Original Research Article

A study of Alvarado score and its correlation with acute appendicitis

Mahesh S.V.1*, Hota P.K.2, Sneha P.3

1Associate Professor, Department of General Surgery, Malla Reddy Medical College for Women, Suraram, Hyderabad, Telangana, India
2Professor and HOD, Department of General Surgery, Mamata Medical College, Khammam, Telangana, India
3Senior Resident, Department of General Surgery, Mamata Medical College, Khammam, Telangana, India

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*Correspondence:
Dr. Mahesh S.V.,
E-mail: sonty_mahesh09@yahoo.com

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ABSTRACT

Background: Scoring systems are valuable and valid for discriminating between acute appendicitis and nonspecific abdominal pain. Alvarado scoring system is one of the many scoring systems available for the diagnosis of acute appendicitis and is purely based on history, clinical examination and few laboratory tests and is very easy to apply. The objectives of the study were to evaluate efficacy of Alvarado scoring system in preoperative diagnosis of acute appendicitis and correlating it with postoperative findings.

Methods: The present study was a prospective study of 50 patients presenting with symptoms and signs of acute appendicitis to the emergency department during a period of 2 years. Patients who met the inclusion criteria were evaluated using Alvarado scoring system. All the patients were operated by conventional method of open appendicectomy. The efficacy of Alvarado scoring system was assessed by calculating sensitivity, specificity, positive predictive value, negative predictive value and negative appendicectomy rate.

Results: Pain was the most common presenting symptom (100%). Time of presentation ranged from 1-7 days with a mean of 1.98 days. Out of 50 patients, 35 (70%) are in the score range of 7-10, 12 (24%) in the score range of 5-6 and 3 (6%) in the 1-4 group. Appendix was inflamed in 86% cases. In the present study, negative appendicectomy rate was 14%.

Conclusions: Alvarado scoring system is an easy, simple, cheap, reliable and safe tool in pre operative diagnosis of acute appendicitis and can work effectively in routine practice.

Keywords: Alvarado scoring system, Appendicitis, Practice

INTRODUCTION

The appendix was first described in 1521 and inflammation of the appendix has been known to be a clinical problem since 1759.12 The term ‘appendicitis’, however, was not used until Reginald Fitz described this condition in 1886.3 Acute appendicitis is one of the commonest surgical emergencies.4 About 6% of the population is expected to have appendicitis in their lifetime.

It is essentially a clinical diagnosis.5 Routine history and physical examination still remains the most practical diagnostic modalities. Absolute diagnosis is only possible at operation and histopathological examination of the specimen.6 Therefore, it is impractical to have a gold standard for definitive preoperative diagnosis, which leads to an appreciable rate of negative appendicectomy as reported in the world literature varying from 20-40% with its associated morbidities of around 10%.7,8 Misdiagnosis and delay in surgery can lead to complications like perforation and finally peritonitis.9
Scoring systems are valuable and valid for discriminating between acute appendicitis and nonspecific abdominal pain. Alvarado scoring system is one of the many scoring systems available for the diagnosis of acute appendicitis and is purely based on history, clinical examination and few laboratory tests and is very easy to apply. The use of an objective scoring system such as the Alvarado system can reduce the negative appendicectomy rate to 0-5%. However, this system is not a substitute for clinical judgment. It is an aid in diagnosing acute appendicitis and arriving at a conclusion whether a particular case should be operated or not, thereby reducing the number of negative laparotomies.

The present study aims at evaluating the efficacy of Alvarado scoring system in preoperative diagnosis of acute appendicitis and correlating it with postoperative findings.

METHODOLOGY

The present study was a prospective study of 50 patients presenting with symptoms and signs of acute appendicitis to the emergency department during a period of 2 years from October 2012 to September 2014.

Inclusion criteria

- Patients with symptoms and signs of acute appendicitis in whom emergency appendicectomy was done.
- Both the genders and all age groups were included in the study.
- Patients who were willing to participate in the study.

Exclusion criteria

- Patients with appendicular mass.
- Patients who underwent elective/interval appendicectomy.
- Patients who were not willing to participate in the study.

Patients with symptoms and signs suggestive of acute appendicitis who met the inclusion criteria were admitted and after taking informed consent and initial assessment were subjected for detailed history taking, physical examination, routine laboratory investigations and imaging.

Then they were evaluated using Alvarado scoring system. Each patient was given a score and based on the score were divided into three groups.

Group 1: Score 7-10: most likely acute appendicitis.

Group 2: Score 5-6: probably acute appendicitis.

Group 3: Score 1-4: unlikely acute appendicitis.

Decision for appendicectomy was taken by the qualified surgeon. All the patients were operated by conventional method of open appendicectomy. Details of intraoperative findings were recorded and definitive diagnosis was based on histopathological assessment of the specimen.

The efficacy of Alvarado scoring system was assessed by calculating sensitivity, specificity, positive predictive value, negative predictive value and negative appendicectomy rate.

RESULTS

<table>
<thead>
<tr>
<th>Clinical features</th>
<th>Number of patients (%) (n=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migratory RIF pain</td>
<td>20 (40%)</td>
</tr>
<tr>
<td>Anorexia</td>
<td>34 (68%)</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
<td>42 (84%)</td>
</tr>
<tr>
<td>Tenderness over RIF</td>
<td>50 (100%)</td>
</tr>
<tr>
<td>Rebound tenderness RIF</td>
<td>37 (74%)</td>
</tr>
<tr>
<td>Elevated temperature</td>
<td>31 (62%)</td>
</tr>
<tr>
<td>Leucocytosis</td>
<td>31 (62%)</td>
</tr>
<tr>
<td>Shift to left</td>
<td>24 (48%)</td>
</tr>
</tbody>
</table>

Pain was the most common presenting symptom (100%) with migratory RIF pain in 40% cases. Nausea/Vomiting was seen in 84% and anorexia in 68%.

<table>
<thead>
<tr>
<th>Time of presentation</th>
<th>7-10</th>
<th>5-6</th>
<th>1-4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 day</td>
<td>15</td>
<td>8</td>
<td>0</td>
<td>23 (46%)</td>
</tr>
<tr>
<td>1-2 days</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>12 (24%)</td>
</tr>
<tr>
<td>&gt;2 days</td>
<td>10</td>
<td>3</td>
<td>2</td>
<td>15 (30%)</td>
</tr>
</tbody>
</table>

Time of presentation ranged from 1-7 days with a mean of 1.98 days and median of 2 days. 46% of patients presented within 24 hrs of onset of symptoms whereas 24% presented after 2 days of start of symptoms.

<table>
<thead>
<tr>
<th>Alvarado score (n)</th>
<th>Total no of pts (n)</th>
<th>No. of patients with Acute Appendicitis (%)</th>
<th>No. of patients with Normal appendix (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-10</td>
<td>35</td>
<td>35 (91.4%)</td>
<td>3 (8.6%)</td>
</tr>
<tr>
<td>5-6</td>
<td>12</td>
<td>10 (83.3%)</td>
<td>2 (16.7%)</td>
</tr>
<tr>
<td>1-4</td>
<td>3</td>
<td>1 (33.3%)</td>
<td>2 (66.7%)</td>
</tr>
</tbody>
</table>

Out of 50 patients, 35 (70%) are in the score range of 7-10, 12 (24%) in the score range of 5-6 and 3 (6%) in the
1-4 group. Out of patients in score range of 7-10, 32 (91.4%) had acute appendicitis whereas, 66.7% (2) out of 3 patients in score range of 1-4 have normal appendix.

**Table 4: Post-operative diagnosis (Per-operative and Histopathology).**

<table>
<thead>
<tr>
<th>Post-operative diagnosis</th>
<th>No. of patients n (%) (n=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute appendicitis</td>
<td></td>
</tr>
<tr>
<td>Simple</td>
<td>19 (38%)</td>
</tr>
<tr>
<td>Suppurative</td>
<td>8 (16%)</td>
</tr>
<tr>
<td>Gangrenous</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>Perforated</td>
<td>5 (10%)</td>
</tr>
<tr>
<td>Eosinophilic</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Recurrent</td>
<td>5 (10%)</td>
</tr>
<tr>
<td>Normal appendix</td>
<td></td>
</tr>
<tr>
<td>No pathology detected</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>Ruptured ovarian cyst</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Meckel’s diverticulitis</td>
<td>1 (2%)</td>
</tr>
</tbody>
</table>

Appendix was inflamed in 86% cases where as it normal in 14%. Out of 7 cases of normal appendix, no pathology was found in 4, Ruptured ovarian cyst in 2 cases and Gangrenous Meckels diverticulitis was seen in 1 case.

**Table 5: Negative appendicectomy rate.**

<table>
<thead>
<tr>
<th>No. of negative appendectomy</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>13.2%</td>
</tr>
<tr>
<td>Female</td>
<td>16.7%</td>
</tr>
<tr>
<td>Total</td>
<td>14%</td>
</tr>
</tbody>
</table>

In the present study, negative appendicectomy rate was 13.2% in males, 16.7% in females and overall was 14%.

**DISCUSSION**

In the present study, the age range was 7-80 with a mean age of 24.08 years. 33 (66%) patients were in the age group of 11-30 which is comparable to those found in Talukder BD et al., Shresha et al, Swagata et al, whereas Subedi et al reported mean age of 42 years.11-14 Gendel L et al studied children with inflamed with mean age of 10.9±3.2 years as compared to those with normal appendix with mean age of 12.1±2.3 years, which was statistically significant, p=0.004.15

In the present study, there was male preponderance (Males 38, 76%) as compared to females 12 (24%) with a male to female ratio of 3.2:1 which is comparable to Patra RK et al, Memon et al, Subedi et al, whereas male to female ratio was 1.27:1 in Swagata et al.13,14,16,17

In the present study, pain was the most common presenting symptom (100%) followed by Nausea/Vomiting in 84% of patients and anorexia in 68%. Migratory right iliac fossa pain was least common seen in 40% cases. Tenderness over right iliac fossa had leukocytosis and 48% had shift to left. These findings were comparable to those of Lameris et al.18 Subedi et al reported that 98% of patients with acute appendicitis presented with pain in peri-umbilical region migrating to right iliac fossa but leukocytosis was seen in only 65% of cases which was comparable to present study.14 Abou-Merhi B et al concluded that anorexia, neutrophils left shift and rebound tenderness are significantly correlated with a correct diagnosis of appendicitis.19

In the present study, maximum number of patients 19 (38%) had a score of 7, only 1 patients with a score of 10 and none with scores of 1, 2 and 4. Seventy percent (35) of the patients were in score range of 7-10, 24% (12) in 5-6 range and 6% (3) were in 1-4 score range which was comparable to Kailashsingh et al.20 Memon ZA et al reported that 31 belonged to Group A (28.2%) with Alvarado score <6 and 79 belonged to Group B (71.8%) Alvarado score ≥6.17

In the present study, simple acute appendicitis was confirmed intra-operatively in 34 (68%) patients. 4 (8%) had acute gangrenous appendicitis (AGA) and 5 (10%) had perforated appendix. These findings were comparable to those reported by Subhajeeat Dey et al.21

Subedi N et al found that the most common pre-operative finding was acutely inflamed appendix (84%) followed by perforated appendix (7.5%), gangrenous appendix (3.5%) and appendicular lump (1.5%).14 Shrestha R et al observed that appendicitis accounted for 88.8%.12

In the present study, overall positive and negative appendicectomy rates were 86% and 14% respectively which was comparable to other studies.11,20,22 Bhattacharjee PK et al concluded that high score was found to be a dependable aid both in the pre-operative diagnosis of acute appendicitis and in the reduction of negative appendicectomies in men and children but the same was not true for women who had a high false positive rate for acute appendicitis.23 Shrivastava et al stated that in women, additional investigations may be required to confirm the diagnosis because of the high negative appendicectomy rate.24

Subhajeeat Dey et al revealed that, out of 92 who underwent appendicectomy with the intention to treat appendicitis, diagnosis was confirmed in 80 patients with positive appendicectomy frequency of 86.9%.21

In the present study, the sensitivity and specificity of the Alvarado scoring system with a cut-off of 7 were 74.42% and 57.14% respectively which was comparable to other studies,13,17,24

In the present study, positive predictive value was 91.43% which was comparable to other studies.17,21,22
In the present study, negative predictive value was 26.67% which was comparable to other studies. It was high in Shrivastava et al with negative predictive value of 52.4% and in momen et al at 83.3%.17,24

CONCLUSION

Alvarado scoring system is an easy, simple, cheap, reliable and safe tool in pre operative diagnosis of acute appendicitis and can work effectively in routine practice. Alvarado score is very effective in the diagnose of acute appendicitis in males but some other diagnostic modality may be necessary to ascertain the diagnosis in females along with the clinical scoring system to rule out other pelvic pathology and thereby reducing the higher rates of negative appendicectomy in females. Thus, the application of Alvarado scoring system definitely improves diagnostic accuracy and reduces negative appendicectomy rate as well as possible complications.

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Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES