Appraisal of the modified Alvarado Score for acute appendicits in adults

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ABSTRACT

Objective: Decision making in cases of acute appendicitis may be difficult specially for junior surgeons. Radiological investigations do not appear to be helpful. In some studies, the Modified Alvarado Scoring System (MASS) was helpful in minimizing unnecessary appendicectomies. The aim this study was to evaluate the sensitivity of MASS in the diagnosis of acute appendicitis in adults.

Methods: All adult patients aged 16-years and above who were admitted with a provisional diagnosis of acute appendicitis between January 2001 and January 2002, into the Armed Forces Hospitals, Southern Region, Khamis Mushayt, Kingdom of Saudi Arabia were prospectively entered into this study. The study included 125 patients between the ages of 16 and 76-years. They were prospectively evaluated on admission using the Modified Alvarado Score (MAS) to determine whether or not they had acute appendicitis. The MASS was correlated with the operative and histopathological findings.

Results: One hundred and 10 patients (88%) had appendicectomies of which 30 patients (27.3%) had normal appendices on histopathology examination. Overall the MAS system showed a sensitivity of 53.8% and a specificity of 80%. For males, the sensitivity was 56.4% and the specificity was 100%. For females, the sensitivity and specificity were 48% and 62.5%.

Conclusion: From the results, the MASS is not sufficiently sensitive adopted as a method of diagnosing of acute appendicitis in adults in our environment. Further, requirements may be needed to improve its sensitivity and specificity.

Saudi Med J 2004; Vol. 25 (9): 1229-1231

The classical signs and symptoms of acute appendicitis were first reported by Fitz[1] in 1886. Since then it has remained the most common diagnosis for hospital admission requiring laparotomy.[2,3] Approximately 6% of the population will suffer from acute appendicitis during their lifetime, therefore, much effort has been directed toward early diagnosis and intervention.[4] This effort has successfully lowered the mortality rate to less than 0.1% for non complicated appendicitis, 0.6% where there is gangrene, and 5% for perforated cases.[4] The diagnosis of appendicitis can be difficult, occasionally taxing the diagnostic skills of even the most experienced surgeon. Equivocal cases usually require inpatient observation. This delay in diagnosis may increase the morbidity and costs. Attempts to increase the diagnostic accuracy in acute appendicitis have included computer aided diagnosis, imaging by ultrasonography, laparoscopy, and even radioactive isotope imaging.[5-8] Various scoring systems have been devised to aid diagnosis.[9-11] The Alvarado score was described in 1986[12] and has been validated in adult surgical practice. This study was undertaken to evaluate the sensitivity of the Modified Alvarado Scoring System (MASS) in adult patients with a diagnosis of acute appendicitis admitted to our hospital.

Methods. One hundred and twenty-five adult

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Received 29th October 2003. Accepted for publication in final form 13th March 2004.

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patients (76 male patients with a mean age 28.57-years and 49 female patients with a mean age 25.98-years) with a mean age of 27.1 ± 11.38-years (Range 16-76-years) admitted to the Surgical Department, Armed Forces Hospital over a one year period formed the base of this study. At admission, all the patients were prospectively evaluated using the MAS to determine whether they had acute appendicitis or not. The scores were subsequently correlated with the clinical, operative and histopathological findings of the removed appendices. The decision to apply the score is based on the following presentations, 3 symptoms, 3 signs and one investigation as shown in (**Table 1**)[13] The classic Alvarado Score included left shift of neutrophil maturation (score 1) yielding a total score of 10 but Kalan et al[13] omitted this parameter which is not routinely available in many laboratories, and produced a modified score. Patients with a score of 1-4 are considered unlikely to have acute appendicitis, those with a score of 5-6 have a possible diagnosis of acute appendicitis, not convincing enough to have urgent surgery, and those with score of 7-9 are regarded as probable acute appendicitis. The MAS was recorded on the admission sheet and played no role in the management of the patients. The diagnosis of acute appendicitis was made clinically by the surgical on call team (Residents and Specialists). Abdominal ultrasonography was performed in 21 doubtful cases leading to the diagnosis of 2 cases each of right ovarian cyst, right iliac fossa mass and one case of dilatation of the pelvicalcyeal system of right kidney. All patients were operated upon using clinical diagnosis.

Results. The operative finding in the 110 patients who underwent appendicectomies are summarized in (**Table 2**). In 43 patients (34.4%) who were placed under observation? The MASS was re-assessed 6 hourly after admission. In 6 patients the MAS decreased from 7 score to 3 score and in 4 patients from 5 score to 4 score, however, in 4 patients MASS increased. In the remaining 29 patients, MASS remained unchanged. The collecting data in this study showed the greater clinical diagnosis accuracy in compared with MAS as summarized in (**Table 3**). Our false positive appendicectomy rate was 27.3% (There were 3 patients with clear intra-operative pathology, one patient had salpingitis, one patient had ovarian cyst and one patient had cecal abscess). Utilizing the Modified Alvarado Score, 52 patients had a score ≥ 7 of whom 43 had confirmed appendicitis, and 73 patients had a score <7 of whom 48 had confirmed appendicitis by histopathology. The overall sensitivity of the MAS was 53.8% and its specificity 80% (**Table 4**).

Table 1 - The modified Alvarado score.

Variables	Score
Symptoms	
Migratory right iliac fossa pain	1
Anorexia	1
Nausea/vomiting	1
Signs	
Tenderness right lower quadrant	2
Rebound tenderness right iliac fossa	1
Pyrexia >37.5^{O}C	1
Investigation	
Leucocytosis	2
Total score	**9**

Table 2 - The final diagnosis.

Item	n	(%)
No surgery	15	(12)
Underwent surgery	110	(88)
Appendicitis	80	(72.7)
Normal appendix	30	(27.3)
Salpingitis	1	(0.9)
Ovarian cyst	1	(0.9)
Cecal abscess	1	(0.9)

Table 3 - Clinical diagnosis compared with modified Alvarado score in the diagnosis of acute appendicitis.

Variables	True +ve	True +ve	True +ve	True +ve	Accuracy
Clinical diagnosis of acute appendicitis					
Male	25	6	15	0	80.3%
Female	25	9	15	0	81.6%
Total	**80**	**15**	**30**	**0**	**76%**
Modified Alvarado score					
Male	31	21	0	24	68.4%
Female	12	15	9	13	50%
Total	**43**	**36**	**9**	**37**	**63.2%**
+ve -positive					

Table 4 - Diagnostic accuracy of the modified Alvarado score.

Variable	Appendicitis	Other diagnosis
Total		
Alvarado score ≥7	**43**	**9**
Alvarado score <7	**37**	**36**
	Sensitivity = 53.9%	Sensitivity = 80%
Males		
Alvarado score ≥7	31	0
Alvarado score <7	24	21
	Sensitivity = 56.4%	Sensitivity = 100%
Females		
Alvarado score ≥7	12	9
Alvarado score <7	13	15
	Sensitivity = 48%	Sensitivity = 62.5%

Discussion. The diagnosis of acute appendicitis continued to be difficult, due to the variable presentation of the disease, and the lack of reliable diagnostic test. Although there has been some improvement in the diagnosis of acute appendicitis over the past several decades, the percentage of normal appendices reported in various series varies from 8-33%.[14-16] Clinical scoring systems have proved useful in the management of number of surgical conditions. In the past few years various scores have been developed to aid the diagnosis of acute appendicitis.[17] Although, many diagnostic scores have been advocated but most are complex and difficult to implement in the clinical situation.[17] The Alvarado score, is a simple scoring system that can be instituted easily in the outpatient setting.[12] In a prospective study of 215 adults and children in Cardiff, use of the Alvarado score decreased an unusually high false-positive appendicectomy rate of 44-14%[18] and in another study from Singapore, they presented a high sensitivity and specificity in using Alvarado score system in the diagnosis of acute appendicitis.[19] Fenyo,[11] reported in one study a sensitivity of 90.2% and specificity of 91.4% for scoring system and a sensitivity of 73%, specificity of 87% with a negative laparotomy rate of 17.5% in another study.[20] To be useful, the score must be both sensitive and specific. The modified Alvarado score proved to be effective in one study in adult patient with acute appendicitis[13] and in another study was not applicable in the pediatric age group.[21] Our study demonstrates that modified Alvarado score is substantially inferior to our current clinical practice in the diagnosis of acute appendicitis in adults, since both sensitivity and specificity are low and the false positive appendicitomies were 27.3%. It is also important to emphasize that the scoring may not be accurate in the diagnosis of acute appendicitis in patients with score ≥7 as showed in our study 9 patients (17.3%) out of 52 with false positive appendicitomies. In sub group analysis; however, we do note that all 31 males with a score of 7 or more did in fact have appendicitis but the MASS was of no predictive value in males scoring less than 7 and none at all in females regardless of the score.

In conclusion, from our data, the MASS was not found to be a useful complementary method in the diagnosis of suspected case of acute appendicitis in adult patients. Further, requirements may be needed to improve its sensitivity and specificity in our environment.

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