

## ALVARADO SCORE AND ITS CORRELATION WITH APPENDICITIS

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### ABSTRACT

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#### BACKGROUND

Acute appendicitis is the most common cause of an acute abdomen. The treatment is surgical and negative appendectomy rates are high. The Alvarado score can be used to stratify patients with symptoms of suspected appendicitis. It enables risk stratification in patients presenting with abdominal pain, linking the probability of appendicitis to recommendations regarding discharge, observation or surgical intervention.

#### AIMS AND OBJECTIVES

This study was conducted to evaluate Alvarado scoring system for diagnosis of acute appendicitis and its correlation with operative finding and histopathology. Patients presenting in the Emergency Department in primary and secondary care settings, especially in low-resource countries where emergency CT scan is not available round the clock can be benefitted from the Alvarado scoring system.

#### MATERIALS AND METHODS

The score has 6 clinical items and 2 laboratory measurements with a total 10 points. This study was conducted on 98 patients irrespective of age and sex, who attended the emergency and OPD during the course of the work with symptoms suggestive of acute appendicitis including abdominal pain, rebound tenderness, nausea, vomiting or elevated temperature with/without leukocytosis and neutrophilia, and charts were made for each of the patients. Using the scoring system for appendicitis developed by Alvarado, each chart was scored. Out of 98 patients, 7 patients with Alvarado score of  $\leq 4$  were treated conservatively and later discharged in stable condition. The remaining 91 patients with score of 5-6 and those with score of  $\geq 7$  were operated. Operative finding and later histopathological examination confirmed the diagnosis of acute appendicitis in 83 patients out of 91 who underwent appendectomy.

#### RESULT

In this study, we compared the Alvarado score of the patient recorded prior to operation with the operative finding and histopathological report. The results were statistically analysed by Student's t-test. The T-value was 3.285208. The P-value was 0.003258, which is statistically significant at  $P < 0.05$ .

#### CONCLUSIONS

Alvarado scoring system is simple yet very strong tool to diagnose acute appendicitis thus reducing negative appendectomy rate to a great extent.

#### KEYWORDS

Appendicitis, Alvarado Score, Rebound Tenderness, Leukocytosis, Neutrophilia.

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#### INTRODUCTION

Acute appendicitis is a common, sometimes confusing and often treacherous cause of an acute abdomen at all ages.<sup>[1,2]</sup> The only way to reduce morbidity and to prevent mortality is to perform appendectomy before perforation or gangrene occurs. In our drive to go for early appendectomy to prevent complication, we often land up in removing a normal appendix where operation could have been avoided.<sup>[2,3]</sup>

So the need for a tool to pin point cases of genuine appendicitis was long sort after. In 1986, Alvarado constructed a 10-point clinical scoring system.<sup>[4]</sup> for the diagnosis of acute appendicitis based on symptoms, signs and diagnostic tests in patients presenting with suspected acute appendicitis.

They are abdominal pain that migrates to the right iliac fossa, anorexia (Loss of appetite) or ketones in the urine, nausea or vomiting, tenderness in the right iliac fossa, rebound tenderness, fever of 37.3°C or more, leukocytosis (WBC > 10,000/ $\mu$ l) and neutrophilia, or an increase in the percentage of neutrophils in the serum white blood cell count.<sup>[4,5]</sup>

The two most important factors, tenderness in RIF and leukocytosis are assigned two points and the six other factors are assigned one point each for a possible total score of ten points.<sup>[5,6]</sup>

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A popular mnemonic used to remember the Alvarado score factors is also known by the acronym MANTRELS. Due to the popularity of this mnemonic, the Alvarado score is also referred to as the MANTRELS score.<sup>[5,6,7]</sup> (Table 1).

	Characteristics	Score
SYMPTOMS	Migration of pain to the RIF	1
	Anorexia	1
	Nausea and vomiting	1
SIGNS	Tenderness in RIF	2
	Rebound pain	1
	Elevated temperature	1
LABORATORY TESTS	Lekocytosiss	2
	Shift of WBC to the left	1
<b>Total</b>		<b>10</b>

**Table 1: Alvarado (MANTRELS) Score**

A score  $\leq 4$  suggests 96% probability that the diagnosis is not appendicitis. A score of 5 or 6 is compatible with the diagnosis of acute appendicitis. A score of 7 or 8 indicates a probable appendicitis and a score of 9 or 10 indicates a very probable acute appendicitis and consider surgery (58-88% chance of positive appendicitis).<sup>[6,7]</sup>

**AIMS AND OBJECTIVES**

This study was conducted to evaluate Alvarado scoring system for diagnosis of acute appendicitis and its correlation with operative finding and histopathology. Patients presenting in the Emergency Department in primary and secondary care settings, especially in low-resource countries where emergency CT scan is not available round the clock, can be benefited from the Alvarado scoring system by reducing negative appendicectomy.

**MATERIALS AND METHODS**

This prospective study was carried out on 98 patients of age varying 7-60 years who attended emergency as well as surgery OPD. Patients suspected of having acute appendicitis were included in the study. Each patient in the study group was examined separately.

A detailed history was taken in each case and their complaints were noted down. Points taken into account were the site of pain, whether localised to right iliac fossa or there has been a shift of pain from umbilical region to right iliac fossa. Nausea, vomiting, fever and loss of appetite were enquired. Following proper history taking, a thorough clinical examination was also done.

The patients were examined for Rovsing's sign, muscle rigidity, rebound tenderness, Cope's Psoas test, obturator test, pain in RIF on coughing. The peristaltic sound was looked for and a PR examination was also done. Patients with urological, gynaecological or surgical problems other than appendicitis and especially patients with mass in right iliac fossa or those patients with incomplete documentations in the case sheets were excluded from the study.

Alvarado scoring was done and patients were categorized into three groups, score  $\geq 7$ , 5-6 and  $\leq 4$ : as it is standard to label those patients with a score  $\geq 7$  as diagnostic of appendicitis, score of 5-6 as doubtful, but potential candidates suffering from the disease and scores of  $\leq 4$  unlikely to suffer from the condition.

Those patients whose Alvarado scores were  $>4$  were operated and those who had Alvarado score 1-4 were treated conservatively. Operative notes were analysed and the histopathological examination of the specimens were correlated with their score done prior to the operation.

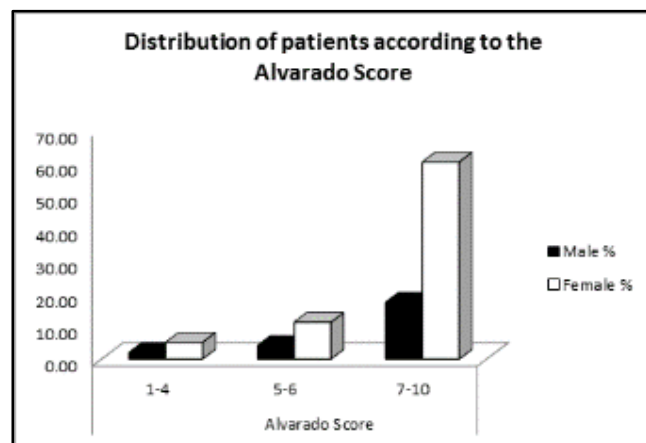
**RESULTS AND ANALYSIS**

A total of 98 patients were included in this study, which comprised of 23 males and 75 females in a range of 7-60 years; 7 patients were placed within the 1-4 score range, 15 patients were categorized as within 5-6 and 76 patients fitted into the last score range of 7-10.

Table-2 and Figure-1 show distribution of patients according to Alvarado score.

Alvarado Score	No. of Patients	Percentage	Male %	Female %
1 - 4	7	7.14 %	2.04 %	5.10 %
5 - 6	15	15.31 %	4.08 %	11.23 %
7 - 10	76	77.55 %	17.35 %	60.20 %

**Table 2: (n = 98)**



**Fig. 1**

Out of the total 98 patients, 91 patients were operated and at operation the status of appendix was studied. The look of appendix was categorised into normal looking, catarrhal type, phlegmonous type, gangrenous type, perforative type and early lump. After operation, the specimens of appendix of each patient were sent for histopathological examination. The reports were consistent with acute appendicitis except the 8 patients with normal looking appendix at operation.

Depending on per-operative findings as well as histopathological examination of the specimens of the patients in our study, the following results were found (Vide Table-3).

Group	Alvarado Score	Type of Appendix	HPE	Number of Patients	%
1	5-6	Normal	Normal	8	8.79 %
2	5-6	Catarrhal	Appendicitis	7	7.69 %
3	7-10	Catarrhal	Appendicitis	19	20.88 %
4	7-10	Phlegmonous	Appendicitis	38	41.76 %
5	7-10	Gangrenous	Appendicitis	14	15.38 %
6	7-10	Perforative	Appendicitis	8	9.79 %
7	7-10	Early Lump	Appendicitis	5	5.49 %

**Table 3: (n = 91)**

In Table-3, we can see that the operative findings and histopathological reports were highly correlated with the Alvarado scoring of patients which was done before operation. The results were statistically analysed by student's T-test. The T-value is 3.285208. The P-Value is 0.003258. The result is significant at  $p < 0.05$ .

Figure-2 compares the Alvarado score of the patients in our study with their per-operative findings and histopathological reports.

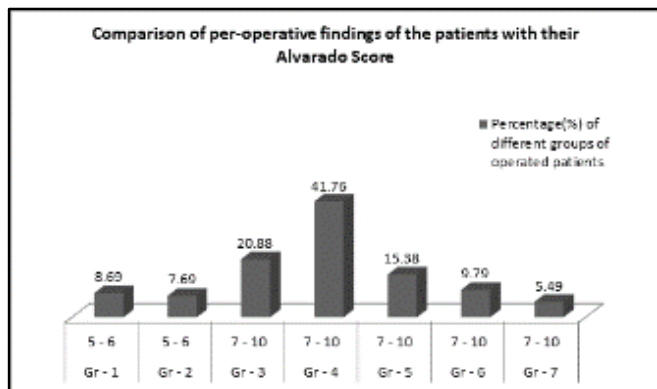


Fig. 2: (n = 91)

**DISCUSSION**

It is very difficult at times to pin point the diagnosis of acute appendicitis, especially in developing countries where advanced radiological investigations are not available round the clock. So history and clinical examination still remains the mainstay for the diagnosis, but misdiagnosis and negative appendectomy still do occur at quite a high rate.<sup>[8,9]</sup> It is the surgeon who has to decide the best management for the patient. The decision to operate or not is very important as any surgical intervention is not without the risk of morbidity and mortality.<sup>[9]</sup>

Alvarado score is a practical, reliable and very easy to score. It can be helpful for safe and accurate decision making in patients with acute appendicitis.<sup>[9,10]</sup> It can also categorize the patients for observation. We had a negative appendectomy in only 8 patients at a rate of 8.79% ( $8/91 \times 100$ ), which is very low as we have already discharged 7 patients from our study group whose Alvarado scores were  $\leq 4$ . Thus the negative appendectomy rate was reduced to almost half.

There are various studies which have considered Alvarado scoring in acute appendicitis. The results of our study are comparable with most of them. Table - 4.<sup>[11,12,13]</sup>

Authors	Year	No. of Patients	Accuracy
Owen T.D, et al.	1992	215	78%
Chan M.Y.P.	2001	148	77%
Saleem M.I.	2002	125	72%
Nabulsi B.E.	2003	125	84%
Baidya N, Rodrigues G, Rao A, Khan S	2005	231	82%
Present Study	2011	98	91%

Table 4: (Comparison with Other Studies)

**CONCLUSION**

Despite the availability of radiological (US/CT) investigative modalities, a recent population-based study in USA indicated that there was essentially no change in the frequency of negative appendectomy.<sup>[14]</sup> Similar results were also reported, where the authors found that ultrasonography did not have any additional benefit over Alvarado score and were of the opinion that ultrasonography is unnecessary in diagnosis of acute appendicitis.<sup>[14,15]</sup>

Alvarado scoring system is easy, simple, cheap and useful tool in pre-operative diagnosis of acute appendicitis and can work effectively in routine practice.<sup>[16]</sup> Scores more than 7 is definitely confirmatory with the diagnosis of acute appendicitis and early operation is indicated to avoid complications.<sup>[15,16]</sup> Patients in the score range of 5-6 require admission and need re-evaluation for possible deterioration of clinical condition and further investigated to confirm the diagnosis of acute appendicitis and earliest possible intervention if required. Patients with score of  $\leq 4$  can be treated conservatively unless any other cause for acute abdomen is found on investigation.<sup>[16,17]</sup>

Thus to conclude assessment of all patients with suspected appendicitis by the Alvarado scoring system definitely improves the diagnostic accuracy and possibly reduces the complication rate as well as reduce negative appendectomy rates.

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