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Application of Appendicitis Inflammatory Response (Air) Scoring System for Diagnosis of Acute Appendicitis and Its Comparison with Alvarado Score

[1]Dr Rekha Porwal, Senior Professor and Unit Head, Department of Surgery, J.L.N Medical College, Ajmer
[2]Dr Yogesh Kumar Agrawal, Resident Doctor, Department of Surgery, J.L.N Medical College, Ajmer
[3]Dr Ram Prasad, Assistant Professor, Department of Surgery, J.L.N Medical College, Ajmer
[4]Dr. U.S. Parihar, Senior Professor & HOD, Department of Surgery, J.L.N Medical College, Ajmer
[5]Dr Anil k Sharma, Assistant Professor, Department of Surgery, J.L.N Medical College, Ajmer
[6]Dr Vinod Yadav, Assistant Professor, Department of Surgery, J.L.N Medical College, Ajmer
[7]Dr Rati Agrawal, PhD Organic Chemistry

Corresponding Author: Dr Yogesh Kumar Agrawal, Resident Doctor, Department of Surgery, J.L.N Medical College, Ajmer

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Abstract

Background: The AIR score has been validated and found to outperform older Alvarado score. This may be because the AIR score relies less on subjective symptoms such as anorexia or nausea, includes C-reactive protein and employs graded parameters, compared with the dichotomized variables in the Alvarado score.

Methods: The present study was conducted in the department of surgery, J.L.N. Medical College attached hospital, Ajmer during the period of Jan 2018 to Dec 2019. The popultion consists of 100 patients presenting with pain in the right lower quadrant of abdomen, who after clinical examination were provisionally diagnosed to have acute appendicitis and warranted surgery for the same.

Results: AIR (98.92%) were more sensitive than Modified alverdo score (83.47%). Specificity (100%) and positive predict value (100%) were same in MAS & AIR.

Conclusion: To conclude, AIR scoring performed well almost equally with Alvarado system with high specificity and high negative predictive value preventing unnecessary negative appendectomies. Follow up of these cases will help in deciding surgical intervention in unnecessary cases. This scoring system also prevents unnecessary and costly radiological investigations thereby reducing the financial burden to the patients.

Keywords: AIR, MAS, Acute appendicitis

Introduction

Acute abdominal pain is a common complaint amongst emergency patients. Diagnosis of one of the most common pathologies behind acute abdominal pain, acute appendicitis, has radically changed over the last decades. Traditionally, the diagnosis of appendicitis was made solely based on clinical symptoms and signs, and later it included results of inflammatory laboratory variables such as leukocytes, neutrophils, and CRP. This practice in diagnosis led to a false positive diagnosis (negative appendectomy) rates in the range of 15-30% [1-3]

Acute appendicitis is the most common surgically correctable cause of abdominal pain, the diagnosis of which remains difficult in many instances. Some of the signs and symptoms can be subtle to both the clinician and the patient and may not be present in all instances. Arriving at the correct diagnosis is essential, however, a delay may allow progression to perforation and significantly increased morbidity and mortality. Incorrectly diagnosing a patient with appendicitis although not catastrophic often subjects the patient to an unnecessary operation [4]

The diagnosis of acute appendicitis is essentially clinical; however a decision to operate based on clinical suspicion alone can lead to removal of a normal appendix in 15-30% cases. The premise that it is better to remove a normal appendix than to delay diagnosis doesn‟t stand up to close scrutiny, particularly in the elderly. A number of clinical and laboratory based scoring systems have been devised to assist diagnosis. The most commonly used is the Alvarado score and equally its modifications [5]

The appendicitis inflammatory response (AIR) score is recently developed diagnostic tool that uses seven scored variables to stratify patients into low-, intermediate and high risk group. Low risk group could be discharged unless any indication of appendicectomy warranted. Whereas high risk patients are likely to require revaluation with focus on timely surgical intervention along with diagnostic imaging. Intermediate risk classification identifies patients likely to benefit from observation and systematic diagnostic imaging.

The AIR score has been validated and found to outperform older Alvarado score. This may be because the AIR score relies less on subjective symptoms such as anorexia or nausea, includes C-reactive protein and employs graded parameters, compared with the dichotomized variables in the Alvarado score. This prospective observational study in a prospective cohort aimed to assess the discriminatory performance of the AIR score and evaluate whether it could safely guide decision making to reduce emergency admissions, optimize diagnostic imaging and prevent negative surgical explorations.

Material & Methods

Study Setting: The present study was conducted in the department of surgery, J.L.N. Medical College attached hospital, Ajmer during the period of Jan 2018 to Dec 2019. The popultion consists of 100 patients presenting with pain in the right lower quadrant of abdomen, who after clinical examination were provisionally diagnosed to have acute appendicitis and warranted surgery for the same.

Study Population: All patients above 12 year of age with suspected acute appendicitis seen at emergency department and in the different surgical wards of JLN hospital.

Inclusion criteria: All patients above 12 year with suspected acute appendicitis that consented to be included in the study.

Exclusion criteria

1. Patients with generalized peritonitis
2. Patients with previous abdominal surgery
3. Patients with blunt and penetrating abdominal trauma
4. Patients with declined to give consent
5. Patients < 12 year at age
6. Pregnant female

Study design: prospective observation study.

Sample size: This was an observational study to evaluate diagnostic accuracy all patients who met the eligibility criteria and who consented to be recruited into the study underwent diagnosis according to a protocol incorporating the modified Alvarado score and AIR score. 100 consecutive patients above 12 year with suspected appendicitis were recruited at the JLN hospital Ajmer, emergency department and different surgical wards over a period of 2 year.

Results

In present study, maximum 34% patients belonged to age group was 21-30 years followed by 28(28%) in 31-40 age group, 2 (2%) cases in >60yrs age group. Male patients (64%) contributed to larger proportion of our study population as compared to females (36%). Male and female ratio was 1.77.

Table1: Distribution of cases according to Modified Alvarado Scoring (N=100 cases)

Modified Alvarado Scoring(MAS)	No.	Percentage
1-4	2	2%
5-6	20	20%
7-9	78	78%

In present study, out of total 100 patients 78(78%) were have MAS score 7-9, 20% were have 5-6 and 2% have MAS score 1-4.

Table 2: Distribution of cases according to appendicitis inflammatory response (AIR) score (N=100 cases)

Appendicitis inflammatory response (AIR) score	No.	Percentage
1 to 4	1	1%
5 to 8	7	7%
>8	92	92%

In present study, out of total 100 patients 92(92%) were have AIR score score more than 8, 7% were have 5 to 8 and 1% were have AIR score 1-4.

Table 3: Distribution of cases according to histopathological finding (HPE) (N=100 cases)

HPE finding	No.	Percentage
Positive	93	93%
Negative	7	7%

In present study, out of total 100 patients 93(93%) were have positive HPE finding and 7% were have negative HPE finding.

Table 4: Overall Sensitivity and Specificity of Modified Alvarado Score

	HPE positive	HPE negative	Total
MAS positive (≥7)	78	0	78
MAS negative (<7)	15	7	22
Total	93	7	100

78 (true positive) patients who had MAS 7 or more had appendicitis on histopathology while no patients (false positive) had a normal appendix; 15(false negative) patients with MAS less than 7 had appendicitis and 7(true negative) had a normal appendix removed.

Sensitivity -83.87%, Specificity- 100%, Positive predictive value-100%

Negative predictive value-31.82%

Table 5: Overall Sensitivity and Specificity of appendicitis inflammatory response (AIR) score

Appendicitis inflammatory response (AIR) score	HPE positive	HPE negative	Total
AIR positive(>9)	92	0	92
AIR negative(<9)	1	7	8
Total	93	7	100

Out of 93 patients who actually had appendicitis, 92(true positive) were positive on AIR while 7 (false negative) were missed; while no patients (false positive) patients were positive on AIR who had a normal appendix.

Sensitivity -98.92%, Specificity- 100%, Positive predictive value-100%

Negative predictive value-87.50%.

Table 6: Comparison of diagnostic variables of MAS and AIR

	MAS	AIR
Sensitivity	83.87%	98.92%
Specificity	100%	100%
Positive predict value	100%	100%
Negative predict value	31.82%	87.50%

AIR (98.92%) were more sensitive than Modified alverdo score (83.47%). Specificity (100%) and positive predict value (100%) were same in MAS & AIR.

Discussion

Acute appendicitis is a common surgical emergency with an incidence of 1.17/1000 population and a lifetime risk of 8.6% in men and 6.7% in women, with highest incidence in adolescent age.[6] Most of the conditions which mimic appendicitis may create confusion in accurate diagnosis and management. Hence most of the surgeons rely on imaging studies which provides valuable information regarding the diagnosis. But as mentioned in many studies, tomographic studies are associated with increased radiation hazard and increased cost in low income countries. Hence false diagnosis and delay in diagnosis may result in unnecessary appendectomies and increased complications and morbidity.[7]

Most of the cases of diagnosis in acute appendicitis relies upon surgeon's knowledge and experience with similar cases. Hence the drawbacks could be overcome by using a clinical scoring system which can help in diagnosis as well as prognosis of the current patient from those presenting with similar clinical scenario. In developing countries and low-income countries, a simple and effective scoring system without tomographic or imaging studies could help in preventing misdiagnosis and decrease the rate of negative appendectomies.

In present study, out of total 100 patients 78(78%) were have MAS score 7-9, 20% were have 5-6 and 2% have MAS score 1-4. Similar result were observed by Thabit et al[8] and Vandakudri AB et al[9].

Modified Alvarado described a scoring system in 1986 which was later modified by kalan et al[9] to modified Alvarado score. The scoring system involves following components with a total score of 9. A score of 7 or more is considered high probability for appendicitis.

In present study, out of total 100 patients 93(93%) were have positive HPE finding and 7% were have negative HPE finding. Same result were observed by Rasoul,et al[10] and Kimaro,S.et al[11].

Modified Alvarado score of 7 and above had a positive predictive value of 100%.In this study 78% of the patients who were predicted to have appendicitis by a high score had confirmed appendicitis on histopathology. This gave a crude negative appendicectomy rate of 12% that is in keeping with what Ongaro[12] found in his study in *2007Year*. A high Alvarado score was however unable to distinguish between appendicitis and other mimicking diagnosis in 5 cases. A systematic review by Ohle et al[13] found out that a high Alvarado score was less sensitive as a 'rule in' score than as a 'rule out' for those below 5.48. Our study suggests that a high Alvarado score is a useful tool to set aside patients for immediate appendicectomy without further diagnostics.

The present study was conducted to compare the AIR score with Alvarado scoring system in cases suspected with acute appendicitis. Another advantage in AIR scoring is not only in accurate diagnosis but also in discriminating objectively the necessity to operate or not to operate with a follow up. In our study there was a good statistical correlation of AIR score in cases of acute appendicitis when compared to Alvarado scoring system. The same was validated in many studies prior by Sudhir et al and Kim BS et al in their studies.[14,15] Few of the studies which used Alvarado scoring system did not include C reactive protein in the study group and found no difference in the rates of perforated appendix, negative appendectomies and complications between the groups. They also found a delayed appendectomy rate (2 vs 8%) and a lower delayed discharge rate (11 vs 22%) in the group.[16]

In the present study, Sensitivity of AIR scoring system was 98.92%. Findings of our study were similar with findings of Castro et al.[17]

Present study clearly validates that AIR scoring system performs well than Alvarado scores. This would clearly help in selecting patients who require surgical intervention and follow up in cases of low score individuals. This also helps the cases to avoid hospitalization and to prevent costly investigations in which the diagnosis is unlikely. Hence a prospective randomized control trial should be done on large scale population to evaluate the effect of AIR scoring system and to compare the results.[18]

Conclusion

To conclude, AIR scoring performed well almost equally with Alvarado system with high specificity and high negative predictive value preventing unnecessary negative appendectomies. Follow up of these cases will help in deciding surgical intervention in unnecessary cases. This scoring system also prevents unnecessary and costly radiological investigations thereby reducing the financial burden to the patients.

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