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Original Research Article

Role of Modified Alvarado Scoring System (MASS) in the Diagnosis of Acute Appendicitis: A Cross-sectional Study

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Abstract

Background: One of the most frequent acute digestive conditions seen in emergency rooms across worldwide is acute appendicitis. Despite improvements in surgical and diagnostic methods, detecting acute appendicitis is still difficult, and delaying treatment can make a seemingly straightforward surgical condition more complicated. In females, the diagnosis is even more difficult. A quick and inexpensive diagnostic method that doesn't require expensive equipment, the Modified Alvarado Scoring System (MASS) can be used in emergency situations and even at odd hours of the night. Aim of this study to test the efficacy and diagnostic accuracy of MASS in the diagnosis of acute appendicitis.

Methods: From December 2024 to May 2025, a prospective cross-sectional study was carried out in Department of Surgery at GMCH, Bettiah, West Champaran, and Bihar. The study included 93 adult patients in total, 55 of whom were male and 38 of whom were female. The effectiveness of MASS in diagnosing acute appendicitis was assessed by comparing the sensitivity, specificity, positive predictive value, and negative predictive value of the test in males and females individually.

Results: Compared to patients with a score of less than 7, the majority of patients with a MASS of 7 or higher were determined to have acute appendicitis. The acceptable positive and negative predictive values for MASS were 5.91 and 0.08, respectively, while its sensitivity and specificity were 93.24% and 84.21%.

Conclusion: For the diagnosis of acute appendicitis, the Modified Alvarado Scoring System is a simple but effective diagnostic tool that has a satisfactory level of accuracy and acceptable sensitivity and specificity.

Keywords: Scoring systems, appendicular pathology, and Diagnostic modalities.

Introduction

The most frequent acute abdominal emergency that necessitates immediate surgical intervention is acute appendicitis [1]. Its lifetime prevalence is predicted to be 7% [2]. Interventions are needed, and efforts are being done to arrive at an early diagnosis [3]. High morbidity could result from a delayed diagnosis [4].

Acute appendicitis can occasionally manifest in unusual ways, and diagnosing it might be more difficult if the symptoms coincide with those of other illnesses [5].

When diagnosing a suspected case of acute appendicitis, the primary concern is whether surgery should be performed without increasing the number of needless negative surgical procedures [1]. Junior surgeons can utilize the Modified Alvarado Scoring System (MASS), which employs a few clinical signs and symptoms, to diagnose acute systemic appendicitis in an emergency situation since it is a straightforward and user-friendly scoring system [6,7].

Material and Methods

From December 2024 to May 2025, a prospective cross-sectional study was carried out in the surgery department of the Government Medical College and Hospital, Bettiah, West Champaran, Bihar. A total of 93 adult patients (55 males and 38 females) were enrolled in the study after taking signed consents from the patients. Patients presenting with acute pain right lower abdomen and suspected to suffer from acute appendicitis were included in the study without any randomization. Children below

eighteen years of age, and non-consenting adults were excluded from the study. Sensitivity, specificity, Positive predictive value and Negative predictive value of MASS were found separately in males and compared with those of females to see the efficacy of MASS in the diagnosis of acute appendicitis. Descriptive statistics was used for the statistical analysis. Patients presenting to the hospital with acute pain in the right lower abdomen was subjected to clinical examination and data was collected as per the required format of the Modified Alvarado Scoring System [Table -1] and blood was collected at that time itself for total leucocyte count and other blood parameters as deemed fit for anesthesia fitness should the patient require surgery at a later date.

Table 1: Showing parameters used in Modified Alvarado Scoring System

Symptoms	**Score**
Migratory right iliac fossa pain	1
Nausea/Vomiting	1
Anorexia	1
Signs	
Tenderness in right iliac fossa	2
Rebound tenderness in right iliac fossa	1
Elevated temperautre	1
Laboratory Findings	
Leucocytosis	2
Total	9

Results

About 80% of appendix was found to be inflamed at surgery [Table-2] and confirmed on histopathological examination after surgery [Table-3]. Most of the patients having a MASS of 7 or higher were found to have acute appendicitis in comparison to those having score <7 [Table-4]. The sensitivity and specificity of MASS was found to be good [Table-5] with acceptable positive and negative predictive values.

Table 2: Showing intraoperative findings of appendix

Operative Findings	**Frequency**	**Percentage (%)**
Inflamed appendix	66	70.97%
Gangrenous appendix	6	6.45%
Perforated appendix	2	2.15%
Normal appendix	19	20.43%
Total	63	100%

Table 3: Showing histological findings of appendix after surgery

Histological Findings	**Frequency**	**Percentage (%)**
Acute appendicitis	57	61.29%
Suppurative appendicitis	10	10.75%
Chronic non-specific appendicitis	7	7.53%
Normal appendix	19	20.43%
Total	93	100%

Table 4: Showing the Alvarado scores in patients with or without appendicitis

Mass	**Histological Findings**		**Total**
	Appendicitis	**No Appendicitis**	
≥7	69	3	72
<7	5	16	21
Total	74	19	93

Table 5: Showing the sensitivity, specificity, PPV, NPV, PLR and NLR in various categories of patients

Variable	Male	Female	Combined	p-value
Sensitivity (95% CI)	93.75% (82.80% to 98.69%)	92.31% (74.87% to 99.05%)	93.24% (84.93% to 97.77%)	0.787
Specificity (95% CI)	85.71% (42.13% to 99.64%)	83.33% (51.59% to 97.91%)	84.21% (60.42% to 96.62%)	0.755
Positive Likelihood Ratio (95% CI)	6.56 (1.07 to 40.34)	5.54 (1.56 to 19.72)	5.91 (2.09 to 16.71)	0.841
Negative Likelihood Ratio (95% CI)	0.07 (0.02 to 0.23)	0.09 (0.02 to 0.36)	0.08 (0.03 to 0.19)	0.973
Positive Predictive Value (95% CI)	97.83% (88.47% to 99.94%)	92.31% (74.87% to 99.05%)	95.83% (88.30% to 99.13%)	0.205
Negative Predictive Value (95% CI)	66.67% (29.93% to 92.51%)	83.33% (51.59% to 97.91%)	76.19% (52.83% to 91.78%)	0.752

Discussion

Acute appendicitis is diagnosed clinically. Despite the extensive use of sophisticated imaging modalities and numerous predicted score systems, many patients continue to have negative appendicectomies [6]. There is no established "acceptable" Negative Appendicectomy Rate (NAR), not even in developed countries like the United Kingdom [6].

Surgeons often tolerate a negative appendectomy rate of roughly 15-20% in order to prevent the complications of perforated appendicitis, while a negative appendectomy rate of 20-40% has been documented in the literature [7]. Although doing an appendicectomy at a higher threshold may boost diagnostic accuracy, there is a greater chance of appendicular perforation and infection, which raises morbidity and mortality [9]. Acute appendicitis can be more accurately diagnosed with ultrasound or computed tomography imaging, although these procedures come at a higher cost [9]. According to Livingston EH et al., improper use of CT imaging can result in the diagnosis of early low-grade appendicitis, which might have been treated with antibiotics alone and prevented appendicectomies [7].

Graded compression sonography and scoring systems may increase the precision of acute appendicitis diagnosis [10].

Three indicators, three symptoms, and two lab results served as the foundation for the initial Alvarado Scoring System. Even though the diagnostic accuracy varies, the Modified Alvarado Scoring System (MASS), which omits the shift of neutrophil count to the left, has also been demonstrated to be a rapid and affordable diagnostic tool for diagnosing acute appendicitis [10–12]. Alvarado initially set a cut-off value of 7 for operating on patients who had suspected acute appendicitis, and this cut-off score has since been widely utilized in numerous subsequent investigations [10–12].

Accordingly, using a cut-off point of 7, our series' sensitivity, specificity, positive predictive value, and negative predictive value were 93.24%, 84.21%, 95.73%, and 76.19%, respectively. The sensitivity, specificity, positive predictive value, and negative predictive value of 94.1%, 90.4%, 95.2%, and 88.4%, respectively, were also achieved by Kanumba et al. [4]. According to Nishikant Gujar et al., the Modified Alvarado Score's sensitivity and specificity were 98.44 and 94.44%, respectively [13].

In their study, Nanjundaiah N et al. found that MASS had sensitivity, specificity, positive predictive value, and negative predictive values of 58.9%, 85.7%, 97.3%, and 19.1%, appropriately [9]. According to TMán E et al., clinical assessment was more sensitive than the Alvarado score for diagnosing acute appendicitis [14]. With the MASS, Gurav et al. demonstrated sensitivity and specificity of 20.00% and 80.00% in cases of acute appendicitis and 28.57% and 78.83% in cases of non-acute appendicitis [15]. At a MASS cut-off point of 7, Shirzad Nasiri et al. series yielded sensitivity, specificity, PPV, NPV, and accuracy of 62.7%, 65.7%, 37.5%, 89.8%, and 11.5%, respectively [16]. In contrast to the conventional cut-off point of 7[17], Sun et al. showed a higher sensitivity and NPV at a cut-off point of 6.

Conclusion

In conclusion, MASS can be used in daily practice and is a low-cost diagnostic technique for acute appendicitis with varied sensitivity and specificity. Ultrasonography may increase MASS's sensitivity and specificity in diagnosing acute appendicitis in questionable situations.

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