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Comparative Analysis of Alvarado Score with Appendicitis Inflammatory Response Score in Diagnosis of Acute Appendicitis

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Abstract

Background and Aim: The lifetime risk of appendicitis is 9.4% for males and 7.2% for females. The diagnosis of appendicitis is essentially clinical and as such it remains an enigmatic challenge and a reminder of the art of surgical diagnosis. This study tries to evaluate the AIR score and compare it with Alvarado score on patients undergoing open appendectomy.

Materials and Methods: The present study included 250 patients with acute appendicitis undergoing open appendectomy. The population consisted of patients above 20 years of age who complained of abdominal pain clinically presumed to be of appendicular origin and supported by imaging studies. The diagnosis of appendicitis was confirmed histologically in all resected specimens. Sensitivity, specificity, PPV and NPV were calculated for both the scores at various cutoff points to define diagnostic zones.

Results: In our study AIR score of > 4 gave sensitivity of 91.40 % for all appendicitis and 96.51% for advanced appendicitis. In our study specificity of AIR score > 4 was found to be 79.72% for all appendicitis and 86.45% for advanced appendicitis. In our study sensitivity of Alvarado score ≥5 was found to be 86.21% and specificity was found to be **54.87**% that translates to a positive predictive value of 96.41%. Sensitivity of Alvarado score 7 – 10 was found to be 70.65 %, specificity to be 70% to a corresponding positive predictive value of 92.48 %.

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Conclusion: Appendicitis Inflammatory Response Score has high specificity at an AIR score of more than 8 in the diagnosis of acute appendicitis. Thus patients with AIR score > 8 can undergo appendectomy without the need for imaging studies. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendectomy rate.
Keywords: AIR score, Alvarado score, Acute appendicitis, Histopathology

Introduction

Appendicectomy is the most frequently performed urgent abdominal surgery and is often the first major procedure performed by a surgeon in training. The lifetime risk of developing appendicitis is 8.6% for males and 6.7% for females, with the highest incidence in the second and third decades.[1] The diagnosis of appendicitis is essentially clinical, requiring a mixture of observation, clinical acumen and surgical science and as such it remains an enigmatic challenge and a reminder of the art of surgical diagnosis. Prompt treatment is required to avoid the substantial morbidity associated with perforation.[2, 3]

Acute appendicitis most often presents with a vague pain which begins in the centre of the abdomen. At first this is often thought to be indigestion and ignored, but after a varying period, usually a few hours but sometime 2–3 days, the pain shifts to the right iliac fossa and becomes more severe.[4] This 'typical' history is almost diagnostic of appendicitis but only occurs in about half the patients. The remainder present with a variety of patterns of pain.[3, 5]

A clinical scoring system estimates the probability of appendicitis in a patient and aids in the decision making and may be used as a tool to select patients for immediate surgery, for further evaluation or observation. Alvarado score is the most well known and best performing in validation studies, but it was based on a review of patients who had been operated with suspicion of appendicitis, whereas the score is supposed to be used on all patients with suspicion of appendicitis.[6]

In spite of the common nature of the condition and the innumerable studies done, the etiological factors leading up to the condition of appendicitis still remains unknown and obscure. Universally, it had been rare prior to the adoption of the western way of living. It has been observed that over the years, appendicitis has risen from being an insignificant disease to the most common serious intra-abdominal inflammatory pathology of the western civilized areas, and this has been a matter of much speculation.[7]

Acute appendicitis begins within the mucosa. The earliest change is margination of mucosal capillary channels with neutrophils which migrate into the lamina propria. These migrate beneath and into the surface epithelium, causing initially erosion; into adjacent crypts, forming crypt abscesses and ulcers that resemble aphthoid ulcers; and into lymphoid follicles, causing deep suppuration[7, 8]

The Appendicitis Inflammatory Response Score resembles the Alvarado score but uses more graded variables and includes CRP. Studies have shown it to perform better than the Alvarado score in accurately predicting appendicitis. This study tries to prospectively evaluate the

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Appendicitis Inflammatory Response score and compare it with Alvarado score on a cohort of patients with suspicion of acute appendicitis attending Medical College and Hospitals.

Material and Methods

Source of data:

Patients presenting with right lower abdominal pain with clinical suspicion of acute appendicitis admitted in hospitals attached to Medical College and admitted for the surgery for appendectomy.

Methods of collection of data:

The present study is the prospective observational study done for the period of two years. It is the hospital based study that included around 250 patients. The patients who fulfilled the inclusion and exclusion criteria were included in the study.

Inclusion criteria:

1. Patients who have given written informed consent
2. Patients of either sex aged above 18 years.
3. Acute pain in right lower quadrant clinically presumed to be of appendicular origin.
4. Patients undergoing surgery for appendectomy.

F. **Exclusion criteria:**

1. Patients who refused to participate in the study.
2. Patient with other pre existing ileocaecal pathology like tuberculosis or malignancy.
3. Patient who refused for surgery.

G. **Methodology:**

In patients of hospitals with clinical suspicion of acute appendicitis fulfilling the inclusion/exclusion criteria were included into the study after obtaining written informed consent. A prestructured proforma was used to collect relevant information from all the selected patients. Alvarado score and Appendicitis inflammatory response score was applied on these patients undergoing surgery.

Initially a senior surgical resident examined the patient and the decision to operate was subsequently confirmed by senior surgical staff member. Imaging by means of transabdominal ultrasonography (USG) or contrast enhanced computed tomography abdomen (CECT) was used selectively at the discretion of the surgeon.

Open emergency appendicectomy was performed after confirmation by the senior surgical staff member. The diagnosis of appendicitis will be confirmed by histopathological examination of all appendicectomy specimens.

Data collected was entered in MS excel woksheets. Statistical analysis was performed with XLSTAT software in MS excel sheets. A p value of < 0.05 was considered to be statistically significant. Sensitivity, specificity, positive predictive value and negative predictive value were calculated for both the scores at various cutoff points to define diagnostic zones. To compare the diagnostic performance characteristics of Alvarado score and Appendicitis Inflammatory Response Score area under receiver operating characteristics curve was used.

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Results

The present is the hospital based study conducted in the hospital attached to medical college for the period of the two years. A total of 250 patients fulfilling inclusion and exclusion criteria were included in the study. Out of 250 patients who underwent surgery, 218 patients had pathologically proven acute appendicitis defined by infiltration of muscularis propria by neutrophils. Out of 250 patients included in the study 32 had normal appendix on histopathological examination. Scoring systems were applied to these 250 patients who were included in the study and underwent surgery.

Gender distribution:

In this study, 158 patients were males and there were 92 females. In this study, patients in the age group 20 – 70 were included. Mean age of the patients in the study was found to be 33 ± 8.10 years. In this study maximum numbers of patients were in second and third decade of life. There were 38 % of the patients that belongs to 20 - 30 years age group, followed by 33% belonging to 30 - 40 years age group, while only 292% belonged to the age group above 45 years.

For analysis of AIR score we defined two cut off points. Score > 4 to obtain sensitivity for appendicitis that could to be used to rule out appendicitis (if Score ≤ 4) and score > 8 to obtain a specificity that could be used to rule in appendicitis. In our study AIR score of > 4 gave sensitivity of 91.40 % for all appendicitis and 96.51% for advanced appendicitis. In our study specificity of AIR score > 4 was found to be 79.72% for all appendicitis and 86.45% for advanced appendicitis. For AIR score >8 it was 100% translating to a positive predictive value of 100% for score >8.

In our study sensitivity of Alvarado score ≥5 was found to be 86.21% and specificity was found to be **54.87**% that translates to a positive predictive value of 96.41%. Sensitivity of Alvarado score 7 – 10 was found to be 70.65 %, specificity to be 70% to a corresponding positive predictive value of 92.48 %.

Table 1: Distribution of patients according to Alvarado score

	No. of patients	1 - 4	5 - 6	7 – 10
Males	158	26	18	114
Females	92	8	4	80
Total	250	34	22	194

Table 2: Analysis of Alvarado score

Alvarado score	**Score 1- 5**	**Score 6 - 10**
Sensitivity	86.51	70.65
Specificity	54.87	74.25
Positive predictive value	96.41	92.48
Negative predictive value	44.65	22.45

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Discussion

The study was undertaken to evaluate the usefulness of Appendicitis Inflammatory Response Score in reducing number of negative appendectomy and to evaluate its sensitivity, specificity and positive predictive value in the diagnosis of acute appendicitis and compare it with that of Alvarado score.

A total of 250 patients fulfilling inclusion and exclusion criteria were included in the study. Out of 250 patients operated, 218 patients had pathologically proven acute appendicitis defined by infiltration of muscularis propria by neutrophils. Scoring systems were applied to these 250 patients who underwent surgery.

In our study specificity of AIR score > 4 was found to be 79.72% for all appendicitis and 86.45% for advanced appendicitis. **de Castro et al (2012)[6]** demonstrated specificity of 85% for all appendicitis and 85% for advanced appendicitis for AIR score >4 which , this being in agreement with the observations of our study. **Malyar et al (2015)[9]** conducted a similar study and found AIR score of >4 gave specificity of 77 % for all appendicitis and 78 % for advanced appendicitis. In our study 32 patients didn't have histopathological diagnosis of acute appendicitis out of which 26 patients had an AIR score <5 and 6 patients had AIR score between 5 and 8 and none had AIR score of more than 8.

This shows AIR score is an effective clinical predictor system to avoid negative appendectomies. In our study sensitivity of Alvarado score ≥5 was found to be 86.21% and specificity was found to be **54.87**% that translates to a positive predictive value of 96.41%. Sensitivity of Alvarado score 7 – 10 was found to be 70.65 %, specificity to be 70% to a corresponding positive predictive value of 92.48 %.

Ohle et al (2011)[10] conducted a large review of forty two studies to assess the diagnostic accuracy of the score at the two cut-off points: score of 5 (1 to 4 vs. 5 to 10) and score of 7 (1 to 6 vs. 7 to 10). The Alvarado score discriminated well as an observation/admission criterion (cut point of 5) by achieving high sensitivity of 99%.

Two cutoff points were defined in AIR score to obtain diagnostic test zones, one with a high sensitivity for appendicitis that could be used to rule out appendicitis, and one with a high specificity for appendicitis that could be used to rule in appendicitis. The results were compared with the corresponding test zones for Alvarado score.

Conclusion

Appendicitis Inflammatory Response Score has high specificity at an AIR score of more than 8 in the diagnosis of acute appendicitis. Thus patients with AIR score > 8 can undergo appendectomy without the need for imaging studies. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendectomy rate.

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