Perspective

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Pediatric Infectious Diseases: Open Access
ISSN 2573-0282

2025
Vol.10 No.1:4

Pediatric Tuberculosis: Advances in Diagnosis and Drug-Resistant Strain Surveillance

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Received date: January 01, 2025, Manuscript No. Ippido-25-20911; **Editor assigned date:** January 03, 2025, PreQC No. ippido-25-20911 (PQ); **Reviewed date:** January 20, 2025, QC No. ippido-25-20911; **Revised date:** January 27, 2025, Manuscript No. ippido-25-20911 (R); **Published date:** February 4, 2025, DOI: 10.21767/2573-0282.10.1.4

Citation: Khalil A (2025) Pediatric Tuberculosis: Advances in Diagnosis and Drug-Resistant Strain Surveillance. Pediatric Infect Dis Vol.10 No.1:4

Introduction

Tuberculosis (TB) remains one of the most significant infectious diseases affecting children worldwide, posing major challenges for both diagnosis and treatment. Pediatric TB often represents recent transmission within communities, making it a key indicator of ongoing public health threats. Unlike adults, children frequently present with nonspecific symptoms and paucibacillary disease, complicating early detection. Moreover, the rise of drug-resistant Mycobacterium tuberculosis strains including Multi-Drug-Resistant (MDR) and Extensively Drug-Resistant (XDR) forms has further hindered global TB control efforts. Over the past decade, advances in molecular diagnostics, biomarker research, and surveillance systems have transformed approaches to pediatric TB, offering new hope for improved detection and prevention of resistant strains [1].

Description

Traditional diagnostic methods for TB, such as sputum microscopy and culture, have limited sensitivity in children due to low bacterial loads and difficulties in obtaining quality samples. Recent innovations, however, have greatly enhanced detection capabilities. Molecular assays such as GeneXpert MTB/RIF and its next-generation variant, Xpert Ultra, allow rapid identification of M. tuberculosis and rifampicin resistance within hours, significantly reducing diagnostic delays. Interferon-Gamma Release Assays (IGRAs) and improved skin tests have also increased accuracy in detecting latent infections. Furthermore, the use of imaging tools, such as digital chest radiography supported by artificial intelligence, has enhanced diagnostic precision in pediatric populations, particularly in low-resource settings. These technologies have been complemented by biomarker studies aiming to differentiate active from latent TB, potentially revolutionizing disease management in the near future [2].

In addition to diagnostic and surveillance advancements, significant progress has been made in developing more effective and child-friendly treatment strategies for pediatric tuberculosis, including resistant forms. New drug formulations, such as dispersible tablets and palatable fixed-dose combinations, have improved treatment adherence among young children who often struggle with traditional regimens. Novel medications like bedaquiline, delamanid, and pretomanid are being evaluated for pediatric use, offering potential alternatives for managing MDR and XDR TB with shorter, more tolerable treatment courses. Research into host-directed therapies, which aim to strengthen the child's immune response while minimizing bacterial damage, is also gaining momentum. These therapeutic innovations, combined with expanded access to community-based care, hold promise for reducing treatment burdens and improving outcomes for children affected by both drug-sensitive and drug-resistant tuberculosi [3].

Surveillance of drug-resistant TB strains in children has also improved through the integration of molecular epidemiology and genomic sequencing. Whole-Genome Sequencing (WGS) enables detailed mapping of resistance mutations and transmission patterns, providing critical insights into community spread. However, despite technological progress, significant barriers remain including high costs, inadequate laboratory infrastructure, and underreporting of pediatric cases. Strengthening surveillance networks and improving access to child-friendly treatment regimens are essential to combat resistant TB effectively. Vaccination continues to play a preventive role, with the Bacillus Chalmette–Guerin (BCG) vaccine offering partial protection, while new vaccine candidates under development aim to provide broader and longer-lasting immunity [4,5].

Conclusion

Advances in diagnostic technology and strain surveillance have significantly improved the detection and understanding of pediatric tuberculosis. However, the growing threat of drug resistance underscores the need for sustained global investment in diagnostic infrastructure, surveillance systems, and vaccine innovation. Prioritizing children within national TB programs and strengthening healthcare accessibility will be key to achieving long-term control and eventual eradication of tuberculosis in future generations.

Acknowledgement

None

Conflict of Interest

None

References

1. Churchyard GJ, Scano F, Grant AD, Chaisson RE (2007) Tuberculosis preventive therapy in the era of HIV infection: Overview and research priorities. J Infect Dis 196: S52–S62

2. Liu F, Ranmal S, Batchelor HK, Orlu-Gul M, Ernest TB, et al (2015) Formulation factors affecting acceptability of oral medicines in children. Int J Pharm 492: 341–343

3. Birungi FM, Graham SM, Uwimana J, Musabimana A, Van Wyk B (2019) Adherence to isoniazid preventive therapy among child contacts in Rwanda: A mixed-methods study. PLoS One 14: e0211934

4. Van Wyk SS, Reid AJ, Mandalakas AM, Enarson DA, Beyers N, et al. (2011) Operational challenges in managing isoniazid preventive therapy in child contacts: a high-burden setting perspective. BMC Public Health 11: 544

5. Orlu M, Ranmal SR, Sheng Y, Tuleu C, Seddon P, (2017) Acceptability of or dispersible films for delivery of medicines to infants and preschool children. Drug Delivery 24: 1243–1248.