Does RIPASA score predict Appendicitis as well as Alvarado score?

Iftikhar Ahmed[1], Arslan Zahid[2], Asma Bibi[1], Shabbir Hussain[3], Nauman Mustafa[1], Haji Ahmad Jasra[4]

ABSTRACT

Objective: To compare RIPASA scoring system with Alvarado scoring system for diagnosing Appendicitis in terms of Diagnostic Accuracy.

Study Design: Prospective Observational Study.

Place and Duration: Department of Surgery, HBS General Hospital, 15th January 2019- 30th March 2020.

Methodology: Patients with appendicitis were enrolled after informed consent. Pregnant females, patients younger than 12 years, duration of pain more than 7 days and patients with established causes of pain other than appendicitis were excluded. RIPASA and Alvarado score were calculated but treating Surgeon was blinded to the scores. Resected specimens were sent for histopathology which was gold standard. Sensitivity, Specificity, Negative and Positive Predictive values and Diagnostic Accuracy were calculated using 2x2 table.

Results: A total of 184 patients were included in the study. Mean age was 23.6±8.2 years. A total of 23.9% patients had normal Appendices on Histopathology while 76.1% patients were found to have acutely inflamed appendices. RIPASA score had a sensitivity of 96.42% as compared to 79.28% of Alvarado score. The Diagnostic accuracy of Alvarado Score was found to be 69.56% as while the diagnostic accuracy of RIPASA score was found to be 89.67%.

Conclusion: RIPASA Score is superior to Alvarado score in terms of diagnostic accuracy in our population.

Keywords: RIPASA, Alvarado, Appendicitis, Scoring system

INTRODUCTION

The most common cause of abdominal surgery worldwide as well as the most common surgical emergency encountered in the emergency department is Acute Appendicitis (AA). Life-time prevalence is around 8% and young age group is the most commonly effected (10-30 years old)[1,2]. As the most common disease seen by surgeons, AA has varied presentation, ranging from clinically evident appendicitis to borderline cases. A range of differential diagnoses having similar presentations to AA also complicate the diagnosis, particularly in female patients. Radiological investigations including Ultrasonography (USG) and Computed tomography (CT) are often employed to assist in reaching the diagnosis preoperatively. Diagnostic laparoscopy is also used in equivocal cases.

Doing a CT scan for every patient with suspected AA would be time and resource consuming as well as expose the patient to a high dose of radiation or General Anaesthetic[3-5]. The various scoring systems for use in patients of suspected AA stratify patients into high probability of AA, probable AA, equivocal cases and low probability of AA[6]. This results in reduced usage of adjunctive investigations and procedures to reach the diagnosis and thus improving overall management and cost-affectivity, while also reducing the morbidity and mortality. A number of different scoring systems have been used in patients of AA but the most commonly used system is the Alvarado score which uses 8 parameters with additive scoring to determine the probability of AA in a patient[2].

The sensitivity and specificity of Alvarado score is 53% and 75% while that of the modified Alvarado score is 88% and 80% respectively[7,8]. It has been argued that the Alvarado scoring system was developed with a Western population and thus it has

1. Assistant Professor of Surgery
2. Senior Registrar Surgery
3. Professor of Surgery
4. Assistant Professor of Anesthesia

   HBS Medical and Dental College Islamabad.

Correspondence:
Iftikhar Ahmed
Assistant Professor of Surgery,
HBS General Hospital, Lehtrar Road, Alipur, Islamabad.
Email: drisoomro4u@gmail.com

a lower sensitivity and specificity in other ethnicities. Based on this observation, the RIPASA scoring system was created in 2010, which has been in limited use since then. Although literature is limited in this regard, with only a single meta-analysis, RIPASA scoring system has been reported to have a higher sensitivity[9]. The specificity of the RIPASA scoring system has been controversial with some authors claiming that it is more specific than Alvarado score while others claiming that it is less specific than Alvarado score. There is a need for further research to quell this controversy and to better illustrate the comparison of the sensitivities and specificities of the two scoring systems. In our study we aim to compare Alvarado and RIPASA scoring systems in our local population in patients of AA in terms of sensitivity and specificity. This should result in better outcomes by better stratification of patients and improved outcome as well as reduced morbidity and mortality.

The Objective of our study is to compare RIPASA and Alvarado score in terms of diagnostic accuracy.

METHODOLOGY

This prospective observational study was carried out at Department of Surgery, HBS General Hospital from 15th January 2019 till 30th March 2020. Ethical approval was obtained from the Ethical review board. Inclusion criteria included Patients presenting with Pain Right Iliac fossa in the Surgical Emergency and Outpatient departments. Exclusion criteria included pregnant females, patients younger than 12 years, duration of pain more than 7 days and patients with established causes of pain other than appendicitis. Data was collected by Senior registrars and Assistant professors of Surgery department, using the performa attached. The operating surgeon was blinded to the calculated scores to eliminate bias. A total of 184 patients were included in the study after applying inclusion and exclusion criteria. All patients had a detailed history and clinical examination by consultant Surgeons and complete blood count, Urinalysis, and chest radiographs were performed. The Alvarado and RIPASA scores (given in Figure I) were calculated but the operating Surgeon was blinded to the scores to eliminate bias7, 9. Clinical diagnosis and decision to operate were made by the operating Surgeon and the patients underwent Appendectomies. Post-operatively the resected appendices were sent for Histopathology to the hospital laboratory for review by Consultant Pathologist. An Alvarado score of >7 was considered highly suggestive of AA while a RIPASA score of >7.5 was considered highly suggestive of AA. Histopathological diagnosis was considered Gold standard.

Data Analysis: Data was analyzed using SPSS 22. Frequencies and percentages were calculated for Qualitative variables like Gender and Histological diagnosis, while Mean and standard deviation was calculated for quantitative variables like age. Sensitivity, Specificity, Positive and Negative predictive values were calculated using a 2x2 table comparing both RIPASA and Alvarado scores with Histological diagnosis being considered Gold standard.

Figure 1: RIPASA and Alvarado scores used in the study

RESULTS

A total of 184 patients were included in the study. Majority of the patients were male (59.2%, n=109) while female patients were 75 in number (40.8%). Mean age was 23.6±8.2 years. A total of 44 patients had normal Appendices on Histopathology (23.9%) while 140 patients (76.1%) were found to have acutely inflamed appendices. Table comparing True negatives, False negatives, True positives and false positives (2x2 table) were used to calculate Sensitivity, Specificity, Positive Predictive value and Negative predictive value. Diagnostic Accuracy for both scoring systems was calculated using the 2x2 tables as well. The Diagnostic accuracy of Alvarado Score was found to be 69.56% as while the diagnostic accuracy of RIPASA score was found to be 89.67%. Table I and II detail the 2x2 tables used for calculations of both scoring systems.

Table - I: 2x2 Table showing Sensitivity, Specificity, Positive and Negative Predictive Values in percentages for Alvarado score.

Alvarado Score	Diseased on Histopathology	Normal on Histopathology	
Alvarado >7	111 (True Positive)	6 (False Positive)	PPV: 94.87
Alvarado <7	29 (False Negative)	38 (True Negative)	NPV: 56.71
	Sensitivity: 79.28	Specificity: 86.36	

PPV: Positive Predictive Value
NPV: Negative Predictive Value

Table I shows the Sensitivity, Specificity, Positive and Negative predictive values for Alvarado score. The sensitivity of Alvarado score was found to be 79% while the specificity was found to be higher at 86% which shows that the Alvarado score is better at ruling out appendicitis while the opposite may be said for RIPASA score which was found to be more sensitive but less specific (Table II, 96% and 68% respectively).

Table - II: 2x2 Table showing Sensitivity, Specificity, Positive and negative Predictive Values as percentages for RIPASA score

RIPASA Score	Diseased on Histopathology	Normal on Histopathology	
RIPASA >7.5	135 (True Positive)	14 (False Positive)	PPV: 90.6
RIPASA <7.5	5 (False Negative)	30 (True Negative)	NPV: 85.71
	Sensitivity: 96.42	Specificity: 68.18	

PPV: Positive Predictive Value
NPV: Negative Predictive Value

DISCUSSION

Acute Appendicitis is the most common cause of referral to a surgical team. It is also the most commonly performed operation on the surgical floor. Scoring systems like the RIPASA score have been developed to stratify patients and optimize management. We compared the RIPASA score with the Alvarado score in our study in term of diagnostic accuracy. A total of 184 patients were included in our study. Male to female ratio was 1.45:1 and mean age was 23.6±8.2 years. The gender and age distribution in our study was in accordance to other studies. It has been established previously that male patients have a higher risk of developing AA while female patients have a larger diagnostic spectrum with more conditions mimicking appendicitis. This was also incorporated as a parameter in the RIPASA score by Chong et al signifying the importance of gender in AA[1, 10]. This is one of the key differences between the Alvarado score and the RIPASA score as the former does not include gender. In our opinion this also results in the better results of RIPASA score in the prediction of Appendicitis.

The Sensitivity of RIPASA score in our study was 96.42%, which is comparable to the reported sensitivity according to previous literature (95.89% and 96.2%)[5,13]. The Alvarado score was found to have a lower sensitivity than the RIPASA score while the inverse was found to be true regarding specificity (Sensitivity: 79.28% vs 96.42%, Specificity: 86.36% vs 68.18%). These results are similar to previous reports that RIPASA score is better in terms of Sensitivity. Our results are comparable in terms of sensitivity but the specificity found during our study was much lower than that of Nanjundaiah N et. al's study (68% vs 90.5%)[5]. Although the samples sizes, populations and materials are comparable, the difference in specificity is significant. This difference can be explained by the following factors. The number of True positives in their study was 184 (89.3%) while in our study it was 140 (76.1%). This affected the false positive rate

which was greater in the RIPASA group in our study thus lowering the specificity in our study. Another difference is the negative appendectomy rate which was 23% in our study and 10.6% in their study, which means that we were more cautious in sending patients home and over-treated our patients by suggesting appendectomies. This difference in the negative appendectomy rate between the two studies is, in our opinion, a testament to the need of scoring systems in the diagnosis and management of this condition. RIPASA score was also found to have Diagnostic Accuracy of 89.67% in our study which is comparable to previous literature (95.1% and 90.5%)[12,13]. Comparing these results with those of the Alvarado score showed that RIPASA score demonstrated better sensitivity and diagnostic accuracy as compared to Alvarado score, this is in keeping with the previous limited literature[10-12].

In our study the negative appendectomy rate overall was 23.9% but retrospective consideration and stratification according to scoring system shows that according to the RIPASA score the predicted negative appendectomy rate was 9.4% while according to Alvarado score the predicted negative appendectomy rate was 5.1%. There is a significant decrease in the negative appendectomy rate when applying both scoring systems, this has been previously demonstrated by Singh A et al. and Butt MQ et al[12,13]. The decrease in predicted negative appendectomy rate according to Alvarado score is more significant than that of RIPASA score but the number of false negative patients as per the Alvarado score shows that the patients would have been under-treated for appendicitis. The sole use of Alvarado score would have meant that the patients who did have appendicitis would not have had adequate and timely treatment which would result in increased morbidity. As can be observed from the 2x2 table, a significantly higher proportion of patients had a false negative rate according to Alvarado score (23.4%, n=34) while RIPASA score had a false negative rate of 3.5% (n=5). RIPASA score does show a slightly increased predicted rate of negative appendectomies as compared to Alvarado score but it is also accompanied by a significantly reduced false negative rate, this results in a much lower rate of under-treatment as compared to Alvarado score. This argument lends favor to the utilization of RIPASA score as compared to Alvarado score, as it is much better at reducing both the number of perforated appendicitis as well as negative appendectomies.

A higher overall negative appendectomy rate might be attributed to a greater number of female patients in the study (M:F ratio = 1.45:1), as the operative threshold is usually lower in female patients owing to various gynecological conditions mimicking appendicitis. This lower threshold leads to higher negative appendectomy rate in female patients[13,14]. Other limitations of our study include a relatively smaller sample size, which was due to the study being carried out at a single trust based center in the outskirts of Islamabad.

Larger multi-centric trials are needed to further solidify RIPASA scoring system as a definitive tool aiding the diagnosis of appendicitis. The replication of results from previous studies in our study demonstrates that the RIPASA score is a well-made

score that has excellent utility in accurate diagnosis of appendicitis, as it correctly diagnoses an overwhelming majority of patients with appendicitis and reduces negative appendectomy rates as well as rates of false negative diagnosis of appendicitis.

CONCLUSION

RIPASA score is superior to Alvarado score in terms of Diagnostic accuracy as well as reducing the rate of negative appendectomies.

AUTHOR'S CONTRIBUTION

Ahmed I: Study conception, Design and Data collection
Zahid A: Data Collection, Data Analysis, Manuscript writing
Bibi A: Data Collection
Hussain S: Proof Reading, Oversight
Mustafa N: Proof Reading, Final Approval of Manuscript
Jasra HA: Data Collection, Manuscript writing

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