

## ROLE OF MODIFIED ALVARADO SCORE IN DIAGNOSING ACUTE APPENDICITIS IN EMERGENCY SETUP

Ahsan Khan, Wasim Hayat, Awais Amjad, Hasan Imtiaz, Mashhood Rao and Mahmood Ayyaz

**Objective:** The objective of the study was to evaluate the diagnostic accuracy of modified Alvarado score on patients presenting in surgical emergency with suspicion of acute appendicitis.

**Material and Methods:** We studied the Alvarado score of 200 patients in 11 months period who presented to the emergency department with right iliac fossa pain. We decided to design this study with the aim of investigating whether the Alvarado Score can be used by emergency doctors as a criteria for diagnosing acute appendicitis. We compared the Alvarado Score with the operative findings and grade of appendicitis.

**Results:** A total of two hundred patients were studied. We found that patients who had a score of less than 5 had a normal appendix, but at the same time 17% had acute appendicitis. While if, Alvarado Score >5, 59% had acute appendicitis and 1% have normal appendix. Thus the Alvarado Score is both specific and sensitive in diagnosis of acute appendicitis.

**Conclusion:** It is concluded that Alvarado score is a free and easy to use tool and is very helpful in diagnosing acute appendicitis and decreasing the incidence of negative appendectomies.

**Key words:** Appendicitis, Alvarado score, Emergency, Acute abdomen, Modified Alvarado score, TLC count.

### Introduction

Acute appendicitis is the most common cause of an 'acute abdomen' in young adults and as such the associated symptoms and sign have become a paradigm for clinical teaching.<sup>7</sup>

The clinical signs and symptoms of acute appendicitis were first reported by Fitz<sup>2</sup> in 1886.<sup>1,4</sup> These fickle sign and symptoms can confuse junior surgeons who are responsible for making diagnosis in emergency and they may be wrong in 50% of time.<sup>2,3</sup> Even with the aid of some special investigation, like ultrasonography, false positive diagnosis ranges between 20 and 40%.<sup>6</sup>

The reported life time prevalence is as high as one in seven.<sup>6</sup> Appendicitis is principally the disease of young and middle aged. The peak age group is 11-30 years in both sexes. After the age of 50 years, the incidence of this disease is only 1:35 for women and 1:50 for men.<sup>9</sup>

The incidence of primary appendectomy is approximately equal in both sexes.<sup>9</sup> However, it is difficult to diagnose in very young or elderly patient and women of reproduction age due to atypical symptoms.<sup>6</sup> The aim of surgeon is to make an accurate diagnosis as early as possible to make treatment of high risk patient more effective.<sup>7,8</sup> Diagnosis of acute appendicitis remains a difficult problem due to atypical presentation and because of

the fact that most other conditions also mimic appendicitis.<sup>10,11</sup> The diagnostic accuracy varies from 25 to 90%, optimum accuracy rate is about 80% and diagnostic error rate is 25% and is twice as common in female as in males.<sup>10</sup>

Constant pain localized in right lower quadrant of the abdomen is the only persistent symptoms of acute appendicitis.<sup>12,13</sup> Pain in right lower quadrant or lower abdomen creates a diagnostic problem as a large number of condition such as pelvic inflammatory disease. Ruptured griffin follicles, ectopic ruptured grafting follicles, ectopic gestation, salpingitis, might ureteric colic and ovarian torsion come into the differential diagnosis.<sup>15</sup>

Various scoring systems have been developed to make an objective score for diagnosing acute appendicitis.<sup>13,14</sup> Of these the Alvarado Score (Fig. 1) is the most widely used and accepted score.<sup>16,17,18</sup>

The Alvarado Scoring System is a clinical assessment tool that gives a numerical score to each of the following clinical findings:

Migration of right iliac fossa pain, nausea/vomiting, anorexia, right iliac fossa tenderness, elevation of temp >37.3°C, rebound pain in right iliac fossa, leukocytosis and shift to left. Tenderness and leukocytosis are given score of 2, whereas the others are given a score 1.

## Purpose of Study

This study has following aims and objectives:

1. To calculate the Alvarado Score on all patients presenting in emergency with right iliac fossa pain and correlate it with the operative findings.
2. Correlate the Alvarado Score with the grading of appendicitis.
3. To reduce the complication (perforation) because of delays in diagnosis is associated with increased morbidity and mortality rates.
4. To reduce the incidence of negative appendectomies.

## Material & Methods

This is an observational study which was carried out on 200 consecutive cases presenting to the emergency in Surgical Unit of Services Hospital, Lahore. The duration of this study is eleven months from Jan 2010 to Nov 2011.

At admission, all the patients were prospectively evaluated using modified Alvarado Score to determine whether they had acute appendicitis or not. Their score were subsequently correlated with the clinical, operative finding and grade of appendicitis of the removed appendix. The decision to apply the score is based on the following presentation, three symptoms, three signs and one investigation. The classic Alvarado Score included left shift of neutrophil maturation (Score1) yielding a total score of 10 but Kalan et al omitted this parameter which is produce a modified score.

### Alvarado scoring system.

Features	Alvarado Score	Modified Alvarado Score
<b>Symptoms</b>		
Migratory right iliac fossa pain	01	01
Nausea / Vomiting	01	01
Anorexia	01	01
<b>Signs</b>		
Right iliac fossa tenderness	01	02
Fever > 37.3°C	01	01
Rebound pain in RIF	01	01
<b>Laboratory Test</b>		
Leucocytosis >10x10 <sup>9</sup>	02	02
Neutrophilic shift to left >75%	01	-
<b>Total</b>	<b>10</b>	<b>09</b>

to have acute appendicitis.

Those with a score of 5-6 have a possible, diagnosis of acute appendicitis, and those with score of 7-9 are regarded as probable appendicitis or perforated appendix in some cases.

The modified Alvarado Score with a total score of 9 was recorded on the separate sheet attached with history chart to be completed in emergency. The score was correlated with the operative finding and grade of appendicitis.

On exploration the severity of the appendicitis was assessed according to the gross appearance and the following grading was used:

Grade	Appendix
I	Normal Below 5
II	Swollen tip, Periappendicular Fluid/pus
III	Gangrenous /Perforated

### Inclusion Criteria

All patients above 13 years presenting with pain in the right iliac fossa in emergency, their appendicectomies performed and those who were available for follow up for six months.

### Exclusion Criteria

1. Patients less than 13 years.
2. Patients with the demonstrable extra-appendicular cause of pain in right iliac fossa.

## Results

The study included 200 patients. This study comprised of 108 male and 92 female with the average age of all patient 21.6 years range (13-55 years). The preoperative Alvarado Score was correlated with the operative findings.

**Table-1:** Age of the patients.

Age	Male	Female
Average: 21.6 years	22.8 Years	20.3 Years
Range: 13-55 Years	13-55 Years	13-35 Years

**Table-2:** Modified Alvarado score with TLC of all patients.

Total	Male	Female
6.32	6.10	5.67
Range:4-9	4-9	4-8

TLC		
Average: 9761	10497	8892
Range: 6000-18000	6000-18000	6000-12000

**Table-3:** Per-operative Findings (Gross).

Grade	Patients %	Operateive finding
I	23 (23%)	Normal
II	59(59%)	Inflammed
III	18(18%)	Gangrenous/ Perforated

**Table-4:** Alvarado Score<5.

Gade-I	Grade-II	Grade-III
23%	17%	
1.92%	76.92%	21.55%
23%	25%	75%

**Table-4a:** Alvarado Score.>5.

Alvarado Score	Grade of Appendix
>5	59%=Acute appendicitis
<5	23%= Normal appendicititis
<5	17% Acute Appendicitis

## Discussion

The diagnosis of acute appendicitis continues to be difficult due to the variable presentation of the disease and the lack of reliable biochemical and radiological diagnostic tests<sup>6,7,8</sup> although there has been some improvement in the diagnosis of acute appendicitis over the past several decades.<sup>9,10</sup>

The percentage of normal appendicitis reported in various series varies from 8 to 33% whereas the clinical Alvarado Scoring System has proved useful in the management of number of surgical condition in the past few years.<sup>16,17,18</sup> Various scoring system have been developed and advocated to aid the diagnosis of acute appendicitis.<sup>12,13,14</sup> Most of them are complex and difficult to implement in the clinical

situation of an emergency room. But we have found that the Alvarado Score is a simple scoring system that can be instituted easily.

In this study we found that patients having Alvarado Score >5 are suffering from acute appendicitis.

Our study showed that the Alvarado score <5 have a normal appendix, but at the same time 17% had acute appendicitis. Where Alvarado Score >5, 59% had acute appendicitis and 1% have normal appendix. Also a score of more than 7 was present in 28% patients and all had acute appendicitis.

Thus the Alvarado Score is both specific and sensitive in diagnosis of acute appendicitis, anybody having Alvarado Score >5 had 78% specificity; and a Score <5 had 65% sensitivity. A score of >7 was 100% specific and a score of <7 was only 35% sensitive. Similarly a score of >8 was also 100% specific but only 31% sensitive to rule out appendicitis. .

## Conclusion

The modified Alvarado Score is a simple score for supporting the diagnosis of acute appendicitis.

Alvarado Score can be used as an objective criterion in selecting patients for admission with suspected appendicitis. It is important to advise patients to return for review 24 hours later or if symptoms worsen. Patients who live alone and do not have family support or unwilling to be observed at home could be admitted as is our current practice.

We recommend every patient presenting to emergency with pain in right iliac fossa should undergo assessment with the Alvarado score. A score of >5 has a high probability (78%) of detecting acute appendicitis and a score of >7 has a 100% sensitivity in diagnosing acute appendicitis. A score of <5 usually means that one should search for an alternative diagnosis as a low score rules out acute appendicitis (65% specificity).

*Department of Surgery  
SIMS/ Serices Hospital, Lahore  
[www.esculapio.pk](http://www.esculapio.pk)*

## References

1. Temple CL, Huncheros of SA. The natural history of appendicitis in adults: A prospective study. *Ann Surg* 1995;221:278.
2. Burke J. Early historical aspects of appendicitis 1951;300(5): 905-17.
3. Williams GR. Presidential address. A history of appendicitis. *Ann Surg* 1988;197: 495-565.
4. Seal A. Appendicitis. A historical review. *Canad J Surg* 1981; 24: 427-33.
5. Kazarian KK, Roeder WJ, Mersheimer WL. Decreasing mortality and increasing morbidity from acute appendicitis. *Am J Surg* 1970; 119: 681-85.
6. Poole GV. Appendicitis. The diagnostic challenge continues.

- Am J Surg 1998;54: 609-12.
7. Jone PF. Suspected acute appendicitis trend in management over 30 years. Br J Surg 2001;88: 1570-7.
  8. Fitz RH. Perforating inflammations of vermiform appendix with special reference to its early diagnosis and treatment. Trans Assoc Am Physicians 1986;1: 107.
  9. I'Connell PR. Vermiform appendix. In: Russell R.C.G. Williams N.S. editors Bailey & Love's short practice of surgery, 23rd ed. London: Arnold Publishers 2000; 1076-92
  10. Horrman J, Rasmussen OO. Aids in the diagnosis of acute appendicitis Br J Surg 1989; 46: 774-90.
  11. Alvarado AA. Practical score for the early diagnosis of acute appendicitis. Ann Emerg Med 1986;15: 557-64.
  12. Bukhari SAH, Rana SH. Alvarado score: a new approach to acute appendicitis. Pak Armed Forces Med J 2002;52(1):47-50.
  13. Chan MY, Teo BS, Ng BL. The Alvarado score and acute appendicitis. Ann Acad Med Singapore 2001;30: 510-12.
  14. Kim HE, Park SB, Woo SU, Rho HR, Chae GB, Choi WJ. [Application of the Alvarado score to the diagnosis of acute appendicitis] J Korean Soc Coloproctol. 2006;22:229234.
  15. Khawaja AR, Rasool MI, Nadeem IA. Perforated appendicitis vs non-perforated appendicitis. JPMA 1987;325-26.
  16. Howell JM, Eddy OL, Lukens TW, Thiessen ME, Weingart SD, Decker WW. Clinical policy: critical issues in the evaluation and management of emergency department patients with suspected appendicitis. Ann Emerg Med. 2010;55:71116.
  17. Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med. 1986;15:557564. doi: 10.1016/S0196-0644(86)80993-3.
  18. Memon AA, Vohra LM, Khaliq T, Lehri A. Diagnostic accuracy of Alvarado score in the diagnosis of acute appendicitis. Pak J Med Sci. 2009;25:118121