Comparision of Modified Alvarado score and Teicher score in predicting acute Appendicitis: A Prospective Study

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ABSTRACT

Introduction: *Acute Appendicitis is the most common surgical emergency encountered by the General Surgeon. It continues to be a clinical dilemma, despite the addition of myriad diagnostic modalities to the surgeon's arsenal. A reliable scoring system would help streamline diagnosis as well as avoid unnecessary surgeries, in a limited resource setting.*

Materials and Methods: *A prospective, observational hospital-based study was conducted in patients presenting in Bir Hospital ER with features suggestive of acute appendicitis. Sample size was 100. History and clinical examination, related laboratory investigations were collected and Modified Alvarado score and Teicher score were calculated. These scores were compared to Histopathology report and with regards to Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Diagnostic accuracy using SPSS version 20.*

Result: *100 patients were enrolled with mean age of 30 years. Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Accuracy for Modified Alvarado Score and Teicher Score respectively were 73.91% vs. 69.57%, 75% vs. 75%, 97.14% vs. 96.97%, 20% vs. 17.65% and 74% vs. 70%. Negative Appendectomy Rate was 8%. Area under curve for ROC of MAS was 0.761 with p-value of 0.015 which was significant statistically. Area under curve for ROC of Teicher Score was 0.747 with p-value of 0.021 which was also statistically significant.*

Conclusions: *Both MAS and Teicher scoring systems can be of value in decision making in acute appendicitis and in reducing the number of negative laparotomies. However, MAS is better scoring system compared to Teicher score in diagnosis of acute appendicitis.*

Keywords: *Acute Appendicitis, Modified Alvarado Score, Teicher Score*

INTRODUCTION:

Acute Appendicitis(AA) has a life time risk of 8.6% and 6.7% for men and women respectively.[1][2][3] Diagnostic errors are common, resulting in a median incidence of perforation of 20% and a negative laparotomy rate ranging from 2% to 30%.[4]

In the classic presentation, the patient describes the pain as beginning in the periumbilical or epigastric region and then migrating to right iliac fossa associated with fever , anorexia, nausea, and vomiting which "classic" symptomatology only occurs in 50-60% of cases making the diagnosis difficult.[5]

Kalan et al. produced a Modified Alvarado Score with an aggregate score of 9 in 1994 which carries high significance in the diagnosis of acute appendicitis.[6][7] Teicher score could also be helpful in recognizing patients that need appendectomy. The scoring system includes seven predictive factors. They are Age, Sex, Duration of symptoms, genital or urinary symptoms, muscle spasm in right lower quadrant, rectal mass in right side and white blood cell count.[8]

Present study aims to evaluate the patients presenting with features of acute appendicitis by Modified Alvarado and Teicher Scoring System and compare them so that they can be applied regularly to diagnose and perform intervention if needed.

MATERIALS AND METHODS:

This was a prospective observational study conducted at Bir Hospital, Kathmandu, Nepal. Patients with clinical features suspicious of acute appendicitis were studied from August 2020 to February 2021. The presumptive diagnosis of acute appendicitis was made by the presence of following clinical and laboratory findings. Cases diagnosed and operated for acute appendicitis were included in the study with exclusion of patient aged <16yr, those managed conservatively and those with appendicular lump, abscess and generalized peritonitis. Minimum sample size was calculated to be 100 using $n=z^2pq/d^2$.

Patients were stratified into different groups on the basis of cut off values for Modified Alvarado and Teicher score. The sensitivity, specificity, positive predictive value and negative predictive value of these scores were calculated. These results were then compared.

Histopathological reports were taken as the standard reference for comparison. ROC curve was obtained for these scores and area under the curves was compared for accuracy of the scores. Data analysis was done using Microsoft Excel 2013 and SPSS version 21.0. Chi-square test was used for testing significance of scoring system.

RESULTS:

Out of 100 cases in our study, 59% were male and 41% were female. Most of the patients (39%) belonged to the age group 21-30 years and male to female ratio was 1.44:1. Mean age of patient was 30.87 ± 12.053.

The most common symptom observed was anorexia in 82 patients followed by pain migration to RIF in 75 patients. The most common sign in the present study was Right Iliac Fossa tenderness on palpation observed in 96 patients followed by rebound tenderness in 90 patients. Out of 30 patients with MAS <7, 24 (80%) patients had positive HPE results, and 6 (20%) had negative results. Out of 70 patients in MAS ≥7, 68 (97.14%) patients had positive HPE results and 2(2.86%) had negative results.

Distribution of positive and negative results in two group had P-value: 0.3106 at 95% CI. Out of 34 patients with Teicher score <-3, 28 (82.35%) patients had positive HPE results, and 6 (17.65%) had negative results. Out of 66 patients in Teicher score of ≥-3, 64 (96.97%) patients had positive HPE results and 2(3.03%) had negative results . Distribution of positive and negative results in two group had P-value: 0.3106 at 95% CI.

In this study, 70% patients had Positive MAS (MAS score ≥7), of which, 68 patients had positive HPE and 2 patients had negative HPE. Of the remaining 30 patients with MAS <7, 24 patients had positive HPE and 6 had negative HPE. This resulted in a sensitivity of 73.91%, specificity of 75%, PPV of 97.14% and NPV of 20%. Accuracy was 74%.

Out of 100 patients enrolled 92 had positive appendectomy HPE reports and 8 patients had negative appendectomy HPE results with overall negative appendectomy rate of 8%.

Table-1: Symptoms of patients

Symptoms	No of patients	Percentage of Patients
Pain migration to RIF	75	75.0
Anorexia	82	82.0
Nausea and vomiting	62	62.0
Duration of symptom $1^{1/2}$days 2days 3days	38 17 6	38 17 6
GU symptoms	16	16

Table-2: Signs of patients

Signs	No of patients	Percentage of patients
RIF Tenderness	96	96.0
Muscle spasm-RLQ 1) Involuntary 2) None	29 71	29.0 71.0
Rebound Tenderness	90	90.0
Rectal mass-R. Side	0	0

Table-3: MAS and Teicher scoring

MAS	Score	Frequency	Percent
	≥ 7	70	70.0
	5-6	24	24.0
	0-4	6	6.0
Teicher scoring	≥-3	66	66.0
	<-3	34	34.0

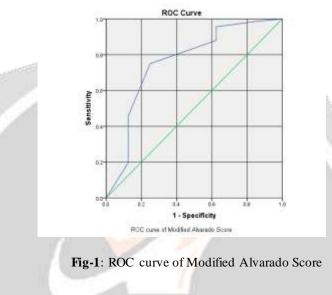**Table-4**: Prevalence of appendicitis according to Teicher Score

Teicher Score	Appendicitis present	Appendicitis absent	Total (n100)
≥-3	64	2	66
<-3	28	6	34
Total	92	8	100

Table-5: Comparison of scoring systems

Index	MAS	Teicher Score
Sensitivity	73.91% (63.71% to 82.52%)	69.57% (59.10% to 78.73%)
Specificity	75.00% (34.91% to 96.81%)	75.00% (34.91% to 96.81%)
Positive predictive value	97.14% (91.05% to 99.13%)	96.97% (90.53% to 99.07%)
Negative predictive value	20.00% (12.85% to 29.76%)	17.65% (11.45% to 26.21%)
Accuracy	74.00% (64.27% to 82.26%)	70.00% (60.02% to 78.76%)
p-value	0.015	0.021

Fig-1: ROC curve of Modified Alvarado Score

DISCUSSION:

This study prospectively compared Modified Alvarado and Teicher score by applying them to the patients attending our hospital with acute abdomen that could probably be acute appendicitis. Teicher score has been compared to MAS score to study its efficacy in terms of sensitivity, specificity and diagnostic accuracy among other factors.

Negative appendectomy rate in this study was 8%. Males had 8.47% NAR (5 of 59 cases) while females had 7.32% NAR. This is similar to a study by Iqbal MM et al who reported a NAR of 10.3%.[9] Historically, NAR has been reported between 15%- 25% with an even higher rate in women.[9] In women the causes for diagnostic uncertainty ranges from PID, nonspecific abdominal pain, UTI, ruptured ovarian follicle, and ectopic pregnancy.

In a study by Ramchandra J et al among 100 patients, 87% of patients had migration of pain to right iliac fossa, 78% of patients had anorexia, 74% of patients had nausea/vomiting, 83% of patients had tenderness over right iliac fossa, 53% of patients had rebound tenderness over right iliac fossa, 67% of patients had fever and leucocytosis was seen in 60 patients.[10] This is comparable with our study except the rebound tenderness over right iliac fossa which is higher in our study.

Sack et al. in his study found that WBCs count was clearly elevated with phlegmonous and perforated appendicitis.[11] Studies have shown inconsistent information regarding the use of WBCs count and differential in AA diagnosis. Although most studies show an association between elevated WBCs count in appendicitis, its significance varies greatly. In a study published in 2013, WBCs count of 9400/cc had sensitivity of 76.81%, specificity of 65.52%, positive predictive value (PPV) of 97.0%, negative predictive value (NPV) of 16.1%, positive likelihood ratio of 2.23, negative likelihood ratio of 0.35.[12]

Timilsina et al in their 2018 study of 131 patients with appendicitis done in College of Medical Sciences, Bharatpur found a sensitivity of 68.64%, specificity of 28.57%, PPV of 94% and NPV of 5.12%.[13] Our study had similar sensitivity and PPV with slightly higher specificity and NPV.

Kiani F et al, in their study found that Teicher score had had sensitivity of 89.55%, specificity of 66.66%, positive predictive value of 85.71%, negative predictive value of 76.66% and diagnostic efficacy of 83%.[14] Sensitivity, specificity, PPV and accuracy were similar to our study but our study had lower NPV.

Similarly, Z. Madar et al, in a study found 89.3% sensitivity and 22.2% specificity, 81.4% PPV and 35.3% NPV of Teicher score.[15] Our study had higher specificity than this study whereas other values are comparable.

In our study, the area under the curve for MAS was 0.761 (0.561-0.961 at 95% CI) and p value of 0.015. Comparing with the ROC curve analysis, the area under curve suggested "good" diagnostic accuracy. Similarly, the area under the curve for Teicher score was 0.747 (0.545-0.949 at 95% CI) and p value of 0.021. Comparing with the ROC curve analysis, the area under curve suggested "good" diagnostic accuracy.

CONCLUSION:

This study shows that MAS and Teicher scoring systems can be of value in decision making in acute appendicitis and in reducing the number of negative laparotomies, particularly in limited resource settings where access to advanced diagnostic modalities is limited and expensive. Based on this study it can be concluded that MAS is better scoring system compared to Teicher score in diagnosis of acute appendicitis. Limitations of the study were that it was a single centre based study where pediatric population were not included and clinical findings may vary when the same patient is examined at different points of time or by different clinician.

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