

## Investigation on the Diagnostic Utility of the Appendicitis Inflammatory Response Score and the Alvarado Score in Cases of Acute Appendicitis in Paediatric Age Group

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### Abstract:

**Background:** “Acute appendicitis has a considerable influence on clinical practice, despite the fact that it may be difficult to diagnose. It is imperative that a correct diagnosis be reached on the first attempt if one wants to stay clear of potentially catastrophic outcomes. The process of clinical decision-making is influenced by both the Alvarado and Acute Inflammatory Response scores to varying degrees.

**Aim:** This study aimed to compare and contrast the AIR and Alvarado scores for their use in diagnosing acute appendicitis.

**Materials & Methods:** The current investigation got under way after receiving clearance from the institution's ethical committee. Participants were followed throughout the course of time in this prospective observational research. The General Surgery Department of GMCH Sundargarh in consultation with Department of Paediatrics & Pathology served as the location for the research that was carried out. The data collection phase of the research endeavor began on August 2022 and lasted for 18 months. All of the participants in this research went to the emergency department with symptoms of acute appendicitis, and they all ended up having their appendix removed after undergoing a thorough examination & investigation.

**Results:** Males accounted for 64% of the total population, while females accounted for 34%. Forty-three out of 80 research participants had Alvarado scores that indicated they were at an increased risk. According to the AIR score, 49 (89% of the total) individuals were at high risk for appendicitis, and HPE confirmed the diagnosis in 55 (69% of the total). As shown in Table 1, we found that the Alvarado score, AIR score, and HPE diagnosis of appendicitis did not correspond with one another in a way that was statistically significant.

**Conclusion:** In terms of validity and reliability, the new appendicitis inflammatory response score performed much better than the Alvarado score.

**Keywords:** Vomiting, Pain abdomen, Nausea, Tenderness, C-reactive protein, White blood cells.

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### Introduction

The continued diagnostic difficulty of acute appendicitis is where the clinical relevance of this condition resides. This is because a wrong diagnosis can lead to severe poor consequences [1,2].

There is hope that the clinical decision-making process can be simplified with the help of scores like the Alvarado and Acute Inflammatory Response (AIR) [3,4]. Nevertheless, medical professionals are now challenged by a lack of comprehensive rules addressing the classification of scoring systems in order of importance [5,6].

The utilization of comparison research enables the provision of direction to medical professionals throughout the procedure of selecting the instrument that is the most effective and suitable for a physician's specific practice.

In the process of making the diagnosis more accurate, inflammatory markers, such as CRP and WBC, among others, are used [7,8]. By placing their effects on the test inside the AIR framework, we will be able to determine whether routinely including these indications improves the accuracy of diagnosis and provides valuable treatment

insights. This is accomplished by affecting the test within the AIR framework. Monitoring the application of markers is an approach that can be used in this direction [1-4]. The objective of this study was to compare the AIR Score to the Alvarado score in the context of making a diagnosis of acute appendicitis in Paediatric age group.

#### Materials & methods:

**Study Design:** The current investigation was not conducted until its creators had secured approval from the institution's ethics committee. This was a prospective observational study, which means that it should be conducted in the future.

**Study Setting:** The research was carried out at GMCH Sundargarh.

**Study Duration:** Data collection for the research project took place over the course of 18 months, beginning on August 2022 and ending on FEB 2024.

**Study Population:** Participants in the research included Paediatric Age Group (2 yrs -14 yrs) who attended the emergency room because they were experiencing symptoms that were consistent with acute appendicitis and then went on to undergo an

appendectomy after a thorough review of their condition.

**Inclusion Criteria:** Patients diagnosed with probable acute appendicitis that provided informed consent and were hospitalized for general surgery were included.

Patients who declined surgery or were treated conservatively, those who had an appendectomy for non-medical reasons (incidental or interval), those who had an appendicular lump, and those who had not provided informed consent were excluded from the study.

**Study Procedure:** The methodology for the study consisted of evaluating everyone who qualified for the study by doing a full clinical assessment on them, conducting necessary laboratory tests, and making use of ultrasonography. Each participant has their own individual Alvarado score [9] and AIR score [10] calculated. All participants underwent abdominal ultrasound examination done on them. In accordance with the institute's standard operating procedure, patients with confirmed acute appendicitis were rushed to surgery for appendectomy. The removed appendix tissue samples were examined histopathologically.

**Table 1: Scoring scheme for Alvarado Score and AIR Score**

Variable (Score)	Alvarado score (Score)	Appendicitis Inflammatory Response Score (AIR)
Anorexia	1	NA
Nausea or vomiting	1	NA
Vomiting	NA	1
Migration of pain to right lower quadrant (RLQ)	1	NA
RLQ Tenderness	2	NA
Pain in the right lower quadrant	NA	1
Rebound tenderness	1	Light-1; Medium – 2; Strong - 3
Elevated temperature (> 37.3°C)	1	>38.5°C
White blood cells (WBC) (> 10000 cells/cu. mm)	2	NA
WBC (10000 – 14999 cells/cu. mm)	NA	1
WBC (> 15000 cells/cu. mm)	NA	2
Leukocytosis shift	1	NA
C-reactive protein (0 – 3mg/l) ???	NA	1
C-reactive protein (≥ 10 mg/l) ???	NA	2
Polymorphonuclear leucocytes (70% -84 %)	NA	1
Polymorphonuclear leucocytes (≥ 85%)	NA	2
<b>Total score</b>	<b>10</b>	<b>12</b>

To calculate the AIR score at the first presentation, a point value was assigned to each clinical and laboratory parameter. In addition to regurgitation, symptoms to look out for include discomfort in the right iliac fossa, stomach pain, fever, and elevated levels of white blood cells, neutrophils, and C-reactive protein.”

The Alvarado score for each patient was determined by assigning points to several pieces of clinical and laboratory data. Body temperature and

white blood cell count may be used to evaluate symptoms, such as nausea and vomiting, loss of appetite, pain in the lower right quadrant, migration, and rebound. These symptoms are amenable to quantitative analysis.

A score of 6 on the Alvarado Scale indicated the presence of severe acute appendicitis. A score of 7 or 8 suggests that appendicitis is likely, and a score of 9 or 10 indicates that the chance is very high. A low possibility is indicated by a sum between 0 and

4, a moderate chance by a range of 5 to 8, and a high potential in the range of 9 to 12. A smaller total indicates a lower likelihood. During the course of the research, patient profiles, clinical presentations, underlying diseases, and hospital protocols were analyzed. ALVARADO - < 4 Appendicitis unlikely, 5-6 Compatible with Appendicitis, 7-8 Probable Appendicitis, 9-10 Very Probable Appendicitis.

AIRS – 0-4 Low Probability, 5-8 Mild Probability, 9-13 High Probability.

**Statistical Analysis:** The mean and standard deviation reflect the numerical data, whereas the frequency and percentage express the qualitative data. Patients at a high risk of acquiring the

disorder were identified using the threshold values of the two risk assessment techniques. Cross-tabulation and the chi-square test were used to determine whether the HPE and scores were correlated.

### Results

Seventy-five of the hundred patients who were brought to the hospital with a suspected diagnosis of acute appendicitis underwent surgery as determined by the clinical scoring technique. All the patients were diagnosed with appendicitis. 55 of the 80 patients who underwent the procedure had appendicitis in a severe state of inflammation.

The surgical procedure revealed that 84% of appendicitis had some degree of inflammation.

**Table 2: Age and gender distribution and results in study sample (n=55)**

Variable	Frequency	Percentage
<b>Sex</b>		
Male	35	64%
Female	20	34%
<b>Histopathological Examination (HPE)</b>		
Positive	55	69%
Negative	25	31%
<b>Alvarado score</b>		
High	43	78%
Low	12	22%
<b>Appendicitis Inflammatory Response (AIR) Score</b>		
High	49	89%
Low	6	11%

Males accounted for 64% of the total population, while females accounted for 34%.

Forty-three out of 80 research participants had Alvarado scores that indicated they were at an increased risk. According to the AIR score, 49 (89% of the total) individuals were at high risk

for appendicitis, and HPE confirmed the diagnosis in 55 (69% of the total).

As shown in Table 1, we found that the Alvarado score, AIR score, and HPE diagnosis of appendicitis did not correspond with one another in a way that was statistically significant.

**Table 3: Association between the risk scores and HPE observations in study sample**

Variable	HPE		Chi-square Value	P value
	Positive n=55	Negative n=25		
<b>Alvarado Score</b>				
High	43	14	4.128	< 0.05
Low	12	11		
<b>AIR Score</b>				
High	52	15	7.855	< 0.05
Low	3	10		

The Alvarado score had a predictive validity of 0.71 (95% CI, 0.66 to 0.85), but the AIR score had a predictive value of 0.94 (95% CI, 0.90 to 0.98).

The AIR score was 94% sensitive, and the Alvarado score was 86%. AIR and alvarado scored 82% and 56%, respectively. The false-positive (40%) and false-negative (10%) rates were greater for Alvarado than for the other two

scores, but only by 6%. AIR had positive and negative predictive values of 98% and 60%, respectively, whereas alvarado had 98% and 26%, respectively. The Alvarado score had an 84% diagnostic accuracy and an AIR score of 98%.

### Discussion

Acute appendicitis is difficult to identify without expensive diagnostic equipment, such as CT

scans; thus, risk stratification scores can help [11]. Low appendectomy rates are due to concerns regarding their validity and dependability [12]. This lowers the rate of appendectomy. When creating a clinical score, examine its applicability, capacity to predict clinical outcomes, and ability to reduce needless testing and treatment. Several grading systems have been devised to predict acute appendicitis. These scores aim to reduce the imaging, negative appendectomy, and perforation rates.

These assertions must be thoroughly explored across demographic groups before becoming standard practice [13,14]. The new scoring methods promise to be better than the current ones, making them more relevant than ever. This study evaluated the validity and reliability of the newly constructed AIR score compared with the previously existing Alvarado score. Alvarado composed the tune. Using the area under the curve (AUC) metric, this study assessed the predictive validity of the Alvarado score using the area under the curve metric. 0.71 (95% CI, 0.66 to 0.85), but the AIR score had a predictive value of 0.94 (95% CI, 0.90 to 0.98).

In a direct comparison of the two approaches [15-17], the AIR score was found to be more accurate than the Alvarado score for several patient factors. Andersson and Andersson's initial prospective research included 545 individuals. According to [18], the AUC was 0.88 and AIR was 0.93. Jose and colleagues studied 130 patients in a cross-sectional observational study. Researchers found that Alvarado's AUC was 0.82 and AIR was 0.90 [19,20]. The research indicated that AIR has 98% sensitivity and 36% specificity at a cut-off value of five. Alvarado's threshold value of six has 72% sensitivity and 79% specificity in studies. In a study by De Castro et al., AIR had an AUC of 0.96 and Alvarado 0.82. It is a frequent misperception that fewer successful appendectomies result in more perforations. Because the problem is ignored or ignored until it is too late, morbidity increases.

Kappa statistics were used to quantify risk assessment reliability. The Alvarado dependability was substantially lower than that of AIR. The AIR score was substantially higher than that of the Alvarado score. This was apparent during the investigation [2]. In a second analysis by the authors of prior research [20], an AUC of 0.90 was related to the AIR score and 0.87 to the Alvarado score. Both the relationships were correlated. AIR scores with AUCs of 0.97 for severe appendicitis and 0.93 for all appendicitis were promising in clinical investigations [12,13]. This finding suggests that the AIR score can be used for diagnosis. The Alvarado score revealed that severe appendicitis

had an AUC of 0.94, whereas all patients had an AUC of 0.86.

The study's observational cross-sectional design and small participant pool of appendectomy patients were its drawbacks. This study was further limited by its small sample size. In-depth prospective studies on diverse groups are needed. These data allowed us to more accurately define the optimum threshold values for a range of scores and attributes, enabling patient risk stratification-based imaging methods.

### Conclusion

Medical professionals continue to face challenges in accurately diagnosing individuals exhibiting symptoms of acute appendicitis. In terms of diagnostic efficacy, the AIR score surpassed the Alvarado score. It demonstrated a remarkable sensitivity and specificity. Consequently, AIR may prove beneficial in determining whether emergency surgery or additional diagnostic tests are required. Conducting follow-up procedures can aid in determining whether surgical intervention is essential in certain situations.

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