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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/16132
DOI URL: http://dx.doi.org/10.21474/IJAR01/16132

RESEARCH ARTICLE

COMPARISON OF ULTRASOUND AND THE ALVARADO SCORE IN THE DIAGNOSIS OF ACUTE APPENDICITIS : A PROSPECTIVE COMPARATIVE STUDY IN A TERTIARY CARE CENTRE IN WESTERN MAHARASHTRA

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Manuscript Info

Manuscript History
Received: 30 November 2022
Final Accepted: 31 December 2022
Published: January 2023

Key words:-
Appendicitis, Alvarado score, Ultrasonography, Mantrels, Appendicectomy

Abstract

Background : Acute appendicitis is one of the most common surgical emergencies with a lifetime prevalence of approximately 1 in 7. The Alvarado scoring system and ultrasonography play a definite role in diagnosis of acute appendicitis, because of the easy availability, cost effectiveness and being radiation free. According to the analysis, the percentage of Appendicectomies done for a normal appendix mistaken to be Acute Appendicitis was found to be as high as 20%.The following study compares the accuracy of the Alvorado scoring system and Ultrasonography in the diagnosis of Acute appendicitis and examines the value of using both modalities together.

Materials and Methods : In this study 100 patients were included with provisional diagnosis of acute appendicitis and admitted and operated in the Department of General Surgery, MGM Medical College, Navi Mumbai between January 2021 to November 2022. Alvarado score was applied and ultra sound abdomen was done pre operatively. The decision for surgery was made independent of the score and ultra sound finding. Diagnosis of patients who underwent appendicectomy was confirmed by histopathology report.

Results : In the present study, 100 cases were provisionally diagnosed of having acute appendicitis and were operated during the study period.Itwas seen that 95.52% of patients who were thought to be positive by Alvarado score >=7 usually had appendicitis by histopathology where as 4.08% of the patients were normal by histopathological examination. This accounted for 47.96% and 33.33% of the total patients respectively. From this the sensitivity of the Alvarado score is calculated to be 47.96%. Ultrasound alone showed a PPV of 67% and a NPV of 66.7%.

Conclusion : In our study, Alvarado score had better sensitivity than ultrasonography. Alvarado score has a high diagnostic value (97.7%). USG has role in ruling out normal appendix and other pathology, with a specificity of 66.67% When we diagnose acute appendicitis based on the individual results of Alvarado score and USG, we get a statistically significant value. Hence as a conclusion of this study, alvaradoscore and USG together could be applied in the diagnosis of acute appendicitis for better outcomes and decision making.

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Introduction:-

Acute appendicitis is one of the most common surgical emergencies with a lifetime prevalence of approximately 1 in 7. It has been claimed that diagnostic aids can dramatically reduce the number of surgical interventions in patients without appendicitis, the number of perforations, and the time spent in hospital[1]

The accuracy of the clinical examination has been reported to range from 71% to 97% and varies greatly depending on the experience of the examiner. Methods that can assist in the diagnosis of appendicitis include ultrasonography[2], scoring systems,[3,4] computer programs,[5] computed tomography,[6] magnetic resonance imaging[7] and laparoscopy.[6,7] Graded compression ultrasonography is the least expensive and least invasive of these and has been reported to have an accuracy of 71% to 95%.[8]

The Alvarado scoring system and ultrasonography play a definite role in diagnosis of acute appendicitis, because of the easy availability, cost effectiveness and being radiation free.

According to the analysis, the percentage ofAppendicectomies done for a normal appendix mistaken to be Acute Appendicitis was found to be as high as 20%. Unnecessary surgical intervention when it is not indicated can be a reason for high morbidity and mortality and stress for the patient.

The following study compares the accuracy of the Alvorado scoring system and Ultrasonography in the diagnosis of Acute appendicitis and examines the value of using both modalities together.

Aims And Objectives:-

To evaluate the sensitivity of use of Alvarado scoring system and ultrasound in the diagnosis of acute appendicitis and to reduce the rate of negative appendicectomy.

Methodology:-

In this study 100 patients were included with provisional diagnosis of acute appendicitis and admitted and operated in the Department of General Surgery, MGM Medical College, Navi Mumbai between January 2021 to November 2022. Alvarado score was applied and ultra sound abdomen was done pre operatively. The decision for surgery was made independent of the score and ultra sound finding. Diagnosis of patients who underwent appendicectomy was confirmed by histopathology report.

Criteria for acute appendicitis by Alvarado score

Table No. 1: Alvarado scoring system.

SCORE	
Symtoms	
Migratory RIF Pain	1
Anorexia	1
Nausea/ Vomiting	1
Signs	
Tenderness RIF	2
Rebound Tenderness RIF	1
Elevated Temperature	1
Laboratory Findings	
Leucocytosis	2
Shift to Left of Neutrophils	1
Total Score	10

Criteria for acute appendicitis by ultra sound
Sonographically, appendicitis is suggested by the presence of pain on graded compression of the area in which abnormal appendix is seen as a tubular, blind ending, aperistaltic structure which is non compressible with a diameter of 7 mm or greater in antero posterior direction. The presence of a fecolith or prominence of peri appendicular fat is an indirect sign. Ultra sonography was considered negative when the appendix could not be found or was normal, or if non appendicular pathology was discovered.

Criteria for appendicitis by histopathology:
A histological criterion for the diagnosis of acute appendicitis is polymorphous leucocytic infiltration of the muscularis mucosa.

Inclusion Criteria
All patients clinically diagnosed with the acute appendicitis and undergoing open or laparoscopic appendicectomy.

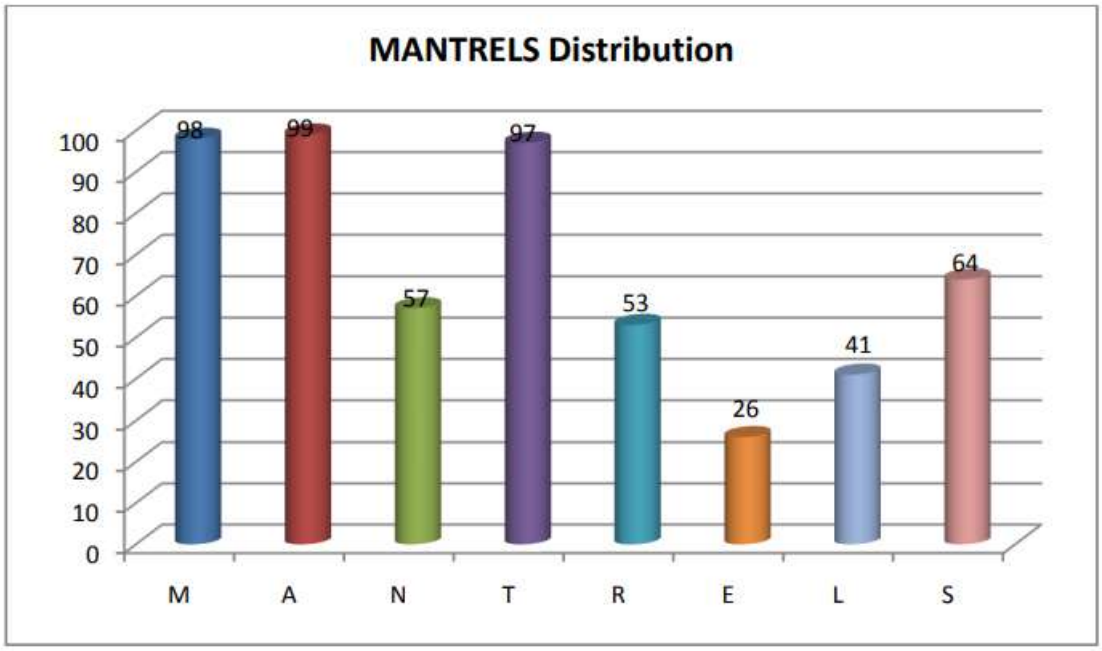
Exclusion criteria:
1. Patients who were diagnosed to have other causes of right lower quadrant pain.
2. Age less than 14 years.
3. Pregnant females
4. Patients who were managed conservatively
5. Patients who had a palpable abdominal mass

Observation And Results:-
In the present study, 100 cases were provisionally diagnosed of having acute appendicitis and were operated during the study period.

According to this study 51 patients were female and 49 patients were male

Table 2:- Mantrels Distribution.

MANTRELS	No. of patients	HPE		Chi-square value	P value
		Present	Normal		
M	98	93	5	79.02	P < 0.01
A	99	93	6	76.45	P < 0.01
N	57	53	4	42.12	P < 0.01
T	97	93	4	81.66	P < 0.01
R	53	51	2	45.3	P < 0.01
E	26	23	3	15.38	P < 0.01
L	41	39	2	33.39	P < 0.01
S	64	60	4	49	P < 0.01



The above table shows the distribution of MANTRELS. 99 patients had anorexia. 98 patients had migratory RIF pain.97 patients had tenderness in right iliac fossa.64 of the patients had shift of neutrophils to the left. 57 patients had nausea and vomiting, 53 had rebound tenderness. 41 patients had leucocytosis >10,000 and 26 had fever. The p values of each of the above parameters, when individually compared to the histopathology report as seen in the table is <0.01 which is statistically significant.

Table 3:- Alvarado Score Distribution.

ALVARADO Score	OUTCOME		
	Present	Normal	Total
4	15	02	17
5	04	0	04
6	28	02	30
7	05	0	05
8	25	01	26
9	15	01	16
10	02	0	02
TOTAL	94	06	100

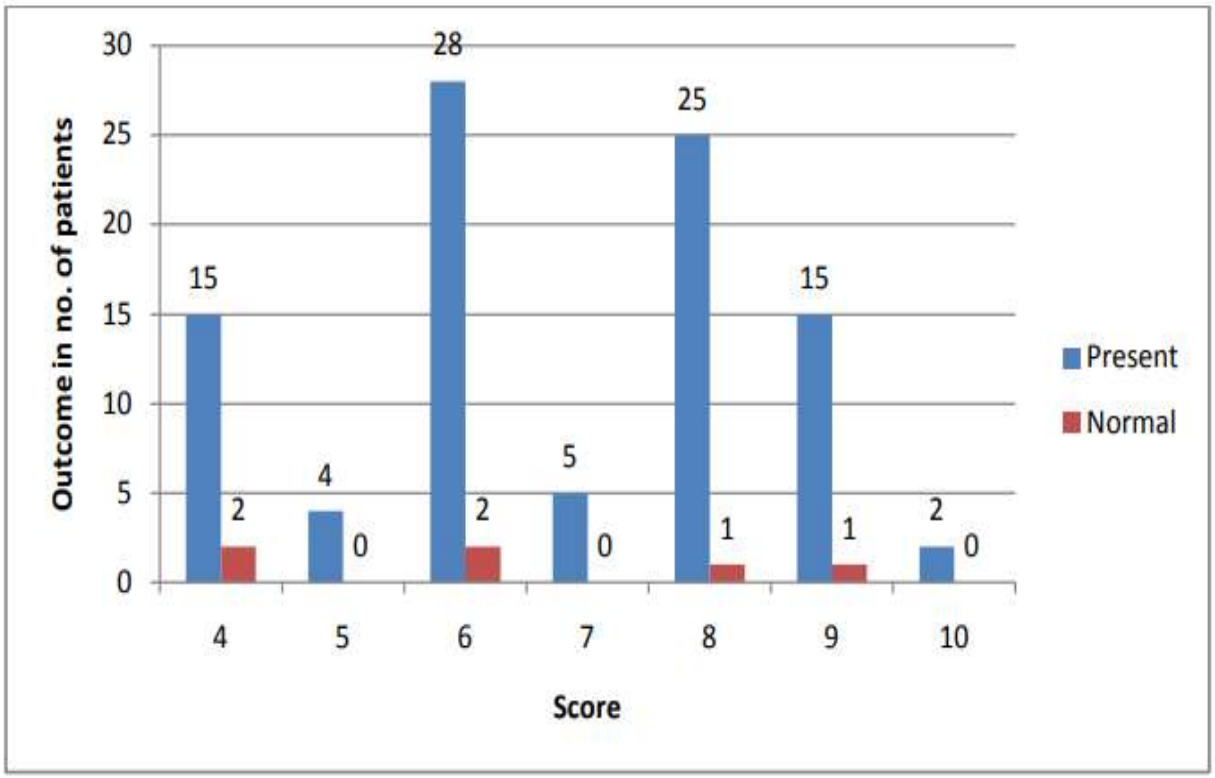
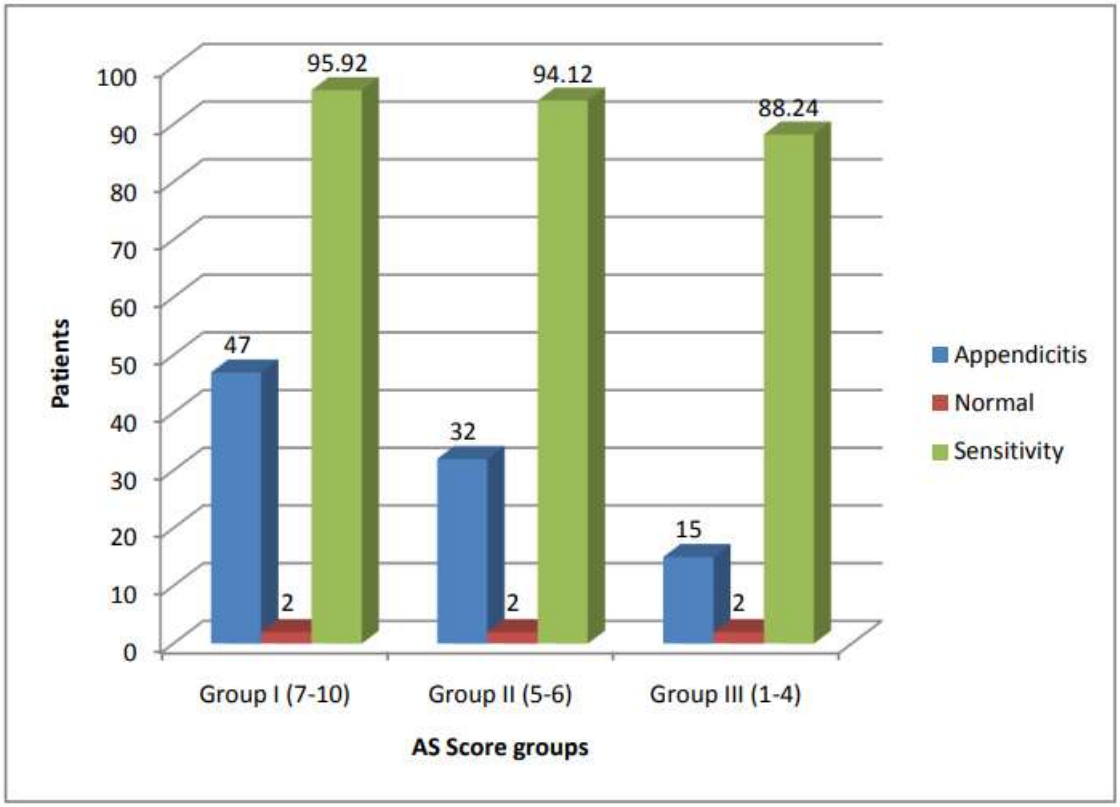


Figure Alvarado Score vs Histopathological Outcome

From the above table it is concluded that in our study,out of 100 patients,17 patients had score of 4 out of whom 2 had normal appendix.4 patients had score of 5 and all had appendicitis. Total of 30 patients had score of 6 out of whom 28 patients had appendicitis and 2 normal.26 patients had score of 8, 25 patients of whom had appendicitis and 1 patient had normal appendix. Out of 16 patients who had score of 9, 15 had appendicitis. Total of 2 patients had score of 10 and both of them appendicitis.

Table 4:- Groupwise Sensitivity of Alvarado Scoring System:

Groups	Score	Appendicitis	Normal	Total	Sensitivity	Chi-square value	P value
I	7-10	47	02	49	95.92%	41.33	< 0.01
II	5-6	32	02	34	94.12%	26.47	< 0.01
III	1-4	15	02	17	88.24%	9.94	< 0.01
	Total	94	06	100	94%	77.44	< 0.01



From the above table; in the study, 49 patients were in the group I among which 47 had appendicitis and 2 were normal with a sensitivity of 95.92%.34 patients were included in the group II amongst whom 32 had appendicitis and 2 had normal appendix. Group II had a sensitivity of 94.12%. 17 patients were included in the group III, of whom 15 had appendicitis and the rest were normal, with over all sensitivity of 88.24%.The over all sensitivity was found to be 94%.

Table 5:- Over all Sensitivity of Alvarado Scoring System.

	Outcome		
	Present	**Normal**	**Total**
ALVARADO Positive for appendicitis	47 95.92% 47.96%	02 4.08% 33.33%	49 100% 49%
Negative	47 92.16% 50%	04 7.8% 66.67%	51 100% 51%
Total	94 94% 100%	6 6% 100%	100 100% 100%

From the table it is seen that 95.52% of patients who were thought to be positive by Alvarado score >=7 usually had appendicitis by histopathology where as 4.08% of the patients were normal by histopathological examination. This

accounted for 47.96% and 33.33% of the total patients respectively. From this the sensitivity of the Alvarado score is calculated to be 47.96%

Table 6:- Ultrasonography findings.

	HPE s/o Appendicitis	**HPE Not s/o Appendicitis**	**Total**
USG s/o Appendicitis	63	02	**65**
USG not s/o appendicitis	31	04	**35**
	94	06	**100**

Ultrasound alone showed a PPV of 67% and a NPV of 66.7%

Discussion:-

The main aim of the clinical decision making process is to reach an accurate diagnosis in the fastest and cheapest way.

Appendicitis still poses a diagnostic challenge and many methods have been investigated to try to reduce removal of a normal appendix without increasing the perforation rate. Radiological methods such as ultrasonography and computed tomography are being used. In an attempt to increase the diagnostic accuracy, several scoring systems have been devised. Alvarado score is one such simple system based on few symptoms, signs, and a basic laboratory investigation. Ultrasound is often used as the initial diagnostic imaging in which cases the clinical diagnosis is equivocal. USG is non invasive, rapidly available and avoids radiation exposure.

In our study of 100 patients (49 males and 51 females), on histopathological examination 94 patients had acute appendicitis with a negative appendicectomy rate of only 6%. In similar studies done by Khan et al[9], Ohmann et al[10], and Arian et al[11] , negative appendicectomy rates of 14%, 14.3% and 16.1% respectively were observed.

According to our study, all the parameters in the MANTRELS score were found to have a statistical significance. According to a study done by Want et al[12], the sensitivity of leucocytosis count was 67% in the diagnosis of appendicitis. In another study done by Cardall et al[13] , the sensitivity of leucocytosis was 76% and elevated temperature was 47%. They considered this significant. In a study done by Anderssonet al[14], elevated temperature, leucocytosis, tender RIF, and rebound tenderness had individual statistical significance in the diagnosis of acute appendicitis.

In our study, 49 patients had a score of >=7 of which 47 proved to have acute appendicitis on operative and histopathological examination, with a sensitivity of 95.92%. In a study by Lone et al[15] a sensitivity of 93% was seen.

The overall sensitivity of patients with a score of 5-6 was 94.12% with a negative appendicectomy rate of 6% and the overall sensitivity of patients who had a score of 1-4 was 88.24% with a negative appendicectomy rate of 11.8%.

According to our study, USG alone had a sensitivity of 67% and a specificity of 66.7% in the diagnosis of acute appendicitis. In other studies done by Skaaneetal[16] and Douglas et al[8], the sensitivity and specificity were 78%, 92% and 94.7% and 88.9% respectively.

As per many studies, Alvarado score and ultrasonography do not show a significant advantage over the other when used alone. When used together and both are positive, the rate of false positives drops down to zero. Ultrasonography is usually helpful and improves diagnostic accuracy when Alvarado score is found to benegative or equivocal.[17]

From the above discussion it can be concluded that Ultrasonography alone cannot replace the clinical examination and judgement and suspicion of the surgeon. Clinical judgement and high index of suspicion is superior to ultrasonography. Although, in usual presentations, ultrasonography can prove useful for aiding in the diagnosis of acute appendicitis when the index of suspicion is not high and Alvarado score is equivocal or negative.

Hence, thorough clinical examination with judicial use of ultrasonography aid can help diagnose acute appendicitis faster and with increased accuracy and avoid delay in deciding need for appendicectomy and at the same time reducing the number of negative appendicectomies.

Conclusion:-

In our study, Alvarado score had better sensitivity than ultrasonography. Alvarado score has a high diagnostic value (97.7%). It is non invasive, not expensive and of immediate help for diagnosis.

USG has role in ruling out normal appendix and other pathology, with a specificity of 66.67%

When we diagnose acute appendicitis based on the individual results of Alvarado score and USG, we get a statistically significant value. Hence as a conclusion of this study, alvarado score and USG together could be applied in the diagnosis of acute appendicitis for better outcomes and decision making.

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