# **Original Research Article**

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# **Evaluation of Alvardo score in diagnosis of acute appendicitis**

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## **ABSTRACT**

**Background:** Acute appendicitis is a common cause of abdominal pain for which a prompt diagnosis is rewarded by a marked decrease in morbidity and mortality. Right Iliac fossa pain is the hallmark of acute appendicitis until proven otherwise. Decision making in a case of acute appendicitis may be difficult, especially for junior surgeons. Hence, we aimed at analysing the Alvarado Score in patients with right iliac fossa pain.

**Methods:** A prospective study involving 120 patients with right iliac fossa pain attending KIMS casualty during May 2015- April 2016 were included in the study.

**Results:** The least was in the age group of 56 to 65 years (2%). Out of 120 patients, 84 were males (70%) and 36 were female (30%). The male to female ratio was 1:0.4. Patients with Alvarado score 7-9 (Group I) includes 60 male and 26 females (71% of total study group). Alvarado score 5-6 (Group II) includes 17 males,19 female (22% of total study group). Alvarado score 1-4 (Group III) includes 7 males, and 1 female (7% of total study group). In patients of Group I, among 60 males, 51 were confirmed with acute appendicitis. Among 26 females, 19 were confirmed with acute appendicitis, with a positive appendicectomy rate of 81.3% and negative appendicectomy rate 19.7%. The numbers of patients were highest in the age group 15 to 25 years (38%) followed by 36 to 45 years (30%).

**Conclusions:** The Modified Alvarado scoring system was found to be highly effective in the diagnosis of the acute appendicitis in men and can be widely used to avoid expensive time consuming and non-readily available additional investigations. However, this system was not very effective in women. Therefore, ultra sound examination of abdomen and pelvis and diagnostic laparoscopy are also advised to minimize the high false negative rate in women which excludes common pelvic pathology that mimic clinically acute appendicitis.

**Keywords:** Acute appendicitis, Alvaro score

## INTRODUCTION

Appendix is also known as Vermiform appendix.<sup>1</sup> The Vermiform Appendix is considered by most to be a vestigial organ, its importance in surgery due only to its propensity for inflammation that results in the clinical condition known as "acute appendicitis" acute appendicitis is a common cause of abdominal pain for

which a prompt diagnosis is rewarded by a marked decrease in morbidity and mortality.<sup>2</sup> Routine history and physical examination both remain the most effective and practical diagnostic modalities.<sup>3</sup> In order to reduce the negative appendicectomy rates various scoring systems have been developing for supporting the diagnosis of acute appendicitis.<sup>4</sup> One such scoring system was Alvarado score, which was based on sophisticated

statistical analysis of symptoms, signs and laboratory data.<sup>5</sup> Delay in the diagnosis will lead to increased morbidity and mortality rate on the other hand overzealous diagnosis may lead to increased negative appendicectomy rate.

Notwithstanding advances in modern radiographic imaging and diagnostic laboratory investigations, the diagnosis of appendicitis remains essentially clinical, requiring a mixture of observation, clinical acumen and surgical science.

It has been usual in surgical practice all over the world to accept a negative appendicectomy rate (even upto 30%) in order to avoid the morbidity and mortality associated with appendicitis.

To decrease negative appendicectomy rate and to increase positive diagnostic rate of appendicitis, various scoring systems were designed. Among them a comprehensive scoring developed by "ALVARADO" in 1986, provides a practical diagnostic aid in interpreting the diagnosis of acute appendicitis.

A controlled prospective study of patients attending with pain in the right iliac fossa during the period of study was assessed using Alvarado score for the diagnosis of acute appendicitis and reducing the rate of negative appendicectomies. A total of 120 patients were included in the study who presented with pain in the right iliac fossa were assessed using Alvarado score and the following analysis of the results were obtained.

### **METHODS**

Patients attending KIMS casualty, Amalapuram and surgery opd during May 2015 to April 2016, presenting with the compliant of right iliac fossa pain, with a minimum age of 15 and maximum of 65 years, were included in the study.

#### Scoring system

After initial presentation of the patient in the emergency or surgical OPD, the detailed history, clinical examination, laboratory investigations were done which included routine Hematological investigations, Urine routine, and USG Abdomen and Pelvis in some equivocal cases.

A specially designed proforma was filled in for each patient. The proforma had general information about the patient plus eight variables based on the Alvarado scoring system. Then the sums of all these scores were calculated for each patient and based on the results patients were divided into three groups. Aggregate score 7-9 (Group I/emergency surgery group): These patients were prepared and all underwent emergency appendicectomy.

Aggregate score 5-6 (group II/ admitted for observation).

Aggregate score 1-4 (Group III/discharge home group): These patients, after giving initial symptomatic treatment, were discharged and sent home with the instructions, to come back if symptoms persist or condition become worse.

The diagnosis of acute appendicitis was confirmed by operative findings and histopathological assessment of the appendicectomy specimen with the ultimate criterion for the final diagnosis of acute appendicitis being the histological demonstration of polymorphonuclear leukocytes throughout the thickness of the appendix wall.

Table 1: Criteria and scoring for acute appendicitis.

Criteria	Alvarado	Modified Alvarado
Migratory pain	1	1
Anorexia	1	1
Nausea	1	1
Tenderness in the RIF	2	2
Rebound tenderness	1	1
Elevated temp	1	1
Leucocytosis	2	2
Shift to left	1	Not included
Total score	10	9

### **RESULTS**

The number of patients were highest in the age group 15 to 25 years (38%) followed by 36 to 45 years (30%). The least was in the age group of 56 to 65 years (2%). Out of 120 patients, 84 were males (70%) and 36 were female (30%). The male to female ratio was 1:0.4. Mean age was 31.55 with standard deviation of 10.49.

Table 2: Age and sex distribution.

Age (years)	Male	Female	Total
15-25	27	18	45
26-35	20	9	29
36-45	28	8	36
46-55	8	0	8
56-65	1	1	2
Total	84	36	120

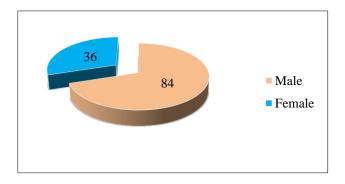


Figure 1: Sex distribution.

According to age and sex distribution, following age groups are diagnosed as acute appendicitis. Among them in the age group between 15-25, 45 people were diagnosed with acute appendicitis (27 males and 18 females) when compared to other age groups

In our study, out of 120 patients 84 males and 36 females attended KIMS casualty, Amalapuram.

Frequency distribution of patients according to Alvarado score, 55 (i.e. 46%) patients were in the score of 9; 30 (i.e. 25%) patients were in score of 8; 1 (i.e. 1%) in the score of 7.

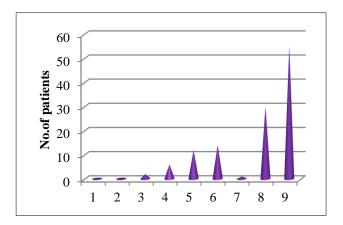


Figure 2: Frequency distribution of patients according to Alvarado score.

Table 3: Results of application of modified Alvarado score.

Alvarado score	Male	Female	Results	Percentage
7-9 (Group 1)	60	26	86	71
5-6 (Group II)	17	9	26	22
1-4 (Group III)	7	1	8	7

Among all the groups more percentage of patients were in group I of Alvarado score 7-9 (71%).

Table 4: Mean scores of different groups.

Group	Mean score
I (7-9)	8.62
II (5-6)	5.53
III (1-4)	3.75

The highest mean score recorded was 8.62 for the group I (7-9).

In group I, among male 51 out of 60 were diagnosed as acute appendicitis and among females 19 out of 26 were diagnosed as acute appendicitis.

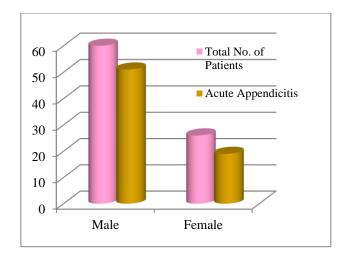


Figure 3: Results of Group I (Score 7 - 9).

Table 5: Appendicectomy rate.

Appendicectomy rate	
Positive appendicectomy	81.3%
Negative appendicectomy	19.7%

86 out of 120 patients were diagnosed as acute appendicitis after appendicectomy. The percentage of patients with positive appendicectomy was 81.3% and negative appendicectomy was 19.7%.

#### **DISCUSSION**

The Alvarado's scoring system was introduced initially as an adjuvant to diagnose appendicitis to correct the previous false positive diagnostic rate.

The scoring system introduced by "Alvarado" was simple, easily applicable and useful in emergency surgical hospitals.

Among different scoring systems, the scoring system developed by "Alvarado" in 1986 to decrease negative appendicectomy rate without compromising the positive diagnosis of appendicitis, was simple, easy to apply and results were good.<sup>6</sup>

#### Alvarado scale (mantrels)

It consists of eight specific indicators as follows:

- Three clinical symptoms
- Three clinical signs
- two laboratory values<sup>7,8</sup>

# Interpretation of the scoring system<sup>9</sup>

- A score of 9-10 indicates almost certain to have appendicitis
- A Score of 7-8 indicates have a high likelihood of appendicitis

- A score of 5-6 indicates, are compatible with, but not diagnostic of appendicitis, doesn't require immediate operation but requires follow up
- A score of 0-4 indicates extremely unlikely (but not impossible).

Table 6: Alvarado score.

	Manifestations	Score
Symptoms	Migratory pain	1
	Anorexia	1
	Nausea and vomiting	1
	Tenderness (RIF)	2
Signs	Rebound tenderness	1
	Elevated temperature	1
Laboratory	Leucocytosis	2
	Shit to left	1
Total		10

In underdeveloped and developing countries where advanced diagnostic modalities are not available on a routine basis

Application of modified Alvarado score in the diagnosis of the acute appendicitis was found to be more valuable when compared to the conventional diagnosis alone.

Kalan et al modified original Alvarado scoring system by removing one item i.e., shift to left of neutrophils maturation because of non-availability of the laboratory finding in emergency laboratory setup on a routine basis.

#### Modified Alvarado score (mantrel)

- It consists of three clinical symptoms
- Three clinical signs
- And one laboratory finding. 10,11

Table 7: Modified Alvarado score.

	Manifestations	Score
	Migratory RIF pain	1
Symptoms	Anorexia	1
	Nausea and vomiting	1
	Tenderness (RIF)	2
Signs	Rebound tenderness	1
	Elevated temperature >37.5°C	1
Laboratory	Leucocytosis>10x109/L	2
Total		9

Interpretation of the modified Alvarado scoring system<sup>12</sup>-

 A score of 9 indicates almost definite acute appendicitis and surgery should be taken up as an emergency measure

- A score of 7-8 indicates probable acute appendicitis and to be considered for surgery
- A score of 5-6 indicates possible diagnosis of acute appendicitis; does not require immediate operation but requires follow up.

A score of 1-4 indicates the acute appendicitis is unlikely. Among the patient groups with a modified Alvarado score of more than 7 and less than 7, the negative appendicectomy rates was much lesser in the first group. In all the groups, negative appendicectomy rate is much higher for females when compared with males.

The overall negative appendicectomy rate in the patients with modified Alvarado score of more than seven was 19.7%. In inference the acute appendicitis, the results of application of this score are best in men with negative appendicectomy rates of 15%. Whereas they are poor in women with a negative appendicectomy rate of 26.9%.

The overall positive appendicectomy rate in patients with modified Alvarado score of more than 7 was 80.3%. in reference acute appendicitis, the results of application of score are best in men with positive appendicectomy rate of 85%. Where as in the women with positive appendicectomy rate of 73.07%.

#### **CONCLUSION**

The diagnostic accuracy of Alvarado score is found to be helpful in the diagnosis and management of acute appendicitis. The modified Alvarado scoring system was found to be highly effective in the diagnosis of the acute appendicitis in men and can be widely used to avoid expensive time consuming and non-readily available additional investigations. However, this system was not very effective in women. The overall negative appendicectomy rate in the patients with modified Alvarado score of more than seven was 19.7%. In inference the acute appendicitis, the results of application of this score are best in men with negative appendicectomy rates of 15%. Whereas they are poor in women with a negative appendicectomy rate of 26.9%. Therefore, ultra sound examination of abdomen and pelvis and diagnostic laparoscopy are also advised to minimize the high false negative rate in women which excludes common pelvic pathology that mimic clinically acute appendicitis.

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