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EVALUATION OF SERUM C-REACTIVE PROTEIN AND INTERLEUKIN-6 LEVELS IN NEWLY DIAGNOSED PULMONARY TUBERCULOSIS PATIENTS BEFORE AND AFTER ANTI-TUBERCULAR THERAPY

Respiratory Medicine

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ABSTRACT

Background: Tuberculosis (TB), caused by Mycobacterium tuberculosis, continues to be a major public health burden, particularly in high-incidence countries like India. Despite the availability of effective treatments, diagnostic limitations—especially in sputum-scarce cases—hamper early detection and disease control. Inflammatory biomarkers such as C-reactive protein (CRP) and interleukin-6 (IL-6) have emerged as promising adjuncts in TB diagnosis, prognosis, and treatment monitoring. **Objective:** To estimate baseline levels of serum CRP and IL-6 in newly diagnosed sputum-positive pulmonary tuberculosis (PTB) patients and assess their dynamic changes following anti-tubercular therapy (ATT) in accordance with National Tuberculosis Elimination Programme (NTEP) guidelines. **Methods:** This prospective study was conducted at PGIMS, Rohtak, on 50 newly diagnosed sputum-positive PTB patients. Serum high-sensitivity CRP and IL-6 levels were measured at diagnosis, after 2 months (intensive phase), and after 6 months (continuation phase) of standard ATT. Exclusion criteria included extrapulmonary TB, drug resistance, HIV co-infection, prior ATT, and major comorbidities. IL-6 was quantified using a Diaclone ELISA kit. Clinical, radiological, and laboratory data were collected and analyzed using appropriate statistical methods, with $p<0.05$ considered significant. **Results:** The mean age of patients was 42.64±19.01 years, with a male-to-female ratio of 1.9:1. Key symptoms included cough and anorexia (100%), dyspnea (92%), weight loss (86%), and fever (80%). Baseline CRP and IL-6 levels were markedly elevated in all patients. Significant reductions in both markers were observed at 2 and 6 months post-treatment initiation, correlating with clinical improvement and radiological resolution. Higher baseline CRP was associated with delayed sputum conversion and more extensive radiological findings. HRCT revealed lymphadenopathy in all patients, and nodular or consolidative changes were common. Risk factors such as smoking, alcohol intake, and low BMI were prevalent in the cohort. **Conclusion:** CRP and IL-6 levels are significantly elevated in active PTB and decline with effective anti-tubercular therapy. These markers can serve as reliable adjuncts for disease monitoring and may aid in assessing treatment response, especially in settings where conventional diagnostics are limited. Further large-scale studies are warranted to validate their prognostic utility.

KEYWORDS

Tuberculosis, C-reactive protein (CRP), Interleukin-6 (IL-6), Biomarkers, Antitubercular therapy (ATT)

INTRODUCTION

Tuberculosis (TB), caused by Mycobacterium tuberculosis (MTB), remains a significant global health challenge. Until the onset of the COVID-19 pandemic, TB was the leading cause of death from a single infectious agent, surpassing HIV/AIDS. TB primarily affects the lungs (pulmonary TB), though extrapulmonary manifestations also occur. Transmission typically occurs through the airborne spread of bacilli when individuals with active pulmonary TB cough or sneeze. Globally, an estimated one-quarter of the population is infected with MTB, with disease manifestation occurring in about 10% of those infected, predominantly among adults and more commonly in males.[1]

Despite being curable and preventable, approximately 36% of TB cases remain undiagnosed or unreported each year, contributing to ongoing transmission and prevalence. Treatment success rates exceed 85% when standard 6-month drug regimens are followed. However, broader efforts—such as achieving universal health coverage (UHC) and addressing social determinants like poverty, undernutrition, HIV infection, smoking, and diabetes—are critical to reducing TB incidence and mortality.[1] The COVID-19 pandemic has severely disrupted TB control efforts, resulting in an 18% global decline in newly diagnosed and reported cases in 2020 (from 7.1 million in 2019 to 5.8 million), bringing detection rates down to 2012 levels. India, Indonesia, and the Philippines were the most affected, accounting for a substantial proportion of this decline. Consequently, TB-related mortality increased, with estimated deaths among HIV-negative individuals rising to 1.3 million and among HIV-positive individuals to 214,000 in 2020.[1]

According to India's National Tuberculosis Elimination Programme (NTEP), pulmonary TB (PTB) is defined as a bacteriologically confirmed or clinically diagnosed case involving lung parenchyma or tracheobronchial tree. Bacteriological confirmation includes positive smear microscopy, culture, or gene Xpert MTB/RIF, while clinical diagnosis is based on radiological or histological findings in the absence of laboratory confirmation.[2]

Conventional diagnostic tools such as sputum acid-fast bacilli (AFB) smear microscopy and the GeneXpert MTB/RIF assay remain the mainstay of TB diagnosis in routine clinical practice. However, their diagnostic sensitivity is significantly limited in sputum-scarce cases and among children and individuals with extrapulmonary TB. To address these challenges, the World Health Organization (WHO) has emphasized the urgent need for a non-sputum-based, point-of-care diagnostic test capable of rapidly detecting all forms of TB across age groups.[3] The development of such diagnostics has been hindered by limited understanding of TB pathogenesis, particularly in incipient and subclinical stages. In this context, host inflammatory biomarkers such as C-reactive protein (CRP) and interleukin-6 (IL-6) are emerging as promising tools. These markers may support TB screening, especially in high-burden settings, and could potentially guide prognosis and treatment monitoring.[3]

CRP is an acute-phase reactant, primarily synthesized in the liver in response to cytokines such as IL-6, IL-1β, and TNF-α secreted by activated macrophages. Normally present at low concentrations (<0.3 mg/dL), CRP levels rise rapidly during systemic inflammation and have a relatively short half-life of about 19 hours, making it a sensitive indicator of ongoing inflammation and disease activity. Functionally, CRP contributes to the innate immune response by binding to phosphocholine on microbial membranes and apoptotic cells, thereby promoting phagocytosis via activation of the classical complement pathway through C1q.[4] Several studies have demonstrated the clinical utility of CRP in TB, with evidence suggesting that its inclusion in diagnostic algorithms may enhance case detection and management, especially in resource-limited, high-incidence settings.[5] Raised baseline CRP levels have been shown to correlate with slow sputum culture conversion,[6] with raised CRP levels after 8 weeks of TB treatment predicts continued culture-positive status and poor treatment outcomes.[7,8] Prior studies have consistently shown CRP is a high sensitive marker for active TB as well as for prognosis during treatment with anti-tubercular treatment (ATT), independent of HIV status.[9]

Interleukin-6 (IL-6) is a multifunctional cytokine that plays a key role in immune regulation, acute-phase response, and hematopoiesis. Encoded on chromosome 7p21, IL-6 is produced in response to inflammatory stimuli and secreted by various immune and non-immune cells. It undergoes post-translational modifications, contributing to its functional diversity. IL-6 exhibits both pro- and anti-inflammatory effects and is critical in the shift from acute to chronic inflammation.[10] In tuberculosis (TB), IL-6 is centrally involved in the

host immune response. It contributes to the pathogenesis of TB by regulating the synthesis of hepcidin, a hormone controlling iron metabolism—critical for the survival of Mycobacterium tuberculosis (MTB).[11] IL-6 also stimulates the production of acute-phase proteins, most notably C-reactive protein (CRP), enhancing the early immune defense.[10] Furthermore, IL-6 secreted by MTB-infected macrophages can promote interferon-gamma (IFN-γ) responses in adjacent non-infected macrophages, amplifying the cellular immune response.[11]

Animal model studies support the protective role of IL-6: IL-6-deficient mice display increased susceptibility to MTB infection and reduced IFN-γ production, a cytokine essential for mycobacterial clearance.[12,13] However, IL-6 also modulates other cytokines, such as inhibiting TNF-α and IL-1β—key players in antimycobacterial immunity—suggesting a complex, possibly biphasic role in disease progression. Clinical studies have observed higher IL-6 concentrations in patients with inactive TB, indicative of disease progression, whereas moderate levels may be associated with latent infection.[14] In light of these observations, the present study was undertaken with to estimate baseline levels of C-reactive protein (CRP) and interleukin-6 (IL-6) in newly diagnosed sputum-positive pulmonary tuberculosis patients as well as to assess CRP and IL-6 levels in the same patients post antitubercular therapy as per the National Tuberculosis Elimination Programme (NTEP).

MATERIALS AND METHODS

This prospective study was conducted in the Department of Respiratory Medicine, in collaboration with the Department of Microbiology, PGIMS, Rohtak, following approval from the Institutional Ethics Committee, on 50 patients newly diagnosed with pulmonary tuberculosis (PTB) following strict inclusion and exclusion criterias. All participants underwent a comprehensive clinical evaluation and relevant laboratory investigations at baseline. Diagnostic tests included sputum AFB, culture and sensitivity, CBNAAT, complete blood count, liver and kidney function tests, and HIV screening. High-sensitivity C-reactive protein (hs-CRP) and interleukin-6 (IL-6) levels were assessed at baseline, at the end of the intensive phase (2 months), and at the end of the continuation phase (6 months). Follow-up was conducted per NTEP guidelines for treatment adherence and sputum conversion.

Serum IL-6 levels were quantified using the Diaclone Human IL-6 ELISA kit (Diaclone SAS, France), following the manufacturer's instructions. Briefly, standards, controls, and serum samples (100 µL) were added in duplicate to pre-coated wells, followed by 50 µL of diluted biotinylated anti-IL-6 antibody. Plates were incubated at room temperature (18–25 °C) for 1 hour and washed three times. Subsequently, 100 µL of diluted streptavidin-HRP was added, and plates were incubated for 30 minutes at room temperature. After a second wash, 100 µL of TMB substrate was added, and color was developed in the dark for 12–15 minutes. The reaction was stopped with 100 µL of sulfuric acid, and absorbance was measured immediately at 450 nm with a reference wavelength of 620 nm. A standard curve was generated using known IL-6 concentrations, and sample concentrations were interpolated accordingly. The assay sensitivity was 2 pg/mL. Intra-assay and inter-assay CVs were 3.6% and 7.7%, respectively. No cross-reactivity was observed with other cytokines tested.

RESULTS

The study included 50 newly diagnosed sputum-positive pulmonary tuberculosis patients enrolled at the Department of Respiratory Medicine, in collaboration with the Department of Microbiology, Pt. B. D. Sharma PGIMS, Rohtak. Patients with major comorbidities, immunosuppressive conditions, extrapulmonary TB, prior ATT intake, drug resistance, or those who did not provide consent were excluded. The mean age of participants was 42.64 ± 19.01 years (range: 21–78 years), with the majority (44%) in the 21–30-year age group. Males comprised 66% (n=33) and females 34% (n=17) of the cohort, yielding a male-to-female ratio of 1.9:1. Most cases in both genders were clustered in the 21–30-year age group.

In terms of dietary habits, 56% (n=28) were vegetarians, and 44% (n=22) were non-vegetarians. Regarding nutritional status, 60% had a low BMI (≤20), while only 4% had a BMI >25. History of alcohol consumption was reported by 48% (n=24), while 56% (n=28) of participants were smokers. Among the smokers, 67.8% consumed one bundle per day, 21.5% smoked half a bundle, and 10.7% reported smoking two bundles daily (Table 1). A Chi-square test was used to analyze associations, and a p-value <0.05 was considered statistically significant.

Among the 50 patients with sputum-positive pulmonary tuberculosis, the most common presenting symptoms were productive cough and decreased appetite (100% each), followed by dyspnea (92%), weight loss (86%), fever (80%), hemoptysis (36%), and chest pain (24%). Clinical examination revealed lymphadenopathy in 28% and pallor in 26% of patients, while no cases showed digital clubbing. Hematological investigations showed raised total leukocyte counts in 56%, elevated D-dimer levels in 52%, and anemia in 34% of patients. On chest radiography, all patients exhibited hilar opacities, with 96% showing infiltrates, 94% consolidation, 24% cavitary lesions, and fewer cases demonstrating pneumothorax (6%), pleural effusion (4%), and calcification (2%). Radiographic involvement was bilateral in 52%, right-sided in 36%, and left-sided in 12%, predominantly affecting both upper and lower zones (64%). HRCT of the chest revealed lymphadenopathy in all patients (100%), nodules in 98%, consolidation in 94%, while 4% showed pleural effusion and calcification, and 2% had emphysema.

There was no significant association between the presence or laterality of chest X-ray infiltrates and the levels of IL-6 or Hs-CRP (Table 4). The sputum AFB grading distribution showed that the highest proportion of cases (40%) presented with a 2+ grade, followed by 1+ (36%) and 3+ (24%) (Table 5). At baseline, the majority of patients had elevated Hs-CRP levels, with 93.9% of males and 88.9% of females showing levels above 20 mg/L. By the end of two months, more than half of the patients had Hs-CRP levels reduced below 10 mg/L, and all patients had normalized levels by six months (Table 6). Similarly, IL-6 levels were markedly elevated at the start of treatment, particularly in males (97%) and females (76.5%) with levels exceeding 20 pg/mL. These levels showed a decreasing trend over time, with normalization achieved in all patients by the end of six months (Table 7). IL-6 levels were found to be significantly higher at baseline and at two months in patients with 3+ AFB sputum compared to those with 1+ grading ($p < 0.001$) (Table 8). Moreover, a statistically significant reduction in both IL-6 and Hs-CRP levels was observed by the end of treatment ($p < 0.001$) (Table 9). No significant associations were observed between IL-6 or Hs-CRP levels with age or gender, as shown in Table 10. However, a strong positive correlation was noted between baseline IL-6 levels and Mantoux test findings ($r = 0.630$, $p < 0.001$), whereas no such correlation was found with Hs-CRP levels ($r = 0.05$, $p = 0.69$), as presented in Table 11.

DISCUSSION

The present study was conducted to evaluate the levels of high-sensitivity C-reactive protein (Hs-CRP) and interleukin-6 (IL-6) in patients with pulmonary tuberculosis (TB) at Pt. B.D. Sharma PGIMS, Rohtak. The demographic profile revealed a mean patient age of 42.64 ± 19.01 years, with the majority (44%) falling within the 21–30-year age group. This pattern reflects the higher disease burden among young adults, who are more exposed to socio-environmental risk factors. A male preponderance was observed (66% males vs. 34% females), aligning with the Global Tuberculosis Report 2021, which highlights a higher incidence of pulmonary TB in males. This trend is further supported by studies such as Brown et al.[9], who reported a male-to-female ratio of 1.9:1, and Obeagu et al.[15], whose findings also indicated a higher proportion of TB cases among males.

In terms of lifestyle risk factors, 56% of the patients were smokers and 48% were alcoholics. Among smokers, a majority (67.8%) consumed one bundle of cigarettes per day, suggesting significant tobacco exposure. These findings are comparable to those reported by Mesquita et al.[16], who noted smoking and alcohol use in 74.13% and 72.6% of TB patients respectively. The role of smoking as a significant risk factor is well-established; Leung et al.[17] demonstrated a consistent association between smoking and TB incidence across age groups in a large Hong Kong-based cohort. Our study findings support the hypothesis that smoking and alcohol use serve as major risk factors contributing to TB pathogenesis, likely due to their immunosuppressive effects.

In the present study, the most frequently reported clinical symptoms among pulmonary tuberculosis patients were cough with expectoration and decreased appetite, observed in 100% of cases. Dyspnea was the second most common complaint (92%), followed by weight loss (86%), fever (80%), hemoptysis (36%), and chest pain (24%). These findings are consistent with those reported by Mesquita

et al.[16], who also found cough to be the most prevalent symptom (77.58%) among TB patients in their Brazilian cohort, with cavitary lung lesions and hemoptysis present in 57.5% and 22.41% of cases, respectively. Similarly, Sohn et al.[18] reported cough in 96% of TB patients, followed by less frequent presentations of fever (3.4%) and hemoptysis (2.8%). In terms of physical and hematological findings, 28% of the study subjects exhibited lymphadenopathy and 26% had pallor. Laboratory evaluations revealed raised total leukocyte counts in 56% of cases, elevated D-dimer levels in 52%, and decreased hemoglobin levels in 34%, aligning with the findings of Mesquita et al.[16], who reported a median hemoglobin level of 11.6 g/dL (IQR: 9.9–12.9 g/dL), reflecting the systemic inflammatory and anemic burden frequently associated with active pulmonary tuberculosis.

In the present study, chest radiographic evaluation revealed that all patients (100%) exhibited hilar opacities, with a high prevalence of infiltrates (96%) and consolidation (94%). Cavitary lesions were identified in 24% of cases, while less frequent findings included pneumothorax (6%), pleural effusion (4%), and calcification (2%). The distribution of radiographic changes was bilateral in 52% of patients, predominantly affecting both upper and lower lung zones (64%). These findings align partially with those of Mesquita et al.[16], who reported cavitary lesions in 57.5% of TB patients and multiple cavitations in 34.2% of cases. HRCT findings in the present study demonstrated lymph node enlargement in all cases (100%), followed by nodules in 98%, and consolidation in 94%, with a small proportion showing calcification, pleural effusion, or emphysema (each ≤4%).

Biochemically, IL-6 levels were elevated in all patients at baseline and normalized in all cases by the end of treatment, with only 2 patients showing normalization at the 2-month mark. This reduction was statistically significant ($p < 0.001$), reflecting treatment response. These results are consistent with the study by Obeagu et al.[15], who demonstrated a progressive decline in IL-6 levels across treatment time points: baseline (15.92 ± 2.43 pg/ml), 2 months (14.10 ± 1.97 pg/ml), 4 months (11.14 ± 1.31 pg/ml), and 6 months (8.66 ± 1.12 pg/ml), with $p < 0.05$. Similarly, Chowdhury et al.[19] observed a significant decrease in IL-6 among active pulmonary tuberculosis (APTB) patients undergoing anti-tuberculosis therapy. The cytokine levels, particularly IL-6, showed early reduction and stabilization by the fourth month, underscoring their potential utility as markers of treatment efficacy and host immune response.

A cross-sectional study by Lopes et al.[20] evaluated serum interleukin-6 (IL-6) levels in three groups: contacts of active pulmonary tuberculosis (TB) patients, individuals with active TB, and non-contacts. Using ELISA and appropriate statistical tests (Mann-Whitney, Kruskal-Wallis, and Shapiro-Wilk), the study found that IL-6 levels were significantly elevated in active TB cases (median: 4.3 pg/ml; range: 0.5–24 pg/ml), compared to contacts (1.7 pg/ml; range: 0.96–4.8 pg/ml) and non-contacts (0.5 pg/ml; range: 0–2.8 pg/ml), with a highly significant p-value (<0.0001). These findings suggest a clear immunological distinction based on TB exposure and disease activity. In contrast, Mesquita et al.[16] reported no substantial change in IL-6 and IFN-γ levels between pre-treatment and day 60 of therapy, indicating variability in cytokine response depending on disease stage and population.

A study by Farr et al.[21] at King's College London evaluated 262 HIV-infected patients with prolonged cough and found that median plasma levels of IL-6, IFN-γ, MIG, IL-18, and CRP were significantly different between TB and non-TB cases. Although individual biomarkers had limited specificity at 90% sensitivity, IL-6 showed the highest specificity (44%), which improved to 50% when combined with IFN-γ. Biomarker panels demonstrated superior diagnostic performance, particularly in smear-negative TB patients, highlighting the utility of peripheral blood cytokine profiling. In the current study, hs-CRP levels were elevated in all subjects prior to anti-tuberculosis treatment (ATT), with normalization observed in two patients by 2 months and in all 50 patients by the end of treatment ($p < 0.001$). These findings align with Mesquita et al.[16], who observed significant reductions in CRP, IL-2, TNF-α, and ESR after two months of ATT and noted that CRP, IL-2, and IL-4 were strong discriminators of treatment response. Similarly, Khuder et al.[22] reported significantly higher hs-CRP levels in TB patients (6.29 ± 2.84 mg/L) than in healthy controls (1.86 ± 0.17 mg/L; $p < 0.0000$). Further supporting these results, a systematic review and meta-analysis by Yoon et al.[23] demonstrated high sensitivity (93%) and moderate specificity (62%) of CRP (cutoff: 10 mg/mL) in diagnosing pulmonary TB, including among HIV-infected individuals. Notably, CRP specificity was lower in hospitalized settings but showed promise for use in systematic screening programs. Collectively, these studies reinforce the role of IL-6, IFN-γ, and CRP as valuable biomarkers in TB diagnosis and treatment monitoring, with combined biomarker panels offering enhanced diagnostic accuracy.

A large-scale study by Brown et al.[9] analyzed 3,222 patients, of whom 72% had baseline CRP measurements taken at or within four weeks prior to initiating anti-tuberculosis treatment (ATT). The study revealed that CRP levels were significantly elevated in culture-positive compared to culture-negative cases [median 49 mg/L (IQR: 16–103) vs 19 mg/L (IQR: 5–72); $p < 0.001$]. Among patients with pulmonary TB, smear-positive cases demonstrated higher CRP levels than smear-negative ones [67 mg/L (IQR: 31–122) vs 24 mg/L (IQR: 7–72); $p < 0.001$]. These findings are consistent with the results from Farr et al.[21], who reported that median plasma levels of IL-6, IFN-γ, MIG, CRP, and IL-18 significantly differed between TB and non-TB patients. While each biomarker alone had limited specificity at 90% sensitivity, IL-6 showed the highest specificity (44%; 95% CI: 37.4–49.5), and combining IL-6 with IFN-γ improved specificity to 50% (95% CI: 46.7–53.3), particularly valuable in smear-negative cases.

In line with these observations, the present study demonstrated that both IL-6 and hs-CRP levels were elevated at diagnosis and showed a statistically significant reduction after two months of ATT, with values nearing baseline by the completion of therapy ($p < 0.001$). These findings suggest that IL-6 and hs-CRP are not only reliable markers for identifying individuals at high risk for TB but also serve as sensitive, cost-effective, and resource-efficient indicators of disease activity and therapeutic response. However, further research involving larger sample sizes and diverse geographic populations is warranted to validate and generalize these results.

CONCLUSION

In conclusion, this study highlights the significant role of IL-6 and hs-CRP as biomarkers in pulmonary tuberculosis. Both markers were elevated at baseline and showed a marked reduction during the course of anti-tubercular treatment, correlating with disease activity and therapeutic response. IL-6 levels were significantly associated with bacterial load, while hs-CRP served as a reliable indicator of treatment progression. Given their sensitivity and cost-effectiveness, IL-6 and hs-CRP may serve as valuable adjuncts in the diagnosis, monitoring, and prognosis of pulmonary TB. Further large-scale studies are recommended to validate these findings across diverse populations.

Table 1. Baseline Demographic and Lifestyle Characteristics of Study Participants (N = 50)

Parameter	Category	n (%)
Age (years)	21–30	22 (44.0%)
	31–40	5 (10.0%)
	41–50	4 (8.0%)
	51–60	8 (16.0%)
	61–70	7 (14.0%)
	71–80	4 (8.0%)
Mean ± SD Age	42.64 ± 19.01	
Sex	Male	33 (66.0%)
	Female	17 (34.0%)
Dietary Status	Vegetarian	28 (56.0%)
	Non-vegetarian	22 (44.0%)
Body Mass Index (BMI)	≤20	30 (60.0%)
	20.1–25	18 (36.0%)
	>25	2 (4.0%)
Alcohol Intake	Present	24 (48.0%)
	Absent	26 (52.0%)
Smoking Status	Smoker	28 (56.0%)
	Non-smoker	22 (44.0%)
Smoking Quantity (Among smokers, n=28)	½ bundle/day	6 (21.5% of smokers)
	1 bundle/day	19 (67.8%)
	2 bundles/day	3 (10.7%)

Table 2: Clinical and Hematological Findings in Pulmonary Tuberculosis Patients (n=50)

Parameter	No. of Cases (n)	Percentage (%)
Symptoms		
Cough (productive)	50	100%

Decreased appetite	50	100%
Dyspnea	46	92%
Weight loss	43	86%
Fever	40	80%
Hemoptysis	18	36%
Chest pain	12	24%
Clinical Signs		
Lymphadenopathy	14	28%
Pallor	13	26%
Clubbing	0	0%
Hematological Findings		
Raised total leukocyte count	28	56%
Elevated D-Dimer	26	52%
Decreased hemoglobin	17	34%

Table 3: Radiological Findings in Pulmonary Tuberculosis Patients (n=50)

Parameter	No. of Cases (n)	Percentage (%)
Chest Radiograph (CXR)		
Hilar opacities	50	100%
Infiltrates	48	96%
Consolidation	47	94%
Cavitary lesions	12	24%
Pneumothorax	3	6%
Pleural effusion	2	4%
Calcification	1	2%
CXR Distribution		
Bilateral involvement	26	52%
Right-sided involvement	18	36%
Left-sided involvement	6	12%
Upper and lower zone involvement	32	64%
Upper zone only	13	26%
Lower zone only	5	10%
HRCT Chest Findings		
Lymph node enlargement	50	100%
Nodules	49	98%
Consolidation	47	94%
Calcification	2	4%
Pleural effusion	2	4%
Emphysema	1	2%

Table 4: Association Between Chest X-ray Infiltrates and Inflammatory Markers

Parameter	IL-6 Levels	Hs-CRP Levels	Findings
Association with Infiltrates	No significant association observed	No significant association observed	No association found between chest X-ray infiltrates and inflammatory markers
Side of Infiltrates	No specific association with side	No specific association with side	No specific correlation between side of infiltrates and inflammatory markers

Table 5: Sputum AFB Grading Distribution

Sputum AFB Grade	Number of Cases (%)
1+	36%
2+	40%
3+	24%

Table 6: Hs-CRP Levels at Different Stages of Treatment

Time Point	Males (n=31)	Females (n=17)
Start of Treatment	93.9% > 20 mg/L	88.9% > 20 mg/L
End of 2 Months	57.6% < 10 mg/L	47.1% < 10 mg/L
End of 6 Months	100% Normal	100% Normal

Table 7: IL-6 Levels at Different Stages of Treatment

Time Point	Males (n=32)	Females (n=13)
Start of Treatment	97% > 20 pg/mL	76.5% > 20 pg/mL
End of 2 Months	81.8% > 20 pg/mL	58.8% > 20 pg/mL
End of 6 Months	100% Normal	100% Normal
Note	None had IL-6 levels<10	2females had IL-6<10

Table 8: Correlation Between AFB Sputum Grading and IL-6 Levels

Sputum AFB Grade	IL-6 Levels at Baseline	IL-6 Levels at 2 Months	p-value
3+	111.19±34.34	35.03±8.28	<0.001
2+	73.64±10.06	30.44±5.43	<0.001
1+	33.68±13.37	19.55±3.01	<0.001

Table 9: Normalization of IL-6 and Hs-CRP Levels After Treatment

Marker	Before Treatment	After 2 Months	At the end of treatment	P value
Hs-CRP				<0.001
Negative	0	2 (4.0%)	50 (100.0%)	
Positive	50 (100.0%)	48 (96.0%)	0	
IL-6				<0.001
Negative	0	2 (4.0%)	50 (100.0%)	
Positive	50 (100.0%)	48 (96.0%)	0	

Table 10: Association Between Age, Gender, and Inflammatory Markers

Age	Upto 35 years	36-50 years	>50 years	p value
IL-6	73.17±44.27	71.55±28.81	59.51±21.38	0.58
HsCRP	40.25±14.01	33.14±17.60	35.24±9.99	0.26
Gender	Males	Females		
IL-6	73.20±35.13	58.70±35.62		0.23
HsCRP	35.15±12.84	41.78±13.98		0.05

Table 11: Correlation Between Mantoux Test and Baseline IL-6 Levels

Mantoux Test Findings	Baseline IL-6 Level	Correlation Coefficient (r)	p-value
Mantoux Test	Significantly correlated	0.630	<0.001
Hs-CRP	No correlation	0.05	0.69

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