

allergen-driven symptoms, and better control rates (60–75% vs. 45–50%) with ICS, while older adults face persistent symptoms, comorbidities, and lower therapeutic response, compounded by diagnostic delays. Age-tailored strategies – early intervention and education for children, multidisciplinary care and comorbidity management for older adults – optimize outcomes, reducing exacerbations by 20–25% when effectively applied.

#### LITERATURE

1. Global Asthma Network. The Global Asthma Report 2022 // International Journal of Tuberculosis and Lung Disease. – 2022.
2. Papi, A. Asthma in the elderly: a different disease? / A. Papi [et al.] // Breathe. – 2016.
3. Busse, P. J. Age-related changes in asthma management / P.J. Busse, S.K. Mathur // Annals of Allergy, Asthma & Immunology. – 2019.
4. Asher, M. I. Worldwide trends in the burden of asthma in children / M.I. Asher [et al.] // Lancet Respiratory Medicine. – 2021.
5. SkSkloot, G. S. Asthma in older adults: clinical challenges and management strategies / G.S. Skloot [et al.] // European Respiratory Review. – 2023.

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### **PULMONARY AND EXTRAPULMONARY MANIFESTATIONS OF TUBERCULOSIS: A COMPREHENSIVE ANALYSIS OF DISEASE PROGRESSION, COMPLICATIONS, AND CLINICAL MANAGEMENT**

#### ***Introduction***

Tuberculosis (TB) remains one of the most significant infectious diseases worldwide, affecting both pulmonary and extrapulmonary systems. This research explores the pathophysiology, clinical manifestations, and complications of TB from an internal medicine perspective, incorporating diagnostic techniques such as auscultation, percussion, and palpation. The study also examines the impact of TB on multiple organ systems, with a focus on its respiratory complications, systemic involvement, and treatment challenges. Special emphasis is given to drug resistance, immunological interactions, and TB management in immunocompromised patients.

#### ***Goal***

Overview of Pulmonary Tuberculosis.

#### ***Material and methods of research***

Analysis of literary sources data on pulmonary tuberculosis.

#### ***The results of research and their discussion***

Pulmonary Tuberculosis: Pathophysiology and Disease Progression

Pulmonary tuberculosis (PTB) primarily affects the lungs and is caused by the inhalation of droplets containing *Mycobacterium tuberculosis*. Upon entering the lungs, the bacteria are phagocytosed by alveolar macrophages, which triggers an immune response leading to the formation of granulomas. This is the body's attempt to contain the infection. The classic Ghon complex, consisting of a primary focus of infection in the lung and associated hilar lymphadenopathy, is a hallmark of primary TB seen in chest X-rays.

In the early stages of primary tuberculosis, the infection may remain asymptomatic or result in mild symptoms. However, as the bacteria proliferate, granulomas form in the affected tissues, and the disease can progress to more severe manifestations. Post-primary tuberculosis, also known as reactivation TB, occurs when latent bacteria become active. This reactivation is often associated with immunosuppression, malnutrition, or underlying chronic diseases. In these cases, TB predominantly affects the upper lobes of the lungs, leading to cavitary lesions and caseous necrosis. These changes can be visualized through imaging techniques, which help clinicians assess the severity of the disease.

#### Clinical Manifestations of Pulmonary Tuberculosis

Pulmonary Tuberculosis (TB) presents with common symptoms like persistent cough, hemoptysis, and dyspnea. The cough is productive and worsens at night. Hemoptysis occurs from bronchial artery erosion, causing blood vessel rupture. As the disease progresses, dyspnea becomes more pronounced. Lung sounds may show decreased breath sounds, coarse crackles, or crackles. Bronchial breathing is often observed in cavitary lesions. Primary TB often shows the Ghon complex, while post-primary TB may have cavitary lesions, fibrosis, and apical consolidation.

#### Tuberculosis-Associated Respiratory Complications

TB can cause pneumonia, marked by bacterial growth and alveolar exudates. It mimics bacterial pneumonia but doesn't respond to standard antibiotics. Symptoms include fever, respiratory distress, and productive cough. It can progress to respiratory failure and requires ventilatory support. Diagnosis is confirmed via sputum cultures and PCR testing.

Chronic TB inflammation may lead to bronchiectasis, causing recurrent infections and copious sputum. Symptoms include persistent cough, coarse crackles, and dull percussion over affected lung fields. This condition worsens quality of life due to frequent exacerbations and complications like pneumonia.

TB can spread to the pleura, causing pleuritis with chest pain and breathlessness. Auscultation may reveal decreased breath sounds and a pleural friction rub. Stony dullness on percussion indicates pleural effusion. Diagnosis is confirmed by pleural fluid analysis, with elevated adenosine deaminase (ADA) levels. Extrapulmonary TB, though less common, can involve any organ system. It spreads via blood or direct extension. Renal TB occurs due to hematogenous spread, causing granulomatous inflammation in the kidneys. Symptoms include dysuria, hematuria, and flank pain. Diagnosis is confirmed through urine culture, PCR testing, and imaging, which may show cortical scarring and calcifications. Tuberculous pericarditis occurs when TB spreads to the pericardial sac, causing chest pain, fever, and heart failure signs. Pericardial effusion may lead to tamponade. Diagnosis is confirmed through fluid analysis and PCR testing for *Mycobacterium tuberculosis*.

#### ***Diagnostic Approaches for Tuberculosis***

The diagnosis of tuberculosis, both pulmonary and extrapulmonary, requires a multifaceted approach. The cornerstone of diagnosis is microbiological confirmation, typically through sputum smear microscopy, culture, and molecular techniques such as PCR.

##### *Sputum Smear and Culture*

Microscopic examination of sputum samples stained with Ziehl-Neelsen or fluorescent dye can identify acid-fast bacilli (AFB), confirming the presence of *Mycobacterium tuberculosis*.

##### *Chest X-Ray and Imaging Studies*

Chest X-ray is crucial in identifying pulmonary TB, especially in cases with characteristic features such as the Ghon complex, cavitary lesions, and fibrosis. In cases of extrapulmonary

TB, imaging studies like ultrasound, CT scans, and MRI can help detect TB-related changes in organs such as the kidneys, bones, or brain.

#### *Molecular Testing*

Polymerase chain reaction (PCR) testing has become increasingly important for the rapid diagnosis of TB. PCR can detect the DNA of *Mycobacterium tuberculosis* in sputum, blood, or tissue samples, providing faster results compared to traditional culture methods. PCR is also invaluable for detecting drug-resistant strains.

#### *Treatment and Management*

The management of tuberculosis involves a multi-drug regimen, typically consisting of four first-line drugs: isoniazid, rifampicin, pyrazinamide, and ethambutol. The treatment duration for pulmonary TB is usually six months, while extrapulmonary TB may require longer treatment. Drug resistance, particularly multidrug-resistant TB (MDR-TB), is a growing concern and complicates treatment. Patients with MDR-TB require second-line drugs, and treatment regimens must be tailored based on drug susceptibility testing.

#### *Drug Resistance in Tuberculosis*

Multidrug-resistant tuberculosis (MDR-TB) and extensively drug-resistant tuberculosis (XDR-TB) present significant challenges to TB management. MDR-TB occurs when the TB bacteria are resistant to at least isoniazid and rifampicin, while XDR-TB is resistant to these two drugs plus at least one of the second-line drugs. The treatment of MDR-TB and XDR-TB requires prolonged courses of second-line drugs, which are often less effective and more toxic.

#### *Management of Complications*

The management of TB-related complications such as pleural effusion, pneumothorax, or cardiac tamponade requires both medical and surgical interventions. In cases of large pleural effusions or tension pneumothorax, procedures such as thoracentesis or chest tube placement may be necessary to alleviate symptoms and prevent respiratory failure.

#### *Conclusions*

Tuberculosis is a complex and multifaceted disease with both pulmonary and extrapulmonary manifestations. Early detection and appropriate treatment are essential for preventing complications and ensuring successful outcomes. With the rise of drug-resistant strains of *Mycobacterium tuberculosis*, it is increasingly important for clinicians to remain vigilant in diagnosing and managing TB. A multidisciplinary approach involving microbiology, radiology, and clinical medicine is critical in addressing the ongoing challenges posed by this ancient yet still-relevant disease.

#### **LITERATURE**

1. The global tuberculosis report 2022: key data analysis for China and the global world / S. Min, L. U. Puxuan, F. Weijun [et al.] // Electronic Journal of Emerging Infectious Diseases. – 2023. – Vol. 8, № 1. – P. 87.
2. Ismail, Y. Pulmonary tuberculosis—a review of clinical features and diagnosis in 232 cases / Y. Ismail // Med J Malaysia. – 2004. – Vol. 59, № 1. – P. 56–64.
3. Laniado-Laborin, R. Tuberculosis: A Clinical Practice Guide. – Bentham Science Publishers, 2020.
4. Wani, R. L. S. Clinical manifestations of pulmonary and extra-pulmonary tuberculosis / R. L. S. Wani // South Sudan Medical Journal. – 2013. – Vol. 6, № 3. – P. 52–56.