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Original Article

Comparative study between ALVARADO Score and RIPASA Score for the diagnosis of Acute Appendicitis

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ABSTRACT

Background: *Several scoring systems have been developed to assist physicians in diagnosing acute appendicitis. The study aimed to compare the ALVARADO score and RIPASA score for the diagnosis of acute appendicitis.* ***Methods & Materials:*** *This comparative study was conducted in Sher-e-Bangla Medical College (SBMC), Barisal, in the Department of Surgery, Unit 1. The study was conducted from 1st January 2021 to 31st December 2021. Data were collected via face-to-face interviews by convenient sampling technique. Informed written consent was taken from the respondents. Data were analyzed by SPSS (Statistical Package for the Social Science) 25 version.* ***Results:*** *Out of 62 respondents, ALVARADO scoring system had Mean ± SD 8.1±1.4, Cut value 8.5, AUC 0.853, Sensitivity 85%, Specificity 73%, PPV (Positive Predictive Value) 48%, NPV (Negative Predictive Value) 94%, Diagnostic accuracy 75%. RIPASA Scoring system had Mean ± SD 11.8±2.1, Cut value 12.75 AUC 0.845, Sensitivity 78%, Specificity 75%, PPV (Positive Predictive Value) 48%, NPV (Negative Predictive Value) 92%, Diagnostic accuracy 76%.* ***Conclusion:*** *Both ALVARADO & RIPASA Scoring system was good for the treatment of acute appendicitis.*

Keywords: *ALVARADO Score, RIPASA Score, Acute appendicitis, Histopathology*

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INTRODUCTION

Acute appendicitis is one of the commonest causes for acute abdomen in any general surgical practice[1]. Being involved with 7-12% of the general population, acute appendicitis is the leading factor of abdominal pain[2]. Acute appendicitis, with an incidence of 1.17 to 1.9 per 1,000 inhabitants per year and a lifetime risk of presenting with it of 8.6%

in men and 6.7% in women. The most common age range is 25-35 years of age[3]. Appendicitis is much less common in under developed countries, suggesting that elements of the Western diet, specifically a low-fibre, high-fat intake, may play a role in the development of the diseases process[4]. Its diagnosis is mainly based on clinical assessment and laboratory tests[5]. Clinical examination is helpful in the diagnosis of acute appendicitis for only 70-87% of the cases [6].

There are several scoring systems are in routine use specifically for the diagnosis of acute appendicitis named the Alvarado score, the Modified Alvarado score, the Samuel score, Kharbanda's Low-Risk score, the Lindberg score, the Ohmann score along with the RIPASA score etc.[7] in this regard of which ALVARADO and RIPASA are commonly used. These two scoring systems are based on the clinical and laboratory evidence. The Alvarado scoring system was developed for people in the western countries, and the RIPASA score was developed for people in the South East Asian region[8].

The most known and used scoring is Alvarado scoring systems described by Alfredo Alvarado in 1986[9] , which is practical and easy to use including 8 predictive factors, with a higher sensitivity and specificity especially if applied to the Western population. When Alvarado scoring systems applying to the middle Eastern, Asian or oriental populations, It has been shown to achieve a sensitivity ranging from 50 to 59% and specificity ranging from 23 to 94% which was relatively low, and was attributed to different factors including diet and environmental factors[10]. The Alvarado score is broadly used in the diagnosis of AA due to its accessibility and low cost; it also avoids exposing the patient to the radiation present in computed tomography (CT)[11]. The use of the Alvarado scoring system can reduce the negative appendicectomy rate to 0-5%[9].

Recently, a new clinical scoring system was established, called the Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score, and it was developed in 2008 at the Department of Surgery, Raja Isteri Pengiran Anak Saleha Hospital, Brunei Darussalam[12]. It is 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 the Asian population[13]. The RIPASA scoring system includes other parameters than Alvarado as gender, age, duration of pain[14]. These parameters are shown to affect the sensitivity and specificity of the Alvarado scoring system in the diagnosis of acute appendicitis[15] .

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. Delayed appendicectomy causes an increased risk of appendicular perforation and sepsis, which in turn increases morbidity and mortality[16]. With reduced diagnostic accuracy, the negative irrelevant appendicectomy rate is increased, and this is mostly reported to be approximately 20%–40% [17]. The present study aimed to compare the Alvarado and the RIPASA scoring system in the diagnosis of acute appendicitis among patients attending Sher-e-Bangla Medical College (SBMC), Barisal, Bangladesh.

METHODS & MATERIALS

This comparative study was conducted in Sher-e-Bangla Medical College (SBMC), Barisal, in the Department of Surgery, Unit 1. The study was conducted from 1st January 2021 to 31st December 2021. Data

were collected via face-to-face interviews by convenient sampling technique. The necessary ethical clearance had been obtained from the ethical committee of the Sher-e-Bangla Medical College prior to the commencement of the present study [Ref no- SBMC/Barishal/ERC/2022/1198. Informed written consent was taken from the respondents. Data were analyzed by SPSS (Statistical Package for the Social Science) 25 version. Respondents more than 12 years of age were included & recurrent cases, chronic cases, and cases with appendicular lumps were excluded from the study. The ALVARADO & RIPASA Score System are described below [13, [18]]:

ALVARADO Scoring system

Parameter	Score
Symptoms	
Migratory RIF Pain	1
Anorexia	1
Nausea & Vomiting	1
Sign	
Tenderness (RIF)	2
Rebound tenderness	1
Elevated Temperature	1
Laboratory	
Leucocytosis	2
Shift of WBC to left	1
Total score	10

Interpretation of ALVARADO Scoring system:
Score 7 or 8 indicated a probable appendicitis

Score 9 or 10 indicates a very probable appendicitis

RIPASA Scoring system

Parameter	Score
Gender	
Female	0.5
Male	1
Age	
<40 years	1
>40 years	0.5
Symptoms	
RIF pain	0.5
Pain migrating to RIF	0.5
Anorexia	1
Nausea & Vomiting	1
Duration of symptoms	
<48 hours	1
>48 hours	0.5
Sign	

RIF tenderness	1
Guarding	2
Rebound tenderness	1
Rovsing's sign	2
Fever >37^0C<39^0C	1
Investigation	
Raise WBC	1
Negative Urine Analysis	1
Additional Score	
Foreign National (Pitfalls)	1
Total	17.5

Interpretation of RIPASA Scoring system: [Score ranges from 3 to 16.5 as Foreign National (pitfalls) score was not used in present study]

Score <7 indicated having a low probability of acute appendicitis
Score >7.5 indicated having a high probability of acute appendicitis

RESULTS

Table 1: Socio-demographic criteria of the respondents (n=62)

Socio-demographic criteria	n(%)
Age (in years)	
12-20	21(33.9%)
21-30	17(27.4%)
31-40	16(25.8%)
More than 40	8(12.9%)
Mean ± SD	29.23±11.8
Sex	
Male	41(66.1%)
Female	21(33.9%)

Table 1 revealed that out of 62 respondents, most of the respondents belonged to the age group of 12-20 years followed by 21 -30 years, the mean age was 29.23±11.8. Most of the respondents were male 41(66.1%).

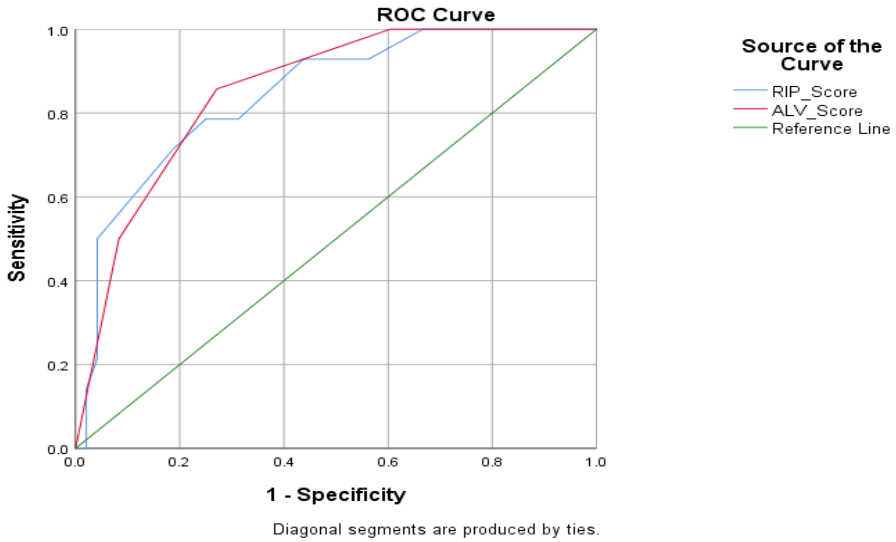
Table 2: Comparison of RIPASA and Alvarado Scoring system in Diagnosis of Acute Appendicitis

Characteristics	ALVARADO	RIPASA
Mean ± SD	8.1±1.4	11.8±2.1
Cut value	8.5	12.75
AUC	.853	.845
Sensitivity	85%	78%
Specificity	73%	75%
PPV (Positive Predictive Value)	48%	47%

NPV (Negative Predictive Value)	94%	92%
Diagnostic accuracy	75%	76%

Table 2 showed, ALVARADO scoring system had Mean ± SD 8.1±1.4, Cut value8.5, AUC .853, Sensitivity 85%, Specificity 73%, PPV (Positive Predictive Value) 48%, NPV (Negative Predictive Value) 94%, Diagnostic accuracy 75%. RIPASA Scoring system had Mean ± SD 11.8±2.1, Cut value 12.75 AUC .845, Sensitivity 78%, Specificity 75%, PPV (Positive Predictive Value) 48%, NPV (Negative Predictive Value) 92%, Diagnostic accuracy 76%.

Figure 1: Receiver-operator characteristics (ROC) for the ALVARADO & RIPASA score in the diagnosis of acute appendicitis



Test Results variables	Area under the Curve (AUC)	P-value	Asymptotic 95% Confidence Interval	
			Lower bound	Upper bound
ALVARADO Score	0.845	P<0.001	.734	.956
RIPASA score	0.853	P<0.001	.753	.954

When the ROC curve was observed, the area under the curve was higher for the ALVARADO scoring system. For both ALVARADO and RIPASA scoring systems the AUC was found significant.

Table 3: Correlation between peroperative findings and ALVARDO scoring among the patients

ALVARADO Scoring	Inflammation			P-value
	Mild	Moderate	Severe	
Mean ± SD	6.6±1.2	7.8±1.1[@]	9±1[@#]	P<.001

The result was found statistically significant by one-way ANOVA test (P<.001).

Table 3 showed that mean of mild inflammation was 6.6±1.2, moderate was 7.8±1.1, and severe was 9±1. The mean value of severe inflammation was found statistically higher.

@ denotes that there was a significant difference between mild with moderate & severe types of inflammation

# denotes that there was a significant difference between moderate with severe types of inflammation

Table 4: Correlation between peroperative findings and RIPASA scoring among the patients

RIPASA scoring	Inflammation			P-value
	Mild	Moderate	Severe	
Mean ± SD	9.6±2.4	11.3±1.7@	13.2±1.5@#	P<.001

The result was found statistically significant by one-way ANOVA test (P< .001).

Table 4 showed that mean of mild inflammation was 9.6±2.4, moderate was 11.3±1.7, and severe was 13.2±1.5. The mean value of severe inflammation was found statistically higher

@ denotes that there was a significant difference between mild with moderate & severe types of inflammation

# denotes that there was a significant difference between moderate with severe types of inflammation

Table 5: Correlation between ALVARDO scoring and histopathological findings among the patients

ALVARDO scoring	Histopathological findings		P-value
	Burst appendix	None	
Mean ± SD	9.3±0.7	7.7± 1.3	P< .001

*The resultwas found statistically significant by the Independent t-test (P<.001).

Table 5 showed that the mean of burst appendix was 9.3±0.7 while the mean of appendix which was not burst was found 7.7± 1.3 in the ALVARADO score. Mean value of the burst appendix was found statistically higher.

Table 6: Correlation between RIPASA scoring and histopathological findings among the patients

RIPASA scoring	Histopathological findings		P-value
	Burst appendix	None	
Mean ± SD	13.6 ±1.4	11.2 ± 2	P< .001

*The result was found statistically significant by the Independent t-test (P< .001).

Table 6 showed that the mean of burst appendix was 13.6 ±1.4while the mean of appendix which was not burst was found 11.2 ± 2 in RIPASA score. Mean value of the burst appendix was found statistically higher.

Table 7: Correlation between RIPASA scoring and histopathological findings among the patients

Peroperative findings	Postoperative complications	P-Value
Mild	2(14.3%)	P> .001
Moderate	4(28.6%)	
Severe	8(57.1%)	

*The results were not found statistically significant by the Chi-square test (P> .001).

Table 7 showed that, in peroperative findings, the mild case had fewer post-operative complications 2(14.3%) while the severe case had more post-operative complications 8(57.1%)

DISCUSSION

Acute appendicitis is a sudden & severe inflammation of the appendix leading to pain in the abdomen. Symptoms usually develop over one or two days and sometimes may worsen within hours. The present study aimed to compare the RIPASA and the Alvarado scoring system in the diagnosis of acute appendicitis. The present study revealed that out of 62 respondents, most of the respondents belonged to the age group of 12-20 years followed by 21 -30 years where the mean age was 29.23±11.8, and most of the respondents were male 41(66.1%) (Table 1). Similar findings were found where males were predominant 127(61.6%) than females 79(38.4%)[13] & the majority of the respondents were below 30 years of age & males were 36 (60%)[19].

In the present study, the mean score of ALVARADO scoring system was 8.1±1.4, Cut value 8.5, AUC 0.853 (p<0.001), Sensitivity 85%, Specificity 73%, PPV (Positive Predictive Value) 48%, NPV (Negative Predictive Value) 94% along with diagnostic accuracy was found 75%. On the other hand, the mean score of RIPASA scoring system was 11.8±2.1, Cut value 12.75 AUC 0.845 (p<0.001), Sensitivity 78%, Specificity 75%, PPV (Positive Predictive Value) 48%, NPV (Negative Predictive Value) 92% and diagnostic accuracy were found 76% (Table 2) (Figure 1). The result was not similar to a study revealed that the sensitivity and specificity of RIPASA score were 96.2% and 90.5% respectively while the sensitivity and specificity of Alvarado score were 58.9% and 85.7% respectively[9]. A study was done in West Bengal, India, reported the RIPASA scoring system had a sensitivity of 96.3%, specificity 76.4%, positive predictive value 95.1, negative predictive value 81.25% and diagnostic accuracy 92.85%, whereas Alvarado score had a sensitivity of 76.82%, specificity of 88.23%, the positive predictive value of 96.92%, the negative predictive value of 45.45%, and diagnostic accuracy of 81.25% where 7.5 was considered as the cut-off for the RIPASA score and 7 were considered as the cut-off score for Alvarado scoring system[7] which was also different from the findings of the present study.

Study done by Pasumarthi narrated that, the sensitivity of ALVARADO score was estimated to be 52.08% for a cut-off value of 6, specificity was 80%, the positive predictive value was 92.59, negative predictive value was 25.81, diagnostic accuracy of ALVARADO scoring was found 56.9. The sensitivity, specificity, positive predictive value and negative predictive values of RIPASA scoring system were 75%, 65%, 91.14%, and 35.14% respectively. The diagnostic accuracy of the RIPASA score was 73.28[20].

A study conducted between two hospitals in two Arab countries; Benha teaching hospital (BTH) in Benha city, Egypt and King Abdulaziz Specialist Hospital (KASH), in Taif city, revealed that sensitivity of RIPASA scoring is greater

than Alvarado scoring system 95.51% & 73.03% respectively in BTH group, while 97.56% & 79.27% respectively in KASH group, whereas the specificity of RIPASA scoring system is less than Alvarado scoring system 72.73% & 81.82% respectively in BTH group while 66.67% & 83.33% respectively in KASH group[10] which was quite different from the present study. In a study of Nepal[21], the specificity or true negative rate for RIPASA was quite low in their context (27.27 %).

A study was conducted to compare both scoring systems (RIPASA & ALVARADO) in the Asian populations to find a better score with greater sensitivity, specificity as well as diagnostic accuracy in Peshawar[22]. Narayana medical college hospital, Nellore and Manipal Hospital, Bangalore, revealed some findings where ROC curve showed a larger area under the curve for RIPASA when compared to Alvarado [3,23]. Present study narrated that, in the ALVARADO & RIPASA scoring system AUC (Area Under the Curve) was found 0.853 & 0.845 respectively, diagnostic accuracy for ALVARADO was found 75% & for RIPASA it was found 76% which was not similar to the study where RIPASA scoring system was more convenient, accurate, and specific scoring system for the Indian sub-continent [13, 19].

CONCLUSION

The use of the scoring systems enhances the diagnostic accuracy and reduces the degree of negative appendectomy. Although a little difference was revealed between the findings of the present study but both the ALVARADO & RIPASA Scoring system was good for the treatment of acute appendicitis. These scoring systems have less significant values in tertiary care centers, due to the advancement of imaging modalities. Moreover, it can be used in rural areas or in primary health care centers where imaging modalities are not sufficient. So, these scoring systems might be used to plan the management of the patients in those remote areas.

LIMITATION & RECOMMENDATION

The results were a reflection of a selected area with a small sample size. There is a requirement for further large-scale studies on the respondents to exhibit the usefulness of scoring systems with large sample size.

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REFERENCE

1. *Soundharya S, Murugesan N, Surana P, Viswanathan MS, Kumbharshamrao U, Anbazhakan R, Shanmugasundram. A Comparative study of RIPASA and Modified ALVARADO scoring systems for the diagnosis of acute appendicitis. International Journal of Current Research. 2016 Aug; 8(8):37216-19.*
2. *Frountzas M, Stergios K, Kopsini D, Schizas D, Kontzoglou K, Toutouzas K. Alvarado or RIPASA score for diagnosis of acute appendicitis? A meta-analysis of randomized trials. International Journal of Surgery. 2018 Aug 1;56:307-14.*
3. *Reddy MG, Reddy VM. Raja Isteri Pengiran Anak Saleha Appendicitis score for the diagnosis of acute appendicitis in comparison with the Alvarado score. International Surgery Journal. 2020 Jan 27;7(2):459-64.*
4. *Richmond B. The Appendix, Sabiston textbook of Surgery. Townsend,CM, Beauchamp RD, Evers BM, Mattox KL. ELSEVIER, 1st south asia edition.2016;50:1296-1306.*
5. *Liu W, Wei Qiang J, Xun Sun R. Comparison of multislice computed tomography and clinical scores for diagnosing acute appendicitis. Journal of International Medical Research. 2015 Jun;43(3):341-49.*
6. *Malla BR, Batajoo H. Comparison of Tzanakis score vs Alvarado score in the effective diagnosis of acute appendicitis. Kathmandu University medical journal. 2014;12(1):48-50.*
7. *Barman MK, Mukherjee K, Das K. A comparative study of ripasa score and modified Alvardo score in the diagnosis of*

acute appendicitis. JMSCR. 2019;7(7):148-53.

8. *Chavan S, Bhatnagar S, Bendre M, Sinha N. Comparative study of Alvarado score and RIPASA score in the diagnosis of acute appendicitis. International Surgery Journal. 2018Apr;5(4):1330-34.*

9. *Alvarado A. A practical score for the early diagnosis of acute appendicitis. Annals of emergency medicine. 1986 May 1;15(5):557-64.*
10. *Abdelrhman TM, Al Saeed MS, Badr SA, Shaban MA, Abuduruk A, Hatem M. 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. 2018 May 24;5(6):2011-17.*
11. *Karami M Y, Niakan H, Zadebagheri N, Mardani P,Shayan Z, Deilami I. Which One is Better? Comparison of the Acute Inflammatory Response, Raja Isteri Pengiran Anak Saleha Appendicitis and Alvarado Scoring Systems. Annals of Coloproctology. 2017;33(6):227-31.*
12. *Chong CF, Thien A, Ahamed Mackie A J, Tin AS, Tripathi S, A Ahmad MA , Tan LT, Mat Daud FM, Tan C, Telisinghe PU, Ang SH. Evaluation of the RIPASA Score: a new scoring system for the diagnosis of acute appendicitis Brunei Int Med J. 2010; 6 (1):17-26.*
13. *Nanjundaiah N, Mohammed A, Shanbhag V, Ashfaque K, Priya SA. A comparative study of RIPASA score and ALVARADO score in the diagnosis of acute appendicitis. Journal of clinical and diagnostic research: JCDR. 2014 Nov;8(11):NC03-NC05.*
14. *Sarkar S, Nandi A. A study to validate RIPASA score in diagnosis of acute appendicitis among clinically suspected cases. PARIPEX-Indian Journal of Research. 2021 Jan;10(1):8-11.*
15. *Wani MM, Yousaf MN, Khan MA, BabaAbdul A, Durrani M, Wani MM, Shafi M. 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.*
16. *Chong CF, Adi MI, Thien A, Suyoi A, Mackie AJ, Tin AS, Tripathi S, Jaman NH, Tan KK, Kok KY, Mathew VV. Development of the RIPASA score: a new appendicitis scoring system for the diagnosis of acute appendicitis. Singapore medical journal. 2010 Mar 1;51(3):220-25.*
17. *Kalan M, Talbot D, Cunliffe WJ, Rich A. Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis: a prospective study. Annals of the Royal College of Surgeons of England. 1994 Nov;76(6):418-19.*
18. *Mulsow J. The vermiform appendix, Bailey & Love's short practice of surgery. Williams NS, O'Connell PR, McCaskie AW. CRC Press, Taylor & Francis Group. 2018;72:1299-1317.*
19. *Suresh P, Janardhanan R, Paul D. A comparative study of RIPASA and Alvarado score for the diagnosis of acute appendicitis. International Surgery Journal. 2020 Nov 27;7(12):4006-10.*
20. *Pasumarthi V, Madhu CP. A comparative study of RIPASA score and ALVARADO score in the diagnosis of acute appendicitis. International Surgery Journal. 2018 Feb 26;5(3):796-801.*
21. *Baral S, Thapa N, Chhetri RK, Sharma R. A Comparative Analysis Between RIPASA and Alvarado Scoring Systems for the Diagnosis of Acute Appendicitis-A Nepalese Perspective. Journal of Lumbini Medical College. 2018 Dec 31;6(2):117-21.*
22. *Noor S, Wahab A, Afridi G, Ullah K. Comparing Ripasa score and Alvarado score in an accurate diagnosis of acute appendicitis. Journal of Ayub Medical College Abbottabad. 2020 Jan 23;32(1):38-41.*
23. *Sanjive JG, Ramaiah RH. Comparison of RIPASA and Alvarado scoring in the diagnosis of acute appendicitis and validation of RIPASA scoring. International Surgery Journal. 2019 Feb 25;6(3):935-39.*