



REVIEW ARTICLE

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Dermatophytosis in Clinical Practice: Epidemiology, Clinical Spectrum, Laboratory Diagnosis and Emerging Challenges

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ABS TRACT

Background: Dermatophytosis is a common superficial fungal infection involving keratinized tissues such as the skin, hair, and nails. The disease remains an important clinical and public health problem, particularly in tropical and subtropical regions where temperature, humidity, overcrowding, occupational exposure, and socioeconomic conditions may facilitate transmission. The clinical presentation varies according to the anatomical site involved and may range from localized lesions to chronic and recurrent disease.

Objective: This review discusses the epidemiology, clinical manifestations, causative dermatophytes, laboratory diagnosis, and important challenges associated with the management of dermatophytosis.

Methods: Relevant concepts concerning dermatophyte infections, clinical presentation, conventional laboratory diagnosis, and epidemiological characteristics were reviewed. Particular attention was given to direct microscopy, fungal culture, and phenotypic identification methods used in routine microbiology laboratories.

Discussion: The three classical genera associated with dermatophytosis are *Trichophyton*, *Microsporum*, and *Epidermophyton*. Among these, *Trichophyton* species are frequently encountered in clinical specimens. Dermatophytosis may manifest as tinea corporis, tinea cruris, tinea capitis, tinea faciei, tinea pedis, tinea manuum, tinea barbae, and tinea unguium. Clinical diagnosis may sometimes be difficult because dermatophytosis can resemble several inflammatory and infectious dermatoses. Direct potassium hydroxide examination provides a rapid method for demonstrating fungal elements, whereas culture permits isolation and further identification of the causative organism. Combining clinical assessment with appropriate laboratory investigation improves diagnostic confidence and assists in selecting appropriate treatment.

Conclusion: Dermatophytosis continues to represent a significant burden in clinical practice. Early recognition, appropriate specimen collection, direct microscopy, culture-based identification, and awareness of local epidemiological patterns are important for accurate diagnosis and effective management. Continued surveillance is necessary because the epidemiology and clinical behavior of dermatophyte infections may vary between geographic regions.

Keywords: Dermatophytosis; Dermatophytes; Trichophyton; Tinea; KOH mount; Fungal culture; Superficial mycosis; Mycology.

INTRODUCTION

Dermatophytosis comprises a group of superficial fungal infections caused by keratinophilic fungi capable of utilizing keratinized tissues. The principal sites of infection are the skin, hair, and nails. The classical dermatophytes are grouped into the genera

Trichophyton, *Microsporum*, and *Epidermophyton*. The distribution of these organisms varies according to geographic location, climatic conditions, host factors, and socioeconomic circumstances.

Dermatophytosis is particularly common in tropical and

subtropical regions. High temperature and humidity provide favorable conditions for fungal growth and transmission. Additional factors such as overcrowding, excessive sweating, occupational exposure, inadequate hygiene, close physical contact, and certain underlying medical conditions may contribute to infection.

A recent tertiary-care hospital study from Maharashtra evaluated 95 clinical specimens and found dermatophytes in 45 samples. Trichophyton accounted for the overwhelming majority of isolates, while Microsporum and Epidermophyton were identified less frequently. Tinea corporis was the most frequent clinical presentation in that study.

The persistent occurrence of dermatophytosis, together with chronic and recurrent infections, makes laboratory confirmation increasingly important. Clinical features alone may not always distinguish dermatophytosis from eczema, psoriasis, bacterial infections, contact dermatitis, or other superficial mycoses.

Epidemiology of Dermatophytosis

The epidemiology of dermatophytosis is influenced by environmental, demographic, occupational, and behavioral factors. Warm and humid environments favor fungal proliferation and may increase transmission. In tropical countries, dermatophyte infections are frequently encountered in outpatient dermatology and general medical practice.

Age and sex distributions may differ between populations. In the reviewed tertiary-care study, males constituted 55.6% of dermatophyte-positive cases, while females constituted 44.4%. The highest number of cases occurred in the 31–40-year age group.

Occupational exposure, physical activity, perspiration, and close contact with potentially contaminated environments may contribute to infection. However, epidemiological patterns should not be generalized to every population because dermatophyte distribution can differ considerably between geographic areas.

Causative Dermatophytes

Three classical genera are responsible for most dermatophyte infections:

1. **Trichophyton:** Trichophyton species can infect skin, hair, and nails. In the reviewed tertiary-care study, Trichophyton constituted 95.6% of the isolates. Among the identified species, *T. rubrum* accounted for 44.4%, followed by *T. mentagrophytes* at 40.0% and *T. violaceum* at 11.1%.

2. **Microsporum:** Microsporum species primarily involve skin and hair. Certain species may have animal reservoirs, making contact with infected animals an epidemiologically relevant consideration.

3. **Epidermophyton:** Epidermophyton species are primarily associated with infection of skin and nails. Epidermophyton floccosum is an established human

dermatophyte.

Clinical Manifestations

The clinical presentation depends largely on the anatomical site involved.

Tinea corporis affects glabrous skin and commonly produces annular, scaly, pruritic lesions with peripheral activity.

Tinea cruris involves the groin and is frequently associated with warmth, moisture, sweating, and friction.

Tinea capitis affects the scalp and may be associated with scaling, hair breakage, and areas of alopecia.

Tinea faciei affects non-bearded areas of the face and can sometimes resemble inflammatory facial dermatoses.

Tinea pedis involves the feet, particularly the interdigital spaces and plantar surfaces.

Tinea manuum involves the hands and may occur together with infection of the feet.

Tinea unguium, commonly referred to as dermatophyte-associated onychomycosis, involves the nails and may produce thickening, discoloration, and structural dystrophy.

Tinea barbae involves the beard and moustache region and is generally associated with infection of hair-bearing areas.

The reviewed study found *tinea corporis* to be the most frequent clinical form, followed by *tinea cruris*.

Pathogenesis

Dermatophytes possess keratin-degrading enzymes that facilitate colonization of keratinized tissues. Infection is generally restricted to the superficial, non-living layers of the epidermis in immunocompetent individuals.

Following inoculation, fungal elements may spread centrifugally through the stratum corneum, producing the characteristic annular appearance associated with many forms of tinea. The degree of inflammation may vary according to the species involved and host response.

Anthropophilic organisms are generally associated with more chronic infection and comparatively less inflammation, whereas geophilic and zoophilic organisms may produce more inflammatory lesions.

Laboratory Diagnosis

Laboratory examination is particularly useful when the clinical appearance is atypical, the infection is recurrent,

or treatment failure occurs.

Specimen Collection

Appropriate specimen collection is essential for successful laboratory diagnosis. Depending on the site, specimens may include skin scrapings, nail clippings or scrapings, and hair stubs or infected hairs.

For skin lesions, material should preferably be obtained from the active peripheral portion of the lesion. In nail disease, specimens should include appropriate material from the affected nail.

Potassium Hydroxide Examination

Direct microscopy using potassium hydroxide is a rapid and inexpensive diagnostic method. KOH clears keratinized material and facilitates visualization of fungal hyphae.

The reviewed study used 10% KOH for skin and hair specimens and higher concentrations for nail specimens. The preparation was examined microscopically after allowing sufficient time for clearing of the specimen.

Fungal Culture

Culture remains useful for isolation and identification of dermatophytes. Sabouraud dextrose agar containing appropriate antimicrobial agents can be used to suppress bacterial contamination and facilitate fungal growth.

In the reviewed study, specimens were cultured regardless of the direct microscopy result. Cultures were incubated at appropriate temperatures and examined periodically for fungal growth.

Lactophenol Cotton Blue Examination

Lactophenol cotton blue preparation permits microscopic examination of fungal structures obtained from culture. Features such as hyphal arrangement, microconidia, and macroconidia can contribute to identification.

Urease Testing

Biochemical testing can provide additional assistance in differentiating closely related *Trichophyton* species. The reviewed study used Christensen's urea agar to assist in differentiating *T. mentagrophytes* from *T. rubrum*.

Importance of Combined Diagnostic Methods

No single diagnostic method is perfect in every clinical situation. Direct microscopy is rapid but may not identify the organism to species level. Culture requires more time but can provide an isolate for morphological and additional laboratory identification.

In the reviewed study, 29 of the 45 dermatophyte-positive specimens were positive by both direct

microscopy and culture, whereas 16 were positive by culture alone. These findings illustrate the value of using complementary laboratory methods. When clinically appropriate, combining direct microscopy with culture may improve diagnostic assessment and reduce the possibility of relying solely on clinical appearance.

Recurrent Dermatophytosis

Chronic and recurrent dermatophytosis is an important clinical problem. Recurrence may occur after apparently successful treatment and can substantially affect quality of life.

Possible contributing factors include incomplete treatment, reinfection, persistence of infection at another anatomical site, exposure to infected contacts, environmental factors, and underlying host conditions.

Patients with recurrent infection may also serve as potential sources of transmission to household members and close contacts. The reviewed article emphasizes that recurrent dermatophytosis represents an ongoing challenge and that its precise underlying mechanisms are not completely understood.

Diagnostic Challenges

Several dermatological disorders may resemble dermatophytosis clinically. Tinea corporis may resemble eczema or other inflammatory dermatoses. Tinea capitis may be confused with non-fungal causes of alopecia, while nail dermatophytosis may resemble non-infectious nail dystrophy.

Therefore, clinical suspicion should be supported by appropriate laboratory investigation, particularly in atypical, recurrent, or treatment-resistant cases.

The reviewed study specifically emphasizes the importance of correlating clinical findings with microbiological confirmation because several dermatological conditions can have overlapping appearances.

Public Health Significance

Although dermatophytosis is generally a superficial infection, its high frequency, prolonged course, recurrence, and potential for transmission make it an important public health concern.

Preventive measures include maintaining personal hygiene, keeping affected areas dry, avoiding sharing personal items such as towels and clothing, recognizing infected household or close contacts, and seeking appropriate medical evaluation for persistent lesions.

Awareness among healthcare professionals is also important because inappropriate empirical treatment may delay diagnosis and contribute to prolonged disease.

Future Perspectives

Future dermatophyte research should focus on continued surveillance of species distribution, geographic variation, recurrence patterns, and laboratory diagnostic performance.

Molecular methods may provide additional opportunities for rapid and precise identification, particularly in laboratories with appropriate infrastructure. However, conventional microscopy and culture remain important diagnostic tools in many clinical microbiology settings.

Local epidemiological studies are valuable because the predominant dermatophyte species and clinical presentations may vary between regions. Continued monitoring can therefore support more appropriate diagnostic and therapeutic strategies.

Conclusion

Dermatophytosis remains one of the most frequently encountered superficial fungal infections affecting skin, hair, and nails. Its occurrence is influenced by climate, occupational exposure, socioeconomic conditions, personal habits, and host-related factors.

Trichophyton remains an important clinical genus, and tinea corporis represents a common clinical presentation. The findings of the reviewed tertiary-care study demonstrate the usefulness of microbiological investigation, with culture identifying cases that were not detected by direct microscopy alone.

Accurate specimen collection, KOH microscopy, fungal culture, and appropriate phenotypic identification can provide valuable diagnostic information. A combined clinical and laboratory approach is therefore preferable, particularly for atypical, recurrent, or treatment-resistant disease.

Improved surveillance, diagnostic awareness, appropriate treatment, and preventive measures are essential to reduce the continuing clinical and public health burden of dermatophytosis.

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