DIAGNOSTIC AND PROGNOSTIC SIGNIFICANCE OF CLINICAL AND LABORATORY PARAMETERS IN PATIENTS WITH TUBERCULOSIS

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Abstract

Tuberculosis (TB) is a major global health problem caused by Mycobacterium tuberculosis. This article reviews the diagnostic and prognostic significance of clinical and laboratory parameters in TB patients. Common findings include anemia, lymphopenia, elevated inflammatory markers (ESR, CRP), and microbiological or molecular confirmation of Mycobacterium tuberculosis. These parameters provide insight into disease activity, severity, and treatment response. Systematic evaluation of clinical-laboratory markers supports early diagnosis, prognosis prediction, and individualized management strategies, highlighting their critical role in modern TB care.

Keywords tuberculosis, clinical parameters, laboratory tests, diagnosis, prognosis, Mycobacterium tuberculosis, molecular diagnostics

ДИАГНОСТИЧЕСКОЕ И ПРОГНОСТИЧЕСКОЕ ЗНАЧЕНИЕ КЛИНИЧЕСКИХ И ЛАБОРАТОРНЫХ ПОКАЗАТЕЛЕЙ У ПАЦИЕНТОВ С ТУБЕРКУЛЁЗОМ

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Аннотация
Туберкулёз (ТБ) — глобальная проблема здравоохранения, вызываемая Mycobacterium tuberculosis. В статье рассматривается диагностическое и прогностическое значение клинических и лабораторных показателей у пациентов с туберкулёзом. Наиболее часто встречаются анемия, лимфопения, повышенные показатели воспаления (СОЭ, С-реактивный белок) и микробиологическое или молекулярное подтверждение Mycobacterium tuberculosis. Эти показатели отражают активность болезни, её тяжесть и эффективность лечения. Комплексная оценка клинических и лабораторных данных способствует ранней диагностике, прогнозированию и разработке

индивидуализированных стратегий лечения, подчёркивая их критическую роль в современной практике борьбы с туберкулёзом.

Ключевые слова

туберкулёз, клинические показатели, лабораторные исследования, диагностика, прогноз, Mycobacterium tuberculosis, молекулярная диагностика

Introduction

Tuberculosis (TB) remains a major global health challenge and is among the leading causes of morbidity and mortality worldwide. The causative agent, Mycobacterium tuberculosis, primarily affects the lungs but may involve extrapulmonary organs. Early diagnosis and assessment of disease severity are crucial for effective treatment, prevention of transmission, and prognosis evaluation.

Despite advances in imaging and molecular techniques, TB diagnosis is often challenging due to nonspecific clinical manifestations such as persistent cough, fever, night sweats, and weight loss. Therefore, clinical and laboratory parameters play a central role in confirming the diagnosis and monitoring disease progression.

Laboratory investigations, including complete blood count, biochemical tests, inflammatory markers such as erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), immunological tests, and microbiological evaluations, provide critical information on the host response and disease activity. Microbiological confirmation through sputum microscopy and culture remains the "gold standard," while molecular assays such as GeneXpert MTB/RIF enable rapid detection of Mycobacterium tuberculosis and rifampicin resistance.

Clinical-laboratory parameters are not only essential for diagnosis but also for prognostic assessment. Alterations such as anemia, lymphopenia, or hypoalbuminemia may reflect severe disease and predict adverse outcomes. Systematic evaluation of these parameters allows clinicians to monitor treatment response, adjust therapy, and predict disease course.

This article aims to review the diagnostic and prognostic significance of clinical and laboratory parameters in TB patients and to highlight their role in modern clinical practice.

Methods

This study is theoretical and analytical in nature; no experimental or patient-based research was conducted. Data were obtained from peer-reviewed scientific literature, international guidelines, and clinical recommendations.

The following clinical-laboratory parameters were evaluated:

- Clinical manifestations: cough, fever, night sweats, weight loss
- Complete blood count: leukocytosis, lymphocyte count, anemia
- Inflammatory markers: ESR, CRP
- Biochemical parameters: liver enzymes, total protein, albumin
- Microbiological and molecular diagnostic tests: sputum smear microscopy, culture, GeneXpert MTB/RIF

The review focused on the role of these parameters in diagnosing TB, assessing disease severity, and predicting clinical outcomes.

Results

Literature analysis indicates that TB patients commonly exhibit the following clinical-laboratory changes:

- Moderate anemia and elevated ESR in the complete blood count
- Relative lymphopenia
- Elevated CRP levels indicating systemic inflammation
- Detection of acid-fast bacilli in sputum samples
- Positive molecular detection of Mycobacterium tuberculosis DNA in rapid assays

These parameters correlate with disease activity, severity, and treatment response, demonstrating their diagnostic and prognostic value.

Discussion

Early and accurate diagnosis of TB is essential for reducing morbidity and preventing transmission. While clinical symptoms are often nonspecific, laboratory parameters provide objective evidence of disease.

1. Complete Blood Count and Biochemical Markers

Alterations in blood count and serum proteins reflect the systemic effects of chronic infection. Anemia and hypoalbuminemia are often associated with prolonged inflammation and nutritional compromise, indicating more severe disease.

2. Inflammatory Markers

Elevated ESR and CRP serve as surrogate markers of active infection and can guide treatment decisions and monitor therapeutic response.

3. Microbiological and Molecular Diagnostics

Sputum smear and culture remain the gold standard for confirming TB. However, culture results may take weeks. Molecular diagnostics, such as GeneXpert, allow rapid detection and assessment of drug resistance, improving clinical decision-making.

4. Prognostic Relevance

Patients with marked laboratory abnormalities, including high inflammatory markers, significant anemia, or lymphopenia, tend to have more severe disease and poorer outcomes. Monitoring these parameters over time supports individualized management and predicts recovery trajectory.

5. Integration into Clinical Practice

A comprehensive approach combining clinical assessment, laboratory testing, and molecular diagnostics optimizes TB management. Such integration allows for early diagnosis, risk stratification, and improved monitoring of treatment efficacy.

In summary, clinical and laboratory parameters are critical not only for diagnosing TB but also for evaluating disease severity and predicting patient outcomes. Their systematic and dynamic assessment enhances clinical management and supports evidence-based decision-making.

Conclusion

Clinical and laboratory parameters provide essential diagnostic and prognostic information in patients with tuberculosis. Combined evaluation of hematological, biochemical, inflammatory, microbiological, and molecular markers enables early diagnosis, assessment of disease severity, and monitoring of treatment response. Incorporating these parameters into routine clinical practice improves patient management, optimizes outcomes, and facilitates timely interventions. Continued research and guideline-based application of clinical-laboratory monitoring remain pivotal for controlling TB at both individual and public health levels.

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