MODIFIED ALVARADO SCORING AS A DIAGNOSTIC TOOL IN ACUTE APPENDICITIS- A PROSPECTIVE STUDY

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ABSTRACT

BACKGROUND

Acute Appendicitis commonest community-acquired intra-abdominal infections. Acute appendicitis and its associated complications are significant source of morbidity and sometimes mortality. The Modified Alvarado Scoring System (MASS) has been reported to be a cheap and quick diagnostic tool in patients with acute appendicitis. Diagnostic accuracy have been observed if the scores were applied to various populations and clinical settings. The purpose of this study was to evaluate the diagnostic value of Modified Alvarado Scoring System in patients with acute appendicitis in our setting.

The aim of the study is to evaluate the efficacy of the modified Alvarado score as a diagnostic tool in Acute Appendicitis, as the diagnosis of appendicitis depends on the onset of symptoms and the subjective interpretation of the physical examination.

MATERIALS AND METHODS

This was a prospective study carried out in Pondicherry Institute of Medical Science during the period of November 2013 to May 2015. This study was done on 50 patients diagnosed with Acute Appendicitis and admitted in General Surgery.

RESULTS

In this study, there were a total of 50 patients who were taken up for surgery based on clinical and radiological diagnosis. Our study demonstrates that modified Alvarado score applied to all adult patients of acute appendicitis in adults with a sensitivity of 60% and a specificity of 40% only. Showing it wasn't efficient in diagnosing acute appendicitis. The positive predictive value shown by our study was 80% which is marginally lower than that explained in literature which reports 87.5%. Negative appendicectomy rate in this study is 12%.

CONCLUSION

Alvarado score is a non-invasive, safe diagnostic procedure, which is simple, fast reliable and repeatable; it can be used in all conditions, without expensive and complicated supportive diagnostic methods. Alvarado score increases the diagnostic certainty of clinical examination in diagnosis of acute appendicitis. The implementation of Modified Alvarado Score though simple, effective and reliable can only be used as a guide in the diagnosis of appendicitis and not as a definite modality to diagnose appendicitis. However, additional investigations may be required to confirm the diagnosis in case of atypical presentation.

KEYWORDS

Acute Appendicitis, Modified Alvarado Scoring.

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BACKGROUND

One of the commonest cause of surgical emergencies in the abdomen is Acute Appendicitis. It is the commonest community-acquired intra-abdominal infections[1,2,3]

Acute appendicitis and its associated complications are significant source of morbidity and sometimes mortality. Hence it is essential to promptly recognize, diagnose and treat the patient. Negative appendicectomy rates are between 15-20% as described in Surgical textbooks.[4,5,6]

Accurate diagnosis of acute appendicitis is still difficult.[7] Diagnosis is usually made on the basis of clinical findings such as fever, right lower abdominal pain, tenderness and muscle guarding in the right lower quadrant of abdomen.[8]

Appendix once considered a vestigial organ is now considered as a part of Gut Associated Lymphoid Tissue. Appendix is also used for reconstructive procedures in biliary, tubal and urological surgeries.[9]

Surgery has been primarily the treatment of appendicitis. Catarrhalis (inflammation within the mucous membrane), or phlegmonous (inflammation in all layers) appendicitis, initial treatment by non-surgical management has been safe and effective. Modified Alvarado scoring is a

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clinical tool by which we can diagnose Acute Appendicitis.[10,11]

Negative appendicectomy is a burden facing both the surgeon and the patient. Early detection and proper management for appendicitis will not only reduce the morbidity but also minimize complications in post-operative period.[12,13]

This study carried out in Pondicherry Institute of Medical Science during the period of November 2013 to May 2015 is to evaluate the efficacy of the modified Alvarado score as a diagnostic tool in Acute Appendicitis, as the diagnosis of appendicitis depends on the onset of symptoms and the subjective interpretation of the physical examination.

Aim

To evaluate the use of modified Alvarado scoring system in the diagnosis of acute appendicitis.

Objectives

The Objectives of the study will be achieved by studying the following parameters.

- Efficacy of Modified ALVARADO Score.
- Sensitivity and specificity of the score in males and females.

MATERIALS AND METHODS

Type of Study

This was a prospective clinical study of 18 months duration from November 2013 to May 2015.

Study Group

This study was done on 50 patients diagnosed with Acute Appendicitis and admitted in General Surgery.

Inclusion Criteria

Adults (above 18 yrs. of age), both gender presenting with Acute Appendicitis were included in the study.

Exclusion Criteria

- Patients who were diagnosed to have other causes of right lower quadrant pain.
- Patients presented with mass abdomen.

All patients presenting with abdominal pain and suspected to have acute appendicitis were worked up, detailed history was taken and patient was physically examined thoroughly. Modified Alvarado score was generated and noted for analysis. The investigations were ordered as per the operating surgeon and followed up.

The decision of operating the patient was in no way interfered by the observers. The observer assisted and observed most of the surgeries done for the patients included in the study. Intra operative findings noted and the appendix specimen was sent for histopathological examination for all the patients.

The histopathological report of each patient was followed up and compared with the modified Alvarado score, generated during time of admission of that patient. Final data was tabulated and analysed.

RESULTS

In this study, there were a total of 50 patients who were taken up for surgery based on clinical and radiological diagnosis. The analysis and interpretations of the data were carried out by the statistical package SPSS statistics 20.

Age Distribution

For convenience, the patients were divided into four groups based on the age at the interval of 10 years. We found that the maximum number of the patients taken up for surgery based on diagnosis were in the first group i. e., 18-27 years of age as illustrated in the Table 1.

Age Group	Number of Patients	Percentage (%)
18-27	24	48
28-37	10	20
38-47	11	22
>47	5	10

Table 1. Distribution of Age Group Among Patients

Distribution of Sex among the Patients

Of the 50 patients included in the study there were 30(60%) male patients and 20(40%) were females as illustrated in Table 2.

Sex	Number of Patients	Percentage
Male	30	60
Female	20	40

Table 2. Distribution of Sex Among Patients

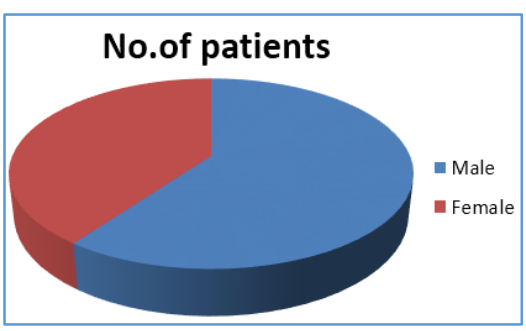

Figure 1. Sex Distribution

Clinical Presentation

Clinical Features	Cases	Percentage
Anorexia	13	26
Fever	22	44
Nausea or Vomiting	39	78
Diarrhoea	5	10
Constipation	0	0
Pyrexia	26	52
Tachycardia	25	50
RIF Tenderness	39	78
Rebound Tenderness	37	74
Leucocytosis	32	64
Abdominal Pain	41	82
Rectal Tenderness	16	32

Table 3. Clinical Presentation

N = 50

The clinical features of the patients were noted and tabulated as shown Table 3. In this study, it was seen that maximum number of presented with abdominal pain in 41 patients (82%) followed by RIF tenderness in 39 patients (78%) and nausea/vomiting in 39 patients (78%).

Distribution of Patients According to the Modified Alvarado Score Components

In the components of the modified Alvarado score most of the patients had right iliac fossa tenderness 49 (98%) and right iliac fossa pain in 41(82%) nausea or vomiting was present in 39 patients (78%) leucocytosis was present in 32(64%) as illustrated in Table 4.

Modified Alvarado Components	Patients	Percentage (%)
Rif pain	41	82
Anorexia	14	28
Nausea or vomiting	39	78
Rif tenderness	49	98
Rebound tenderness	37	74
Pyrexia	23	46
Leucocytosis	32	64

Table 4. Distribution of Patients According to the Modified Alvarado Score Components

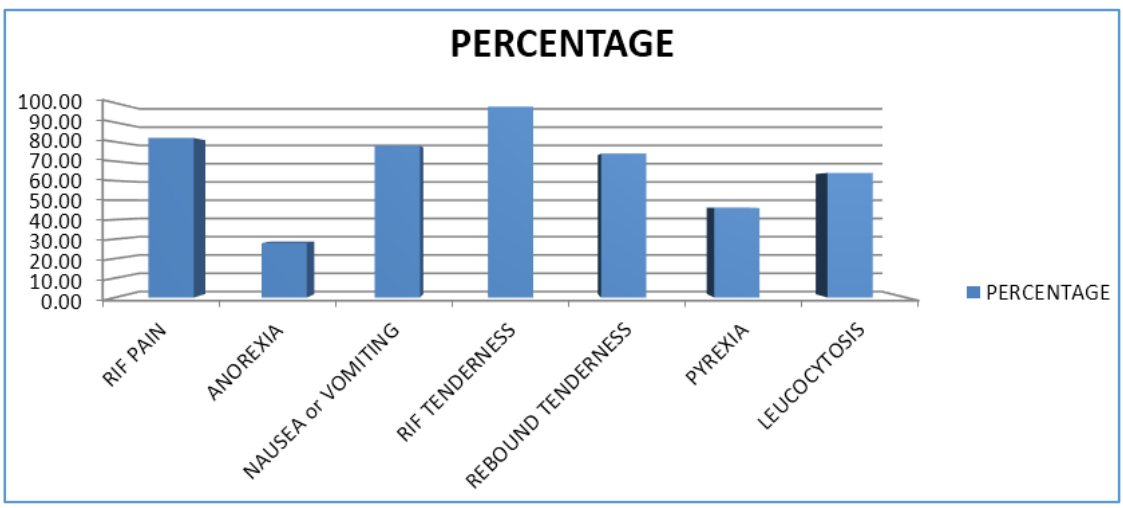

Figure 2. Distribution of Patients According to Modified Alvarado Components

Sex Distribution in the Different Grades of Modified Alvarado Score

There were more number of cases with score of 7 were 13 patients (26%) and 21 patients (42%) with score less than 7 and 16 patients (32%) with score more than 7 as illustrated in Table 5.

Modified Alvarado Score	Male	Percentage	Female	Percentage	Total	Percentage (N=50)
1	2	4	0	0	2	4
2	0	0	0	0	0	0
3	0	0	4	8	4	8
4	6	12	1	2	7	14
5	1	2	3	6	4	8
6	4	8	0	0	4	8
7	8	16	5	10	13	26
8	6	12	5	10	11	22
9	3	6	2	4	5	10

Table 5. Sex Distribution in the Different Grades of Modified Alvarado Score

Histopathology Results

In this study it was observed that total of 40 patients had positive histopathological results and 10 patients were negative. 26 male patients and 14 female patients had positive histopathological reports.

Negative histopathology was found in 8 male and 2 female patients as illustrated in Table 6.

	Positive	Negative
Males	26	8
Females	14	2
Total Patients	**40**	**10**

Table 6. Histopathology Results

Correlation of Modified Alvarado Score with Histopathology in Both Sexes

By correlating the modified Alvarado score with the histopathology reports, the following observations were made. In patients with score more than 7, the results were 80% had histopathological evidence of acute appendicitis and 20% had features not consistent with acute appendicitis.

Among patients who had score of 5-6, 87.5% of the patients had histopathological evidence of acute appendicitis and 12.5% had no features of acute appendicitis. In patients having score of 1-4, 75% had histopathologic features of acute appendicitis and 25% had no features of acute appendicitis. This is illustrated in Table 7.

Modified Alvarado Score	Acute Appendicitis (Histopathology)	Percentage (%)	Not Consistent with Appendicitis (Histopathology)	Percentage (%)
0-5	9	75	3	25
5-6	7	87.5	1	12.5
>7	24	80	6	20

Table 7. Correlation of Modified Alvarado Score with Histopathology in Both Sexes

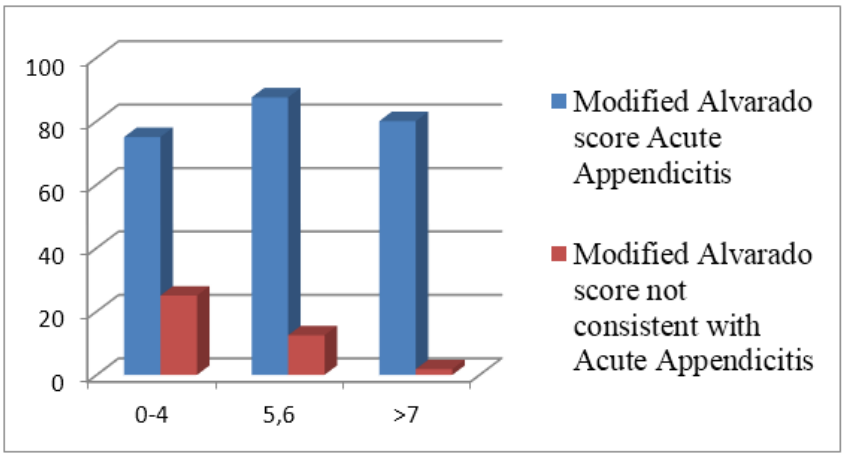

Figure 3: Correlation of Modified Alvarado Score in Both Sexes in Percentage

Sensitivity and Specificity

For the convenience of calculation, the cut of value of 7 was taken to analyse the data, as illustrated in Table 8.

Modified Alvarado Score	Patients	Acute Appendicitis (Histopathology)	Percentage (%)	Not Consistent with Acute Appendicitis (Histopathology)	Percentage (%)
More than 7	30	24	80	6	20
Less than 7	20	16	80	4	20

Table 8. Sensitivity and Specificity

$$\text{Sensitivity of the Test} = \frac{\text{True positive}}{\text{True positive + false negative}} \times 100$$

$$= 24/40 \times 100 = 60\%$$

$$\text{Specificity of the Test} = \frac{\text{True negative}}{\text{True negative + false positive}} \times 100$$

$$= 4/10x100 = 40\%$$

$$\text{Positive Predictive Value} = \frac{\text{True positive}}{\text{True positive + false positive}} \times 100$$

$$= 24/30x100 = 80\%$$

$$\text{Accuracy} = \frac{\text{True positive + False negative}}{\text{Total No. of patients}} \times 100$$

$$= 40/50x100 = 80\%$$

$$\text{Negative Appendicectomy} = \frac{\text{Histopathologically(-ve) cases rate}}{\text{Total No. of appendicectomies}}$$

$$= 6/50 \times 100$$

$$= 12\%$$

DISCUSSION

Acute appendicitis is the commonest clinical condition requiring emergency surgery. Clinical scoring systems have proved useful in the management of number of surgical conditions. In the past few years, various scores have been developed to aid the diagnosis of acute appendicitis. Although many diagnostic scores have been advocated, most are complex and difficult to implement in the clinical situation.

The modified Alvarado score, is a simple scoring system that can be instituted easily. In a prospective study of 215 adults and children in Cardiff, use of the Alvarado score decreased an unusually high false – positive appendicectomy rate of 44% to 14%. 18 Fenyo 11, reported in one study a sensitivity of 90.2% and specificity of 91.4% and others reported a sensitivity of 73%, specificity of 87% with negative laparotomy rate of 17.5%.

To be useful, a scoring system must be both sensitive and specific.

Our study demonstrates that modified Alvarado score applied to all adult patients of acute appendicitis in adults with a sensitivity of 60% and a specificity of 40% only. Showing it wasn't efficient in diagnosing acute appendicitis. This may be due to the sample size of our study is comparatively low with other studies.

The modified Alvarado score did not prove to be effective in adult male patients with acute appendicitis and also to the same extent in females of reproductive age group due to pelvic pathological condition in females.

In our study population those who had a score of less than 7 but proceeded to surgery purely on clinical basis had evidence of acute appendicitis on histological examination in 16 out of 20 patients (80%).

The Alvarado score is both simple to remember and to use. Scoring system seems ideal for the diagnosis of acute appendicitis because it is non-invasive, requires no special equipment and can be easily used. The positive predictive value shown by our study was 80% which is marginally lower than that explained in literature which reports 87.5%. Negative appendicectomy rate in this study is 12%. Whereas in general the negative appendicectomy rate reported in literature is 15-30%.

Thus, it has only marginally reduced the negative appendicectomy rates.

In comparison, the abdominal ultrasound has shown results, with an average sensitivity of 86% and a specificity of 94% under the conditions of well controlled clinical trials, namely in the hands of experienced person.

CT scan has excellent sensitivity and specificity, ranging 87-100% and 91-97% respectively. Leucocyte count has a sensitivity of 85% and abdominal radiography 40%.

But, abdominal ultrasound requires special equipment and it is operator dependant. Computerized tomography is expensive and not readily available everywhere. It's the same with radio isotope studies. Abdominal X-ray is of limited use and has the risk of radiation exposure.

Appendicitis may be missed in pregnancy.

I. Due to displacement of appendix by the gravid uterus.
II. Leucocytosis may not be indicative of inflammation as it is frequently elevated in pregnancy.

Here ultrasound may be helpful if thickened or dilated appendix is identified.

Children younger than 5 years of age and patients older than 65 years of age have high rate of appendicular perforation due to delayed presentation and difficulty in obtaining accurate history in children while it is due to diminished inflammatory response in elderly who can present with less impressive symptoms and signs of acute appendicitis, long duration of symptoms and decreased leucocytosis (compared to younger patients).

CONCLUSION

This study was conducted on 50 patients, who underwent emergency appendicectomy at our medical institution during the period of November 2013 to May 2015 and the following conclusions were made. In our study, we found that there were more patients in the age of twenties 24 patients. There were more males 30 patients (60%) than female patients 20 (40%).

In this study, it was seen that maximum number of patients presented with abdominal pain 41 patients (82%), followed by right iliac fossa tenderness 39 patients (78%), nausea or vomiting 39 patients (78%), rebound tenderness in 37 patients (74%), leucocytosis was present in 32 patients (64%).

In our study 40 out of 50 patients had positive histopathological report. From our study, it was found that when the score is less than 7 chances of missing acute appendicitis was highly likely, than when the score was more than 7.

The negative appendicectomy rate of our study is 12% which is not very high. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy were 60%, 40%, 80%, 20% and 80% respectively.

Alvarado score is a non-invasive, safe diagnostic procedure, which is simple, fast reliable and repeatable; it can be used in all conditions, without expensive and complicated supportive diagnostic methods. Alvarado score increases the diagnostic certainty of clinical examination in diagnosis of acute appendicitis.

The implementation of Modified Alvarado Score though simple, effective and reliable can only be used as a guide in the diagnosis of appendicitis and not as a definite modality to diagnose appendicitis.

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