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# ALVARADO SCORE IN DIAGNOSIS OF ACUTE APPENDICITIS

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## ABSTRACT

Acute appendicitis is a common surgical emergency. In acute appendicitis it is not possible to have definitive diagnosis by gold standard test (histopathology) preoperatively, we would like a simple test like Alvarado scoring system which depends on the presence and absence of certain variable and which provide an accurate guide to whether or not the patient has the condition. Accurate diagnosis and timely intervention reduces mortality and morbidity. Present study was conducted to evaluate Alvarado scoring system to diagnosis of acute appendicitis and its co relation by histopathology in our set up.

A retrospective study of 164 patients who presented to emergency department with right lower abdominal pain with suspected appendicitis for the last 8 month was reviewed. Patient demographics, presenting sign, and symptoms were documented. Using the scoring symptom for appendicitis, developed by Alvarado, each chart was retrospectively scored. Alvarado scores were correlated with pathological finding. Patients were categorized into three groups, score ≥7,≤6 and ≤3; as it standard to label those patients with a score ≥7 as diagnostic of appendicitis, score≤6 as doubtful but potential candidates suffering from the disease and score ≤3 unlikely to suffer from the condition. And finally we tried to find out the sensitivity, specificity, positive predictive value, negative predictive value and accuracy in order to assess the reliability of Alvarado scoring system.

Out of 121 eligible patients 47 patients was found to have acute appendicitis by histopathological examination. The overall sensitivity was 59.57%, and the specificity was 85.13%, while the positive predictive value was 71.79%, and negative predictive value was 76.82% .the overall accuracy was 75.2%. Although the diagnosis of acute appendicitis remains mainly clinical evaluation, the scoring system is easy, simple and cheap complementary aid for supporting the diagnosis of acute appendicitis.

*Key Words: Alvarado Score, Abdominal Pain, Acute Appendicitis*

## INTRODUCTION

Acute abdominal pain is one of the commonest surgical emergencies. Emergency physician may find it difficult to diagnose acute appendicitis based on clinical ground alone. (Chan, 2003)  scoring system used as a diagnostic tool may help to determine earlier and more convincingly the group of patients who will require further investigation, observation or urgent surgery (Liu et al., 2006). Clinical scoring systems are good supporting tool for diagnosing acute appendicitis because the simple, easy to use, and noninvasive to use in clinical routine practice, requiring no special equipment. In this respect, several scoring systems, computer models and algorithms have been developed for supporting the diagnosis of acute appendicitis ( Christian, 1992, Eskelinen, 1992).One such scoring system is Alvarado score, which is based on analysis of symptoms, sign and laboratory data and is easy to apply(Alvarado, 1986). Good diagnostic validity of Alvarado score has been reported in diagnosing acute appendicitis (Chan, 2001). Although some reports have found that the Alvarado score alone is inadequate as a single diagnostic test (Ohman, 1995) and the Alvarado score showed poor result in assessment of women, children, and elderly patient (Al-Hashemy 2004) it has also been advocated as a tool to identify patients who should undergo imaging study or active

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observation (Douglas 2003). The purpose of this study is to evaluate the accuracy of Alvarado score in predicting acute appendicitis in our setup.

## MATERIALS AND METHODS

This retrospective study was conducted in a 1500 bedded tertiary care teaching hospital in Saudi Arabia. The present investigation included patients who presented to emergency department between June 2011 to January 2012 with right lower quadrant pain who were suspected to having acute appendicitis. A total of 164 patient charts were reviewed that met inclusion criteria.

The pro forma containing demographics, presenting signs, and symptoms were documented. The patient s 3symptoms, 3signs, and 2 laboratory indicators of appendicitis recorded, according to Alvarado score for appendicitis. (Table 1)

The patients were further divided into 3  group, score ≥7, ≤6and ≤3. As it standard to label those patients with a score≥7 as diagnostic (high probability), score≤6 as doubtful ( equivocal) but potential candidates suffering from the disease and score ≤3 unlikely(low probability) to suffer from disease. Further they were classified into 2 group: group 1 clinically typical (Alvarado score ≥7), group 2 clinically doubtful (Alvarado score≤6).The patients who has typical clinical presentation of appendicitis were operated without CT scan .But in the patient where the presentation was atypical or nonspecific, CT scan was done with intravenous and oral contrast. If the appendectomy or surgical intervention was performed, all appendices and other specimens were submitted to pathology department. Official radiology reports, surgical pathology report, and medical records were reviewed retrospectively. Patients were excluded if lost to follow up or transferred to other hospital. Other alternative diagnosis was recorded. If  acute appendicitis was considered unlikely and no other acute etiology was found , patients were discharged with discharge instruction to come back if symptom worsen. With appropriate followup statistical analysis was performed using statistical package for the social science software (SPSS version 17). The sensitivity, specificity, negative predictive value, positive predictive value and accuracy were calculated.

## RESULTS

The study began with retrieval of 164 patients who presented to emergency department with right lower quadrant pain. 43 were excluded because they were transferred to other hospital after making the diagnosis of appendicitis because non availability of bed in surgical ward.2 were discharged against medical advice, and follow up was lost of these patents. Total of 121 patients was included in the study, which comprised of 55 male (45.5%) and 66 female (54.5%) . mean age 28.14 years in a range of 12to 74 years with a median of 26 years.

After calculating Alvarado score 39 patients were found to have Alvarado score ≥7 (high probability group), of which 28 were found to have acute appendicitis (71.79%). While 47 patients were found to have Alvarado score between 4 to 6 (equivocal group), of which 16 patients were found to have acute appendicitis (34.04%). In 35 patients of low probability group (Alvarado score ≤3), 3 patients was find to have acute appendicitis(8.57%).[table number 2] . patients with Alvarado scores 7 or higher had an incidence of acute appendicitis of 71.79%(28/39) and patients with Alvarado scores of less than 7  has incidence of 23.17%(19/82) of acute appendicitis. [4]

The sensitivity and specificity were 59.57% and 85.13% whereas the positive and negative predictive values were 71.79% and 76.82% and over all accuracy of Alvarado score was 75.2%.[table number 4]

## DISCUSSION

Acute appendicitis is the most common acute surgical condition of the abdomen .over past 100 years, morbidity and mortality rates related to the condition have markedly decreased.

Various scoring systems are being used to aid the diagnosis of acute appendicitis and bring down the negative appendectomy rates. In 1986 A. Alvarado published 8 predictive factors, which he found to be useful in making the diagnosis of acute appendicitis (Alvarado 1986).since then there have been various

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studies, trying to validate the utility of this simple scoring system(Christian1992, Eskelinen 1992 ) The Alvarado scoring system was identified as a useful clinical tool because it is readily available, extremely affordable, and relatively accurate .The aim in

**Table 1: Alvarado Score As An Aid For Diagnosing Acute Appendicitis**

| Characteristics | Score |
|---|---|
| 3 symptoms | |
| Migration of pain to the right lower quadrant | 1 |
| Nausea and vomiting | 1 |
| Anorexia | 1 |
| 3 signs | |
| Tenderness in right iliac fossa | 2 |
| Rebound tenderness in right iliac fossa | 1 |
| Elevated temperature | 1 |
| 2 laboratory finding | |
| Leukocytosis | 2 |
| Shift to left of Neutrophils | 1 |
| **Total** | **10** |

*Interpretations of Alvarado Score*
*Score 1-3 very unlikely acute appendicitis*
*Score 4-6 probable (equivocal) acute appendicitis*
*Score 7 -10 definitely (high probable) acute appendicitis*

**Table 2: ALVARADO * DIAGNOSIS Cross tabulation**

| Count | | | | |
|---|---|---|---|---|
| | | DIAGNOSIS | | Total |
| | | ACUTE APPENDICITIS | NORMAL APPENDIX | |
| ALVARADO | EQUIVOCAL | 16 | 31 | 47 |
| | HIGH PROBABLITY | 28 | 11 | 39 |
| | LOW PROBABLITY | 3 | 32 | 35 |
| Total | | 47 | 74 | 121 |

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**Table 3: Chi-Square Tests**

|  | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 31.784[a] | 2 | .000 |
| Likelihood Ratio | 34.506 | 2 | .000 |
| N of Valid Cases | 121 |  |  |

*a. 0 cells (.0%) have expected count less than 5.*
*The minimum expected count is 13.60.*

**Table 4: ALVARDO * DIAGNOSIS Cross tabulation**

| Count |  | DIAGNOSIS | |  |
|---|---|---|---|---|
|  |  | ACUTE APPENDICITIS | NORMAL APPENDIX | Total |
| ALVARDO | SCORE>7 | 28 | 11 | 39 |
|  | SCORE <7 | 19 | 63 | 82 |
| Total |  | 47 | 74 | 121 |

**Table 5: Chi-Square Tests**

|  | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 26.305[a] | 1 | .000 |  |  |
| Continuity Correction | 24.298 | 1 | .000 |  |  |
| Likelihood Ratio | 26.487 | 1 | .000 |  |  |
| Fisher's Exact Test |  |  |  | .000 | .000 |
| N of Valid Cases | 121 |  |  |  |  |

*a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 15.15.*
*b. Computed only for a 2x2 table*

the emergency setting is to have a screening tool with high sensitivity because one would not want to miss acute appendicitis, as it is treatable disease by relatively uncomplicated surgical procedures.
The Alvarado score has been shown to provide variable values of diagnostic performance. Sensitivity, 87% to 95.4%; specificity , 45% to 84%; positive predictive value , 77% to 93% and negative predictive value of 72.4% to 97.6% in various studies (Chan2001, Crnogorac, 2001; Gwynn, 2001; Khan, 2005; and Denizbassi, 2003 ).

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In our study we found the sensitivity of 59.57%, specificity of 85.13%, positive predictive value of 71.79%, and negative predictive value of 76.82% .and accuracy of 75.2%.

Our present study has several limitations due to inherent flaws of retrospective study. Our study comprised a review of patients' medical records and pathological reports. Retrospective nature of the study may limit the diagnostic performance of Alvarado score and CT scan. There was possibility bias due to different CT methodology and limitation to one institution.

 clinical implication of the present result are that the Alvarado  score should be supplemented with CT examination for accurate diagnosis of acute appendicitis in all man and woman patients who are suspected of acute appendicitis because of low sensitivity  of the Alvarado score specially in females.

The diagnosis of acute appendicitis depends on experience and clinical judgment. The diagnosis of acute appendicitis remains a challenging task for surgeons. Alvarado scoring system is a non-invasive, safe diagnostic procedure that is simple, fast, cheap and reliable. It is applied purposefully and objectively in the patients of abdominal emergencies. The application of this scoring system improves diagnostic accuracy and consequently reduces complication rate. Moreover, Alvarado score can be used as an objective criterion in screening patients with suspected appendicitis for admission.

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