

A STUDY OF CLINICO-MYCOLOGICAL CORRELATES OF ONYCHOMYCOSIS

Chandni Jain¹, Savita Chaudhary^{2*}, Priyanka Shukla³, Soumya Agarwal⁴, Harris I Shaafie¹, Ayesha Khalid¹, Aditya Tripathi¹

¹ Resident, Dept. of Dermatology, Venereology and Leprosy, Era's Lucknow Medical College and Hospital, Lucknow, India

² Professor, Dept. of Dermatology, Venereology and Leprosy, Era's Lucknow Medical College and Hospital, Lucknow, India

³ Associate Professor, Dept. of Microbiology, Era's Lucknow Medical College and Hospital, Lucknow, India

⁴ Assistant Professor, Dept. of Dermatology, Venereology and Leprosy, Era's Lucknow Medical College and Hospital, Lucknow, India

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Corresponding author: Savita Chaudhary

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Abstract

Onychomycosis (OM) is one of the most common problems affecting the nails and has shown to have an extreme variability in clinical presentation, risk factors and etiology. The aim of our study was to study the clinico-etiological profile of OM in patients at a tertiary care centre in North India. A total of 100 cases of OM attending the Dermatology OPD were enrolled in the study. Their demographic profile, exposure to risk factors and medical history was recorded. Clinical examination was done and the pattern of disease was recognised. Nail and skin scrapings were obtained and subjected to KOH mounting and culture assessment. Data was analysed using SPSS 21.0, Chi-square and ANOVA tests. Age of patients ranged from 13 to 75 years (Mean age 35.53±15.46 years). Majority of the patients were males (64%). Laborers/farmers and housewives comprised the majority of patients (29% +23%). DLSO (63%) was the most common pattern. Co-morbidities were seen in 17% cases. 89% were either KOH or culture positive, 36% were both KOH and culture positive, 1% was only KOH positive and 52% were only culture positive. A total of 11% cases were both culture and KOH negative. Dermatophytes (47%) were the most common species, followed by yeast/yeast-like isolates (28%) and non-dermatophytes (13%). Among dermatophytes, *T. rubrum* (n=40), *C. albicans* (n=16) and *Aspergillus niger* (n=4) were the most common Dermatophytes, Yeast and non-Dermatophyte species respectively. A significant association of clinical pattern was observed with sex and site of involvement. KOH positivity was significantly associated with culture positivity for different isolates. The clinicopathological spectrum of OM was quite diverse. The study emphasised the need for comprehensive diagnostic work-up of these patients in view of diverse etiology and clinical spectrum.

Keywords: Onychomycosis, Trichophyton Rubrum, Candida Albicans, Aspergillus Niger

Introduction

Onychomycosis (OM) is a common ailment comprising almost half of the all nail disorders¹. It is a superficial nail infection caused by dermatophytes, non-dermatophyte molds and yeasts². Despite being fairly common; affecting nearly 5% of the world's population³ and being one of the foremost reasons for visit to a dermatologist¹, OM until recently was one of the most neglected conditions. Attention of the medical fraternity has shifted towards this problem, more so in the Asian countries where it has become a topic of interest for the last two decades⁴. OM is recognized as a painful and discomforting ailment that also impairs the tactile functions. It

causes toenail dystrophy which in turn could compromise ambulation, exercise or shoe wearing⁵. The prevalence of OM is dependent on a host of modifiable and non-modifiable demographic and environmental factors like age and sex, occupation, chronic illnesses, immunity, footwear, use of community bathrooms, swimming pools, nail trimming practices, climatic conditions, frequency of travel, etc.^{6,7} As far as the causative organisms are concerned, they show a tremendous variability. OM can be caused by dermatophytes, non-dermatophytes and yeast or yeast-like isolates. Moreover, the spectrum of different fungal species among these classes also show an extreme variability

in terms of their proportional representation in different studies⁸⁻¹⁰. In view of the variability in clinical presentation, risk factors and responsible pathogens, it is essential that the problem of OM should be understood in context connected with local climatic and environmental risk factors and corresponding immunity of the affected patients in different regions.

Materials and Methods:

The present study was carried out as a cross-sectional, observational study at the Department of Dermatology in a tertiary care center in Lucknow, India in collaboration with the Department of Microbiology of the same institution. Data for the study was collected from December, 2017 to January, 2019 over a span of 14 months, after obtaining clearance from Institutional Ethics Committee and getting informed consent from the patients. Sample size of the study was calculated using the following formula:

$$n = z^2 * p(1-p) / d^2$$

where, $z=1.96$ at 95% confidence and 80% power

$p = 0.5$ for exploratory study

$d =$ error allowance, taken as 10% or 0.10

The calculated sample size was 96, however, we targeted a sample size of 100.

A total of 100 cases aged >12 years, having untreated OM and those who had not received oral anti-fungal treatment during previous six months, or any specific topical anti-fungal treatment during previous 1 month were enrolled in the study. Patients with chronic paronychia without any clinical evidence of direct nail plate involvement by the fungus; onychopathies associated with skin diseases such as psoriasis, lichen planus, autoimmune connective tissue disorders and yellow nail syndrome; onychopathy secondary to local tumors; and those having associated nail abnormalities such as Trachyonychia, Onychiauxis and Onychogryphosis were excluded from the study. After enrolment, demographic details were noted. All the patients underwent a thorough clinical evaluation. The clinical pattern of the disease was identified as per classification given by Hay *et al.*¹¹:

Distal Lateral Subungual Onychomycosis (DLSO)

Superficial Onychomycosis (SO)

Endonyx Onychomycosis (EO)

Proximal Subungual Onychomycosis (PSO)

Mixed Pattern Onychomycosis (MPO)

Total Dystrophic Onychomycosis (TDO)

Site and side of involvement, total number of nails involved and involvement of skin was noted. All the patients were asked about their shoe-wearing practices, exposure to predisposing factors such as wet work, travel, trauma or sports. A relevant medical history of the patients was also recorded. Following history taking and clinical examination, the specimens were obtained from the patients under aseptic conditions. Scrapings or clippings from the nail plate or a moistened swab rubbed in the nail fold were obtained for mycological study using a nail clipper¹¹. In case of involvement of fingers as well as toe nails and skin, separate samples were obtained. In case of presence of more than one clinical pattern of OM, samples were obtained from each one of them. The obtained specimens were subjected to KOH mounting and culture. For KOH mount, a portion of the obtained specimen was placed on a glass slide and then a drop of 40% KOH was poured. The slide was then warmed for some time on a spirit lamp. The wet mount was viewed under optical microscope using magnification 10X and 40X. Visualization of branching septate, hyphae or budding yeast was considered as KOH positivity. Fungal culture was performed using Sabouraud's Dextrose Agar (SDA). The portion of remaining specimen after KOH mount was placed in both SDA and SDA with cycloheximide (0.5 g/l) in sterile culture tubes. The culture tubes were incubated at 25°C under biological oxygen conditions for 6 weeks. In case of absence of growth during this period, the culture was declared as negative. In case of presence of a growth, it was isolated from the culture tube and subjected to slide cultures on Corn Meal Agar for detailed morphological analysis in order to recognize the specific species. The colony characteristics, surface color, color on reverse and presence of any diffusible pigment were also noted from the primary culture tubes. Urease test and hair perforation test were also done for the identification of dermatophytes. For confirmation of yeast species, level germ tube test was also used. The data so obtained was entered into computer using Microsoft Excel software. It was analyzed with the help of Statistical Package for Social Sciences, IBM Inc., version 21.0, Chi square test and ANOVA. The associations were considered significant when 'p' value was less than 0.05.

RESULTS:

Age of patients ranged from 13 to 75 years (Mean age 35.53±15.46 years). Majority of patients (66%) were within 40 years of age and were males (64%).

Laborers/farmers/skilled workers (31%) and housewives (23%) together comprised the most commonly affected occupational group. However, a sizeable proportion of patients were office workers (20%) and students (19%) too. Among clinical features, Nail Dystrophy (ND, 93%) and Subungual Hyperkeratosis (SUH, 89%) were the major presenting features while Onychomadesis (OM) was present in 8% of the cases. Majority of patients (55%) had involvement of fingers while 25% had involvement of toes only. There were 20% patients with involvement of both fingers as well as toes. Unilateral involvement (60%) was more common than bilateral involvement (40%). 50% patients had involvement of 2-5 nails while 30% had involvement of only one nail. There were 11% patients with involvement of >10 nails. Co-existing skin involvement was seen in 33% cases. Exposure to predisposing factors was seen in only 10% cases with wet work (4%), travel (3%), trauma (2%) and sports (1%) as the most common risk factors. Presence of co-morbidities was reported in 17% cases with diabetes and/or hypertension as the major comorbidity (11%) followed by hyperhidrosis (5%). There was one HIV positive patient who had diabetes with hypertension (Table 1). Clinically, majority of patients were identified as DLSO (63%) followed by MPO and TDO (16% each). There were 4% patients identified as SWO and 1% as PSO (Table 2). On diagnostic work up, 89% samples were positive on KOH mount or culture. Among these, 36% were both KOH as well as culture positive. A total of 52% were only culture positive and 1% only KOH positive. There were 11% cases that were both KOH mount as well as culture negative/contaminated samples

(Table 3). Fungi could be isolated in 88 cases. Dermatophytes had a predominance (n=47) followed by yeast/yeast-like molds (n=28) and non-dermatophytes (n=13). *Trichophyton rubrum* (n=40) and *Candida albicans* (n=16) were the two most common isolates. *Fusarium spp.* and *Candida parasilosis* comprised 8% and 5.7% of total fungal isolates. *Alternaria spp.* (n=2), *Curvularia spp.* and *Scopuloropsis* (n=1 each) were the least common isolates (Table 4). Group analysis according to clinical analysis could be done in 99 cases only (after excluding the single case of PSO). No significant association of age, occupation, laterality, number of nails involved, skin involvement, shoe wearing, exposure to predisposing factors and co-morbidities could be seen with clinical diagnoses. However, SWO and MPO had significantly higher proportion of males as compared to DLSO and TDO (p=0.030). Among clinical features, Nail plate Crumbling (NC) was more common in MPO (75%) and TDO (62.5%) as compared to DLSO (27%) and SWO (0%) (p<0.001). Involvement of toes, both toes and fingers was more common in MPO (87.5%) as compared to other types (25%-SWO to 42.9% DLSO) (p=0.005) (Table 5). On evaluating the association between culture positivity and KOH mount positivity for different fungal isolates, the KOH mount positivity rate was significantly higher for *Trichophyton mentagrophytes* (100%), *Aspergillus fumigatus* (100%), *Curvularia sp.* (100%), *Trichophyton verrucosum* (75%) and *Fusarium sp.* (71.4%) as compared to other species where positivity rate ranged from 0% (*Candida parasilosis*, *Alternaria sp.*, *Scopuloropsis*) to 50% (*Aspergillus niger*, *Aspergillus flavus*) (Table 6).

Table 1: General Demographic Profile of Patients

SN	Characteristic	No. / %
1.	Age	
	13-20 Years	20
	21-30 Years	25
	31-40 Years	21
	41-50 Years	20
	51-60 Years	5
	61-70 Years	7
	>70 Years	2
	Mean Age±SD (Range) in years	35.53±15.46 (13-75)
2.	Sex	
	Male	64
	Female	36
3.	Occupation	
	Laborer	14
	Farmer	15
	Housewife	23

Office	20
Student	19
Retired	5
Skilled worker	2
Unemployed	2

Table 2: Clinical Features of Onychomycosis patients

SN	Characteristic	No. / %
1.	Clinical Features	
	SUH	89
	ND	93
	OL	34
	NC	39
	PNT	20
	OMD	8
2.	Sites involved	
	Fingers	55
	Toes	25
	Both	20
4.	Side involved	
	Unilateral	60
	Bilateral	40
5.	Total No. of nails involved	
	One only	30
	2-5	50
	6-10	9
	>10	11
6.	Skin involvement	33

Table 3: Risk factors and Comorbidity profile of patients

SN	Characteristic	No. / %
1.	Habit of wearing shoes	26
2.	Predisposing factors	
	Non-specific	90
	Wet work	4
	Travel	3
	Trauma	2
	Sports	1
3.	Comorbidities	17
	DM and/or HTN	11
	DM+HTN+HIV	1
	Hyperhidrosis	5

Table 4: Distribution of cases according to clinical diagnosis

SN	Clinical Diagnosis	No. / %
1.	Distal lateral subungual onychomycosis (DLSO)	63 (63%)
2.	Superficial Onychomycosis (SWO)	4 (4%)
3.	Proximal subungual onychomycosis (PSO)	1 (1%)
4.	Mixed pattern onychomycosis (MPO)	16 (16%)
5.	Total dystrophic onychomycosis (TDO)	16 (16%)

Table 5: Distribution of cases according to KOH Mount/Culture Positivity

SN	Diagnosis	No. / %
1.	Either KOH mount or Culture positive	89 (89%)
2.	Both KOH and Culture Positive	36 (36%)
3.	Only KOH Mount positive	1 (1%)
4.	Only culture positive	52 (52%)
5.	Both negative/contaminated	11 (11%)

Table 6: Fungal Isolates on Culture (n=88)

SN	Diagnosis	No. (%)
<i>Dermatophytes</i> (n=47)		
1.	<i>Trichophyton rubrum</i>	40 (45.5%)
2.	<i>Trichophyton verrucosum</i>	4 (4.5%)
3.	<i>Trichophyton mentagrophytes</i>	3 (3.4%)
<i>Yeast/Yeast-like</i> (n=28)		
4.	<i>Candida albicans</i>	16 (18.2%)
5.	<i>Candida parasilosis</i>	5 (5.7%)
<i>Non-dermatophyte</i> (n=20)		
6.	<i>Fusarium sp.</i>	7 (8.0%)
7.	<i>Aspergillus niger</i>	4 (4.5%)
8.	<i>Aspergillus fumigatus</i>	3 (3.4%)
9.	<i>Aspergillus flavus</i>	2 (2.3%)
10.	<i>Alternaria sp.</i>	2 (2.3%)
11.	<i>Curvularia sp.</i>	1 (1.1%)
12.	<i>Scopuloropsis</i>	1 (1.1%)

Table 7: Association of Clinical Diagnosis with general Profile of Patients (n=99)

SN	Characteristic	Total No.	DLSO (n=63)	SWO (n=4)	MPO (n=16)	TDO (n=16)	Sig.
1.	Mean Age±SD	35.2± 15.1	35.98± 14.8	32.5± 19.7	39.4± 17.45	28.5± 15.14	F=1.576; p=0.200 (ANOVA)
2.	Sex						
	Male	63	34 (54.0)	4 (100)	14 (87.5)	11 (68.8)	$\chi^2=8.949$; p=0.030
	Female	36	29 (46.0)	0	2 (12.5)	5 (31.3)	
3.	Occupation						
	Laborer	13	7 (11.1)	1 (25.0)	2 (12.5)	3 (18.8)	$\chi^2=27.6$; p=0.151
	Farmer	15	8 (12.7)	0	3 (18.8)	4 (25.0)	
	Housewife	23	22 (34.9)	0	1 (6.3)	0	
	Office	20	10 (15.9)	1 (25.0)	4 (25.0)	5 (31.3)	
	Student	19	11 (17.5)	2 (50.0)	3 (18.8)	3 (18.8)	
	Retired	5	2 (3.2)	0	3 (18.8)	0	
	Skilled worker	2	2 (3.2)	0	0	0	
	Unemployed	2	1 (1.6)	0	0	1 (6.3)	

Table 8: Association of Clinical Diagnosis with Clinical Profile of Patients (n=99)

SN	Characteristic	Total No.	DLSO (n=63)	SWO (n=4)	MPO (n=16)	TDO (n=16)	Sig.
1.	Clinical Features						
	SUH						
	ND	88	56 (88.9)	4 (100)	15 (93.8)	13 (81.3)	p=0.609
	OL	92	59 (93.7)	3 (75.0)	14 (87.5)	16 (100)	p=0.268
	NC	34	17 (27.0)	1 (25.0)	10 (62.5)	6 (37.5)	p=0.061
	PNT	39	17 (27.0)	0	12 (75.0)	10 (62.5)	p<0.001
	OMD	20	12 (19.0)	1 (25.0)	4 (25.0)	3 (18.8)	2 p=0.949
		8	3 (4.8)	1 (25.0)	2 (12.5)	(12.5)	

2. Sites involved							
Fingers	55	36 (57.1)	3 (75.0)	2 (12.5)	11 (68.8)	$\chi^2=18.34;$ p=0.005	
Toes	24	16 (25.4)	1 (25.0)	5 (31.3)	5 (31.3)		
Both	20	11 (17.5)	0	9 (56.3)	0		
3. Side involved							
Unilateral	60	38 (60.3)	3 (75.0)	6 (37.5)	13 (81.3)	$\chi^2=6.783;$ p=0.079	
Bilateral	39	25 (39.7)	1 (25.0)	10 (62.5)	3 (18.8)		
4. Total No. of nails involved							
One only	30	21 (33.3)	2 (50.0)	0	7 (43.8)	$\chi^2=15.69;$ p=0.074	
2-5	50	30 (47.6)	2 (50.0)	9 (56.3)	9 (56.3)		
6-10	8	5 (7.9)	0	3 (18.8)	0		
>10	11	7 (11.1)	0	4 (25.0)	0		
5. Skin involvement	33	18 (28.6)	2 (50.0)	7 (43.7)	5 (31.3)	$\chi^2=1.94;$ p=0.585	

Table 9: Association of Clinical Diagnosis with Risk factors and comorbidities of Patients (n=99)

SN	Characteristic	Total No.	DLSO (n=63)	SWO (n=4)	MPO (n=16)	TDO (n=16)	Sig.
1.	Shoe wearing	25	19 (30.2)	1 (25.0)	2 (12.5)	3 (18.8)	$\chi^2=2.54;$ p=0.468
2.	Predisposing factors						
	Unspecific						
	Wet work	89	58 (92.1)	4 (100)	12 (75.0)	15 (93.8)	$\chi^2=15.35;$ p=0.223
	Travel	4	2 (3.2)	0	1 (6.3)	0	
	Trauma	3	3 (4.8)	0	1 (6.3)	1 (6.3)	
	Sports	2	0	0	0	0	
		1	0	0	2 (12.5)	0	
3.	Comorbidities	16	12 (19.0)	0	3 (18.8)	1 (6.3)	$\chi^2=2.40;$ p=0.494

Table 10: Association between KOH Mount positivity and culture positivity for different isolates (n=88)

SN	Diagnosis	Total isolates	KOH Positive (n=36)	KOH Negative (n=52)
1.	<i>Trichophyton rubrum</i>	40	13 (32.5%)	27 (67.5%)
2.	<i>Trichophyton verrucosum</i>	4	3 (75.0%)	1 (25.0%)
3.	<i>Trichophyton mentagrophytes</i>	3	3 (100%)	0
4.	<i>Candida albicans</i>	16	5 (31.3%)	11 (68.8%)
5.	<i>Candida parasilosis</i>	5	0	5 (100%)
6.	<i>Fusarium sp.</i>	7	5 (71.4%)	2 (28.6%)
7.	<i>Aspergillus niger</i>	4	2 (50.0%)	2 (50.0%)
8.	<i>Aspergillus fumigatus</i>	3	3 (100%)	0
9.	<i>Aspergillus flavus</i>	2	1 (50.0%)	1 (50.0%)
10.	<i>Alternaria sp.</i>	2	0	2 (100%)
11.	<i>Curvularia sp.</i>	1	1 (100%)	0
12.	<i>Scopuloropsis</i>	1	0	1 (100%)

Percentages have been calculated row-wise

$\chi^2=22.26;$ p=0.022

Table 11: Association between Clinical subtypes and Fungal Isolates (n=99)

SN	Characteristic	Total No.	DLSO(n=63)		SWO (n=4)		MPO(n=16)		TDO(n=16)	
			No.	%	No.	%	No.	%	No.	%
1.	<i>Trichophyton rubrum</i>	40	28	44.4	1	25.0	3	18.8	7	43.8
2.	<i>Trichophyton verrucosum</i>	4	4	6.3	0	0.0	0	0.0	0	0.0
3.	<i>Trichophyton mentagrophytes</i>	3	3	4.8	0	0.0	0	0.0	0	0.0
4.	<i>Candida albicans</i>	16	7	11.1	0	0.0	7	43.8	2	12.5
5.	<i>Candida parasilosis</i>	5	4	6.3	0	0.0	0	0.0	1	6.3

6. <i>Fusarium sp.</i>	7	4	6.3	0	0.0	1	6.3	2	12.5
7. <i>Aspergillus niger</i>	4	2	3.2	1	25.0	1	6.3	0	0.0
8. <i>Aspergillus fumigatus</i>	3	3	4.8	0	0.0	0	0.0	0	0.0
9. <i>Aspergillus flavus</i>	2	2	3.2	0	0.0	0	0.0	0	0.0
10. <i>Alternaria sp.</i>	2	0	0.0	0	0.0	2	12.5	0	0.0
11. <i>Curvularia sp.</i>	1	1	1.6	0	0.0	0	0.0	0	0.0
12. <i>Scopuloropsis</i>	1	1	1.6	0	0.0	0	0.0	0	0.0
13. No growth	12	4	6.3	2	50.0	2	12.5	4	25.0

$\chi^2=46.35$; $p=0.116$

There was no significant association between clinical type and pathogen isolated.



(Figure 1- DLSO involving twenty nails)



(Figure 2- Total Dystrophic Onychomycosis)

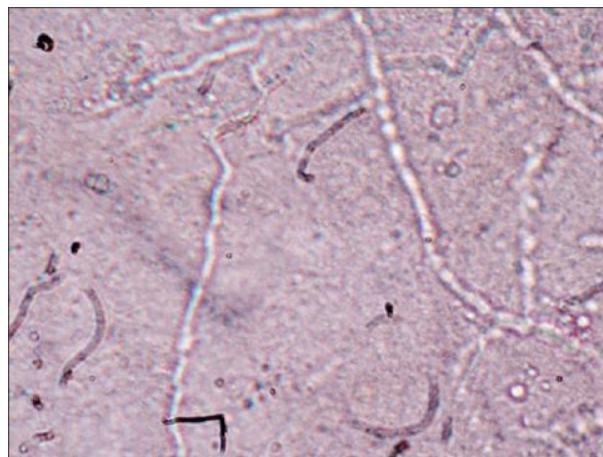


Figure 3 -KOH mount showing branching septate hyphae and spores

DISCUSSION:

The present study showed a dominance of young males with various occupations, having unilateral involvement of ≤ 5 fingers and not having any specific risk exposure. Sen *et al.*⁸ in their study also reported dominance of young males aged 20-40 years and involvement of fingers rather than toes. However, Sarkar *et al.*¹² in a study from a tertiary care center in Kolkata and Chetana *et al.*¹³ in a study from Puducherry, though reported the dominance of young (21- 40) years and involvement of fingers as compared to toenails yet reported females to be

more commonly affected as compared to males. However, some other studies from India show a dominance of young males among the affected patients^{10,14-16}. In the present study, a total of 17 patients had other systemic/chronic illnesses including one patient with HIV. HIV patients are reported to have a higher risk for OM¹⁷, however, in our study, it did not seem to play a dominant role. In fact, HIV is an uncommon finding in OM patients in different studies from India^{8-10,13-16}. For other systemic illnesses, there is no predisposition cited so far but chronic health problems could be considered

to affect the peripheral blood circulation which might predispose these patients to a greater risk of acquiring fungal infection⁴. In the present study, DLSO (63%), MPO (16%) and TDO (16%) were the most dominant clinical patterns. Dominance of DLSO in clinical studies have been reported in different other studies from India with its prevalence ranging from 47.6% to 70.59%^{8-10,13-16}. MPO and/or TDO have also been recognized as the other most common patterns in these studies^{8-10,13-16}. KOH mount positivity was seen in 37 cases, however, a total of 88 were culture positive. Either KOH or culture positive cases were 89. Both culture and KOH positive cases were 36, only culture positive were 52 and only KOH positive was 1. A total of 11 cases were both KOH and culture negative. Thus, culture positivity rate was higher whereas KOH mount was less sensitive. Compared to the present study, Sen *et al.*⁸ found KOH positivity in 60.52% of their clinically suspected cases and found only 73.9% of those KOH positive cases to be culture positive. In our study, we carried out both KOH mount as well as culture simultaneously and found 36/37 (97.3%) of them to be culture positive. However, culture of all the clinically suspected cases revealed an additional 56 cases to be positive for fungal strains, thereby showing that KOH mount did not have an adequate sensitivity. Contrary to the present study, Asifa *et al.*⁹ also reported direct microscopy by KOH mount to be more sensitive (65.9%) as compared to culture (58.9%), however, they also found that culture helped to detect fungal positivity in 21% additional cases as compared to KOH. But Chetana *et al.*¹⁴ in their study, similar to ours found fungal positivity rate to be higher on culture (59.1%) as compared to KOH mount (41.1%). The findings thus suggest that it is appropriate to carry out both KOH mount as well as culture in order to establish a confirmed fungal positivity in OM cases. In the present study, among culture positive and duly identified fungal strains, Dermatophytes (n=47) were most common and included *Trichophyton rubrum* (n=40), *Trichophyton verrucosum* (n=4) and *Trichophyton mentagrophytes* (n=3) respectively. Yeasts were isolated in 28 cases and were dominated by *Candida albicans* (n=16) followed by *Fusarium sp.* (n=7) and *Candia parasitosis* (n=5) respectively. The remaining 13 samples were positive for non-dermatophytes and were dominated by *Aspergillus sp.* (n=9), *Aspergillus niger* (n=4), *Aspergillus fumigatus* (n=3) and *Aspergillus flavus* (n=2) respectively. The other non-*Aspergillus* non-

dermatophytes included 2 cases of *Alternaria sp.* and 1 case each of *Curvularia sp.* and *Scopuloropsis* respectively. Similar to findings of our study, Sen *et al.*⁸ in their study also reported dominance of dermatophytes (80.9%). They reported *T. rubrum* (51.5%) as the most common dermatophyte, *Candida albicans* (6.82%) as the most common yeast and *Aspergillus niger* (1.47%) as the most common non-dermatophyte. Other workers from some of the Indian studies also report a similar pattern of pathogens with dominance of dermatophytes followed by yeasts and non-dermatophytes respectively^{13, 14}. However, Asifa *et al.*⁹ in a study from Kashmir, reported dominance of yeasts (*Candida sp.*) followed by dermatophytes (*Trichophyton*) and non-dermatophytes (*Aspergillus*) respectively. On the other hand, Borah *et al.*¹⁰ in a study from Assam, India reported dominance of non-dermatophytes (47.5%) followed by yeast (33.8%) and dermatophytes (18.8%) respectively. In another study from Kashmir¹⁵, though dermatophytes were most dominant (61.66%), they were followed by non-dermatophytes (31.66%) and yeasts (6.66%) respectively. Nevertheless, *T. rubrum* as the dominant dermatophyte, *Candida albicans* as the dominant yeast and *Aspergillus sp.* as the dominant non-dermatophyte has been reported in almost all the studies. The variance in type of pathogens in different studies could be dependent on seasonal, climatic or environmental variability, however, for certain some species (*T. rubrum*, *C. albicans* and *Aspergillus sp.*) could be recognized as the most common causative pathogens responsible for onychomycosis in our region. Compared to Indian studies, where non-dermatophytes and yeasts also seem to play a dominant role, in western studies, dermatophytes seem to overshadow other fungal types. In their epidemiological study of 15,000 Canadian patients, Gupta *et al.*¹⁸ found 90.5% to be dermatophyte followed by 7.8% non-dermatophyte molds, and 1.7% yeasts. In our study, we observed a significant association of clinical diagnosis with sex and site involved. It was observed that though for all clinical patterns, there was a dominance of males, however, DLSO pattern was significantly more common in females as compared to males. Similarly, involvement of toes and/or both toes and fingers was more common for MPO types. These associations are site specific. As far as low prevalence of females in general is concerned, it could be attributable to the better level of nail care by the women as compared

to men, for aesthetic purposes as well as beauty of nails being linked to the femininity. However, the higher prevalence of women with DLSO pattern could be attributable owing to the fact that while for other types, the nail paint can hide the nail defect, DLSO owing to its specific locational value cannot be hidden for long in view of the proximal nature of growth of nails which makes a visible impact of the disease. The present study, thus showed that the treatment availing pattern of women was also related with their gender specific roles. The present study, thus showed the clinical and etiopathological profile of OM from a tertiary care center in Northern India. The findings highlight the importance of simultaneous wet-mount and culture evaluation to assess the exact burden of pathogens. The study also highlighted that local environmental, seasonal and climatic factors have a role to play in determining the spectrum of pathogens.

CONCLUSION:

Although clinical diagnosis of a suspected case of OM is useful in primary management of the patient, however, in view of variable etiology and the need for specific treatment, the diagnostic work-up of a patient should be carried out till the confirmatory identification of underlying pathology. Clinical features should be taken as the criteria for understanding the extent and severity of disease and can act as quantitative measure to assure the progression of therapeutic outcome.

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