ALVARADO SCORE AND C-REACTIVE PROTEIN PREDICTOR OF SEVERITY IN ACUTE APPENDICITIS- AN INSTITUTION BASED STUDY

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ABSTRACT

BACKGROUND
Traditional approach of high rate of negative appendicectomies is being questioned in today’s era of cost-effective healthcare. The goal of surgical treatment is removal of an inflamed appendix before it goes in for complications with minimal number of negative appendicectomies. Because of the high morbidity of complicated appendicitis, prompt diagnosis and treatment is imperative. The aim of the study is to study the relation between Alvarado score and C-reactive protein in predicting severity of acute appendicitis.

MATERIALS AND METHODS
Study was conducted in Government Medical College, Calicut. All patients with clinical diagnosis of acute appendicitis presenting to surgery casualty, qualifying the inclusion criteria of the study were evaluated with routine investigations. Patients were informed regarding the study and consent obtained.

RESULTS
CRP cannot replace clinical diagnosis, but is an useful adjunct in predicting the severity of appendicectomies. It has been found that negative appendicectomies belonged to group with <7 Alvarado score and most of complicated appendicectomies had score >7.

CONCLUSION
Both Alvarado score and CRP are reliable indicators in predicting the severity of appendicitis. Comparing the two CRP is a better predictor of severity of acute appendicitis.

KEYWORDS
Alvarado Score, CRP, Acute Appendicitis.

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BACKGROUND
Acute appendicitis is the most common general surgical emergency and early surgical intervention improves outcome.¹ It has been claimed that diagnostic aids can dramatically reduce the number of negative appendicectomies. Various scoring systems are used to aid in diagnosing acute appendicitis.² The Alvarado sore is a 10-point scoring system for the diagnosis of appendicitis based on clinical signs and symptoms and the goal of surgical treatment is removal of an inflamed appendix before perforation with a minimal number of negative appendicectomies.

Complicated appendicitis is closely related to wound infection, intraabdominal abscess formation, postoperative intestinal obstruction, prolonged ileus and rarely enterocutaneous fistula. In females, it has been associated with fallopian tube dysfunction leading to infertility.³ Because of high morbidity of complicated appendicitis, careful diagnosis and prompt treatment is imperative. Even with recent advances in imaging, no single test can accurately diagnose perforation or gangrenous changes of the appendix. C-reactive protein was first discovered in 1930 in the Avery Laboratory of Rockefeller Institute.⁴ It is a sensitive systemic marker of inflammation and tissue damage.⁵ A normal preoperative serum CRP measurement is most likely associated with a normal appendix and deferring surgery in these patients would probably reduce the rate of unnecessary appendicectomies. This prospective study is aimed to determine the accuracy of Alvarado score and serum CRP in predicting the severity of acute appendicitis. The severity is determined by peroperative findings and the histopathological diagnosis, which is taken into account as the final diagnosis.
AIMS AND OBJECTIVES
The objectives of the study are-
1. To study the relation between severity of acute appendicitis and serum C-reactive protein.
2. To assess the reliability of Alvarado score in predicting the severity of acute appendicitis.
3. To compare the efficacy of the Alvarado score and serum C-reactive protein in predicting severity of acute appendicitis.

MATERIALS AND METHODS
Study Design
Prospective cohort study.

Study Group
Patients with a clinical diagnosis of acute appendicitis admitted to surgery casualty, Government Medical College, Kozhikode, for emergency appendicectomy.

Number of Patients Included
200 patients.

Inclusion Criteria
All patients in the study group who were posted for emergency appendicectomy.

Exclusion Criteria
1. Age <13 years.
2. Pregnant women.
3. Patients with inflammatory bowel disease, connective tissue disorders.

Methodology
All patients with clinical diagnosis of acute appendicitis presenting to surgery casualty, qualifying the inclusion criteria of the study were evaluated with routine investigations. Patients were informed regarding the study and consent obtained. Alvarado score, which takes into account symptoms, signs and the lab parameters will be ascertained to each of the patient in this group.

The study population was divided into subgroups based on Alvarado score as;
1. Those with Alvarado score of <7.
2. Those with Alvarado score of ≥7.

Quantitative determination of C-reactive protein in serum by means of particle enhanced turbidimetric immunoassay is calculated in these patients. This was compared with the operative findings and histopathological diagnosis.

For the convenience of statistical analysis operative outcomes were grouped into 3 sets;
1. Minimally inflamed appendix.
2. Gangrenous appendix.
3. Perforated appendix.

The histopathological report was categorised into;
1. Histologically unremarkable.
2. Simple appendicitis.
3. Complicated appendicitis (gangrene/perforation).

Finally, accuracy of CRP and Alvarado score in predicting severity of acute appendicitis was evaluated. A comparison of these two also be conducted.

RESULTS AND OBSERVATIONS
65% patients were males and 35% of patients were females. Indicates that appendicitis incidence is relatively common in males.

Age of patients vary from 13 to 65 years. Maximum number of patients were in the age group of 13 to 25 years, which accounted for 41%. It points that appendicitis is more common in young adults.

Most of the operated cases were minimally inflamed appendicitis. Gangrenous appendix is least encountered.

Rate of negative appendicectomy was around 20.5%.
RIF pain is the most common sign that is 98.5%, vomiting in 79%, anorexia in 77.5%, whereas migrating pain was only seen in 23.5%.

<table>
<thead>
<tr>
<th>Alvarado Group</th>
<th>Unremarkable</th>
<th>Simple Appendicitis</th>
<th>Complicated Appendicitis</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;7</td>
<td>35</td>
<td>46</td>
<td>17</td>
<td>98</td>
</tr>
<tr>
<td>≥7</td>
<td>6</td>
<td>59</td>
<td>37</td>
<td>102</td>
</tr>
</tbody>
</table>

**Table 1. Alvarado Score Vs. HPR**

P value is 0.000 indicating it is significant.

Maximum value of CRP obtained was 166.70 and minimum was 0.2 with a median of 4.8.

Both complicated and negative appendicectomy are common in young adults 73.2% and 57.4%, respectively.

<table>
<thead>
<tr>
<th>Unremarkable</th>
<th>Simple Appendicitis</th>
<th>Complicated Appendicitis</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6</td>
<td>39</td>
<td>78</td>
<td>11</td>
</tr>
<tr>
<td>&gt;6</td>
<td>2</td>
<td>27</td>
<td>43</td>
</tr>
</tbody>
</table>

**Table 2. CRP Group Vs. HPR**

Most of the complicated appendicitis has got high CRP that is 79.6% and value of CRP is increasing with histopathological severity and the result has got significant p value (0.00) indicating severity of appendicitis can be predicted by a high CRP value.

<table>
<thead>
<tr>
<th>Study</th>
<th>Mean CRP (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emin Gurleyik et al5</td>
<td>33.8</td>
</tr>
<tr>
<td>Eugene Albu et al6</td>
<td>10.1</td>
</tr>
<tr>
<td>Present study</td>
<td>7.743</td>
</tr>
</tbody>
</table>

**Table 5**

Mean Alvarado score calculated was significantly high in simple appendicitis and complicated appendicitis, which were 6.52 and 7.33, respectively. Results obtained are similar to study done by Muhammad Omar Afshal et al.7

These results indicates that both Alvarado score and CRP can predict the severity of appendicitis. Both were compared using ROC curve and it is found that CRP is better in predicting the severity of appendicitis than Alvarado score.

By comparing the efficacy of two in predicting the severity using ROC curve, CRP turned out to be a better predictor of severity.

**DISCUSSION**

Most of the patients who presented with acute appendicitis were young adults with a mean age group of 24.65 and it was more common in males. In this study, most of the appendicitis patients were young adults, 13-25 age group that is 67.5%. Age varied from 13 to 65 with a mean age of 24.53 and it is more common in males. In this study, mean CRP in each histopathological category was quantitatively assessed. Mean CRP in histologically unremarkable category is only 1.8317 mg/dL and 7.743 mg/dL in simple appendicitis. The mean CRP is significantly high in complicated appendicitis, which is 23.313 mg/dL. These results are similar to other studies.
Appendicitis is the most common abdominal surgical emergency and appendectomy is one of the most frequently performed abdominal operations. Epidemiological studies have shown that appendicitis is more common in the 10-29 years of age group. Males are more susceptible than female. The percentage of negative appendicectomies in various series varies from 8 to 33%. In a study, Lone et al observed negative appendicectomy rate as 17%. This was 20.5% in our study. For the entire modern era of surgery, many surgeons opined that maximum 15-20% negative appendicectomy is acceptable. Removal of normal appendices is inevitable to lower the rate of perforation and consequent mortality. On the other hand, unnecessary appendicectomy carries long-term risks to the patients.

Even today, a thorough clinical examination with basic investigation like WBC count remains cornerstone in the diagnosis of acute appendicitis. With this background, many eminent surgeons and physicians have been adopting different scoring systems in order to decrease negative appendicectomy (Fenyo G. 1987; Ambjornsson E. 1985; Teicher et al, 1983).

The Alvarado score is a 10-point scoring system based on clinical signs and symptoms and a differential count. A high score was found to be an easy and satisfactory aid to early diagnosis of acute appendicitis in children and men, but had a high false-positive rate in women. In present study, patients were grouped into two groups based on the Alvarado score, 7 and ≥7. It is found that 85.4% negative appendicectomies belonged to <7 group and most of the complicated appendicitis were in Alvarado score ≥7 group that is 51%.

Despite extraordinary advances in radiographic imaging and diagnostic laboratory investigations, the diagnosis of acute appendicitis remains an enigmatic challenge.

C-reactive protein is used as a measure of acute phase reactions to inflammation for the last 15 years. Recently, improved high sensitive and standardised quantitative assays in serum have allowed a re-evaluation of its potential as a diagnostic test. Many studies have investigated the role of CRP in improving the diagnosis of acute appendicitis. Most of the negative appendicectomies belong to CRP <6 group, which is 95.1% and complicated appendicectomies were under CRP ≥6 group that is 79.6%.

This study proves the adjunct value of serum CRP estimation in suspected cases of acute appendicitis. The present study involves serum CRP estimation because of its ease of applicability, availability and cost effectiveness and so is being rapidly emerging as a diagnostic tool with proven use. Being an acute phase reactant, CRP maybe elevated in other conditions as well and hence the specificity of CRP is low. Thus, in the end, it should be stressed that serum CRP estimation does not replace clinical diagnosis, but is useful adjunct in predicting the severity of appendicitis. In conclusion, elevated CRP in a patient with suspected acute appendicitis increases the odds of finding an inflamed appendix at operation. Therefore, CRP estimation is a good "rule-in" test and no-so-good "rule-out" test. Serum CRP estimation does not undermine the importance of clinical diagnosis by a skilled surgeon, but compliments it.

CONCLUSION

1. Alvarado score is useful aid in diagnosing appendicitis
   Alvarado score can be used for assessing the severity of appendicitis.

2. Preoperative estimation of serum CRP in acute appendicitis is a reliable indicator in determining the severity of appendicitis.
Among CRP and Alvarado score, CRP is the best predictor of severity in acute appendicitis.

In the presence of a normal CRP and normal Alvarado score, diagnosis of appendicitis is unlikely and needs further study to determine the cause of right iliac fossa tenderness.

REFERENCES


