

Original Research Article

A comparative study of RIPASA and Alvarado score for the diagnosis of acute appendicitis

Praveena Suresh, Rajan Janardhanan*, Deepak Paul

Department of General Surgery, Sree Gokulam Medical College and Research Foundation, Venjaramoodu, Trivandrum, Kerala, India

Received: 08 October 2020

Accepted: 22 October 2020

***Correspondence:**

Dr. Rajan Janardhanan,

E-mail: rajanjanardhanan516@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Acute appendicitis is a common problem and can be difficult to diagnose at time. There are many scoring systems to predict the diagnosis of acute appendicitis. The most commonly used scoring system is Alvarado scoring system but, it is far from perfect. In this study we compare Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) scoring system to Alvarado scoring system in correctly diagnosing acute appendicitis.

Methods: This prospective observational study was conducted in the department of general surgery, Sree Gokulam Medical College and Research Foundation. It comprised of 60 consecutive patients who were admitted with suspicion of appendicitis who had right iliac fossa pain. RIPASA and Alvarado scoring was done and compared to histopathology after surgery. Sensitivity, specificity and accuracy was calculated.

Results: Majority of the patients were below 30 years of age majority were males 36 (60%). When Alvarado score predicted appendicitis in 31 (51.77%) and RIPASA in 54 (90%). When the RIPASA score was >7.5 the sensitivity was 100%, specificity 67% and accuracy was 95%.

Conclusions: RIPASA scoring system is more accurate to diagnose acute appendicitis especially when RIPASA score is >7.5. literatures.

Keywords: RIPASA score, RIPASA versus Alvarado score, Negative appendectomy

INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies, with a lifetime prevalence rate of approximately one in seven.¹ In the male and female population, the incidence is 1.5-1.9 per 1,000 individuals, and is approximately 1.4 times greater in men than in women.² A delay in performing an appendectomy in order to improve its diagnostic accuracy increases the risk of appendicular perforation and sepsis, which in turn increases morbidity and mortality.³ With reduced diagnostic accuracy, the negative or unnecessary appendectomy rate is increased, which is the opposite of the first scenario and this is generally reported to be approximately 20-40%.⁴

Negative appendectomy is taken as a surgery performed for a preoperative diagnosis of appendicitis that results in a normal histopathology specimen. Different techniques have been devised to assist in equivocal cases in attempts to decrease negative appendectomy rates. A number of scoring systems have been used for aiding in early diagnosis of acute appendicitis and its prompt management. These scores make use of clinical history, physical examination and laboratory findings. The 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 to have significantly higher sensitivity, specificity and diagnostic accuracy compared to Alvarado Score particularly when applied to Asian population.⁵ Although

RIPASA score is more extensive than Alvarado system, 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.⁶

The Alvarado score was assessed as to its accuracy in the preoperative diagnosis of acute appendicitis by Kalan, Rich, Talbot and Cunliffe in 1994.⁴ The presence of a high score was found to be an easy and satisfactory aid to early diagnosis of appendicitis in children and men. However, the false-positive rate for appendicitis in women was unacceptably high. Chong et al in 2010 did a prospective study on patients presenting to the Accident and emergency department or the surgical wards in RIP AS National Hospital at Brunei, Darussalam with right iliac fossa pain.⁵ They concluded that RIPASA score is a more suitable appendicitis scoring system developed for local settings that is South-east Asia and has high sensitivity, specificity and diagnostic accuracy. The aim of this study is to compare RIPASA and ALVARADO scoring systems in accurately diagnosis acute appendicitis.

METHODS

Our study is a prospective observational study conducted in the department of general surgery of Sree Gokulam Medical College and research foundation, Venjaramoodu, Trivandrum. The study duration was 18 months from November 2015 to May 2017. The study population included 60 consecutive patients admitted in general surgery department with right iliac fossa pain with a clinical suspicion of appendicitis. Sample size was calculated with the formula:

$$n = [Z_{\alpha}\sqrt{2p(1-p)} + Z_{\beta}\sqrt{p_1(1-p_1) + p_2(1-p_2)}]$$

$$(p_1-p_2)^2$$

$$2$$

30 in each arm

So, n=60 where, p1=96.2%, p2=58.9%, α=5%, β=5%, Zα=1.96, Zβ=1.645.

Inclusion criteria

The inclusion criteria for the study was as follows: all patients, in the age group of 15 to 65 coming to surgery Outpatient department (OPD) or emergency department with right iliac fossa pain, clinically suspected to be acute appendicitis and patients who have undergone emergency appendectomy as the primary procedure.

Exclusion criteria

The exclusion criteria for the study was as follows: children under the age group of 15 years, pregnant women,

patient with right iliac fossa mass, patient with previous history of urolithiasis or pelvic inflammatory disease were excluded, chronic recurrent right iliac fossa pain and patients not willing to give consent for the study.

In this prospective observational study involving the patients between 15-60 years coming to the hospital with right iliac fossa pain, informed consent was taken from patients. The patients were monitored following admission, surgery and till discharge from the hospital. The daily follow up including monitoring of vitals thrice a day, systemic examination twice a day. The histopathology findings were documented.

Patients were observed as follows as per RIPASA score and Alvarado score; histopathology examination of the specimen after surgery; blood examination and complete urine examination.

Patients were followed up intra-operatively and during post-operative hospital stay. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy at the optimal cut-off threshold scores were calculated. Predicted negative appendectomy rates for both scores were calculated and compared using Chi-square test for statistical analysis. All continuous variables were analysed using unpaired student's t-test so as to compare the differences between the groups.

RESULTS

In our study of 60 patient's majority were of the 20-29 years of age group 27 (45%). (Table 1) 36 (60%) of the 60 patients were male and 24 (40%) were females. (Table 2) When Alvarado score was used 31 (51.7%) were suggestive of acute appendicitis. When ultrasound abdomen was used 55 (91.7%) were suggestive of acute appendicitis. When RIPASA was used 54 (90%) were suggestive of acute appendicitis. Histopathology was taken as gold standard and in which 51 (85%) had acute appendicitis.

The RIPASA score with respect to histopathology report

Out of 60 patients who underwent appendectomy, 51 patients showed RIPASA score >7.5 suggesting probability of acute appendicitis and there was no patient who had a negative RIPASA score for a positive histopathology. Sensitivity of RIPASA is 100%, specificity is 66.7%, PPV of 94.4% and NPV of 100%. Accuracy rate is 95% and Kappa of 0.77; which has got a substantial agreement.

The Alvarado score with respect to histopathology

Of the 60 patients who underwent appendectomy, 31 patients showed Alvarado score >7, suggesting probability of acute appendicitis, 20 patients whose Alvarado score <7 showed positive histopathology report. Sensitivity is

60.8%, specificity is 100%, PPV is 100%, NPV is 31%, accuracy is 66.7%, kappa of 0.32; which has got only fair agreement.

Comparison of RIPASA and Alvarado scoring systems in terms of diagnostic accuracy (Table 3).

Table 1: Age distribution.

Age (in years)	Count	Percentage
<20	15	25.0
20-29	27	45.0
30-39	11	18.3
≥40	7	11.7
Mean±SD	27.6±9.9	

Table 2: Distribution of the sample according to sex.

Sex	Count	Percentage
Male	36	60.0
Female	24	40.0

Table 3: Comparison of RIPASA and Alvarado scoring systems in terms of diagnostic accuracy in a case of acute appendicitis.

Diagnostic accuracy for acute appendicitis	RIPASA	Alvarado	Z	P value
Sensitivity	100.0	60.8	5.41**	0.000
Specificity	66.7	100.0	4.899**	0.000
False negative	0.0	39.2	5.41**	0.000
False positive	33.3	0.0	4.899**	0.000
PPV	94.4	100.0	1.852	0.064
NPV	100.0	31.0	7.947**	0.000
Positive likelihood ratio	3.0	-	-	-
Negative likelihood ratio	0.0	0.4	0.486	0.631
Accuracy	95.0	66.7	3.943**	0.000

DISCUSSION

Acute appendicitis is one of the most common surgical emergencies, with a lifetime prevalence rate of approximately one in seven. 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 gynaecological inflammatory conditions can present with signs and symptoms that are similar to those of acute appendicitis.⁷ The differential diagnosis of acute appendicitis being Crohn's disease,

ulcerative colitis, renal colic, perforated peptic ulcer, pancreatitis, rectus sheath hematoma, diverticulitis, intestinal obstruction, colonic carcinoma, mesenteric ischemia in general. Ectopic pregnancy, dysmenorrhea, pelvic inflammatory disease, endometriosis in females and testicular torsion in males.⁸

A delay in performing an appendicectomy in order to improve its diagnostic accuracy increases the risk of appendicular perforation and sepsis, which in turn increases morbidity and mortality. The opposite is also true, where with reduced diagnostic accuracy, the negative or unnecessary appendicectomy rate is increased, and this is generally reported to be approximately 20-40%. Several authors considered higher negative appendicectomy rates acceptable in order to minimize the incidence of perforation.⁹ Diagnostic accuracy can be further improved through the use of ultrasound sonography or computed tomography (CT) imaging. Although ultrasonography has some limitations such as, it does not reveal any abnormalities despite the presence of appendicitis especially in early appendicitis before the appendix has become significantly distended and in adults where larger amounts of fat and bowel gas make visualization of appendix actually difficult.

However such routine practice may inflate the cost of health care substantially. A recent study has suggested that indiscriminate use of CT imaging may lead to early low-grade appendicitis and unnecessary appendicectomies which would otherwise be resolved spontaneously by antibiotics therapy.

Hence, a host of scoring system were derived in order to diagnose acute appendicitis. Among them, the most popular being Alvarado scoring system.¹⁰ This scoring system had a very good sensitivity and specificity when applied to western population. Subsequently when this scoring was applied to oriental populations, it showed relatively less specificity and sensitivity to diagnose acute appendicitis. So, a new scoring system was devised called the RIPASA scoring system which was more extensive yet simple scoring system consisting of 18 fixed parameters and an additional parameter (NRIC) that is unique to Asian population.¹¹

In our study, comparing Alvarado scoring system to RIPASA the RIPASA score was considerably better than Alvarado score in correctly diagnosing acute appendicitis. Using the RIPASA score, 100% of patients who actually had acute appendicitis were correctly diagnosed and placed in the high probability group (RIPASA score >7.5) compared to only 60.8% when using the Alvarado score on the same population sample. Thus, the Alvarado score failed to diagnose 39.2% of patients (n=60) with acute appendicitis and wrongly classified them in the low-probability group (Alvarado score <7.0), when compared to RIPASA score which did not fail to diagnose any patient with acute appendicitis. This was comparable to other studies.¹¹⁻¹³

Similarly, for patients who were classified in the low-probability group, i.e. true negative group with RIPASA score <7.5 and Alvarado score <7.0, the Alvarado score outperformed the RIPASA score by correctly diagnosing 100% of patients who did not have acute appendicitis, compared with the RIPASA score, which only managed to correctly diagnose 66.7% ($p < 0.001$). The sensitivity and specificity of RIPASA score is 100% and 66.7% respectively. The sensitivity and specificity of Alvarado score is 60.8% and 100% respectively. The PPV and NPV of RIPASA score is 94.4% and 100% respectively. The PPV and NPV of Alvarado score is 100% and 31% respectively. The above results indicate that RIPASA score is a better diagnostic tool for the diagnosis of acute appendicitis than Alvarado score. This was in line with a study done by Chong et al.¹²

The difference in diagnostic accuracy was 28.3% between the RIPASA score and Alvarado score was statistically significant ($p < 0.001$), indicating that the RIPASA score is a much better diagnostic tool for the diagnosis of acute appendicitis in Indian subcontinent. This is similar to a study done by Akbar et al also from the Indian subcontinent.¹⁴

The RIPASA score is a useful, rapid diagnostic tool for diagnosing acute appendicitis, as it requires only the patient's demographics (age, gender and nationality, which are all available on registration), a good clinical history (RIF pain, migration to RIF, anorexia, nausea, vomiting and fever), clinical examination (RIF tenderness, localized guarding, rebound tenderness, Rovsing's sign) and two simple investigations (raised white cell count and negative urinalysis performed at triage, which is defined as an absence of red and white blood cells, bacteria and nitrates).⁵ The RIPASA score can also help to reduce unnecessary and expensive radiological investigations such as routine CT imaging, thus further helping to reduce annual healthcare expenditure.

The limitation of this study is that majority 51 of the 60 patients in this study had a RIPASA score of more than 7.5 and there were only 9 patients with a RIPASA score less than 7.5. So, it was difficult to have a fair comparison.

CONCLUSION

From our study we conclude that RIPASA scoring system has a good sensitivity, specificity and diagnostic accuracy when compared to Alvarado scoring for Asian population especially when RIPASA score is >7.5. Since RIPASA consist of 18 fixed parameter that are easy to obtain it can very easily be replicated and as it has the option of adding parameters, it makes RIPASA score more flexible and adaptable to different geographical regions. RIPASA score helps in reducing costs and unnecessary inpatient admissions.

ACKNOWLEDGEMENTS

I would like to thank the department of general surgery to help me complete this study.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Stephens PL, Mazzucco JJ. Comparison of ultrasound and the Alvarado score for the diagnosis of acute appendicitis. *Conn Med*. 1999;63(3):137-40.
2. Cuschieri A. The small intestine and vermiform appendix. *Essent Surg Pract*. 3rd edition. London Butter worth Heinman. 1995;1325-8.
3. Velanovich V, Satava R. Balancing the normal appendectomy rate with the perforated appendicitis rate: implications for quality assurance. *Am Surg*. 1992;58(4):264-9.
4. Kalan M, Talbot D, Cunliffe WJ, Rich AJ. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: a prospective study. *Ann R Coll Surg Engl*. 1994;76(6):418.
5. Chong CF, Adi MIW, Thien A, Suyoi A, Mackie AJ, Tin AS, et al. Development of the RIPASA score: a new appendicitis scoring system for the diagnosis of acute appendicitis. *Singapore Med J*. 2010;51(3):220.
6. Wani MM, Yousaf MN, Khan MA, BabaAbdul A, Durrani M, Wani MM, et al. Usefulness of the Alvarado scoring system with respect to age, sex and time of presentation, with regression analysis of individual parameters. *Internet J Surg*. 2007;11(2):1-5.
7. Humes DJ, Simpson J. Acute appendicitis. *BMJ*. 2006;333(7567):530-4.
8. Kumar A, Ramakrishnan TS, Sahu S. Differential Diagnosis for Acute Appendicitis: Epiploic Appendagitis. *Med journal, Armed Forces India*. 2009;65(3):276-7.
9. John H, Neff U, Kelemen M. Appendicitis diagnosis today: clinical and ultrasonic deductions. *World J Surg*. 1993;17(2):243-9.
10. Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med*. 1986;15(5):557-64.
11. N N, Mohammed A, Shanbhag V, Ashfaq K, S A P. A Comparative Study of RIPASA Score and ALVARADO Score in the Diagnosis of Acute Appendicitis. *J Clin Diagn Res*. 2014;8(11):NC03-5.
12. Chong CF, Thien A, Mackie AJA, Tin AS, Tripathi S, Ahmad MA, et al. Comparison of RIPASA and Alvarado scores for the diagnosis of acute appendicitis. *Singapore Med J*. 2011;52(5):340-5.
13. Alnajat I, Abdallah B. Alvarado versus RIPASA score in diagnosing acute appendicitis. *Rawal Med J*. 2013;38(2):147-51.

14. Akbar I, Shehzad JA, Ali S. Diagnostic Accuracy Of Ripasa Score. J Ayub Med Coll Abbottabad. 2019;31(3):411-4.

Cite this article as: Suresh P, Janardhanan R, Paul D. A comparative study of RIPASA and Alvarado score for the diagnosis of acute appendicitis. Int Surg J 2020;7:4006-10.