Comparison of Diagnostic Accuracy of Modified Alvarado's Score Vs AIR Score in Acute Appendicitis

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Abstract

Objective: To determine the diagnostic accuracy of MASS Vs AIR score in patients with acute appendicitis taking histopathology as gold standard.

Material and Methods: Study design is cross sectional study (Validation). The study took place in the Department of General Surgery Nishtar Hospital Multan form 2nd august 2022 to 1st Feb 2023. The technique used for sampling is Non-Pro-bability consecutive sampling. Sample size is calculated using PASS 11, through formula for paired sensitivities (McNemar test). In total, 148 patients with diagnosis of acutely inflamed appendix, fulfilling the inclusion criteria, after taking informed consent, were enrolled. Baseline data including age, gender, MASS and AIRS was noted.

Results: patients were having a mean age of 32.91±9.06 years. There were 97(65.54%) male and 51(34.46%) female. Histopathology showed 114(77.03%) patients had acute appendicitis. Sensitivity, specificity, PPV, NPV& DA was 71.05%, 85.29%, 94.18%, 46.77%&74.23% respectively for MASS. Sensitivity, specificity, PPV, NPV& DAwas 94.49%, 88.23%, 96.49%, 88.23% &94.59% respectively for AIR.

Conclusion: AIR score is an improved diagnostic scoring system than MASS for acute appendicitis.AIR is more sensitive and more specific than MASS. In addition, the two scores can be easily computed through a detailed history and clinical exam and basic laboratory tests.

Keywords: Histopathology, AIR, MASS, Appendicitis

How to cite: *Aziz M, Javaid AH, Ayub M, Khan H, Qureshi UH, Qureshi KH. Comparison of Diagnostic Accuracy of Modified Alvarado's Score Vs AIR Score in Acute Appendicitis. Esculapio - JSIMS 2023;19(03):292-297*

DOI: https://doi.org/10.51273/esc23.25131936

Introduction

Appendicitis is defined as inflammation of appendix. It is common cause of pain in right iliac fossa. Acute appendicitis is an acute inflammation (lasting less than 4 days) of the vermiform appendix.[1] Chronic Appendicitis is defined by the following: (A) The patient has a history of pain in the right iliac fossa for a minimum of 3 weeks without an alternate diagnosis. (B) After the appendectomy, the patient is completely relieved of the symptoms. (C) Histopathology supports chronic active inflammation of the wall of the appendix or fibrosis of the appendix.

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Submission Date: 11-08-2023
1st Revision Date: 27-08-2023
Acceptance Date: 11-09-2023

One of the most common surgeries in emergency is appendectomy for acute appendicitis and it poses a difficulty in accurate diagnosis as the symptoms are ambiguous and remains a diagnostic difficulty. It has great numbers of clinical imitators and confirmation is done mainly on clinical bases leading to the formation of the scoring system based on clinical imitators to identify the correct diagnosis.[2]

Modified Alvarado's scoring system (MASS) and Appendicitis Inflammatory Response (AIR) Score are scoring systems for diagnosis of acute appendicitis,[3] as there is approximately 15-20% of negative appendectomies done in most of the studies done using MASS.[4,5]

A study was conducted in Kerala, INDIA in 2018-19 showing MASS was found to have a sensitivity of 64.44%, specificity of 58.82 when cutoff value of score was set at 7 and sensitivity & specificity of AIR score was found 97.78% and 29.41% respectively When the cut-off value for the score has been set to 5.. Total number of

patients positive for acute appendicitis on histopathology were 90 (84.11%).[1] A study was conducted in Ayyub Teaching Hospital, Abbottabad in 2018 that showed the sensitivity of 63% and specificity of 83% of MASS when cut off value of score was set at 7 while diagnosing the case of acute appendicitis, which was less than other scoring systems mentioned in study. Histopathology showed acutely inflamed appendix in 81.6 % (102) patients & 18.4% (23) patients underwent negative appendectomy.[6] The present study aims to reduce the risk of a negative appendectomy. As few surgeons frequently and unne-cessarily rely on imaging studies to diagnose the case of acute appendicitis, it puts a burden on countries with limited resources & these imaging studies are also asso-ciated with increased radiation hazard which can be avoided. The present study was aimed to determine and compare the diagnostic accuracy of MASS Vs AIR score in acute appendicitis taking histopathology as gold standard.

Material & Methods

Study Design is Cross Sectional Study (Validation). The study took place in the Department of General Surgery Nishtar Hospital Multan form 2nd august 2022 to 1st Feb 2023. The technique used for sampling is Non-Probability consecutive sampling. Sample size is calculated using PASS 11, through formula for paired sensitivities (McNemar test). Where sensitivity of Modified Alvarado's score is 64.4% and sensitivity of appendicitis inflammatory response score is 97.7%, power of the study is 80%, significance level is 5% and prevalence of acutely inflamed appendix in patients presenting with acute abdomen is 40%. Sample size calculated is 148. All consenting patients (males and females) clinically suspected of acute appendicitis. Age range 18-50 years, pregnancy, patients with mass in right iliac fossa (assessed on clinical examination) and history of stone in urinary tract or pelvic inflammatory disease assessed on medical records.

It is defined as acute, non traumatic pain of <4 days in right lower quadrantin congruous with diagnosis of acutely inflamed appendix via clinical and USG findings.[1] Score of ≥ 7 will be taken as high likelihood for acutely inflamed Appendix as per literature available. Score of ≥ 9 will be taken as high likelihood foracutely inflamed Appendix as per literature available.[1] The acute inflammation of the microscopic examination of appendix specimen will show mucous erosions or scattered crypts abscess or collection of neutrophils or mural necrosis[7].

Following approval by the Hospital Ethical Board, all patients who met the inclusion criteria were registered for the study by the Department of General Surgery. (Emergency/OPD) Nishtar Hospital Multan. Written informed consent was obtained after the study subject matter was explained Patients were assessed and scores were calculated. Surgery was performed by a consultant surgeon having minimum 3 years of experience in surgery. Demographic data regarding age, gender, address were noted. A detailed history and a physical exam were conducted. Baseline labs including CBC, LFTs, RFTs, S/E (as a pre-requisite of surgery) and CRP were done. All post operation sample of appendix were sent to Histopathology Department, Nishtar Hospital Multan for Histopathology. The data was recorded in a specifically designed proforma. Data has been entered and analyzed through SPSS ver-sion 23.0. Mean and SD was determined for quantitative variables like age, MASS and AIR score. Frequency and %age was determined for qualitative variables like gender. Effect modifiers like age, gender were addressed through stratification of data. Chi square after stratifi-cation was applied and p-value ≤ 0.05 was considered significant. Diagnostic accuracy was assessed using 2×2 contingency table taking histopathology as gold standard for both Modified Alvarados score & appendicitis inflammatory response score.

Results

Mean age of the patients was 32.91 ± 9.06 having minimum age of 18 and maximum age of 50. There were

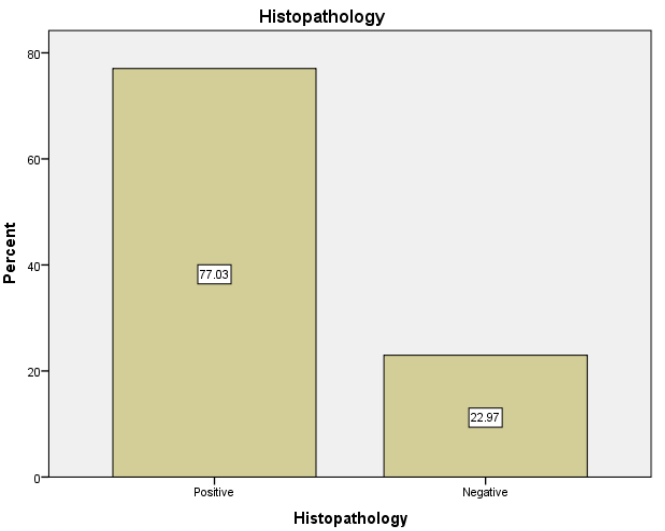

Fig-1: *Distribution of histopathology report of patients having surgical intervention on suspicion of acute appendicitis (n=148).*

97(65.54%) male and 51(34.46%) female. Histopathology showed 114(77.03%) patients had acute appendicitis and 34(22.97%) didn't have acute appendicitis. So rate of negative appendectomies was 22.97%. . Sensitivity, specificity, PPV, NPV and DA was 71.05%, 85.29%, 94.18%, 46.77%, 74.23% respectively for MASS. **(Table1)** Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy was 94.49%, 88.23%, 96.49%, 88.23%, 94.59% respectively for AIR. **(Table 2)**

Table 1: *Diagnostic Values of Modified Alvarado's Scoring system (MASS) using 2×2 contingency table taking histopathology as gold standard.*

MASS	Histopathology Positive	Histopathology Negative
MASS ≥7	81	5
MASS <7	33	29

Sensitivity: 71.05 % : Specificity: 85.29 %: PPV: 94.18 %: NPV: 46.77 %: DA: 74.23 %

Table 2: *Diagnostic Values of Appendicitis Inflammatory Response Score using 2×2 contingency table taking histopathology as gold standard.*

AIR Score	Histopathology Positive	Histopathology Negative
AIR Score ≥9	**110**	**4**
AIR Score <9	**4**	**30**

Sensitivity: 96.49 %: Specificity: 88.23 %: PPV: 96.49 %: NPV: 88.23 %: DA: 94.59%

Discussion

Surgical removal of the acutely inflamed appendix is one of the most common emergency surgical procedure done in general surgery. The risk of developing acute appendicitis throughout life is 8.6% for men and 6.7% for women. Lifetime risks of having surgical intervention for acutely inflamed appendix is approximately 12% for males and 23% for females.

It is very difficult to decide whether to go for appendectomy or conservative management in a suspected case of acute appendicitis as there is increase risk of perforation of acutely inflamed appendix and infection ultimately leading to increased morbidity and mortality if one avoids appendectomy to increase diagnostic accuracy, on the other hand if one doesn't go for diagnostic accuracy then there is increased risk of negative appendectomies.[8]

Since introduction of Alvarado scoring system in 1986 the correct diagnosis of acute appendicitis significantly improved and it became very famous due to its greater efficacy when applied to populations in the USA and Europe. Since last decade AIR, another scoring system has shown promising results even better than Alvarado scoring system in validation studies for diagnosis of acutely inflamed appendix.[9] Our study compared the sensitivities, the specificities, the PPVs, and the NPVs between the modified Alvarado score and AIR scoring systems. The PPVis the ratio of patients actually diagnosed as positive versus all those who tested positive. NPV is the ratio of patients actually diagnosed as negative to everyone who had negative test results.

A study was conducted in Kerala, INDIA in 2018-19 showing MASS was found to have a sensitivity of 64.44%, specificity of 58.82 when cutoff value of score was set at 7 and AIR score was found to have a sensitivity of 97.78%, specificity of 29.41% when cut off value of score was set at 5. Total number of patients positive for acute appendicitis on histopathology were 90 (84.11%).[1] A study was conducted in Ayyub Teaching Hospital, Abbottabad in 2018 that showed the sensitivity of 63% and specificity of 83% of MASS when cut off value of score was set at 7 while diagnosing the case of acute appendicitis, which was less than other scoring systems mentioned in study. Histopathology showed acutely inflamed appendix in 81.6 % (102) patients & 18.4% (23) patients underwent negative appendectomy.[6]

In our study, the sensitivity of AIR score was remarkably better than MASS. Sensitivity, specificity, PPV, NPV was 71.05%, 85.29%, 94.18%, 46.77 respectively for MASS. Sensitivity, specificity, PPV, NPV value was 94.49%, 88.23%, 96.49%, 88.23% respectively for AIR. As per our results it can be safely assumed that AIR scoring system can diagnose a case of acute appendicitis with better accuracy and also reduces the need of USG or other radiological studies.[10] AIR score of ≥ 9 in patient with Right iliac fossa pain indicate need of surgery. With the help of AIR scoring system, operating surgeon can make timely and quick decision.[11]

Conclusion

It can be safely assumed that AIR scoring system can diagnose a case of acute appendicitis with better accuracy and also reduces the need of USG or other radiological studies and it has high discriminating power than MASS. AIR score may help to select patients who require timely surgical intervention or those who need additional

imaging assessment and can be given a trial of medical management according to imaging reports. The AIR score has the potential to be a preferred scoring system. With the help of AIR scoring system, a timely decision can be made by operating surgeon, with a score ≥ 9 recommending a need for surgical intervention.

Conflict of Interest: *None*

Funding Source: *None*

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Authors Contribution

MA: Conceptualization of Project
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MY: Literature Search
HK: Statistical Analysis
UHQ: Drafting, Revision
KHQ: Writing of Manuscript