis in acute appendicitis patients can be seen in Table 5.2.

Table 2 Relations of Age, Gender, and Alvarado Score to the occurrence of complicated acute appendicitis.

Variable	Appendicitis Severity Status		RP	95% CI	p Nilai value
	Complicated appendicitis (n=54)	Non-complicated appendicitis (n=54)			
Age (n, SD%)					
• 40 years	9 (8.3%)	6 (5.6%)	1.2	0.78-1.97	0.404
• < 40 years	45 (41.7%)	48 (44.4%)			
Gender (n, %)					
• Male	34 (31.5%)	18 (16.7%)	1.8	1.22-2.74	0.002*
• female	20 (18.5%)	36 (33.3%)			
Alvarado Score (n,%)					
• 7	45 (41.7%)	29 (26.9%)	2.2	1.27-4.14	0.001*
• < 7	9 (8.3%)	25 (23.1%)			

*Chi-square Test: p < 0.05: significant relation

The age category with acute appendicitis status obtained data based on age 40 years with the occurrence of complicated appendicitis as many as 9 respondents (8.3%) and non-complicated as many as 6 respondents (5.6%) while age < 40 years with complicated appendicitis status as many as 45 respondents (41.7%) and 48 respondents (44.4%). The results of the analysis were obtained with a p value of 0.404 > 0.05 meaning there was no significant relationship between age and the severity of acute appendicitis but the RP

value 1.2 > 1 (CI: 0.78-1.97) meaning age can be a risk factor that increases the risk of acute appendicitis. complicated acute appendicitis.

Based on gender with acute appendicitis status, data obtained for male sex with the occurrence of complicated appendicitis as many as 34 respondents (31.5%) and non-complicated as many as 18 respondents (16.7%), while female gender data obtained with complicated appendicitis status. as many as 20 respondents (18.5%) and non-complicated as many as 36

respondents (33.3%). The results of the analysis were obtained with a p-value of 0.002 <0.05, meaning that there was a significant relationship between gender and the severity of acute appendicitis, the RP value of 1.8 > 1 (CI: 1.22-2.74), meaning that male risk factors that increase the occurrence of complicated acute appendicitis.

Alvarado score with acute appendicitis status obtained data based on a score of 7 with the occurrence of complicated appendicitis as many as 45

respondents (41.7%) and non-complicated as many as 29 respondents (26.9%) while the score < 7 with complicated appendicitis status as many as 9 respondents (8,3%) and non-complicated as many as 25 respondents (23.1%). The results of the analysis obtained with a p value of 0.001 <0.05, meaning that there was a significant relationship between Alvarado's score and the severity of acute appendicitis, but the RP value of 2.2 > 1 (CI: 1.27-4.14) means that Alvarado's score 7 can be a factor. increased risk of complicated acute appendicitis.

Table 3 Variables that affect the occurrence of complicated acute appendicitis in acute appendicitis patients

Variabel	B	Adj (PR)	CI 95%	p
Age	0,218	1,2	0,37-4,13	0,721
Gender	1,144	3,1	1,36-7,23	0,007*
Alvarado Score (n, %)	1,401	4	1,60-10,26	0,003*

*p value <0.05: significantly different

The description of table 3 shows the variables that were analysed together and then obtained age data with a positive B value with adj OR 1.2 and p value = 0.721, gender was obtained with a positive B value adj OR 3.1 and p value = 0.007 and the Alvarado score was obtained with a positive B value with the highest adj OR value of 4 with a p value of 0.003. So it can be concluded that a high Alvarado score can cause complicated acute appendicitis in acute appendicitis patients with 4 times the chance of occurrence. A high Alvarado score is the most dominant factor in the occurrence of complicated acute appendicitis in acute appendicitis patients.

DISCUSSION

Characteristics of Respondents

The age of the respondents in this study was found to be an average of 27.8 years in complicated cases of appendicitis and an average of 25.8 years in non-complicated cases. The results of this study differed in mean age from the study Ashkan et al., (2020) which found the mean age was 28.3 years. [10] The results of different studies in age characteristics were found in Butt et al., (2014) which found a mean age of 23.5 years but with the highest number of cases being male.[11] Different results were also obtained in the study Dharmarajan and

Arvindraj, (2019) in their research, the average age was 22.9 years.[12] The mean age of 26.8 years was found in the study Ozsoy et al., (2017) with the highest number of cases found in men (52.9%).[9]

Characteristics based on gender found that the most cases in complicated cases were men as much as 31.5% while in non-complicated cases, women were the most cases (33.3%). The results of this study are different from research Ashkan et al., (2020) which found that the largest number in their study 56% were men with 42.1% of patients having a low probability, 29.2% having a moderate probability and 28.8% having a high probability of appendicitis. [10] The number of male patients was also found to be higher than that of women in the study.[12]

The relationship between age, gender and high Alvarado score with the occurrence of complicated acute appendicitis in acute appendicitis patients undergoing appendicectomy surgery

The age group 40 years with the occurrence of complicated appendicitis obtained as much as 8.3% while the age < 40 years with the status of complicated appendicitis was 41.7% and the non-complicated was 44.4% with no significant relationship between age and the severity of

acute appendicitis. Mohammad et al., (2020) found the median age was 20 years (range: 5 years to 81 years).[13] The status of complicated acute appendicitis in this study was found to be more male than female, while non-complicated appendicitis was found to be more female (33.3%). The incidence of appendicitis reaches its peak in the late adolescent age group, namely the age of 17-25 years. The cases of appendicitis between men and women are generally the same. There is a difference at the age of 20-30 years, where cases of appendicitis are more common in males at that age.[14]

The results of the analysis showed that there was a relationship between gender and the severity of acute appendicitis, the value of $RP\ 1.8 > 1$, which means that male sex can be a risk factor that increases the occurrence of complicated acute appendicitis. The study Mohammad et al., (2020) involving 201 respondents found 115 men and 86 women with a total of 67.6% being adults and 32.3% being pediatrics. Of the adult group, 83 were male and 53 female, and of the children group, 32 were male and 33 female.

Alvarado score category with acute appendicitis status obtained data based on Alvarado score 7 with the occurrence of complicated appendicitis as many as 45 respondents (41.7%) and non-complicated as many as 29 respondents (26.9%) while Alvarado score <7 with complicated appendicitis status as many as 9 respondents (8.3%) and non-complicated as many as 25 respondents (23.1%). The results of the analysis were obtained with a p-value of $0.001 < 0.05$, meaning that there was a relationship between Alvarado's score and the severity of acute appendicitis, but the RP value of $2.2 > 1$ ($CI: 1.27-4.14$) means that Alvarado's score 7 can be risk factors that increase the occurrence of complicated acute appendicitis.[13]

The division of categorization of acute appendicitis into complicated or non-complicated, based on the operating report and the results of histopathological

examination of the appendix. Complicated acute appendicitis was defined as gangrenous or perforated appendicitis, or the presence of diffuse peritonitis. In the event that there is a discrepancy between the operative findings and the pathology report, the surgical findings are decisive. Meanwhile, what is meant by non-complicated acute appendicitis, namely Acute Suppurative Appendicitis and Phlegmontosa Appendicitis [15]. According to the study, it was found that the mean Alvarado score in patients with normal or inflamed appendix (non-complicated) was 4.5 & 6, while in gangrenous and perforated appendicitis (complicated) it was 7.5 and 8.

The Alvarado score can be used to stratify patients with suspected symptoms of appendicitis but the validity of the scores in specific patient groups and at different cut-off points remains unclear. At the cut-off point 7, recommended for 'defining' appendicitis and progression to surgery, poor performers scored in each subgroup (81% overall specificity, 57% men, 73% women, 76%). Alvarado scores were well calibrated in men across all risk strata. The Alvarado score is well calibrated in men but inconsistent in children and overestimates the likelihood of appendicitis in women across all risk strata.[16]

The diagnosis of acute appendicitis can be made with a physical examination and simple laboratory tests. However, in certain circumstances, additional tests may be required. This approach has given good results in various studies around the world and has proven that the Alvarado score is a simple, practical, economical and reliable method for the diagnosis of acute appendicitis.[17] In recent years, controversy has arisen over the use of the RIPASA score in which some investigators claim that it gives better results than using the Alvarado score in South Asian and Middle Eastern populations. It is questionable how the RIPASA score containing the same predictive factors as the modified Alvarado score could lead to better clinical outcomes. It is important to know

that all additional parameters including the RIPASA score (age, gender, duration of pain, right lower back pain, guards, circumference marks, normal urinalysis and foreign ID card) did not have statistical significance items.[18]

The Alvarado score is still very useful in the diagnosis of acute appendicitis in the early stages of the disease and is aimed at reducing negative appendicitis and the rate of perforation. Nevertheless, there is still room for improvement and it is for that reason that I introduce here the Alvarado score (MANTRELS) while maintaining the original scoring scheme by adding some predictive factor substitutes which show good statistics. This Alvarado score can be useful for statistical purposes by providing more precise indexing of disease. For example, it can be used as a clinical indicator [12]

The most influential risk factors for complicated acute appendicitis in acute appendicitis patients undergoing appendicectomy surgery

The results showed that a high Alvarado score can cause complicated acute appendicitis in patients with acute appendicitis with a chance of 4 times. A high Alvarado score is the most dominant factor in the occurrence of complicated acute appendicitis in patients with acute appendicitis compared to age and gender.

Patients with high risk scores should be closely monitored postoperatively. Patients with a moderate risk score should receive immediate surgical treatment to prevent the risk of developing a complicated disease. Management should not be delayed by radiological examinations such as physical signs of fever, localized in the right lower quadrant tenderness, and rebound pain are signals for complicated appendicitis and should be properly examined. The absolute neutrophil count has predictive value for severe appendicitis and should be included in laboratory tests for patients with suspected acute appendicitis.[19]

Acute appendicitis is a disease with a long history of disease. The final diagnosis of acute appendicitis is only accurate by histopathological findings after appendectomy. Improper clinical judgment results in an incorrect diagnosis of appendicitis. Because of this, the system scoring system emerged to make the right decisions. The results showed that the modified Alvarado score at the cut-off value of 7 had a sensitivity of 93.33%, specificity 52.94%, and an accuracy of 84.42%, so that the modified Alvarado score is a safe tool in the diagnosis of acute appendicitis. due to the accepted sensitivity and higher specificity. This is especially helpful in low-income countries with limited resources [20]

A good diagnostic score for acute appendicitis should be simple, easy to remember, reusable, economical, and easy to apply In an emergency a diagnostic score for acute appendicitis can be useful for statistical purposes by providing a more precise index of disease. [21]

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that there is a significant relationship between a high Alvarado score and the occurrence of complicated acute appendicitis in acute appendicitis patients who underwent appendicectomy surgery with a 4 times chance of complications if they have a high Alvarado score.

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