

Therapeutic Challenges in Dermatophytosis: Resistance Expanding with New Strains

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Dear Editor,

I would like to draw attention to the emerging challenges in treating dermatophytosis, particularly the increasing resistance posed by new fungal strains, such as *Trichophyton indotineae*. Dermatophytosis is the most common superficial fungal infection affecting the skin, hair, and nails. Although it is not considered life-threatening, its high prevalence and negative impact on patients' quality of life make it one of the most widespread infectious diseases in various populations. The causative agents of this disease are dermatophytes, with over 50 identified species belonging to seven genera: *Trichophyton*, *Microsporum*, *Epidermophyton*, *Arthroderma*, *Nannizzia*, *Lophophyton*, and *Paraphyton*, which can affect both healthy individuals and those with compromised immune systems.

According to the World Health Organization (WHO), 20% to 25% of the global population suffers from fungal skin infections, with dermatophytosis being one of the most common types. Studies conducted in the United States and Europe indicate that dermatophytes are responsible for 90% of fungal nail infections. Additionally, previous studies have reported that the prevalence of dermatophytosis in Brazil ranges between 18.02% and 23.2% among skin wounds. In Iran, superficial fungal infections are among the most common mycoses, with the prevalence of dermatophytosis varying from 2.1% to 74% across different regions.^{1,2}

Trichophyton indotineae has recently been identified as an emerging dermatophyte species responsible for dermatophytosis and fungal infections of the skin and nails. This species has been observed primarily in specific geographic regions and among individuals without immune system disorders. A key characteristic of *T. indotineae* is its high resistance to conventional antifungal drugs such as terbinafine and itraconazole. The treatment of dermatophytosis caused by *T. indotineae* presents significant challenges, particularly in cases where patients do not respond to standard oral and topical

therapies.

Based on data from the ITS gene region, terbinafine-resistant *Trichophyton mentagrophytes* complex strains have been classified as *Trichophyton mentagrophytes* type VIII. However, genome analysis has revealed that these strains are distinct from *Trichophyton interdigitale* and *Trichophyton mentagrophytes*, leading to the identification of *T. indotineae* as a new species. The global rise of terbinafine-resistant strains, such as *T. interdigitale* and *T. mentagrophytes*, has led to significant treatment challenges, particularly in Iran, where these resistant strains are increasingly prevalent. Moreover, the spread of terbinafine-resistant strains, including *T. indotineae*, is expanding. Initially prevalent in the Indian subcontinent, these strains are now being reported in Middle Eastern and European countries.^{3,4}

Studies have shown that terbinafine resistance in Iran ranges from 5% to 18% in regions such as Tehran and Sari. The misuse of antifungal medications and corticosteroids is one of the primary factors contributing to the increasing drug resistance in these strains. Treatment resistance, particularly in advanced cases where the fungus spreads beneath the nail or into deeper layers of the skin, may result in treatment failure and recurrent infections.⁵

In hospitals, one of the primary challenges in managing treatment-resistant dermatophytosis is the timely identification and diagnosis of these new resistant strains. Due to their lack of response to standard therapies, these infections may lead to prolonged hospital stays and increased healthcare costs. Additionally, preventive measures are essential in hospitals to limit the spread of resistant fungal infections, particularly in intensive care units and among immunosuppressed patients.

Given the rising resistance to *T. indotineae* and the decreasing efficacy of conventional treatments, it is imperative to develop new strategies for the rapid diagnosis and effective treatment of these infections.

Advanced molecular techniques such as PCR and gene sequencing can aid in the quick identification of resistant strains, while the development of rapid diagnostic tests can facilitate the detection of antifungal resistance, particularly against terbinafine and azole-based drugs.^{3,4}

For effective treatment, combination therapies should be explored, and the efficacy of novel antifungal agents such as next-generation azoles (e.g., luliconazole and sertaconazole) should be further investigated. Additionally, the use of nanotechnology-based treatments, such as silver nanoparticles and liposomal drug formulations, may enhance drug penetration and reduce resistance. The potential antifungal properties of plant-derived extracts and natural antifungal compounds should also be evaluated as alternative treatment options.

To prevent further resistance development, educational programs for physicians and pharmacists should be implemented to promote the rational use of antifungal drugs. Furthermore, reinforcing personal and environmental hygiene practices can help reduce the transmission of dermatophytes. Finally, the publication of scientific articles and clinical guidelines is essential to keep healthcare professionals informed about the latest treatment recommendations and resistance management strategies.

Conflict of Interest Disclosures

The author declares no conflict of interest.

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