THE RAJA ISTERI PENGIRAN ANAK SALEHA APPENDICITIS (RIPASA) VERSUS ALVARADO SCORING SYSTEM IN DIAGNOSIS OF ACUTE APPENDICITIS

By

Khalifa Hassan Khalifa Agwider, Magdy Mahmoud Moustafa and Osama Fathy Ibrahim El-Mezaien

Department of General Surgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

Corresponding author: Khalifa Hassan Khalifa Agwider,

Mobile: (+20)01129842206, **E-mail:** khalifahassan322@gmail.com

ABSTRACT

Background: Multiple scoring systems have been developed in order to identify patients who need emergency appendectomy and those who are unlikely to have acute appendicitis. The Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) and Alvarado scoring systems are two of these systems. The aim of this article was to compare both systems in terms of diagnostic accuracy.

Objective: To compare RPASA and Alvarado scoring systems in terms of diagnostic accuracy for acute appendicitis.

Patients and Methods: This prospective comparative study was conducted over a period of six months, from May 2020 to November 2020, on 150 patients presented with right iliac fossa pain that was highly suggestive of acute appendicitis in Bab-EL-Sharia Hospital and included 150 patients of suspected acute appendicitis. RIPASA and Alvarado scores were performed for all. However, patients above 14 years in who decision to operate was made already by independent surgeons. Sensitivity, specificity, predictive values and accuracy were calculated. Data were analyzed using Statistical Package for Social Science (IBM SPSS) version 20.

Results: Sensitivity of RIPASA score in confirmed positive histology group was 83.0%, specificity 86.0%, PPV 85.0%, NPV 86.5% and total accuracy 84.5. Sensitivity of Alvarado score in Confirmed positive histology group was 77.0%, specificity 42.0%, PPV 78.0%, NPV 43.0% and total accuracy 59.5%.

Conclusion: RIPASA score is more sensitive and specific in diagnosing of acute appendicitis than Alvarado score.

Keywords: Acute appendicitis, RIPASA score, Alvarado score.

INTRODUCTION

Acute appendicitis is the most common indication for emergency surgery worldwide, with incidence of 1.17 per 1000 and lifetime risk of 8.6% in men and 6.7% in women. The incidence is highest in adolescents and young adults, but the incidence of complicated appendicitis shows little variance between different age groups. The diagnosis of acute appendicitis is based purely on clinical history and examination combined with laboratory investigations such as elevated white cell count. Despite being a common problem, acute appendicitis remains a difficult diagnosis to establish, particularly among the young, the elderly and females of reproductive age, where a host of other genitourinary and

gynecological inflammatory conditions can present with signs and symptoms that are similar to those of acute appendicitis *(Angel et al., 2016).*

Early surgical intervention is the traditional gold standard for preventing appendicular perforation. High rate of unnecessary negative appendectomies, however, it leads to unnecessary morbidity and even mortality *(Rushing et al., 2019).*

RIPASA score is a new diagnostic scoring system developed for the diagnosis of Acute Appendicitis and has been shown to have significantly higher sensitivity, specificity and diagnostic accuracy. The RIPASA scoring system includes more parameters than Alvarado system and the latter did not contain certain parameters such as age, gender, duration of symptoms prior to presentation. These parameters are shown to affect the sensitivity and specificity of Alvarado scoring system in the diagnosis of acute appendicitis *(Davis and Swaminathan, 2019).*

RIPASA score is a more extensive yet simple additive scoring system consisting of 14 fixed parameters and an additional parameter, National Registration Identity Card (NRIC) that is unique to our population setting. All these 15 parameters are easily obtainable from a good clinical history, examination and investigation *(Varma et al., 2019).*

Alvarado scoring system, which is based on histopathology, physical examination, and a few laboratory investigations and is very easy to apply but, falls disappointingly short of expectations in females, especially of child-bearing age, reporting a negative

appendectomy rate of 30% in females *(Chung et al., 2019).*

The present work aimed to compare between Alvarado versus RIPASA scores.

PATIENTS AND METHODS

The current study was performed as a prospective comparative study that was conducted over a period of six month, from May 2020 to November 2020, on 150 patients presented with right iliac fossa pain that was highly suggestive of acute appendicitis in Bab-EL-Sharia Hospital.

Children from and below 14 years and patients with history of appendectomy were excluded from the study. Pregnant women, patients with right iliac fossa mass and patients with previous history of urolithiasis and pelvic inflammatory disease were also excluded from the study.

Patients were within the age group 15-58 y. All the 150 patients were scored as per Alvarado and RIPASA scoring system. Alvarado score contained 8 parameters, whereas RIPASA score contained 18 parameters. The score for the parameters ranged from 0.5 to 2 for RIPASA and 1 to 2 for Alvarado as shown in respectively *(Chung et al., 2019).*

Scoring charts were filled by the attending surgeon at the time of presentation. A score of 7 was taken as high probability of acute appendicitis for Alvarado scoring system and a score of 7.5 for RIPASA scoring system. The decision on appendectomy was solely based on surgeon's clinical judgment after taking into consideration all the findings of clinical, laboratory and radiological

investigation. RIPASA and Alvarado score were only done for the study purpose. Patients were monitored following admission, surgery till discharge from the Hospital. Daily follow up included monitoring of vitals thrice a day, systemic examination once a day. Histopathology findings of the operated case were collected and correlated with either score.

Data were collected, revised, coded and entered to the Statistical Package for the Social Science (IBM SPSS) version 20. The qualitative data were presented as number and percentages while quantitative data were presented as mean, standard deviations and ranges when their distribution found parametric. The comparison between two groups with qualitative data were done by using Chi-square test, the confidence interval was set to 95% and the margin when P < 0.05 error accepted was set to 5%. So, the p-value was considered significant.

RESULTS

Among the studied cases (n = 150) there were 82 (54.7%) Males and 68 (45.3%) Females with mean Age 39.9 and ± 9.36 SD and range (20 - 58) years **(Table 1)**.

Table(1): Distribution of the studied cases according to Age and Sex

		No. (%)
Sex	Female	68 (45.3%)
	Male	82 (54.7%)
Age	Mean ± SD	39.9 ± 9.36
	Range	15 – 58
	< 40	58 (38.7%)
	≥40	92 (61.3%)

Among the studied cases 62.7 % presented with fever, 60.7 % presented with rebound tenderness, 59.3% presented with guarding, 58% presented with positive Rovsing sign, 56.7% presented with anorexia, 53.3 % presented with leucocytosis, 46 % presented with shifting of pain to RIF, 40 % presented with nausea and vomiting while 41.3% presented with negative urine analysis **(Table 2&3)**.

KHALIFA H. AGWIDER *et al.,*

Table (2): Distribution of the studied cases according to RIPASA score

RIPASA score	No.	%
Fever > 37º - < 39º	94	62.7%
Rebound tenderness	91	60.7%
Guarding	89	59.3%
Rovsing's sign	87	58.0%
Anorexia	85	56.7%
Duration of symptoms<48 hours	81	54.0%
Raised WBC	80	53.3%
Duration of symptoms>48 hours	73	48.7%
Migration of pain to RIF	69	46.0%
Negative urine analysis	62	41.3%
Nausea and vomiting	60	40.0%

Table (3): Distribution of the studied cases according to ALVARADO score

ALVARADO score	No.	%
Shift to the left neutrophils	96	64.0%
Fever	94	62.7%
Rebound tenderness	91	60.7%
Right iliac fossa tenderness	87	58.0%
Anorexia	85	56.7%
Leucocytosis	80	53.3%
Nausea and vomiting	60	40.0%

There was no statistically significant difference found between RIPASA score and ALVARADO score **(Table 4)**.

Table(4): Comparison between RIPASA score and ALVARADO score

RIPASA score		≥7.5		< 7.5	
		No.	%	No.	%
ALVARADO score	≥7	51	44.3%	18	51.4%
	< 7	64	55.7%	17	48.6%
P-value		**0.462**			

The RIPASA score considerably better than the Alvarado score in terms of correctly diagnosing patients with acute appendicitis (sensitivity and diagnostic accuracy) as well was found to be as those who were negative for acute appendicitis **(Table 5)**.

Table (5): Comparison between Confirmed positive histology and Confirmed negative histology Regarding RIPASA score and ALVARADO score.

Histopathology Score		Confirmed negative histopathology		Confirmed positive histology		P-value
		No.	%	No.	%	
RIPASA score	≥7.5	20	40.0%	95	95.0%	0.000
	< 7.5	30	60.0%	5	5.0%	
ALVARADO score	≥7	16	32.0%	53	53.0%	0.015
	< 7	34	68.0%	47	47.0%	

Histological examination of the surgical specimen showed changes consistent with acute inflammation acute appendicitis, acute suppurative appendicitis, gangrenous appendicitis, periappendicular abscess and fibrosed appendix **(Figure 1)**.
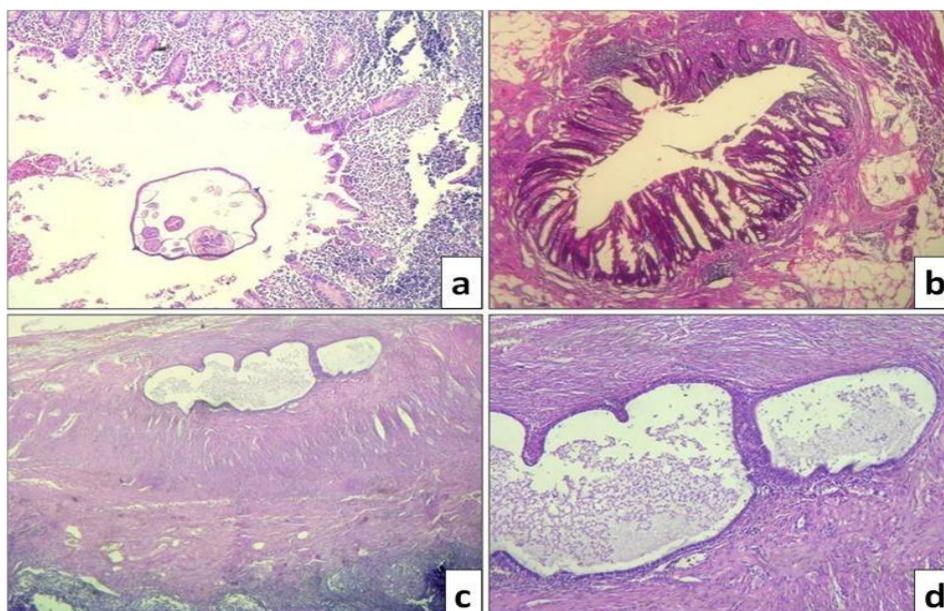
Figure (1): Histopathological findings of appendicitis.

Receiver operating characteristic curve (ROC) showed that The sensitivity of RIPASA score to detect confirmed positive histology group was found 83.0%%, specificity of 86.0%, PPV of 85.0%, NPV of 86.5% and total accuracy of 84.5%, and receiver operating characteristic curve (ROC) showed that the sensitivity of ALVARADO score to detect confirmed positive histology group was found 77.0%%, specificity of 42.0%, PPV of 78.0%, NPV of 43.0% and total accuracy of 59.5% **(Table 6)**.

Table (6): ROC curve (Confirmed positive histology and Confirmed negative histology) group regarding RIPASA score and ALVARADO score.

	AUC	Sensitivity	Specificity	+ PV	- PV
RIPASA score ≥ 7.5	84.5%	83.0%	86.0%	85.0%	86.5%
ALVARADO score ≥ 7	59.5%	77.0%	42.0%	78.0%	43.0%

DISCUSSION

Acute appendicitis can be challenging for surgeons because of appendectomy delays and problems with diagnostic accuracy. A delay in performing appendectomy may increase the risk of appendicular perforation or an appendicular inflammatory mass *(Cheng et al., 2017).*

A quick and correct diagnosis of acute appendicitis leading to early appendectomy and avoidance of complications arising from perforation can be difficult at times. Radiological modalities such as computed tomography (CT) imaging further aid in making a definite diagnosis and have been reported to have high sensitivity (94%) and specificity (95%) for diagnosing acute appendicitis *(Naglaa et al., 2019).*

The rate of negative appendectomies is 20%–30%. Several studies consider this rate to be unacceptable. Improving diagnostic accuracy and reducing the negative appendectomy rate can be achieved through the use of several diagnostic investigations, such as computed tomography (CT) and ultrasonography, although these can increase the overall healthcare costs *(Shuaib et al., 2017).*

A study by *Woodham et al. (2012)* has suggested that such indiscriminate use of CT imaging may lead to the detection of early low-grade appendicitis and unnecessary appendectomies in a condition that would otherwise have resolved spontaneously with antibiotics therapy.

Several diagnostic scoring systems have been developed with the most popular scoring systems are the Alvarado score and the modified Alvarado score. The Alvarado score, which was developed in 1986, was a simple additive scoring system to help with the diagnosis of acute appendicitis. Although it showed very good sensitivity and specificity when applied in a Western population, several subsequent studies by *Salminen et al. (2015)* have shown its limitations when applied in an Asian or Oriental population.

As a result, we developed a new scoring system called the RIPASA score, which is a more extensive yet simple additive scoring system consisting of 14 fixed parameters and an additional parameter (NRIC) that is unique to our population setting. All these 15 parameters are easily obtainable from a good clinical history, examination and investigations *(Chong et al., 2011).*

This study compared the RIPASA and Alvarado scores in our patient population who presented with RIF pain, and who were suspected of acute appendicitis. The RIPASA score considerably better than the Alvarado score in terms of correctly diagnosing patients with acute appendicitis (sensitivity and diagnostic accuracy), as well was found to be as those who were negative for acute appendicitis (NPV).

In a retrospective study by *Chong et al. (2011)*, the RIPASA score has been shown to achieve better sensitivity (88%) and specificity (67%) than the Alvarado score (sensitivity 59%, specificity 23%) in Comparison RIPASA and Alvarado scores reported a sensitivity 98% and specificity 81%.

Nanjundaiah et al. (2014) revealed that the RIPASA score is currently a better diagnostic scoring system for acute appendicitis compared to the Alvarado score, with the former achieving significantly higher sensitivity and diagnostic accuracy and both of these studies supports our results. *Frountzas et al. (2018)* and *Dezfuli et al. (2020)* showed that the RIPASA scoring is commonly a much better diagnostic scoring system for acute appendicitis versus Alvarado scoring, with higher sensitivity.

CONCLUSION

RIPASA score was more sensitive and specific in diagnosing of acute appendicitis than Alvarado score.

REFERENCES

1. **Angel MA., Gonzalez MS., Telléz SW., Marin PP., Gomez JD. and Torres AF. (2016):** Acute Appendicitis: Evidence Based Management. Invest. Art, 2(1): 45-78.

2. **Cheng Y., Xiong X., Lu J., Wu S., Zhou R. and Cheng N. (2017):** Early versus delayed appendectomy for appendicular phlegmon or abscess. Cochrane Database Syst. Rev., 25(6): 840-846.

3. **Chong CF., Adi MI. and Thien A. (2011):** Development of the RIPASA score: a new appendicitis scoring system for the diagnosis of acute appendicitis. Singapore Med J., 12(9): 220-225.

4. **Chung PH., Dai K., Yang Z. and Wong KK. (2019):** Validity of Alvarado Score in predicting disease severity and postoperative complication in pediatric acute appendicitis. World Journal of Pediatric Surgery, 2(1): 330-370.

5. **Davis GN. and Swaminathan M (2019):** Acute appendicitis-new diagnostic algorithm using RIPASA score and non-contrast Computeed Tomography Scan. The Journal of the Pakistan Medical Association, 69(1): 12-16.

6. **Dezfuli SAT., Yazdani R., Khorasani M. and Hosseinikhah SA. (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.

7. **Frountzas J., Maximos M., Stergios J., Konstantinos N. and Dimitra SA. (2018):** Alvarado or RIPASA score for diagnosis of acute appendicitis A meta-analysis of randomized trials. International Journal of Surgery, 56(15): 307–314.

8. **Naglaa HS, Amr MA and Ayman AE. (2019):** Role of Computed Tomography In Diagnosis Of Appendicitis And Its Complications. ZUM J.; 25(6); 840-846.

9. **Nanjundaiah N., Mohammed A., Shanbhag V. and Ashfaque K (2014):** A comparative study of RIPASA score and ALVARADOb score in the diagnosis of acute

appendicitis. Journal of Clinical and Diagnostic Research, 8(11): 214-219.

10. **Rushing A., Bugaev N., Jones C. and Como JJ. (2019):** Management of acute appendicitis in adults: A practice management guideline from the Eastern Association for the Surgery of Trauma. Journal of Trauma and Acute Care Surgery, 87(1): 214-224.

11. **Salminen P, Paajanen H, Rautio T. and Grönroos JM. (2015):** Antibiotic therapy vs appendectomy for treatment of uncomplicated acute appendicitis: the APPAC randomized clinical trial. JAMA. 313:2340–2348.

12. **Shuaib A., Shuaib A., Fakhra Z. and Marafi B. (2017):** Evaluation of modified Alvarado scoring system and RIPASA scoring system as diagnostic tools of acute appendicitis. West J Emergancy Med., 8(4): 276-280.

13. **Varama den Bogaard VA., Euser SM. and van der Ploeg M. (2019):** Diagnosing perforated appendicitis in pediatric patients: a new model. J Pediatr Surg., 51(3):444–448.

14. **Woodham BL, Cox MR and Eslick GD. (2012):** Evidence to support the use of laparoscopic over open appendicectomy for obese individuals: a meta-analysis. Surg. Endosc. J; (2)26:2566–2570

مقياس ريباسا مقابل مقياس ألفارادو في تشخيص التهاب الزائدة الدودية الحاد

خليفة حسن خليفة أقويدر, مجدى محمود مصطفي, أسامة إبراهيم المزين

قسم الجراحة العامة، كلية الطب، جامعة الأزهر، القاهرة، مصر

E-mail: khalifahassan322@gmail.com

خلفيـــة البحـــث: طـــورت تقنيـــات مختلفـــة للمساعدة فـــي تقليـــل معـــدلات استئصـــال الزائـــدة الدودية الملتبسة في تشخيصها و مقياس ريباسا و مقياس ألفارادو هما من هذه التقنيات.

الهـدف مـن البحـث: مقارنـــة بـين مقيـاس ريباسـا الجديـد، ومقيـاس ألفـارادو مـن حيـث الدقـة فـي تشخيص إلتهاب الزائدة الدودية.

المرضـى و طـرق البحـث: تمـت هـذه الدراسـة فـي قسـم الجراحـة بمستشـفيات جامعـة الأزهـر علـى مـدار سـتة أشـهر علـى 150 مريضـا يعـانون مـن آلام الحفـرة الحرقفيـة اليمنـى، و التـي تنـذر بوجـود إلتهـاب حـاد بالزائـدة الدوديـة بمستشـفي بـاب الشـعرية حيـث إعتمـدنا علـى 18 معيـارا فـي مقيـاس ريباسـا, وكـان الحـد الأمثـل القـاطع هـو 7.5 درجـة. وإسـتخدمنا 8 معـايير فى مقياس ألفارادو، وكانت درجة 7 هى الحد الأمثل القاطع للمقياس.

نتـائج البحـث: كـان معـدل حساسـية دقـة مقيـاس ريباسـا 83% فـى الحـالات الإيجابيـة المؤكـدة لعينـات الهسـتوباثولوجى للأنسـجة ومعـدل الخصوصـية 86%, وكانـت القيمـة التنبؤيـة الإيجابيـة للمقيـاس 85%, و القيمـة التنبؤيـة السـلبية للمقيـاس 86.5%, والدقـة الكليـة 84.5%. كمـا أشـار معـدل حساسـية دقـة مقيـاس أفـارادو فـى مجموعـة الحـالات الإيجابيـة المؤكـدة لعينـات الهسـتوباثولوجى للأنسـجة 77%, و معـدل الخصوصـية 42%, و القيمـة التنبؤيـة الإيجابيـة للمقيـاس 78%, و القيمـة التنبؤيـة السـلبية للمقيـاس 43%, و الدقـة الكليـة 59.5%.

الاسـتنتاج: يُـعتبر مقيـاس ريباسـا أكثـر حساسـية و دقـة و تحديـداً فـى تشـخيص الزائـدة الدودية من مقياس ألفارادو.

الكلمات الدالة: مقياس ريباسا, مقياس ألفارادو, إلتهاب الزائدة الدودية.