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Assessment of serum levels of C-reactive proteins as an indicator of disease activity in pulmonary tuberculosis

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Abstract

Background: Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*. The present study was conducted to assess serum levels of C-reactive proteins as an indicator of disease activity in pulmonary tuberculosis.

Materials and Methods: This cross-sectional study was conducted with 60 new sputum-positive pulmonary tuberculosis cases and 60 healthy subjects in 2020. Baseline serum C-reactive proteins (CRP) levels were measured and the values were correlated to clinical and radiological findings.

Results: The mean CRP level (mg/dl) in patients with fever was 66.5 mg/dl and it was 28.2 mg/dl among those without fever. Mean level of CRP in haemoptysis was 50.3 mg/dl and 54.2 mg/dl in those without haemoptysis. Mean levels of CRP were 76.2 mg/dl and 26.5 mg/dl among those with and without tachycardia respectively. Mean level was 78.4 mg/dl with tachypnoea and 27.1 mg/dl among those with no tachypnoea. The mean CRP level in patients with minimal disease was 24.2 mg/dl, and with moderate disease it was 41.8 mg/dl and with advanced disease it was 90.5 mg/dl ($P < 0.05$).

Conclusion: CRP levels in Pulmonary tuberculosis patients before initiating anti-tubercular therapy showed a positive correlation with clinical features and radiological severity.

Keywords: CRP, pulmonary tuberculosis, radiological severity

Introduction

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis* and mainly affects lungs. It is estimated that between 19% and 43% of the world's population is infected with *Mycobacterium tuberculosis*.¹ In spite of substantial investments in global tuberculosis (TB) control, TB incidence remains high, with over 9 million TB cases in 2013 alone. High-risk groups such as HIV positive persons contribute significantly to the caseload of pulmonary TB. The World Health Organization (WHO) now recommends systematic screening of high-risk groups, but the lack of an accurate yet simple screening tool is a key barrier^[2]. A good screening test would rule-out TB in the majority of patients without disease and limit referrals for more costly positive testing to patients with a high likelihood of having TB. A test with these characteristics that is also low-cost and can be performed by front-line health workers has been ranked among the highest priority needs for TB diagnostics^[3].

C-reactive protein (CRP) is produced by the liver in response to inflammation and its levels are also elevated in patients with pulmonary tuberculosis^[4]. At present, there is insufficient information correlating CRP levels to clinical findings, radiological severity and response to anti-tubercular treatment^[5]. The identification of biomarkers that are predictive of adverse outcomes can help in risk stratification of patients for early intervention and better patient management. Biomarkers for early detection of treatment failure measurable during early treatment of TB may help in identification and shifting of these patients to newer drugs^[6]. The present study was conducted to assess serum levels of CRP as an indicator of disease activity in pulmonary tuberculosis.

Materials and Methods

This cross-sectional study comprised of 60 patients with new sputum positive pulmonary tuberculosis and 60 healthy subjects in Prakash institute of medical sciences and research, Islampur in 2020. Diagnosis of pulmonary TB was based on symptoms, x-ray findings and

positive sputum smear microscopy for M tuberculosis. After obtaining ethical clearance and obtaining consent, besides name socio-demographic data such as age, gender, region was collected. Before initiating treatment, baseline serum CRP levels were measured and the values were correlated to clinical and radiological findings. Serum CRP levels were correlated with age, BMI, presence or absence of fever, dyspnoea, haemoptysis, tachycardia, tachypnoea, hypotension, respiratory distress and mortality. Statistical significance was tested using t-test. A P-value of less than 0.05 was considered statistically significant.

Results

The study comprised 120 subjects and 66.6% were males (80) and 33.4% were females (40). Table 1 shows the mean serum CRP levels in those with clinical finding and those without. The mean CRP level (mg/dl) in patients with fever was 66.5 mg/dl and it was 28.2 mg/dl among those without fever. Mean level off CRP in haemoptysis was 50.3 mg/dl and 54.2 mg/dl in those without haemoptysis. Mean levels of CRP were 76.2 mg/dl and 26.5 mg/dl among those with and without tachycardia respectively ($P<0.02$). Mean level was 78.4 mg/dl with tachypnoea and 27.1 mg/dl among those with no tachypnoea. The mean CRP level in patients with minimal disease was 24.2 mg/dl, and with moderate disease it was 41.8 mg/dl and with advanced disease it was 90.5 mg/dl ($P<0.05$). Mean CRP level was 104.2 mg/dl in those with hypotension and 43.7 mg/dl in those without hypotension ($P<0.01$). Mean CRP level were 94.5 mg/dl and 35.5 mg/dl in subjects with and without respiratory distress ($P<0.05$). Table 2 shows that mean CRP level (mg/dl) in patients with minimal disease was 24.2 mg/dl, with moderate disease was 41.8 mg/dl, and with advanced disease was 90.5 mg/dl. The difference was statistically significant ($P<0.05$).

Table 1: Mean CRP levels (mg/dl) in patients with and without clinical findings (N = 120)

Clinical finding	Clinical finding present	Clinical finding absent	P value
Fever	66.5	28.2	0.05
Haemoptysis	50.3	54.2	0.19
Tachycardia	76.2	26.5	0.02
Tachypnoea	78.4	27.1	0.04
Hypotension	104.2	43.7	0.01
Respiratory distress	94.5	35.5	0.05

Table 2: CRP levels and radiological severity of disease (N = 120)

Radiological severity	Mean mg/dl	P value
Minimal disease	24.2	0.04
Moderate disease	41.8	
Advanced disease	90.5	

Discussion

Current TB screening tools endorsed by the WHO are insufficient and include symptom assessment and chest radiography (CXR) [7]. A symptom-based approach to TB screening requires *a priori* knowledge of the patient's HIV status to be sufficiently sensitive and has poor specificity for active TB, particularly among key high-risk groups such as people living with HIV [8]. Although CXR is sufficiently sensitive and has higher specificity, it requires costly infrastructure and trained interpreters, both of which are often absent in lower-level health centres where most

patients with symptoms suggestive of TB first present for care. To simplify scale-up of systematic screening of high-risk groups, there is an urgent need to recognize an accurate and practical screening tool [9]. C-reactive protein (CRP) is an acute phase reactant whose levels rise in response to IL-6 mediated pyogenic infections such as active TB. Previous studies have consistently shown CRP to have high sensitivity for TB and that TB-associated elevations in CRP levels are independent of HIV status. In addition, CRP can be measured using a low-cost, point-of-care (POC) assay [10]. The present study was conducted to assess serum levels of C-reactive proteins as an indicator of disease activity in pulmonary tuberculosis.

In present study, we observed that the mean serum CRP levels in those with clinical finding and those without. The mean CRP level (mg/dl) in patients with fever was 66.5 mg/dl and it was 28.2 mg/dl among those without fever. Mean level off CRP in haemoptysis was 50.3 mg/dl and 54.2 mg/dl in those without haemoptysis. Mean levels of CRP were 76.2 mg/dl and 26.5 mg/dl among those with and without tachycardia respectively ($P<0.02$). Mean level was 78.4 mg/dl with tachypnoea and 27.1 mg/dl among those with no tachypnoea. Mean CRP level were 94.5 mg/dl and 35.5 mg/dl in subjects with and without respiratory distress ($P<0.05$). Sharma *et al.* [11] conducted a study on 50 new sputum-positive pulmonary TB patients and 50 healthy individuals. The patients were evaluated for clinical and radiological findings, which were correlated to baseline CRP levels. CRP levels were measured at 2 months and after completion of treatment and correlated to treatment end results. Mean baseline CRP levels in pulmonary tuberculosis patients were 55.32 mg/L (range 16- 144mg/L). CRP levels among normal healthy individuals were 4.46 mg/L (range 2-8 mg/L). CRP levels were significantly higher in TB patients with fever, tachycardia, tachypnoea, hypotension, respiratory distress and the need for ventilatory support when compared to patients without these features. The study showed significant correlation between CRP levels and radiological extent of disease. Baseline CRP levels were significantly higher in mortality group when compared to survivor group. CRP levels showed progressive decline in patients who were cured. We observed that mean CRP level in patients with minimal disease was 24.2 mg/dl, with moderate disease was 41.8 mg/dl and with advanced disease was 90.5 mg/dl. Caner SS *et al.*, [12] showed that CRP levels were significantly higher in patients with fever. Another study by Kaminskaia GO *et al.*, [13] showed similar correlation between degree of intoxication and CRP levels.

Conclusion

Authors found that CRP levels in pulmonary tuberculosis patients before initiating anti-tubercular therapy showed a positive correlation with clinical features and radiological severity.

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