

## Comparison of Modified Alvarado Score with Ultrasonogram in the Diagnosis of Acute Appendicitis at a Tertiary Care Center of Dakshina Kannada

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### Abstract

**Introduction:** Acute appendicitis is one of the commonest emergency presenting at general surgery department calling for an emergency appendectomy either by open laparotomy or laparoscopic technique is performed. Thus a rapid yet accurate diagnosis becomes important to prevent wrong procedure. **Objectives:** We intend to compare the diagnostic accuracy of Modified Alvarado Score System (MASS) and ultrasound in the diagnosis of acute appendicitis at our institution in Dakshina kannada. **Materials and methods:** A prospective study was conducted between October 2015 to October 2017 at our institution. 100 patients were included in the study after obtaining an informed consent. A detailed clinical examination was performed following which the clinical finding and laboratory findings including total leucocyte count and differential count were in noted in the patient's study proforma. Patients were then subjected to ultrasound examination for appendicitis. The radiological findings were also then tabulated. Appendectomy was then performed followed by histopathological examination of the specimen for confirmation of the diagnosis. The histopathological diagnosis of acute appendicitis was considered as positive report and using SPSS software and MEDCALC Software descriptive statistics were calculated for MASS and ultrasound. **Results:** Out of 100 patients 52 were males and 48 were females. MASS and ultrasound showed sensitivity, specificity, positive predictive value and negative predictive value of 60%, 90%, 98.18%, 20%,

93.3%, 20%, 91.3%, and 25% respectively. Application of Chi-square test showed that MASS had better correlation histopathological finding with a statistically significant p value of 0.000 (< 0.005). **Conclusion:** Both MASS and Ultrasound examination have a distinct advantage and limitation when used independently. But utilisation of both modalities complementarily serves as a better management strategy in acute appendicitis.

**Keywords:** MASS; Ultrasound; Sensitivity; Specificity; p value; Complementary Value.

### Introduction

Acute appendicitis is one of the commonest emergencies presenting at general surgery department [1] calling for an emergency appendectomy either by open laparotomy or laparoscopic technique is performed. Thus a rapid yet accurate diagnosis becomes important to prevent wrong procedure [2]. Alvarado scoring system which includes scores for clinical finding and blood investigation like total WBC count is commonly utilized method in the diagnosis of acute appendicitis. Acute appendicitis many a times presents with atypical symptoms or symptoms overlapping with other disorders making the clinical diagnosis difficult. Ultrasound on the other hand is non-invasive, broadly available and used imaging modality in the diagnosis of acute appendicitis. The challenge associated with ultrasound is its availability at peripheral centres. Many studies are conducted comparing the efficacy of Modified Alvarado score (MASS) and ultrasound in diagnosis of acute appendicitis and have obtained varied results [3]. Thus in our study we intend to compare the diagnostic accuracy of MASS and ultrasound in the diagnosis of acute appendicitis at our institution in Dakshina kannada.

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## Materials and Methods

The prospective study was conducted between October 2015 to October 2017 at our institution. After obtaining an informed consent, 100 patients in the age group of 15-60 years and clinical suspicion of acute appendicitis were enrolled in the study. Cases with appendicular mass formation and perforation were excluded from the study. A detailed clinical examination was performed following which the clinical finding and laboratory findings including total leucocyte count and differential count were noted in the patient's study proforma. Patients were then subjected to ultrasound examination for appendicitis. The radiological findings were also then tabulated. Appendectomy was then performed followed by histopathological examination of the specimen for confirmation of the diagnosis. The histopathological diagnosis of acute appendicitis was considered as positive report and diagnosis of chronic appendicitis or normal appendix were considered as negative report. MASS was calculated which include a score of 2 points for findings like tenderness in right iliac fossa and leucocytosis. For other findings like pain in the right iliac fossa, anorexia or presence of ketone bodies in urine, nausea or vomiting, rebound tenderness and fever with temperature of  $> 37^{\circ}\text{C}$  were given score of one. The data were entered in Microsoft Excel and analysed using SPSS software and MEDCALC Software.

Using histopathology findings as gold standard descriptive statistics was calculated for MASS and ultrasound. The descriptive statistics included sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy expressed as percentage.

## Results

Out of 100 patients 52 were males and 48 were females. The percentage distribution of patient with respect to age is  $<20$ , 21-30, 31-40 and  $>40$  years are 39%, 35%, 16% and 10% respectively. 55 patients had MASS of more than 7 which was highly suggestive of

acute appendicitis. 90 cases were positive for acute appendicitis on histopathological examination. The results of Alvarado score with respect to histopathological examination are as shown in Table 1.

**Table 1:** Diagnostic accuracy of MASS in diagnosis of acute appendicitis

		HPR		
		Positive No (%)	Negative No (%)	Total No (%)
MASS	Positive	54 (60.0)	1 (10.0)	55 (55.0)
	Negative	36 (40.0)	9 (90.0)	45 (45.0)
	Total	90 (100.0)	10 (100.0)	100 (100.0)

**Table 2:** Diagnostic accuracy of Ultrasound in diagnosis of acute appendicitis

		HPR		
		Positive No (%)	Negative No (%)	Total No (%)
USG	Positive	84 (93.3)	8 (80.0)	92 (92.0)
	Negative	6 (6.7)	2 (20.0)	8 (8.0)
	Total	90 (100.0)	10 (100.0)	100 (100.0)

Ultrasound examination showed 92 cases as positive for acute appendicitis. The diagnostic accuracy of ultrasound in diagnosis of acute appendicitis is as shown in Table 2.

The analysis of the data for descriptive statistics showed that MASS has higher specificity favouring MASS as a better diagnostic modality in making definitive diagnosis of acute appendicitis whereas ultrasound having a higher sensitivity serves as an excellent tool in screening for acute appendicitis. The results are as shown in Table 3.

The comparison of MASS with USG showed Chi-square = 27.574, with p-value = 0.000 ( $<0.05$ ) showing that there is significant statistical difference in the results obtained by both techniques. Thus the two tests will have to be used complementary to each other rather than alternative to each tests.

**Table 3:** Statistical evaluation of Modified Alvarado scoring system and ultrasound

Diagnostic test evaluation	MASS		USG	
	Value	95% CI	Value	95% CI
Sensitivity	60.00%	49.13% to 70.19%	93.33%	86.05% to 97.51%
Specificity	90.00%	55.50% to 99.75%	20.00%	2.52% to 55.61%
Disease prevalence	90.00%	82.38% to 95.10%	90.00%	82.38% to 95.10%
Positive Predictive Value	98.18%	89.30% to 99.71%	91.30%	88.46% to 93.50%
Negative Predictive Value	20.00%	15.28% to 25.74%	25.00%	7.18% to 58.96%
Accuracy	63.00%	52.76% to 72.44%	86.00%	77.63% to 92.13%
P-Value	0.000 ( $<0.05$ )		0.791 ( $>0.05$ )	

## Discussion

Acute appendicitis being the commonest ailment presenting at surgery department in any place requiring surgical intervention an accurate diagnosis becomes essential. Various studies have compared the diagnostic utility of Alvarado score and ultrasound in the diagnosis of acute appendicitis. In our study as we evaluated the utility of MASS in diagnosis of acute appendicitis we found MASS to have higher specificity of 90% similar to studies [4]. But MASS definitely has gray area because pelvic inflammatory disease, ovarian torsions and other causes of acute pain in right iliac fossa mimics appendicitis curbing utility of MASS as sole diagnostic criteria. Ultrasound examination on the other hand showed higher sensitivity similar to other studies [5]. In our study it is found that false positive rates were in ultrasound examination (80%) in comparison to MASS with (10%). Several causes for these falsely elevated rates of acute appendicitis in ultrasound are been described in literature. Lesions like Chron's disease, lymphoid hyperplasia and peritonitis have been described as a possible cause of abnormal appearance of appendix on ultrasound as inflamed appendix [6,7,8]. Non visualisation of appendix is another important limitation in utilization of ultrasound as a sole diagnostic modality. In our study we found that both MASS and ultrasound together yielded a higher sensitivity and specificity thereby higher diagnostic accuracy and show that both have complimenting rather than comparative results. Similar conclusions have been drawn by other studies [9].

## Conclusions

From our study we conclude that both MASS and Ultrasound examination have a distinct advantage and limitation when used independently. But utilisation of both modalities complementarily serves as a better management strategy in acute appendicitis.

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