Determining Accuracy of Alavarado Score and Ultrasonography in Diagnosis of Acute Appendicitis

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Abstract: Objective: Comparative study of Diagnostic accuracy of Modified Alvarado Score and Ultrasonography in Acute Appendicitis. Methods: A total of 798 patients of with all age group, both male and females, with clinical features suggestive of acute appendicitis were selected non-randomly for the study. Data was collected as Alvarado score, ultrasonograpic findings and histopathological reports. Statistical analysis was performed and results of both Alvarado score and Ultrasonography were compared. Results: Of 798 patients taken, maximum percentage of patients were in age group 21-30 yrs with males dominated the series. The sensitivity and specificity of alvarado score was 80.36% and 81.89% with PPV 91.02% and NPV 64.61% and diagnostic accuracy of 80.82% respectively. Ultrasonography study revealed 85.05% sensitivity and specificity of 51.02%,PPV and NPV were 79.86% and 59.90% and diagnostic accuracy was 74.68% respectively. Conclusions: The Alvarado score is better investigative tool than ultrasonography alone in diagnosis of acute appendicitis. [Kaushal S NJIRM 2017; 8(6):41-45]

Key Words: Alvarado Score, Ultrasonography, Acute Appendicitis.

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Introduction: Appendix is considered as vestigial part anatomically but is one of the most important surgically involved organs in human body. Appendicitis is most commonly encountered condition involving almost every age group and requires urgent interventions most of the time.[1]

In 1886 Reginald Heber Fitz described the classic case presentation of acute appendicitis which includes migratory paraumbilical to right illiac fossa pain, nausea, vomiting and low to high grade fever.[2]Variation in the age, degree of inflammation and position of appendix clinical presentation is variable and makes the diagnosis difficult. Early diagnosis is important in management of case of appendicitis to reduce further complications. Incidence of 1.17 per 1000 with lifetime risk of 8.6 %among males and 6.7% in females.[3] In acute appendicitis it is not possible to have definite diagnosis by gold standard test which histopathological examination.[4]Many attempts to increase the diagnostic accuracy in appendicitis are made which includes imaging techniques like ultrasonography, abdominal X-ray films, barium meal follow, colourDoppler ultrasonography, CT scan, radioisotope imaging. It has been claimed that ultrasonography can alone help in reducing the number of negative appendicectomy especially in children and in young females it helps to exclude the gynecological problems.[5]

Over the last years many scoring systems are introduced,studied and tested like Fenyo, Christian, Lidverg, Ohman and Alvarado scoring system to make an early diagnosis in case presented with suspicion of acute appendicitis. It has been claimed that ultrasonography dramatically reduces the number of negative appendicectomies. It is especially useful in children and young adults and in females it will allows exclusion of gynecological causes mimicking appendicitis leading to diagnostic accuracy.[6-8]

The aim of our study is to validate the diagnostic accuracy of Alvarado score and ultrasonography in early diagnosis of acute appendicitis.

Alvarado Score

Symptoms /signs/investigation	Score	
Symptoms	**Yes**	**No**
Migration of pain to right iliac fossa	1	0
Anorexia	1	0
Nausea /vomiting	1	0
Signs		
Tenderness in right iliac fossa	2	0
Rebound tenderness	1	0
Temperature> 37.3oC	1	0
Investigations		
Leukocytosis > 10 *10 /l	2	0
Shift to the left	1	0
Total	10	0

Scoring system: 1-4 Appendicitis likely, 5-6 appendicitis possible, 7-10 appendicitis definitive.

Method: This retrospective study was conducted in a Smt Shardaben Municipal general Hospital, Saraspur, Ahmedabad in state of Gujarat in western India. The present investigation included patients who presented to OPD, indoor and emergency department between April 2015 and April 2017 with right lower quadrant abdominal pain who were suspected to be having acute appendicitis. A total of 798 patients qualified based on inclusion criteria. The proforma containing demographics, presenting symptoms and signs were documented. The patients' symptoms, signs and laboratory indicators of appendicitis recorded according to Alvarado score for Appendicitis. The patients were further divided into 4 groups. With a score ≥7 as diagnostic (high probability) operated in 24 hrs, score 4-6 as doubtful (equivocal) with positive ultrasonography reports were operated in 24 hrs and considered as USG positive group ,score 4-6 as doubtful (equivocal) with negative USG finding were managed conservatively and marked as USG negative, and score ≤3 unlikely (low probability) to suffer from disease were given conservative treatment. Comparison made between accuracy of Alvarado scoring and ultrasonography in diagnosis of appendicitis with definitive histopathological reports and tables made for comparison and values were calculate by using statistical software (SPSS) version 22 (SPSS Inc, Chicago, IL, USA). The sensitivity and specificity were calculated.

Results: Our study consisted of 798 patients with acute appendicitis, among whom 507 (63.53%) were males and 291 (36.46%) females.

Out of 798 patients, maximum patients with acute appendicitis was found in 21-30 years age group (n=314, 39.34%), (Figure - 1).

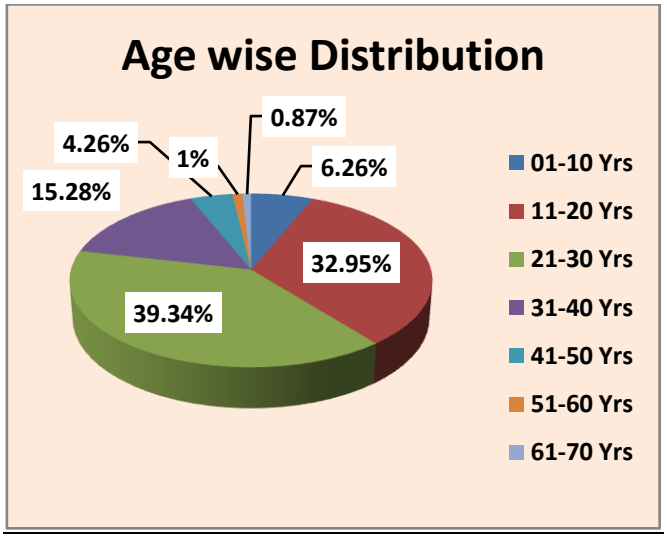

Table 1: Results of our treatment plan of score >7

Sex	Alvarado score >7	USG Positive		Treatment plan	Confirmed appendicitis	
		No	%	Appendicectomy	No.	%
Male	336	251	74.70	336	321	95.53
Female	154	112	72.72	154	125	81.16
Total	490	363	74.08	490	446	91.02

From Table-1, accuracy of acute appendicitis confirmed to 446 (91.02%) patients out of 490 (59.32%) patients have Alvarado score >7 while 74.08% of patients have confirmed of acute appendicitis by USG positive.

Table 2: Results of our treatment plan of score <7

Sex	Alvarado score <7	USG Positive		Treatment plan		Confirmed appendicitis	
		No	%	Conservative	Appendicectomy	No.	%
Male	172	126	73.25	46	126	56	44.44
Female	136	102	75	34	102	53	51.96
Total	308	228	74.02	80	228	109	47.80

From Table-2, Patients whose USG finding suggestive of appendicitis were operated and rest are managed conservatively and discharged according to their recovery.

Table 3: Sensitivity and specificity of Alavarado score

Diagnostic test result	Appendicitis	No appendicitis	Total
Score >7	446	44	490
Score< 7 (both group 1 and 2)	109	199	308
Total	555	243	798

Table 4: Sensitivity and specificity of Ultrasonography

Diagnostic test	Appendicitis	No appendicitis	Total
USG positive	472	119	591
USG negative	83	124	207
Total	555	243	798

Sensitivity and specificity of Alavarado score and Ultrasonography were found in Table 3 and Table 4.

Table 5: Diagnostic accuracy of both Alavarado score and Ultrasonography

	Alavarado score	Ultrasonography
Sensitivity	80.36	85.05
Specificity	81.89	51.02
Positive predictive value	91.02	79.86
Negative predictive value	64.61	59.90
Negative appendicectomy rate	8.97	20.13
Diagnostic accuracy	80.82	74.68

Diagnostic accuracy of acute appendicitis was found in Alavarado score80.82 % compare to Ultrasonography 74.68% in Table 5.

Discussion: The diagnostic accuracy in cases of acute appendicitis should be high because negative appendicectomy conveys significant morbidity as there is a greater risk for abdominal adhesions after appendicectomy. However, the symptoms of appendicitis may not be classical, and in such situation; a policy of involvement to avoid damage may lead to high negative appendicectomy rate. Difficulties in diagnosis arise in very young, elderly patients and females of reproductive age because they are more likely to have an atypical presentation, and many other conditions may simulate acute appendicitis in these patients. In such cases, clinical examinations should be complemented with various investigations to exclude other diseases and helpful to achieve a more accurate diagnosis.

Data were studied for age and sex distribution revealed that occurrence of appendicitis more common among males with 63.55%. Kailas singh et al[9] in 2008 study found male female cases respectively 55% and 45% and Talukadar et al found the ratio of 1.38:1 respectively.[10]

Maximum case presented were from age group of 21-30 (39.34%) wide predominance of males and next in age group 11-20 (32.95%) both of these group includes almost 72% of cases. Similar study was performed by Talukadar et al[10] and Kailas singh[9] also found that maximum incidence is among 2nd and 3rd decade.

In present study, we have divided the Alvarado scoring system in two groups. Firstly with a score >7 termed as Alvarado Score positive and secondly with a score <7 termed as Alvarado Score negative. Out of 798 patients; 490 were considered positive (score >7) and they underwent appendicectomy irrespective of ultrasonographic finding.Patients who were scored negative for Alvarado Score (Score <7); underwent appendicectomy on the basis of positive ultrasonographic findings.

Out of the 308 patients with negative Modified Alvarado Score, 228 showed positive ultrasonographic findings and underwent appendicectomy. In present study; the sensitivity and specificity of Modified Alvarado Score is 80.36% and 81.89% respectively. Anand Rao et al have documented similar results with a sensitivity and specificity of 88.8% and 75% respectively. Alamgir et al have reported the finding of sensitivity (94.14%); which is inagreement with the present study but the finding of specificity was 66.66%, which was lower than the finding of present study.[12] R. Yegane et al have documented low sensitivity (55%) and specificity (59%) and concluded that Alvarado Score is neither sensitive nor specific for diagnosis of acute appendicitis.[13]In contrast, Srivastava et al have reported low positive and negative predictive value of about 77% and 52%; which is lower than the present study.[14]The present study; the negative appendicectomy rate is 8.97% .T.D. Owen et al have agreement (<10%) with the present study.[15]Moreover, I. Khan et al[16]and Talukder DB et al[10]were documented negative appendicectomy

rate between 16% to 22%, which is higher than this study.[10,16]

In our study in present series; the sensitivity and specificity of ultrasonography is 85.05% and 51.02% respectively. The positive and negative predictive value being 79.86% and 59.90% respectively and the negative appendicectomy rate being 20.13% by ultrasonography. Puylaert et al have recognised sensitivity of ultrasonography 75%; which was lower than the findings of present series; but specificity was 100%, which is higher than the present study.[17] J.A. Worrel et al have found sensitivity and specificity of 68% and 98% respectively.[18]

There are even opinions and evidences that if negative appendicectomy rates are below 10-15% the surgeon is operating on too few patients thus increasing the risk of complications.Even though the scoring system may be effective in the adults but not in younger children because it does not contain variables that allow for further differentiating appendicitis from the numerous other conditions mimicking it in the pediatric population.

Conclusion: From present study it is concluded that Alvarado scoring system has better role in diagnosis of acute appendicitis than Ultrasonography alone and better at reducing the negative appendicectomy rate. But still neither Alvarado nor USG can alone relied upon in management of cases suspected for appendicitis. Alavarado score performs well as a rule out criterion. As a decision rule in relation to surgery the alavarado score can't be used to rule in a diagnosis of appendicitis without surgical assessment and further diagnostic testing.

Although ultrasonography alone has higher rate of negative appendicectomy than alavarado score so positive ultrasonography cannot be prerequisite for appendicectomy in patients with suspected appendicitis. It can be only complimentary to clinical course or clinical judgements.

References:

1. Sim KT, Picone S, Crade M, Sweeney JP. Ultrasound with graded compression in the evaluation of acute appendicitis. J Natl Med Assoc 1989; 81:954-957.
2. Mohamed AA and Bhat NA. Acute appendicitis dilemma of diagnosis and management. The internet journal of surgery 2010; 23(2), DOI: 10.5580/18e0
3. Addiss DG, Shaffer N, Fowler BS, Tauxe RV: The epidemiology of appendicitis and appendectomy in the United States. Am J Epidemiol. 1990, 132: 910-925.
4. Kalan M, Talbot D, Cunliffe WJ, et al. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: a prospective study. Ann R Coll Surg. 1994;76:418–419.
5. Singh SK, Kunal C. Comparative study of diagnostic accuracy of modified Alvarado score and ultrasonography in acute appendicitis. IOSR-JDMS. 2014;13:36-40.
6. Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med 1986; 15 : 557-564.
7. Owen TD, William H, Stiff G, Jinkinsen LR, Rees BI. Evaluation of Alvarado score in acute appendicitis. J R Soc Med 1992; 85: 87-8.
8. Ohmann C, Yang O, Frank C. Diagnostic score for acute appendicitis. Abdominal pain study group. Eur J Surg 1995; 161: 273-281.
9. Singh K, Gupta S, Pargal P. Application of Alvarado Scoring System in Diagnosis of Acute Appendicitis.Vol. 10,No. 2, April-June 2008.
10. Talukder DB, Siddiq AZ. Modified Alvarado scoring system in the diagnosis of acute appendicitis. Journal of Armed Forces Medical College, Bangladesh. 2009;5:18-20.
11. Anand Rao Internet Journal of Surgery, 2007
12. Khan A, Munir A, Qadir S. Acute Appendicitis: Role of Alverado Scoring System in the Diagnosis. Gomal Journal of Medical Sciences. 2009 Dec 31;7(2).
13. R. Yegane et al. Evaluation of Modified Alvarado score in acute appendicitis in Iranian Patients. ActaMedicaInranica 2008; 46; 501-506.
14. Shrivastava UK, Gupta A, Sharma D. Evaluation of the Alvarado score in the diagnosis of acute appendicitis. Tropical gastroenterology: official journal of the Digestive Diseases Foundation. 2004;25:184-6.
15. Owen TD, Williams H, Stiff G, Jenkinson LR, Rees BI. Evaluation of the Alvarado score in acute appendicitis. Journal of the Royal society of medicine. 1992;85:87-8.
16. Khan I, Rehman A. Application of Alvarado scoring system in diagnosis of acute appendicitis. J Ayub Med Coll Abbottabad. 2005;17:13-21.

17. Puylaert JB, Rutgers PH, Lalisang RI, De Vries BC, Van Der Werf SD, Dörr JP, Blok RA. A prospective study of ultrasonography in the diagnosis of appendicitis. New England Journal of Medicine. 1987;317:666-9.
18. Worrell JA, Drolshagen LF, Kelly TC, Hunton DW, Durmon GR, Fleischer AC. Graded compression ultrasound in the diagnosis of appendicitis. A comparison of diagnostic criteria. Journal of ultrasound in medicine. 1990;9:145-50

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