

# The Validity of Alvarado Score in Diagnosis of Acute Appendicitis among Sudanese Patients

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## Abstract

### Background

Acute appendicitis is the most common cause of an acute abdomen in young adult with a life time risk of about 6% and appendectomy is the most frequently performed urgent abdominal operation. Diagnosis of acute appendicitis is clinical, the most widely used clinical scoring system is the Alvarado score also known by the acronym mantrels. A decision to operate depending on clinical suspicion only lead to removal of a normal appendix in 15- 30 % of cases

### Objectives

To Measure the diagnostic accuracy of Alvarado score as rule in score at cut point of 7 and Assessment of the rule of application of the score in reduction of negative appendectomy.

### Methods

This study is designed as descriptive cross sectional and includes 84 patients whom are admitted as a case of acute appendicitis by surgical emergency unit, Alvarado score was calculated for each patient. Data is analysed using SPSS.

### Results

Negative appendectomy was found in 7.1% of patients, all were Alvarado score below 7. 37% of overall patients had complicated appendix. At cut point 3 of the score no inflamed appendix was found and at cut of point 7 no normal appendix was found. Elevated temperature was found negative in 43.6% of positively inflamed appendix.

### Conclusion and recommendations

At cut point of 7 Diagnostic accuracy of Alvarado score is 100% (all patients at or above 7 have positive surgical appendicitis). 43% of those with positive appendicitis have no fever. Health education is required to improve and ensure early detection of appendicitis and decrease the high percentage of complicated appendix. Application of Alvarado score may decrease negative appendectomy. Alvarado score require revision and modification to include only high sensitive and specific clinical symptoms and signs and also it includes left shift of Neutrophil maturation, which is not routinely done in many laboratories.

**Keywords:** Alvarado score; Acute appendicitis; Sudanese patients; Complicated appendix

## Introduction

### Literature review

Acute Appendicitis is the most common abdominal emergency in both developed and developing countries. Approximately 6% of the population will suffer from acute appendicitis during their life time in Sudan it was found to be 63% of overall patients presented as acute abdomen [1-5].

### Aetiology of acute appendicitis

There is no unifying hypothesis regarding the aetiology of acute appendicitis. Decreased dietary fibre and increased consumption of refined carbohydrates may be important. The incidence of appendicitis is lowest in societies with a high dietary fibre intake. In developing countries that are adopting a more refined western-type diet, the incidence continues to rise. This is in contrast to the dramatic decrease in the incidence of appendicitis in western countries observed in the past 30 years. No reason has been established for these paradoxical changes; however, improved hygiene and a change in the pattern of childhood gastrointestinal infection related to the increased use of antibiotics may be responsible. While appendicitis is clearly associated with bacterial proliferation within the appendix, no single organism is responsible. A mixed growth of aerobic and anaerobic organisms is usual. The initiating

event causing bacterial proliferation is controversial. Obstruction of the appendix lumen has been widely held to be important, and some form of luminal obstruction, either by a facecloth or a stricture, is found in the majority of cases. A facecloth is composed of insistent faecal material, calcium phosphates, bacteria and epithelial debris. Rarely, a foreign body is incorporated into the mass. The incidental finding of a facecloth is a relative indication for prophylactic appendectomy [6,7]. The incidence of acute appendicitis was maximum in the second and third decades of life (59.2% patients at 16-29 years 9 & its complications more in young children & the elderly. Acute appendicitis is a clinical diagnosis and no laboratory or radiological tests are 100% accurate and there are many symptoms and signs that commonly overlap with other diagnosis. The differential diagnosis differs in patients of

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different ages; in women, additional differential diagnoses are diseases of the female genital tract and delay in diagnosis and management may increase the morbidity & costs. Lots of efforts have been directed toward early diagnosis and treatment of acute appendicitis. A number of scoring systems have been used for aiding in early diagnosis of acute appendicitis and its prompt management. Scoring systems are valuable and valid instruments for discriminating between acute appendicitis and nonspecific abdominal pain. One of the scoring systems is the Alvarado Scoring System which is purely based on history, clinical examination and few laboratory tests and is very easy to apply.

## Background information

Acute appendicitis is the most common cause of an acute abdomen in young adult with a life time risk of about 6% [8] and appendectomy is the most frequently performed urgent abdominal operation.

Symptoms of appendicitis overlap with a number of other conditions making diagnosis a challenge, particularly at an early stage of presentation [8].

The diagnosis of acute appendicitis is essentially clinical however A number of clinical and laboratory –based scoring systems have been devised to assist diagnosis. the most widely used is the Alvarado score also known by the acronym MANTRELS, for the diagnosis of acute appendicitis as based on symptoms, signs and diagnostic tests in patients presenting with suspected acute appendicitis.

## Problem statement

A decision to operate depending on clinical suspicion only lead to removal of a normal appendix in 15- 30 % of cases [7].

the validity of Alvarado score in certain patient groups and at different cut points is still unclear however it was found to be useful diagnostic ‘rule out’ score at a cut point of 5 for all patient groups. The score is well calibrated in men, inconsistent in children and over-predicts the probability of appendicitis in women across all strata of risk [8] but still unclear is it valid as rule in score at a cut point of 7.

## Justification

in developing countries where there are no facilities to do imaging as abdominal ultrasound or contrast enhanced CT-examination in patient in whom there is diagnostic uncertainty the decision to operate depend on clinical suspicion

Thus the aim of this study is to determine the validity of Alvarado score in diagnosis of acute appendicitis and reduction of negative appendectomy

## Objectives

**General objective:** To assess the diagnostic validity of Alvarado score in diagnosis of acute appendicitis at different cut points.

**Specific objective:** Measure the diagnostic accuracy of Alvarado score as rule in score at cut point of 7. Asses the rule of application of Alvarado scores in reduction of negative appendectomy.

## Methodology

prospective observational study of adult patients with suspected appendicitis comprising consecutive patients labelled by surgical emergency unit as acute appendicitis and going to have appendectomy (N =84) who gave a consent to be included in the study with exclusion of Patients refused to participate or had bad reports or operation sheets.

Patients of both sexes and all age groups, except those younger than 10 years, presented with pain in the right lower quadrant or periumbilical pain shifting to the right iliac fossa and those who were clinically diagnosed as cases of acute appendicitis were included in the study and their Alvarado scores calculated Sample was classified into three groups according to their Alvarado score:

Group 1: comprising patients with Alvarado score (1, 2, 3)

Group 2: comprising patients with Alvarado score (4, 5, 6)

Group 3: comprising patients with Alvarado score (7, 8, 9, and 10)

The decision for admission and surgical intervention was made by the surgeon independent of the score and was based on patients’ history and clinical examination

Gross operative findings are considered the final diagnosis of acute appendicitis and were classified based on surgeon comment into:

Positive inflammation: macroscopic appearance of red appendix

Negative inflammation: There was no macroscopic appearance of inflammation

Complicated appendix: when ruptured appendix or appendicular mass was found

Database management and analysis was performed using the Statistical Package for the Social Science (SPSS), version 20.

Written consent from emergency department unit was taken.

## Results

Total number of 85 patients were included in this study 54 were male (64.3%) and 30 (35.7%) were female there was no significant difference in inflammation table (2), the majority of the patients in the third decade the mean age was (26.19) (Figure 1), (Tables 1 and 2).

70% of patients had Alvarado sore 7 or above the median of Alvarado score was 7, there was 1% had Alvarado score below 4 (low score) (Figure 2).

Negative appendectomy was found in 6 patients (7.1%), all were Alvarado score below 7, while 23 patients ( 37% of overall patients ) had complicated appendix (22 ) had score 7 or above and only 1 patient had score 6 (figure 3) shows the status of appendix at time of operation (Figure 3).

At cut point 3 of the score no inflamed appendix was found and at cut of point 7 no normal appendix was found, at score 4, 5, 6 there was 24 patients (28% of all patients) among whom there was 19 patients (79.16%) had inflamed appendix (Table 3).

## Discussion

Negative appendectomy was 9% almost the same figure noted at Pakistan in [2] study but the universal negative appendectomy is 15-30 %, our low rate it may be due to delaying in reaching the hospital which make the clinical picture of acute appendicitis more clear and raise Alvarado score of our patients, also our dependence on surgical observations instead of histopathological confirmation do play role in this low rate. The median of Alvarado score was 7, 30% had score below 7 (25 patients, 27% of our patients had complicated appendix. The diagnostic predictive value of Alvarado score was 100%, negative appendectomy at high score group was found .0%. While it was found to be 90%, 83.79% at [2] study and [7] study respectively the difference may be due to defect in our selection of sample which wasn't include all

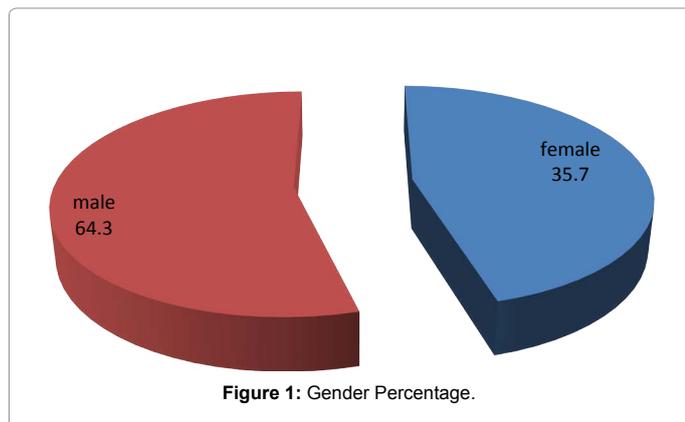


Figure 1: Gender Percentage.

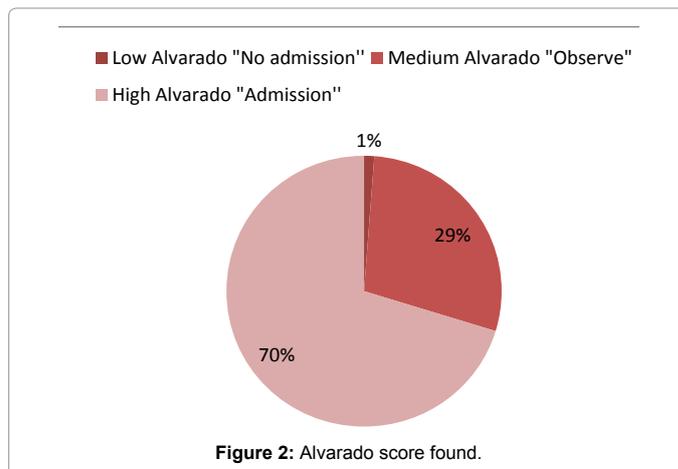


Figure 2: Alvarado score found.

Appendix	Gender		Total
	male	female	
positive	51 94.40%	27 90.00%	78 92.90%
negative	3 5.60%	3 10.00%	6 7.10%
Total	54 100.00%	30 100.00%	84 100.00%
Pearson Chi-Square	Value	Asymp. Sig. (2-sided)	Sig. Exact (2-sided) Sig. Exact Sig. (1-sided)

Table 1: Inflamed appendix against gender difference.

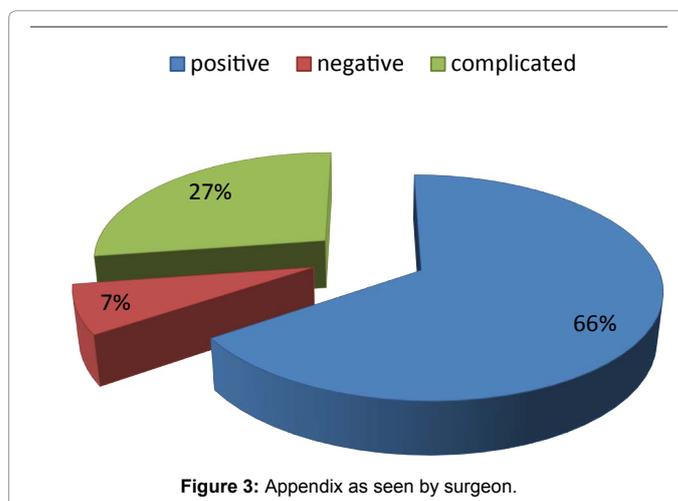


Figure 3: Appendix as seen by surgeon.

appendix	Alvarado Score			Total
	Low Alvarado "No admission"	Medium Alvarado "Observe"	High Alvarado "Admission"	
positive	0 0.00%	19 79.20%	59 100.00%	78 92.90%
negative	1 100.00%	5 20.80%	0 0.00%	6 7.10%
Total	1 100.00%	24 100.00%	59 100.00%	84 100.00%
Pearson Chi-Square	Value	Df	Asymp. Sig. (2-sided)	
	24.321 <sup>a</sup>	2	.000	

P value was 0.000

Table 2: Alvarado score groups and appendix status at time of operation.

acute abdomen patients. At cut off point of 3 Alvarado score was found to be accurate rule out score in our study which meet the international report [1]. Fever wasn't found in 43% of positively inflamed appendix, the sensitivity was 63.8 and specificity was 39.2 at [5-10] it was not a constant feature of appendicitis.

## Conclusion

In conclusion diagnostic accuracy of Alvarado score is found to be 100% at cut point of 7, because all patients with Alvarado score 7 or above have positive surgical appendicitis. 43% of those with positive appendicitis have no fever. No difference regarding age and gender distribution.

Elevated temperature	Appendix		Total
	+ve	-ve	
+ve	44 56.4%	2 33.3%	46 54.8%
-ve	34 43.6%	4 66.7%	38 45.2%
Total	78 100.0%	6 100.0%	84 100.0%

Chi-Square Tests

Pearson Chi-Square	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
	1.198a	1	0.274	0.403	0.252

Table 3: Elevated temperature was found negative in 43.6% of positively inflamed appendix.

## Recommendations

1. Another study with histopathological confirmation is required to cover our weak points and ensure the diagnostic accuracy of Alvarado score.
2. Alvarado score require revision and modification to include

only high sensitive and specific clinical symptoms and signs and also it includes left shift of Neutrophil maturation, which is not routinely done in many laboratories.

3. Health education is required to improve and ensure early detection of appendicitis and decrease the high percentage of complicated appendix.

4. Application of Alvarado score is helpful in decreasing negative appendectomy rate.

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