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Original Research Article

A comparative study of RIPASA score and modified Alvarado score in diagnosis of acute appendicitis

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ABSTRACT

Background: Various diagnostic criteria have been described for diagnosing acute appendicitis. Of these, Alvarado score has been the most commonly used. The RIPASA score is a new diagnostic scoring system developed for the diagnosis of acute appendicitis and showed higher sensitivity, specificity and diagnostic accuracy as compared to Alvarado score. we want to compare prospectively Alvarado and RIPASA score by applying them to patients attending emergency department complaining of right iliac fossa pain that could probably be acute appendicitis.
Methods: Patients with clinically suspected acute appendicitis were classified according to both Alvarado and RIPASA scoring systems before undergoing surgery. Histopathological examination of the removed appendix was taken as the gold standard for diagnosis of acute appendicitis.
Results: Among (90%) patients had histologically confirmed appendicitis. With the cut-off value greater than 7.5 for RIPASA score; sensitivity, specificity, positive predictive value, negative predictive value, diagnostic accuracy were 88.2%, 14.5%, 73.1%, 32%,and 68% respectively. With the cut-off value greater than 7 for Alvarado score, sensitivity, specificity, positive predictive value, negative predictive value, diagnostic accuracy and negative appendectomy rates were 51.2%, 80 %, 91 %, 29%, and 57%, respectively. 87.5% of patients were correctly stratified by RIPASA under higher probability group while only 45% were classified by Alvarado as high probability.
Conclusions: RIPASA scoring system showed high sensitivity and diagnostic accuracy in comparison to Alvarado scoring system. So, it can be applied for the diagnosis of acute appendicitis.

Keywords: Acute appendicitis, Alvarado score, Comparison, Diagnostic accuracy, RIPASA score

INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies in clinical practice with an estimated lifetime prevalence of approximately 1 in 7.[1] the diagnosis is primarily clinical, and only contrast enhanced computed tomography has high sensitivity and specificity for the right diagnosis.[2,3] But high cost and limited availability are factors that hinder its use especially in developing countries. There has been a need of scoring system that can overcome these problems with acceptable sensitivity, specificity and negative appendectomy rate. The modified Alvarado and RIPASA scoring systems are two important scoring systems that have been developed to aid in the rapid diagnosis of acute appendicitis.[4-6] Author prospectively compared the RIPASA score with modified Alvarado score in 200 patients presenting with right iliac fossa pain with suspected appendicitis at author's institution.

METHODS

This prospective study was carried out in the Department of Surgery, Tanta University Emergency Hospital, on 200 patients presented with right iliac fossa pain over a period of 1 year from July 2018 to July 2019. Relevant variables

such as age, sex, nationality, right iliac fossa (RIF) pain, migration of right lower quadrant (RLQ) pain, anorexia, nausea and vomiting, duration of symptom was recorded from the medical history and RIF tenderness, RIF guarding, rebound tenderness, Rovsing's sign, fever were taken from clinical examination and blood investigations such as complete blood counts and urine analysis were performed and data collected for analysis. Ultrasound (USG) examination was done in every patient by a radiologist. The decision for appendectomy was based on the surgeon's clinical judgment after taking into consideration all the findings of clinical, laboratory and radiological investigation. All patients presented with right iliac fossa pain were included in the present study. Patients excluded from the study were those with multiple co-morbid diseases, coagulation disorders, adverse anesthetic history, severe cardiorespiratory embarrassment, suspected or proven malignancy as these conditions may delay the surgery.

RIPASA scoring was applied to the patients as in Table 1. Modified Alvarado score was applied to the same patients as in table 2. The patients with clinical diagnosis of appendicitis were taken to operating theater for appendectomy and specimens were sent for histopathological analysis. Histopathology reports were used as the gold standard for diagnosis of acute appendicitis and correlated with both the scoring systems to calculate the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) and accuracy for each scoring system.

Table 1: RIPASA score for appendicitis.

Characteristics	Score
Female	0.5
Male	1.0
Age <39.9 years	1.0
Age >40 years	0.5
Rif pain	0.5
Pain migration to RIF	0.5
Anorexia	1.0
Nausea and vomiting	1.0
Duration of symptoms <48 hrs	1.0
Duration of symptoms >48 hrs	0.5
Rif tenderness	1.0
Rif guarding	2.0
Rebound tenderness	1.0
Rovsing sign	2.0
Fever >37°c-<39°c	1.0
Investigation	
Raised WBC	1.0
Negative urine analysis	1.0
Foreign nationality	1.0
Total score	17.5

Table 2: RIPASA score interpretation.

Total RIPASA score	Decision making guidelines
<5	Unlikely acute appendicitis
5-7	Probably acute appendicitis
7.5-11.5	High probability acute appendicitis
>12	Definite acute appendicitis

Table 3: ALVARADO score for appendicitis.

Symptoms	Score
Migratory pain	1.0
Anorexia	1.0
Nausea and vomiting	1.0
Signs	
RLQ pain	2.0
Rebound tenderness	1.0
Fever >37.5°c	1.0
Lab	
Leucocytosis	2.0

Table 4: ALVARADO score interpretation

Alvarado score	Interpretation
Score <5	Not sure, keep under observation
Score 5-6	Compatible, may be for regular observation
Score 6-9	Probable, operate
Score >9	Confirmed, operate

RESULTS

The study period was 12 months with a total of 200 patients that were involved. patients age ranged from 15 to 60 years with a mean age of 25.74 years. Peak age group was 15 to 25 years of age (46%). Males were predominantly affected with M:F ratio 2.3:1. Most common presentation was pain in abdomen in 97% of patients followed by nausea and vomiting in 90% and right iliac fossa tenderness in 90% of the patients. Majority of patients (65%) presented after 48 hours of the onset of symptoms to the hospital. WBC counts were found to be raised (>10,000/mm^3) in 60 % of the patients. In 90% of the patients urine routine microscopic examination was found normal. Almost 85% of the patients were diagnosed positive for acute appendicitis on ultrasonography. In histopathology, 90% of the patients tested positive for acute appendicitis. Mean hospital stay was 3.5±1.8 days. Most of the patients (70%) were discharged within 4 days of admission. Regarding Alvarado score and RIPASA score, out of 200 patients 110(55%) patients had Alvarado score <7 and 90 (45%) had score ≥7 and 10 (5%) patients had RIPASA score <5, 15 (7.5%) patients have scores between 5-7, 130 (65%) patients had scores between 7.5-11.5, 45 (22.5%) patients had scores ≥12 i.e. (87.5% of patients were >7.5 and 12.5% were <7.5) (Tables 5-9).

Table 5 : Alvarado scoring for the studied cases.

Alvarado scoring interpretation	Number of cases	Percentage
Not sure	52	26
Compatible	58	29
Probable	80	40
Confirmed	10	5

Table 6: RIPASA scoring for the studied cases.

RIPASA scoring interpretation	Number of cases	Percentage
Appendicitis unlikely	10	5
Low probability appendicitis	15	7.5
High probability appendiciti	130	65
Confirmed appendicitis	45	22.5

Table 7: Relation between Alvarado scoring and histopathology results.

Alvarado scoring interpretation	Histopathology			
	Appendicitis		No appendicitis	
	N	%	N	%
Appendicitis	82	41%	8	4%
No appendicitis	78	39%	32	16%

Table 8: Relation between RIPASA scoring and histopathology results.

RIPASA scoring interpretation	Histopathology			
	Appendicitis		No appendicitis	
	N	%	N	%
Appendicitis	128	64%	47	23.5%
No appendicitis	17	8.5%	8	4%

Table 9: Accuracy, sensitivity, specificity, PPV and NPV of both Alvarado and RIPASA scores.

Parameter	Estimate	
	Alvarado score	RIPASA score
Accuracy	57	68
Sensitivity	51.2	88.2
Specificity	80	14.5
PPV	91	73.1
NPV	29	32

DISCUSSION

Acute appendicitis is one of the most common surgical emergencies encountered in the world particularly in age group less than 30 years.[7] In United States, rate of negative appendicectomy is approximately 15% out of total appendicectomies done each year. Surgeon's good clinical assessment is considered to be the most important requisite in the diagnosis of appendicitis. Several other conditions can mimic this clinical condition.[8] There has been a need of scoring system that can overcome these problems with acceptable sensitivity, specificity and negative appendectomy rate. One of the most commonly used is the Alvarado scoring system which incorporates symptoms, signs and laboratory investigations to reach the diagnosis.[4] Another scoring system, RIPASA score has been developed, claimed to have better outcomes in Asian settings.[6]

According to Alvarado score 45% of patients had high probability of acute appendicitis and 55% were with low probability and this was very comparable to the study of Raikwar et al, that stated Alvarado score when applied in all patients clinically suspected to have appendicitis, had 92 cases (46%) with a score of ≥7 and 108 cases (54%) with a score of <7.[9] And when compared to histopathologic results the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were 51.2%, 80%, 91%, 29%, and 57%, while Raikwar et al, the sensitivity and specificity of the scoring system came out to be 70% and 20% respectively.[9] The positive and negative predictive values were 94.32% and 3.38% respectively and accuracy was 74%.

Khan et al, applied the Alvarado scoring system in Asian population and achieved a sensitivity and specificity of 59% and 23% respectively, with a positive predictive value of 83.3% with negative appendectomy rate of 15.6%.[10] Chong et al, reported the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were 68.3%, 87.9%, 86.3% ,86.5% respectively for Alvarado score.[11]

Also Al-Hashemy et al, reported sensitivity and specificity of 53.8% and 80% respectively for Alvarado.[5] Whereas Jang et al, reported a sensitivity of 50.6% and specificity of 94.5%.[12]

In this study, RIPASA score when applied in all the patients clinically suspected of having appendicitis, had 87.5% of patients with a score >7.5 and 22.5% <7.5 and this is near to the results of Raikwar et al, that reported that 188 patients (94%) in ≥7.5 group and 12 patients (6%) in <7.5 score group.[9] compared to histopathology results for RIPASA score; sensitivity, specificity, positive predictive value, negative predictive value, diagnostic accuracy were 88.2%, 14.5%, 73.1%, 32%, and 68% respectively, while Raikwar et al, reported that the sensitivity of the RIPASA scoring system was 98.42%, specificity of 90%, positive and negative predictive values of 99.46% and 75% respectively.[9]

In the retrospective study by Chong et al, ROC analysis quoted that the expected sensitivity and specificity of the RIPASA scoring system were 88% and 67% respectively with a diagnostic accuracy of 81%.[6] The positive and

negative predictive values were expected to be 93% and 53% respectively.

On comparing both the scoring systems in the present study, RIPASA score has been found to be more sensitive (88.2%) as compared to Alvarado score (51.2%). Alvarado score is also more specific (80%) as compared to RIPASA score (14.5%). Positive and negative predictive values of RIPASA came out to 73.1% and 32% as compared to Alvarado having 91% and 29%. Accuracy of the RIPASA score was 68% as compared to the Alvarado score having accuracy of 57%.

In a prospective study by Chong et al, the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of the RIPASA score were 98%, 81.3%, 85.3%, 97.4% and 91.8% respectively when compared to Alvarado score with sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of 68.3%, 87.9%, 86.3%, 71.4% and 86.5% respectively.[11]

Also Baral et al, reported that for RIPASA score; sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy and negative rates were 94.5%, 27.27%, 92.16 %, 37.5% and 88.18% respectively.[13] With the cut-off value greater than 7 for Alvarado score, sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy rates were 71.72%, 72.73 %, 95.95%, 22.22% and 71.82%, respectively.

Whereas, Pasumarthi et al, reported that, the sensitivity of Alvarado score is estimated to be 52.08 for a cut off of 6.[14] The specificity is 80%, positive predictive value is 92.59, negative predictive value is 25.81. The Diagnostic accuracy of Alvarado scoring is found to be 56.9. The sensitivity, specificity, positive predictive value and negative predictive values of RIPASA scoring system are 75%, 65%, 91.14%, 35.14%. The diagnostic accuracy of RIPASA score is 73.28.

Also similar results were reported by Timislina et al, who said that the cut-off threshold point of the modified Alvarado score was set at 7.0, which yielded a sensitivity of 68.64% and a specificity of 28.57%.[15] The PPV was 95% and the NPV was 5.12%. The cut-off threshold point of the RIPASA score was set at 7.5, which yielded 88.13% sensitivity and 28.57% specificity. The PPV was 95.41% and the NPV was 12.5%

Muduli et al, reported that at the optimal cut-off threshold score of 7.5 for the RIPASA score, the calculated sensitivity and specificity were 97.26% and 75% respectively compared with 68.49% and 84.37% respectively for Alvarado score at an optimal cut-off threshold of 7.[16]

While Brman et al, in his study reported that the RIPASA scoring system had sensitivity of 96.29, specificity 76.4, positive predictive value 95.1, negative predictive value 81.25% and diagnostic accuracy 92.85% whereas Modified Alvarado score had sensitivity of 76.82%, specificity of 88.23%, positive predictive value of 96.92%, negative predictive value of 45.45%, and diagnostic accuracy of 81.25%.[17]

Also Regar et al, reported that, RIPASA scoring system is more sensitive 94.74% as compared to Alvarado scoring system (67.37%).[18] Alvarado scoring system is more specific (80%) as compared to RIPASA scoring system (60%). PPV of Alvarado scoring system is 98.46% as compared to 97.83% in RIPASA scoring system. NPV of RIPASA scoring system is 37.5% as compared to 11.43% in Alvarado scoring system. Diagnostic accuracy of RIPASA scoring system is 93% as compared with 68% in Alvarado scoring system. Negative appendectomy rate with Alvarado scoring system is 1.54% as compared to 2.17% with RIPASA scoring system.

CONCLUSION

The RIPASA score can be a better diagnostic scoring system for acute appendicitis compared to the Alvarado score, with the former achieving higher sensitivity and diagnostic accuracy. Moreover, this scoring system is easy, quick, inexpensive to use and can be used in both rural and urban areas where other diagnostic modalities may not be available.

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