Quantitative Changes in Procalcitonin Levels in Pulmonary Tuberculosis

Abdukarimov M. U.[1,*], Usmonov I. Kh.[2]

[1]Doctoral Student, Department of Phthisiology and Pulmonology, Bukhara State Medical Institute, Bukhara, Uzbekistan
[2]Republican Specialized Scientific-Practical Medical Center for Phthisiology and Pulmonology, Tashkent, Uzbekistan

Abstract Procalcitonin (PCT) is a crucial biomarker for evaluating infection and inflammation in various diseases, including tuberculosis (TB). While PCT levels are significantly elevated in conditions like sepsis, its role in TB, particularly in distinguishing disease severity, requires further exploration. This study investigates PCT levels in patients with pulmonary TB, comparing destructive and non-destructive forms, gender differences, and the impact of comorbidities. The results indicate that PCT levels are notably higher in patients with destructive TB, but there is no statistically significant correlation between PCT levels and gender or the presence of comorbidities [1,4,5].

Keywords Procalcitonin, Tuberculosis, Inflammation, Biomarker, Comorbidities

1. Introduction

Procalcitonin (PCT) is widely recognized as an important biomarker for assessing bacterial infections and the inflammatory response in various diseases. Elevated levels of PCT are typically associated with severe bacterial infections, including sepsis. However, the role of PCT in tuberculosis (TB) is less clear, especially regarding its potential to indicate disease severity. Pulmonary TB, particularly in its destructive form, is characterized by significant inflammation and tissue damage, which may influence PCT levels. Understanding the relationship between PCT levels and the severity of TB, as well as other factors like gender and comorbidities, can provide valuable insights for clinical decision-making and patient management [2,7,8].

This study aims to analyze the variation of PCT levels in patients with pulmonary TB, comparing destructive and non-destructive forms, exploring gender differences, and examining the effect of comorbidities on PCT levels [3,6].

2. Methods

Study Design

This observational study involved patients diagnosed with pulmonary TB. The patients were categorized into two groups: those with destructive TB and those with non-destructive TB. Additionally, PCT levels were analyzed based on gender and the presence of comorbidities.

Participants

A total of 72 patients with pulmonary TB were included in the study. Among them, 47 had destructive TB and 25 had non-destructive TB. The participants were further categorized by gender (25 males and 47 females) and the presence of comorbidities (62 with comorbidities, 10 without comorbidities).

Measurements

Blood samples were collected from all participants to measure PCT levels. The patients were grouped based on their PCT levels: <0.5 ng/mL, 0.5-2 ng/mL, 2-10 ng/mL, and >10 ng/mL. The Mann-Whitney U test was used to analyze the statistical significance of differences in PCT levels between the groups.

Statistical Analysis

The Mann-Whitney U test was applied to assess the statistical significance of differences in PCT levels between destructive and non-destructive TB groups, between genders, and in relation to comorbidities. A p-value of <0.05 was considered statistically significant.

3. Results

Procalcitonin Levels in Destructive vs. Non-Destructive Tuberculosis

The PCT levels in the blood of patients with destructive and non-destructive forms of TB are shown in Table 1. The results indicate that patients with destructive TB had significantly higher PCT levels compared to those with non-destructive TB (p = 0.001). In the destructive group, 6 patients had PCT levels <0.5 ng/mL, 29 patients had

levels between 0.5-2 ng/mL, 11 patients had levels between 2-10 ng/mL, and one patient had a PCT level >10 ng/mL. In contrast, the majority of non-destructive TB patients (21 out of 25) had PCT levels <0.5 ng/mL, and only 4 patients had levels between 0.5-2 ng/mL. No patients in the non-destructive group had PCT levels above 2 ng/mL.

Gender Differences in Procalcitonin Levels

The analysis of PCT levels by gender is presented in Table 2. There was no statistically significant difference in PCT levels between males and females (p = 0.375). Both genders showed similar patterns of PCT distribution across the various categories, with no significant difference in the mean PCT levels between them.

Procalcitonin Levels and Comorbidities

The influence of comorbidities on PCT levels is summarized in Table 3. Patients with comorbidities had a mean PCT level of 1.22 ng/mL, while those without comorbidities had a significantly lower mean level of 0.54 ng/mL. However, the difference was not statistically significant (p = 0.204).

4. Discussion

This study highlights significant differences in procalcitonin levels between patients with destructive and non-destructive forms of pulmonary tuberculosis. The results indicate that patients with destructive TB have significantly higher PCT levels, supporting the hypothesis that elevated PCT is associated with more severe infection and an increased risk of septic complications. These findings align with previous studies suggesting that PCT can be used to assess the severity of infections.

However, the study did not find any statistically significant differences in PCT levels based on gender. Both males and females showed similar distributions of PCT levels, indicating that gender does not significantly influence PCT levels in TB patients.

The analysis of comorbidities also showed that patients with comorbidities had higher mean PCT levels compared to those without comorbidities. However, this difference was not statistically significant, suggesting that while comorbidities may affect PCT levels, the correlation is not strong enough to be conclusive.

5. Conclusions

In conclusion, procalcitonin levels are significantly higher in patients with destructive pulmonary tuberculosis, indicating more severe infection and a higher risk of complications. Gender does not appear to have a significant effect on PCT levels, and while patients with comorbidities tend to have higher PCT levels, this finding is not statistically significant. These results suggest that PCT could be a useful biomarker for assessing the severity of TB, particularly in destructive cases, but further research is needed to clarify its role in relation to comorbidities.

Table 1. Quantitative Indicators of Procalcitonin Levels in the Blood of Patients with Pulmonary Tuberculosis

Indicators	Destructive			Non-destructive			p
	abs	M	m	abs	M	m	
Procalcitonin levels <0.5 ng/ml	6	0,23	0,13	21,00	0,11	0,10	
Procalcitonin levels 0.5-2 ng/ml	29	1,00	0,40	4,00	0,87	0,18	
Procalcitonin levels. 2-10 ng/ml	11	3,08	1,09	-	-	-	0,001
Procalcitonin level >10 ng/ml	1	11,40	-	-	-	-	
Total	47	1,61	1,86	25,00	0,23	0,30	

Table 2. Changes in blood procalcitonin (by gender)

Indicators	male (n=25)			woman (n=47)			Manna-Whitney criterion P
	Abs	M	m	abs	M	m	
Procalcitonin levels <0.5 ng/ml	9	0,13	0,11	19	0,14	0,12	
Procalcitonin levels 0.5-2 ng/ml	9	0,97	0,27	23	1,02	0,40	
Procalcitonin levels. 2-10 ng/ml	7	3,38	1,27	4	2,56	0,39	0,375
Procalcitonin level >10 ng/ml	-	-	-	1	11,40	-	
Total	25	1,34	1,50	47	1,02	1,72	

Table 3. Changes in procalcitonin in concomitant diseases

Indicators	there is a concomitant disease			no comorbidities			Manna-Whitney criterion P
	abs	M	m	Abs	M	m	
Procalcitonin	62	1,22	1,75	10	0,54	0,34	0,204

REFERENCES

[1] Abdukarimov M.U. Clinical Forms of Extrapulmonary Tuberculosis // Research Journal of Trauma and Disability Studies. – 2024. – T. 3. – №. 3. – P. 366-373.

[2] Abdukarimov M.U. Complex treatment algorithm of destructive pulmonary tuberculosis and its rationale // Open Access Repository. – 2023. – T. 4. – №. 3. – P. 1292-1300.

[3] Abdukarimov M.U. Modern approach to the treatment of spinal tuberculosis // Young scientists. - 2024. - V. 2. - No. 8. - P. 48-55.

[4] Abdukarimov M.U. Clinical aspects of tuberculosis disease // Barqarorlik va yetakchi tadqiqotlar onlayn ilmiy jurnali. – 2022. – T. 2. – №. 12. – P. 73-80.

[5] Abdukarimov M.U., Usmonov I.Kh. The study of the prognostic value of procalcitonin and changes in the blood coagulation system in the course of pulmonary tuberculosis // Journal of Survey in Fisheries Sciences. – 2023. – T. 10. – №. 1S. – P. 3217-3247.

[6] Korzh E. V. et al. The Role of the Hemostatic System in the Formation of Destruction in Pulmonary Tuberculosis // Ukrainian Pulmonology Journal. – 2006. – No. 2. – P. 70-72.

[7] Ovsyankina E. S. et al. Procalcitonin Test as a Method for Predicting Bacterial Shedding in Children and Adolescents with Respiratory Tuberculosis // Zemsky Doctor. – 2016. – No. 3-4 (31-32). – P. 18-21.

[8] WHO consolidated guidelines on drug-resistant tuberculosis treatment. Geneva: World Health Organization; 2019. Executive summary. Available from: https://www.ncbi.nlm.nih.gov/books/NBK539513/.