

COMPARISON OF MODIFIED ALVARADO SCORE AND ANDERSON SCORE IN PREDICTING ACUTE APPENDICITIS

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ABSTRACT

Introduction: Acute Appendicitis is one of the most common surgical emergencies encountered by the General Surgeons with wide spectrum of presentation as well as diagnostic modalities. Modified Alvarado Score and Anderson Score are scoring systems used for diagnosis of acute appendicitis. This study aims to compare the diagnostic value of Anderson score with Modified Alvarado Score.

Materials and methods: A prospective, analytical, hospital-based study was conducted in 71 patients presenting to Bir Hospital ER with features suggestive of acute appendicitis. History and clinical examination, related laboratory investigations were collected and Modified Alvarado score and Anderson score were calculated. These scores were compared to Histopathology report after appendectomy based on operating surgeon decision with regards to Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Diagnostic accuracy to predict acute appendicitis.

Result: 71 patients were enrolled with mean age of 29.68 ± 10.88 years with Male to female ratio of 1.08:1. Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value and Accuracy for Modified Alvarado Score and Anderson Score respectively were 77% vs 93.4%; 60% vs 80%; 88.23% vs 96.6%; 30% vs 66.6%; and 53% vs 93.4%. Negative Appendectomy Rate was 14.08%.

Conclusion: Anderson scores have better sensitivity, specificity, positive predictive value and accuracy for diagnosis of Acute Appendicitis than Modified Alvarado Score. The negative predictive value compared to Modified Alvarado Score is also higher in Anderson score.

Keywords: Acute appendicitis, Modified Alvarado Score, Anderson 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 appendectomy rate ranging from 2% to 30%.³ 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. The "classic" symptomatology however only occurs in 50-60% of cases creating a diagnostic dilemma. Kalan et al. produced a

Modified Alvarado Score with an aggregate score of 9 in 1994 which has carried high significance in the diagnosis of acute appendicitis.⁴ Overall sensitivity was 59.57%, the specificity 85.13%, positive predictive value 71.79%, and negative predictive value 76.82%, and the overall accuracy was 75.2%.⁵

The Anderson scoring system includes objective variables that reflect the inflammatory response during acute appendicitis hence improving the diagnostic accuracy of the pathology. Instead of dichotomous variables, the clinical variables are graded according to the severity of the symptoms and signs and the laboratory variables are divided into intervals. It includes clinical features (pain in right iliac fossa, rebound tenderness, vomiting, fever) and laboratory values (total count ,proportion of neutrophil ,CRP concentration- all divided into intervals) .Overall sensitivity, specificity, PPV,NPV are 73.7%, 100, 100% and 16.67% which appear to be better than MAS.⁶

The aim of this study is to compare the accuracy of Anderson score with MAS and to see whether this scoring system will be more useful tool than MAS to accurately diagnose acute appendicitis.

MATERIALS AND METHODS:

A prospective hospital based study was performed in Department of General Surgery, Bir Hospital for a duration of 1 year from August 2020 to August 2021. 71 patients presenting to the Emergency or Surgery Out Patient Department with periumbilical abdominal pain shifting to RIF during the study period were included in the study after obtaining informed consent. Patient not willing for operative intervention, patients with appendicular lump, pregnant women, patients younger than 16 years of age and patients with previous history of appendectomy were excluded from the study. Patients were stratified into different groups on the basis of cut off values for Modified Alvarado and Anderson score. Non probability purposive sampling technique was used. The sensitivity, specificity, positive predictive value and negative predictive value of these scores were calculated and compared.

The performance of Modified Alvarado & Anderson scoring system were compared with the results of histopathological reports and intraoperative findings of appendix. 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 26.

RESULTS

The study was conducted with 71 patients suspected of acute appendicitis. The mean age was 29.68 years with Standard deviation of +/- 10.88. The youngest age of patient in the study was 16 years and the eldest was 65 years. Of the total 71 patients, 37 were male and 34 were female with Male to female ratio of 1.08. The most common symptom observed was RIF pain in 44 patients followed by nausea in 32 patients and then anorexia in 26 patients.

Table - 1: Distribution of symptoms

Symptom	No. of patients	Percentage of Patients
RIF Pain	44	62%
Anorexia	26	36.6
Nausea	32	45.1

The most common sign in the present study was Right Iliac Fossa tenderness on palpation observed in 70 patients followed by rebound tenderness in 67 patients. Fever >38.5C was observed only in 33 cases.

Table - 2: Distribution of Signs

Signs	No. of patients	Percentage of patients
RIF Tenderness	70	98.6
Rebound Tenderness	67	94.4
Fever	49	70

Leukocytosis was observed in 68 patients and elevated CRP in 67 patients in this study.

Table - 3: White Blood Cell Count

WBC count	No of patients	Percentage of patients
<10,000	3	40.2
10,000-15000	25	35.2
>15000	43	60.0

Table - 4: CRP values (Quantitative analysis)

CRP values(Quantitative)	No of patients	Percentage of patients
<10mg/l	4	5.6
10-49mg/l	17	23.9
≥ 50 mg/l	50	70.4

Table - 5: Modified Alvarado Score (MAS) versus HPE findings

MAS	HPE Finding			Total
	Uncomplicated Acute appendicitis	Gangrenous Appendicitis	Normal Appendix	
7-9	42	5	4	51
5-6	11	3	6	20

0-4	0	0	0	0
Total	53	8	10	71

Table - 6: Anderson Score versus HPE findings

Anderson Score	HPE Finding			Total
	Uncomplicated Acute appendicitis (positive)	Gangrenous Appendicitis (positive)	Normal Appendix (negative)	
9-12-positive	49	8	2	59
5-8 negative	4	0	8	12
0-4negative	0	0	0	0
Total	53	8	10	71

Table - 7: Comparison of Modified Alvarado Score (MAS) vs. Anderson Score

Index	MAS	Anderson score
Sensitivity	77	93.4
Specificity	60	80%
PPV	88.23	96.6
NPV	30	66.6
Accuracy	47	91.54

In this study, out of 71 patients enrolled 61 had positive appendectomy HPE reports and 10 patients had negative appendectomy HPE results with overall negative appendectomy rate of 14.08%.

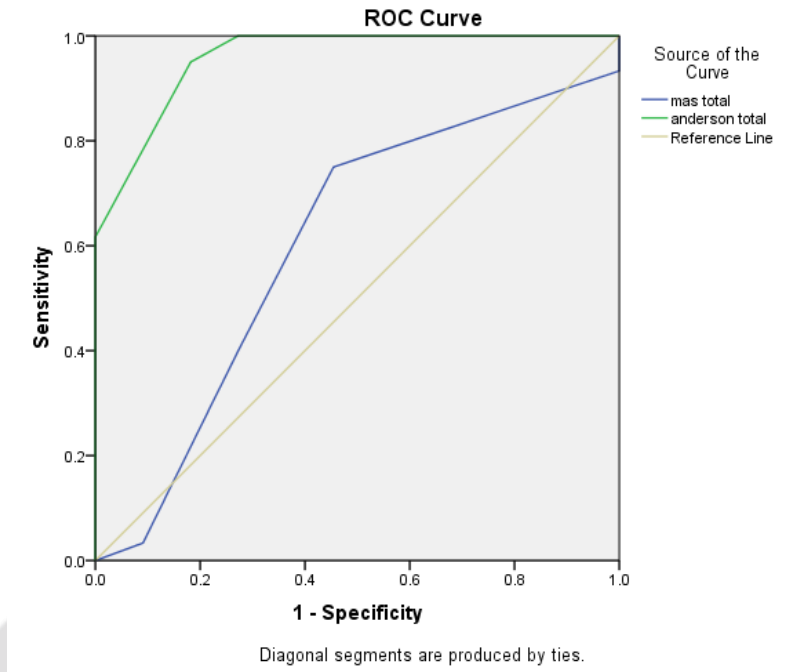


Fig- 1: Receiver Operative Curve of MAS and Anderson Score

DISCUSSION

In 2008, Anderson published the appendicitis inflammatory response score (AIRS) or Anderson score following prospective evaluation of 545 patients with suspected appendicitis and had found that specificity for all appendicitis was 99 % and PPV was 97%. Thus it was concluded that simple clinical score (Anderson) can correctly classify the majority of patients with suspected appendicitis, leaving the need for diagnostic imaging or diagnostic laparoscopy to the smaller group of patients with an indeterminate scoring result.⁷

Not many researchers have done a study to compare MAS and Anderson Score unlike our study where we have compared the two studies with each other as well as the diagnostic accuracy based on the final histopathology reports.

In the study by Z.Madazar et. al (2016) in 130 female using Fenyó-Lindberg score (constant pain, gender, WBC, pain duration, pain progression, vomiting, aggravation with cough, rebound tenderness, rigidity and pain over RIF) and Treicher score (gender, age, duration of symptoms, genital or urinary symptoms, muscle spasm, in right lower quadrant, rectal mass on right side, WBC) score found PPV of 87.9% and of 81.4% for diagnosing acute appendicitis respectively.⁸ This study shows that other parameters besides those used in Modified Alvarado score can be relevant in diagnosis of acute appendicitis in cases of diagnostic dilemma.

In prospective study by Alawayshih M.M et .al in (2019) in 100 patient found that Alvarado score has sensitivity of 54%, specificity of 75%, PPV of 89 % respectively in diagnosing acute appendicitis.⁹

In 60 patients in Vardhman Institute of Medical Sciences(VIMS) in 2019 by Gupta Vijay Kumar et al. found that Sensitivity of the Anderson scoring system was 76.6%, specificity came out to be 100%, the positive and negative values were 100% and 21.43% respectively.¹⁰ Goel KS et al in 2018 conducted a study on 100 patients where the specificity of Anderson scoring system was found to be 100%, sensitivity 73.7%, positive predictive value 100% and negative predictive value 16.67%.⁶ In the study by Devender Choudhary et al .in 2017 in 50 patients found that sensitivity of the Anderson scoring system was 76.6%, specificity 100% with positive and negative predictive values of 100% and 21.43% respectively.¹¹ These studies have shown the varied sensitivities and specificities on Anderson score. All these studies have results similar to our study except NPV which is higher in our study.

In this study, the area under the curve for MAS was 0.60 (0.40-0.90 at 95% CI). Comparing with the ROC curve analysis, the area under curve suggested poorer diagnostic accuracy. Similarly, the area under the curve for Anderson score was 0.95 (0.9-1 at 95% CI) Comparing with the ROC curve analysis, the area under curve suggested “very good” diagnostic accuracy.

Hence, this study shows that Anderson score has more sensitivity, specificity, PPV, NPV and diagnostic accuracy than Modified Alvarado’s score.

CONCLUSION

Both MAS and Anderson score are fast, simple, noninvasive, repeatable and safe scoring systems without extra expenses or complications for the diagnosis of Acute Appendicitis. Both systems are useful in hospitals where back up facilities are sparse.

The Anderson score has been shown to have a higher sensitivity and Positive predictive value as compared to MAS, hence incorporation of this score into our daily practice seems reasonable. Based on the findings of this study, Anderson Scoring System seems better suited than Modified Alvarado Scoring System in diagnostic accuracy of Acute Appendicitis and could be applied for the operative decision. Based Anderson scoring system could help in preventing negative laparotomies and appendectomies as well as be more sensitive for the diagnosis of acute appendicitis.

However there are certain limitations in this study as the study was based on single center and also the clinical findings varied when the same patient was examined at different points in time or by different clinicians consequently causing variation in aggregate scores.

REFERENCES

1. Shrestha S, Upadhyay PK, Shakya N, Pradhan S, Ajay KC. Comparison of Modified Alvarado score and Teicher score in predicting acute Appendicitis : A Prospective Study. 2022;(3):5400–5.
2. Shelton T, McKinlay R, Schwartz RW. Acute appendicitis: Current diagnosis and treatment. *Curr Surg*. 2003;60(5):502–5.
3. G. Sigdel, P. J. Lakhey, and P. R. Mishra, “Tzanakis score vs Alvarado score in acute appendicitis,” *J. Nepal Med. Assoc.*, vol. 49, no. 2, pp. 96–99, 2010, doi: 10.31729/jnma.105.
4. D. Talbot, R. V. Infirmary, and W. J. Cunliffe, “Evaluation of the modified Alvarado score in the diagnosis of acute appendicitis : a prospective study,” pp. 418–419, 1994.
5. Tamanna Md.Z.et al.Alvarado’s score in diagnosis of acute appendicitis.IJS.2012;2(1):66-67.
6. Goel K.S. , Goel S.Evaluation of validation of Anderson score for diagnosis of acute appendicitis by histopathology . *Int Surg J*. 2018 ;5(11):3489-3495.
7. Andersson M, Andersson RE. The appendicitis inflammatory response score: A tool for the diagnosis of acute appendicitis that outperforms the Alvarado score. *World J Surg* 2008;32(8):1843–9.
8. Madzar z. et. al .Sensitivity and specificity of fenyo-lindberg and teicher scores in the diagnosis of acute appendicitis in women .*Acta Clin Crota* .2016;55:593-599.
9. Awayshih M.M.A,Nofa M. N,Yousef J A. evulation of Alvarado score in diagnosing acute appendicitis :Pan African medical journal .2019;34:15.
10. Gupta V.K , Singh Dr S.P .Study of Anderson Score Evaluation in the Diagnosis of Acute Appendicitis.JMSCR. 2019; 7(3):104-108.
11. Choudhary D.,Nangarwal B. et al . Evaluation of anderson score in the diagnosis of acute appendicitis. *International Journal Of Science Research* . 2017;6(10).