Alvarado score as an admission criterion in children with pain in right iliac fossa

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ABSTRACT

Background: Acute appendicitis is an important differential diagnosis in children with pain in the right iliac fossa. Some patients have equivocal signs that make the diagnosis difficult. Many patients with suspected acute appendicitis are admitted for observation and finally discharged because they did not have appendicitis. We decided to design this study to investigate whether the Alvarado score could be used by emergency room doctors as a criterion for admission to hospital. **Patients and Methods:** This is a prospective study comprising 350 patients who attended the emergency department with suspected acute appendicitis in the period from May 2007 to April 2009. All patients were scored by Alvarado score in the emergency department before admission. The Alvarado score is based on three symptoms, three signs and two laboratory findings. The decision for admission and surgery was made independent of the score. The diagnosis of patients who underwent appendicectomy was confirmed by both operative findings and postoperative histopathology. **Results:** We studied the Alvarado scores of 350 patients who presented to the emergency department with pain in the right iliac fossa; their age ranged from 8 to 14 years; 182 patients (52%) operated with the aim to treat acute appendicitis, 168 patients (48%) were discharged without surgical intervention and advised to attend the out-patient clinic after 24 hours for re-evaluation. we have found that patients with a low Alvarado score (less than 6) did not have acute appendicitis. **Conclusion:** Patients with equivocal signs can present a diagnostic challenge and are very often admitted to the surgical department for observation. The Alvarado score can be used as a scoring system that help in taking the decision for admission of cases with suspected acute appendicitis especially by primary healthcare providers.

Key words: Acute appendicitis in children, Alvarado score

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INTRODUCTION

The classical Sings and symptoms of acute appendicitis were first reported by Fitz in 1886.[1] Acute appendicitis remained the most common diagnosis for hospital admission requiring laparotomy.[2,3] Appendicitis is the most common abdominal condition requiring surgery in children accounting for over 320,000 operations per year in the United States.[4] The diagnosis of acute appendicitis in children remains challenging, occasionally taxing the diagnostic skills of even the most experienced surgeon because not all patients present with the classic symptoms. It is also more difficult to obtain a clear history in children. Furthermore, many disorders in the gastrointestinal tract can mimic acute appendicitis.[5] So the diagnosis of acute appendicitis can be difficult, especially in equivocal cases that present a diagnostic challenge and usually require admission and inpatient observation. As a consequence, the management of appendicitis consumes an enormous amount of healthcare resources and accounts for most of the hospital days spent among children.[6,7] Hospital charges for treatment of this surgical disease have been estimated conservatively in excess of three billion dollars annually within the United States. Not surprisingly, cost-containment efforts in many institutions target this group of patients.[8]

Various scoring systems such as Madan score, Ohmann score, Eskelinen score, DeDombal score and Alvarado score have been devised to aid diagnosis of acute appendicitis.[9] The Alvarado score is the most well known and best performing in validation studies.[10] Alvarado score was described in 1986 and has been validated in children surgical practice.[11] Alvarado followed up patients admitted to surgical unit at the Nazareth Hospital in Philadelphia with suspected acute appendicitis, until surgery confirmed or refuted diagnosis. He found that eight criteria had high diagnostic accuracy for acute appendicitis.[12]

This study aims to evaluate whether the Alvarado score can be used in emergency room as a criterion helps the emergency doctors to take the decision of admission or

discharge cases with query acute appendicitis.

PATIENTS AND METHODS

This prospective study was carried out at the Paediatric Surgery unit, Zagazig University Hospitals, Egypt and Edawdmy General Hospital Saudia Arabia in the period from 2007 to 2009. The study comprising all children attended the emergency department with suspected acute appendicitis during this period, their ages ranged from 8 to 14 years [Table 1]. All patients were evaluated using the Alvarado score in the emergency room before admission. The decision of admission and surgery was made independent of the results of the applied score. The classical Alvarado score is based on three symptoms, three signs and two laboratory finding as shown in [Table 2]. Finally the scores were subsequently correlated with clinical, operative and histopathological findings of the removed appendices [Table 3].

Table 1: Patient characteristics

Number of patients	350
Age (in years)	8-14
Sex	
Male	228 (56.1%)
female	122 (34.9%)

Table 2: Alvarado scoring system

Symptoms	Score
Migratory right iliac fossa pain	1
Nausea, vomiting	1
Anorexia	1
Signs	
Tenderness in right iliac fossa	2
Rebound tenderness in right iliac fossa	1
Elevated temperature 37.3^{0}c	1
Laboratory findings	
Leucocytosis	2
Shift to the left of neutrophils 75%	1
Total	10

RESULTS

Three hundred and fifty patients were admitted with clinical features suggestive of acute appendicitis. The mean age was 9.3 years (ranged from 8 to 14 years); 182 patients (52%) were operated on with to treat acute appendicitis, 132 of them (72.5%) had inflamed appendices, which proved during surgery and by histopathological examination, in the remaining 50 patients (27.4%) that appendices were normal [Table 4]. A total of 168 patients (48%) were discharged without surgical intervention and advised to attend the out-patient clinic after 24 hours for re-evaluation and those who did not attend the outpatient clinic were contacted by telephone. None of the discharged patients required re admission as their symptoms improved or they developed other specific symptoms and diagnosed as gastroenteritis or acute tonsillitis.

DISCUSSION

Acute appendicitis is a common surgical emergency that the emergency physician faces. It causes a problem when the patient presents with pain in right iliac fossa with equivocal signs. In such questionable cases the decision making for admission or discharge of these patients is always difficult, especially if the examining doctor is a junior staff with little experience.[13] Although there has been some improvement in the diagnosis of acute appendicitis over the paste several decades, the percentage of normal appendices reported in various series varies from 8–33%.[14,15] The Alvarado score, is a simple scoring system that can be instituted easily in out-patient setting to decrease high false-positive

Table 3: Alvarado scoring distribution among all admitted patients compared to final outcome

Alvarado score	1	2	3	4	5	6	7	8	9	10	Total
Operated patients	0	0	0	0	0	31	51	63	32	5	182
Discharged patients without surgery	0	3	25	42	70	28	0	0	0	0	168
Total	0	3	25	42	70	59	51	63	32	5	350

With Cut off at score of 6 (either > 6 or ≤ 6), Sensitivity will be 100%, Specificity will be 84.4%, positive predictive value of 83% and negative predictive value of 100% and accuracy of 91.1%.

Table 4: Distribution of proven acute appendicitis among operated patients in relation to Alvarado score

Alvarado score	1	2	3	4	5	6	7	8	9	10
Operated Patients (n=182)	0	0	0	0	0	31	51	63	32	5
Proved acute appendicitis (n=132)	0	0	0	0	0	18	33	49	27	5
%			Zero			58.1	64.7	77.8	84.4	100

With cut off at score of 6 (either > 6 or ≤ 6), sensitivity will be 86.4%, specificity will be 26%, positive predictive value of 75.5% and negative predictive value of 41.9% and total accuracy of 69.8%.

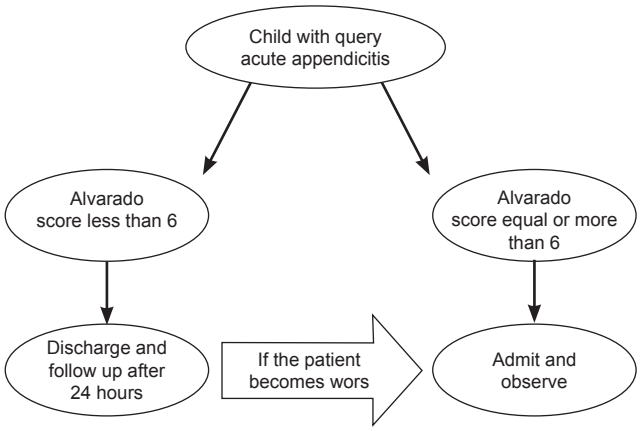


Figure 1: Algorithm to use Alvarado score as an objective criterion for admission to the paediatric surgical department

appendectomy. In a prospective study of children in Gradiff, use of Alvarado score decreased an unusually high false-positive appendectomy of 44-14%.[16] These results match with our statistics as with cut off at score of 6 (either > 6 or ≤ 6), sensitivity will be 86.4%, specificity will be 26%, positive predictive value of 75.5% and negative predictive value of 41.9% and total accuracy of 69.8% [Table 4].

This study is designed to evaluate the use of Alvarado score as an objective criterion that helps the emergency doctor to take the decision regarding patient admission. According to this study, no patients with a score below 6 had acute appendicitis; these results are nearly similar to other studies.[13] Statistical analysis of our results proved that with cut off at score of 6 (either > 6 or ≤ 6), sensitivity will be 100%, specificity will be 84.4%, positive predictive value of 83% and negative predictive value of 100% and accuracy of 91.1%.

According to our results if the Alvarado score was used as an admission criterion, 40 (48%) patients who were admitted could have been observed as out-patient with reduction of admission rate and cost.

CONCLUSION

The Alvarado score can be used as an objective criterion to help the emergency room doctor in taking the decision regarding admission or discharge of the patients with query acute appendicitis [Figure 1]. If this criterion is applied, the discharged patients are instructed to attend the out-patient clinic after 24 hours for follow-up and re-evaluation.

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