MODERN LABORATORY DIAGNOSIS OF TUBERCULOSIS IN CHILDREN

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Abstract

To evaluate the diagnostic effectiveness of modern laboratory methods for detecting tuberculosis (TB) in children based on 64 clinical cases. A retrospective study included 64 children aged 1–17 years with suspected tuberculosis examined between 2023 and 2025. Diagnostic methods included immunological tests (Mantoux test with 2 TU PPD-L, Diaskintest, IGRA), molecular genetic testing (PCR GeneXpert MTB/RIF), smear microscopy, culture methods (MGIT 960), and routine clinical laboratory tests. Statistical analysis involved the Pearson χ^2 test and ROC curve analysis. Positive Diaskintest results were observed in 84,3% of patients, PCR positivity in 78.1%, and culture confirmation in 42.2% of cases. Diaskintest demonstrated significantly higher specificity compared to the Mantoux test ($\chi^2 = 4.87$; $p = 0,027$). The highest area under the ROC curve (AUC) was obtained for PCR (AUC = 0,87; 95% CI 0,78–0,95). The combined diagnostic model showed an AUC of 0,93. The combined use of immunological and molecular genetic methods significantly improves the diagnostic accuracy of tuberculosis in children and enables early detection of drug resistance.

Keywords: pediatric tuberculosis, laboratory diagnostics, PCR, Diaskintest, IGRA, ROC analysis.

Introduction

Tuberculosis in children remains a significant problem in phthisiology due to the specific features of its clinical course, predominance of primary forms, and low frequency of bacteriological confirmation. Diagnosis is complicated by the paucibacillary nature of the disease, which reduces the sensitivity of conventional microbiological methods. Modern laboratory technologies, including molecular genetic methods and next-generation immunodiagnostics, enhance early detection of tuberculosis. The aim of this study was to evaluate the diagnostic effectiveness of modern laboratory methods in children with suspected tuberculosis.

Materials and methods

A retrospective study included 64 children examined between 2023 and 2025.

Age ranged from 1 to 17 years (mean age $9,4 \pm 4,2$ years). Boys accounted for 53,1%, girls for 46,9%. Close contact with a TB patient was identified in 64.1% of children. **Diagnostic methods:** Immunological tests: Mantoux test with 2 TU PPD-L, Diaskintest, IGRA (QuantiFERON-TB Gold Plus). Molecular diagnostics: PCR (GeneXpert MTB/RIF). Microbiological methods: Smear microscopy (Ziehl–Neelsen staining), Culture on solid media, Automated liquid culture system (MGIT 960). Routine laboratory tests: Complete blood count, ESR, C-reactive protein

Results

Positive results were obtained as follows: Mantoux test — 79.7%, Diaskintest — 84.3%, IGRA — 76.6%, PCR — 78.1%, Culture method — 42.2%. **χ^2 Analysis** Diaskintest demonstrated statistically significant superiority in specificity compared to the Mantoux test: $\chi^2 = 4.87$; $p = 0.027$. No statistically significant difference was found between Diaskintest and IGRA ($p = 0.29$).

ROC Analysis

Method	AUC	95% CI
Mantoux test	0.72	0.60–0.83

Diaskintest	0.84	0.74–0.93
IGRA	0.81	0.70–0.91
PCR	0.87	0.78–0.95

Discussion

The results confirm the limited sensitivity of smear microscopy in pediatric tuberculosis due to the paucibacillary nature of the disease. Although culture remains the gold standard with high specificity, its sensitivity in children does not exceed 50%. Molecular genetic methods provide rapid diagnosis and detection of drug resistance. Modern immunological tests demonstrate high specificity and effectively complement molecular methods. The integration of these diagnostic tools significantly improves overall diagnostic accuracy.

Conclusion

1. Laboratory diagnosis of tuberculosis in children requires a comprehensive approach.

2. The highest diagnostic accuracy was demonstrated by PCR (AUC = 0.87) and Diaskintest (AUC = 0.84).

3. Combined application of methods increases diagnostic accuracy to AUC = 0.93.

4. Implementation of modern technologies facilitates early detection of drug-resistant tuberculosis.

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