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Original Article

Comparative Study of Modified Alvarado Score and Eskelinen Score in Diagnosing Acute Appendicitis

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ABSTRACT

Introduction: Despite many advances in diagnosis, diagnosing appendicitis remains difficult. Various diagnostic scoring systems have been developed in an attempt to improve the diagnostic accuracy of acute appendicitis. The study aimed to determine the accuracy of the Modified Alvarado and Eskelinen score in diagnosing acute appendicitis and to correlate the histopathological findings with the severity of acute appendicitis.

Materials and Methods: A prospective study was conducted in TUTH including 84 patients with a clinical diagnosis of acute appendicitis managed surgically for 10 months. Modified Alvarado and Eskelinen Score were calculated and histopathological findings were correlated for predicting the severity of appendicitis.

Results: Out of 84 patients Modified Alvarado Score had sensitivity and specificity of 67.79% and 32% when the score was taken as 7 and Eskelinen Score had sensitivity and specificity of 70.17% and 29.62% when the score was taken as 55. However, the sensitivity of the Modified Alvarado Score increased to 92.85% and specificity to 14.28% when the cut-off score was taken as 6. Modified Alvarado Score predicted 67% and 63% of uncomplicated and complicated appendicitis respectively and Eskelinen Score predicted 72% of uncomplicated and 67% of complicated appendicitis when the score was taken as 7 and 55 respectively.

Conclusions: Both Modified Alvarado and Eskelinen Scores have low sensitivity in diagnosing acute appendicitis. With cut off for Modified Alvarado Score taken as 6, sensitivity increased. There was no correlation between the severity of appendicitis with the increase in Modified Alvarado and Eskelinen Score.

Keywords: Acute Appendicitis; Eskelinen Score; Modified Alvarado Score

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INTRODUCTION

Acute appendicitis is the commonest surgical emergency and the second most common cause of right lower quadrant pain in patients presenting to the emergency department.[1] Lifetime risk of suffering from appendicitis is about 7%.[2] Despite advances in diagnosis, diagnosing appendicitis still remains difficult.[3]

Diagnosis is made clinically and the decision to undergo surgery is often given without certainty of the definitive diagnosis.[4] Surgical intervention early in the course of the disease limits complications and leads to too many negative appendectomies being performed with an

associated mortality rate of 10%.[5] There is a significant rise in mortality from less than 1% in nonperforated cases to 5% or more when perforation occurs.[6]

Based on various reports the negative appendectomy rate is about 20 to 30%.[7] Misdiagnosis and late surgical intervention lead to complications with high morbidity and mortality such as perforation and peritonitis.[8]

Several scoring systems are being used to aid in the diagnosis of acute appendicitis. Of these, the Modified Alvarado score (MAS) is frequently used. Among other scoring systems, Eskelinen Score (ES) is also used. These scoring systems take into consideration various signs and symptoms and also laboratory findings. This study aimed to compare MAS and ES systems to predict the severity of appendicitis using histopathological diagnosis as a gold standard.

MATERIALS AND METHODS

A prospective observational study was conducted in the Department of GI and General Surgery, IOM-TUTH between Kartik 2075 to Asoj 2076 with a sample size of 84. Inclusion criteria of the study include admitted cases with the diagnosis of acute appendicitis managed surgically and exclusion criteria being age less than 16 years, complications of acute appendicitis such as appendicular abscess, appendicular lump, appendicular perforation peritonitis (managed by midline laparotomy) and patient not giving consent. Ethical clearance was taken from IRB, TUTH, Maharajgung.

Patients were initially assessed in the emergency department. History and physical examination were done and whether to opt for surgical management or not was decided by the attending surgeon. Obtained data entered as per diagnostic score (MAS and ES). Statistical data analysis was done using SPSS version 20 using the Chi-square test and ROC curve and the level of significance was taken as 5 percent.

RESULTS

Out of 84 patients mean and standard deviation of the age of patients were 29.20± 11.68 with the range of 17 – 72 years as shown in figure.1. Maximum patients were in of age group 16-24 years out of which 55(65.4%) were male and 29(34.52%) were female.

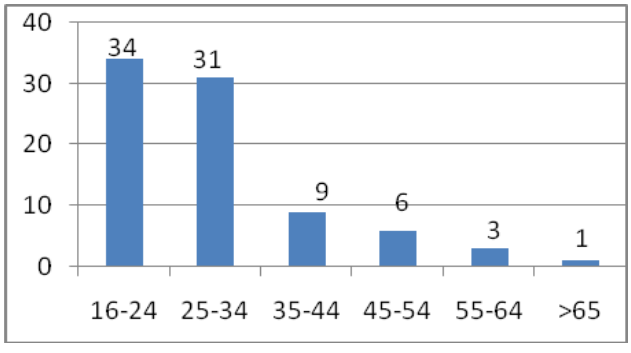

Figure 1: Age-wise distribution among the study population

MAS of 7 were 29 patients which accounted for the highest percentage similarly with the score of 8 there were 23 patients and score of 6 were 19 patients. ES was highest with a score of > 57 which accounted for 55 patients and with 16 patients with a score of 48-57 and 13 patients in<48. Patients with MAS ≥ 7 were 57 and < 7 were 27 patients and Eskelinen scores≥ 55 were 59 and <55 were 25 patients as shown in figures 2 and 3.

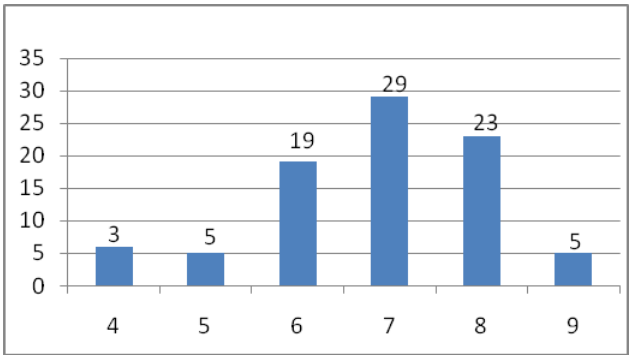

Figure 2: Modified Alvarado Score (n=84)

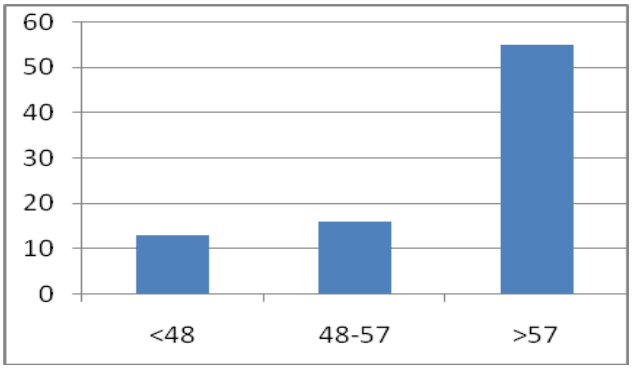

Figure. 3: Eskelinen Score (n=84)

The histopathological finding revealed 43 to be inflamed appendicitis, 37 gangrenous, 1 perforation, 2 follicular hyperplasias, and 1 case of resolving appendicitis. 52.3% were uncomplicated appendicitis and 45.2% were complicated appendicitis and 2.3% were normal.

MAS with a score ≥ 7 predicted 69 % of uncomplicated and 67 % of complicated appendicitis and a score < 7 predicted 31% of uncomplicated and 33% of complicated appendicitis. Whereas ES ≥55 predicted 72 % of uncomplicated and 67% of complicated appendicitis and a score < 55 predicted 28% of uncomplicated and 33% of complicated appendicitis as shown in figures 4 and 5.

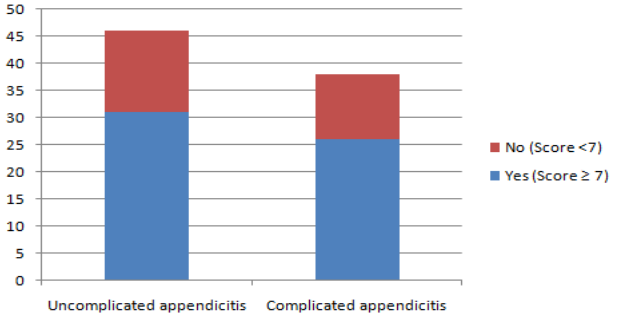

Figure 4: Predicted complicated and uncomplicated appendicitis according to MAS

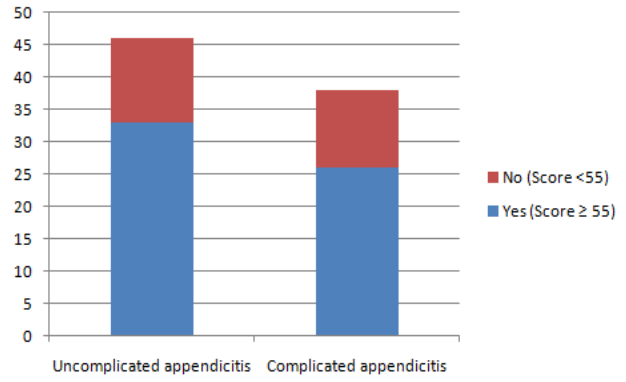

Figure 5: Predicting complicated and uncomplicated appendicitis according to ES

When the cut-off score for MAS was taken as 7 the sensitivity, specificity, PPV, and NPV were 67.79%, 32%, 70.17, and 29.62 respectively and when the cut-off for ES was taken as 55, sensitivity, specificity, PPV, and NPV were 70.17%, 29.62%, 67.79 and 32 respectively with the area under curve for MAS 0.523 and ES 0.488. However when the cut-off for MAS was taken as 6 the sensitivity of MAS increased to 92.85% and specificity of 14.28%, PPV 68.42%, and NPV 50%, and with ES cut-off as 57 sensitivity, specificity, PPV and NPV were 68.42%, 50%, 92.85%and 14.28 respectively with the area under curve for MAS 0.74 and ES 0.46.

DISCUSSION

Acute Appendicitis is one of the commonest surgical emergencies. Although being one of the most common abdominal emergencies with a lifetime risk of about 7 %[2], the pathogenesis of appendicitis is still not fully understood. However, making a correct and timely diagnosis remains a challenge.[9] Besides clinical evaluation with various clinical signs and symptoms many modern diagnostic tools such as graded compression sonography, CT, and diagnostic laparoscopy have proven to be effective in the diagnosis of acute appendicitis. It is generally accepted that the removal of a normal appendix is safer in questionable cases and that delaying surgery leads to an increased rate of perforation.[10] Several scoring systems have been devised for the purpose of increasing both sensitivity and specificity in diagnosing acute appendicitis.[11] According to publications criteria for diagnostic quality have been postulated as a 15 % rate of negative appendectomies, a 10% rate of negative laparotomy, a 35% rate of potential perforation, and a 15% rate of overlooked perforations, and a 5 % rate of overlooked acute appendicitis.[12] Further misdiagnosis and late surgical intervention lead to complications with high morbidity and mortality such as perforation and peritonitis. The generally accepted negative appendectomy rate is approximately 15-20 % .[13]

The incidence of acute appendicitis in the study population fall at a maximum in the 16-24 age group which accounted for 34.84% and the minimum in the age group > 65 years which accounted for 1.1% which is similar to other studies.[14 15]

Out of 84 patients in the study 65.4% were male and 34.5% were female similar to the sex distribution as done by Wu Xingye et al.[16] Other studies have also suggested the male preponderance of disease, Carditello A showed a male: female ratio of 3:1 and Ko Ys Lin Lh showed male: female ratio to be 10:1 .These studies also had similar observations as compared to this study.[17 18 19 20] In comparison to the study done by Kanumba et al, where the sensitivity and specificity of MAS was 94.1% and 90.4%, PPV of 95.2 and NPV of 88.4.[13] This study had Sensitivity of 67.79%, Specificity of 32%, Positive Predictive Value of 70.17 and Negative Predictive value of 29.62 keeping cut off of MAS as 7 and ROC analysis revealed an area index of 0.53 which was also lower than the study done by Pejana Rastovic et al.[21]

In a study done by Arzu Sencan et al, the Eskelinen score had sensitivity, specificity, PPV, and NPV of 79%, 85%, 65 and 91 respectively and ROC analysis revealed an area index of 0.91[22] In this study, the Eskelinen Score had sensitivity, specificity, PPV and NPV of 70.17%, 29.62%, 67.79 and 32 respectively when the cut off value was taken as 55 and ROC analysis revealed an area index of 0.48. However, when the cut-off value was taken to be 57, the sensitivity, specificity, PPV, and NPV were 68.42%, 50%, 92.85, and 14.28 respectively and ROC analysis revealed an area index of 0.46.

On analyzing the Modified Alvarado Score with respect to the histopathology, the results were comparable with the other study.[14] In our study, histopathological analysis out of 84 patients showed that 52.3% were uncomplicated appendicitis, 45.2% were complicated appendicitis and 2.3% were normal. Out of which, the Modified Alvarado score predicted 67% of uncomplicated appendicitis and 63% of complicated appendicitis when the score was ≥ 7 similar to the study conducted by Kamal Koirala et al in 2018.[23] Eskelinen Score predicted 72% of uncomplicated appendicitis and 67% of complicated appendicitis of score ≥ 55 which was less than a study in which ES predicted 80 % of appendicitis when correlated with histopathological reports.[24]

CONCLUSIONS

Both the MAS and ES have low sensitivity in diagnosing acute appendicitis. However taking the cut-off score for MAS from 7 to 6 the sensitivity of MAS increased. There was no correlation with the severity of appendicitis with the increase in both scores.

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