



Research Article

Comparative Study between RIPASA Scoring System and ALVARADO Scoring System in Diagnosing Acute Appendicitis in Adults

Aous Hameed Majeed^{1*}, Hameed Hussein Alaraji²

¹ Al-Kindy Teaching Hospital, Al-Risafa Health Directorate, Baghdad, Iraq

² Al-Kindy College of Medicine, University of Baghdad, Baghdad, Iraq

* Corresponding author's email: aoushameed@gmail.com

ABSTRACT

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Background: Acute appendicitis is regarded as one of the most common inflammation that needs surgical intervention. Different scoring systems have been used for diagnosing of acute appendicitis. ALVARADO score is one of the most widely used score in diagnosing of acute appendicitis, but the accuracy of the latter is insufficiently low in Middle-East patients. Thus a new scoring system called RIPASA score has been designed for diagnosing of acute appendicitis in those patients. The aim of this study is to use RIPASA score and compare its result with ALVARADO score in diagnosing of acute appendicitis.

Subjects and Methods: The study includes 200 patients with symptoms and signs of acute appendicitis in Al-Kindy Teaching Hospital/Baghdad/Iraq from 1st of November 2017 to 30th of November 2018. The variables of both scoring systems are registered for each patient included in this study and all patients who are underwent appendectomy their specimens are sent for histopathology.

Results: The study includes 200 patients with suspicion of acute appendicitis. By applying both scores for each patient, then comparing the result of the two scores with the histopathology reports; RIPASA score has shown sensitivity, specificity, and diagnostic accuracy (93.6%, 74.4%, 89.5%) more than ALVARADO score (82.8%, 65.1%, 79%) respectively. The area under the receiver operating characteristic (ROC) curve of RIPASA score (0.957) is higher and significantly better than that of ALVARADO score (0.893) with P value <0.05.

Conclusions: The RIPASA score is more sensitive, more specific, and has high diagnostic accuracy than ALVARADO score.

Introduction

Acute Appendicitis is one of the most common surgical emergencies in clinical practice with estimated life time prevalence approximately one in seven. The incidence of occurrence is nearly 1.4 times greater in men than in women [1].

Acute Appendicitis may occur for several reasons, such as an infection of the appendix, but the most important factor is the obstruction of the appendicular lumen. If acute appendicitis is left untreated, it may lead to severe complications, like appendicular

mass, perforation or sepsis. However, the differential diagnoses of appendicitis are often a clinical challenge because acute appendicitis can mimic several abdominal conditions [2].

However, the decision to perform appendectomy is based solely on clinical evaluation supported by laboratory data. Ultrasonography and computed tomography scan are used nowadays to decrease the incidence of negative laparotomies [3]. Therefore, scoring systems have been made to overcome these problems, due to their good sensitivity and specificity and acceptable negative appendectomies on exploration [1].

Raja Isteri Pengiran Anak Saleha Appendicitis [RIPASA] score is a new diagnostic scoring system developed for the diagnosis of acute appendicitis and has been shown significantly higher sensitivity, specificity and diagnostic accuracy than that reported for the ALVARADO scoring system, particularly when the latter score is applied to an Asian or Middle-East patients[5].

Aim of the study: The study aims to assess the accuracy of RIPASA score in diagnosing acute appendicitis and comparing it with ALVARADO score.

Subjects and Methods

This cross-sectional study has been carried out for patients who suffer from intense lower abdominal pain in Accident and Emergency department of Al-Kindy Teachin Hospital/Baghdad/Iraq, from 1st of November 2017 to 30th of November 2018. It includes patients who have right lower quadrant abdominal pain. While patients who are less than 15 years old, greater than 50 years old, having past medical history of urolithiasis or pelvic inflammatory diseases (in female patients), patients with co-morbidities or coagulation disorders, and patients with foreign nationalities are excluded from this study.

Pre-operative clinical examination was done for all patients who were included in this study. They were admitted to the hospital ward and consent of all patients was taken. A pre-tested checklist was filled by the researcher through direct interview with each patient and his family at time of admission to the hospital or prior to the surgery. ALVARADO score and RIPASA score were applied to each patient. The score for the parameters ranged from 1 to 2 for ALVARADO score and from 0.5 to 2 for RIPASA score as shown in (Table/1, 2) respectively.

Table 1: ALVARADO Scoring system

Symptoms	
Pain migration to right iliac fossa	1
Anorexia	1
Nausea and Vomiting	1
Signs	
Right iliac fossa tenderness	2
Rebound tenderness	1
Fever	1
Investigation	
Elevated White cell count	2
Shift of White cell count to left	1
Total Score	10

Table 2: RIPASA Scoring system (Raja Isteri Pengiran Anak Saleha Appendicitis Score)

Patient's demographic feature	
Male	1
Female	0.5
Age <39.9 years	1
Age >40 years	0.5
Symptoms	
Right iliac fossa pain	0.5
Pain migration to right iliac fossa	0.5
Anorexia	1
Nausea and Vomiting	1
Duration of symptoms <48 hrs	1
Duration of symptoms >48 hrs	0.5
Signs	
Right iliac fossa tenderness	1
Rebound tenderness	1
Fever >37oC <39oC	1
Guarding	2
Rovsing's sign	2
Investigation	
Elevated white cell count	1
Negative urine analysis	1
Additional score	
Foreign nationality [Additional point]	1
Total score	17.5

Although the decision of appendectomy was solely based on surgeon's decision as we know, but at the same time ALVARADO score and RIPASA score can help surgeon to decide to do the operation or not. The patient who considered to have acute appendicitis and exposed to surgical excision of the appendix if he/she had a score of equal or greater than 7 in both score, at initial evaluation. The patients, who had a score below 7 for both scores, were admitted to the hospital and observed for the next 12 to 24 hours and reevaluated. If the clinical condition of the patients were highly suspicious to have acute appendicitis as decided by the surgeon who's in charge, they were subjected for appendectomy. The final diagnosis was done by histopathology report of the resected specimen macroscopically and microscopically.

Ethical Consideration: The research proposal of the study was fully discussed by the scientific and ethical committee of the Iraqi board of general surgery. The agreement of health authority in Al-Kindy Teaching Hospital was approved before starting of data collection. A written consent was taken from each including patient after a full explanation about the aim of the study and ensures the including patients that the collected data will be used for scientific purposes only and will be anonymous.

Statistical Analysis: The collected data were processed in personal computer device, Microsoft Excel 2010 and IBM-SPSS V23 statistical software programs were used in the statistical analysis. Screening test parameters were measured which included: sensitivity, specificity, positive & negative predictive values and

Diagnostic accuracy. These parameters were calculated for both ALVARADO and RIPASA systems in comparison with the gold standard final diagnosis of acute appendicitis by histopathology. Scores will be tabulated and compared by applying Chi-square test. Receiver operating characteristic (ROC) curve and Area under the curve (AUC) were used for both of the scoring systems. The P value less than 0.05 was considered to be the cut-off point for significant discrimination.

Results

Regarding the frequency of symptoms and signs in this study, right iliac fossa pain and tenderness were the most frequent symptoms of the patients that attend the emergency department, while the lowest frequencies were fever, nausea and vomiting. According to this study, patients with RIPASA score and ALVARADO score (less than 7 points) didn't have acute appendicitis, and patients with RIPASA score and ALVARADO score (greater than or equal 7 points) had acute appendicitis. The cut-off threshold point was set as 7. Thus, it is good statistical point of discrimination for diagnosing patients who have acute appendicitis from those who don't have.

Out of 200 patients who had Appendectomy and sent for histopathology report, we found that 157(78.5%) patients had acute appendicitis and 43(21.5%) patients didn't have appendicitis.

When applying ALVARADO score, we found that 145(72.5%) patients with a score of equal or greater than (7) have acute appendicitis, and 55(27.5%) of patients had a score less than (7) had no appendicitis.

On the other hand, by applying RIPASA score we found that 158(79%) of patients with a score of equal or greater than (7) have acute appendicitis, and 42(21%) of patients had a score less than (7) had no appendicitis, as shown in table 3.

Table 3: comparison between the result of histopathology report with both scores

	Histopathology report		RIPASA Score		ALVARADO Score	
Acute appendicitis	157	78.5%	158	79%	145	72.5%
Not Appendicitis	43	21.5%	42	21%	55	27.5%

By calculating the sensitivity, specificity, and diagnostic accuracy of both scoring systems, we found that RIPASA score had higher sensitivity, specificity, and diagnostic accuracy than ALVARADO score, which is shown on table 4.

Table 4: sensitivity, specificity, and diagnostic accuracy of both scoring systems

Parameters	RIPASA Score	ALVARADO Score
Sensitivity	93.6%	82.8%
Specificity	74.4%	65.1%
Positive predictive value	93%	89.7%
Negative predictive value	76.1%	50.9%
Diagnostic accuracy	89.5%	79%

By making comparison between the ALVARADO and RIPASA score of all studied cases, we found that 141 of patients had Acute Appendicitis and 38 of patients didn't have acute appendicitis in both scores. In addition, RIPASA score detect 17 patients had acute appendicitis (which approved by histopathology) but ALVARADO score considered that these 17 patients didn't have acute appendicitis. The study found that there was statistically significant difference between these two scores (p value < 0.001) which reflects fair accuracy. And the kappa value between these two scores was 0.854 which reflects good agreement of the reliability of RIPASA score over the ALVARADO score as it is shown in table 5.

Table 5: Comparison between scores among two groups

RIPASA Score	ALVARADO Score				Total
	Acute Appendicitis		Not Appendicitis		
	Count	Percent %	Count	Percent %	
Acute Appendicitis	141	70.5	17	8.5	158
Not Appendicitis	4	2	38	19	42
Total	145		55		200

By applying the receiver operating characteristic (ROC) curve analysis for both scores, it is obvious that ROC curve of RIPASA score is higher than ROC curve of ALVARADO score.

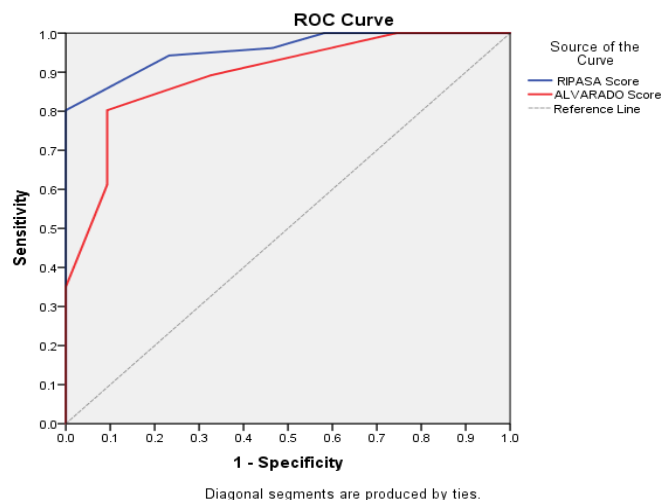


Figure 1: ROC curves for both scores

The table below shows the area under the curve (AUC) of both scores, which is statistically significant for RIPASA score (p value < 0.001).

Table 6: Area under curve for both scores in predicting acute appendicitis of all studied cases

Test result variables	Area	P value	Standard Error	Asymptotic 95% confidence interval	
				Lower bound	Upper bound
ALVARADO score	0.893	0.001	0.026	0.842	0.945
RIPASA score	0.957	0.001	0.013	0.932	0.982

From the above results, the study declares that RIPASA score is more sensitive, specific, and accurate than ALVARADO score regarding the diagnosis of acute appendicitis among patients presented with symptoms and signs suspected to have acute appendicitis.

Discussion

In this study, regarding to the frequency of symptoms and signs of acute appendicitis, the most frequent symptoms were right iliac fossa pain and tenderness. so it is worth mentioning that both frequent symptoms are identical with R.S Raikwar et al study which is done in Indore, India 2017 [1], H. Mazeh et al study 2007 [8], Sabir S. et al study which is done in Rawalpindi, Pakistan 2017 [9], and Rodrigues & Sindhu study which is done in Tamil Nadu, India 2015 [10] respectively.

This study compared the widely used ALVARADO score with the RIPASA score in the study sample. RIPASA score has been found to be more sensitive (93.6%), more specific (74.4%) as compared to ALVARADO score (82.8%), (65.1%) respectively. Diagnostic accuracy of RIPASA score was (89.5%) while ALVARADO score was (79%).

The results of this study agreed with the following studies, R.S Raikwar et al study which is done in Indore, India 2017 [1], Shuaib A et al study which is done in Jabriya, Kuwait 2016 [4], Chong CF et al study which is done in Brunei, Darussalam 2011 [5], Pasumarthi V et al study which is done in Karnataka, India 2017 [6], Nanjundaiah N et al study which is also done in Karnataka, India 2012 [7], Subramani B et al study which is done in Chennai, India 2015 [11], Ismail Alnjadat and Baha Abdallah study which is also done in Aqaba, Jordan 2013 [12].

By comparing between the RIPASA and ALVARADO scores for patients who have acute appendicitis and those who don't have in this study, we found that (70.5%) of patients had acute appendicitis and (19%) of them didn't have and there was a statistical significant difference between these two scores with p value < 0.001 which reflects fair accuracy. The kappa value between these two scores was (0.854), and this agreed with Pasumarthi V et al study [6].

The ROC curve and the area under the curve (i.e. diagnostic accuracy) is high for both scoring system (figure, table). But it is higher for RIPASA score (95.7%) than that of ALVARADO score (89.3%). The difference in the area under the curve (6.4%) is significant between the two scoring systems (p value <0.001), which equates to 17 (8.5%) patients with acute appendicitis who were misdiagnosed using the ALVARADO score compared to the RIPASA score which is agreed with the following studies, Chong CF et al study which is done in Brunei, Darussalam 2011 [5], Pasumarthi V et al study which is done in Karnataka, India 2017 [6], Nanjundaiah N et al study which is also done in Karnataka, India 2012 [7].

Conclusion

This study approved that the RIPASA score has a higher sensitivity, specificity and diagnostic accuracy than that of ALVARADO score in diagnosing of acute appendicitis.

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This research did not receive any specific fund.

Conflict of Interest

Authors declare no conflict of interest

Data availability

Data are available upon reasonable request

ORCID

Aous Majeed 0009-0006-8592-597

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