

EVALUATION OF VALIDITY OF ALVARADO SCORING SYSTEM FOR DIAGNOSIS OF ACUTE APPENDICITIS

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ABSTRACT

Objective: Appendicitis is part of the differential of an acute abdomen and can be difficult diagnosis to make. A number of clinical scores have been developed attempting to decrease the false- positive rates of appendectomies. In this study we evaluated validity of Alvarado score in patients with suspected appendicitis and compared its performance between men and women.

Methodology: From May 2006 to December 2007, 152 adults who were operated for acute abdominal pain and diagnosis of acute appendicitis were evaluated. In each patient, signs, Symptoms, laboratory values and pathology reports were collected and evaluated. The sensitivity, specificity, positive and negative predictive values and receiver operator characteristic curves of each indicator were calculated in men and women.

Results: In this study, we evaluated 152 patients (85 men, 67 women). In men, 71 patients had acute appendicitis. In women, 49 patients had acute appendicitis. In men the mean of total score was 7.3 ± 1.18 in patients with acute appendicitis and $5.40.75$ in non- appendicitis patients ($p=0.001$). In women, the mean of total score was $7.21.19$ in patients with appendicitis and $6.31.37$ in non-appendicitis patients ($p=NS$). The area under the curve was 0.91 for men and 0.71 for women

Conclusion: Our study showed that Alvarado score is not accurate for determination of acute appendicitis in women. It also showed that in all patients with abdominal pain and right lower quadrant tenderness, operation should be performed without using the Alvarado score.

KEYWORDS: Alvarado, Appendicitis, Scoring system, Validity.

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INTRODUCTION

Acute appendicitis is one of the most common surgical emergencies.¹ Patients with acute appendicitis may present with different signs and symptoms varying from non-specific vague abdominal pain to typical findings of right lower quadrant pain, tenderness and rebound tenderness.^{2,3} This variability has been attributed to a series of possible causes, including patient age,⁴ inflammation severity and perforation,⁵ or a combination of these factors. A number of clinical scores have been developed attempting to decrease the false- positive rates of appendectomies.^{6,7} In the last two decades

Alvarado⁶ proposed a practical score for the early diagnosis of acute appendicitis, but it should be validated in a different sample before widespread use.

In this study, we evaluated validity of Alvarado score in patients who had operation for suspected appendicitis and compared its performance between men and women

METHODOLOGY

From May 2006 to December 2007, in a cross-sectional study, 152 adults who were referred consequently to our center with diagnosis of acute appendicitis and had operation were evaluated in Al-zahra Hospital of Medical University of Isfahan in Iran. Entry into the study required surgical operation for possible appendicitis. In this study, we did not use computed tomography scans for assisting of clinical evaluation.

Signs, Symptoms, laboratory values and pathology reports were collected and evaluated. There were four patient symptoms, (migration of pain, anorexia, nausea, vomiting), three signs (tender right iliac fossa, rebound tenderness, temperature ≥ 37.3 °C), and two laboratory indicators of appendicitis (Leukocytosis, shift to the left). Table-I shows the Alvarado score for diagnosis of appendicitis.

The sensitivity, specificity, positive predictive value and negative predictive value of score was calculated in women and men based on pathology results of appendectomy. Additionally, receiver operator characteristic curves (Roc) were generated for all scores to graphically represent overall score performance. Statistical analysis was performed using the SPSS 15.0; (SPSS, Inc. Chicago, IL). P less than 0.05 was considered significant. The area under the curve of Alvarado score is less than 0.8 is considered in-accurate for diagnosis of acute appendicitis. Diagnosis of appendicitis was based on the observation of an inflamed appendix and histological presence of neutrophilic infiltration through the wall and within the muscularis of the appendix.

RESULTS

In this study, we evaluated 152 patients (85 men, 67 women). The mean age of patients was 21.02 ± 8.18 (22.05 ± 7.29 in men, $19.768.12$ in women, $P=NS$). In men, 71 patients had acute appendicitis. In women, 49 patients had acute appendicitis. In men the mean of total score was $7.31.18$ in patients with acute appendicitis and $5.40.75$ in non- appendicitis patients ($p=0.001$). In women, the mean of total score was $7.21.19$ in patients with appendicitis and $6.31.37$ in non-appendicitis patients ($p=NS$).

A ROC curve for scoring system of men and women is shown in figure 1 and 2 respectively. As shown in figure 2, the area under the curve of Alvarado score is less than 0.8 in women and therefore, this score is not accurate for diagnosis of acute appendicitis in this patients. The area under the curve was 0.91 for men and 0.71 for women. The best cut of point for diagnosis of appendicitis was 4-5 score in men (Table-II). Sensitivity of tenderness was 100% for diagnosis of appendicitis in both sexes.

DISCUSSION

Acute appendicitis is one of the most common surgical emergencies¹ and its clinical findings may be quite different among cases and therefore, a number of clinical scores have been developed attempting to improve accuracy of diagnosis of appendicitis.⁸⁻¹⁰ Alvarado described a clinical scoring system to differentiate

Table-I: The Alvarado scoring system

	Mnemonic (MANTRELS)	Value
Symptoms	Migration	1
	Anorexia	1
	Nausea-Vomiting	1
Signs	Tenderness in RLQ	1
	Rebound Pain	2
	Elevation of temperature $>37.3^{\circ}\text{C}$	1
Laboratory	Leukocytosis	1
	Shift to the left	1

Table-II: Assessment of cut points of Alvarado score

Score	men		women	
	<i>sensitivity</i>	<i>specificity</i>	<i>sensitivity</i>	<i>specificity</i>
2	1.00	0.00	—	—
3.5	1.00	0.18	1.00	0.00
4.5	0.98	0.58	0.98	0.23
5.5	0.93	0.93	0.87	0.50
6.6	0.60	0.93	0.61	0.73
7.5	0.39	1.00	0.38	0.95
8.5	0.18	1.00	0.10	0.95
9.5	0.04	1.00	0.04	0.95
11	0.00	1.00	0.00	1.00

patients in need of surgical intervention.⁶ According to available data, in his study, the sensitivity and specificity of his score was 81% and 74% respectively.

Using Alvarado 9-point score (Table-I), additional validation of this score had mixed results. In Schneider et al,¹¹ study, Alvarado score greater than or equal to 7 yielded a sensitivity of 72% and specificity 81%. Although in their study, area under the curve was 0.83 but, AUC was not analyzed in men or women separately. In our current study, the area

under the curve, representing the overall performance for all possible cut points, was 0.91 for men and 0.71 for women. In Gwynn et al¹² study, the sensitivity and specificity of Alvarado score were 91.6% and 84.7% respectively. He noted that patients in extreme age groups are more likely to be falsely diagnosed for appendicitis by Alvarado's prediction model.

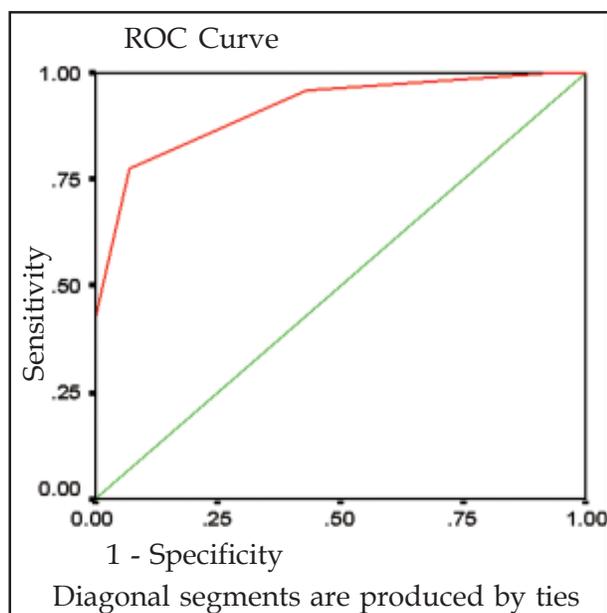


Fig-1: Rocs for the performance of the Alvarado scoring system in men.

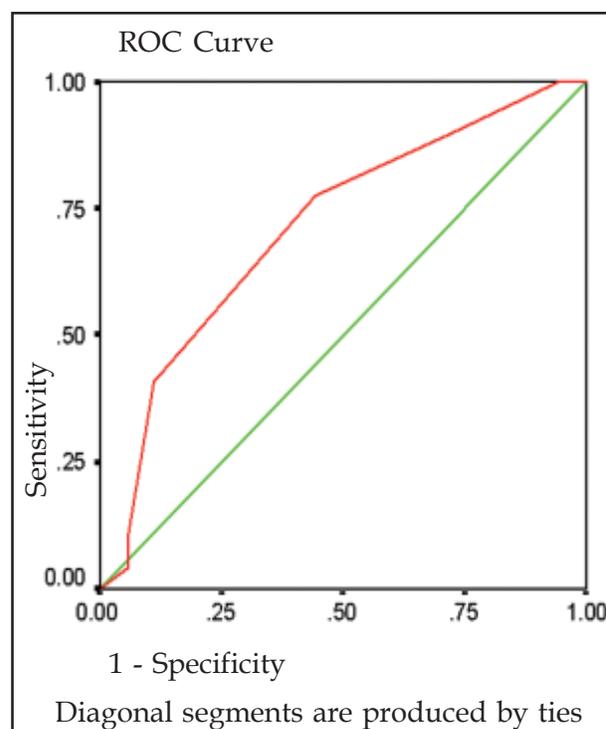


Fig-2: Rocs for the performance of the Alvarado scoring system in women

Females of reproductive age are a difficult group to differentiate appendicitis from gynecologic pathologies, by comparison of sensitivity and specificity of Alvarado score determinants in men and women. It may be due to high prevalence of these common general findings in women presenting with abdominal pain. Therefore we don't recommend Alvarado score for determination of acute appendicitis in women. This conclusion was also noted in McKay et al study.² As showed by Gwynn et al,¹² we also found that sensitivity of tenderness is 100% for diagnosis of appendicitis, and therefore it is highly recommended that in patients with abdominal pain and tenderness, operation is performed without using the Alvarado score, and it seems that the omission of this variable from Alvarado score model can be safely performed.

In conclusion, our study showed that Alvarado score is not accurate for determination of acute appendicitis in women. Secondly in all patients with abdominal pain and right lower quadrant tenderness; operation should be performed without using the Alvarado score.

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