

Comparison of alvarado and ripasa scores in patients with acute appendicitis

Akut appendisit tanılı hastalarda alvarado ve ripasa skorlamalarının karşılaştırılması

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Received/Accepted: November 20, 2020 /December 21, 2020

Conflict of interest: There is not a conflict of interest.

SUMMARY

Objective: Acute appendicitis management delays results in perforation and increases the morbidity and mortality. Studies have reported a 20% perforation rate, and 2-30% negative laparotomy whose diagnoses are made by symptoms and physical examination. By using anamnesis, clinical signs-symptoms and inflammatory parameters to reduce the diagnosis time, complications, and morbidity-mortality of AA, various scoring methods have been developed. The first scoring system defined for this purpose is Alvarado scoring system. The RIPASA scoring system was developed for patients in Asia. In this study, we aimed to determine which scoring is more suitable for our population by comparing Alvarado and RIPASA scoring methods in patients who underwent an appendectomy.

Method: The Alvarado and RIPASA scores of each patient were calculated by the scoring system parameters after the 182 patient files were analyzed retrospectively. At cut-off value of 7.5 for RIPASA score and 7 for Alvarado score, patients were divided into high and low-risk groups. The positive predictive value, negative predictive value, sensitivity, and specificity were calculated and the two scoring systems' effectivity were compared with Chi-square and area under curve analysis.

Results: According to the histological examination 42(23%) patients were not considered as acute appendicitis. RIPASA scoring systems high-risk group classification was better by predicting the acute appendicitis patients ($p = 0.001$, $p < 0.05$). The area under the curve for RIPASA score calculated as 0.738 and this is statistically significant ($p = 0.001$; $p < 0.05$). The result was better than the Alvarado AUC score (0,633). Alvarado scoring systems' negative predictive value was higher than the RIPASA score, respectively (58,14%, 32,56%).

Conclusions: It is beneficial to use the RIPASA scoring system for patients in our region to reduce the rate of negative laparotomy and unnecessary surgical procedures in patients admitted to emergency services with the suspicion of acute appendicitis.

Keywords: Acute appendicitis, ripasa, alvarado

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ÖZET

Amaç: Akut apandisit hastalarının değerlendirilmesi ve tedavisindeki gecikmeler perforasyonlar sonucunda mortalite ve morbiditede artmalara sebep olabilir. Bazı çalışmalarda semptom ve fizik muayeneler ile değerlendirilen vakalarda perforasyon oranı %20, negatif laparotomi oranı ise %2-30 arasında tespit edilmiştir. Akut apandisit tanısını hızlandırmak, komplikasyonları ve morbidite-mortaliteyi azaltmak için hastanın öyküsünü, klinik bulgularını, semptomlarını ve inflamatuvar belirteçlerini de içeren parametreler kullanılarak çeşitli skorlama sistemleri geliştirilmiştir. Bu amaçla hazırlanan ilk skorlama sistemi Alvarado skorlama sistemidir. Asya'daki hastaların değerlendirilmesinde RİPASA skorlama sistemi uygulanmıştır. Bu çalışmada hastanemizde appendektomi yapılan hastalarda Alvarado ve RİPASA skorlarını karşılaştırarak bizim bölgemizdeki hastalarımız için hangisinin daha uygun olacağını tespit etmeyi amaçladık.

Yöntem: 182 hastanın dosyası geriye dönük olarak incelenerek Alvarado ve RİPASA skorları hesaplandı. Alvarado için 7 puan, RİPASA için 7.5 puan sınır kabul edilerek hastalar düşük ve yüksek risk grubu olarak sınıflandırıldılar. Gruplar için pozitif prediktif değer, negatif prediktif değer, sensitivite ve spesifite hesaplanarak iki skorlama sisteminin etkinliği Ki-kare ve ROC analizleri ile karşılaştırıldı.

Bulgular: Histopatolojik inceleme sonuçlarına göre 42(%23) hastada akut apandisit tespit edilememiştir. RİPASA skorlama sisteminin akut apandisit hastalarını tespit etme gücü daha iyi bulunmuştur. ($p = 0.001$, $p < 0.05$). Yapılan ROC analizinde AUC=0.738 için RİPASA skoru anlamlı bulunmuştur ($p = 0.001$; $p < 0.05$). Alvarado skorlama sisteminin AUC değeri ise daha düşük (AUC=0,633) tespit edildi. Alvarado skorlamasında ölçülen negatif prediktif değer RİPASA skoruna göre daha yüksek bulunmuştur, sırasıyla (58,14%, 32.56%).

Sonuç: Bölgemizde acil servise başvuran akut apandisit şüpheli hastalarda RİPASA skorlama sisteminin kullanılması gereksiz cerrahi işlemleri ve negatif laparotomi oranlarını azaltıp erken tanı konulmasında yardımcı olacaktır.

Anahtar sözcükler: Akut apandisit, RİPASA skoru, Alvarado skoru.

INTRODUCTION

Acute appendicitis (AA), inflammation of appendix, is one of the most common causes of acute abdominal pain in emergency department admissions. When the surgical intervention is delayed, simple appendicitis results in perforation and increases the morbidity and mortality.¹⁻⁴

Scoring systems are important in supporting the decision in many clinical conditions. They support the decision of the target disease based on the basic symptoms, findings, radiological and laboratory diagnostic test. These scoring systems have an independent diagnostic and prognostic value by reducing the diagnostic error, increase quality, and improve appropriate patient care.⁵

The perforation rate in AA diagnosed by symptoms and physical examination is determined as 20%, and negative laparotomy rates 2-30%.⁶ Many scoring methods based on computer-programs have been developed by using the patient's history, clinical symptoms-findings, and inflammatory parameters to aid in the diagnosis of AA. The aim of all scoring systems is to reduce morbidity and mortality by decreasing negative laparotomy and perforation rates. The first scoring system defined for this purpose is the Alvarado scoring system.⁷ Thereafter Lintula scoring system was developed⁸ for the pediatric age group, and the RİPASA⁹ scoring system was developed for patients in Asia.

The Alvarado scoring system was developed in 1986 according to physical examination and laboratory results. It consists of two major criterias

(each with 2 point); tenderness in the right lower quadrant and leukocytosis, and the minor criterias (each with 1 point) are migration of pain to the right lower quadrant, nausea-vomiting, anorexia, rebound, left shift of white blood cell and fever. According to Alvarado scoring system patients with 9-10 points should be operated, the ones with 7-8 points were considered as high risk AA, and we must be alert to the patients who has 5-6 points. 0-4 points level is accepted as low risk for AA.

In addition to the Alvarado scoring system parameters such as age, gender, duration of symptoms, Rovsing sign and urine analysis were included in the RİPASA scoring system. Although the scoring is generally evaluated over 15 points, in some studies 1 point is also added if the patient is not an Asian. Patients who has ≥ 7.5 points were accepted as AA with a high probability.

In this study, we aimed to find out which scoring would be more beneficial for the Turkish society by comparing both scoring systems.

MATERIAL AND METHODS

This study included the patients who admitted between January 2017 and October 2018 to the Emergency Service or General Surgery clinics with the complaint of abdominal pain and were diagnosed as K35.9 (acute appendicitis) according to ICD10 codes. Of the 203 patients, 21 patient were excluded from the study whose data could not be accessed, and the data of 182 patients were analyzed retrospectively. All of the study was made after obtaining the approval of the ethics committee

from the Faculty of Medicine of Cumhuriyet University. The Alvarado and RIPASA scores of each patient were calculated by the scoring system parameters after the patient file analysis. Patients were divided into high risk and low risk groups at cut-of value of 7.5 for RIPASA score and 7 for Alvarado score. Histopathological results of the operated cases had been analyzed and correlated with either score. The positive predictive values, negative predictive values, sensitivity, and specificity values of the scoring systems were calculated according to the histopathological diagnosis. Two scoring systems effectivity are compared with Chi-square and area under curve (ROC) analysis. The data were evaluated using the

Statistical Package for the Social Sciences 23.0 program, and those with $p < 0.05$ were considered statistically significant.

RESULTS

74 (40.6%) of the patients examined were female and 108 (59.4%) were male. When the groups analysed according to age ($\chi^2 = 0.03$, $p = 0.86$) and gender ($\chi^2 = 2.57$, $p = 0.1$), no difference was found between the groups. The distribution of symptoms, physical examination, and laboratory findings according to the scoring system of the patients are presented in the table 1.

Table 1. Distribution of symptoms, physical examination and laboratory results used in Alvarado or RIPASA scoring systems

			Acute appendicitis		Total
			(+)	(-)	
Right Lower Quadrant Pain	(+)		135	39	174
	(-)		4	4	8
Abdominal pain migration to RLQ	(+)		44	5	49
	(-)		95	38	133
Anorexia	(+)		49	15	64
	(-)		90	28	118
Nausea-Vomiting	(+)		88	25	113
	(-)		51	25	69
Symptoms duration	<48 hour		101	27	128
	>48 hour		38	16	54
RLQ tenderness	(+)		135	38	173
	(-)		4	5	9
Muscular rigidity	(+)		95	25	120
	(-)		44	12	68
Rebound	(+)		101	29	130
	(-)		38	14	52
Rovsing sign	(+)		95	7	102
	(-)		44	36	80
Fever	37°-39°		84	30	124
	<37° >39°		55	13	68
White blood cell	≤10000		114	33	147
	<10000		25	10	35
Urine analysis	Not normal		13	11	24
	Clear		126	32	158

From 182 patients who were included in our study and underwent appendectomy, a histopathological diagnosis examination was made for 180 patients.

The distribution were as follows; acute appendicitis (63), ulcero phlegmonous appendicitis (69), gangrenous appendicitis (3), perforated

appendicitis (3), periappendicitis (6), adenocarcinoma (2), neuroendocrine tumor (1), fibrous obliteration (4), and serositis or reactive lymph node in 29 patients. According to the histological examination 42(23%) patients were not considered as acute appendicitis.

While 118 patients could be detected by high risk RIPASA scoring system (> 7.5 point), only 88 patients had been detected by high risk Alvarado scoring system group. The difference between these two groups (p = 0.001, p <0.05) was found to be significant, and those who scored > 7.5 in the

RIPASA scoring system were more likely to be diagnosed with AA than those who scored ≥ 7 in the Alvarado scoring system. Histopathologically 42 patients who were included in our study had an negative appendectomy. Twenty five of these patients had an Alvarado score <7 and 14 of these patients had a RIPASA score of $\leq 7,5$. The difference between these two groups (p = 0.007, p <0.05) was considered significant. Low risk group of Alvarado scoring system can determine the unnecessary appendectomy rate better than RIPASA. (Table 2)

Table 2: Comparison of acute appendicitis according to Alvarado and RIPASA risk classification groups

		Acute appendicitis		Total	P
		(+)	(-)		
Ripasa Score	>7,5	118	29	147	p=0,011
	$\leq 7,5$	21	14	35	
Alvarado Score	≥ 7	88	18	106	p=0,013
	<7	51	25	76	

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy values of the scoring were calculated in order to

compare the efficiency of the RIPASA and Alvarado scoring systems in the diagnosis of acute appendicitis. (Table 3)

Table 3: A Comparison of RIPASA and Alvarado Scoring Systems in Terms of the Acute Appendicitis Diagnosis

	RIPASA % (95% CI)	ALVARADO % (95% CI)
Sensitivity	80.27% (%72,91- 86.37)	%63,31 (%74,50- 89.61)
Specifity	40.00% (%23,87- 57.89)	%32,89 (%22.54-44.63)
PPV	84.89% (%80,91- 88.17)	%63,21 (%59.05-67.37)
NPV	32.56% (%22.29-44.83)	%58,14 (%44,99-70.22)
Accuracy values	72.53% (%65,43-78.87)	62,09 (%54,61-69,16)

The Reciever Operator Characteristics Curve test was performed for the diagnostic efficiency for

Alvarado and RIPASA scoring systems in acute appendicitis (Figure 1).

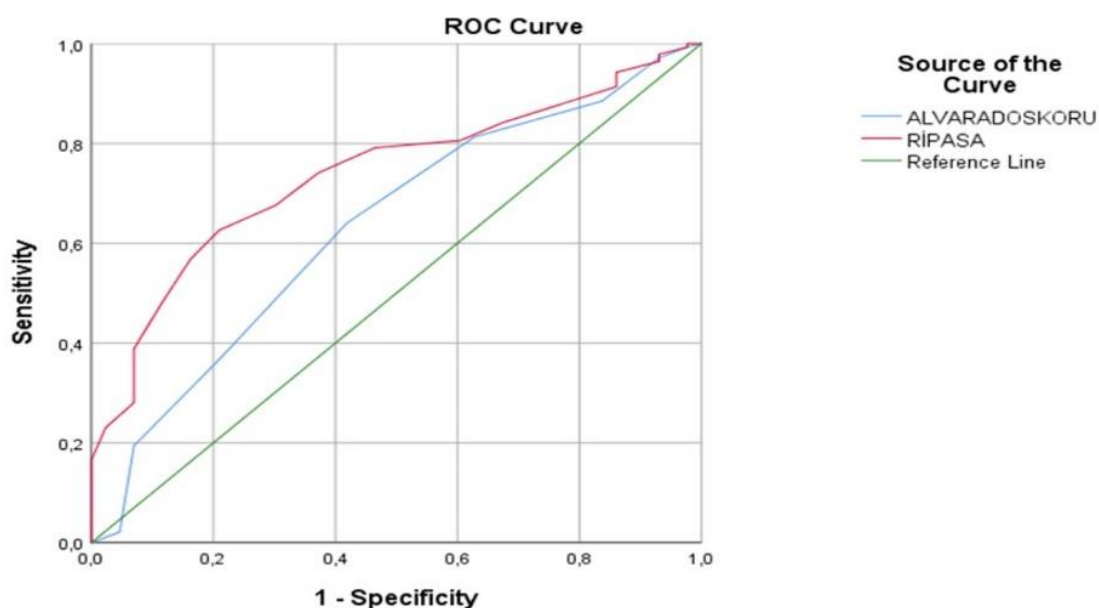


Figure 1. ROC Analysis of Alvarado and RIPASA Scoring in Acute Appendicitis

The size of the area under the curve for Alvarado scoring system was calculated as 0.633 and is significant ($p = 0.009$; $p < 0.05$). The 95% CI for this area is 0.54-0.74 with a 64% sensitivity and 58% specificity. When ROC analysis was applied for RIPASA score, the size of area under the curve was calculated as 0.738 and this is statistically significant ($p = 0.001$; $p < 0.05$). The 95% CI for this area is 0.66-0.81 with a 74% sensitivity and 62% specificity.

DISCUSSION

In our study, we found that the results of our patients did not differ between groups in terms of gender and age. Patients in the high-risk group for Alvarado and RIPASA were found to have a significantly higher probability of having AA compared to those in the low-risk group. However, while the RIPASA score was able to detect 118 patients out of 182 AA patients, Alvarado was able to detect only 88 patients. In this respect, the RIPASA scoring system was found to be superior to the Alvarado scoring for AA prediction ($p = 0.001$, $p < 0.05$). The negative predictive selectivity of Alvarado scoring was found to be higher than that of RIPASA scoring.

The negative appendectomy rate in Alnjadat I. and Abdallah B. study was determined as %17. Whereas they expected that the negative appendectomy rate could be decrease to %7.8 and %8, when the patient would be managed with RIPASA and Alvarado score respectively. There

wasn't any significant statistically difference between the scoring systems.¹⁰

In the study of Nanjundaiah N. et al. in which the appendectomy decision was based on surgeon's clinical judgment, the negative histology rate for acute appendicitis was determined as %10.6.¹¹ Karami MY. detected a similar rate among the patients who underwent appendectomy, 12%.¹²

In our study the negative appendectomy rate was quite higher, %23(42). This can be due to the classification of the histopathological differences or it can be a sign for the necessity of the scoring systems.

Pasumarthi V. and Madhu C.P designed a retrospective study and evaluated the Alvarado and RIPASA scoring systems effectivity among the patients who admitted with right iliac fossa pain. The mean age of the patient was 34,4/year and 116 patients were included in the study. The RIPASA scoring systems sensitivity (75%) and NPV (35,14%) were higher than Alvarado scoring results; sensitivity (52,08%), NPV (%25,81). The diagnostic accuracy for the scores was better in favour of the RIPASA group with a difference of 16,38%, $p < 0,001$.¹³ Only the NPV for Alvarado score does not resemble our results and is different than the literature also.

Frontzas M. et al. meta-analysis included 2161 patients. The sensitivity and specificity of RIPASA score were determined as 94% (95% CI, 92%-95%) and 55% (95% CI, 51%-55%) respectively.

Whereas the sensitivity and specificity of Alvarado scores were as 69% (95% CI, 67%–71%) and 77% (95% CI, 74%–80%) and concluded that RIPASA score was more sensitive than Alvarado. But it was not suitable to provide the accurate diagnosis due to the low specificity. Nevertheless they suggested the scoring systems should be used in the developing countries or rural hospitals that lack electronic diagnostic tests ¹⁴.

Chong CF et al. performed sensitivity, specificity, PPV, NPV, accuracy values and ROC analysis to evaluate the effectiveness of scoring systems in the diagnosis of acute appendicitis. Sensitivity and specificity were calculated as 98.02% and 81.32%, PPV 85.34%, NPV 97.37% for the RIPASA scoring system. For the Alvarado scoring system, the sensitivity was 68.32%, specificity 87.91%, PPV 86.25% and NPV 71.43%. As a result, it was concluded that the RIPASA scoring system, which has higher sensitivity, NPV and accuracy rate, is better compared to the Alvarado scoring system in the Southeast Asian population. ⁹

In the study of Regar MK et al., a correlation was found between the Alvarado scoring system and histopathological diagnoses ($p < 0.0495$). The sensitivity was 67.3%, specificity 80%, PPV 98.46%, NPV 11.43% and accuracy rate was 68%. Correlation with histopathological diagnoses was also observed in the RIPASA scoring system ($p < 0.0032$). Sensitivity of RIPASA was determined as 94.7%, specificity 60%, PPV 97.83%, NPV 37.50% and accuracy value 93%. The negative appendectomy rate was found to be 1.54% in the Alvarado scoring system and 2.17% in the RIPASA scoring system. In this study it seems that the Alvarado scoring system is better than the RIPASA scoring system according to the negative appendectomy rate. ¹⁵

In the study of Rodrigues W and Sindhu S. Alvarado scoring systems sensitivity was found to be better than the specificity for the diagnosis of acute appendicitis. PPV was measured as 83.5% and it has been suggested that it is compatible with the literature. The Alvarado scoring system was found to be lower when compared with the RIPASA scoring system in terms of NPV. Similarly, sensitivity was found better than specificity in the RIPASA scoring system. When both scoring systems were compared, it was found that the sensitivity of RIPASA was higher, but its specificity was lower than Alvarado. They concluded that mortality and morbidity associated with appendicitis would decrease by using the RIPASA scoring system ¹⁶.

In Arroyo-Rangel C. et al. study, the sensitivity of the RIPASA scoring system was 98.8%, the specificity was 71.4%, PPV value was 95.5% and the NPV value was 90.9%. Sensitivity of Alvarado scoring system was 90.7%, specificity was 64.3%, PPV value was 94.1% and NPV value was 60%. This study demonstrated that the RIPASA scoring system showed greater diagnostic accuracy than the Alvarado scoring system. ¹⁷

In the study of Nanjundiah et al. the RIPASA scoring system results for acute appendicitis diagnosis were as follows; sensitivity 96.2%, specificity 90.5%, PPV value 98.9% and NPV value 73.1%. Whereas for the Alvarado scoring system the predictivity for the diagnosis were lesser and are calculated as; sensitivity 58.9%, specificity 85.7%, PPV value 97.3% and NPV value 19.1%. The difference between the diagnostic values of the Alvarado and RIPASA scoring systems was calculated as 33.93% and $p < 0.0001$ and was considered statistically significant. As a result the RIPASA scoring system was thought to be significantly better than the Alvarado scoring in the diagnosis of acute appendicitis. ¹¹

Karami et al compared the acute inflammatory response, RIPASA and Alvarado scoring systems to the patients who presented with right quadrant pain and also the scores were correlated with the postoperative pathology reports. According to their results they determined that the RIPASA scoring system had a better sensitivity, NPV and a positive likelihood ratio, and a less negative likelihood ratio for the Iranian population. ¹²

In our study, we could not detect any significant difference when comparing the RIPASA and Alvarado scores in terms of specificity and sensitivity. Whereas the RIPASA scoring system had a more effective positive predictive value = 0.001 ($p < 0.005$). When we compared in terms of NPV, which we used to identify healthy patients, we found that the Alvarado scoring system was more significant ($p = 0.001$). In terms of diagnostic accuracy, we found that the two scoring systems were not superior to each other ($p = 0.382$; $p > 0.005$).

Area under curve calculation was made in many manuscripts and all of the determined that RIPASA scoring system had a significant sensitivity and specificity in determining the acute appendicitis cases. ^{11-13,16,17} Our results are also in favor of the RIPASA score.

CONCLUSION

After our study, we found that it is beneficial to use the RIPASA scoring system for patients in our region in order to reduce the rate of negative laparotomy and unnecessary surgical procedures in patients admitted to emergency services with the suspicion of Acute appendicitis. This will provide more accurate medical treatment to the patients and decreases the malpractice rate.

Limitations

Since the study is retrospective and includes only patients in our region, it would be appropriate to conduct the study prospectively and multicenteric with a large number of patients to evaluate the validity of scoring systems in patients in the Turkish community.

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