

Modified Alvarado score for acute appendicitis in overweight patients

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ABSTRACT

الأهداف: لمعرفة أهمية استخدام تقييم الفارادو المعدل في المساعدة في تشخيص التهاب الزائدة الدودية الحاد عند المرضى أصحاب الوزن الزائد.

الطريقة: شملت هذه الدراسة المرضى الذين تم تشخيصهم حالتهم كالتهاب زائدة دودية حاد، والذين تم تنويمهم في مستشفى الملك فهد الجامعي - الهفوف - الإحساء - المملكة العربية السعودية، خلال الفترة مابين سبتمبر 2004م وحتى ديسمبر 2006م. شملت الدراسة المرضى اللذين حصلوا على معدل 7 أو أكثر بناء على تقييم الفارادو المعدل، بينما المرضى اللذين حصلوا على معدل 6 أو اقل تم استثنائهم من هذه الدراسة. خضع جميع المرضى لتنظير جوف البطن، وتأكيد التشخيص عن طريق فحص الأنسجة.

النتائج: كان هناك 228 مريض، 24% من المرضى هم من أصحاب الوزن زائد، و12% منهم كانوا من مرضى السمنة. نسبة 60% من المرضى تأكدت اصابتهم بالتهاب حاد في الزائدة الدودية.

خاتمة: إن تقييم الفارادو المعدل يعتبر وسيلة سهلة وعملية، ويمكن استخدامه في المساعدة لتشخيص التهاب الزائدة الدودية الحاد عند المرضى أصحاب الوزن الزائد ومرضى السمنة.

Objective: To find out the efficacy of Modified Alvarado (MA) scoring system in diagnosis of acute appendicitis in the overweight patients

Methods: All the patients with suspected acute appendicitis admitted in the surgical department at King Fahad Hospital, Hofuf, Al-Hassa, during the period from September 2004 to December 2006 were included in the study. Patients with score of 7 or more of modified Alvarado score were included, patients with score of 6 or less were excluded. All patients underwent diagnostic laparoscopy, and the diagnosis was confirmed by histopathological examination.

Results: There was total of 228 patients. Twenty -four percent were overweight and 12% patients were obese. Sixty percent of the patients had confirmed diagnosis of acute appendicitis.

Conclusions: Modified Alvarado scoring system is an easy method for diagnosis for acute appendicitis. It can be used as complementary aid for supporting the diagnosis of acute appendicitis in overweight and obese patients.

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Acute appendicitis is one of the most common surgical emergencies.^{1,2} Its diagnosis has been based on careful history taking, detailed physical examination and proper investigations. Difficulty in diagnosis, misdiagnosis, delay in surgery with complication and negative appendectomy is common in surgical practice.³ A definite diagnosis can be obtained only after pathological examination of the appendectomy specimen. Alvarado in his original work recommended an operation for all patients with a score of 7 or more.⁴ It was reported that obesity is a limiting factor in the detection of appendicitis in obese children and adult, even with use of different imaging techniques.^{5,6} The Modified Alvarado (MA) score is a 9-point scoring system for the diagnosis of appendicitis based on symptoms, clinical signs, and leucocytes count which is shown in Table 1.⁷ We prospectively evaluated whether overweight patients derived the same benefit from MA scoring system,⁷ as compared to normal weight individuals.

Methods. Prospective analysis of 228 patients who had appendectomy following clinical suspicion of acute appendicitis was carried out between September 2004

and December 2006, at the King Fahad Hospital, Hofuf, Al-Hassa (Eastern province of Saudi Arabia). This study was approved by the Hospital Ethics Committee. All patients were admitted through the emergency department, and the MA scoring system was used for diagnosis of acute appendicitis.⁷ The on call surgical consultant obtained the final decision for surgery, the patients consent for laparoscopic and open appendectomy. Those patients with a score of 7-8 were considered to have a probable diagnosis of acute appendicitis, and those with a score of 9 were considered to have definite diagnosis of acute appendicitis. Patients with a cumulative score of 7 or more (228 patients) were prepared and all underwent diagnostic laparoscopy and laparoscopic appendectomy. Patients with score of 6 or less were kept for further evaluation and repeated assessment by using the MA score, and no antibiotic or analgesic was administered during that time. Patients were excluded from the study if they have opened appendectomy, generalized peritonitis, and palpable mass in the right iliac fossa. The final diagnosis of appendicitis was based on the intra-operative finding (laparoscopy) and histopathology examination of the appendectomy specimen.

In our study, acute appendicitis was defined as transmural acute inflammation of the appendix on histopathological examination and normal appendix was defined when non-inflamed appendix was removed at surgery. The body mass index (BMI) of patients was calculated by weight (kg)/ height (m²), and then grouped accordingly. Overweight was defined as a BMI of 25-30 and obesity was defined as a BMI greater than 30. There were 145 patients with normal weight, 55 overweight patients and 27 obese patients. The reliability of the MA scoring system was evaluated by negative appendectomy rate and positive predictive value.

Results. We conducted our study in 228 consecutive patients with clinical features suggestive of acute appendicitis. There were 89 (39%) females and 139 male patients (61%). The mean age was 21.7 years (range from 12-58 years, \pm SD =10.5). One hundred and forty-five patients had normal weight, 55 patients were overweight and 27 patients were obese according to the BMI (Table 2). Out of the 145 normal weight patients who underwent appendectomy, 12 patients (8.3%) had normal appendix on histopathology. Six patients (10.9%) out of 55 overweight patients had normal appendix, and 4 patients (14.8%) out of 27 obese patients had normal appendix on histopathology. The incidence of perforated and gangrenous appendix is given in the Table 2. The incidence of appendicitis was strongly aged dependent, the incidence peaking at 12-30 years. Most cases (94.5%) occurred in patients below 40 years of age. The rate of negative appendectomy rate was 22 (9.6%). Distribution of the patients according to

Table 1 - Modified Alvarado scoring system.⁶

Symptoms	Score
Migratory right iliac fossa pain	1
Nausea / vomiting	1
Anorexia	1
<i>Signs</i>	
Tenderness in right iliac fossa	2
Rebound tenderness in right iliac fossa	1
Elevated temperature	1
<i>Laboratory findings</i>	
Leucocytosis	2
Total	9

Table 2 - Patients characteristics and histology findings.

Character	Normal weight	Over weight	Obese
<i>Numbers</i>	145 (63.6)	55 (24.12)	27 (11.84)
Male	98	34	15
Female	47	21	12
<i>Appendix length</i>			
<5 cm	11 (7.5)	5 (9.1)	2 (7.4)
5-10 cm	126 (87.0)	29 (52.7)	14 (51.9)
>5 cm	8 (5.5)	21 (38.2)	11 (40.7)
<i>Appendix width</i>			
<0.5 cm	7 (4.8)	3 (5.5)	2 (7.4)
0.5-1.0 cm	117 (80.7)	40 (72.7)	19 (70.4)
>1.0 cm	21 (14.5)	12 (21.8)	6 (22.2)
<i>Histopathology</i>			
Normal	12	6	4
Acute	106	43	17
Perforated	9	4	2
Gangrenous	10	2	2
Chronic	8	0	2
Data are expressed as number and (percentage)			

weight, MA scoring system, and pathology are given in Table 3. Among the included population the MA scoring system as a test to diagnose appendicitis it is shown that, in the desirable weight group, after categorizing the subjects according to the obtained score >8 versus <8, a positive predictive value of 89.3% was achieved considering a pre-test probability of 80%. However, in the overweight and obese subjects after considering a pre-test prevalence of obesity among Saudi population of approximately 25%,¹³ the positive predictive value for system using the same categorization was 77.2% namely, the MA scoring system can predict appendicitis in more than 77% of overweight/obese individuals at a score \leq 8. (Reliability of the MA scoring system is higher when applied to normal versus overweight-obese

Table 3 - Characteristics of the patients according to weight, modified Alvarado scoring system, laparoscopic finding, and confirmed histology.

Alvarado scoring system	No. of patients n (%)	Normal appendix	Acute appendix	Perforated appendix	Gangrenous appendix	Chronic appendix
<i>Normal weight patients (n=145)</i>						
7	26 (18.0)	7	16	-	-	3
8	34 (23.4)	5	24	9	10	5
9	85 (58.6)	-	66	-	-	-
<i>Over weight patients (n=55)</i>						
7	11 (20.0)	4	7	-	-	-
8	15 (27.3)	2	12	1	2	-
9	29 (52.7)	-	24	3	-	-
<i>Obese patients (n=27)</i>						
7	6 (22.0)	3	2	-	-	1
8	10 (37.0)	1	8	-	-	1
9	11 (41.0)	-	7	2	2	-

subjects in clinical diagnosis of appendicitis especially those with low score).

Discussion. Surgical exploration for suspected appendicitis is one of the most common surgical emergencies in young population worldwide.³ Different diagnostic aids are used in the diagnosis of acute appendicitis,^{5,6,8} still the negative appendectomy rate is high (15-30%).^{9,10} There are many clinical scoring systems,¹¹ and MA scoring system is one of the simple, objective assessment score of right lower abdominal pain. It has an easy application since it relies purely on history, clinical examination, and simple investigation. We know that obesity imposes unfavorable operating conditions, and the prevalence of obesity continues to increase among both males and females in all age worldwide as well as in Saudi Arabia.^{12,13} The obesity has negative influence on the detection rate of the appendicitis by clinical examination and imaging techniques,^{5,6} the higher the BMI, the more difficult it is to detect appendicitis. We wanted to establish whether being overweight create any impediment to MA score. In this study, application of MA score system improves diagnostic accuracy and accordingly reduces negative appendectomies in all groups, and the results are comparable with the literatures for non-obese patients.¹⁴ This is important for over weight and obese patients as obesity hinders early mobilization in postoperative period, and consequently the complications become more frequent. Positive predictive value shown by our study is 84.3% (9.4% was normal, 6.3% was chronic), and it is comparable with the literatures.⁶ Removal of a few normal appendices is bound to lower the rate of perforation, and data in the literature show an inverse relationship between a negative appendectomy rate and perforation rate.^{15,16} Although the negative appendectomy has negligible mortality, it has associated

morbidity rate in overweight patients,¹⁶⁻¹⁸ and this can be decreased by laparoscopic procedure.¹⁹ The choice to operate or not is important due to early or delayed surgery carries definitive risk for morbidity and mortality in both normal and overweight patients. All patients who have score of 9 were proved to have appendicitis, and the patients with perforated cases had symptoms at least 24 hours before admission. This work showed that MA score system could be used as an objective criterion in selecting overweight patients for surgery, as well as normal weight patients. In some cases, especially obese patients, additional investigations may be needed to improve the percentage of correct diagnosis. Small number of patients was included in this study, it is well known that age and gender play a role in the clinical presentation of acute appendicitis, and MA score proved in many studies to be effective in children and adult, but no data in obese patients (Table 2).

We found that Alvarado score may be used as an adjuvant clinical assessment for diagnosis of acute appendicitis in overweight and obese patients, however, clinical assessment and skills of the surgeon remain the mainstay for diagnosis of acute appendicitis.

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