

ORIGINAL RESEARCH

A comparative study of predictive accuracy of RIPASA versus Alvarado and AIR Scores in diagnosis of Acute Appendicitis

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ABSTRACT

Background: Acute appendicitis is one of the most common surgical emergencies encountered in the world particularly among young adults and children. The present study was conducted to assess predictive accuracy of RIPASA versus Alvarado and AIR Scores in diagnosis of acute appendicitis. **Materials & Methods:** 67 patients presenting with right iliac fossa pain in the department of general surgery of Sharda Hospital, Greater Noida undergoing conservative treatment were enrolled. AIR and RIPASA score were calculated. For each scoring system, specificity, sensitivity, positive and negative predictive values of each score was calculated. **Results:** There were about 64.2% males and 35.8% females. Total mean RIPASA score was 10.01 ± 1.94 . Total mean Alvarado score was 7.93 ± 1.17 . Total mean AIR score was 6.69 ± 1.77 . In patients with RIPASA score >7.5 , appendicitis was seen in 59 and normal appendix in 1. Sensitivity was 92.19% and specificity was 66.67%. In patients with Alvarado score >7 , appendicitis was present in 53 and normal appendix in 1. Sensitivity was 82.8% and specificity was 66.67%. In patients with AIR score >8 , appendicitis was present in 15. Sensitivity was 23.4% and specificity was 100%. **Conclusion:** This study validates that the Raja Isteri Pengiran Anak Saleha Appendicitis score and Alvarado score have strong discriminating powers and surpass the appendicitis inflammatory response score.

Key words: Acute appendicitis, AIR, RIPASA

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INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies encountered in the world particularly among young adults and children. Diagnosis is aided by biochemical testing, clinical prediction scoring, serial clinical examinations and radiological imaging. Definitive confirmation of diagnosis is based on tissue histopathology.

If an appendectomy is delayed in order to improve the diagnostic accuracy of the procedure, this raises the risk of appendicular perforation and sepsis, which in turn increases the likelihood of morbidity and fatality.¹ The converse is also true, namely that a decline in diagnostic precision results in an increase in the proportion of appendectomies performed for no reason, a proportion that is typically estimated to range between 20 - 40 percent.^{2, 3} Acute appendicitis can be diagnosed by the use of a few different grading systems that have been created like Alvarado, Appendicitis Inflammatory Response (AIR), Tzanakis etc. The presence of so many scores attest to the fact

that none seems to be overwhelmingly popular than others for day to day use by surgeons. Recently a new scoring system namely, Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score has been put forward to aid the diagnosis of acute appendicitis. This thesis would include the comparative evaluation of different scores developed for diagnosing acute appendicitis such as RIPASA, Alvarado and AIR score in terms of their specificity, sensitivity, positive predictive value (PPV) and negative predictive value (NPV). The present study was conducted to assess predictive accuracy of RIPASA versus Alvarado and AIR Scores in diagnosis of acute appendicitis.

MATERIALS & METHODS

The present study consisted of 67 patients presenting with right iliac fossa pain in the department of general surgery of Sharda Hospital, Greater Noida. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. All patient undergoing conservative treatment. AIR and

RIPASA score were calculated. For each scoring system a cut-off threshold value was obtained from ROC (Receiver operating curve). Finally, the post operative diagnosis and the histopathological findings of the patient was tallied with all the three scores

obtained and thereafter specificity, sensitivity, positive and negative predictive values of each score was further calculated. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

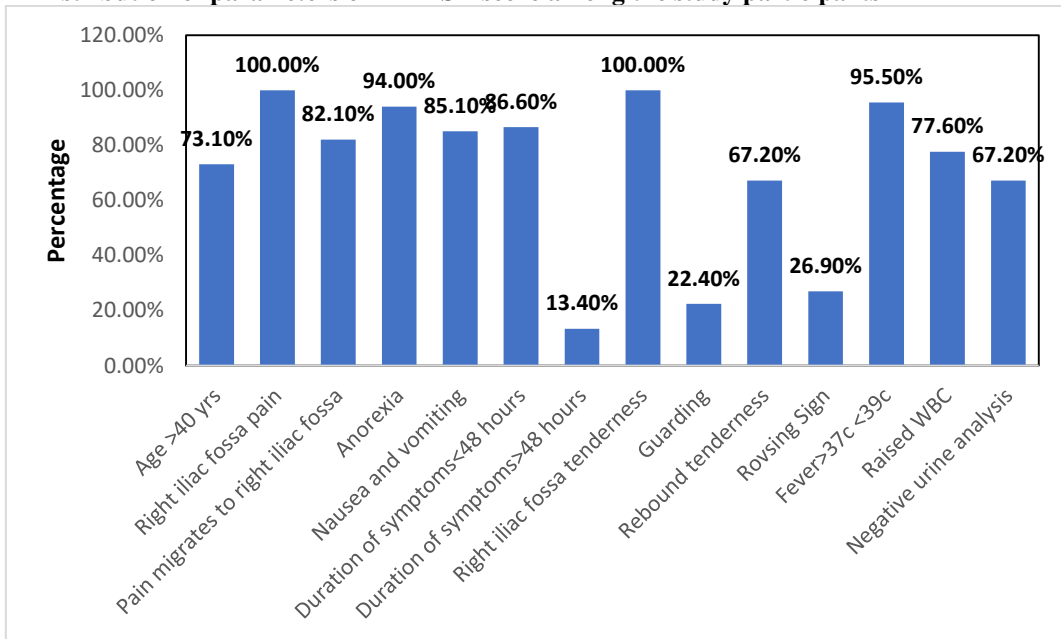
RESULTS

Table I Distribution of patients

Total- 67		
Gender	Male	Female
Number	64.2%	35.8%

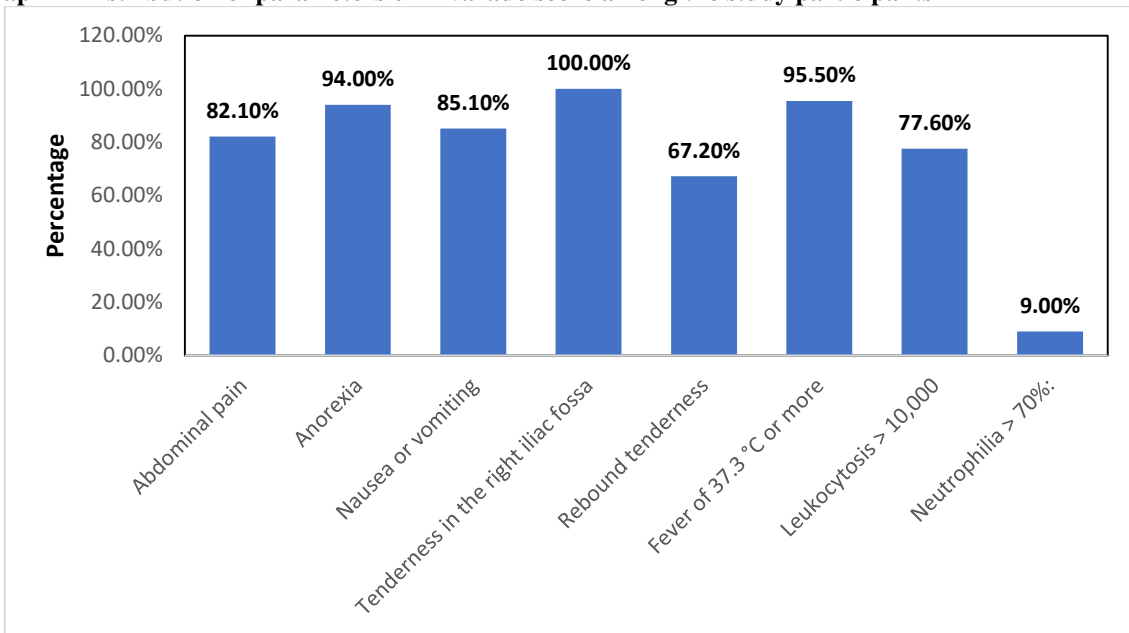
There were about 64.2% males and 35.8% females.

Graph I Distribution of parameters of RIPASA score among the study participants



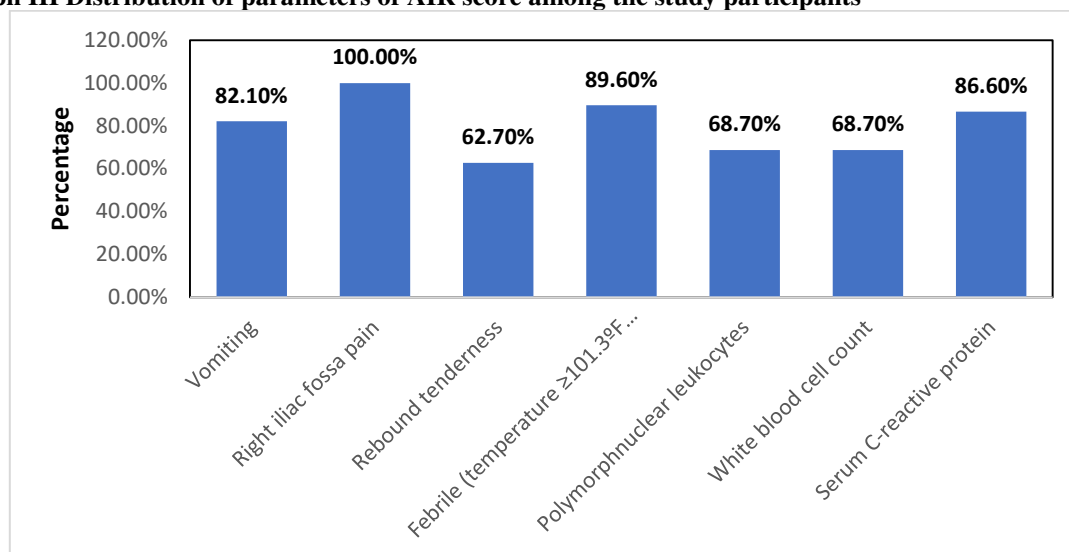
Graph I shows that total mean RIPASA score was 10.01±1.94.

Graph II Distribution of parameters of Alvarado score among the study participants



Graph II shows that total mean Alvarado score was 7.93±1.17.

Graph III Distribution of parameters of AIR score among the study participants



Graph III shows that total mean AIR score was 6.69±1.77.

Table II Diagnostic accuracy of RIPASA score

RIPASA score	Appendicitis	
	Present	Normal appendix
>7.5	59	1
<7.5	5	2

Table II shows that in patients with RIPASA score >7.5, appendicitis was seen in 59 and normal appendix in 1.

Table III Sensitivity, Specificity

Statistics	Value	95% CI
Sensitivity	92.19%	82.70% to 97.41%
Specificity	66.67%	9.43% to 99.16%
Positive Likelihood Ratio	2.77	0.56 to 13.72
Negative Likelihood Ratio	0.12	0.04 to 0.37
Disease prevalence (*)	95.52%	87.47% to 99.07%
Positive Predictive Value (*)	98.33%	92.24% to 99.66%
Negative Predictive Value (*)	28.57%	11.13% to 56.09%
Accuracy (*)	91.04%	81.52% to 96.64%

Table III shows that sensitivity was 92.19% and specificity was 66.67%.

Table IV Diagnostic accuracy of Alvarado score

Alvarado score	Appendicitis	
	Present	Normal Appendix
>7	53	1
<7	11	2

Table IV shows that in patients with Alvarado score >7, appendicitis was present in 53 and normal appendix in 1.

Table V Sensitivity, Specificity

Statistic	Value	95% CI
Sensitivity	82.81%	71.32% to 91.10%
Specificity	66.67%	9.43% to 99.16%
Positive Likelihood Ratio	2.48	0.50 to 12.36
Negative Likelihood Ratio	0.26	0.10 to 0.68
Disease prevalence (*)	95.52%	87.47% to 99.07%
Positive Predictive Value (*)	98.15%	91.42% to 99.62%
Negative Predictive Value (*)	15.38%	6.48% to 32.29%
Accuracy (*)	82.09%	70.80% to 90.39%

Table V shows that sensitivity was 82.8% and specificity was 66.67%.

Table VI Diagnostic accuracy of AIR score

AIR score	Appendicitis	
	Present	Normal Appendix
>8	15	0
<8	49	3

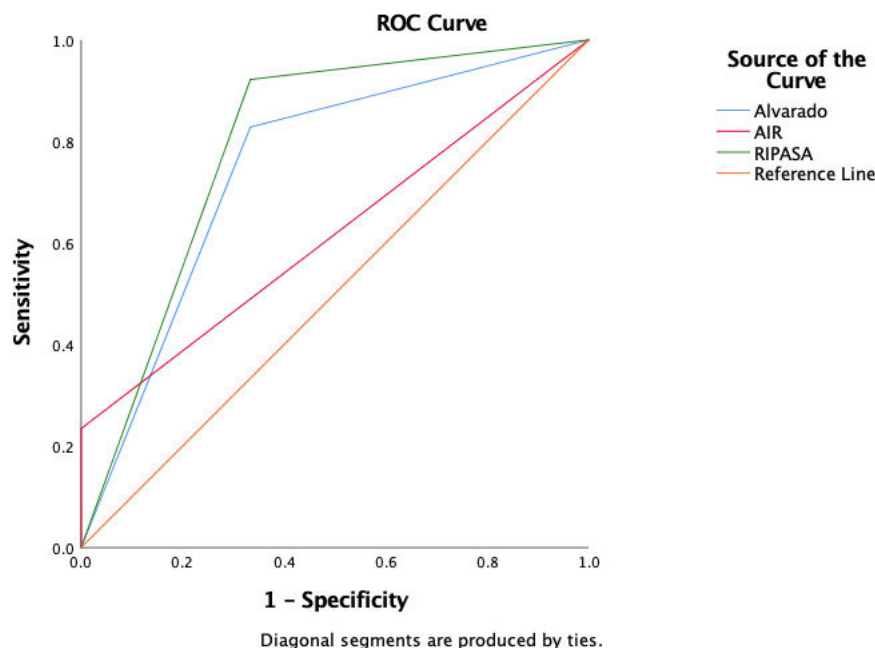
Table VI shows that in patients with AIR score >8, appendicitis was present in 15.

Table VII Sensitivity, Specificity

Statistic	Value	95% CI
Sensitivity	23.44%	13.75% to 35.69%
Specificity	100.00%	29.24% to 100.00%
Positive Likelihood Ratio		
Negative Likelihood Ratio	0.77	0.67 to 0.88
Disease prevalence (*)	95.52%	87.47% to 99.07%
Positive Predictive Value (*)	100.00%	
Negative Predictive Value (*)	5.77%	5.07% to 6.55%
Accuracy (*)	26.87%	16.76% to 39.10%

Table VII shows that sensitivity was 23.4% and specificity was 100%.

Graph IV Comparative diagnostic accuracy of Alvarado score, AIR score and RIPASA Score according to ROC curve



Graph IV shows comparative diagnostic accuracy of Alvarado score, AIR score and RIPASA score according to ROC curve.

DISCUSSION

The overall negative appendectomy rate found in the study was 5%, which was comparable to and lower than those found in other studies that looked at the same topic. Andersson et al reported 15 percent negative appendectomy rate.⁶ In a different study carried out in North America with a substantial number of participants, the proportion of unsuccessful appendectomy outcomes was as low as 13 percent.⁷ On the other hand, research that was carried out by Hanson et al⁸ and Chong et al⁹ discovered much higher rates of negative appendectomies, with percentages of 22.9 percent and 20.69 percent, respectively. Large population-based studies have suggested that the rate

of negative appendectomies is remaining stable at 15–20 percent and has not decreased over the past 15 years despite the increasing availability of newer scoring systems.

Because of its purportedly high sensitivity and specificity, the Alvarado scoring system has maintained its position as the most widely used scoring system for acute appendicitis for a considerable amount of time. The important thing to keep in mind is that the diagnostic efficacy of Alvarado has only been demonstrated conclusively in western populations; when tested on eastern populations, it exhibited significantly lower levels of both specificity and sensitivity. Only medium levels of

sensitivity and specificity were determined to exist for the Alvarado score at the completion of this research project's findings. In our study Alvarado score had a sensitivity of 82.81%, specificity of 66.67%, Positive Predictive Value of 98.15% and Negative Predictive Value of 15.38%. The sensitivity and specificity of the Alvarado scoring system were found to be 93.5% and 80.6%, respectively, in a study that was conducted by Memon and colleagues on the Indian population.¹⁰

On the other hand, the PPV of Alvarado was only 58 percent when it was evaluated in a study that was carried out on a sample of paediatric patients by Schneider et al.¹¹ Due to its high sensitivity, the Alvarado score works well as a 'rule out' criterion for decision making about observation or admission, as demonstrated by the findings of a systematic review. The research did find, however, that the Alvarado score cannot be used to 'rule in' a diagnosis of appendicitis in the absence of a competent surgical assessment and other diagnostic tests. The Jerusalem guidelines that were published in 2015 by the World Society of Emergency Surgeons (WSES)¹¹⁶ also stated that the Alvarado score (with a cut-off score of 5) has sufficient sensitivity to rule out acute appendicitis but does not have sufficient specificity to diagnose acute appendicitis.

The current findings on AIR score, which show very high sensitivity but low specificity, are consistent with findings from other studies that were conducted in a similar manner. In our study AIR score had a sensitivity of 23.44%, specificity of 100%, Positive Predictive Value of 0% and Negative Predictive Value of 5.77%. According to the findings of the research conducted by Scott and colleagues, an AIR score of 5 or higher revealed strong sensitivity for individuals with appendicitis who were at intermediate and high risk (90 %), as well as for patients who had progressed appendicitis (98 %).¹²

In contrast to the findings of the Alvarado score, those of the AIR score were found to be much more favourable in another investigation. It is likely that the AIR score functions better in the paediatric population than the Alvarado score does since it is simpler to apply the criteria for scoring to children. In order to receive an Alvarado score, children need to identify symptoms such as nausea, anorexia, and migration of pain, which is not necessarily an appropriate assessment. Because the adolescent age group so closely resembles the cohort for which the Alvarado score was initially established, it is probably for this reason that the Alvarado score performs better when compared to the AIR score in the adolescent age group. According to the findings of Di Saverio and colleagues, the combination of the AIR score and the Alvarado score may greatly lower the probability of over-diagnosing acute appendicitis, giving a valid diagnostic performance and allowing treating surgeons to avoid the frequent use of CT.¹³

In our study RIPASA score had a sensitivity of 92.19%, specificity of 66.67%, Positive Predictive

Value of 98.33% and Negative Predictive Value of 28.57%. According to the findings of the research, RIPASA shown significant levels of sensitivity as well as specificity. These findings are analogous to those found in the research carried out by Chong et al.⁹ The findings of that study indicated that the RIPASA score, with a cut-off threshold total score of 7.5, was a superior diagnostic scoring system than the Alvarado score for the diagnosis of appendicitis. This was the conclusion reached by the researchers. The RIPASA score provided Rathod et al. with the following results: a sensitivity of 82.61 percent, a specificity of 88.89 percent, a positive predictive value (PPV) of 96.61 percent, a negative predictive value (NPV) of 57.14 percent, and an accuracy in diagnostics of 83.91 percent. In their research, Nanjundaiah and colleagues demonstrated that RIPASA was more effective than Alvarado.¹⁴ According to the findings of another study, the level of sensitivity of the Alvarado system was 81 percent when the cut-off value was set at 6.5, while the level of sensitivity of the RIPASA system was 83.1 percent when the cut-off value was set at 10.25. On the other hand, there are a couple of studies in which the RIPASA score was not able to show any advantages over the modified Alvarado score in patients who had a possible case of acute appendicitis.¹⁵

CONCLUSION

This study validates that the Raja Isteri Pengiran Anak Saleha Appendicitis score and Alvarado score have strong discriminating powers and surpass the Appendicitis Inflammatory Response score. They might be useful in determining which patients require emergency surgery and which ones need extra testing first. Although an attempt was made to compare the diagnostic accuracy of RIPASA versus Alvarado and AIR scores hoping to establish RIPASA as a superior score in terms of reduction in negative appendectomy rate and to grade the severity of acute appendicitis, this research has shown that this hypothesis holds true for RIPASA only in case of reducing negative appendectomy rate, which might have been possible due to more number of parameters used in RIPASA thus excluding other differential diagnosis of acute appendicitis.

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