ORIGINAL ARTICLE

Concordance between RIPASA and ALVARADO scoring system for the diagnosis of acute appendicitis

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Abstract

Objective: To determine the diagnostic accuracy of RIPASA and ALVARADO scoring system by taking histopathology as gold standard.

Materials and methods: This was a cross-sectional study in which total of 201 patients who were presented with right iliac fossa pain were enrolled. Non-probability sampling technique was employed. The RIPASA and ALVARADO scores were derived and decisions based on clinical judgement was done. After appendectomies, resected appendix was sent for histopathological examination by consultant pathologist. SPSS version 23 was used for statistical analysis. Sensitivity, specificity, positive predicted value, negative predicted value & diagnostic accuracy were calculated.

Results: At optimal cutoff threshold for RIPASA score≥7.5, the sensitivity, specificity, positive predictive value, negative predictive value & diagnostic accuracy of the RIPASA scoring system were calculated as 100%, 96.23%, 98.67%, 100% & 99% respectively. Similarly, at optimal cutoff threshold for ALVARADO score≥7 the sensitivity, specificity, positive predictive value, negative predictive vale & diagnostic accuracy of the Alvarado scoring system were 95.95%, 92.45%, 97.26%, 89.09% and 95.02% respectively.

Conclusion: RIPASA is more accurate and useful diagnosing tool for detection of appendicitis compared to ALVARADO.

Keywords: Acute appendicitis, RIPASA score, ALVARADO score

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Introduction:

Acute appendicitis is one of the widely recognized surgical emergencies, with a lifetime prevalence rate of approximately 1 in 7.[1] The incidence is highest in adolescents and young adults, but the incidence of complicated appendicitis shows little variation among different age groups.[2]

A negative appendectomy is taken as a surgery performed for a pre-operative diagnosis of appendicitis that results in a normal histo-pathology specimen. Different techniques have been devised to assist in equivocal cases in attempts to decrease negative appendectomy rates.[3] Different techniques have been devised to assist in equivocal cases in attempts to decrease negative appendectomy rates. The number of scoring systems designed to accurately diagnose the acute appendicitis. The Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) and ALVARADO score are new diagnostic scoring systems developed for the diagnosis of Acute Appendicitis and has been shown to have significantly higher sensitivity, specificity and diagnostic accuracy.[3] Although the RIPASA score is more extensive than the Alvarado score, it is simple to apply and has several parameters that are absent in the Alvarado score, such as age, gender and duration of symptoms prior to presentation. These parameters have been shown to affect the sensitivity and specificity of the Alvarado and Modified Alvarado scores.[4]

Table-1: RIPASA appendicitis (RIPASA) score

		score
1	**Patients**:	
	Female	0.5
	Male	1.0
	Age < 39.9 years	1.0
	Age > 40 years	0.5
2.	**Symptoms**:	
	RIF Pain	0.5
	Pain Migration to RIF	0.5
	Anorexia	1.0
	Nausea & Vomiting	1.0
	Duration of Symptoms < 48 hrs	1.0
	Duration of Symptoms > 48 hrs	0.5
3.	**Signs**:	
	RIF Tenderness	1.0
	Guarding	2.0
	Rebound Tenderness	1.0
	Rovsing Sign	2.0
	Fever > 37° C < 39° C	1.0
4.	**Investigation**:	
	Raised WBC	1.0
	Negative Urine Analysis	1.0
5.	**Additional Score**:	
	Foreign NRIC	1.0
	Total score	17.5

Table-2: ALVARADO appendicitis scoring system

		score
1.	**Symptoms :**	
	Pain Migration to RIF	01
	Anorexia	01
	Nausea – Vomiting	01
2.	**Signs**:	
	RIF tenderness	02
	Rebound Tenderness	01
	Fever	01
3.	**Investigation**:	
	Raised WBC	02
	Shift of WBC to Left	01
	Total score	10

The opposite is also true, where with reduced diagnostic accuracy, the negative or un-necessary appendectomy rate is increased, and this is generally reported to be approximately 20 - 40%. Diagnostic accuracy can be further improved through the use of ultrasonography or computed tomography imaging.[5,6] However, these modalities are costly and may not be easily available when they are required. Making arrangements for these diagnostic modalities may lead to further delays in diagnosis and surgery.

"RIPASA score" which was claimed to have sensitivity and specificity of 88 and 67% respectively.[7] The sensitivity and specificity for the Alvarado and the modified Alvarado scores range from 53 - 88% and 75 - 80%, respectively.[8] A recent study conducted at Pakistan shows sensitivity of RIPASA score as 91.11%, specificity as 60%, diagnostic accuracy as 88% and rate of negative appendectomy was 10.25%. However, sensitivity of Alvarado score was 11.67%, specificity 95%, diagnostic accuracy 20% and negative appendectomy rate was 0.132%.[9]

The primary aim of the present study was to find out the concordance between RIPASA and ALVARADO scoring systems in the diagnosis of acute appendicitis by applying them to the patients attending our hospital with right iliac fossa pain. The secondary aim was to determine the diagnostic accuracy of RIPASA and ALVARADO scoring system by taking histo-pathology as gold standard.

Material and Methods:

This was a cross-sectional study conducted at the department of Jinnah Medical and Dental College, Karachi, Pakistan from January 2016 to July 2016. Institutional ethical clearance was obtained prior to the commencement of the study. The sample size was calculated by using sample size calculator for sensitivity & specificity by Dr. Lin Naing (available online). The estimated sample size was 201, based on the sensitivity and specificity of Alvarado scoring system as 68.32% and 87.91%[4], prevalence of acute appendicitis as 50%(10) and margin of error as 9.2%. Non-probability consecutive sampling was done and informed consent was taken from all the patients. All patients presenting with right iliac fossa pain of less than 7 days and who were suspected with acute appendicitis of aged 15-60 years of either gender were recruited into the study. Patient with right iliac fossa mass, previous history of urolithiasis, pelvic inflammatory

Table-3: Concordance between RIPASA & ALVARADO scoring system

RIPASA scoring system	ALVARADO scoring system		Total	Kappa (P-value)
	≥7	<7		
≥7.5	142	8	150	
<7.5	4	47	51	0.846 (0.001)
Total	146	55	201	

Table-4: Diagnostic accuracy of RIPASA and ALVARADO scoring system by taking histopathology as gold standard

RIPASA scoring system	Histopathology			Diagnostic test values
	Positive	Negative	Total	
≥7.5	148	1	149	Sn=100%, Sp=96.23%, PPV=98.67%, NPV=100% DA= 99%
<7.5	3	49	52	
Total	151	50	201	

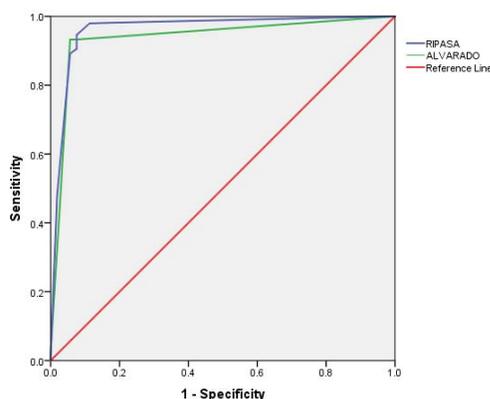| ALVARADO scoring score	Histopathology			Diagnostic Test Values
	Positive	Negative	Total	
≥7	147	0	147	Sn=95.95%, Sp=92.45%, PPV=97.26%, NPV=89.09% DA= 95.02%
<7	4	50	54	
Total	151	50	201	

Fig. 1: ROC plots for the RIPASA score and Alvarado score

disease, generalized peritonitis, pregnancy and who had underwent appendectomy were excluded from the study.

Each patient was scored as per ALVARADO and RIPASA scoring system. (table-1,2) Scoring charts were filled by the attending surgeon at the time of presentation. ALVARADO score of 7 or more is strongly predictive of acute appendicitis[11] & RIPASA score of 7.5 or more is strongly predictive of acute appendicitis.[12] Only scores derived by a surgeon of the grade of senior medical officer and above were considered. After appendectomies, resected appendix was sent for histo-pathological examination by consultant pathologist. All the data was recorded on the proforma.

SPSS version 23 was used for statistical analysis. Frequency and percentage was calculated for qualitative data and mean & SD was calculated for quantitative data. Concordance between RIPASA & ALVARDO scoring system was measure using Cohen's kappa statistics. The kappa statistic measures the extent of exact agreement, adjusting for chance agreement with values greater than 0.75 representing excellent concordance; values of 0.40 to 0.75 representing moderate concordance; and values less than 0.40 representing poor concordance.[9] 2X2 contingency table was used to calculate sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of RIPASA & ALVARADO scoring system by taking histo-pathology as gold standard. Diagnostic accuracy at the optimal cut-off threshold scores were derived from the ROCs for both the RIPASA and Alvarado scores. P-value<0.05 was taken as statistically significant.

Results:

A total of 201 patients were recruited in the study, during the study period. Mean age of the patients was recorded as 26.56±9.2 years. Out of 201 patients, 125(62.1%) were male while 76(37.8%) were female. The concordance between RIPASA and ALVARADO scoring system was calculated using Kappa statistics. The Kappa value was calculated as 0.846 (P<0.05) which showed strong agreement between two scoring system RIPASA and ALVARADO. (table 1)

At optimal cutoff threshold for RIPASA score ≥ 7.5, the sensitivity, specificity, positive predictive value, negative predictive value & diagnostic accuracy of the RIPASA scoring system were calculated as 100%, 96.23%, 98.67%, 100% & 99% respectively. Similarly, at optimal cut off threshold for ALVARADO score ≥ 7 the sensitivity, specificity, positive predictive value, negative predictive vale & diagnostic accuracy of the Alvarado scoring system were 95.95%, 92.45%,

97.26%, 89.09% and 95.02% respectively.

Using ROC the area under the curve is 0.962 which is greater than that for ALVARADO score, which is 0.938. The difference in the area under the curves of 2.5% is significant between two scoring systems (p<0.001). (Fig 1)

Discussion:

Acute appendicitis is the daunting surgical emergencies. It can prompt appendiceal perforation and peritonitis, which are accompanying with high rate of morbidity and mortality.[13] Hence being a most common issue, its diagnosis is still remain a difficult task. Rate of negative appendectomy done every year is roughly estimated as 15% among United States. Surgeon's good clinical evaluation is thought to be the most imperative essential in the finding of appendicitis. A few different conditions can imitate this clinical condition.[14] The clinical judgment can be supplemented by the radiological imaging like ultrasound and C.T examine however in a current report this case is challenged.[15] Multiple scoring systems have been created to help the determination of the acute appendix among them the Alvarado is the most main stream. Alvarado invented this scoring system in 1986 and its highly sensitive and specific when applied to the western population.[16,17] While this scoring system has restrictions when applied to the Asian populace.[9] RIPASA is a new scoring modality with preferable sensitivity and specificity over Alvarado in the diagnosis of acute appendicitis as reported in various studies.[4,7,18] It is a simple and consists of additional parameter (NRIC) for Asian populace.[3]

In our study we have compared the diagnostic accuracy of Alvarado scoring system and RIPASA scoring system for acute appendicitis among 201 patients. The excellent agreement was found between the both scoring systems as 84.6%. In the present study when ALVARADO scoring was analyzed with respect to histo-pathology the sensitivity came out to be 95.95% while specificity, positive predictive value & negative predictive value were calculated as 92.45%, 97.26% & 89.09% respectively. Similar findings

were observed in the study conducted by Regar MK et al. in their study; sensitivity, specificity, PPV, NPV were calculated as 67.37%, 80%, 98.46% &11.43% respectively.[1] In the present study when RIPASA scoring was analyzed with respect to histo-pathology the sensitivity came out to be 100% while specificity, positive predictive value & negative predictive value were calculated as 96.23%, 98.67% & 100% respectively. Similar findings was observed by Khadda et al in their study; sensitivity, specificity, positive predictive value, negative predictive value were calculated as 97.73%, 77.42%, 86.00% & 96.00%. They concluded that RIPASA score is currently a much better diagnostic scoring system for acute appendicitis with relatively higher sensitivity and negative predictive value, which may help to cut down the un-necessary hospital admissions and costly radiological investigation.[19]

The ROC curve was made in the current study to look for the cut off score for both scoring systems having good sensitivity and specificity. For Alvarado cut-off score was calculated as >7 whereas for RIPASA optimal cut-off point was > 7.5. These findings are in agreement with study conducted by Regar MK et al.[1]

Conclusion:

RIPASA is more accurate and useful diagnosing tool for detection of appendicitis compared to ALVARADO. The sensitivity and specificity of RIPASA score is significantly higher for Asian populace & it may be helpful in making prompt decisions of right iliac fossa pain.

Role and contribution of authors:

Dr. Anum Naz, collected the data, references and wrote the initial writeup

Khadijah Abid, collected the data, references and helped interpretation of data.

Dr. Nabeel Naeenm Baig, collected the data, ref-

erences and critically evaluate the article.

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