Original Article

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Comparison of Lintula Score with Modified Alvarado Score for Diagnosing Acute Appendicitis in Adults

Ashis Pun,[1] Akin Jung Raymajhi,[1] Dipendra Neupane[1]

[1]Department of Surgery, Bharatpur Hospital, Bharatpur, Chitwan.

ABSTRACT

Background: Acute inflammation of the appendix or acute appendicitis is one of the most prevalent surgical emergencies seen in day-to-day practice. The delay in the diagnosis and the treatment of the condition can lead to complications and even death. Various scores have been developed over the time for aiding the diagnosis of Acute Appendicitis.

Methods: A hospital based cross-sectional study was conducted in Bharatpur hospital of Chitwan district of Nepal from December 30, 2020 to December 29, 2022 .This study identified and enrolled acute appendicitis patients that were treated in a tertiary hospital's emergency department of Bharatpur. The data were obtained and used to calculate modified Alvarado, and Lintula scores. All the patients were categorized into two groups according to their histopathological results, i.e., positive appendectomy and negative appendectomy. The sensitivity and specificity of different scoring systems in diagnosing Acute appendicitis was investigated.

Results: Sensitivity and specificity of Modified Alvarado score were 89.2% and 80.0% respectively. Diagnostic accuracy of Modified Alvarado Score was 88.57%. Positive productive value and Negative productive values of this scoring tool were 98.3% and 36.3% respectively whereas, diagnostic accuracy of Lintula score was 75.0%.

Conclusions: It can be inferred from the study that Modified Alvarado Score is a good screening tool for diagnosing need of appendectomy.

Keywords: Acute appendicitis: lintula score; modified alvarado score.

INTRODUCTION

Acute appendicitis (AA) is one of the most common cause of acute abdomen requiring surgical emergencies throughout the world.[1] Its prevalence varies around the world between 13% and 77%.[2] Approximately one-third of AA cases present with atypical clinical symptoms.[3] The delay in the diagnosis and the treatment of the condition can lead to complications. It is estimated that as much as 6% to 7% of the general population may develop appendicitis during their lifetime with the incidence peaking in the second decade of life.[4]

Various scores have been developed over the time for aiding the diagnosis of Acute Appendicitis.[5-8] Negative appendectomy is still a significant problem which requires further evaluation and reduction.[9,10] Histopathological evaluation of the post-appendectomy specimen remains the only gold standard test to confirm the diagnosis.[7] Both Lintula Score and Modified Alvarado Score are simple, easily accessible, cost-effective scoring system with Lintula score having added advantage of not requiring any investigation other than history and clinical exam that can facilitate surgeons in evaluating the disease rapidly and deciding the course of treatment but their diagnostic performance and clinical utility have been a matter of debate.[11, 12]

The aim of this study is to compare the diagnostic performance of Modified Alvarado score and Lintula score to determine their efficacy in predicting Acute Appendicitis in patients with acute abdominal pain.

METHODS

A cross sectional study was conducted among Acute Appendicitis patients from December 30, 2020 to December 29, 2022 in the department of Surgery, Bharatpur Hospital, Chitwan. Ethical approval was taken from InstitutionReview Committee (IRC) Bharatpur Hospital (reference number: 077/078-007A)

Correspondence: Dr Ashis Pun, Department of Surgery, Bharatpur Hospital, Bharatpur, Chitwan. Email: ashis_pun@hotmail.com, Phone: +9779851094189.

and informed written consent was taken from the patient. Patients aged 18 years and above undergoing emergency appendectomy at Bharatpur hospital with diagnosis of acute appendicitis were included in study. Pregnant patients, patients diagnosed with complicated appendicitis or it's sequales (Appendicular lump, Appendicular perforation, Peritonitis) and patients who have been planned to manage conservatively were excluded from study.All cases were assessed at emergency department by on duty residents and consultant .

A research conducted by Linjing Guan found that the prevalence of Acute Appendicitis in Adults was 8.7%.[13] By taking this as a prevalence with 95% confidence interval and 5% margin of error, sample size was calculated using the formula $n = \frac{Z^2pq}{e^2} = \frac{1.96^2 * 0.087 * 0.913}{0.05^2} = 123.$ By adding 10% non-response rate, the sample size of this research was 123+13=135. However, this research was conducted among 140 patients to maximize the robustness in the face of potential data loss or unforeseen variations, thus enhancing the reliability of the study findings.

Lintula Score and Modified Alvarado Score was measured and data was calculated using structured proforma. Lintula score of 21 or greater and Modified Alvarado Score of 7 or greater were considered diagnostic cut-off for appendicitis.[12,15,16] The final diagnosis as absence or presence of Acute appendicitis or it's sequels was decided by histopathological (HPE) report of the sample. Statistical analysis was done by using Statistical Package for Social Sciences (SPSS V21).

RESULTS

Table 1. General Characteristics of the patient group.

Variables	Values (%)
Age in years	
<40 years	115 (82.2)
40-59 years	14 (10.0)
60 years and above	11 (7.8)
Mean ±SD 29.95±12.27	
Gender	
Male	69 (49.3)
Female	71 (50.7)
Preliminary findings for AA	
Acute appendicitis	130 (92.9)
Appendicular abscess	3 (2.1)
Appendicular perforation	7 (5.0)

Table 1. General Characteristics of the patient group.

Variables	Values (%)
Histopathological finding	
Acute appendicitis with peri-appendicitis	111 (79.3)
Acute gangrenous appendicitis	9 (6.4)
Acute suppurative appendicitis	4 (2.9)
Grossly inflamed appendix, base healthy	3 (2.1)
Inflammatory bowel disease	4 (2.9)
Mycobacterium tuberculosis	1 (0.7)
Normal appendix	5 (3.6)
Perforated appendicitis	3 (2.1)

The table presents the distribution of general characteristics in the study population. The majority of patients were below 40 years of age (82.2%) and the mean age was 29.95±12.27 years. Gender distribution was almost equal, with 49.3% male and 50.7% female patients.

The preliminary findings for acute appendicitis revealed that 92.9% of patients had acute appendicitis, while 2.1% had appendicular abscess and 5.0% had appendicular perforation. The histopathological findings showed that 79.3% of patients had acute appendicitis with peri-appendicitis, 6.4% had acute gangrenous appendicitis, 2.9% had acute suppurative appendicitis, 3.6% had normal appendix, 2.1% had perforated appendicitis, 2.9% had inflammatory bowel disease, and 0.7% had Mycobacterium tuberculosis.

Table 2. Distribution of Modified Alvarado Score and Lintula Score among patient.

Score	Cutoff	Value (%)
Modified Alvarado	<4	1 (0.7)
	4-6	21 (15.0)
	≥7	118 (84.3)
Lintula	<21	31 (22.1)
	≥21	109 (77.9)

Table 2 shows the cutoff values and corresponding percentages for Modified Alvarado and Lintula scores used for diagnosis of acute appendicitis among the study population. Of the total study population, 84.3% had a Modified Alvarado score of ≥7, while only 0.7% had a score of <4. Similarly, for Lintula score, 77.9% of patients had a score of ≥21, while 22.1% had a score of <21.

Table 3. Diagnostic accuracy of Modified Alvarado Score.			
Group	n (%)	**Confirmed Appendicitis n (%)**	**Normal Appendix** n (%)
Modified Alvarado Score ≥7 (Acute Appendicitis)	118 (84.3)	116 (89.2) True Positive	2 (1.7) False Positive
Modified Alvarado Score <7 (Normal Appendix)	22 (15.7)	14 (10.8) False negative	8 (80.0) True negative

The table presents the results of the diagnostic performance of Modified Alvarado Score (MAS) in predicting acute appendicitis. The group with MAS score of at least 7 had a total of 118 patients, of which 116 (89.2%) were confirmed to have acute appendicitis and 2 (1.7%) were false positive cases. In contrast, the group with MAS score less than 7 had a total of 22 patients, of which 14 (10.8%) had acute appendicitis (false negative) and 8 (80.0%) were true negative cases.

Hence, Sensitivity and specificity of Modified Alvarado score were 89.2% and 80.0% respectively. Positive productive value (PPV) and Negative productive values (NPV) of this scoring tool were 98.3% and 36.3% respectively. Diagnostic accuracy for this score is 88.57%.

Table 4. Diagnostic accuracy of Lintula Score.			
Group	**n (%)**	**Confirmed Appendicitis n (%)**	**Normal Appendix** n (%)
Lintula Score ≥21 (Acute Appendicitis)	109 (77.9)	102 (78.5) True Positive	7(70.0) False Positive
Lintula Score <21 (Normal Appendix)	31 (22.1)	28 (21.5) False negative	3 (30.0) True negative

The study finding suggests that a total of 140 patients suspected of having appendicitis were evaluated using the Lintula score as a diagnostic tool.[15,16] The patients were categorized into two groups based on their Lintula score: high probability of acute appendicitis (n = 109), and low probability of acute appendicitis (n = 31).

Among the patients with a Lintula score of above 21, 102 (78.5%) were confirmed to have appendicitis while 7 (6.4%) were confirmed to not have appendicitis (false positive). Among the patients with a Lintula score less than 21, 28 (21.5%) were confirmed to have an appendicities, while 3 (9.7%) were confirmed to have normal appendix (true negative). Diagnostic accuracy of Lintula score was 75.0%.

Hence, sensitivity and specificity of the Lintula score was observed 78.5% and 30% respectively. Positive productive value and Negative productive values were 93.5% and 9.67% respectively.

DISCUSSION

Acute Appendicitis is the most common cause of acute abdomen in Nepal accounting for 52% of cases with median age being 23 years and the frequency being higher in male than females.[14] Acute appendicitis is most often diagnosed clinically and requires a high index of suspicion to facilitate prompt treatment of this condition, thereby avoiding the substantial morbidity like such as recurrent episodes of intestinal obstruction due to intra-abdominal adhesions, ectopic pregnancy etc. and even mortality associated with delayed diagnosis and subsequent perforation.[15] So, accurate and timely diagnosis is paramount for the proper management of AA.[16]

Modified Alvarado score and Lintula score are two commonly used diagnostic tools for acute appendicitis. The Modified Alvarado score is a clinical scoring system that includes eight parameters, such as migration of pain, rebound tenderness, and white blood cell count, to assess the likelihood of acute appendicitis. The Lintula score, on the other hand, is a more recent diagnostic tool that includes six parameters, such as age, gender, and duration of symptoms, to predict the probability of acute appendicitis.[12, 17]

This study's results showed that the Modified Alvarado score had a sensitivity of 89.2% and specificity of 80.0%, with a positive predictive value of 98.3%, negative predictive value of 36.3% and diagnostic accuracy for this score is 88.57%. These findings are consistent with previous studies that have shown the Modified Alvarado score to be a reliable diagnostic tool for acute appendicitis. Similar finding was observed in a study conducted in Eastern part of Nepal by Bushal et. al. where the sensitivity, positive predictive value and diagnostic accuracy of Alvarado scoring system were 95.5%, 93.4% and 90.91% respectively.[18]Another

similar study by Abou Merhi et. al. reported with 80.7% positive predictive value.[19] But, another similar study by Schneider et al revealed a positive productive value of 58 % only.[20]A study by Khan et. al. reported with the very supporting finding as compared the present study with 83% sensitive, 62% specific, and 65% accurate to detect acute appendicitis through the modified Alvarado score where PPV and NPV were 94% and 33%, respectively.[21]

In contrast to Modified Alvarado score, the Lintula score had a sensitivity of 78.5% and specificity of only 30.0% only with a positive predictive value of 93.5%. These findings suggest that the Lintula score has a relatively high true positive rate but also a high false positive rate, which may lead to unnecessary surgeries.[12] These results suggest that the Lintula score has poor diagnostic accuracy for acute appendicitis compared to the Modified Alvarado score. The findings of this study are consistent with previous studies that have also reported low sensitivity and specificity positive productive value and negative productive value of the Lintula score in diagnosing acute appendicitis.[22, 23] The limitation of the study is it includes the data of only one tertiary hospital with limited sample so findings may not be generalized to the wider population.

CONCLUSIONS

Our results showed better sensitivity, specificity, PPV, NPV and diagnostic accuracy of Modified Alvarado scoring system than Lintula scoring system. Therefore, it is important to consider using the Modified Alvarado score instead of the Lintula score for diagnosing acute appendicitis.

CONFLICT OF INTEREST

None

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