

# Acute Appendicitis in Children: Comparison of Clinical Diagnosis Versus Modified Alvarado Score System

M HUSSAIN M KASHIF . S AHMAD H K PASHA

Department of Paediatric Surgery, Nishtar Medical College/Hospital, Multan  
Correspondence to Dr. Mukhtar Hussain, Associate Professor

**Objective:** To compare the accuracy of clinical diagnosis of Acute Appendicitis with that of Alvarado Score System in Children. **Design:** A Prospective and Comparative Study. **Patients and Duration of Study:** Department of Paediatric Surgery, Nishtar Medical College & Hospital, Multan from January 2001 to June 2002. All patients of pain abdomen with suspicion of acute appendicitis were included in study. **Subjects and methods:** 92 patients were admitted with pain abdomen. After preliminary history and examination sixty were suspected of acute appendicitis. A Detailed history, clinical examination and relevant investigations were done. These patients were divided in two equal groups of 30 each. In group-I all the findings were entered on Performa based on the indicants of modified Alvarado Score. Later on their Score was calculated according to the assigned weightage of each indicant. Twenty-eight patients were submitted for Surgery having Alvarado Score of  $>7$ . In group-II patients were clinically evaluated by one of the consultant to declare the diagnosis of Acute Appendicitis or otherwise. Twenty-nine out of 30 were submitted for surgery in this group. Three cases turned out to be of mesenteric lymphadenitis confirmed on Ultrasonography. The diagnosis of Acute Appendicitis was further confirmed by Histopathology of appendix after removal. Hence the accuracy of both methods was compared. **Results:** The diagnostic accuracy of Alvarado Score was 85.71% with false positive or negative appendectomy rate of 14.29% while the accuracy of clinical diagnosis was 93.01% with false positive or negative appendectomy rate of 6.99%.

**Key words:** Acute appendicitis-child-diagnosis, clinical, Alvarado Score System.

Acute appendicitis is common with a life time occurrence of 7%<sup>1</sup>. The diagnosis of acute appendicitis remains, despite of all medial advances and investigation, a difficult task even for an experienced surgeon<sup>2</sup>. The rate of negative appendectomy up to 30% is acceptable in literature by most of the surgeons<sup>3,4</sup>. To prevent the complications of negative appendectomy (i.e. increased morbidity, Pneumonia, wound sepsis, adhesive obstruction etc), a high diagnostic accuracy is required in cases of acute appendicitis<sup>5</sup>. Since unnecessary surgery carries a complications rate of 20% while at the same time unnecessary delay carries high morbidity<sup>6</sup>. Although improvement in pre-operative diagnosis by Ultrasonography, barium enema, CT Scan and Laparoscopy has greatly reduced the rate of negative appendectomy but it involves lot of economic strains. Therefore clinical judgment has to be relied upon mostly in developing countries like Pakistan. Abdominal pain, vomiting, loss of appetite and tenderness in the right iliac fossa (RIF) are the predominant clinical signs and symptom in children. A complete blood count and urine analysis are helpful in determining the diagnosis. Traditionally the decision of an experienced surgeon has been of utmost importance in the diagnosis of Acute Appendicitis. For the last few years, a diagnostic scoring system such as modified Alvarado Score System has been employed in diagnosing the disease in children<sup>7</sup>. The aim of this study is to compare the diagnostic accuracy of traditional clinical methods with that of modified Alvarado Score System. Study also helps in evaluation of the modified scoring system as well.

## Material and methods

We have conducted a prospective study during a period of eighteen months from January 2001 to June 2002 in the department of the Paediatric Surgery, Nishtar Medical College & Hospital, Multan. Out of 92 patients of pain abdomen, 60 patients were admitted with the suspected diagnosis of acute appendicitis. All patients were attended by the Registrar/Senior Registrar on duty. A detailed history and clinical examination were performed and blood complete and urine complete examination were also done in all the cases. These patients were divided in two groups of 30 each.

### Group-I.

These patients were diagnosed on the basis of modified Alvarado Score System. Proper entries were made in the Performa after this work up. The Alvarado Score System assigns a numerical value to eight signs and symptoms associated with acute appendicitis (Table-1). Total score is ten. A score  $< 7$  means some other entity and a score of  $>7$  means either suspicious or confirmed acute appendicitis (Table-2). Those cases where modified Alvarado Score was  $> 7$  at the first or subsequent examination were submitted for surgery.

### Group-II.

These patients were evaluated by one of the consultant on call in order to diagnose the acute appendicitis as a traditional method. Of course all the clinical signs and symptoms along with laboratory findings were taken into consideration for the diagnosis. However tenderness in right iliac fossa and rebound tenderness were mainstay of clinical diagnosis by the surgeon.

The specimens of removed appendix of all cases were sent for histopathology and decision of exact diagnosis and sensitivity was based on histopathology report. The results of sensitivity of clinical diagnosis with that of Alvarado Score System are further analysed.

**Results**

The ages of the patients were in the range of 3-14 years. Majority of them were between 5-10 years of age. There were 38 male and 22 female children with F:M of 1:1.72 (Table-3). All these patients were admitted through emergency. Table-4 shows the distribution of indicants of Alvarado Score System. In-group I, amongst the symptoms, vomiting was the commonest feature seen in 28(93.33%) patients and migratory pain RIF least common symptom seen in 16(53.33%) patients.

Amongst the signs, tenderness in RIF was the commonest feature seen in 29(96.66%) patients and left shift of neutrophils was the least common seen in 20(66.66%) patients. Table-5 shows the total score distribution of patients. Maximum No. of patients i.e. 18 (60%) scored between 9 to 10 which also includes four cases of perforated appendix. None scored between 1-4 while only 2(6.6%) patients scored between 5-6, which were diagnosed as mesenteric lymphadenitis on ultrasonography and were excluded from study. In-group 2 vomiting was present in 29(96.66%), tenderness in 29(96.66%), rebound tenderness in 26(86.66%) and leucocytosis was seen in 26(86.66%) cases. Diagnostic accuracy on clinical grounds is shown in Table-6. Twenty-nine cases were submitted to surgery on clinical diagnosis. Twenty-seven (93.10%) cases were diagnosed as acute appendicitis on histopathology, which also include 6 cases of perforated appendix.

Table 1. The Alvarado scoring system

Symptoms	Score
Migratory pain right iliac fossa	1
Nausea/vomiting	1
Anorexia	1
<b>Signs</b>	
Tenderness in RIF	2
Rebound tenderness in RIF	1
Elevated temperature	1
<b>Laboratory findings</b>	
Leucocytosis	2
Shift to left of neutrophils	1
Total score	10

Table 2. Significance of scoring system

Score	Significance
1-4	Unlikely to have acute appendicitis
5-6	Diagnosis comparable with acute appendicitis, does not warrant appendectomy
7-8	Probably acute appendicitis
9-10	Definite acute appendicitis

Table 3. Age and sex distribution (F:M: 1:1.72)

Age	n=	Male	Female
0-5 years	03	03	-
5-10 years	35	23	12
10-14 years	22	12	10
Total	60	38	22

Table 4. Distribution of indicants of Alvarado score system

Indicants	n=	%age
Migratory pain RIF	16	53.33
Anorexia	26	86.66
Nausea/vomiting	28	93.33
Fever	26	86.66
Tenderness RIF	29	96.66
Rebound tenderness	24	80.00
Leucocytosis	26	86.66
Left shift to neutrophils	20	66.66

Table 5. Score distribution of patients

Score	n=	%age
1-4	-	-
5-6	02	6.6
7-8	10	33.33
9-10	18	60

Table 6. Clinical diagnostic accuracy

No. of cases	Histopathology	%age
29	27	93.10

Table 7. Diagnostic accuracy of alvarado score system

Score	No. of Pts. Operated	Histopathology	Sensitivity
7-8	10	07	70
9-10	18	17	94.44

Hence diagnostic accuracy on clinical diagnosis came out to be 93.10%. The diagnostic accuracy was 70% in patients with Alvarado Score of 7-8 while it was 94.44% in patients with Alvarado Score of 9-10, with an overall sensitivity of 85.71%.

**Discussion**

Acute appendicitis is by far one of the most commonly diagnosed abdominal emergency in children like adults 8. Therefore exact diagnosis of disease is utmost important. Since it involves surgical intervention after diagnosis, hence the importance of accurate diagnosis becomes double fold. The traditional clinical decision process involving history and clinical examination by some experienced surgeon can solve the problem to a greater and better extent. But at the same time the junior surgeon who has to make a decision for surgery might need some complementary aids. Amongst all the diagnostic aids, USG, Laparoscopy and C T Scan have shown good clinical results but have its own limitations and draw backs at the same time. They are time consuming and are not cost effective.

In recent years different scores have been developed to help in diagnosing acute appendicitis. They are non invasive, require no special equipment, consume less time and can be used in routine<sup>9</sup>. The initial assessment can be improved by using a scoring system such as modified Alvarado score system as it relies purely on clinical history, physical examination and few laboratory investigations and easy enough to apply<sup>10</sup>.

Maximum No. of children 38(63.33%) were 5-10 years of age which is almost similar to the study of Abbasi et al<sup>11</sup>. Regarding the pattern of clinical presentation, vomiting was present in 57(95%), tenderness in RIF in 58(96.66%), Rebound Tenderness in 50(83.33%) and leucocytosis in 53(86.66%) cases while in the study of Bhopal G.Faisal<sup>12</sup> Vomiting was present in 72%, Tenderness RIF 99% and Leucocytosis in 86% cases; where as Jobst-M<sup>13</sup> detected the vomiting in 100%, Tenderness in 89% and fever in 61%. The clinical findings of both these studies are almost similar to that of our study.

There is no sign, symptom or disease, which is 100% reliable in the diagnosis of acute appendicitis; however, we can use the diagnostic score as a guide to decide if the patient needs an observation or surgery. Diagnostic accuracy in our study on clinical ground was 93.10%, which is probably due to the fact that every patient was examined by one of the consultant on call to make the decision. Bhopal<sup>12</sup> et al has concluded that careful clinical assessment is the single most important factor in diagnosis of acute appendicitis. Our clinical diagnostic accuracy is more or less similar to the study of Hoffman et al<sup>14</sup>.

We had 7% rate of negative appendectomy in Group-II. Krakaus diagnosed 237 cases of acute appendicitis on clinical grounds and had a rate of negative appendectomy of 13%<sup>15</sup>, which he refers due to retrospective type of study where selection criteria of patient is variable.

At the same time diagnostic accuracy of Alvarado scoring system has turned out to be 85.7% in our study. The diagnostic accuracy range of Alvarado scoring system has been given by different studies from 76.3% to 87.5%<sup>3,7,16,17</sup> Stephen and Mazzucco while comparing diagnostic accuracy of Alvarado Score and Ultrasonography has concluded that Alvarado Score Alone has accuracy of 88%<sup>18</sup>.

### Conclusion

1. Clinical diagnosis by expert surgeon still have better accuracy.

2. Alvarado score system can be used as a good adjunct to surgical decision-making in suspected cases of acute appendicitis.
3. It can help pediatricians and Gen. Practitioners regarding referral to surgical specialist.

### References

1. Hardin-DM Jr. Acute appendicitis: review and update. *Am-Fam-Physician* 1999; 60(7): 2027-2034.
2. Krihav-K; Rod-Z; Houstack-S. Appendicitis and ultrasound diagnosis in children. *Rozhi-Chir* 1999; 78(6): 266-9.
3. Kalan M, Talbot D, Cunliffe WJ. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: A prospective study. *Ann R Coll Surg* 1994; 76:418-9.
4. Rao PM, Rhea JJ, Novelline RA et al. Effect of computed tomography of the appendix on treatment of patients and use of hospital resources. *NEJM* 1998; 338:141-46.
5. Chaudhry Z, Ayyaz M. Appendicectomy and reproductive health: the role of a general surgeon in preventing infertility in the young female – a preliminary report. *J Coll Phys Surg Pakistan* 1995; 5(4): 212-3.
6. Malik AA, Wanie NA. Continuing diagnostic challenge of acute appendicitis: evaluation through modified Alvarado score. *Aust.NZ. J. Surg.*, 1998;68:504-5.
7. Macklin Cp, Merei JM, Radeliffe G.S, Striner MD. A appendicitis in children *Ann R Coll Surg* 1997; 79:203-5.
8. Temple CL, Huchcroft SA, Temple WJ. The natural history of appendicitis in adults: A prospective study. *Ann Surg* 1995:221:278.
9. J. Ambreen, A Ansul et al. Clinical Scoring System: A Valuable Tool for Decision making in cases of Acute Appendicitis. *J. Pak. Med. Assoc.* 1999;49(10): 254-59.
10. Alvarado AA practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med* 1986; 15(5): 557-65.
11. Abbasi A, Shah Y et al, Acute Appendicitis in Children, *J Surg. Pakistan* Vol 3(2): 1998 28-30.
12. Bhopal G Faisal, Khan TS, Iqbal M. Surgical audit of acute appendicitomy. *JCPSP* vol.9 (5): 223-226.
13. Jobst-M. Diagnosis of appendicitis in early childhood *Zentralbl-Chir.*1998; 123 Suppl 4:77-9.
14. Hoffman JO, Rasmussen O. Aids in the diagnosis of acute appendicitis. *Br J Surg* 1989; 76:774-9.
15. Karakas-SP, Guelfguat-M, Leonidas-Jc et al. Acute appendicitis in Children: Comparing of clinical diagnosis with US&CT imaging. *Pediatr Radiol*, 2000Feb; 30(2): 94.
16. A Kamran, K Asadullah, W Irashad. Evaluation of Alvarado Score in diagnosis of Acute Appendicitis *JCPSP* 2000 Vol.10 (10): 392-394.
17. Owe TD, Williams H, Stiff G et al. Evaluation of Alvarado Score in acute appendicitis. *JR Soc Med* 1992; 85:87-8.
18. Stepheus PL, Mazzucco JJ. Comparison of US and Alvarado Score for the diagnosis of acute appendicitis. *Comm-Med.*1999March; 63(37): 137-40.