

The Alvarado Score and Acute Appendicitis

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Abstract

Introduction: This is a retrospective study to assess the accuracy of the Alvarado score in predicting appendicitis for patients with right iliac fossa pain. **Materials and Methods:** This is a retrospective study of consecutive patients with suspected appendicitis. The Alvarado score was computed from the admission notes and correlated with the final outcome of the patient. Patients discharged without surgery were reviewed in the outpatient's clinic to ascertain that they did not need surgery. **Results:** There were 148 patients in the study and 63 had appendectomies with intention to treat appendicitis. The normal appendectomy rate was 21%. The number of patients with score 1-4, 5-6, 7-8 and 9-10 were 46, 40, 44 and 18, respectively, while the number of appendicitis in each group were 0, 2 (5%), 30 (68%) and 18(100%), respectively. The positive and negative predictive values of Alvarado's scores of 7 or more were 77% and 97.6%, respectively. **Conclusion:** Alvarado score is a useful tool in the diagnosis of appendicitis, especially at both ends of the scale.

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Introduction

Acute appendicitis is a common surgical emergency. However, it is often difficult to make an accurate pre-operative diagnosis,¹ especially during the early stage of the disease. This will lead to either unnecessary operations or delayed surgical intervention. There is still appreciable morbidity and occasional mortality related to failure of making an early diagnosis.¹

Scoring systems using various clinical and laboratory parameters have been designed to aid in the diagnosis of appendicitis. Many of these are complex and difficult to apply in the clinical setting.² Imaging modalities such as ultrasound and computed tomographic (CT) scan,^{3,4} and diagnostic laparoscopy^{5,6} have also been investigated in aiding the diagnosis.

The aim of this study was to assess the accuracy of a simple scoring system, the Alvarado score,⁷ in the diagnosis of acute appendicitis in a hospital setting.

Materials and Methods

This is a retrospective study comprising consecutive patients admitted to the surgical department of Alexandra Hospital with suspected appendicitis over a 4-month period from December 1998 to March 1999.

TABLE I: THE ALVARADO SCORE

	Score
Symptom	
Migratory RIF pain	1
Anorexia	1
Nausea/vomiting	1
Sign	
Tenderness RLQ	2
Rebound pain RIF	1
Elevation of temperature >37.3°C	1
Laboratory finding	
Leukocytosis >10 x 10 ⁹ /L	2
Neutrophilic shift to left >75%	1
Total score	10

The scoring system is based on 3 symptoms, 3 signs and 2 laboratory findings giving a maximum score of 10 as shown in Table I.

The score was computed and summed up in each patient based on the admission clinical records. The diagnosis was made clinically by the surgeon-in-charge without knowledge of the score or the aid of any imaging study.

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In suspected appendicitis, an appendicectomy was performed and the diagnosis confirmed by operative findings and histology. Patients whose symptoms subsided were discharged and reviewed 2 weeks later at the outpatient clinics.

For this study, normal appendicectomy was defined as when an uninflamed appendix was found in a patient who had operation with an intent to treat for appendicitis.

Results

A total of 148 patients were recruited in the study. There were 107 male and 41 female patients, with age ranging from 10 to 73 years (mean 29 years). The diagnoses of these patients are presented in Table II. Sixty-three patients had operations with an intent to treat for appendicitis. Two other patients required emergency operations, 1 for ruptured ectopic pregnancy and another had repair for an obstructed paraumbilical hernia. In the group of patients with an intent to treat, appendicitis was confirmed in 50 patients giving a normal appendicectomy rate of 21%. Of the 13 normal appendicectomies, the most common diagnosis in the male was diverticulitis (6/8) whilst pelvic inflammatory disease was the most common in the female (3/5). The individual scores are shown in Table III.

In the group of patients with Alvarado's scores of 7 and above, 48 of 62 (77%) patients had appendicitis. All 18 patients with scores of 9 or 10 had appendicitis, while 30 of 44 (68%) patients with scores of 7 or 8 had appendicitis. All 10 patients with perforated appendices had scores of 7

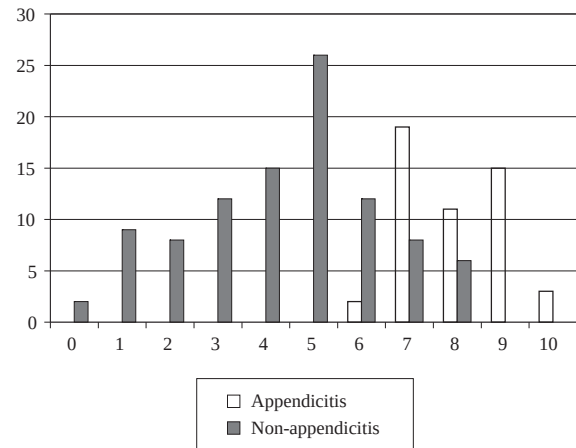


Fig. 1. Number of patients with or without appendicitis and their respective Alvarado score.

or more, although they were equally distributed within the range of 7 to 10 (30%, 20%, 30%, 20%, respectively). In the group of patients with scores of 5 to 6, 2 of 40 (5%) patients had appendicitis. These 2 patients had a score of 6 and an inflamed retrocaecal appendix was found during operation. All 46 patients with scores of 4 or less did not require surgery (Fig. 1). The positive predictive value of the Alvarado's score (7 and above) was 77%, while its negative predictive value was 97.6%.

Patients who were discharged without operation were reviewed in the clinic and none had further symptoms requiring surgery.

Discussion

Appendicitis remains a diagnostic problem in some patients. The normal appendicectomy rate varies between 5% and 35% in various institutions and is inversely proportional to the perforation rate.⁸ Imaging modalities such as ultrasound and CT scan of the abdomen have been used to establish an accurate preoperative diagnosis,^{3,4} but the drawbacks are exposure to radiation and the lack of availability of 24-hour radiological service. Diagnostic laparoscopy has also been investigated as a possible alternative to reduce unnecessary appendicectomies. Studies have shown that it is safe and can reduce unnecessary appendicectomies, especially in females.^{5,6} However, one author questioned the widespread use of diagnostic laparoscopy due to its invasiveness.¹

The Alvarado score, first reported in 1986, is a simple scoring system that incorporates symptoms, signs and an easily available blood investigation. Patients are divided into 3 groups, a score of 0 to 4 is considered very unlikely to have acute appendicitis, a score of 5 to 6 indicates a diagnosis compatible with appendicitis while a score of more than 7 is considered to have almost definite acute appendicitis.

TABLE II: FINAL DIAGNOSIS OF 148 PATIENTS ADMITTED FOR SUSPECTED APPENDICITIS

Diagnosis	Male	Female	Total
Appendicitis	32 (30)	8 (21)	40 (27)
Perforated appendix	9 (8)	1 (2)	10 (7)
Gastroenteritis	13 (12)	3 (7)	16 (11)
Urinary pathology	6 (6)	5 (12)	11 (8)
Diverticulitis	6 (6)	0	6 (4)
Gynaecological causes	-	7 (17)	7 (5)
Viral fever	4 (4)	0	4 (2)
Others	2 (2)	1 (2)	3 (2)
Non-specific abdominal pain	35 (32)	16 (39)	51 (34)

Values in parentheses are percentages

TABLE III: ALVARADO SCORE IN NORMAL APPENDICECTOMY

Diagnosis	Alvarado score
Diverticulitis	5 ; 5 ; 5 ; 5 ; 7 ; 7
Perforated peptic ulcer	8
Pelvic inflammatory disease	4 ; 6 ; 8
Urinary tract infection	6
Non-specific abdominal pain	6 ; 7

Our result seems to support the findings of other investigators, i.e., the Alvarado score may be a useful adjunct in the management of right iliac fossa pain.⁹⁻¹¹ As in most scales, it appears to be most useful at both ends of the scale. When the initial Alvarado score was less than 5, none of our patients had acute appendicitis; while the group of patients with scores of 9 to 10 had appendicitis. The group of patients with intermediate scores (5 to 6) had a 5% probability of appendicitis. This suggests that this group of patients may be placed under observation, and surgical intervention instituted if their condition worsens. Furthermore, diagnostic laparoscopy was a useful adjunct in these patients. In the group of patients with scores of 7 to 8, a large number of patients did not need surgery—the decision was made after other investigations and careful observation. This is similar to the conclusion reached by Izicki et al¹² that scoring systems cannot be substituted for an experienced surgeon's judgement. Another shortcoming of the score appears to be its inability to differentiate between early or late (perforated) stages of appendicitis; although all cases with perforation in this study had scores of 7 and above.

Interestingly, the Alvarado score for patients with diverticulitis seems to be lower than appendicitis in this study; hence, further studies are needed to look into this.

The Alvarado score may be a helpful guide to the admitting physician. None of the patients with a score below 5 needed surgery. This finding is similar to Owen et al⁹ who reported no perforations amongst their group of patients with an admission score of less than 6 who were observed for the first 24 hours. For this reason, the author suggested that the Alvarado score could be used safely by the general practitioners in deciding whether a hospital referral is needed for the patient.

Conclusion

The Alvarado score is shown to have a high sensitivity in predicting appendicitis. It can be used as an adjunct in the management of right iliac fossa pain, especially at both ends of the scale. It provides the clinician with an objective scale to predict for appendicitis although other selective investigations may be required. It may be most useful for

doctors in the primary health care and emergency room to help them decide if a patient requires hospitalisation. However, as the disease may progress quickly from the early stage to its established form, the symptoms and signs may change and patients that are not admitted should be reviewed within 24 hours for re-evaluation. As this study was performed on inpatients, we are conducting further studies in the emergency-room setting to evaluate its clinical use for outpatient care.

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