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Original Article

Role of Modified Alvarado Score in the Management of Acute Appendicitis

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Abstract

Introduction: *This study was carried out in Rajshahi Medical College Hospital, Rajshahi to evaluate the role of modified Alvarado score in the diagnosis of acute appendicitis.*

Methods: *It was a cross-sectional study. A total of 227 cases having features of appendicitis, admitted in the surgery unit of Rajshahi medical college hospital, were selected for our study.*

Results*: About 221 (97.4%) of patients complained sudden onset of anorexia. The second leading symptom was nausea and vomiting 214 (94.3%). About 186 (82%) of the patients had history of onset of pain around umbilicus. Pain shifting to right iliac fossa was complained by 78% of the patients. The affected patients exhibited tenderness in right lower quadrant (RLQ), positive cough test, muscle guard/rigidity, rebound tenderness, Rovsing's signs and leukocytosis 220 (96.9%), 215 (94.7%), 215 (94.7%), 210 (92.5%), 206 (90.7%) and 157 (69.2%) were found respectively. The patients with score (8-10) along with history of pain migrating to right iliac fossa and associated with tenderness indicate high possibility of acute appendicitis. While patients with score (1-4) are unlikely to have appendicitis and could be discharged home safely.*

Conclusion: *Modified Alvarado score (8-10) along with history of pain migrating to right iliac fossa and tenderness in right lower quadrant indicate high probability of acute appendicitis and should be operated immediately, while patients with score (1- 4) are unlikely to have appendicitis and could be sent home safely. Patients with score (5- 7) may have variable outcome and further decisions should be taken according to guidelines of disease.*

Key words: *Acute appendicitis, Alvarado score, Rovsing's sign*

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Introduction

Acute appendicitis is a common cause of abdominal pain for which a prompt diagnosis is very essential to reduce both morbidity and mortality.[1] Fitz R,[2] a Harvard pathologist, described first time the classical signs and symptoms of acute appendicitis. It is rare in infancy and old age, but is common in children, teenagers and young adults.[3] Much effort has been directed towards early diagnosis and intervention as approximately 7% of population suffers from this disease during their life time.[4] Delay in the diagnosis definitely increases the morbidity, mortality and the cost of treatment.

In the recent years, to diagnose acute appendicitis and to reduce the incidence of negative appendicectomy without increasing the risk of gut perforation, various scoring systems have been developed to evaluate the patients with suspected acute appendicitis for observation and/or surgery.[5] Many of them are difficult and complex to apply in clinical setting, but the Alvarado Score (after the name of Alfredo Alvarado, an American surgeon) is simple, effective and can easily be applied.[6]

The Alvarado Score was based on a retrospective analysis of 305 patients and subsequently validated by prospective studies in adults.[1] This score comprises 10 points and consists of 3 symptoms, 3 signs and 2 laboratory tests. According to this score patients are categorized into 4 groups and patients with score 9-10 are considered cases of acute appendicitis with high probability.

Several modifications were done in Alvarado score, but Al-Fallouji MAR[7] has modified the Alvarado score into a more practical, reliable and easy for junior doctors. The modified Alvarado score was based on a prospective assessment of appendicitis patients to design a more clinically oriented and more practical score. Improvement in clinical performance with their use has increased the diagnostic accuracy from 58% to 78% with a drop in perforation rate from 27% to 1.25%.[8] This study was carried out with an aim to evaluate acute appendicitis by using modified Alvarado score to increase diagnostic accuracy and cost effective treatment for the poor patients like those in our country.

Materials and Methods

This cross-sectional study was conducted in the Department of General Surgery, Rajshahi Medical College Hospital, Rajshahi over a period of one year from January to December 2008. Clinically suspected cases of acute appendicitis admitted in the general surgery units of Rajshahi Medical College Hospital, Rajshahi were the study population. A total of 227 cases of suspected acute appendicitis, selected purposively, were included in the study.

Selection criteria for the admitted patients must have fulfilled the criteria likely pain in

the right iliac fossa and/or periumbilical pain, tenderness in right lower abdomen, tenderness in Mcburney's point, and modified Alvarado score with 5 – 10.

Exclusion criteria of the patients of this study were such as those patients aged less than 12 years old, patients with lump or abscess in the right iliac fossa, ultrasonography suggestive of pelvic pathology in female patients and modified Alvarado score having in between 1–4.

The modified Alvarado score (MAS) consists of 3 symptoms, 4 signs and 1 laboratory test were shown in table I. According to this score, patients with score 8-10 were diagnosed as having acute appendicitis and patients with score <8 as probable appendicitis or other acute abdomen cases or normal appendix (Table II). All cases underwent open appendisectomy and the resected specimens were sent for histopathological diagnosis. Then the diagnoses made by MAS were compared against histopathological diagnoses and sensitivity, specificity, positive predictive value (PPV), negative predictive values (NPV) of MAS were computed. All variables data were collected by using a structured questionnaire containing all the variables of interest and analyzed using SPSS (Statistical Package for Social Sciences) version 22.

The key variables of our interest of this study were modified Alvarado score and histopathological diagnosis of resected specimen of vermiform appendix. To calculate modified Alvarado score consists of 3 symptoms (migratory pain in right iliac fossa, anorexia and nausea/vomiting), 4 signs (tenderness in RLQ, rebound tenderness in right iliac fossa). Elevated temperature >37.3^{0}C/> 99.14^{0}F and Rovsing's sign/cough test/rectal tenderness) and total count of WBC were studied in each patient and recorded. Besides these, age, sex and other pertinent clinical variables were studied by Alvarado A and Al-Fallouji MAR.[6,7]

Results

A total of 227 clinically suspected cases of appendicitis was included in the study to evaluate the role modified Alvarado score (MAS) in diagnosing acute appendicitis. The mean age was 24.9 years with the lowest and highest ages were 13 and 54 years respectively. The age distribution of the patients were observed over 69 (30%) of the patients were < 20 years, 101 (44.5%) in 20 – 30 years, 37 (16.3%) in 30 – 40 years and 20 (8.8%) in 40 or above 40 years old (Table I).

Table I: Distribution of patients by age (n - 227)

Age (years)*	Frequency	Percentage
< 20	69	30.4
20 – 30	101	44.5
30 – 40	37	16.3
≥ 40	20	8.8

* mean age ± SD = 24.9 years**;** range = 13 – 54 years**.**

More than half, 119 (52%) of the patients were male and the rest were female, having male to female ratio of roughly 1:1 (Figure 1).

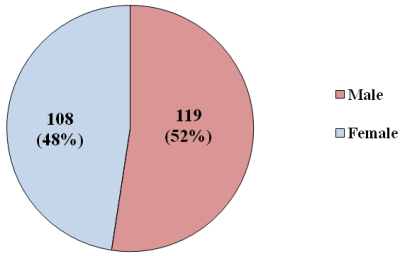

Figure I: Distribution of patients by sex

In our study, we observed 221 (97.4%) of patients complained of sudden onset of anorexia. The second leading symptom was nausea & vomiting 214 (94.3%). 186 (82%) of the patients had history of onset of pain around umbilicus. Pain shifting to right iliac fossa was complained by 187 (78%) of the patients. The affected patients exhibited tenderness in right lower quadrant (RLQ), positive cough test, muscle guard/rigidity, rebound tenderness, Rovsing's signs and leukocytosis were found 220 (96.9%), 215 (94.7%), 215 (94.7%), 210(92.5%), 206 (90.7%) and 157 (69.2%)) respectively. The peroperative findings of resected appendices were observed in 131 (57.7%), 41 (18.1%), 40 (17.6%) and 15 (6.6%) as inflamed, gangrenous, normal and perforated respectively (Table II).

Table II: Distribution of patients by per-operative findings of appendix (n-227)

Peroperative findings	Frequency	Percentage
Normal	40	17.6
Inflamed	131	57.7
Gangrenous	41	18.1
Perforated	15	6.6

Histopathological diagnosis of the resected specimens revealed that 177 (78%) patients had appendicitis and the rest 50 (22%) were with normal appendices (Figure 2).

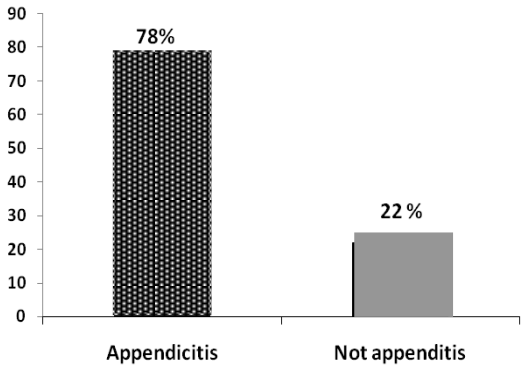

Figure 2: Distribution of patients by histopathological diagnosis

Discussion

Appendicitis is the most common surgical disease for hospital admission and emergency surgery. Delay in diagnosis definitely increases the morbidity, mortality and cost of treatment. In equivocal cases aggressive surgical approach 'when in doubt

take it out' has resulted in increased negative appendicectomy which has been reported in various series from 8-33%.[9-11] Efforts must be made to avoid unnecessary appendicectomy of otherwise normal appendix and to increase the diagnostic accuracy of whatever tool used to diagnose the diseased appendix.

In this study, the sensitivity of modified Alvarado score in correctly diagnosing appendicitis of those who have the disease was high while the specificity of the score in ruling out of those who do not have the disease was low. Fenyo G[12] reported in his study that a sensitivity of 90.2% and specificity of 87.0% with negative laparotomy rate of 17.5%. In a prospective study of 215 adults and children in Cardiff, use of the Alvarado score decreased an unusually high false-positive appendisectomy rate of 44% to 14%.[1] However, 7.5% patients with low scores were subsequently shown to have appendicitis. In relatively small study of 49 consecutive patients from Newcastle region, the overall sensitivity of the score was 87.5%, but its specificity was poor,[13,14] however, reported a low sensitivity (66.7%) and high specificity (83.3%) with a negative appendicectomy rate of 32.3%. Keeping consistency with these findings, our results showed that the modified Alvarado scoring system has a low sensitivity and high specificity.

The data clearly show that the specificity and hence the ability of the modified Alvarado scoring system to exclude true negatives (i.e., patients who do not have appendicitis) remains reasonably high. In contrast, the sensitivity shows the ability of the score to detect true positives those have appendicitis. Hence, as a clinical aid for diagnosing cases of acute appendicitis among patients complaining of right iliac fossa pain it is not as useful as its ability in avoiding unnecessary surgery in patients who do not have acute appendicitis. As a result, the negative appendectomy rate can be lowered by the use of the Alvarado scoring system. However, to be sure that patient does not have appendicitis, some steps need to be followed.[7] Accordingly patients with score 1-4 are unlikely to have acute appendicitis and can be discharged home safely thus reducing unnecessary admission, a cost-effective policy that can prevent wastage of money, staff time and effort that can be spent on urgent efforts. Patients with score 5-7 (in more than 80% cases) are unstable group of patients. They must be re-scored subsequently until they switch into score 8 and consequently operated on or they may pass into a lesser score (in less than 20% cases) due to the underlying normal or resolving appendicitis and therefore can be discharged home. Persistent score 7 after 24 hour is better to operate. Patients with score 8-10 must be operated on immediately because their probability of being appendicitis is about 67-90%. [1, 13]

By adopting this safe policy, one can obviate nearly 30% of negative laparotomy and thus the old policy 'when in doubt take it out' would be replaced with policy 'observe and conserve'. The results of the regression

analysis of the parameters in the Alvarado score show that migration of pain is the single most important symptom pointing towards a diagnosis of acute appendicitis.

Conclusion

Though the function of appendix is still not clear, but it can be used for reconstructive surgery, such as replacement of damaged common bile duct and right ureter, for appendicecostomy to divert faecal effluent in distal colonic obstruction and as a caecal reservoir with appendicular conduit in bladder reconstruction. Therefore, every effort should be made to preserve healthy appendix for future reconstructive surgery.

Contribution of the Authors

First author was the main researcher. Next two were responsible for data collection, drafting work or revising it critically for intellectual content. Others were responsible for statistical analysis and computer composing.

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