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Role of C-reactive protein in acute appendicitis: A Diagnostic Approach

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Abstract---Background: Acute appendicitis is one of the common surgical emergencies. Appendicitis is a common surgical emergency and diagnostic dilemma. Making the correct diagnosis is often difficult as the clinical presentation varies according to the age of the patient and the position of appendix. Objective-To investigate the efficacy of C-reactive protein in the diagnosis of acute appendicitis. Methods: A prospective study done on patients coming to hospital with clinical diagnosis of acute appendicitis and underwent appendectomy. The blood samples for C-reactive protein were drawn before taking the patient to the operating theatre. Removed appendices were sent for histopathological confirmation of diagnosis. Operative and histopathological findings were compared and analyzed with C-reactive protein. The data was entered and analysed in SPSS 23. Results: A total of 100 patients were included in the study. CRP was more than 6mg/l in 89 patients 87 patients had histopathologically inflamed appendix and serum CRP estimation in diagnosis of acute appendicitis yield sensitivity of 94%, specificity of 50%, positive predictive value of 95% and negative predictive value of 74%. Conclusions: CRP was raised in patients with acute appendicitis and it aids as a marker for diagnosing acute appendicitis and decreasing the rate of negative appendectomy. CRP is helpful in making diagnosis

of acute appendicitis. It is highly sensitive but has a relatively low specificity.

Keywords---acute appendicitis, CRP, histopathology, appendectomy, emergency.

Introduction

Acute appendicitis is one of the common surgical emergencies and appendectomy is the most widely performed emergency operation worldwide.[1] Simple appendicitis can progress to perforation, which is associated with a much higher morbidity and mortality, and surgeons have therefore been inclined to operate when the diagnosis is probable rather than wait until it is certain.[2] The surgical principle about acute appendicitis "when in doubt, take it out", is not correct in view of the number of major and minor complications following appendectomy. Despite more than 100 years' experience, accurate diagnosis still evades the surgeon. Owing to its myriad presentations, acute appendicitis is a common but difficult diagnostic problem. The accuracy of the clinical examination has been reported to range from 71% to 97% and varies greatly depending on the experience of the examiner.[3] However, because missed ruptured appendixes have direct consequences, surgeons have traditionally accepted a 20% rate of negative findings at appendectomy and the removal of a normal appendix.[4]

Approximately 6% of the population will suffer from acute appendicitis during their lifetime, therefore much effort has been directed toward early diagnosis and intervention. This effort has successfully lowered the mortality rate to less than 0.1% for non-complicated appendicitis, 0.6% where there is gangrene, and 5% for perforated cases.[5]. C-reactive protein (CRP) is an acute phase reactant, which rises rapidly in response to inflammation and can be measured in serum 6-12 hours after the onset of the inflammatory process. It is produced in liver, controlled by interleukin-6. Its concentration is increased in infection, autoimmune disorders, neoplasia and ageing. Its normal concentration is less than 10 mg/l (9-11 mg/l).[6,7]

Materials and Methods

This prospective study was conducted in the department of general surgery, Government medical college, from July 2021 to January 2022. A total of 100 patients were included in the study that reported in surgical emergency. The study was performed according to the guidelines set by the ethical committee of the institute. The data was tabulated and results were expressed using SPSS software. Purposive sampling technique was used. Patients coming to hospital with clinical diagnosis of acute appendicitis and patients who undergo appendectomy were included in the study. Pregnant females, patients on steroids, immune-compromised patients, patients with liver disease, patients on chemotherapy for malignancy and appendicular lump were excluded from the study.

Methodology

Clinical diagnosis of acute appendicitis was, based on symptoms of pain in right iliac fossa, migration of pain to RIF, nausea/vomiting, anorexia, fever and signs of peritoneal inflammation like right iliac fossa tenderness, rebound tenderness and guarding. Once acute appendicitis was suspected, patient was subjected to routine investigations like total leucocyte count (TLC), differential leucocyte count (DLC), C-reactive protein (CRP). Ultrasonography of abdomen was done in all of the cases to rule out alternative diagnoses. Elderly patients were subjected to further investigations as part of pre-anaesthetic work up including X-ray chest, ECG etc. Serum C-reactive protein estimation was done in all these cases. The serum or whole blood specimen was collected under standard laboratory conditions. The specimen was tested within one hour of collection. CRP was estimated by using latex agglutination slide test method using a Humatex CRP test kit. The test is based on immunological reaction between CRP in patient's serum and anti-CRP antibodies bound to latex particle. A positive reaction indicates a CRP content of more than 6mg/l in the serum, and is denoted by a distinctly visible agglutination of the latex particles in the test cell of the slide.

Statistical Analysis

The data was entered and analysed in SPSS 23. Sensitivity, specificity, positive and negative predictive values were calculated. CRP analysis was carried out free of cost at the hospital laboratory and all the patients in this study underwent standard treatment.

Results

Table 1
Age and Gender wise distribution of Patients

Age (years)	N	%
0-10	08	08
11-20	18	18
21-30	30	30
31-40`	20	20
41-50	16	16
51-60	04	04
>60	04	04
Total	100	100

As per table 1 young adult are most commonly affected. Maximum patients were in age group of 21-30 years about 29% followed by 20% of the patients in both 11-20 and 31-40 age groups. A total of 100 patients were included in our study, out of which 72 were male and 28 were female, which shows the study was male preponderance.

Table 2
Association of C-reactive protein with appendicular inflammation

CRP (>6mg/dl)		Appendicitis		Statistical relation
		Positive	Negative	Sensitivity- 94%
	Positive	87	09	PPV-95%
	Negative	02	02	NPV-74%

As per table 2 around 96 patients have inflamed appendix suggest appendicitis. Sensitivity was 94% with Positive predictive value of 95% and was statistically significant. Negative predictive value of 74%.

Table 3
Alternative Diagnosis in Negative Appendectomies

Diagnosis	N (%)
Ruptured Ovarian Cyst	4 (4)
Pelvic inflammatory disease	3 (3)
Ovarian torsion	3 (3)
Mesentric lymphadenitis	2 (2)
Non-Specific abdominal pain	07 (65)

As per table 3 Out of the 11 patients whose appendices did not show inflammation, majority had non-specific abdominal pain (65%) followed by ruptured ovarian cyst 34%.

Discussion

Subjective criteria and scoring systems make it tough to reach the correct diagnosis all the time. Consequently, the rate of negative explorations for acute appendicitis continues to remain high.[5] Making diagnosis of acute appendicitis among the elderly and females is rather more challenging, as in elderly, usual textbook signs are often diminished or absent, similarly in females, signs and symptoms are vague most of the time due to the wide range of causes, therefore the chances of wrong diagnosis are highest.[6] Good history taking and sound clinical examination organized in different scoring systems helps us to reach the diagnosis in most of the cases.[4] It is most cost effective, repeatable, fast and widely used method specially in periphery but the clinical presentation shows a wide range of variations, many other acute abdominal conditions also mimic acute appendicitis and missing a case of acute appendicitis can result in gangrenous perforation, abscess formation, peritonitis and sepsis.

Acute appendicitis remains a common abdominal emergency throughout the world. Despite the advances in the diagnostic field, the diagnosis of acute appendicitis remains an enigma for the surgeon[8] In the present study, total 100 patients were studied. Out of which 72 were male and 28 were female. The male:female ratio in the present study was 2.85:1. In the study by Ghimire et al 62.96% of patients were male while 37.04% were female.[9] Most common age

group was between 21-30 years. In the present study CRP was more than 6mg/l in 89 patients, and out of 89 patients, 87 patients had histopathologically inflamed appendix and serum CRP estimation in diagnosis of acute appendicitis yield sensitivity of 90.6% and specificity of 50%. Al-Abed et al conducted a study on 447 patients with suspected acute appendicitis had found that a CRP concentration of ≥ 6 mg/l alone had a sensitivity of 76.4% and a specificity of 55.7% which is comparable with the present study[1]. The sensitivity of CRP in present study is comparable with that of other studies done in past but specificity of CRP in present study is less in comparison with other studies done in past except one study by Al-Abed et al. In the study, the predictive value for positive test was 97.75% and predictive value for negative test was 18.2% which is consistent with the study by Ghimire et al.[9,10]

Conclusion

CRP analysis augments the clinical diagnosis of acute appendicitis. It is highly sensitive but has a relatively low specificity. CRP more than 6mg/l, help in the diagnosis of acute appendicitis and the negative appendectomy rate can be decreased if appendectomies are avoided in cases where CRP < 6 mg/l. Diagnostic laparoscopy may detect other abnormality especially in females with suspected acute appendicitis.

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Conflict of Interest- None declared

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