

# Diagnostic Accuracy of Alvarado Scoring for Diagnosis of Acute Appendicitis in Children

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## ABSTRACT

**Objective:** To determine the diagnostic accuracy of Alvarado scoring for diagnosis of acute appendicitis in children. **Study Design:** This was a cross sectional validation study. **Place of Study:** Department of Pediatric Surgery, Services Hospital. Lahore. **Duration:** July 2017 to December 2017. **Methodology:** In this study the cases of both gender with age range 2 to 12 years were included. The diagnosis of acute appendicitis was made on the basis of fever, vomiting and right sided abdominal pain with raised total leucocyte count. True positive was labelled when there were inflammatory cells found on histopathology. The detailed Alvarado scoring was used and to label the cut off value of 6 was used. **Results:** In the present study there were total 386 cases with mean age of  $7.45 \pm 2.45$  years. There were 208 males and 178 females. Alvarado score in cases who underwent appendectomy was 5 and maximum 8 with mean of  $6.92 \pm 0.898$ . The mean Alvarado score was  $5.76 \pm 2.77$ . Alvarado score 6 or above was seen in 286 cases while 280 cases were confirmed as acute appendicitis on histopathology. The sensitivity, specificity, PPV, NPV and diagnostic accuracy of Alvarado score 6 or more was seen in 89.29%, 66.04%, 87.41%, 70% and 82.90% respectively with a significant p value of 0.001. **Conclusion:** Acute appendicitis is an acute emergency and Alvarado score 6 or above has shown significant better diagnostic accuracy in such cases.

**Keywords:** Appendicitis, PPV, NPV Alvarado score

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## INTRODUCTION

Acute appendicitis is one of the most common causes of abdominal pain and the most common surgical emergency in children and adolescents. It has a life time risk of one out of every seven cases. Acute appendicitis can complicate to abscess formation, rupture or can lead to complications like peritonitis and acute abdomen which can be fatal, hence need to be diagnosed early.<sup>1-2</sup>

There is diverse clinical presentation and that's why the diagnosis is a dilemma and mimic various clinical scenarios that can result in a diagnostic challenge. Early surgery and better care can lead to decrease the risk of complications.<sup>3</sup> It can be diagnosed on various clinical scoring and imaging studies. Alvarado scoring system is one of the most commonly used in such cases and comprise a range of clinical points on examination and supported by laboratory data. There are variable results regarding its diagnostic accuracy.<sup>4-5</sup>

## OBJECTIVE

To determine the diagnostic accuracy of Alvarado scoring for diagnosis of acute appendicitis in children.

## METHODOLOGY

### Study Design:

Cross sectional validation study.

### Place of Study:

Department of Pediatric surgery, Services Hospital, Lahore

### Duration of Study:

July 2017 to December 2017

### Sampling technique:

Non-probability consecutive sampling

In this study the cases of both gender with age range 2 to 12 years were included. The diagnosis of acute appendicitis was made on the basis of fever, vomiting and right sided abdominal pain with raised total leucocyte count. True positive was labelled when there were inflammatory cells found on histopathology. The detailed Alvarado scoring was used and to label the cut off value of 6 was used.

## RESULTS

In the present study there were total 386 cases with mean age of  $7.45 \pm 2.45$  years as shown in table 01. There were 208 males and 178 females. Alvarado score in cases who underwent appendectomy was 5 and maximum 8 with mean of  $6.92 \pm 0.898$ . The mean Alvarado score was  $5.76 \pm 2.77$  (table 01). Alvarado score 6 or above was seen in 286 cases while 280 cases were confirmed as acute appendicitis on histopathology. The sensitivity, specificity, PPV, NPV and diagnostic accuracy of Alvarado score 6 or more was seen in 89.29%, 66.04%, 87.41%, 70% and 82.90% respectively with a significant p value of 0.001 (table 02).

**Table 1: Demographics of study subjects**

	Mean	Range
Age (years)	7.45±2.45	2-12
Weight (kg)	21.34±8.49	8-34
Duration of symptoms (hours)	8.45±4.89	1-24
Alvarado score	5.76±2.77	4-9

**Table 2: Diagnostic accuracy of Alvarado scoring (n= 386)**

Alvarado score	Positive results on histopathology	Negative results on histopathology	Statistics
6 or above	TP 250	FP 36	p= 0.001
< 6	FN 30	TN 70	

TP= True positive, TN= True negative, FN= False negative, FP= False positive

**Sensitivity= 89.29, Specificity= 66.04**

**PPV= 87.41, NPV= 70**

**Accuracy= 82.90**

## DISCUSSION

Appendicitis is one of the most common causes of acute abdominal pain in all age groups. The key to a successful outcome is early diagnosis followed by appendectomy before gangrene or perforation develops. Although appendicitis occurs less frequently in young children, this group can be particularly difficult to diagnose because the presentation may be nonspecific. In addition, the evaluation can be challenging because the child is often apprehensive and uncomfortable.

In this study the sensitivity of Alvarado score 6 or above for the diagnosis of acute appendicitis was 89.29%. This finding was in contrast to studies carried out by Ahmad et al and Memon et al who found sensitivity of score above 7 only in 58% and 53.3% respectively.<sup>6-7</sup> However, the other studies found a higher sensitivity ranging from 85 to 100% as is high in this study.<sup>8-9</sup> These studies had lesser sensitivity because true positive cases that had score 6 or above were in lesser number as compared to cases with score less than 6 because of certain confounding factors. These include treatment at the peripheries before presenting to the hospitals with analgesics and antibiotics which not only relieved pain but also declined the temperature which were the markers used in the Alvarado scoring hence decreasing its number and adding up the false negative number and decreasing its sensitivity.

The positive predictive value in this study was 87.41%. This was consistent with other studies conducted by Hizbullah et al and Ikramullah et al who had PPV of 85% and 83.5% respectively.<sup>10-11</sup> However these results were at lower side when compared to other studies who found PPV approaching almost 100% by Memon et al and Majita et al who documented PPV of Alvarado scoring in the diagnosis of appendicitis to be 98.1% and 100%

respectively.<sup>6,12</sup> The higher degree of PPV in their study was due to their lower threshold for the diagnosis of appendicitis where they used score of 6 to label positive hence maximum cases were included with positive diagnosis. These higher values of sensitivity and Positive predictive value of Alvarado score indicate it as a good diagnostic tool for the diagnosis of acute appendicitis.

The specificity in this study was seen in 66.04%. This was in contrast to study carried out by Jalil A et al who found specificity of about 81% in their study<sup>13</sup> while it was consistent with the studies who had specificity of less than 70%.<sup>14-15</sup> Why the specificity is at lower side in this study compared to Jalil et al. This might be due to a relatively higher number of females in this study which was almost equal in our study as compared to their studies that had a lesser number. As females have more chances of other causes like pelvic inflammatory disease, ectopic pregnancy in adolescent age and endometriosis, so they have higher chances of giving a higher degree of symptoms which can mimic appendicitis and can add to false positive and lowering the specificity.

The negative predictive value in this study was seen in 70%. Similar results were seen in other studies done by Malik KA et al and Sanei B et al who found NPV of 69% and 72% respectively in their studies.<sup>16-17</sup> While a study conducted by Jang SO found NPV of 81%.<sup>18</sup> The value in Jang SO et al study was higher because of their lower threshold to diagnose appendicitis where they used 5 as cut off value to label as a positive case, thus leaving very less cases to be false negative behind.

## CONCLUSION



Acute appendicitis is an acute emergency and Alvarado score 6 or above has shown significant better diagnostic accuracy in such cases.

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### **AUTHORSHIP AND CONTRIBUTION DECLARATION**

AUTHORS	Contribution to The Paper	Signatures
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<b>Dr. Afaq Ahmad</b> Medical Officer Sheikh Zayed Hospital, Rahim Yar Khan	Correspondence and Literature Review	
<b>Dr. Muhammad Mannan</b> PGR, Department of Orthopedics Sheikh Zayed Hospital, Rahim Yar Khan	Comparison of results, References collection	