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Original Research Article

Clinico-Etiological Profile and Drug Sensitivity Patterns of Dermatophytosis: An Observational Study

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Abstract

Aim: The aim of the present study was to assess the prevalence of pathogenic dermatophytes, clinical types of dermatophyte fungal infection, and in vitro antifungal drug susceptibility testing against dermatophytes.

Methods: The present study was conducted at Department of Dermatology and patients with dermatophyte infections visiting the outpatient department during this period were screened. A total of 200 consecutive patients aged between 18 and 65 years (~30 from each center), clinically suspected with dermatophyte skin infection.

Results: Male preponderance was observed (75%) among 200 cases studied. The mean age of the study population was 35.5 ± 12.78 years. Most patients were in the 18–30 years group (n = 80), followed by 31 to 40 years (n = 44), > 50 years (n = 40) and 41 to 50 years (n = 36). Itching (98%), scaling (90%), dryness (82%) and inflammation (42%) were the most common clinical presentations. Relatively, a lesser proportion of patients presented lesion with central clearing surrounded by an advancing, red, scaly, elevated border, erythema and pustules. Out of 200, 90 (45%) were culture positive. Trichophyton genus represented the majority of the isolates of dermatophytes. Trichophyton rubrum was the most commonly reported, followed by T. mentagrophytes and T. tonsurans. The MIC values for itraconazole were within the range; while griseofulvin had the lowest mean MIC (0.25–3.0 µg/mL). The MICs of itraconazole, luliconazole, amorolfine, sertaconazole and eberconazole were within the reference range.

Conclusion: T. rubrum was the most common, followed by T. mentagrophytes as an emerging/codominant fungal isolate in India. Tinea corporis was the most common clinical type of dermatophytosis. Mean MIC of terbinafine was above the reference range, while it was within the range for itraconazole; griseofulvin had the lowest mean MIC.

Keywords: Antifungal, coastal areas, dermatophytes, potassium hydroxide mount, susceptibility, tinea, Trichophyton

Introduction

Fungal infections of the skin, hair, and nails due to dermatophytes are a common problem across the globe. Dermatophytosis commonly referred to as ringworm. Amongst these, dermatophytes are responsible for the highest proportion of cases. Dermatophytes are classified under three asexual genera, namely Trichophyton, Epidermophyton, and Microsporum. [1] Dermatophytes spread by direct contact from other people (anthropophilic), animals (zoophilic) and soil (geophilic), as well as indirectly from fomites. [2] Microsporum, Trichophyton, and Epidermophyton species are the most common pathogens causing dermatophytic infection of hair, nail and skin. [2] Clinically, tinea can be classified according to the site of involvement including tinea capitis, tinea corporis, tinea cruris, tinea pedis, tinea barbae, tinea manuum, tinea faciei and tinea unguium. [3]

Although dermatophytosis occurs worldwide, individual dermatophyte species may vary in their geographic distribution and self-virulence. These disorders cannot be differentiated by ethnicity or socioeconomic status, but poverty and overcrowded living conditions are important underlying social determinants. [4] The prevalence of superficial dermatophytic infections affects more than 20-25% of the world population and is one of the most frequent forms of infections. [5] The prevalence of superficial mycoses has recently increased by many folds in India resulting in an epidemic-like situation. [6,7] Various factors have been implicated, such as hot and humid climatic conditions, overcrowding, poor hygiene, occlusive tight garments and footwear, low compliance to treatment, and irrational use of topical corticosteroids, prevalence of virulent species, socioeconomic conditions,

individual immune system, etc., may also affect the epidemiology and incidence of dermatophyte infections. [8,9]

The infection is very common among children and people who have pets, have wet skin condition, have skin injuries or abrasions, use public showers, are barefoot, and share hairbrushes or unwashed clothing with other people. Those have an increased risk of developing the infection [2,10,11] The various antifungal agents currently available in clinical use against dermatophytes are terbinafine, itraconazole, fluconazole, luliconazole, etc. Even though antifungal agents' inappropriate use may result in resistant strains, their activity against dermatophytes has not yet been fully explored.

The aim of the present study was to assess the prevalence of pathogenic dermatophytes, clinical types of dermatophyte fungal infection, and in vitro antifungal drug susceptibility testing against dermatophytes.

Materials and Methods

The present study was conducted at Department of Dermatology, Netaji Subhas Medical College and Hospital, Bihta, Bihar, India for one year and patients with dermatophyte infections visiting the outpatient department during this period were screened. A total of 200 consecutive patients aged between 18 and 65 years (~30 from each center), clinically suspected with dermatophyte skin infection (excluding infection at the sites of nails, palms, soles and scalp) with recurrent cases of tinea and other atypical presentations, receiving antifungal treatment, and willing to have minimum three days washout period before antifungal drug susceptibility testing of the clinical specimen (fungal isolate), were recruited. Patients with a non-mycotic pathology in the area of fungal infection or any condition that, in the investigator's opinion, does not justify the patient's inclusion in the study were excluded from the study.

All patients provided written consent in the patient authorization form to participate in the study. Adetailed history was obtained from all patients, who were then subjected to clinical examinations and investigations, including a wet preparation for direct microscopic examination, fungal culture and antifungal susceptibility tests.

Sample Processing

All the 395 scraping samples were collected, and the specimens were shipped to a central facility. The primary identification of dermatophytes was done using direct microscopy with 10% potassium hydroxide (KOH) mount. Direct microscopic examination of the wet-mount was performed under a microscope, under ×10 and ×40 for fungal hyphae, spores or yeast cells.

The Sabouraud dextrose agar (SDA) was used for isolation and identification of fungal isolates. Specimens were cultured on SDA media (Micro Master Laboratories Pvt. Ltd) with 0.05% chloramphenicol alone (Micro Master Laboratories Pvt. Ltd), or with 0.5% cycloheximide (HiMedia Laboratories Pvt. Ltd) and 0.05% chloramphenicol (Micro Master Laboratories Pvt. Ltd) and incubated at 30°C for up to four weeks. Cultures were examined once a week and professed negative if no growth was observed until 6 weeks. Identification of dermatophytes to the species level was done by assessing the colony morphology, microscopy (Lactophenol Cotton Blue Mount), and physiological and biochemical tests. Further antifungal drug susceptibility testing was performed, and the minimum inhibitory concentration (MIC) of the drugs was determined.

Antifungal Drug Susceptibility Testing

Antifungal drug susceptibility testing was performed as per the microbroth dilution technique of Clinical and Laboratory Standards Institute Guidelines (CLSI M38-A).6,7 The antifungal drug susceptibility testing was done for seven antifungal agents, namely, luliconazole, sertaconazole, eberconazole, itraconazole, terbinafine, griseofulvin and amorolfine. The MIC for the antifungals was interpreted according to the CLSI M38-A guidelines.

Statistical Analysis

All statistical analyses were done using Statistical Analysis System® version 9.4 software.

Results

Table 1: Demographic data

Gender	**N%**
Male	150 (75)
Female	50 (25)
Age group in years	
18-30 years	80 (40)
31-40 years	44 (22)
41-50 years	36 (18)
>50 years	40 (20)

Male preponderance was observed (75%) among 200 cases studied. The mean age of the study population was 35.5 ± 12.78 years. Most patients were in the 18–30 years group (n = 80), followed by 31 to 40 years (n = 44), > 50 years (n = 40) and 41 to 50 years (n = 36).

Table 2: Clinical features

Category	Male (*n*=150)	Female (*n*=50)	Total (*n*=200) (%)
Itching	148	48	196 (98)
Dryness	140	24	164 (82)
Inflammation	60	20	84 (42)
Scaling	140	40	180 (90)
Pustules	6	4	10 (5)
Erythema	45	25	70 (35)
Alopecia	6	2	6 (3)
Local hair loss	3	1	4 (2)
Lesion with central clearing surrounded by an advancing, red,scaly and elevated border (Ring worm lesions)	50	30	80 (40)
Annular patches of inflammatory or non-inflammatory alopecia	6 (2.4)	1 (0.7)	7 (1.8)
Erythema and mild scaling on the dorsal aspect of the hands	2 (0.8)	1 (0.7)	3 (0.8)

Itching (98%), scaling (90%), dryness (82%) and inflammation (42%) were the most common clinical presentations. Relatively, a lesser proportion of patients presented lesion with central clearing surrounded by an advancing, red, scaly, elevated border, erythema and pustules.

Table 3: Distribution of fungal isolates

Species	Gender		Age in years	
	Male (*n*=60)	Female (*n*=30)	18–50 (*n*=70)	>50 years (*n*=20)
Trichophyton rubrum	36	20	42	12
Trichophyton mentagrophytes	18	6	25	6
Trichophyton tonsurans	6	0	1	2
Microsporum canis	0	2	1	0
Trichophyton rubrum var. granulare	0	2	1	0

Out of 200, 90 (45%) were culture positive. Trichophyton genus represented the majority of the isolates of dermatophytes. Trichophyton rubrum was the most commonly reported, followed by T. mentagrophytes and T. tonsurans.

Table 4: Antifungal susceptibility testing among culture positive patients

Category	Culture positive (n=90)
Terbinafine	
High MIC	10 (11.11%)
Susceptible	81 (90%)
MIC (µg/mL), mean (SD)	0.05 (0.043)
MIC90	0.001–0.03
Griseofulvin	
High MIC	0 (0.0%) [NE]
Susceptible	90 (100%)
MIC (µg/mL), mean (SD)	0.19 (0.082)
MIC90	0.25–0.30
Itraconazole	
High MIC	0 (0.0%) [NE]
Susceptible	90 (100%)
MIC (µg/mL), mean (SD)	0.84 (0.252)
MIC90	0.05–1.0

Luliconazole	
High MIC	0 (0.0%) [NE]
Susceptible	90 (100%)
MIC (µg/mL), mean (SD)	0.28 (0.286)
MIC90	0.05–1.0
Sertaconazole	
High MIC	0 (0.0%) [NE]
Susceptible	90 (100%)
MIC (µg/mL), mean (SD)	0.38 (0.372)
MIC90	0.05–1.0
Amorolfine	
High MIC	0 (0.0%) [NE]
Susceptible	90 (100%)
MIC (µg/mL), mean (SD)	0.60 (0.306)
MIC90	0.05–1.0
Eberconazole	
High MIC	0 (0.0%) [NE]
Susceptible	90 (100%)
MIC (µg/mL), mean (SD)	0.35 (0.251)
MIC90	0.05–1.0

The MIC values for itraconazole were within the range; while griseofulvin had the lowest mean MIC (0.25–3.0 µg/mL). The MICs of itraconazole, luliconazole, amorolfine, sertaconazole and eberconazole were within the reference range.

Discussion

The various antifungal agents currently available in clinical use against dermatophytes are terbinafine, itraconazole, fluconazole, luliconazole, etc. Even though antifungal agents' inappropriate use may result in resistant strains, their activity against dermatophytes has not yet been fully explored. The research outlining the antifungal susceptibility of common dermatophyte species in India is inadequate, posing a therapeutic challenge to practitioners. [12]

Dermatophytes are fungi that cause superficial infections of the skin, hair and nails that require keratin for growth. Dermatophytosis commonly referred to as ringworm. Dermatophytes spread by direct contact from other people (anthropophilic), animals (zoophilic) and soil (geophilic), as well as indirectly from fomites. Male preponderance was observed (75%) among 200 cases studied. The mean age of the study population was 35.5 ± 12.78 years. Most patients were in the 18–30 years group (n = 80), followed by 31 to 40 years (n = 44), > 50 years (n = 40) and 41 to 50 years (n = 36). Most enrolled patients were in the age group of 18–30 years, followed by 31–40 years which agrees with India's reported literature on dermatophytosis-centric studies. [13-16]

Itching (98%), scaling (90%), dryness (82%) and inflammation (42%) were the most common clinical presentations. Relatively, a lesser proportion of patients presented lesion with central clearing surrounded by an advancing, red, scaly, elevated border, erythema and pustules. Out of 200, 90 (45%) were culture positive. In this study, the commonly reported clinical features were itching, scaling, dryness, inflammation, a lesion with central clearing surrounded by an advancing, red, scaly, elevated border (ringworm lesions) and erythema, as reported by Gupta et al. [17] Furthermore, in accordance with the earlier study, infected sites for more than 5% of patients were groin, abdomen and buttock and groin.

Trichophyton genus represented the majority of the isolates of dermatophytes. Trichophyton rubrum was the most commonly reported, followed by T. mentagrophytes and T. tonsurans. The MIC values for itraconazole were within the range; while griseofulvin had the lowest mean MIC (0.25–3.0 µg/mL). The MICs of itraconazole, luliconazole, amorolfine, sertaconazole and eberconazole were within the reference range. A similar study from India also reported a higher prevalence of T. mentagrophytes from the coastal area. [18] This could be attributed to the humid climate in the coastal cities which has been indicated as an essential component for T. mentagrophytes. [19] Apart from humidity, other factors such as temperature, trauma and internal factors such as host-parasite relationships, host susceptibility and immunological factors are also indicated as probable reasons for this recent shift in prevalence. [20]

Among all antifungal agents, griseofulvin reported the lowest mean MIC value. This is an encouraging trend considering the recently reported increasing clinical resistance cases to oral antifungal among Indian patients. Pai V et al [21] had also reported lower MIC of systemic griseofulvin and topical amorolfine than fluconazole. Hence, the clinician must consider the plausible reasons such as

virulence potential of the infecting species, clinical type of dermatophytosis and external factors such as heat, humidity, sweating, type of clothing and the pharmacological factors such as the quality of the drug, compliance, pharmacokinetics and absorption of the drug to understand the recalcitrant infection better. [22]

Conclusion

T. rubrum was the most common, followed by T. mentagrophytes as an emerging/codominant fungal isolate in India. Tinea corporis was the most common clinical type of dermatophytosis. Mean MIC of terbinafine was above the reference range, while it was within the range for itraconazole; griseofulvin had the lowest mean MIC.

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