

STUDY OF PREDICTIVE VALUES OF ALVARADO SCORES, SERUM C-REACTIVE PROTEIN AND WBC COUNT IN THE DIAGNOSIS OF ACUTE APPENDICITIS IN ODISHA POPULATION

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Received : 21/04/2022
 Received in revised form : 12/07/2022
 Accepted : 20/07/2022

Keywords:
 Alvarado score,
 White blood count,
 Serum c-reactive protein,
 Acute appendicitis,
 Odisha

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DOI: 10.47009/jamp.2022.4.3.60

Source of Support: Nil,
 Conflict of Interest: None declared

Int J Acad Med Pharm
 2022; 4 (3); 266-269



Abstract

Background: Acute appendicitis (AA) is one of the most common surgical emergencies. Apart from increased utilization of imaging diagnostic facilities and laboratory test. Thus, Alvarado score WBC cell count and serum CRP was carried to study AA in different age groups. **Materials and Methods:** 207 patients of different age group were categorised in 3 different groups based on Alvarado score Group-I score between 7-10, group-II 4-6, group-Less than 3, CRP estimation and complete blood count (CBC) was done and PPV, NPV was studied for confirmation of AA. **Result:** 131 patients were in category I and 107 (51.1) were confirmed as AA, 86 was PPV of elevated CRP 35 was NPV of normal CRP, 69 patients were in category II and 35 (16.9%) were confirmed as AA, 62 was PPV of elevated CRP and 70 was NPV of normal CRP, 7 patients were in category, III of Alvarado score 2 (0.96%) were confirmed as AA, 32 was PPV of elevated CRP, 84 was NPV of normal CRP. In group-I – 70 (33.8%) had Normal WBC count, group-II 170 (51.6%) had high WBC count (10-15x10⁹x1) and group-III 30 (14.4%) had very high WBC count (>15x10⁹x1) and combined inflammatory variables of WBC and CRP had 100% sensitivity and 89.5% specificity. **Conclusion:** This pragmatic study will be helpful for confirmation of AA in different age group and to prevent morbidity and mortality in complicated AA patients.

INTRODUCTION

The morbidity and mortality rates associated with appendicitis are greatly increased when perforation ensues; wound infection rates increases 15 fold times greater. Ruptured retro-cecal appendicitis can present as extremely fulminant form of common disease such as extensive retroperitoneal and right thigh abscess.^[1,2]

Early diagnosis is often based on history and clinical examination and sometimes laboratory tests. This approach usually results in unacceptably high negative appendectomy rate as many conditions of the gastro-intestinal tract mimic acute appendicitis. This may pose a serious diagnostic dilemma which can result in delayed intervention and consequently lead to increased incidence of complications.^[3] The Alvarado score is the most well studied and best performing in validation studies. Elevated white blood count (WBC) count with its differential count or neutrophil, lymphocyte ratio has been shown to be helpful in the diagnosis of AA and more recently introduced laboratory biomarker is c-reactive

protein.^[4,5] There is paucity of literature on the use of Alvarado score WBC, and CRP in aiding diagnostic efficacy of AA hence attempt is made to correlate Alvarado score with WBC count, and CRP biomarker.

MATERIALS AND METHODS

207 (Two hundred seven) patients of different age group regularly visiting to Paediatrics and Surgery departments of Saheed Laxman Nayak medical college and Hospital, Koraput-764020 odisha were studied.

Inclusive Criteria

Patients admitted with clinical diagnosis of acute appendicitis were selected for study.

Exclusion Criteria

(1) Appendicular mass planned for conservation management. (2) Recurrent appendicitis / stump appendicitis (3) Patients with co-existing inflammatory disorder (4) Pregnancy

Method: The patients aged between 10-45 years were selected. The patients were categorised into three groups based on Alvarado score. Group-I score between 7-10, Group-II 4-6 score, Group-III less than 3 score CRP estimation was done. The laboratory tests were performed on the blood samples collected at the time of admission. The serum CRP was estimated by using i-chroma Reader (which is a fluorescence scanning instrument) manufactured by Boditech Med. Inc. Germany using diagnostic reagent kit for the in vitro detection of C - reactive protein in human serum by semi-quantitative rapid latex slide tests. CRP levels were considered to be elevated when it was above normal range of 0-5 mg/L. The PPV (positive predictive value) NPV (Negative predictive value) for normal and elevated CRP for histologically confirmed appendicitis in patients having signs and symptoms of Acute appendicitis (AA),

Duration of study was July-2019 to May-2021

Statistical Analysis

The Alvarado score of different categories were conformed to acute appendicitis (AA) and elevated CRP, PPV and NPV of normal CRP. The statistical analysis was performed in SPSS software. The ratio of male and female was 2:1.

RESULTS

[Table 1] Features of Alvarado scores

[Table 2]

- Group-I – 70 (33.8%) had normal WBC count (10x10⁹/l)
- Group-II were 107 (51.6%) had high WBC count (10-15x10⁹/l)
- Group-III were 30 (14.4%) had very high WBC count (>15x10⁹/l)

[Table 3] Results of Alvarado scores in relation CRP study

- In category-I (group-I) score (7-10) had 13 patients and 107 (51 %) were confirmed as AA elevated CRP, PPV was 86 and NPV was 35
- In category-II (group-II) had 69 patients confirmed A was 35 (16.9%) PPV for elevated CRP was 62 and NPV for CRP Normal was 70
- In category-III 7 patients and 2 (0.96%) were confirmed AA PPV for elevated CRP was 32 and NPV for normal CRP was 84

Table 1: Features of Alvarado score

Details Features	Score
Migration of pain	1
Anorexia	1
Nausea	1
Tenderness in right lower quadrant	2
Rebound pain	1
Elevated temperature	1
Leucocytosis	2
Shift of white blood count to the left	1
Total	10

[Table 4] Study of inflammatory variables in combined CRP and WBC had 100% sensitivity and 89.5% specificity.

In the Alvarado score was 2 in Tenderness in right lower quadrant and Leucocytosis

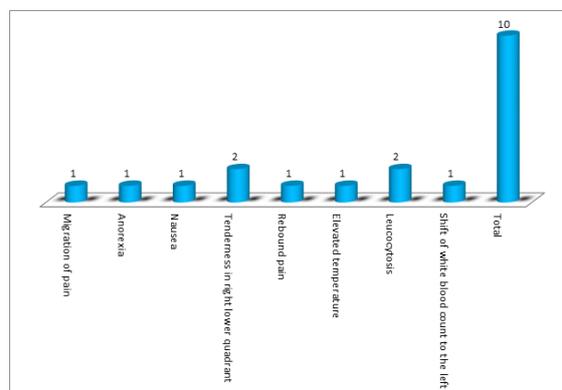


Figure 1: Features of Alvarado score

Table 2: Study of WBC count in acute appendicitis patients (Total No. of Patients: 207)

Particulars	No. of cases	Percentage (%)
Group-I Normal WBC count (10x10 ⁹ /l)	70	33.8
Group-II High WBC count (10-15x10 ⁹ /l)	107	51.6
Group-III Very high WBC count (>15x10 ⁹ /l)	30	14.4

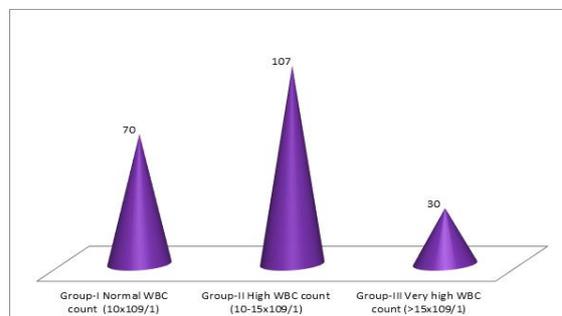


Figure 2: Study of WBC count in acute appendicitis patients

Table 3: Results of Alvarado scores in relation to C-reactive protein study

Alvarado score	No. of patients 207	Confirmation of Acute appendicitis	PPV of elevated CRP	NPV of Normal CRP
Alvarado 7-10 (group-I)	131	107 (51.3%)	86	35
Alvarado 4-6 (group-II)	69	35 (16.9)	62	70
Alvarado less than 3 (group-III)	7	2 (0.96%)	32	84

CRP=C-reactive protein, NPV=Negative predictive value,

PPV= Positive predictive value

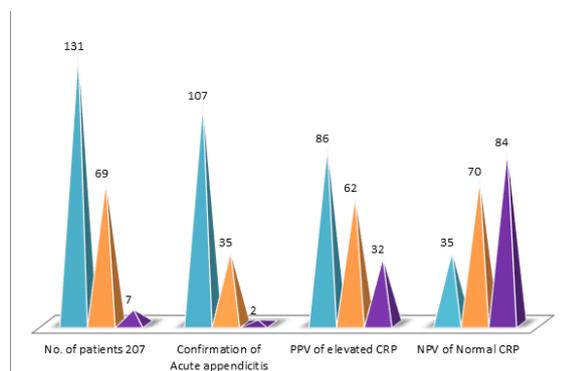


Figure 3: Results of Alvarado scores in relation to C-reactive protein study

Table 4: Study if inflammation variables (combined with WBC and CRP positive)

Sensitivity	100%
Specificity	89.58

DISCUSSION

The Alvarado score is 10 point scoring system based on clinical signs and symptoms and a differential leucocytes count. Alvarado recommended an operation for all patients with scores of 7 or more and observation for patients with score of 5 or 6. A high score was found to be an easy and satisfactory aid to early diagnosis of acute appendicitis in children and adult.

Present study of predictive values if Alvarado scores serum CRP and WBC count in the diagnosis of AA in odisha population. The features of Alvarado score were 1-10 [Table 1]. Group-I – 70 (33.8%) had normal WBC count ($10 \times 10^9 \times 1$), Group-II were 107 (51.6%) had high WBC count ($10-15 \times 10^9 \times 1$), Group-III were 30 (14.4%) had very high WBC count ($>15 \times 10^9 \times 1$) [Table 2]. The results of Alvarado scores in relation to CRP study. 131 patients were in group-I (Alvarado score 7-10) 107 (51.3%) were confirmed as AA, 86 was PPV elevated CRP, 35 was the NPV of normal CRP, 69 patients were group-II (Alvarado score 4-6) and 35 (16.9%) were confirmed as AA, 62 were PPV of elevated CRP, 70 was NPV of normal CRP, 7 patients in group-III (Alvarado score less than 3) and 2 (0.9%) confirmed as AA and 32 was PPV elevated value, 84 was NPV of normal CRP [Table 3]. Study of inflammatory variables in combined CRP and WBC had 100% sensitivity and 89.5% specificity [Table 4]. It is shown that, sensitivity and specificity values are comparable with that of other comparable with that of other studies done in the past.^[6,7,8,9]

The present study supports the Alvarado score (A score) having 7-10 had (51.3%) confirmed on of AA, Alvarado score 4-6 had (16.9%) AA and less than 3 Alvarado score had (0.96%) AA with elevated PPV and NPV of CRP values because serum CRP

estimation is easy and cost-effectiveness availability in rural areas also hence it has emerged rapidly as diagnostic tool, especially in acute phase reactant CRP may be elevated in other conditions as well and hence the specificity of CRP is low as comparative to sensitivity.

CRP is the easiest to measure as inflammatory marker because of its dramatic rise in response to inflammation associated with pathological condition. Though CT, ultrasound and laparoscopy gave the best diagnostic accuracy in terms of high sensitivity and specificity. Their use is fraught with many limitations first CT emits radiations that could lead to cancer in future; secondly it is not cost effective in low income families, third factor is ultrasound needs not only quality of machine but also qualified and experienced operator for proper imaging and diagnosing which is great disadvantage.^[10,11]

Under such scenario Alvarado score correlated with NPV, PPV value of CRP was great importance to confirm AA.

One main controversy of Alvarado score is its applicability in paediatric population. This is the simply because Alvarado score requires children to identify migratory pain, nausea and anorexia which are symptoms that are not easily verified in the extremely young children,^[12,13] Moreover WBC count to the diagnosis of AA in children is controversial but WBC, CRP and neutrophil count may assist in the diagnosis AA.^[14,15] CRP is an acute phase reactant whose serum concentration increase in response to inflammatory processes. There is plethora of reports documenting the value of CRP in improving the diagnostic value of AA.

CONCLUSION

Alvarado score may help in the diagnosis of AA however these predictive values of WBC count, CRP value and Alvarado score cannot be find diagnostic value for confirmation of AA rather useful adjunct of AA because features of Alvarado scores are equivocal hence the final decision lies with surgeon.

Limitation of Study

Owing to tertiary location of present studied hospital, less number of patients, lack of latest instruments we have limited results.

REFERENCES

- Ademola TO, Oludayo SA, Samuel OA, Amarachukwu EC, Akinwunmi KO, Olusanya A. Clinicopathological review of 156 appendectomies for acute appendicitis in children in Ile-Ife, Nigeria: a retrospective analysis. *BMC Emerg Med.* 2015;15:7. doi: 10.1186/s12873-015-0030-9.
- Pogorelič Z, Rak S, Mrklič I, Jurić I. Prospective validation of Alvarado score and Pediatric Appendicitis Score for the diagnosis of acute appendicitis in children. *Pediatr Emerg Care.* 2015;31(3):164-8. doi: 10.1097/PEC.0000000000000375.
- John SK, Joseph J, Shetty SR. Avoiding negative appendectomies in rural surgical practice: is C-reactive protein

- estimation useful as a diagnostic tool? *Natl Med J India*. 2011;24(3):144-7.
4. Agrawal CS, Adhikari S, Kumar M. Role of serum C-reactive protein and leukocyte count in the diagnosis of acute appendicitis in Nepalese population. *Nepal Med Coll J*. 2008;10(1):11-5.
 5. Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med*. 1986;15(5):557-64. doi: 10.1016/s0196-0644(86)80993-3.
 6. Andersson M, Andersson RE. The appendicitis inflammatory response score: a tool for the diagnosis of acute appendicitis that outperforms the Alvarado score. *World J Surg*. 2008;32(8):1843-9. doi: 10.1007/s00268-008-9649-y.
 7. Ohle R, O'Reilly F. The Alvarado score for predicting acute appendicitis: a systemic review. *BMC Med*. 2011;9:139-42.
 8. Shogilev DJ, Duus N, Odom SR, Shapiro NI. Diagnosing appendicitis: evidence-based review of the diagnostic approach in 2014. *West J Emerg Med*. 2014;15(7):859-71. doi: 10.5811/westjem.2014.9.21568.
 9. Ohle R, O'Reilly F, O'Brien KK, Fahey T, Dimitrov BD. The Alvarado score for predicting acute appendicitis: a systematic review. *BMC Med*. 2011;9:139. doi: 10.1186/1741-7015-9-139.
 10. Yang HR, Wang YC, Chung PK, Chen WK, Jeng LB, Chen RJ. Role of leukocyte count, neutrophil percentage, and C-reactive protein in the diagnosis of acute appendicitis in the elderly. *Am Surg*. 2005;71(4):344-7.
 11. Bates MF, Khander A, Steigman SA, Tracy TF Jr, Luks FI. Use of white blood cell count and negative appendectomy rate. *Pediatrics*. 2014;133:e39-44.
 12. Sengupta A, Bax G, Paterson-Brown S. White cell count and C-reactive protein measurement in patients with possible appendicitis. *Ann R Coll Surg Engl*. 2009;91(2):113-5. doi: 10.1308/003588409X359330.
 13. Kim HC, Yang DM, Lee CM, Jin W, Nam DH, Song JY, et al. Acute appendicitis: relationships between CT-determined severities and serum white blood cell counts and C-reactive protein levels. *Br J Radiol*. 2011;84(1008):1115-20. doi: 10.1259/bjr/47699219.
 14. Chung JL, Kong MS, Lin SL, Lin TY, Huang CS, Lou CC, Lin JN. Diagnostic value of C-reactive protein in children with perforated appendicitis. *Eur J Pediatr*. 1996;155(7):529-31. doi: 10.1007/BF01957898.
 15. Mekhail P, Naguib N, Yanni F, Izzidien A. Appendicitis in paediatric age group: correlation between preoperative inflammatory markers and postoperative histological diagnosis. *Afr J Paediatr Surg*. 2011;8(3):309-12. doi: 10.4103/0189-6725.91676.