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Evaluation of Modified Alvarado Score in Patients Presenting With Acute Appendicitis at a Tertiary Care Hospital

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Abstract
Introduction
Acute appendicitis is one of the most common causes of acute abdominal pain in surgical patients. After reviewing the literature, we found that negative appendectomy rates have remained consistent over the past few years. Negative appendectomy not only adds an economic burden to healthcare facilities in developing countries such as India, but also negatively impacts patients overall health. The following study was done to evaluate the diagnostic accuracy of the Modified Alvarado scoring systemand its ultimate effect on mortality and morbidity of the patient.
Materials and Method
This study was conducted in Narayan Medical College and Hospital, Sasaram Bihar, over a period of 1 year in which 25 patients presenting with the lower quadrant abdominal pain and fulfilling the inclusion criteria were selected randomly and included in the study. Modified Alvarado Score was calculated for each one of them. Confirmation of the diagnosis was done after the histopathological examination of appendix.
Result
Modified Alvarado Score >7 was found in 80% (i.e., 82.75% of males and 76.19% of females) of patients with appendicitis. In addition to these findings, we also got exact information about the age and sex distribution along with the most common presenting complaint, the postoperative complications and the need for post operative stay in appendicitis patients.
Conclusions
The modified Alvarado scale is a quick, simple, non-invasive, repeatable and highly economical assessment. When applied intentionally and objectively, delays in surgery and subsequent complications can be prevented, as well as the number of negative appendectomies can be reduced.

Keywords: *Acute Appendicitis; Right Iliac Fossa Pain; Modified Alvarado Score (MAS); RIPASA Score.*

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I. Introduction

Acute appendicitis is one of the most common surgical emergencies [1]. The diagnosis of acute appendicitis is hampered by the absence of typical symptoms and of suggestive laboratory data in about 20–33% of the cases[2]. A quick and correct diagnosis of acute appendicitis with subsequent early appendectomy can avoid complications arising from perforation[3]. A high percentage of negative appendectomies (20%) was considered reasonable, based on the premise that delay would inevitably lead to perforation, increasing morbidity and even mortality[4]. Clinical examination, when used alone, can lead to negative appendectomy rate (NAR) of 15- 30% and this rate is even higher in the females of reproductive age group i.e., 15- 50%.[5,6]. Preoperative evaluation with CECT abdomen has been reported to decrease this rate from 20% to as low as 5% [7], but in a developing country like India, prescribing CECT abdomen for every suspected appendicitis patient, can cause a substantial economic burden on the health care facilities. So, a good clinical scoring system is the only viable option for the emergency setting in our country. Alvarado Scoring System, most popularly used for diagnosing acute appendicitis, was first described in 1986. Since then, many other scoring systems have been reported from time to time like Modified Alvarado Score, Fenyo, Ohmann, IRA Teicher, RIPASA, Lindberg, AIRS etc. Out of

these, Alvardo and its modification by Kalan et al in 1994 are the most widely used scoring systems. Modified Alvarado Score (MAS) excludes the last criterion of Alvardo Score i.e., Shift to left in WBC count as it is not available in all the laboratories. Patients are thus scored out of 9 instead of 10 as in Alvarado Score.[8] MAS is the most easily reproducible score and hence the present study was taken up with the aim to evaluate its diagnostic accuracy and clinical relevance. The cost to both the patient and the healthcare system of negative appendectomies is considerable, and a complication rate of up to 6.1% following removal of normal appendices was reported [9-11]. These facts have made the need for a scoring test for the diagnosis, such as the Alvarado's Score, possible. It can contribute to the early detection of cases of acute appendicitis, reducing individual damage as well as social and material costs [12]. The present study aims to evaluate the efficacy of the Alvarado scoring system in the preoperative diagnosis of acute appendicitis and correlate it with postoperative findings.

II. Material And Methods

The present study was conducted for a period of oneyear and 25 patients were randomly selectedout of all who presented with right lower quadrant abdominal pain. Patients selected belonged to the age group 15-70 years and an informed written consent was taken from all of them. Patients unfit for spinal anesthesia, 70 years, those with generalized peritonitis and females who were pregnant were excluded from the study. Modified Alvarado score was then calculated for each one of them after evaluating them by a comprehensive history and clinical examination and along with the routine blood investigations. Those with scores between 5-6, were considered to have possible diagnosis of acute appendicitis[13], but not convincing enough to warrant immediate surgery. These patients were monitored at 4 hourly intervals and if within 24 hours of observation, their score become >7 or their clinical features were convincing enough to warrant surgery, irrespective of their scores, appendectomy was performed. All patients having score 7 to 97 were posted for an emergency open appendectomy. According to the intraoperative findings, appendectomy was done. Specimen was then sent for histopathological examination. Patient were discharged on the next day after dressing and followed up after 7 days of discharge, for suture removal. Confirmatory diagnosis of acute appendicitis was done by the histopathological examination of appendix in all the operated cases.

III. Results

In our study, from a total of 25 cases, age group having maximum number of patients was 21-30 years followed by age group 15-20 years and the least number of patients were found in the 61-70 years age group (figure-1). In our study, out of 25 cases 14 (58%) were male patients and 11 (42%) were female patients (figure-2). In our study, the most commonly presenting complaint of the patient was migratory pain (92%) followed by nausea in 88% of patients (figure-3). Maximum patients included in our study were discharged on 3rd day of admission i.e., postoperative day 2 (figure-4). Maximum patients included in our study i.e., 87.5% recovered without any postoperative complications (table-2).

Sex	**No. of patients**	**Percentage**
Male	14	82.75
Female	11	76.19
Total	25	80.00

Table-1: Modified Alvarado Score (MAS) >7

Post op complication	**No of patients**	**%**
Nil	17	87.5
Seroma	3	5
SSI	2	2.5
Fever	3	5

Table-2: Postoperative complications

Sex	**Kalan et al (first study)[14]**	**Surendranath etal (recentstudy)[15]**	**Presentstudy**
Male	93%	96.6%	82.75%
Female	67%	84.6%	76.19%
Total	83.7%	92.6%	80.00%

Table-3: Comparison of sensitivity of Modified Alvarado Score >7

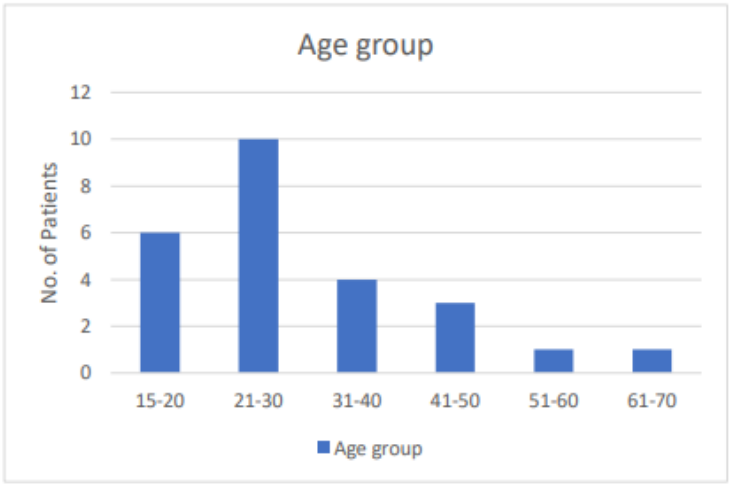
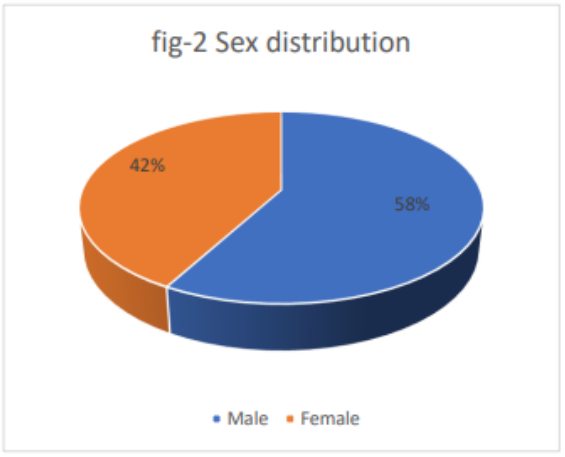
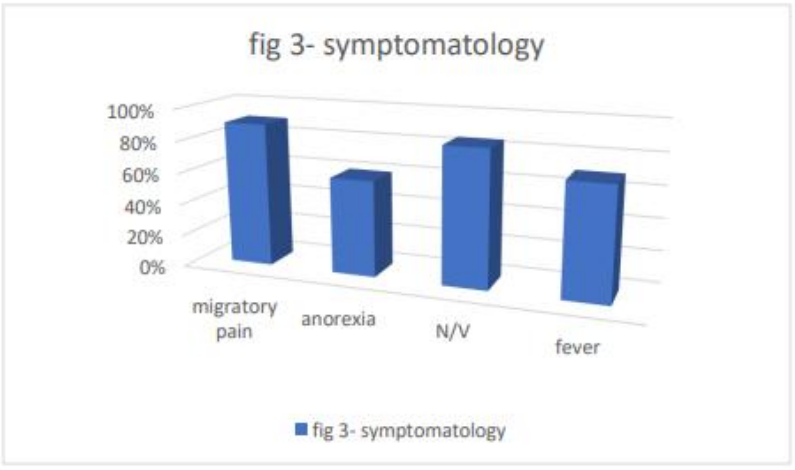
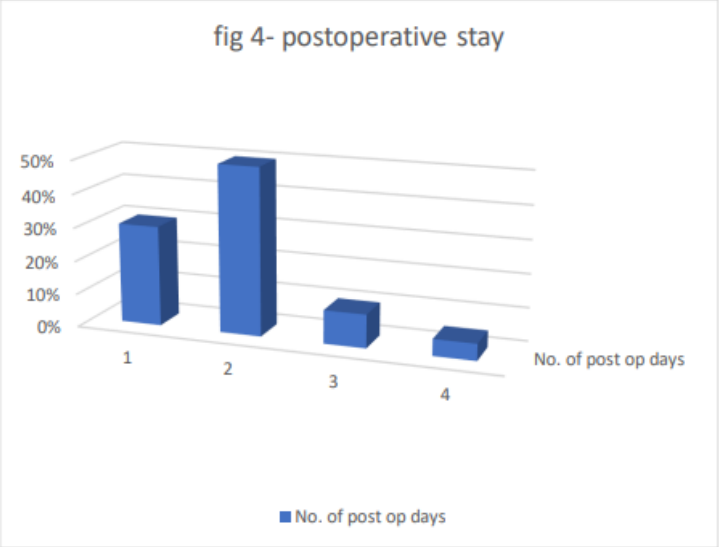


Fig-1: Age distribution







IV. Discussion

Various scoring systems were designed to decrease the negative appendectomy rate and increase the positive diagnostic rate of appendicitis[16]. Among them, a comprehensive scoring developed by "ALVARADO" in 1986 provides a practical diagnostic aid in interpreting the diagnosis of acute appendicitis[17]. The Alvarado's scoring system was introduced initially as an adjuvant to diagnose appendicitis to correct the previous false-positive diagnostic rate[18]. The Alvarado scoring system was simple, easily applicable, and useful. Routine diagnosis of acute appendicitis still poses a challenge, especially in developing countries where advancedradiological investigations do not appear cost effective and clinical parameters remain the main stay of the diagnosis. In our study, a total number of 25 patients with lower right quadrant pain were selected randomly, investigated, operated and followed up. On compilation of the results of our study, the disease was found to be most prevalent in theage group 21- 30 years with more of male predominance. This finding correlated well with other studies in literature.[19,20,21] In our study the most common symptom in the patients was migratory pain i.e. 92% of the patients. These findings couldnot be actually found to be replicated in any other study in literature. Nshuti R et al found migratory pain in only 31% of their patients while Kohla SM et al found this symptom inonly 49% of their cases.[22,23,24] Nausea (88%) was thesymptom whose values correlated with those of other studies i.e., 80% in the study by Nshuti R et al, 78% in study byJain S et al. Rebound tenderness was found in 89% of ourpatients while elevated leucocyte count was found in 92%.Both these parameters have been well documented to holdstrong correlation with appendicitis not only in the publishedliterature but also in the standard surgery textbooks.[25,26] Sensitivity of MAS at score > 7 was found to be 80% sensitivein our study, which was very near to that found by Jain S etal i.e., 86.1%, by Borra S et al i.e., 92.6% and by Memon ZAet al i.e. 94.1%. In all the studies reviewed, the sensitivity ofMAS was always found lower in the female group.[27] We also reviewed the results already published about theold Alvarado score containing 10 points instead of 9 pointsof MAS. We found that, the sensitivity of both the scoreswas quite comparable. At a cutoff point of 7, for ruling inappendicitis and progression to surgery, the old Alvaradoscore has moderate to high sensitivity i.e. 82% as documentedby Ohle R et al whereas in our study at the same cut off pointof 7, the MAS showed a sensitivity of 80%.[28] Results of our study were found to be comparable to the studyby Kalan et al in 1994, while the sensitivity was little lessthan that found by Surendernath et al in 2016 (table- 3).[29]Lastly, we also reviewed the literature to find out if therewas a major difference in sensitivity of diagnosingappendicitis between MAS and the newer RIPASA score.Diaz- Barrientos et al, in their study, reported no advantageof RIPASA scoring over widely used MAS system.[30] Hence,MAS being a more economical and more easily reproduciblescore than RIPASA, thus holds good significance in accuratetimely diagnosis of appendicitis and prevent complicationslike appendicular perforation, occurring due to delay indiagnosis. MAS system also helps to reduce the negative appendectomies which need to be avoided wheneverpossible, due to the risk of surgical complication and thefinancial burden associated with the unnecessary surgeries.[31] Thus, the Alvarado score showed a good correlation with the histopathological results: "the higher the score, the greater the incidence of histologically proven acute appendicitis." Moreover, applying Alvarado's clinical scoring among the patients presenting with clinical manifestations of acute appendicitis in the emergency setup prevents false-negative operation.[32]

V. Conclusion

Commonest affected age group according to our study was 21-30 years with majority of patients being male. Most common presenting complaint was migratory right iliac fossa pain and nausea. In the diagnosis of acute appendicitis, clinical scoring is a fast, simple, reliable, non-invasive, repeatable and safe diagnostic modality without extra expense and complications. Alvarado scoring system is useful tool in pre-operative diagnosis of acute appendicitis and can work effectively in routine practice. Use of clinical scoring in diagnosis of acute appendicitis can lead to significant reduction in negative appendectomies.

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