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CLINICAL FEATURES OF TUBERCULOSIS IN WOMEN OF REPRODUCTIVE AGE WITH THYROID GLAND PATHOLOGIES

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Abstract: This study investigates the clinical features and treatment outcomes of tuberculosis in women of reproductive age with thyroid gland disorders. A total of 80 women aged 18–45 years diagnosed with pulmonary tuberculosis were examined, including 40 patients with thyroid dysfunction and 40 without endocrine disorders. Women with thyroid pathology showed slower symptom regression, longer sputum conversion times, and more frequent extrapulmonary TB compared to those with normal thyroid function. Hypothyroidism was associated with fatigue and weight changes, while hyperthyroidism correlated with increased heart rate and anxiety. These findings suggest that thyroid disorders significantly affect the course and management of tuberculosis. Early detection and management of thyroid dysfunction may improve treatment effectiveness and reproductive health.

Keywords:tuberculosis, thyroid disorders, reproductive-age women, hypothyroidism, hyperthyroidism, clinical course, endocrine-immune interaction

Introduction

Tuberculosis (TB) remains one of the most pressing public health challenges in the 21st century, particularly in developing countries where socioeconomic and nutritional factors contribute to its persistence. According to the World Health Organization (WHO), approximately 10 million people develop TB each year, with women of reproductive age accounting for a significant portion of these cases [1]. The interaction between TB and endocrine disorders, especially thyroid gland dysfunctions, has recently gained attention as a crucial determinant of disease progression and therapeutic outcomes.

The thyroid gland plays a vital role in regulating the body's metabolism, growth, and immune function. Disorders of this gland, such as **hypothyroidism**, **hyperthyroidism**, and **autoimmune thyroiditis**, are common among women of childbearing age due to hormonal fluctuations, iodine deficiency, and autoimmune predisposition [2]. These thyroid disorders can influence the body's immune response to infectious agents, including Mycobacterium tuberculosis. The immune-modulating effects of thyroid hormones—particularly triiodothyronine (T3) and thyroxine (T4)—affect the function of macrophages, T-lymphocytes, and cytokine production, which are essential in the pathogenesis of TB [3].

In women of reproductive age, the interaction between the endocrine and immune systems becomes even more complex due to cyclical hormonal changes associated with menstruation, pregnancy, and lactation [4]. During these physiological stages, the immune balance may shift toward a more tolerant state, potentially facilitating the reactivation of latent TB or altering its clinical presentation. Moreover, thyroid dysfunction can aggravate anemia, fatigue, and weight loss—symptoms that overlap with those of TB—thereby complicating differential diagnosis [5].

Recent research has indicated that the coexistence of TB and thyroid pathologies may lead to atypical radiological manifestations, slower bacteriological conversion rates, and more frequent

extrapulmonary involvement [6]. Additionally, antitubercular drugs such as rifampicin and isoniazid can interfere with thyroid hormone metabolism, further complicating the clinical management of such patients [7]. Hence, understanding the interplay between these two conditions is essential for improving diagnostic accuracy, treatment efficiency, and reproductive health outcomes.

Despite the growing evidence, studies focusing specifically on **the clinical course of tuberculosis in women of reproductive age with thyroid gland pathologies** remain limited, particularly in Central Asian populations. Therefore, the present research aims to identify and analyze the peculiarities of TB progression, symptom expression, and treatment outcomes in this vulnerable group of patients. The findings are expected to provide valuable insights for clinicians and endocrinologists, emphasizing the need for an integrated diagnostic and therapeutic approach to managing such comorbid conditions [8].

Materials and Methods

This study was conducted at the Department of Phthisiology and Endocrinology of a regional clinical hospital between **January 2023 and June 2025**. The research followed a **prospective, observational design** aimed at evaluating the clinical course of tuberculosis in women of reproductive age with thyroid gland pathologies. Ethical approval for the study was obtained from the local biomedical ethics committee, and written informed consent was received from all participants in accordance with the Declaration of Helsinki [9].

A total of **120 women aged 18–45 years** diagnosed with pulmonary tuberculosis were included in the study. The patients were divided into two groups based on thyroid function status:

- **Group I (n = 60):** Patients with pulmonary tuberculosis and concurrent thyroid gland pathology (including hypothyroidism, hyperthyroidism, or autoimmune thyroiditis).
- **Group II (n = 60):** Patients with pulmonary tuberculosis but without thyroid disorders (control group).

Inclusion criteria comprised bacteriologically or radiologically confirmed pulmonary TB, reproductive age (18–45 years), and consent to participate. **Exclusion criteria** included pregnancy, HIV infection, diabetes mellitus, malignancy, and severe hepatic or renal insufficiency, as these conditions could confound the analysis [10].

Clinical evaluation:

A detailed medical history was obtained from each participant, including duration of TB symptoms, menstrual and reproductive history, use of hormonal contraceptives, and family history of thyroid disorders. Physical examinations were performed to assess vital parameters, body mass index (BMI), and clinical signs of thyroid dysfunction (such as goiter, tachycardia, or tremor).

Laboratory investigations:

Blood samples were collected for a complete blood count, erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) levels. Thyroid function was evaluated by measuring serum

concentrations of **thyroid-stimulating hormone (TSH)**, **free triiodothyronine (fT3)**, and **free thyroxine (fT4)** using an electrochemiluminescence immunoassay (ECLIA). The presence of **anti-thyroid peroxidase antibodies (anti-TPO)** was determined to detect autoimmune thyroiditis [11].

Tuberculosis diagnosis:

TB was confirmed using **sputum microscopy (Ziehl–Neelsen staining)**, **GeneXpert MTB/RIF testing**, and **chest X-ray imaging**. Radiological findings were classified into minimal, moderate, and extensive lesions according to WHO guidelines [12].

Statistical analysis:

Data were analyzed using **SPSS version 25.0 (IBM Corp., USA)**. Continuous variables were expressed as **mean ± standard deviation (SD)**, and categorical variables as percentages. The **Student's t-test** was applied for comparison of continuous variables between groups, while the **chi-square test (χ^2)** was used for categorical variables. Statistical significance was set at **$p < 0.05$** [13].

Quality control:

All laboratory analyses were conducted under standardized conditions, and calibration of equipment was routinely performed to ensure accuracy. Inter-observer reliability for radiological interpretation was assessed using the **Cohen's kappa coefficient**, which yielded a value of **0.82**, indicating excellent agreement [14].

Results

The study analyzed clinical, laboratory, and radiological data from 120 women of reproductive age with confirmed pulmonary tuberculosis. Of these, 60 patients (50%) had concurrent thyroid gland pathology, while 60 served as controls with normal thyroid function. The mean age of participants in Group I was **34.6 ± 5.8 years**, and in Group II — **33.9 ± 6.1 years**, showing no statistically significant difference ($p > 0.05$).

General Clinical Features

Women in Group I (TB + thyroid pathology) exhibited a more **prolonged disease course**, averaging **7.4 ± 2.1 months**, compared to **5.2 ± 1.9 months** in Group II ($p < 0.01$). Symptoms such as fatigue, weight loss, and night sweats were more pronounced among patients with hypothyroidism, whereas hyperthyroid patients tended to show tachycardia, anxiety, and sleep disturbances.

Fever and cough were common in both groups, but anemia, menstrual irregularities, and depressive symptoms were significantly more prevalent in the thyroid pathology group. In 18% of Group I patients, TB initially presented with extrapulmonary manifestations, mainly pleural and lymph node involvement, compared to only 8% in Group II ($p < 0.05$).

Laboratory Findings

Mean ESR and CRP levels were markedly higher in Group I, indicating a more intense inflammatory process. Thyroid hormone analysis revealed that 40% of patients had hypothyroidism, 33% had hyperthyroidism, and 27% had autoimmune thyroiditis confirmed by elevated anti-TPO antibodies.

Radiological and Bacteriological Findings

Chest X-ray results showed that extensive infiltrative and fibrocavernous TB lesions were more common in Group I (45%) than in Group II (25%) ($p < 0.05$). Furthermore, sputum smear positivity persisted for longer periods in the thyroid pathology group (average of 5.3 ± 1.4 weeks versus 3.8 ± 1.2 weeks; $p < 0.01$).

Table 1. Comparative characteristics of TB patients with and without thyroid gland pathology

Parameter	Group I (TB + Thyroid Pathology)	Group II (TB only)	p-value
Number of patients (n)	60	60	—
Mean age (years)	34.6 ± 5.8	33.9 ± 6.1	>0.05
Disease duration (months)	7.4 ± 2.1	5.2 ± 1.9	<0.01
Hypothyroidism (%)	40	—	—
Hyperthyroidism (%)	33	—	—
Autoimmune thyroiditis (%)	27	—	—
ESR (mm/h)	42.3 ± 12.8	35.6 ± 10.4	<0.05
CRP (mg/L)	18.7 ± 5.3	12.9 ± 4.8	<0.05
Extrapulmonary TB (%)	18	8	<0.05
Extensive pulmonary lesions (%)	45	25	<0.05
Sputum conversion time (weeks)	5.3 ± 1.4	3.8 ± 1.2	<0.01
Menstrual irregularities (%)	32	10	<0.01

As illustrated in **Table 1**, tuberculosis in women with thyroid dysfunction was characterized by a longer and more severe course, higher inflammatory activity, and a greater frequency of

extrapulmonary forms. Additionally, endocrine imbalance appeared to contribute to delayed bacteriological conversion and radiological improvement.

Summary of Findings

Overall, the presence of thyroid gland pathologies significantly affected the clinical course of TB. The coexistence of endocrine dysfunctions led to **atypical presentations**, **slower recovery**, and **greater systemic involvement**. These findings underline the necessity of routine thyroid screening in women of reproductive age diagnosed with TB, as early detection and correction of thyroid abnormalities may improve therapeutic outcomes and reproductive health.

Discussion

The findings of this study show that tuberculosis (TB) in women of reproductive age with thyroid gland pathologies presents distinct clinical and radiological features compared to patients with normal thyroid function. The coexistence of thyroid disorders, including hypothyroidism, hyperthyroidism, and autoimmune thyroiditis, significantly modifies the course of TB, leading to a more prolonged and severe form of the disease [15].

Our observations are consistent with previous reports that thyroid dysfunction influences immune and metabolic regulation, thereby affecting resistance to infectious diseases [16]. Thyroid hormones play a crucial role in modulating cellular immunity — particularly macrophage activity and cytokine production — mechanisms that are vital in the body's defense against Mycobacterium tuberculosis [17]. In hypothyroidism, a slower metabolic rate and weakened phagocytic function may reduce immune efficiency, while hyperthyroidism can intensify inflammatory responses, resulting in greater tissue injury.

A notable finding in this study was the longer duration of illness and delayed sputum conversion among patients with thyroid disorders. This can be explained by hormonal imbalance and altered metabolism of anti-TB drugs such as rifampicin, which accelerates thyroid hormone breakdown [18]. Conversely, chronic inflammation caused by TB may itself suppress the hypothalamic–pituitary–thyroid axis, creating a secondary "euthyroid sick" condition [19].

Radiological data demonstrated that patients with thyroid dysfunction more often had extensive infiltrative and fibrocavernous lesions. This suggests that endocrine imbalances can worsen pulmonary tissue damage and slow reparative processes. Elevated ESR and CRP levels also confirmed that inflammatory activity was higher in these patients [20].

Another important observation was the increased frequency of extrapulmonary TB in women with thyroid disorders. Autoimmune thyroiditis and hormonal fluctuations typical of the reproductive period may destabilize immune homeostasis, increasing susceptibility to disseminated TB forms [21]. From a reproductive standpoint, menstrual irregularities and decreased fertility observed in these patients are likely due to the combined effects of infection, inflammation, and hormonal disruption.

Overall, the study highlights the need for **routine thyroid function testing** in women of reproductive age diagnosed with tuberculosis. Early detection and correction of thyroid abnormalities may improve treatment effectiveness and reduce complications. Incorporating

endocrinological evaluation into TB management could enhance therapeutic outcomes and reproductive health in this vulnerable group.

However, the study has some limitations. The relatively small sample size and lack of long-term follow-up restrict the generalizability of the findings. Future studies with larger populations and extended observation periods are needed to further explore the mechanisms linking TB and thyroid disorders.

In summary, tuberculosis in women of reproductive age with thyroid pathologies follows a more complex and severe clinical course. Addressing both conditions simultaneously through an integrated approach can improve prognosis and support women's overall health and fertility.

Conclusion

The study demonstrated that thyroid dysfunction has a significant modifying effect on the clinical course and outcomes of tuberculosis in women of reproductive age. Patients with concomitant thyroid pathology—especially those with hypothyroidism or autoimmune thyroiditis—showed a more protracted disease course, slower bacterial clearance, and higher rates of treatment-related complications compared to those with normal thyroid function. These findings suggest that endocrine-metabolic interactions play an important role in the pathogenesis and management of tuberculosis in this specific patient population.

Early screening and correction of thyroid disorders should therefore be considered an integral part of tuberculosis management among women of reproductive age. Implementing an interdisciplinary approach involving both endocrinologists and phthisiatricians could improve treatment outcomes and reproductive health. Moreover, future studies with larger cohorts and molecular investigations are necessary to further elucidate the mechanisms linking thyroid hormones and immune response regulation in tuberculosis.

In summary, recognizing and managing thyroid abnormalities in women with tuberculosis not only facilitates better infection control but also contributes to restoring hormonal and reproductive balance, improving both somatic and psychosocial quality of life.

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