

Role of CRP and Serum Procalcitonin in the Prevention of Negative Appendectomies in Covid Era

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A B S T R A C T

Introduction: Acute appendicitis is one of the most common acute intraabdominal affections seen in surgical departments, which can be treated easily if an accurate diagnosis is made in time. C-Reactive Protein is a non-specific inflammatory marker. It may be used as an aid in the workup of acute abdomen. Study aimed to determine specificity, sensitivity and predictive value of positive test and predictive value of negative test of CRP and Serum Procalcitonin in diagnosis of acute appendicitis to reduce negative appendectomies in COVID era and to compare it with the surgeons clinical diagnosis.

Material and methods: It was a prospective study conducted on 50 patients who have been clinically diagnosed by Surgeons as having acute appendicitis and posted for emergency appendectomy in General Surgery Department, for a period of 5 months. Preoperatively blood was sent for CRP and Serum Procalcitonin estimation along with complete blood picture and after operation, all specimens were sent for histopathological examination, results of CRP and Serum Procalcitonin were correlated with HPE reports to evaluate their role in diagnosis of acute appendicitis.

Results: The sensitivity 97.7% and positive predictive value of the CRP is 97.7% in diagnosing acute appendicitis, when compared to Serum Procalcitonin with 25% specificity. But Serum Procalcitonin has got high sensitivity in cases of complicated appendicitis with sensitivity being 80%.

Conclusion: conclude that CRP has got higher beneficial value when compared to Serum Procalcitonin and a definite association between raised CRP and acute appendicitis was made, hence CRP stands as best laboratory test which can be used to reduce negative appendectomies thus aiding the surgeon to reduce morbidity in this pandemic era.

Keywords: Acute Appendicitis, Procalcitonin, C-Reactive Protein.

INTRODUCTION

Acute appendicitis is one of the most common cause of right iliac fossa pain and one of the most common cause of surgical emergencies. Its diagnosis is established by surgeon's clinical impression depending on presenting history, clinical evaluation and laboratory tests. Atypical presentations are not uncommon as many inflammatory and non-inflammatory conditions may mimic the presentation of acute appendicitis.^{1,2}

The classic triad of a history compatible with acute appendicitis, pain at McBurney's point and leucocytosis has diagnostic accuracy rate of less than 80 percent. And even when radiological techniques such as ultrasonography, computer tomography are included, the accuracy does not usually reach 90%. This is especially seen in females because

of prevalence of pelvic inflammatory disease (PID) and other common obstetrical and gynaecological disorder and in the extremes of ages. These factors resulted in relatively high rate of about 15-30% of negative explorations for acute appendicitis and post operative morbidity associated with these negative explorations is 5-15%. On one hand, a normal appendix at appendectomy represents a misdiagnosis, on the other hand, a delayed diagnosis of appendicitis may lead to perforation and peritonitis. So traditionally surgeons have accepted a higher incidence of unnecessary appendectomies in order to decrease the incidence of perforations. This approach is being increasingly questioned in today's era of evidence based medicine. The high rate of negative explorations for appendicitis is a burden faced not only by the general surgeon, but also by the patient and the society as a whole, since appendectomy like any other operation

results in socioeconomic impact in the form of hospital expenses, lost working days and declining productivity. The goal of surgical treatment is removal of an inflamed appendix before perforation with a minimal number of negative appendicectomies.^{3,4}

To conclude as acute appendicitis may simulate many other acute abdominal conditions/illness and despite intensive clinical research and discussion, the diagnosis of acute appendicitis still remains a challenge. And the exact diagnosis is important for proper management. C-reactive protein (CRP) , Serum Procalcitonin together with other acute phase proteins, increases in response to tissue injury. Many reports have investigated the value of raised serum CRP measurement in improving the diagnosis of acute appendicitis. In this study we correlate the serum levels of CRP and Serum Procalcitonin with the histopathology of the removed appendix. This study emphasizes the impact of normal rather than raised serum C-reactive protein and Serum Procalcitonin in reducing the rate of negative explorations.

MATERIAL AND METHODS

The present study was a prospective study conducted on 50 patients who have been clinically diagnosed by Surgeons as having acute appendicitis and posted for emergency appendicectomy in General Surgery Department, during the period April 2020 to August 2020. Preoperatively blood was sent for CRP and Serum Procalcitonin estimation along with complete blood picture and after operation, all specimens were sent for histopathological examination, results of CRP and Serum Procalcitonin were correlated with HPE reports to evaluate their role in diagnosis of acute appendicitis.

Consent was obtained from the patients after full disclosure. Detailed history with clinical examination was done. A 5cc blood in a disposable syringe was taken from the patients with the help of paramedical staff and sent to the hospital laboratory for Serum C-reactive protein levels. Patients judged as having acute appendicitis by consultant surgeon were operated for appendectomy. Specimens of the subjects after appendectomy were sent to hospital laboratory, for the final diagnosis i.e. histopathology for confirming the diagnosis, presence and absence of appendicitis was recorded and then correlated with the Serum C-reactive protein reports.

All this information was recorded on a pre-designed proforma (attached). The raised C-Reactive protein(CRP) levels were considered, positive if the values was > 6mg/L.

Analysis of data was done by SPSS software . Mean and S.D was calculated for quantitative data while frequency and percentage were calculated for qualitative data. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of raised serum C-reactive protein levels taking histopathology was done.

RESULTS

In our study of 50 patients who were clinically diagnosed as acute Appendicitis by the surgeons age and sex distribution are as follows
54% are females and 46% are males with female predominance.

In the present study age of patients varied from 12-50 years , maximum no of patients were in age group 21-30 years with 40 % followed by 11-20 age interval 22%.

All the patients in our study presented with pain abdomen, Most common site of pain being right iliac fossa. Fever as a presenting complaint was present in 22 patients. Vomiting seen in 80% patients . In 90% of patients Mc Burney point tenderness noted . Rebound tenderness in 80% and shifting tenderness is noted in very few i.e 20% of patients .

The specimen was sent for histopathological examination after the surgery and 7 patients had normal appendix , so our negative appendicectomy rate was 14% and 86% are positive for appendicitis.

In this out of the total 43 patients with raised CRP values

Age in years	No. of Patients	Percentage %
0-10	-	-
11-20	11	22%
21-30	20	40%
31-40	10	20%
41-50	9	18%
>50	-	-

Table-1: Age distribution in acute Appendicitis

Signs & symptoms	No. of Patients	Percentage
Abdominal pain Right iliac Fossa umbilical	44 6	88% 12%
Vomiting	40	80%
Fever	22	44%
Diarrhea	2	4%
Mc Burney tenderness	45	90%
Rebound Tenderness	40	80%
Shifting Tenderness	10	20%

Table-2: Signs and symptoms in present study

Histopathology of appendix	No of patients	Percentage
Normal histology	7	14%
Acute suppurative	29	58%
Acute catarrhal	7	14%
Acute gangrenous	7	14%

Table-3: Histopathology of appendix after surgery.

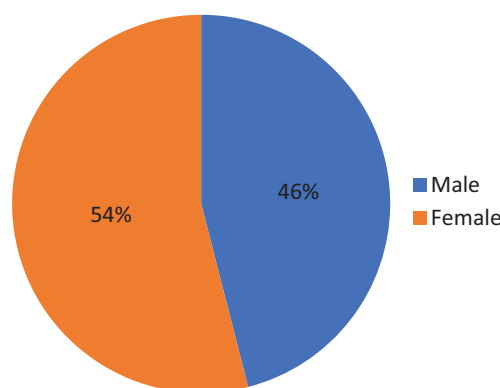


Figure-1: Gender distribution in study

CRP Test	Acute Appendicitis	Normal	Total
Positive (Elevated)	42(True Positives)	1 (False Positives)	43
Negative (Normal)	1 (False Negatives)	6 (True Negatives)	7

Table-4: Correlation between CRP value and histopathology findings :

Serum procalcitonin value	Acute appendicitis	Normal	Total
Elevated	20	18	38
Normal	6	6	12

Table-5: Correlation of Serum Procalcitonin with Histopathology Findings

histopathology report of 42 specimens shows changes of acute appendicitis, whereas 1 shows normal appendicular architecture.

Of the 7 patients with normal CRP values 6 shows normal appendix whereas 1 specimen shows features of acute appendicitis in spite of normal CRP values.

Hence the

- Sensitivity -97.7%
- Specificity -85.7%
- Positive predictive value-97.7%
- Negative predictive value -85.7%

In this out of total 38 positive cases, only 20 histopathology reports show changes of acute appendicitis, and the rest 18 shows normal appendix.

Out of total 12 negative cases, only 6 histopathology reports show changes of acute appendicitis and the rest shows normal appendix.

Hence the

- Sensitivity -76.9%
- Specificity-25%
- Positive predictive value -52.6%
- Negative predictive value -50%

But out of the total 20 confirmed cases of acute appendicitis with raised Serum Procalcitonin value 16 histopathological reports show changes of perforated and gangrenous changes.

DISCUSSION

Acute appendicitis is one of the major surgical emergencies encountered in a surgeon's practice world wide. Laparoscopic / open appendicectomy are the preferred surgical interventions with laparoscopic appendicectomy being the most commonly practised in tertiary and urban setup due to its own advantages over open method. But the rate of negative appendicectomies were also not less. In this pandemic era laparoscopic appendicectomy leads to unwanted exposure of the surgeon and the team leading to unwanted morbidity. In this study in order to reduce the unwanted exposure and negative appendicectomies, the efficacy of CRP and Serum procalcitonin in diagnosing acute appendicitis were assessed.⁵ In our study maximum no of patients were in age group 21-30 years (40%) followed by 11-20 years(22%) with 54% are females and 46% are males with female predominance. Our study coincides with Falak Sher et al⁶ study, 42.22% patients (n=57) were between 20-40 years, 63(46.67%) were male and 72(53.33%) were females.

In our study 43 (86%) are positive for acute appendicitis and negative appendicectomy rate was 14% and Falak Sher et al histopathology 112(82.96%) were determined to be acute

appendicitis while 23(17.04%) had no findings of acute appendicitis.

In our study In this out of the total 43 patients with raised CRP values histopathology report of 42 specimens shows changes of acute appendicitis, whereas 1 shows normal appendicular architecture. Of the 7 patients with normal CRP values 6 shows normal appendix whereas 1 specimen shows features of acute appendicitis in spite of normal CRP values. Hence the Sensitivity -97.7%, Specificity -85.7%, Positive predictive value-97.7% and Negative predictive value -85.7%. Falak Sher et al⁶ recorded 104(77.04%) were true positive, 5(3.70%) were false positive, 8(5.93%) were true negative and 18(13.33%) were false negative with Sensitivity, specificity, positive predictive value, negative predictive value and accuracy rate was computed as 92.86%, 78.26%, 94.39%, 69.23% and 90.37% respectively with is near to our study

In another study⁷ these values were 93.42%, 79.17%, 93.42%, 79.17% and 59%, the only difference with our results was increased diagnostic accuracy.

Our results are contrary with another study⁸ showing these findings as 75%, 72%, 90%, 46% and 75.5% respectively. Although Shakhathreh⁹ considered CRP measurement to be helpful in making diagnosis of acute appendicitis, however it cannot be used to replace the clinical judgement of a surgeon. WBC and neutrophil count were found to be better diagnostic aids in a prospective study of 420 patients with suspected diagnosis of acute appendicitis.¹⁰ A normal CRP in paediatric population was not found to rule out acute appendicitis.¹¹ Shefki Xharra¹² noted that with regards to age and gender, there was no significant difference regarding CRP values.

On the basis of a retrospective study the sensitivity of CRP in diagnosis of acute appendicitis has been documented to be greater than 90%. In patients having normal levels of CRP and white blood cell count, postponement of surgery led to a 8% reduction of the negative appendectomy.^{13,14}

out of the total 20 confirmed cases of acute appendicitis with raised Serum Procalcitonin value 16 histopathological reports show changes of perforated and gangrenous changes. Out of total 12 negative cases, only 6 histopathology reports show changes of acute appendicitis and the rest shows normal appendix. Hence the Sensitivity -76.9%, Specificity-25%, Positive predictive value -52.6% and Negative predictive value -50%. But. A previous meta-analysis showed that CRP was more accurate in the diagnosis of perforated appendicitis.¹⁵ The present results suggested a better diagnostic accuracy of procalcitonin than CRP in diagnosing complicated

AA. The ability to discriminate between uncomplicated and complicated AA is important because the treatment decision is drastically different between the two conditions. Emergency appendectomy remains the cornerstone of treatment for uncomplicated AA. For complicated AA, however, an inflammatory mass may distort the anatomy and emergency surgery is not warranted.¹⁶

The sensitivity and positive predictive value of the CRP is high in diagnosing acute appendicitis, when compared to Serum Procalcitonin with low specificity. The rate of negative appendicectomies with CRP is 14% when compared to 24% of Serum procalcitonin. Apart from the statistical significance, Serum procalcitonin was not so cost effective adding extra burden on the patient side making it least significant. But Serum Procalcitonin has got high sensitivity in cases of complicated appendicitis with sensitivity being 80%.

CONCLUSION

In this study we were able to conclude that CRP has got higher beneficial value when compared to Serum Procalcitonin and a definite association between raised CRP and acute appendicitis was made, hence CRP stands as best laboratory test which can be used to reduce negative appendicectomies thus aiding the surgeon to reduce morbidity in this pandemic era. No doubt surgeon's clinical diagnosis using time tested clinical signs is effective in acute appendicitis and it remains the gold standard. However elevated CRP levels support the surgeon's diagnosis and hence avoids chances of error in diagnosis due to atypical presentation.

REFERENCES

1. Shakhtrah HS. The accuracy of C-reactive protein in the diagnosis of acute appendicitis compared with that of clinical diagnosis. *Med Arh.* 2000;54(2):109-110.
2. Asfar S, Safar H, Khoursheed M, Dashti H, al-Bader A. Would measurement of C-reactive protein reduce the rate of negative exploration for acute appendicitis? *J R Coll Surg Edinb.* 2000;45(1):21-24.
3. Beecher SM, Hogan J, O'Leary DP, McLaughlin R. An Appraisal of Inflammatory Markers in Distinguishing Acute Uncomplicated and Complicated Appendicitis. *Dig Surg.* 2016;33(3):177-181.
4. Salem TA, Molly RG, O'Dwyer PJ. Prospective study on the role of crp in acute abdomen. *Ann R Coll Surg Eng.* 2007;89(3):233-237.
5. Shelton JA, Brown JJ, Young JA. Preoperative C-reactive protein predicts the severity and likelihood of complications following appendectomy. *Ann R Coll Surg Engl.* 2014;96(5):369-372.
6. Falak Sher, Wasim Hayat Khan, Usman Ismat Butt, Syed Muhammad Bilal, Muhammad Uma, Said Omer Diagnostic Accuracy of Raised Serum C-Reactive Protein Levels in Diagnosis of Acute Appendicitis: *P J M H S, JUL – SEP 2019;13(3):667-69.*
7. Kamal D, Akhtar A, Siraj A, Shukr I, Shah SHA. Accuracy of Total Leukocyte Count and C – Reactive Protein in the Diagnosis of Acute Appendicitis. *Journal of Rawalpindi Medical College (JRMC);2010;14(2):75-7*

8. Siddique K, Baruah P, Bhandari S, Mirza S, Harinath G. Diagnostic accuracy of white cell count and C-reactive protein for assessing the severity of paediatric appendicitis. *JRSM 2011;2(2):1-6.*
9. Shakhtrah HS. The accuracy of C-reactive protein in the diagnosis of acute appendicitis compared with that of clinical diagnosis. *Med Arh 2000, 54(2):109-110.*
10. Andersson RE, Hugander A, Ravn H, Offenbartl K, Ghazi SH. Repeated clinical and laboratory examinations in patients with an equivocal diagnosis of appendicitis. *World J Surg 2000;24(3):479-85*
11. Grönroos JM. Do normal leukocyte count and C-reactive protein value exclude acute in children? *Acta Paediatr 2001;90(6):649-5.*
12. Xharra S, Gashi-Luci L, Xharra K, Veselaj F, Bicaj B, Sada F. Correlation of serum C-reactive protein, white blood count and neutrophil percentage with histopathology findings in acute appendicitis. *World Journal of Emergency Surgery 2012;7(5):27.*
13. Paajanen H, Mansikka A, Laato M, Kettunen J, Kostiainen S. Are serum inflammatory markers age dependent in acute appendicitis? *J Am Coll Surg 1997;184(2):303-308.*
14. Eriksson S, Granstrom L, Bark S. Laboratory tests in patients with suspected acute appendicitis. *Acta Chir Scand 1989;155(1):117-120.*
15. Andersson RE. Meta-analysis of the clinical and laboratory diagnosis of appendicitis. *Br J Surg 2004; 91(4): 28-37.*
16. Lugo JZ, Avgerinos DV, Lefkowitz AJ, Seigerman ME, Zahir IS, Lo AY et al. Can interval appendectomy be justified following conservative treatment of perforated acute appendicitis? *J Surg Res 2010; 164(2): 91 – 94.*

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