Section: General Surgery

Original Research Article

STUDY OF PREDICTIVE VALUE OF SERUM C-REACTIVE PROTEIN IN DIAGNOSIS OF ACUTE APPENDICITIS

Abhishek Mahna[1], Sandeep Kumar[2], Amanpreet Singh[3]

[1]*Associate Professor, Department of General Surgery, M.M. College of Medical Sciences& Research, Sadopur, Ambala, India.*
[2,3]*Assistant Professor, Department of General Surgery, College of Medical Sciences& Research, Sadopur, Ambala, India.*

Received *: 18/08/2024*
Received in revised form *: 12/10/2024*
Accepted *: 28/10/2024*

Corresponding Author:
Dr. Abhishek Mahna,
Associate Professor, Department of General Surgery, M.M. College of Medical Sciences& Research, Sadopur, Ambala, India.
Email: abhimahna87@gmail.com

DOI: 10.70034/ijmedph.2024.4.87

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

Int J Med Pub Health
2024; 14 (4); 455-458

ABSTRACT

Background: Acute appendicitis is a common surgical condition and the one of the leading causes of acute surgical abdomen. Diagnosis of acute appendicitis is routinely done on the basis of analysis of WBC count, CRP levels, ESR and procalcitonin (PCT) levels. In present study, the serum levels of CRP were correlated with the histopathology of the removed appendix to study predictive value of serum C- reactive protein in diagnosis of acute appendicitis.

Materials and Methods: Present study was conducted in 50 patients with possibility of acute appendicitis, underwent appendicectomy. The histopathology report was considered as the final diagnosis. CRP more than 10 mg/dl was considered to be positive.

Results: In present study total 50 patients were included. Male to female ratio was 1.28:1, most common age group was 21-30 years (48%) followed by 11-20 years (22%). Abdominal pain (92%), McBurney tenderness (78%), vomiting (72%), were the most common common signs and symptoms noted in present study. On histopathology examination, inflamed appendix (54%) was most common finding, others were gangrenous appendix (24%), perforated appendix (6%) and normal appendix (18%). In present study diagnostic efficacy of serum CRP was sensitivity (82.5%), specificity (80%), positive predictive value (94.2%), negative predictive value (53.31%), diagnostic accuracy (82%).

Conclusion: Serum CRP estimation is useful adjunct in diagnosis of acute appendicitis along with clinical diagnosis. Serum CRP value should be interpreted in combination with clinical findings.

Keywords: Serum CRP levels, acute appendicitis, diagnosis.

INTRODUCTION

Acute appendicitis (AA) is one of the leading causes of severe pain in the lower abdominal region with which patients present in the surgical emergency. The incidence of this disease is nearly 8.5% in males and 6.8% in females.[1] It is one of the most common reasons of morbidity which is seen in all age groups, and if untreated, can lead to life threatening complications like abscess formation, gangrene and eventually perforation. The mortality rate ranges from 00.6–5% depending on the detection and treatment.[2] Early detection of this condition can be established based on the history, clinical examination, laboratory and radiological investigations which can be helpful in management of acute appendicitis and its consequent complications. However, despite the availability of a number of diagnostic techniques, a large number of negative appendectomy cases have been reported due to incorrect diagnosis (15–39%).[3] With the introduction of molecular diagnostic techniques in the recent years, novel biomarkers such as C-reactive protein (CRP), bilirubin, alanine transaminase (ALT), and albumin, white blood cell (WBC) count, procalcitonin, interleukin-6 (IL-6), and calprotectin have been proposed as diagnostic markers for acute appendicitis.[4] CRP is a pentameric acute-phase reactant protein which is

produced by the liver in response to inflammation and various conditions such as SLE, ITP, RA, MI, and malignancies and has been attributed as an indicator for appendicitis as well.

The aim of the present study was to assess the levels of CRP in serum collected from blood samples of patients with acute appendicitis and compare it with the histopathology of the surgically removed appendix to analyze the predictive value of serum C-reactive protein in the diagnosis of acute appendicitis.

MATERIALS AND METHODS

The present study was conducted in the general surgery department, MMCMSR Medical College, Sadopur, Ambala, from February 2024 to September 2024. It was a hospital-based observational study.

Inclusion Criteria: Patients who were willing to participate in the study after they were diagnosed with acute appendicitis and gave an informed consent before undergoing appendectomy.

Exclusion Criteria: Patients with physiological conditions such as pregnancy and pathological conditions such as HIV seropositivity, corticosteroid therapy, inflammatory bowel diseases or sickle cell disease, patients with associated diseases like rheumatoid arthritis, SLE.

In the present study, a total of 50 patients were included who met the desired criteria.

After that patient underwent routine blood investigations including, CRP. CRP estimation was done using diagnostic reagent kit for the in vitro detection of C-reactive protein in human serum by semi-quantitative rapid latex slide tests. Based on patient history, clinical examination, laboratory results and radiological investigations, after confirming diagnosis of appendicitis, patients underwent appendectomy and biopsy of appendix was sent for histopathological examination. The histopathology report was considered as the final diagnosis. The histopathologically positive cases among CRP positive group were considered true positives. CRP serum levels greater than 10 mg/dl was considered to be positive. The histopathologically positive cases for the CRP were segregated. All the treated patients were followed up for 3 months postoperatively to rule out any complications. Data was collected and compiled using Microsoft Excel and then analyzed using SPSS 23.0 version. Statistical analysis was done using descriptive analysis.

RESULTS

The male-to-female ratio was 1.28:1, and the most common age group was 21-30 years (48%), followed by 11-20 years (22%). [Table 1]

Abdominal pain was found to be the most common presenting sign and symptom (92%), followed by McBurney tenderness (78%), and vomiting (72%) among the patients included in the present study. [Table 2]

Histopathological examination of the operated cases revealed inflamed appendix in 54% of the patients while in some cases, gangrenous appendix (24%), perforated appendix (6%) and normal appendix (18%) was seen. [Table 3]

In the present study, the diagnostic efficacy of serum CRP was found to have sensitivity (82.5%), specificity (80%) with positive predictive value of (94.2%), negative predictive value (53.31%), and diagnostic accuracy (82%). [Table 4]

Table 1: Age and gender wise distribution

Age group in years	No. of patients	% of patients
0-10 years	0	0
11-20 years	11	22
21-30years	24	48
31-40years	10	20
41-50years	3	6
>50years	2	4

Gender	No. of patients	% of patients
Male	28	56
Female	22	44

Table 2: Signs and symptoms

Signs and symptoms	No. of patients	Percentage of patients
Abdominal pain	45	92
McBurney tenderness	39	78
Vomiting	36	72
Rebound tenderness	31	62
Fever	26	52
Shifting tenderness	7	14
Diarrhea	3	6

Table 3: Histopathology Report

Histopathology report	No. of patients	Percentage of patients
Inflamed appendix	27	54
Gangrenous appendix	11	22
Perforated appendix	3	6
Normal appendix	9	18

Table 4: Correlation between CRP levels and histopathological findings

CRP level	Histopathology report		Total No. of patients
	Positive	Negative	
Elevated	33	2	35
Normal	7	8	15

Table 5: Diagnostic efficacy of serum CRP

Sensitivity	82.5%
Specificity	80%
Positive predictive value	94.2%
Negative predictive value	53.31%
Diagnostic accuracy	82%

DISCUSSION

Acute appendicitis is amongst the most common causes of acute abdominal pain which affect all age groups, but is most commonly seen in young patients as per standard data. Similar results were seen in our study as the disease was prominent in 3rd decade. Delay or misdiagnosis of appendicitis often leads to related to increased morbidity, longer hospital stay, subsequent complications and mortality in these patients. The diagnosis of acute appendicitis is still challenging and can lead to an unacceptably high negative appendectomy rate in spite of the clinical, laboratory and introduction of modern imaging techniques.[5]

C-reactive protein (CRP) was discovered by Tillett and Francis in 1930, which is increased in various inflammatory conditions. CRP is the earliest inflammatory marker of appendicitis, whose concentration has been found to rise on repeated testing if the condition goes untreated. CRP level is also elevated in appendicitis complications.[7]

In the present study, appendicitis was seen more in male patients as compared to female patients (1.28:1), which was consistent with available literature. Also, the negative appendectomy rate was higher in females (10% compared with 8% for males) in the present study which is also similar to the available data. The possible reasons for high rate of negative appendectomy in females could be attributed to similar pain arising from pelvic organs such as fallopian tubes and ovaries mimics appendicitis leading to misdiagnosis.[3]

In the present study, the sensitivity, specificity, PPV, and NPV of CRP are 82.5%, 80%, 94.2%, 53.3%, and diagnostic accuracy of 82%, which was comparable to various previous studies.

The sensitivity and specificity of CRP for appendicitis in study by Kumari B et al. was found to be 94.1% and 73.3%, respectively, where as positive predictive value was 95.23% and negative predictive value 68.75%.[8]

Retrospective study by Shogilev et al. revealed that the sensitivity and specificity of serum CRP to diagnose acute appendicitis ranged from 65 to 83% and 59 to 73%, respectively.[5] In the present study, an appendicitis diagnosis was made based on the CRP and other lab findings (WBC), CT finding, and Alvarado score and compared to the preceding record.

In the study conducted by John et al. with a sample size of 238 patients, the sensitivity and specificity of CRP in diagnosing appendicitis were 98% and 87%, respectively, whereas 193 patients had histological evidence of acute appendicitis.[6]

In the present study, serum CRP was also found to be normal in patients with the normal histology of the removed appendix. Patients in this group, when subjected to other diagnostic tests, had reduced misdiagnosis and negative exploration.

The limitation of the present study was that the sensitivity and specificity of other investigations like radiological investigations (USG, CT scan) and other laboratory tests (WBC) was not taken into account. Also, the cause of abdominal pain in patients who underwent negative exploration could not be established.

CONCLUSION

Serum CRP levels have been found to have a significant role in diagnosing appendicitis with sensitivity (82.5%), specificity (80%), positive predictive value (94.2%), negative predictive value (53.33%), diagnostic accuracy (82%). Serum CRP estimation helps in diagnosis of acute appendicitis along with clinical diagnosis, lab test and other radiological findings. Further studies with a much larger sample size should be conducted to establish this diagnostic marker as an important diagnostic tool.

REFERENCES

1. Téoule P, Laffolie J, Rolle U, et al. Acute Appendicitis in Childhood and Adulthood. Dtsch Arztebl Int. 2020 Nov 6;117(45):764-774. doi: 10.3238/arztebl.2020.0764. PMID: 33533331; PMCID: PMC7898047.
2. Di Saverio S, Podda M, De Simone B, et al. Diagnosis and treatment of acute appendicitis: 2020 update of the WSES Jerusalem guidelines. World J Emerg Surg. 2020 Apr 15;15(1):27. doi: 10.1186/s13017-020-00306-3. PMID: 32295644; PMCID: PMC7386163.
3. Noureldin K, Hatim Ali AA, Issa M, et al. Negative Appendicectomy Rate: Incidence and Predictors. Cureus. 2022 Jan 22;14(1): e21489. doi: 10.7759/cureus.21489. PMID: 35223267; PMCID: PMC8859749.
4. Zosimas D, Lykoudis PM, Strano G, et al.. Bilirubin is a specific marker for the diagnosis of acute appendicitis. Exp Ther Med. 2021 Oct;22(4):1056. doi: 10.3892/etm.2021.10490. Epub 2021 Jul 23. PMID: 34434270; PMCID: PMC8353631.
5. Shogilev DJ, Duus N, Odom SR , et al. Diagnosing appendicitis: evidence-based review of the diagnostic approach in 2014. West J Emerg Med. 2014 Nov;15(7):859-71. doi: 10.5811/westjem.2014.9.21568. Epub 2014 Oct 7. PMID: 25493136; PMCID: PMC4251237.
6. 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 May-Jun;24(3):144-7. PMID: 21786842.
7. Webster DP, Schneider CN, Cheche S, et al. Differentiating acute appendicitis from pelvic inflammatory disease in women of childbearing age. Am J Emerg Med. 1993 Nov;11(6):569-72. doi: 10.1016/0735-6757(93)90002-s. PMID: 8240553.
8. Kumari B, Kumar P, Chaudhary N, et al. The study of serum c-reactive protein and its diagnostic importance in reducing the rate of negative appendectomy. Int J Res Med Sci [Internet]. 2017 Jun. 24 [cited 2024 Sep. 26];5(7):2841-4. Available from: https://www.msjonline.org/index.php/ijrms/article/view/3472.