

Original Research Article

Application of Modified Alvarado scoring system in the diagnosis of acute appendicitis: a study in a tertiary care hospital

Anup Kumar Saha*, Ankit Sandhu, Kumar Vikram

Department of General Surgery, Agaratala Government Medical College, Agaratala, Tripura, India

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***Correspondence:**

Dr. Anup Kumar Saha,

E-mail: aks.bmc@gmail.com

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ABSTRACT

Background: Acute Appendicitis is one of the common surgical diseases which require early intervention; however, it may lead to higher negative appendectomy rates, in uncertain Diagnosis. Negative appendectomy rate is 20-40%. There are various scoring systems to assist in diagnosis. The aim of this study is to assess the effectiveness of Modified Alvarado Scoring System (MASS) in patients with acute appendicitis in AGMC and GBP Hospital.

Methods: This was a cross sectional study to evaluate the effectiveness of MASS in patients presenting with acute appendicitis. The Principal Investigator scored all the patients according to the variables of MASS and divided them into three groups. Group I included patients with MASS of four and below, Group II were patients with MASS of 5-6 and Group III included patients with MASS of seven and above. The diagnosis of acute appendicitis was confirmed by histopathological examination. Data was collected using a coded, pre-tested questionnaire and analyzed using SPSS statistical software version 11.5.

Results: In this study, 36 cases out of 42 cases had acute appendicitis. The sensitivity of Modified Alvarado Score of >7 was 85.7% (proportion of true positive). The sensitivity was highest among males i.e., 92% while in females, it was 76.4%. Negative appendectomy rates were highest among females (23.6%), whereas in case of males it was 8%.

Conclusions: The present study has shown that MASS provides high degree of sensitivity, specificity, PPV, NPV and accuracy in the diagnosis of acute appendicitis and has found to be more helpful in and high positive predictive value for male patients as compared to females.

Keywords: Acute appendicitis, Modified Alvarado scoring

INTRODUCTION

Acute appendicitis, with a lifetime prevalence of 1 in 7 worldwide, considered one of the most common causes of abdominal surgical emergencies.¹⁻³ It has high morbidity and sometimes mortality due to failure to diagnose early.^{4,5} Approximately it has been estimated that during life time 6% of population will suffer from acute appendicitis. Increasing efforts are made to enable early diagnosis and thereby early surgical intervention.^{6,7}

Successful management of acute appendicitis depends on early diagnosis and prompt surgical intervention. However, it may lead to higher negative appendectomy rates in case this policy of early intervention is followed where diagnosis is uncertain.^{8,9} Atypical presentation and other condition mimicking appendicitis is common in very young, reproductive age group females and elderly age group leading to difficulty in diagnosis in such age group patients.¹⁰ In this age group clinical examination and imaging studies like USG/CT Scan abdomen should be done to exclude other diseases mimicking

appendicitis. In literature, negative appendectomy rate 20-40% has been reported. Many surgeons accept negative appendectomy rate of about 15-20% to avoid perforation and early surgical intervention.¹¹ The premise that removing a normal appendix is better than delay in diagnosis doesn't stand up to close scrutiny especially in the elderly patients and poses economic burden on patient and health resources. Complications like perforation and peritonitis occurs if there is delay in diagnosis or misdiagnosis.¹² Various scoring systems to assist in diagnosis have been developed. Most of these are complex and not feasible in emergency settings.²

Recent studies have shown MASS to be simple, easy and cheap diagnostic tool helpful especially for junior surgeons for supporting the diagnosis of acute appendicitis.^{2,13} However, its application and effectiveness in the preoperative diagnosis of acute appendicitis has not been evaluated at AGMC and GBP Hospital. The aim of this study is to assess the effectiveness of MASS in patients with acute appendicitis in AGMC and GBP Hospital.

METHODS

This was a cross sectional study to evaluate the effectiveness of MASS in patients presenting with acute appendicitis at the Department of Surgery, AGMC and GBP Hospital over a period of one year and six months from January 2014 to June 2015. All patients with a provisional clinical diagnosis of acute appendicitis and undergoing appendectomy during the study period were, after informed consent, consecutively enrolled into the study. Patients with a mass in the right iliac fossa and those who fail to provide information and had no relatives nearby were excluded from the study. Patients who had no histopathological results were also excluded from the study.

Ethical approval to conduct the study was obtained from the Institutional Ethic Committee of Agartala Government Medical College before the commencement of the study.

All patients included in the study were initially seen by the admitting registrar or resident surgical student who made the decision to operate. The Principal Investigator scored all the patients according to the variables of MASS (Table-I) and then divided them into two groups. Group I included patients with MASS of four and below (patients unlikely to have acute appendicitis) and Group II were patients with MASS of 5-6 (patients likely to have acute appendicitis) and Group III included patients with MASS of seven and above (patients probably to have acute appendicitis). The Principal Investigator did not influence the management of the patient and the decision to operate was not based on MASS but the clinical impression by the clinician taking charge of the patient. Abdominal ultrasound was performed in case of atypical presentation. All patients underwent emergency appendectomy and all appendices removed at operation were sent for histopathology. The diagnosis of acute appendicitis was confirmed by histopathological examination. Data was collected using a coded, pre-tested questionnaire and analyzed using SPSS statistical software version 11.5. The MASS groups were cross-tabulated against histology, the gold standard. Then, the sensitivity, specificity, accuracy, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) and accuracy were determined in males and females.

RESULTS

- Group I: Fifteen patients were in first group (MASS 1-4) who were not considered likely to have appendicitis. They were observed and were treated conservatively. Discharged after 2-3 days and were followed up every month for 6 months and none of them required surgery.
- Group II: Twenty-three patients were in second group (MASS 5-6), 7 were operated upon clinical suspicion of high probability of acute appendicitis.
- Group III: Of the 42 patients in third group, 38 patients underwent appendectomy.

Table 1: Distribution of cases according to Modified Alvarado Score (5-6).

Category of cases	No. of cases operated	No. of cases with HP Appendicitis	No. of cases without HP Appendicitis	Proportion of true positive
Male (n=17)	5	3	2	60%
Female (n=6)	2	1	1	50%
Total (n=23)	7	4	3	57.1%

Table 2: Distribution of cases according to modified Alvarado Score (7-9).

Category of cases	No. of cases operated	No. of cases with HP Appendicitis	No. of cases without HP Appendicitis	Proportion of true positive
Male (n=25)	25	23	2	92%
Female (n=17)	17	13	0	76.4%
Total (n=42)	42	36	2	85.7%

Rest of the 16 cases were not operated, were observed and discharged after 3 to 4 days of stay in hospital and followed up every month for 6 months and none of them required surgery during the period of observation.

Of the 7 patients, whose score was 5-6 (Table 1) who were operated, 5 were males and 2 were females.

There were 3 out of 5 males and 1 out of 2 females had acute appendicitis. The overall negative appendectomy rate of patients with scores ≤ 6 is 42.9%.

There were 4 female patients on subjecting for ultrasonography of abdomen had other pathology mimicking acute appendicitis and they didn't undergo appendectomy. Two patients had pelvic inflammatory diseases, and two patients had ruptured ectopic pregnancy. 36 cases out of 42 cases had acute appendicitis. The sensitivity of Modified Alvarado Score of ≥ 7 (Table 2) was 85.7% (proportion of true positive).

The sensitivity was highest among males i.e., 92% while in females, it was 76.4%. Negative appendectomy rates were highest among females (23.6%), whereas in case of males it was 8%. 2 male patients with normal appendix had Meckel's diverticulitis.

In this study there were 51 (63.7%) male patients, 29 (36.3%) female. The common symptoms seen in the present study were anorexia (76.3%) and nausea and vomiting (73.7%). The most common sign seen in the present study was tenderness over RIF (78.8%).

The next common signs were elevated temperature $>37.3^{\circ}\text{C}$ (75%) and rebound tenderness over RIF (40%). The leucocytosis seen in present study is 73.8%.

DISCUSSION

The use of MASS has been reported to improve the diagnostic accuracy in diagnosis of acute appendicitis and thereby reduces negative appendectomy rate and complications.^{2,13} This study was conducted to evaluate the effectiveness of MASS in patients with acute appendicitis in this setting.

Studies in Kenya, Nigeria and Ethiopia found a male dominance similar to our study.¹⁴ The reason for the difference in sex distribution in these studies may be attributed to the fact that female patients with right iliac fossa pain have a wide range of differential diagnoses as a result acute appendicitis may be over-diagnosed in this gender group. In this case, therefore, additional investigations may be required in female patients to confirm the diagnosis of acute appendicitis.

The result of present study showed that a high score (≥ 7) in men was a satisfactory aid in the early diagnosis of

acute appendicitis, the overall sensitivity in men with scores ≥ 7 was 92%, with a negative appendectomy rate of 8%.

But in females the negative appendectomy rates were quite high in groups with score of 5 to 6 as well as 7 to 9. The negative appendectomy rate in the above groups being 50% and 23.6% respectively.

Out of the 80 patients; 51 (63.7%) were male and 29 (36.3%) were females. The male: female ratio is 1.75:1. Similar results had been documented by Kimberly et al, in their study, incidence of male and female was 55% and 45% respectively.¹⁵ Sanjot et al, also documented similar result with a male-female ratio of 1.38:1.¹⁶ Smink et al, documented different result in which the male: female ratio was 1:1.66.¹ Saidi H et al, also documented different results of male: female ratio is 1:1.¹⁴ The difference in the result may be due to racial and dietary and regional variations.

According to the previous studies, 80 percent of acute appendicitis cases may present with migratory pain, in this study it is 60 percent. It may range from 61 to 92 percent for nausea and vomiting, in this study it is 73.7 percent and 74 to 78 percent for loss of appetite, in this study it is 76.3 percent. Positive physical findings excluding pyrexia can be seen in up to 96 percent of cases.

In this patients factors related to positive history (shifting pain, anorexia, and nausea-vomiting) were prominently less than previous studies. Lower frequency of symptoms in this case may be the result of inability of patients to define the symptoms. Most of the times, relatives had to be asked for assistance. This is a common problem faced by physicians working in developing countries with low socioeconomic status. Other studies from Iran revealed that these factors are not as diagnostic as physical findings.¹⁷ The cause of this difference with other regions is unknown. Maybe our patients do not give an accurate history.

Among the adult patients, 80 to 85 percent of cases may have leukocytosis in this study it is 73.8 percent.¹⁶ But the literatures do not agree on the prevalence of leukocytosis in paediatric and elderly.^{18,19}

Sensitivity of acute appendicitis 92% for males in the present study with score of 7 to 9 correlates well with the figures of studies by Kalan et al, (who have reported 93%) and Bhattacharjee et al, (who have reported 94.1%).^{9,20}

Sensitivity of acute appendicitis 76.4% for females in the present study with score of 7 to 9 correlates well with the figures of studies by Kalan et al, (who have reported 67%) and Bhattacharjee et al, (who have reported 71.9%).^{9,20}

The overall sensitivity of acute appendicitis being 85.7% in the present study with score of 7 to 9 correlates well with the figures of studies by Kalan et al, (who have reported 83.7%) and Bhattacharjee et al, (who have reported 82.7%).^{9,20}

In another study by Bengezi et al, was conducted on 45 patients prospectively using the modified Alvarado score. They found positive predictive value of 95.2% for males and for females, 93.3%.²¹

They concluded that the score was useful in distinguishing acute appendicitis from other acute abdominal conditions, thus decreasing negative appendectomy. In another study by Fente BG was conducted on 128 patients retrospectively using the modified Alvarado score. They found that sensitivity of 92.93% and specificity of 92.93% were recorded in their study.²²

It has been shown in the present study that MASS provides high degree of sensitivity, specificity, PPV, NPV and accuracy in the diagnosis of acute appendicitis, which is in agreement with findings reported by others.^{11,23} Our study also revealed that MASS is more helpful in male patients by showing lower negative appendectomy rate and high positive predictive value for male patients as compared to females. In females, additional investigations may be required to confirm the diagnosis. Literatures also support this observation.²⁴⁻²⁶

CONCLUSION

The present study has shown that MASS provides high degree of sensitivity, specificity, PPV, NPV and accuracy in the diagnosis of acute appendicitis and has found to be more helpful in male patients by showing lower negative appendectomy rate and high positive predictive value for male patients as compared to females.

Recommendations

MASS should be used at AGMC to improve the diagnostic accuracy of acute appendicitis and subsequently reduce negative appendectomy and complications. The use of MASS in the diagnosis of acute appendicitis in female patients should be supplemented by additional investigations like abdominal ultrasound or laparoscopy. A MASS score above 7 should indicate appendectomy without the need for further imaging.

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