

## **Evaluation of Alvarado Score and Its Diagnostic Importance in Reducing Negative Appendectomy in Right Iliac Fossa Pain**

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### **Abstract**

**Background:** Globally, acute appendicitis is a common surgical emergency<sup>1-7</sup> with a lifetime risk of 1 in 7, which means that 6% of the individuals suffer an attack during their lifetime<sup>6-7</sup>. The condition is difficult to diagnose especially during the early stages when the classical signs and symptoms are usually subtle<sup>1-6</sup>. It has been observed that many patients undergoing appendectomy prove to be negative on histopathology. Alvarado scoring system introduced in 1986<sup>12</sup>. It is based purely on history, clinical examination, some lab tests and is easy to apply. The aim of our study was to analyse the usefulness of Alvarado scoring system in Right iliac fossa and reducing the percentage of negative appendectomy.

**Methods:** In a prospective non-randomized study including 99 patients presenting with acute onset right iliac fossa pain included in study in whom the Alvarado score was obtained at admission and categorized into three groups and group 3 and group 2 patients with deterioration underwent emergency appendectomy

compared with histo-pathological diagnosis. Sensitivity, specificity, positive predictive value, negative predictive value and negative appendectomy rate calculated.

**Results:** In our study, overall sensitivity and specificity were 98.50% and 87.09% respectively. Positive and negative predictive values were 94.36% and 96.42% respectively. Overall Negative appendectomy rate in our study was 5.9%.

**Conclusions:** We conclude that Alvarado scoring system is easy, simple, cheap and useful tool in pre-operative diagnosis of acute appendicitis which can be used in the community by general practitioner and residents in the referral hospitals. Scores more than seven virtually confirm the diagnosis of acute appendicitis and early operation is indicated. For this reason the scoring system could be safely used by general practitioners in deciding whether to refer a patient to hospital. Patients with score 5-6 must be admitted and scored frequently.

**Keywords:** Acute appendicitis, appendectomy, clinical diagnosis, histopathological diagnosis, Alvarado score

## Introduction

Globally, acute appendicitis is a common surgical emergency<sup>1-7</sup> with a lifetime risk of 1 in 7, which means that 6% of the individuals suffer an attack during their lifetime<sup>6-7</sup>. The condition is difficult to diagnose especially during the early stages when the classical signs and symptoms are usually subtle<sup>1-6</sup>. Different disease processes mimic the diagnosis of acute appendicitis as there are a number of causes leading to pain in the right iliac fossa particularly in female patients<sup>2</sup>. It has been observed that many patients undergoing appendectomy prove to be negative on histopathology of the surgically removed appendix, which is the gold standard for diagnosis of appendicitis<sup>11</sup>. Removing a normal appendix is a burden both on patients and health resources<sup>3</sup>. However, early recognition of the condition and prompt operation have been the most important factors in reducing morbidity and possible mortality, length of stay, and cost of treatment<sup>4</sup>. Alvarado scoring system introduced in 1986<sup>12</sup>. It is based purely on history, clinical examination and few lab tests and is easy to apply.

## Aims and Objectives

The aim of our study was to analyse the usefulness of Alvarado scoring system in Right iliac fossa pain and reducing the percentage of negative appendectomy.

## Material and Methods

This study was carried out in Department of General Surgery, Max Hospital Gurgaon from July 2018 to April 2019. All patients with pain in right iliac fossa were considered for the study irrespective of signs and severity. Alvarado Scoring was documented in every case on admission. Patients were divided into three groups based on ALVARADO score. Group 1 (1-4), Group 2 (5-6), Group 3 (7-10).

**Table 1:**

ALVARADO SCORING SYSTEM CRITERIA	SCORE
<b>SYMPTOMS</b>	
Migratory RIF Pain	1
Nausea and Vomiting	1
Anorexia	1
<b>SIGNS</b>	
RIF Tenderness	2
Fever	1
Rebound Tenderness in RIF	1
<b>LAB TESTS</b>	
Leucocytosis	2
Neutrophilic Left Shift	1
<b>TOTAL SCORE</b>	10

## Methodology

1. Group 1: Patients were discharged on OPD basis and asked to follow up.
2. Group 2: Admitted and observed for 24 hours, treated with O-S regimen. Deterioration in scores by more than 2 was taken up for surgery.
3. Group 3: Taken up for emergency surgery (TABLE 2).

All specimens were sent for histopathology and diagnosis was confirmed. The sensitivity, specificity, positive predictive value, negative predictive value, negative appendectomy rate was found out in order to assess the reliability of Alvarado Score.

## Observations and Results

The study was carried out in 99 patients presented with complain of pain in right iliac fossa in the department of general surgery, max hospital, Gurgaon from July 2018 to April 2019. Clinical examination was performed and investigations noted. Accordingly, data was calculated and observations and results were interpreted.

### 1. Distribution of patients According to score

In our study, out of 99, 15(15.15%) patients were placed in Group 1, 13(13.13%) patients were placed in Group 2, and 71(71.71%) patients were placed in Group 3 based upon Alvarado Scoring system (Table 2).

**Table 2: Showing distribution of patients According to score**

ALVARADO SCORE	NO. OF PATIENTS
1-4 (GROUP 1)	15
5-6 (GROUP 2)	13
7-10 (GROUP 3)	71

### 2. Age wise distribution of study cohort

In the present study, Patients were in range of 0-80 years with mean age of 30.8 years (Table 3).

**Table 3: Showing age wise distribution of study cohort**

AGE ( IN YEARS )	NO OF PATIENTS
0-10	5
11-20	27
21-30	30
31-40	11
41-50	16
51-60	4
61-70	4
71-80	2
<b>TOTAL</b>	<b>99</b>

### 3. Gender distribution of study cohort

In the present study, amongst the 99 patients who presented to us with pain in right iliac fossa, 54 (54.54%) were male and 45 (45.45%) were female (Table 4). The male to female ratio in our study was 1.2:1.

**Table 4: Showing gender distribution of study cohort**

Gender	Number of patients	Percentage (%)
Male	54	54.54
Female	45	45.45

Total	99	100.0
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### 4. Percentage of male and female in different groups:

In the present study, gender distribution was 10 (66.6%) males and 5 (33.33%) females in group 1, 9 (69.3%) males and 4 (30.7%) females in group 2, 35 (50.7%) males and 36 (49.29%) females in group 3. (Table 5)

**Table 5: Showing percentage of male and female in different groups**

GROUP	MALE	FEMALE
Gr 1(1-4)	10 (66.66%)	5(33.33%)
Gr 2(5-6)	9 (69.23%)	4(30.76%)
Gr 3(7-10)	35 (50.70%)	36(49.29%)

### 5. Correlation of histopathology report and operative findings:

In Group 3, All 71 patients were operated. Appendicular pathology was confirmed histopathologically in 67 cases. No pathology in 2 female patients, gangrenous intestine in 1 female patient and salpingoophritis in 1 patient was detected (TABLE 6).

In Group 2, 7 out of 13 patients were operated, in which acute Appendicitis was confirmed in all 7 patients. Psoas abscess in 3(2 female and 1 male), intususception in 1 female, tubercular peritonitis in 2 patients (1 male and 1 female) were detected.

**Table 6: Showing correlation of histopathology report and operative findings**

Histopathology report (group 3)	Number of patients
Acute appendicitis	51
Gangrenous appendicitis	1
Chronic appendicitis	10
Perforated appendicitis	2
Appendicular abscess	3
No specific pathology	2

Gangrenous intestine	1
Salpingo-opheritis	1
Total	71

**6. Sensitivity and specificity of our diagnostic approach in male and female:**

In our study, in males the sensitivity and specificity was (97.29%) and (100%) and positive and negative predictive value was (100%) and (94.44%) respectively (TABLE 7).

**Table 7: Showing sensitivity and specificity of our diagnostic approach in male**

Diagnostic result	Appendicitis	Not appendicitis	Total
Positive	True positive(36)	False positive(0)	36
Negative	False negative(1)	True negative(17)	18
Total	37	17	54

In females the sensitivity and specificity was (100%) and (71.42%) and positive and negative predictive value was (88.5%) and (100%) respectively. Negative appendectomy rate (0%) and (11.4%) in males and females(TABLE 8).

**Table 8: Showing sensitivity and specificity of our diagnostic approach in female**

Diagnostic result	Appendicitis	Not appendicitis	Total
Positive	True positive(31)	False positive(4)	35
Negative	False negative(0)	True negative(10)	10
Total	31	14	45

**7. Overall sensitivity and specificity of our diagnostic approach:**

In the present study, overall sensitivity and specificity was (98.50%) and (87.09%) and positive and negative

predictive value was (94.36%) and (96.42%) respectively. Overall negative appendectomy rate was (5.9%) (TABLE 9).

**Table 9: Showing overall sensitivity and specificity of our diagnostic approach**

Diagnostic result	Appendicitis	Not appendicitis	Total
Positive	True positive(67)	False positive(4)	71
Negative	False negative (1)	True negative(27)	28
Total	68	31	99

**Discussion**

Decision making in acute appendicitis poses a challenge in developing countries where radiological investigations do not appear cost effective. Negative appendectomy rate of 25% and 35-45% in males and females respectively has been found in studies conducted earlier by Dunn et al<sup>10</sup> and Lewis et al<sup>11</sup>. Diagnostic accuracy (75%) was much less than our study and negative appendectomy rate was much more than our study in males and females. Clinical scoring systems devised by Teicher et al<sup>13</sup>, Lindberg and Fenyo reports of 97%<sup>17</sup>, 97.6%<sup>19</sup>, 83.5%<sup>18</sup>, We had a negative appendicitis rate of (5.9%). Similar results were reported in literature 21%<sup>19</sup>, 15.6%<sup>18</sup>, 7%<sup>17</sup>. This is a simple scoring system which can easily be interpreted by non-surgical residents<sup>20</sup>.

**Conclusion**

Acute appendicitis is a diagnostic challenge for the surgeons in spite of having radiological investigations in the modern era; there is no laboratory or radiological test which can reliably diagnose the condition. Alvarado Scoring system is easy, simple, cheap, useful tool in preoperative diagnosis of acute appendicitis. Scores more than 7 is definitely warrant a virtual confirmed diagnosis

of acute appendicitis and early operation is indicated. For this reason the scoring system could be safely used by general practitioners in deciding to refer a patient to hospital. Patients with score 5-6 must be admitted and scored frequently.

## References

1. T.D. Owen, H. Williams, G. Stiff, L.R. Jenkinson, B.I. Rees(1992) Evaluation of Alvarado scoring in acute appendicitis *J R Soc Med*, 85 (1992), pp. 87–88
2. A.G. Soomro, F.G. Siddiqui, A.H. Abro, S. Abro, N.A. Shaikh, A.S. Memon (2008)Diagnostic accuracy of Alvarado scoring system in acute appendicitis *J Liaquat Univ Med Health Sci*, 7 (2008), pp. 93–96
3. I. Khan, A.U. Rehman (2005) Application of Alvarado scoring system in diagnosis of acute appendicitis *J Ayub Med Coll Abbotabad*, 17 (2005), pp. 41–44
4. C. Limpawattanasiri (2011) Alvarado score for the acute appendicitis in a provincial hospital *J Med Assoc Thai*, 94 (2011), pp. 441–44
5. M.Y.P. Chan, C. Tan, M.T. Chiu, Y.Y. Ng (2003) Alvarado score: an admission criterion in patients with right iliac fossa pain *Surgeon*, 1 (2003), pp. 39–4
6. K. Singh, S. Gupta, P. Parga(2008) Application of Alvarado scoring system in the diagnosis of acute appendicitis *JK Sci*, 10 (2008), pp. 84–86
7. E.S. Kanumba, J.B. Mabula, P. Rambau, P.L. Chalya (2011)Modified Alvarado scoring system as a diagnostic tool for acute appendicitis at Bugando Medical Centre, Mwanza, Tanzania *BMC Surgery*, 11 (2011), pp. 1–5
8. Fitz RH(1886) perforating inflammation of the vermiform appendices with special reference to its early diagnosis and treatment. *Am J Med Sci* 92:321-346
9. Hobson T,Rosenman LD(1964) Acute Appendicitis: when is it right to be wrong? *Am J Surg* 108:306-311
- 10.Dunn EL, Murphy JR(1982) the unnecessary laprotomy for appendicitis: can it be decreased? *Am Surg* 48:320-323
- 11.Lewis FR, Hocolt JW,(1975) Appendicitis: a critical review of diagnosis and treatment in 1000 cases. *Arch Surg* 110:677-684
- 12.Alvarado A(1986) A practical score for early diagnosis of acute appendicitis. *Ann Emerg Med* 15:557-564
- 13.Teicher IRA, Cohen M(1983) Scoring system to aid in diagnosis of appendicitis. *Ann Surg* 198:753-759
- 14.Kalan M (1994) Evaluation of modified Alvaradoscore in diagnosis of acute appendicitis a prospective study: *Ann R Coll Surg Engl* 76:418-419
- 15.Lindberg G, Fenyo G (1988) algorithmic diagnosis of appendicitis using bayes theorem and logistic regression.in: Bayesian statistics 3rd edition, Bernardo JM, Degroot MH. Proceedings of the third Valencia International meeting Oxford: CLARENDON Press 665-668
- 16.Ramirez JM, Dens J(1994) Practical score to aid decision making in doubtful cases of appendicitis. *Br J Surg* 81:680-683
- 17.Jawaid A, Asad A(1999) Clinical scoring system a valueable tool for decision making in cases of acute appendicitis *J Pak Med Assoc* 49(10): 254-259
- 18.Khan I,R Rehman A(2005) Application of Alvarado scoring in diagnosis of acute appendicitis. *J Ayub Med Coll Abbottabad* 17(3):41-44
- 19.Chan MY,Teo BS(2001) The Alvarado score and acute appendicitis. *Ann Acad Med Singapore* 30(5):510-512
- 20.Denizbasi A, Unleur EE,(2003) The role of emergency medicine resident using the Alvarado score in the diagnosis of acute appendicitis compared with emergency general surgery resident *Eur J Emerg Med* 10 (4) 296-301.