

# Diagnostic Accuracy of Modified Alvarado Scoring System in Acute Appendicitis

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## ABSTRACT

**Objective:** Diagnostic accuracy of modified alvarado scoring system in acute appendicitis.

**Study Design:** Observational study

**Place and Duration of Study:** This study was conducted at the Department of Surgery, Liaquat and Peoples University of Medical and Health Sciences Hospital Hyderabad and Nawabshah from Jan. 2015 to Dec. 2016.

**Materials and Methods:** This study was carried out on 227 consecutive patients of suspected acute appendicitis in the Physical examination started from general look of the patient, pulse, blood pressure, temperature and respiratory rate. Systematic examination included examination of central nervous system, respiratory system, cardiovascular system and spines. Examination of abdomen including distention, various signs, exact location of tenderness, signs of peritoneal irritation like guarding, rigidity, rebound tenderness. In group 1 all patients treated conservatively and discharged to home with advice that if symptoms persist or condition deteriorates, visit emergency department immediately. In group 2 all patients kept under observation for 24 hours and reassessed at 6 hourly intervals. Those who improve on conservative treatment were discharged to home. Others in whom condition is not improved and the score increased then the later group patients were submitted to group 3.

**Results:** Out of 227, 150 (66.7%) were male and 77 (33.92%) were female. Age ranged from 10-62 year with mean age was 23.4±7.7 years. 33 (14.54%) patients had an alvarado score of 1-4. All of them were discharged after initial assessment and symptomatic treatment. 3 patients were readmitted due to increase in severity of symptoms and required surgical intervention. Operative findings confirmed acute appendicitis. 49 (21.59%) patients with an Alvarado score of 5 were admitted for observation and evaluation. 37 patients required appendectomy because of persistence of symptoms and 12 patients were discharged after 24 hours of observation. 61 (26.87%) patients had score of 6-7 and were admitted for observation and evaluation. All the patients had increased severity of symptoms and required surgical intervention. 37% out of 227 patients were in the score range of 8-10, all of the underwent emergency surgery.

**Conclusion:** We conclude that modified Alvarado scoring system is a reliable, cheap, handy tool for diagnosis of acute appendicitis.

**Key Words:** Modified Alvarado scoring system, Acute Appendicitis, Diagnostic accuracy

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## INTRODUCTION

Acute Appendicitis is a common and urgent surgical illness. "It is most commonly seen in young and middle age with male dominance". It is one of the most common causes of abdominal surgical emergencies with a lifetime prevalence of approximately 1 in 7 population. It has been estimated that approximately 6% of population suffer from acute appendicitis during

their life time<sup>2</sup>. In the United States, 2,50,000 cases of appendicitis are reported annually, occurring mostly in the second and third decades of life<sup>3</sup>.

The incidence is highest in the teenage group, in which it is about 233/1,00,000 of the teenage population. In Asian and African countries, incidence of acute appendicitis is lower<sup>4</sup>. In mild cases it may resolve without treatment but in most cases require removal of inflamed appendix by appendectomy or laparoscopy."

The diagnosis of acute appendicitis is mostly clinical with typical features<sup>5</sup>. In order to reduce the negative appendectomy rate, various scoring systems have been devised to aid diagnosis of acute appendicitis. The Alvarado score is the most well-known and best performing in validation studies<sup>6</sup>. One such scoring system is modified Alvarado scoring system (MASS) which is based on statistical analysis of symptoms signs and laboratory data. The MASS has been shown by recent studies to be easy, simple and cheap for supporting the diagnosis of acute appendicitis<sup>6</sup>.

However, variations in clinical presentation occur according to the different positions of inflamed

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appendix<sup>7</sup>. "Acute appendicitis sometimes may be difficult to diagnose. Frequently appendix removed on clinical suspicion is reported histopathological as normal. The acceptable negative appendectomy rate in most surgical units varied from 5-25 percent<sup>8</sup>. Although nowadays normal appendectomy is considered to be quite a safe procedure but still associated with significant morbidity and may cause complications in 6-18% cases<sup>8</sup>."

Like elsewhere acute appendicitis is the most common general surgical emergency confronted in accident and emergency department. Appendectomies comprised about 50% of all cases admitted through emergency department, so a prospective study was carried out at surgical department Hyderanad and Nawabshah to ascertain the diagnostic accuracy based on clinical findings in accordance with the MASS.

## MATERIALS AND METHODS

This observational study was carried out on 227 consecutive patients of suspected acute appendicitis in the department of surgery of Liaquat and Peoples university of Medical and Health Sciences Hospital Hyderabad and Nawabshah from January 2015 to December 2016 over a period of 2 years.

Physical examination started from general look of the patient, pulse, blood pressure, temperature and respiratory rate. "Systematic examination included examination of central nervous system, respiratory system, cardiovascular system and spines. Examination of abdomen including distention, various signs, exact location of tenderness, signs of peritoneal irritation like guarding, rigidity, rebound tenderness. Presence of any intraabdominal mass / visceromegaly. Rectal examination was conducted in all patients and vaginal examination in selected patients. On investigation routine blood examination, including blood CP, urine analysis, blood sugar, ultrasonography of abdomen and pelvis was done in all cases and uric creatinine in selective patients. Score was calculated for each patient based on clinical results. Patients were divided in three groups with respective score. Group 1: immediate discharge and sent home group with judicious follow up (SCORE 1-4), Group 2: observation group (5-7) and Group 3: immediate appendicectomy (8-10). Age less than 5 years, evidence of generalized peritonitis, evidence of appendicular mass and evidence of ruptured appendix were excluded from this study."

In group 1 all patients treated conservatively and discharged to home with advice that if symptoms persist or condition detonates, visit emergency department immediately. In group 2 all patients kept under observation for 24 hours and reassessed at 6 hourly intervals. Those who improve on conservative treatment were discharged to home. Others in whom condition is not improved and the score increased then the later group patients were be submitted to group 3

## RESULTS

**Table No.1: Demographic Variable of Patients N=227**

Variable	No.Patients	Percentage
<b>Age</b>		
• 10-12 years	12	5.31%
• 13-20 years	120	52.91%
• 21-30 years	81	35.71%
• 31-40 years	7	3.01%
• 41-50 years	4	1.76%
• > 50 years	3	1.32%
<b>Modified Alvarado scoring</b>		
• 1-4 SCORE	33	47.5%
• 5 SCORE	49	67.4%
• 6 SCORE	37	80.6%
• 7 SCORE	24	
• 8 SCORE	52	
• 9 SCORE	18	
• 10 SCORE	14	
<b>Clinical Presentation (SIGNS)</b>		
• Distension	40	80%
• Dehydration	24	48%
• Tenderness	22	44%
• Operation	15	30%
• External Hernia	11	22%

**Table No.2: Clinical presentation and laboratory findings**

Table 10.12: Clinical presentation and laboratory findings			
Symptoms	N (%)	Score (mean+SD)	P Value
<b>Migratory Pain</b>			
• Present	108(47.5%)	5.7 ± 2.0	< 0.001
• Absent	109(52.4%)	7.1 ± 1.6	
<b>Nausea/Vomiting</b>			
• Present	153(67.4%)	6.8 ± 1.9	<0.001
• Absent	74(32.5%)	5.5 ± 1.7	
<b>Anorexia</b>			
• Present	183(80.6%)	6.4 ± 2.1	0.76
• Absent	44(19.3%)	6.3 ± 0.6	
<b>SIGNS</b>			
<b>Tenderness +ve in RIF</b>			
• Present	212(93.3%)	6.5±1.8	<0.001
• Absent	15(6.6%)	4.8±2.6	
<b>Rebound Tenderness</b>			
• Present	149(65.6%)	6.6±1.8	0.06
• Absent	78(34.3%)	6.1±2.1	
<b>Elevated Temperature</b>			
• Present	156(68.7%)	6.3±2.3	0.14
• Absent	71(31.2%)	6.7±0.8	
<b>Investigation</b>			
<b>Leukocystosis</b>			
• Present	157(69.1%)	6.71±1.9	0.002
• Absent	70(30.8%)	5.8±1.9	
<b>Neutrophilia</b>			
• Present	189(83.2%)	6.6±1.8	0.002
• Absent	38(16.7%)	5.5±2.5	

Out of 227,150 (66.7%) were male and 77(33.92%) were female. Age ranged from 10-62 year with mean age was 23.4±7.7 years (Table No.1). 33(14.54%) patients had an alvarado score of 1-4. All of them were discharged after initial assessment and symptomatic treatment. 3 patients were readmitted due to increase in severity of symptoms and required surgical intervention. Operative findings confirmed acute appendicitis. 49 (21.59%) patients with an Alvarado score of 5 were admitted for observation and evaluation. 37 patients required appendectomy because of persistence of symptoms and 12 patients were discharged after 24 hours of observation . 61 (26.87%) patients had score of 6-7 and were admitted

for observation and evaluation .All the patients had increased severity of symptoms and required surgical intervention 37% out of 227 patients were in the score range of 8-10, all of the underwent emergency surgery (Table No.2)."

"Out of 227, 185 patients underwent surgery in this series, the operative finding included acute inflamed appendix in 145 patients (78.3%). In 40(21.6%) cases, the appendix was found to be normal, resulting negative appendectomy. The other pathology revealed in 5 patients including mesenteric lymphadenitis, rupture ovarian cyst, meckel's diverticulitis and twisted ovarian cyst one patients each and no pathology was found in 1 case (Table No.3).

**Table No.3: Mode of treatment findings on exploration**

Treatment	Group Score (N=227)				Total	P Value
	1-4 (n=33>)	5 (n=49)	6-7 (n=61)	>8 (n=84)		
• Operative	3(9.1%)	37(75.5%)	61(100%)	84(100%)	185	< 0.001
• Conservative	30(90.9%)	12(24.5%)	0	0	42	
Findings on Exploration						
• Inflamed appendix	3(1.6%)	20(10.8%)	40(21.6%)	82(44.3%)	145 (78.3%)	<0.001
• Normal appendectomy	0	16(8.6%)	10(10.2%)	0	35(18.9%)	
• Mesenteric lymphadenitis	0	1(0.5%)	0	0	1(0.5%)	
• Ruptured ovarian cyst	0	0	0	1(0.5%)	1(0.5%)	
• Meckels diverticulitis	0	0	1 (0.5%)	0	1 (0.5%)	
• Twisted ovarian cyst	0	0	0	1 (0.5%)	1 (0.5%)	
• No pathology found	0	0	1 (0.5%)	0	1 (0.5%)	

## DISCUSSION

Appendix is a most frequent organ removed from body. The popularity this approach once gained is easy to understand. The surgeon's per operative diagnosis based on naked eye findings is well known to be unreliable, and without routine histological examination of the excised specimen there is possibility for our diagnostic appendicitis. But even if examination is made a routine the problem of misdiagnosis is still not completely solved. Understandably in larger number of operations one does not suppose acute appendicitis, but there is high incidence of 'acute appendicitis' on histopathology<sup>9</sup>.

According to some studies the clinical scoring system like Alvarado scoring can be used as quick and handy tool to apply in emergency departments and in rural area clinics to rule or rule out acute appendicitis<sup>10</sup>.

In last few years several scoring system have been developed for supporting the diagnosis of acute appendicitis<sup>11</sup>. Alvarado score has been found a good aid in making the diagnosis of acute appendicitis. It is a mathematical tabulation of a common clinical signs and symptoms found in patients of acute appendicitis. Usage of this scoring in children remains debatable and various modifications are under trial at various centers.

Proceeding to exploration in children should not be necessarily determined by scores , high complication rate is very common in this age group<sup>12</sup>. In this study patients below the age of ten years were kept in exclusion criteria.

The disease can occur at any time in a person's life the highest incidence is between the ages of 12-13 years while the lowest incidence is in individuals over the age of 60 years. Our data show that the majority of patients suffering from acute appendicitis were young patients. 88.55% of the patients suffering from were between 13-20 years of age. However we compare our results with those reported in other countries<sup>13</sup>.

Regarding the sex males had a highest incidence of acute appendicitis than females in nearly in all of age groups. Here males had a 1.95 times greater risk of having acute appendicitis than female which is in agreement in other studies<sup>14</sup>.

In present study all the patients complained of pain 108 patients presented with typical migratory pain, 38 with pain right iliac fossa, 60 complained of periumbilical pain while 21 presented with pain whole abdomen. Temperature elevation is not an essential finding in acute appendicitis. The fever may be low grade or high grade particularly associated with complications like perforation of appendicular abscess. Fever may be

associated with chills in out of 227 patients 156 were having fever 119 with low grade fever ( $\leq 100 F$ ) while 37 (23.72%) were having high grade fever ( $>100F$ ). Anorexia is an important and prevalent symptom in acute appendicitis in our study 80.6% of patients presented with anorexia this is comparable to studies<sup>15</sup>. When vomiting occurs in acute appendicitis it nearly always follows the onset of pain. Vomiting that proceeds is suggestive of intestinal obstruction. In our study 67.4% of patients presented with nausea or vomiting which is comparable with other studies<sup>16</sup>.

Debate has occurred for many years on the acceptable rate of negative appendectomy. The major concerns of surgeons managing a patient with acute right lower quadrant pain are the risks associated with negative exploration versus the hazards of the conservative management which may allow an appendix to perforate. In our study 185 (81.49%) out 227 patients with suspected acute appendicitis underwent appendectomy. Of those operated, 35 (18.94%) patients were found to have normal appendix while 5 (2.7%) had other pathologies so total normal appendix were 40 (21.64%). Hence, the negative appendectomy rate in present study was 21.6% which is comparable with other studies and reported 9.2% to 15.8%<sup>17</sup>.

This highlights the sensitivity of Alvarado scoring system. In female additional investigation may be required to confirm the diagnosis. Only 3 patients in this series with a score of below 4 had appendicitis. If this was used as admission criteria 33 patients with score of 1-4 did not require admission can be sent home with advise to come if symptoms aggravate. Forty nine patients with score of 5 were admitted in hospital of which 37 patients required appendectomy. The remaining twelve patients were discharged on conservative treatment. This highly suggests that patients with Alvarado score of 4 or less have minimal chances of appendicitis and thus no surgical intervention is required. While patients with score with the score of 5 or above will probably require surgical intervention.

"It is also important to emphasize that scoring may not be accurate in patients who are unable to give proper history, such as very young or those with communication problem<sup>18</sup>. Eighty four patients in this study were in the score range of 8-10. All underwent emergency surgery and were found to have acute appendicitis or its complications or found to have other pathology. The result of this study that clinical judgement can be prioritized and can lead to good clinical performance in management of patients with suspected appendicitis with no significant increase in rate of complicated appendicitis and negative findings on appendectomy<sup>8</sup>."

Modified Alvarado scoring system is easy to apply in emergency departments to rule in acute appendicitis. This system is a dynamic one along with observation

and clinical re-evaluation of the symptoms for the clinical picture.

## CONCLUSION

Acute appendicitis is a diagnostic challenge for the surgeons. Modified Alvarado scoring system is a reliable, cheap, handy tool for diagnosis of acute appendicitis. In spite of having radiological investigations in the modern era there is no laboratory or radiological test which reliably diagnose the condition. Alvarado scoring system is found to be helpful in the diagnosis and management of acute appendicitis. Diagnosis is virtually confirmed with score of 7-10 especially in males and they should undergo appendectomy

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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