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Original research article

Alvarado scoring systems in evaluating suspected cases of acute appendicitis

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Abstract
No perfect diagnostic evaluation tool exists to detect appendicitis if symptoms are ambiguous. If symptoms are vague diagnostic process takes longer, thus delaying surgery increasing the possibility of complications. On the other hand, hasty operation without accurate diagnosis will lead to negative appendectomy, increasing the morbidity and cost of treatment. In this study, over a period of one year,100 patients presenting with pain in the right lower quadrant of abdomen, who after clinical examination were provisionally diagnosed to have acute appendicitis and warranting surgery for the same were evaluated using the scoring system – Alvarado Score. Alvarado diagnosed 75 patients as acute appendicitis (at score>4) of which 5 cases were false positive ones. Alvarado ruled out acute appendicitis (at score≤4) in 25 individuals of which 19 were false negative ones. Alvarado score (at score >8) correctly diagnosed in 19 individuals with zero false positive cases.
Keywords: Alvarado scoring system,acute appendicitis, abdominal emergency

Introduction
Reginald Fitz from Boston first identified appendixas cause of right lower quadrant pain. He coined the term appendicitis and recommended early surgery intervention.
Robert Lawson performed first appendectomy in England [1].
Now 130 years later, acute appendicitis still remains one of the most common abdominal emergency, demanding surgery. Mortality rate has improved since advent of antibiotics in 1940.
No perfect diagnostic evaluation tool exists to detect appendicitis if symptoms are ambiguous. If symptoms are vague diagnostic process takes longer, thus delaying surgery increasing the possibility of complications.
On the other hand, hasty operation without accurate diagnosis will lead to negative appendectomy, increasing the morbidity and cost of treatment [2, 3].
With the advent of modern diagnostic tools, misdiagnosis of appendicitis has remained constant. The percentage of misdiagnosis is higher among women than men.
Diagnostic approaches include symptoms, physical examinations, labarotory findings and imaging modality like ultrasonography and computerized tomography(CT) of abdomen.
Although with the advent of ultrasound has improved the diagnosis of appendicitis, it is highly operator dependant. The abdominal CTcarries risk of radiation exposure and also increases the cost[4].
Many surgeons tend to rely on abdominal ultrasound or CT examination for objective diagnosis.
Many scoring systems have been designed for diagnosis of acute appendicitis.
Among those systems, Alvarado system being simple to apply and efficacious [5, 6].
The Alvarado score-a scoring system for diagnosing appendicitis uses eight variables with total of 10 points.

Methodology
In this study, over a period of one year,100 patients presenting with pain in the right lower quadrant of abdomen, who after clinical examination were provisionally diagnosed to have acute appendicitis and warranting surgery for the same were evaluated using the scoring system-Alvarado Score.
The study was conducted on the patients presenting with clinical features suggestive of acute appendicitis admitted in surgical wards.

Inclusion criteria
- Patients with provisional clinical diagnosis of acute appendicitis.

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Exclusion criteria

- Patients presenting with non-right iliac fossa pain and those who had been admitted by other specialities for other complaints but subsequently developed right iliac fossa pain.

Sample Size

A total of 100cases of suspected acute appendicitis who were admitted, investigated and treated were taken for the study. After detailed examination and investigations

Alvarado Score

This system consisits of 4-symptoms, 1-sign, 3-labarotory findings.

Alvarado score	
Nausea or vomiting	1
Anorexia	1
Pain in right lower quadrant	2
Migration of pain to right lower quadrant	1
Rebound tenderness	1
Body temperature>37.5 C	1
Leukocytosis shift	1
WBC count >10000/cumm	2

Results

Table 1: Alvarado with HPR

Score	AA	CA	Total
>4	70	5	75
≤4	19	6	25
Total	89	11	100

Alvarado diagnosed 75 patients as acute appendicitis (at score>4) of which 5 cases were false positive ones. Alvarado ruled out acute appendicitis (at score≤4) in 25 individuals of which 19 were false negative ones.

Table 2: Alvarado with HPR

Score	AA	CA	Total
>8	19	0	19
≤8	70	11	81
Total	89	11	100

Alvarado score (at score >8) correctly diagnosed in 19 individuals with zero false positive cases.

Discussion

The Alvarado was first reported in 1986. It was based on several variables found in 305 patients with acute appendicitis. Other variantions exist but do not differ much [7].

Use of Alvarado like scoring system was evaluated in large German study. The scoring system consisted of eight variables. The scoring system also did not include C-reactive protein and it found no significant difference in negative appendectomy rates [8].

More recently a AIR-like scoring system was developed by Sammalkorpi*et al*.[9]. The scoring system also included C-reactive protein was evaluated. It demonstrated a sensitivity of 95% and specificity of 54% respectively.

Anorexia was the most common symptom in the present study. It is said that the sequence of appendicitis that is anorexia, followed by pain, in turn followed by vomiting in present in more than 95% individuals. if vomiting preceeds the onset of pain the diagnosis of acute appendicitis should be questioned.

Rebound tenderness was demonstrated in 75% individuals in the present study which was comparable with the studies of Bin Soo Kim *et al*.[10](68%). It is a simple test that does not need lot of experience to perform or interpret. Lawrie considers it a "popular and somewhat unkind way of emphasizing what is already obvious".

C-reactive Protein demonstrated a sensitivity of 92% and specificity of 45.5% in the present study. A recent meta-analysis has shown that there is fivefold increase in the positive likelihood ratio for acute appendicitis when both WBC count and C-reactive protein are elevated [11].

Ultrasound is a safe, radiation-free method. In a review of graded compression US in the diagnostics of acute appendicitis the mean respective sensitivities and specificities of ultrasound were 78% and 83%.

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Ultasound demonstrated a sensitivity of 86.5% and specificity of 72.7% which was comparable with study conducted by Al-Ajerami[12], which demonstrated a sensitivity of 84.8% but a higher specificity of 83.3%.

Conclusion

- At score >4 Alvarado demonstrated a sensitivity of 78.6% and specificity of 54.5%.
- At score >8 Alvarado demonstrated a sensitivity of 21.3% and specificity of 100%.

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