

## Case Report

# EVALUATION OF ALVARADO SCORE IN DIAGNOSIS OF ACUTE APPENDICITIS

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## Abstract

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**Background:** Abdominal pain is frequently caused by acute appendicitis, which can be diagnosed early and result in a lower morbidity and death rate. Improved diagnostic procedures should minimize the progression to complicated appendicitis as well as reduce the number of unwanted surgical interventions. However, even with the advancements in diagnostic laboratory tests and contemporary radiographic imaging, appendicitis diagnosis is still primarily clinical. Different scoring methods were developed to reduce the negative appendectomy rate and raise the positive diagnosis rate of appendicitis such as Alvarado score. The present study aimed to evaluate the sensitivity and specificity of the Alvarado score as a method for the diagnosis of acute appendicitis. **Methods:** A total of 146 operated cases of appendectomy in Zawia Medical Center, Libya were studied. All patients presented during a period from July 2018 to July 2019 with symptoms and signs of acute appendicitis, and after that, they were operated on by the conventional method of open appendectomy. The relevant data was collected and analyzed, and the efficiency of the Alvarado scoring system was assessed by calculating sensitivity, positive predictive value, and negative appendectomy rate. **Results:** In this study, 100% of patients reported pain as their primary presenting symptom; presentations occurred between one and seven days, with a mean of two days; 100% of patients had surgery; and the overall negative appendectomy rate in Alvarado  $\geq 7$  was 5% and 72.5% was the positive predictive value (PPV). **Conclusion:** Our findings suggest that the Alvarado score has a very high positive predictive value, i.e., diagnostic accuracy. Also, with the help of the Alvarado score, we can reduce the number of negative appendectomies. Besides that, this scoring system is an easy, simple, cheap, reliable, safe, and fast tool in the preoperative diagnosis of acute appendicitis and can work effectively in routine practice.

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**Keywords:** Alvarado score, acute appendicitis, sensitivity, specificity, Positive predictive value

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## Introduction

Appendicitis is the most frequent abdominal surgical emergency worldwide (1) with an annual incidence

of 233 per 100,000 people, and its lifetime incidence risk ranges from 6.7% to 8.6%. (2) The term "appendicitis"

refers to inflammation of the vermiform appendix's internal lining. Its symptoms are nonspecific and may overlap with numerous other medical conditions, and it can be difficult to diagnose, especially in the early stages of presentation. (3,4) There is a high risk of morbidity caused by a delayed diagnosis, whereas appendicitis can cause serious consequences such as ileus, peritonitis, abscess, and even death. It can also result in considerable costs for the healthcare system. That leaves surgeons with no option but to operate when diagnosed clinically rather than wait until it is confirmed, which can lead to subjecting the patient to an unnecessary operation with all its pre-operative risks, especially in older people, ended by the removal of the normal appendix in about 15–30% of the cases. (5,6) Therefore, prompt and precise diagnosis is crucial for the appropriate management of this disease. For the diagnosis of acute appendicitis, the length of stomach discomfort, physical exam findings, and laboratory data are the most helpful factors. Various imaging techniques like ultrasound (US), computerized tomography (CT), and diagnostic laparoscopy have been employed to confirm the prediagnosis, with the goal of providing a quick and precise diagnosis. (7,8) In addition, numerous clinical scoring systems (CSSs) have been devised to predict acute appendicitis using various factors, Alvarado Scoring System (ASS) is one of them. (9,10) By using a clinical scoring system, one may forecast the occurrence of acute appendicitis and identify patients who require urgent medical attention or surgery to avoid

potential complications that could raise mortality and morbidity. However, the majority of them are complicated and impractical in an emergency situation. (11,12) The application and usefulness of ASS in the diagnosis of acute appendicitis has not been evaluated before at Zawia Medical Centre; as a result, the rate of negative appendectomy is not known. The aim of this study was to evaluate the usefulness of the scoring system in patients with a provisional diagnosis of acute appendicitis in Zawia Medical Center.

### **Materials and Methods**

In order to correct a high percentage of false-positive appendectomy, the Alvarado scoring system was first implemented as a diagnostic aid. This grading system is based on two test findings, three symptoms, and three signs (Table 1). (13) Our study was carried out on 146 patients admitted to the Surgical Ward of Zawia Medical Center, from the emergency department with clinical suspicions of acute appendicitis during the period from July 2018 to July 2019. Patients presenting to the emergency department with right iliac fossa pain and operated with appendectomy are included in the study. All included patients were admitted after initial assessment in the emergency department and base-line investigations, and the study format was filled in for each patient by a general surgery officer. The format included Alvarado score variables along with general patient demographics. Each patient's total score was computed, and according to the results,

the patients were categorized as males, females, and children (<12 years) and divided into two groups: group I, the Alvarado score  $\leq 7$  (low and intermediate suspicion group), and group II, the Alvarado score  $\geq 7$  (high suspicion group). Patients with a score of  $\geq 7$  underwent an appendectomy, while those with a score less than 7 were not considered for surgery unless there were compelling reasons to otherwise. After 24 hours of observation, regardless of score, patients were thought on clinical grounds to require appendectomy; this has been done. The decision for appendectomy was taken by a qualified surgeon. All patients were operated on by the conventional method of open appendectomy; details of the intraoperative findings were recorded. The sensitivity, specificity, positive and negative predictive value of Alvarado scoring system were calculated.

**Table 1:** Alvarado scoring system

Alvarado scoring system	
Symptoms	Score
Migratory right iliac fossa pain	1
Nausea/ vomiting	1
Anorexia	1
<b>Signs</b>	
Tenderness in right iliac fossa	2
Rebound tenderness in right iliac fossa	1
Elevated temperature	1
<b>Laboratory Findings</b>	
Leukocytosis	2
Shift to the left of neutrophils	1
<b>Total</b>	<b>10</b>

## Results

Our study was conducted on 146 patients with clinical picture of acute appendicitis. Among these patients 44 were female (30%) and 41 were male (28%) and 61 children (42%) as shown in Table 2. In group I, we had 44 patients with an Alvarado score of  $\leq 7$  (19 males, 15 females, and 10 children). The true negative (normal appendix) in this group was 13. In group II, with 47 patients, the Alvarado score was  $\geq 7$  (22 male, 15 female, and 10 children) with 4 false positives (normal appendix). In this study, the sensitivity of the Alvarado score was 58%, the specificity was 76%, and the positive predictive value was 91%, as shown in Table 4.

**Table 2:** Patient distribution

	Number of patients	Percentage
<b>Male</b>	41	28%
<b>Female</b>	44	30%
<b>Children</b>	61	42%
<b>Total</b>	<b>146</b>	

**Table 3:** Alvarado score distribution among patients

Alvarado score	No. of cases			
	Male	Female	Children	Total
$\leq 7$	19	15	10	44
$\geq 7$	22	15	10	47
<b>Total</b>				<b>91</b>

**Table 4:** Diagnostic accuracy of Alvarado score

Group	Total number of cases	Confirmed Appendicitis	Normal Appendix
<b>I (score <math>\geq</math> 7)</b>	47	43	4
<b>II (score <math>\leq</math> 7)</b>	44	31	13
<b>Sensitivity</b>		58%	
<b>specificity</b>		76%	
<b>Positive predictive value (PPV)</b>		91%	
<b>Negative predictive value (NPV)</b>		30%	

## Discussion

Even though it is the most frequent cause of acute abdominal pain, acute appendicitis is still difficult to diagnose because it is primarily a clinical diagnosis with several clinical pictures. The negative appendectomy rate in our study was 24%, which is consistent with the rates reported in the literature of 8 to 33%. (14) Clinical scoring systems have demonstrated potential for identifying several surgical conditions, including appendicitis. Different scoring methods have been created in recent years to aid in the diagnosis of

acute appendicitis. (15) To be helpful, the scoring system must be both sensitive and specific. In our study, the sensitivity was 58%, which is similar to that reported by Al Hashemy and Seleem (16) and lower than that reported by Lone et al., of 88% (17). The predicative value 91% in this study is close to that of other studies. (18,19) According to our findings, the Alvarado scoring system is not sensitive enough to be helpful in the diagnosis of acute appendicitis. The removal of a healthy appendix is a load on both patients and health resources (20) and in order to lower the rate of negative appendectomy in instances that are unclear, clinical diagnosis should be supported by other diagnostic modalities such as ultrasound, computed tomography (CT), and laparoscopy in atypical cases. (21)

## Conclusion

According to our findings, the Alvarado scoring system was not demonstrated to be a very helpful tool in the diagnosis of acute appendicitis in our study, perhaps due to the heterogeneity of the study population. Some adjustments and enhancements may be necessary to increase the sensitivity of the Alvarado scoring system.

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