

RIPASA Score in Diagnosis of Acute Appendicitis: To What Extent Is It Accurate?

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ABSTRACT

Background: The accuracy of different scores of acute appendicitis (AA) is extremely variable and sometimes unsatisfactory in different ethnic communities. The validity of the RIPASA score among the Eastern Mediterranean population is still questionable.

Objective: This study aims at evaluating The RIPASA diagnostic accuracy for AA among Egyptians.

Patients and methods: The current prospective study included 123 patients suffering from AA attending the Emergency Surgery Department. All items of the RIPASA score were fulfilled. The diagnostic cut-off score for AA by RIPASA was 7.5. Histopathological assessment for the appendix was done for all included patients and correlated to the RIPASA score.

Results: The mean age of the included patients was 31.85 (SD 8.7) years, and 76 (61.8%) of patients were <39.9 years old, while 47 (38.2%) were >40 years old. RIPASA score sensitivity for AA was 96.4% while the specificity was 75%. The positive predictive value was 97.27 %, while the negative predictive value was 69.23 %. The diagnostic accuracy was 94.3 %.

Conclusion: RIPASA is a reliable and feasible score for AA with high sensitivity, positive predictive value, and diagnostic accuracy.

Keywords: Acute appendicitis, Accuracy, RIPASA score, Prospective study, Diagnostic score, Benha University.

INTRODUCTION

Acute appendicitis (AA) is a common abdominal emergency requiring urgent intervention with a high incidence of negative appendectomy [1]. The diagnosis depends mainly on the clinical presentation with additional confirmation using radiological investigations that are costly and may be not available in developing countries [2]. However, a great spectrum of diseases present with symptoms matching the clinical presentation of AA making the diagnosis of AA in some cases challenging [3]. Surgery carries a wide scale of morbidities. Negative appendectomy (NA), appendicular abscess and perforation, wound infection and dehiscence, or even recurrent attacks of adhesive intestinal obstructions are examples of such comorbidities. The cost burden on the patient and health system is a crucial issue to be considered [4].

Many scoring systems had been developed to correlate the clinical presentation and investigations with the pathological confirmation of AA that depends mainly on the presence of neutrophils in the wall of the appendix with a global aim to lower the negative appendectomy rates [5,6]. The above-mentioned facts raised a red flag for the crucial need for assisting need for an accurate scoring system for acute. Since 1980, many Scores such as Alvarado, RIPASA, Eskelinen, Fenyó, Tzakis, and Ohmann were developed for diagnosis of AA [7]. Many studies had described the accuracy, sensitivity and specificity of different scoring systems to be highly variable and sometimes unsatisfactory results in different ethnic communities [5,8,9]. RIPASA (Raja Isteri Pengiran Anak Saleha Appendicitis), is accurate in the Asian

population [10]. The validity of the RIPASA score among the Eastern Mediterranean population is still questionable and this has motivated us to conduct this study to establish the clinical prediction rules for predicting AA among Eastern Mediterranean ethnic communities and avoid needless procedures and improve the patient outcome.

PATIENTS AND METHODS

Study design

A prospective study was conducted throughout the period from May 2022 to December 2022, and included 123 patients suffering from AA attending the Emergency Surgery Department at Benha University Hospital and Benha Teaching Hospital.

Inclusion criteria included all patients presented to the Emergency Department with pain in the right lower abdominal quadrant suspicious for AA.

Exclusion criteria included patients who received appendectomies for other causes or in the middle of another surgery, patients with perforated viscus and peritonitis, and patients with a history of renal or ureteric stones, or pelvic inflammatory disease. Patients with untraceable or incomplete medical records were also excluded.

The sample size of $1 - \beta = 0.80$ (80%) for the spearman's correlation at level $\alpha = 0.05$ (5%), under these assumptions, amounts to 50 (G*power, version 3.1).

Procedure and assessment

After history taking, clinical examination and investigations, all items of RIPASA score were fulfilled.

Data of interest were retrieved from the hospital's Medical Records.

The RIPASA score consists of 15 parameters (listed in Table 1). The diagnostic cut-off score for AA by RIPASA was 7.5 (11).

Histopathological assessment for the appendix was done for all included patients and correlated to the RIPASA score.

Assessment: Five main Diagnostic Parameters of RIPASA Score for AA included:

Sensitivity of RIPASA score = True Positive cases / (True Positive cases + False Negative cases).

Specificity of RIPASA score = True Negative cases / (True Negative cases + False Positive cases).

Positive Predictive Value (PPV) = True Positive cases / (True Positive cases + False Positive cases).

Negative Predictive Value (NPV) = True Negative cases / (True Negative cases + False Negative cases).

Diagnostic Accuracy of RIPASA score = (True Positive cases + True Negative cases) / All Patients.

Outcomes: The primary Research Objective was to assess the accuracy of RIPASA score in patients who underwent appendectomy. The secondary Research Objective was to decrease the number of negative appendectomies and overall cost.

Table 1: RIPASA score for diagnosis of acute appendicitis.

Scoring element	Score
Sociodemographic data	
Male	1
Female	0.5
Age <39.9 years	1
Age >40 years	0.5
Symptoms	
RIF pain	0.5
Pain migration to RIF	0.5
Anorexia	1
Nausea & Vomiting	1
Duration of symptoms <48 hrs.	1
Duration of symptoms >48 hrs.	0.05
Signs	
RIF tenderness	1
Guarding	2
Rebound tenderness	1
Rovsing sign	2
Fever >37°C <39°C	1
Investigations	
Raised WBC counts	1
Negative urine analysis	1
Total score	16.5

Ethical Approval:

This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Benha University. Written informed consent was obtained from all participants. This study was executed according to the code of ethics of the World Medical Association (Declaration of Helsinki) for studies on humans.

Statistical Analysis

The collected data were introduced and statistically analyzed by utilizing SPSS (Statistical Package for Social Sciences, IBM Corp., Armonk, New York, USA) version 25 for windows. Qualitative data were defined as numbers and percentages. Chi-Square test/Fisher's exact test was used for comparison between categorical variables as appropriate. Quantitative data were tested for normality by Kolmogorov-Smirnov test. Normal distribution of variables was described as mean and standard deviation (SD), and independent sample t-test was used for comparison between groups. P value ≤0.05 was considered to be statistically significant.

RESULTS

The present prospective study included 123 patients with AA with RIPASA score more than 7.5. Table 2 summarizes the sociodemographic data and RIPASA scoring of the participants. The confirmed histopathology of acute appendicitis presented in 110 (89.43%) of cases.

Table 2: Sociodemographic data, Frequency of RIPASA scoring and Histopathology of the studied patients.

Variable	N= 123
Age <39.9 years N (%)	76 (61.8%)
Age >40 years N (%)	47 (38.2%)
Age Mean ± SD	31.85 ± 8.7 years
Sex Male N (%)	58 (47.15%)
Sex Female N (%)	65 (52.85%)
RIPASA Score Frequency	
7	13 (10.57%)
8	15 (12.2%)
10	12 (9.75%)
12	16 (13%)
13.5	10 (8.13%)
14	13 (10.57%)
14.5	12 (9.75%)
15	9 (7.3%)
RIPASA Score (Mean ± SD)	10.2 ± 2.3
Confirmed Histology for AA	110 (89.43%)
Negative Histology for Acute Appendicitis	13 (10.57%)

Correlation between RIPASA scores and histopathological findings was illustrated in **Table 3**.

Table 3: Correlation between RIPASA score and histopathological findings.

Acute Appendicitis on Histopathology	RIPASA Scoring	
	Positive (>7.5)	Negative (7.5)
Positive (+ve evidence of Acute Appendicitis)	107 (True positive)	3 (False Positive)
Negative (No inflammatory changes)	4 (False negative)	9 (True negative)

Interpretation of **Table 3** determined the **Diagnostic Parameters of RIPASA Score for AA**.

1. **Sensitivity of RIPASA score** = 96.4%.
2. **Specificity of RIPASA score** = 75%.
3. **PPV of RIPASA score** = 97.27%.
4. **NPV of RIPASA score** = 69.23%.
5. **Diagnostic Accuracy of RIPASA score** = 94.3%.

DISCUSSION

AA is a prevalent surgical emergency. The clinical variability and high prevalence of AA is a diagnostic challenge [12]. Many promising diagnostic tests had emerged in clinical practice to avoid negative appendectomy and to decrease overall healthcare costs. Complications related to AA have a bad impact on the patient's prognosis. This is why the need of an accurate prediction scoring system is crucial [13]. The use of clinical scoring systems will have a good helping tool for healthcare providers for accurate diagnosis of AA [12]. RIPASA Score accuracy and PPV were established for the Asian population with promising sensitivity, PPV and NPV results [10].

Many studies [14,15,16,17] had documented the sensitivity of RIPASA score taking into consideration a cut-off value of 7.5 and reported a range from 95.5% up to 98.5 % and this is going with the results of the current study which reported sensitivity of 96.4%. However, this was much higher than *Korkut et al.* [18] and *Ozdemir et al.* [19], who reported sensitivity of 75% and 68%, respectively. This is assumed to the smaller sample size of their study and the higher cut-off value as they considered 12 and 10, respectively, while 7.5 was the significant cut-off value in the present study.

Specificity of RIPASA score in the current study was 75% which matched with the results of *Odzemeir et al.* [19] and *Akbar et al.* [15]. However, it was much higher than those reported by *Dezfuli et al.* [20] and *Şenocak et al.* [21] who reported 46.5% and 37.5 %, respectively, and this is assumed to be due to large number of false negative cases reported in their study also it was less than what reported by *Korkut et al.* [18], who reported 99.7 %

specificity and this can be explained by higher cut-off value in their study which was 12.

The positive predictive value reported in the present study was 97.2% and this matched the results of *Chae et al.* [22] and *Noor et al.* [14] who reported 99.2% and 98.9 % respectively and this was much higher than what was reported by *Dezfuli et al.* [20] and *Golden et al.* [23] who reported 69.6% and 39%, respectively, and this is assumed to be due to the large number of false positive cases reported in their study.

The NPV in the present study was 69.23% and this matched with the results of *NaNjuNdaiah et al.* [24]. However this was less than what was reported by *Subramani et al.* [25] who reported 97.4%, and this is assumed to be due to the large number of true negative cases reported in their study in relation to the sample size.

Many studies [14,17,26,27] had documented the accuracy of RIPASA score to be within the range from 90.5% up to 97.5%, and this was similar to the diagnostic accuracy of RIPASA reported in the present study was 94.7% although the current results were much higher than *Pasumarthi et al.* [28] and *Chae et al.* [22], and this may be due to very large number of false positive cases reported in their study and this due to inclusion of many patients with urological symptoms.

CONCLUSION

RIPASA is a reliable and feasible score for AA with high sensitivity, positive predictive value, and diagnostic accuracy. PIPASA score can be used as a reliable method for diagnosis of AA among Egyptian considering a cut-off value of 7.5.

Conflicts of interest: NIL

Funding/ Support: Not funded by any scientific organizations.

REFERENCES

1. **Aman T, Yaqoob L, Shah S et al. (2018):** Evaluation of RIPASA score for diagnosis of acute appendicitis. *KJMS.*, 11 (2):189-96.
2. **Madhushankar L, Rai R, Anirudh V et al. (2021):** Comparison of modified Alvarado and RIPASA scoring systems correlated with intra-operative findings in predicting acute appendicitis. *Int J Surg.*, 8(9):2662-8.
3. **Karamanacos S, Sdralis E, Panagiotopoulos S et al. (2010):** Laparoscopy in the emergency setting: a retrospective review of 540 patients with acute abdominal pain. *Surg. Laparosc. Endosc. Percutaneous Tech.*, 20(2):119-24.
4. **Khairy G (2009):** Acute appendicitis: is removal of a normal appendix still existing and can we reduce its rate? *Saudi Journal of Gastroenterology*, 15(3):167-70.
5. **Mumtaz H, Sree S, Vakkalagadda P et al. (2022):** The RIPASA scoring system: A new Era in appendicitis diagnosis. *Annals of Medicine and Surgery*, 80:104174.

6. **Frountzas M, Stergios K, Kopsini D et al. (2018):** Alvarado or RIPASA score for diagnosis of acute appendicitis? A metaanalysis of randomized trials. *International Journal of Surgery*, 56:307-14.
7. **McKay R, and Shepherd J (2007):** The use of the clinical scoring system by Alvarado in the decision to perform computed tomography for acute appendicitis in the ED. *Am J Emerg Med.*, 25(5):489-93.
8. **Ozkan S, Duman A, Durukan P et al. (2014):** The accuracy rate of Alvarado score, ultrasonography, and computerized tomography scan in the diagnosis of acute appendicitis in our center. *Niger J Clin Pract.*, 17(4):413-8.
9. **Tade AO (2007):** Evaluation of Alvarado score as an admission criterion in patients with suspected diagnosis of acute appendicitis. *W Afr J Med.*, 26(3):210-2.
10. **Nanjundaiah N, Mohammed A, Shanbhag V et al. (2014):** A comparative study of RIPASA score and ALVARADO score in the diagnosis of acute appendicitis, *J Clin Diagn Res.*, 8(11):3-5.
11. **Abdullah A, Katoof M and Jasim H (2018):** RIPASA versus modified Alvarado scoring system in the diagnosis of acute appendicitis, as a new scoring system of acute appendicitis in ASIA. *International Journal of Surgery Open*, 15:42-5.
12. **Di Saverio S, Podda M, De Simone B et al. (2020):** Diagnosis and treatment of acute appendicitis: 2020 update of the WSES Jerusalem guidelines. *World J Emerg Surg.*, 15(1):27-34.
13. **Favara G, Maugeri A, Barchitta A et al. (2022):** Comparison of RIPASA and ALVARADO scores for risk assessment of acute appendicitis: A systematic review and meta-analysis. *PLoS ONE*, 17(9):e0275427.
14. **Noor S, Wahab A, Afridi G et al. (2020):** Comparing Ripasa Score and Alvarado Score in An Accurate Diagnosis Of Acute Appendicitis. *J Ayub Med Coll Abbottabad*, 32(1):38-41.
15. **Akbar I, Shehzad A and Ali S (2019):** Diagnostic Accuracy of Ripasa Score. *J Ayub Med Coll Abbottabad*, 31(3):411-4.
16. **Bolivar-Rodríguez M, Osuna-Wong B, Calderón-Alvarado B et al. (2018):** Comparative analysis of diagnostic scales of acute appendicitis: Alvarado, RIPASA and AIR. *Cir.*, 86(2):169-74.
17. **Devarajan L, Ramesh A and Gayathri S (2019):** A prospective study of comparison of RIPASA and Alvarado scores for the diagnosis of acute appendicitis in government Vellore medical college. *J Evolution Med Dent Sci.*, 8(19):1578-81.
18. **Korkut M, Bedel C, Karancı Y et al. (2020):** Accuracy of Alvarado, Eskelinen, Ohmann, RIPASA and Tzanakis Scores in Diagnosis of Acute Appendicitis; a Cross-sectional Study. *Arch Acad Emerg Med.*, 8(1):e20.
19. **Ozdemir Z, Ozdemir H, Sunamak O et al. (2018):** Comparison of the reliability of scoring systems in the light of histopathological results in the diagnosis of acute appendicitis. *Hong Kong Journal of Emergency Medicine*, 26:323-7.
20. **Dezfuli T, Yazdani R, Khorasani M et al. (2020):** Comparison between the specificity and sensitivity of the RIPASA and Alvarado Scoring systems in the diagnosis of acute appendicitis among patients with complaints of right iliac fossa. *AIMS Public Health*, 7(1):1-9.
21. **Şenocak R and Kaymak Ş (2020):** Diagnostic accuracy of ultrasonography and scoring systems: The effects on the negative appendectomy rate and gender. *Ulus Travma Acil Cerrahi Derg.*, 26(2):306-13.
22. **Chae S, Hong K, Ha R et al. (2017):** Can clinical scoring systems improve the diagnostic accuracy in patients with suspected adult appendicitis and equivocal preoperative computed tomography findings? *Clin Exp Emerg Med.*, 4(4):214-21.
23. **Golden K, Harringa B, Pickhardt J et al. (2016):** Prospective evaluation of the ability of clinical scoring systems and physician-determined likelihood of appendicitis to obviate the need for CT. *Emerg Med J.*, 33(7):458-64
24. **Nancharaiah P, Aishwarya M, Venkateswarulu M (2019):** Comparative Study of Alvarado and RIPASA Scoring System in Diagnosing Acute Appendicitis. *Indian J Surg.*, 81:150-3.
25. **Subramani B, Kalaichelvan L, Selvam G et al. (2017):** Comparison between RIPASA and ALVARADO scoring in diagnosing acute appendicitis. *J Evid Based Med Healthc.*, 4(11):624-7.
26. **Abdelrhman T, Al Saeed M, Badr S et al. (2018):** Validity of RIPASA scoring system as a diagnostic tool of acute appendicitis in comparison with Alvarado scoring system in the Arab population. *International Surgery Journal*, 5(2):20-6.
27. **Verma M, Vashist G, Goyal K et al. (2016):** Comparison of Alvarado And Ripasa Scoring Systems in Diagnosis of Acute Appendicitis. <https://www.semanticscholar.org/paper/Comparison-of-Alvarado-And...>
28. **Pasumarthi V and Madhu P (2018):** A comparative study of RIPASA score and ALVARADO score in diagnosis of acute appendicitis. *Int Surg J.*, 5:796-801.