

Clinico-Mycological correlation of Superficial Fungal Infections

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ABSTRACT

Background: Cutaneous fungal infections are one of the most common diseases in clinical practice. Superficial mycoses refers to fungal infection of skin and its appendages and include dermatophytosis, tinea nigra, piedra, pityriasis versicolor, candidiasis, dermatomycoses caused by *Scytalidium* spp. and onychomycosis caused by non-dermatophyte moulds. The prevalence of fungi causing superficial mycoses varies with time and geographical location. This study was conducted to study the clinicomycological correlation of superficial fungal infections.

Material & Method: A total of 100 clinically diagnosed cases of superficial mycoses were included in the study. After detailed history and clinical examination, specimens like nail, hair, skin & mucosal scrapings were sent for KOH (potassium hydroxide) smear and fungal culture in the mycology laboratory. The clinical and mycological findings thus obtained were correlated.

Results: In this study, male to female ratio came out to be 1:1. Most common clinical type seen was tinea corporis followed by onychomycosis. KOH positivity was 78% and 52% of the cases were culture positive. Most common fungal isolate was *Trichophyton rubrum* followed by *T. mentagrophytes*.

Conclusion: Dermatophytes remain the most common cause of superficial mycoses, but yeasts and non-dermatophytic moulds are also emerging as one of the causes, especially in nail infections. This study emphasizes the role of good hygiene in preventing transmission and further spread of such infections. Fungal culture identifies the species but it is not essential for the diagnosis, as it is not a sensitive test, but is useful for studying epidemiology of the disease.

INTRODUCTION

Fungal infections are extremely common and can produce varied human infections ranging from superficial skin infections to internal organ involvement. Superficial mycoses refer to the diseases of the skin and its appendages caused by fungi and include dermatophytosis, tinea nigra, piedra, pityriasis versicolor, candidiasis, dermatomycoses caused by *Scytalidium* spp. and onychomycosis caused by non-dermatophyte moulds. The prevalence of superficial mycoses

varies in different countries because of different climatic conditions across the world.^{1,2} Its incidence is high in the Indian subcontinent because of warm and humid climate, poverty, overcrowding and relative lack of medical facilities.

Fungal infections can have varied clinical presentation that can be confused with other skin disorders. It may be due to unchecked use of topical high potency steroids that lead to misdiagnosis and mismanagement, hence any

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such clinical diagnosis needs to be supported by laboratory diagnosis.³ The prevalence of fungi causing superficial mycoses varies with time and geographical location. A correct knowledge of the etiological agents of superficial mycoses is therefore important to initiate appropriate treatment, and is also essential for epidemiological purposes. The present study was undertaken to identify the species of fungi & to correlate clinical and mycological findings among the patients of superficial mycoses attending the outpatient department of Dermatology in Dayanand Medical College and Hospital, Ludhiana.

MATERIAL AND METHODS

A total of hundred clinically diagnosed cases of superficial fungal infections who attended the dermatology OPD of Dayanand Medical College & Hospital, Ludhiana over a period of 1 year (February 2014-February 2015) were included in the study. Patients who had taken oral or topical antifungal treatment in the past 3 weeks, applied topical steroids and patients of tinea incognito were excluded from the study. Detailed history of the patients including age, sex, duration of disease, history of previous treatment, family history, history of pets, site of infection was taken. Patients were thoroughly examined and grouped in various clinical types.

Specimens like nail, hair, skin & mucosal scrapings were collected in sterile petri dishes and processed in the department of Microbiology. One portion of the sample was used for direct KOH examination and the other half was used to inoculate SDA medium for culture. Ten percent KOH was used for skin, mucosal and hair samples while the concentration of KOH

was increased to twenty percent for nail samples for direct microscopic examination.⁴ For fungal culture, the sample was inoculated on two set of media- Sabouraud's Dextrose Agar (SDA) with antibiotics (chloramphenicol 0.05mg/ml) and cycloheximide (0.5mg/ml) & on Sabouraud's Dextrose Agar (SDA) with antibiotics (chloramphenicol 0.05mg/ml) alone. In case of pityriasis versicolor, a layer of olive oil was poured over the culture medium. The inoculated media was incubated at 22-30°C and 37°C for a minimum period of three weeks. Positive cultures were examined both microscopically as well as macroscopically for the identification of species. Special tests like urease production test, slide culture techniques (for filamentous fungi), germ tube test, spore production on corn meal agar (for yeast isolates) and hair perforation test were performed wherever required.

RESULTS

Of the total hundred clinically diagnosed patients, males (50%) and females (50%) were equally affected. The most commonly affected age group was 21-30 years with 26% cases followed by 31-40 years with 24% cases and 11-20 years with 16 % cases. The least number of patients were seen below ten years of age (3%). The mean age was 34.26 years with standard deviation of 15.15 (Table 1)

In this study, maximum number of patients were housewives (32%) and students (27%) followed by service class people. Most of the patients (78%) were of urban background and were seen in the months of July to September (33%) followed by April to June (30%). Least number of cases were in the months of October to December.

Table 1 Distribution of patients according to the age-groups and gender

Age group (in years)	Female		Male		Total	
	No.	%age	No.	%age	No.	%age
Less than 10	1	33.3%	2	66.7%	3	100.0%
11-20	10	62.5%	6	37.5%	16	100.0%
21-30	12	46.2%	14	53.8%	26	100.0%
31-40	17	70.8%	7	29.2%	24	100.0%
41-50	6	40.0%	9	60.0%	15	100.0%
51-60	2	18.2%	9	81.8%	11	100.0%
More than 60	2	40.0%	3	60.0%	5	100.0%
Total	50	50.0%	50	50.0%	100	100.0%

Clinically, the most common superficial fungal infection diagnosed was dermatophytosis (ringworm) (66%) followed by onychomycosis (16%), candidiasis (10%) and pityriasis versicolor (8%). Tinea corporis was the most common clinical presentation (21/100) followed by onychomycosis (16/100). Toenails were found to be more commonly involved (50%) followed by fingernails (37.5%) while 12.5% had both toe and fingernail involvement. Most common type of onychomycosis was distal lateral subungual

**Fig. 1** Positive family history of tinea cruris et corporis in a father and son**Table 2** Clinical types of superficial fungal infections

Type of Superficial Fungal Infection	No. of patients (n=100)	Percentage (%age)
Tinea corporis	21	21.0
Onychomycosis	16	16.0
Tinea corporis et cruris	11	11.0
Candidiasis	10	10.0
Pityriasis versicolor	8	8.0
Tinea cruris	7	7.0
Tinea faciei	6	6.0
Tinea capitis	5	5.0
Tinea cruris et corporis et faciei	4	4.0
Tinea pedis	4	4.0
Tinea corporis et faciei	2	2.0
Tinea pedis et onychomycosis	2	2.0
Tinea manuum	2	2.0
Tinea manuum et onychomycosis	1	1.0
Tinea barbae	1	1.0
Total	100	100.0

onychomycosis (DLSO) i.e. 56.5% followed by total nail dystrophy (TD) i.e. 31.25%. Two cases of distal lateral subungual onychomycosis had associated paronychia. One case each of proximal subungual onychomycosis (PSO) and superficial white onychomycosis (SWO) was seen. Many cases of tinea corporis were also associated with dermatophytic infections of other sites. Tinea corporis et cruris occupied third position with 11 cases. (Table 2) Family history was positive in 24% of the patients, and all had history of sharing of fomites. (Fig. 1) Twenty seven percent of the patients of superficial fungal infections were diabetics in our study.

Confirmation of the diagnosis by direct microscopic examination was obtained in 78% of the patients, while fungal culture confirmation was obtained only in 52% of patients. (Table 3) *Trichophyton rubrum* was the most common isolate (53.8%) followed by *Trichophyton*

mentagrophytes (25%), *Candida albicans* (13.5%), *Aspergillus flavus* (7.7%). Maximum KOH and culture positivity was seen in ringworm infections (86.4% and 57.6% respectively) followed by onychomycosis (75% and 56.3% respectively). Out of 10 diagnosed cases of candidiasis, 30% were KOH positive and culture positivity was seen in 50% cases. Seventy five percent KOH positivity was observed in cases of pityriasis versicolor, however no fungus was cultured. *Candida* species was the only isolate where there was more culture positivity than smear positivity. (Table 4)

Table 5 depicts clinicomycological correlation between superficial fungal infections. The most common isolate was *Trichophyton rubrum* mainly isolated from cases of tinea corporis and patients having both tinea corporis as well as tinea cruris followed by *Trichophyton mentagrophytes* which was also mostly isolated from cases of

Table 3 Correlation of KOH examination with growth on SDA

KOH findings (n=100)	Culture (n=100)				Total		p-value
	Negative (n=48)		Positive (n=52)				
	No.	%age	No.	%age	No.	%age	
Negative (n=22)	20	90.9%	2	9.1%	22	100.0%	0.000
Positive (n=78)	28	35.9%	50	64.1%	78	100.0%	
Total	48	48.0%	52	52.0%	100	100.0%	

Table 4 Frequency of KOH and culture positive among samples

Type of superficial fungal infection	KOH positive		Culture positive	
	No.	%age	No.	%age
Ringworm (n=66)	57	86.4%	38	57.6%
Onychomycosis (n=16)	12	75.0%	9	56.3%
Candidiasis (n=10)	3	30.0%	5	50.0%
Pityriasis versicolor (n=8)	6	75.0%	0	0.0%
Total	78	100.0%	52	100.0%

Table 5 Clinicomycological correlation of superficial fungal infections

Clinical diagnosis	Trichophyton rubrum	Trichophyton mentagrophytes	Candida albicans	Aspergillus flavus	No Growth
Tinea Corporis (n=21)	10	4	0	1	6
Onychomycosis (n=16)	3	1	2	3	7
Tinea Corporis et cruris (n=11)	6	4	0	0	1
Candidiasis (n=10)	0	0	5	0	5
Pityriasis versicolor (n=8)	0	0	0	0	8
Tinea Cruris (n=7)	2	2	0	0	3
Tinea faciei (n=6)	0	0	0	0	6
Tinea Capitis (n=5)	1	0	0	0	4
Tinea Cruris et corporis et faciei (n=4)	2	0	0	0	2
Tinea pedis (n=4)	1	1	0	0	2
Tinea corporis et faciei (n=2)	1	0	0	0	1
Tinea pedis et onychomycosis (n=2)	2	0	0	0	0
Tinea manuum (n=2)	0	0	0	0	2
Tinea manuum et onychomycosis (n=1)	0	0	0	0	1
Tinea barbae (n=1)	0	1	0	0	0
Total	28	13	7	4	48

tinea corporis and tinea cruris. Out of the 16 cases of onychomycosis, dermatophytes were isolated from 4 cases while in 2 cases growth of *Candida albicans* was seen and 3 cases showed non-dermatophytic mould, *Aspergillus flavus*. No fungus could be cultured from cases of pityriasis versicolor.

DISCUSSION

In the present study of 100 clinically diagnosed cases of superficial fungal infections, majority of the patients seen were in the age group of 21-30 years (26%) followed by 31-40 years (24%). This may be due to greater mobility of this age group and the potential for contact with other patients, making them prone to infection. The infection being common in third followed by fourth decade is in concordance with various other studies from India and abroad.^{5,6} In contrast to our results, a study at Jaipur, India found 5-10 years as commonest age group⁷ and C M Gupta et al found it to be above 60 years of age.³ In most of the studies done earlier, male preponderance was seen^{8,9} but in our study, males were found to be affected equally when compared with females. This difference could be because of increasing awareness about disease among females and chronicity of infections forcing increased number of females reporting to the hospitals which earlier was less due to prevailing social stigma, especially in the rural population of India. Similar to our study, a study done in Saudi Arabia also found equal number of males and females affected.¹⁰ Amongst different age groups affected, most of the patients were in adult age group i.e. 21-60 years constituting 80% cases. All cases of tinea capitis (5/100) were seen in younger age group, 60% below 10 years and remaining 40% between 11-20 years (Fig. 1). These findings are in agreement with studies by other workers.¹¹ Various factors explaining tinea capitis in younger age group includes their immature immune system, enhanced exposure to subclinical infection carriers in the school and at home, inability to maintain hygiene, hence

making them prone to repeated and frequent trauma.

The hot and humid climate of Indian subcontinent is highly favorable for the acquisition of fungal infections. Maximum number of cases (33%) in our study were seen in the monsoon (i.e. July to September) followed by summer (i.e. April to June in 30%) season. Similarly, more cases in hot and humid months of year have been reported by Rangnathan S *et al.*¹²

Our study comprised more of urban patients (78%) as compared to patients from rural background (18%). This can be attributed to the fact that our institute is a tertiary care hospital, situated in a city. Therefore, most the people attending outpatient department are from urban background. Similar findings have been reported in a study from Calicut.¹³ Urban people seek medical advice sooner due to more awareness and easy accessibility of medical care. While in rural areas, early lesions are neglected and only chronicity forces people to seek medical advice.¹⁴ An infected family member is also an important source of infection in superficial mycoses. In our study, family history of superficial fungal infections was seen in 24% cases which could be due to unsanitary conditions and sharing of fomites among the family members contributing to the spread of infection.⁶ (Fig. 2). Our results are consistent with results of study done by Kalla *et al* which reported positive family history in 29% cases.¹⁵ This confirms that superficial mycoses especially dermatophytic infections are transmitted from person to person by sharing common household clothes.

Direct microscopy by KOH examination is commonly used modality to visualize and characterize the superficial mycoses. Although



Fig. 2 Tinea capitis in a 6 year old boy.



Fig. 3A *Trichophyton rubrum* (front) white cottony
B *Trichophyton rubrum* (reverse) red pigment.

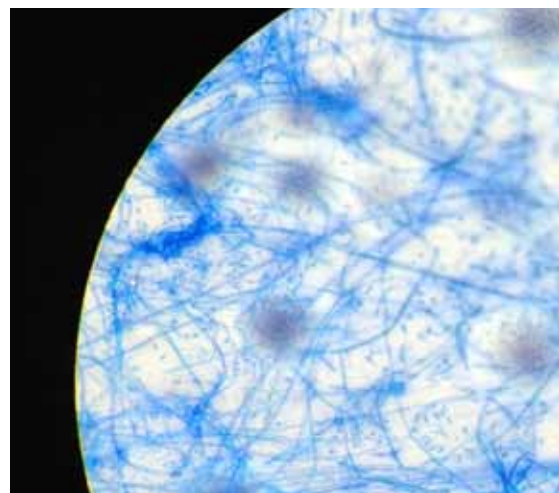


Fig. 4 LCB Mount of *Trichophyton rubrum*.

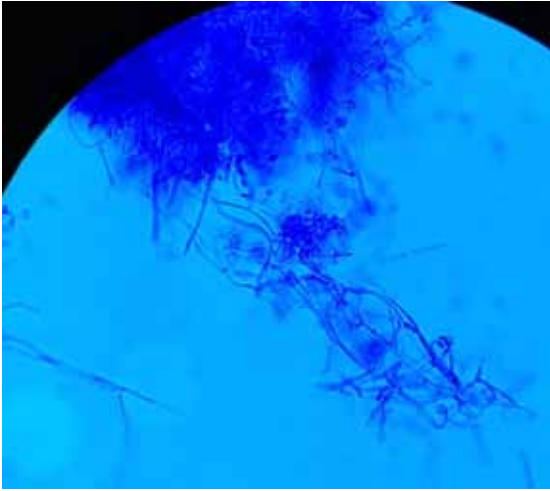


Fig. 5 LCB Mount of *Trichophyton mentagrophytes*.

it can provide evidence of fungal infection within minutes but there may also be some false negative results.¹⁶

In our study, overall KOH positivity and culture positivity was 78% and 52% respectively. Fifty cases were both KOH and culture positive, while 20 were negative on both microscopy and culture. Two cases were diagnosed negative in KOH preparation but were culture positive.

Various other studies revealed KOH positivity rates ranging from 49% to 100% and culture positivity ranging from 20.15% to 79.1%.^{11,17} Results of the present study compare well with the other studies.

Most common isolates obtained in our study were dermatophytes (78.8%) followed by yeasts (13.5%) and non-dermatophytic moulds (7.7%). *Trichophyton rubrum* (53.9%) was the commonest dermatophyte isolated in the present study followed by *Trichophyton mentagrophytes* (25%) (Fig. 3,4,5). This is in accordance with the other studies.^{3,8,18} However, Aruna Vyas et al found *Trichophyton violaceum* followed by *Microsporium audouinii* as the commonest dermatophyte.⁷ Whereas, U S Aggarwal

et al observed *Trichophyton mentagrophytes* as most common dermatophyte.⁵

Tinea corporis showed culture positivity of 72.4% with most common isolate being *Trichophyton rubrum* followed by *Trichophyton mentagrophytes*. Out of 7 cases in which *Candida albicans* growth was seen, 2 patients presented with onychomycosis, 2 patients had intertrigo & one each of balanoposthitis, vulvovaginitis and oral candidiasis. Out of the 16 cases of onychomycosis, culture positivity rate seen was 56.25%. Non-dermatophytic mould (*Aspergillus flavus*) was isolated in 4% cases. Growth was seen in 3 nail samples and 1 skin sample. Similarly, Pradeep Naval et al reported growth of non dermatophytic moulds in five out of seven nail samples.¹⁹ No fungus could be cultured from pityriasis versicolor. Only 1 out of 5 cases of tinea capitis was positive on culture and fungus isolated was *Trichophyton rubrum*. Although the findings of our study match with many studies done across India, it differs significantly with some studies suggesting the role of geographical variation in clinical and mycological pattern. Good personal hygiene and sanitary conditions can prevent further spread of infection.

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