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Clinicomycological Study of Onychomycosis in Dermatology Patients Attending a Tertiary Care Hospital

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KEYWORDS

Onychomycosis, Dermatophytes, Trichophyton

ABSTRACT:

Background: Onychomycosis is a chronic fungal infection involving the nail plate, nail bed, and periungual tissues. It represents the most common nail disorder, accounting for nearly 50% of all nail diseases. Although it is not life-threatening, onychomycosis causes significant morbidity due to pain, discomfort, functional impairment, and cosmetic disfigurement. Additionally, affected nails may act as a reservoir for fungal infections, particularly in immunocompromised individuals, thereby necessitating early diagnosis and appropriate management.

Aim: To study and evaluate the clinico-mycological pattern of onychomycosis among patients attending a tertiary care hospital in Navi Mumbai.

Methods: A total of 118 nail specimens were collected from patients clinically suspected of having onychomycosis. Severely affected nail clippings were subjected to direct microscopic examination using potassium hydroxide (KOH) mounts. Fungal culture was performed on Sabouraud's dextrose agar and Dermatophyte Test Medium to facilitate isolation and identification of the causative organisms.

Results: Out of 118 nail specimens cultured, fungal growth was obtained in 50 cases. The highest prevalence of onychomycosis was observed in patients aged 46–55 years. Males were more commonly affected than females. Distal and lateral subungual onychomycosis was the most frequent clinical presentation, accounting for 42% of cases. Diabetes mellitus and hypertension were the most commonly associated co-morbidities. Dermatophytes constituted the predominant etiological agents (58%), followed by non-dermatophyte molds (24%). The most frequently isolated organisms were Trichophyton rubrum, Trichophyton mentagrophytes, Candida albicans, and Aspergillus niger.

Limitations: Treatment and long-term follow-up of patients could not be undertaken due to time constraints.

Conclusion: Accurate identification of the etiological agents of onychomycosis is crucial for effective treatment, prevention of recurrence, and improvement in patient quality of life. Early diagnosis enables timely

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intervention, promotes nail recovery, and minimizes complications.

INTRODUCTION

Previously referred to specifically as a non-dermatophytic nail infection, the term onychomycosis is now broadly used to describe any fungal infection of the nails. Dermatophytic infection of the nail are referred to as Tinea ungium. The term encompasses all fungal infections involving the nail apparatus, including the nail plate, nail matrix, cuticle, surrounding mesenchymal tissue, and nail folds. Onychomycosis accounts for up to 50% of nail-related disorders and approximately 30% of all superficial fungal infections affecting the nails. [(1)]

In accordance with the clinical condition and the identified invasion route, onychomycosis is divided into four categories: Proximal subungual nail infection, candidal nail infection, white superficial nail infection, and distal subungual nail infection. Aging, nail injuries, decreased peripheral circulation, psoriasis, history of athlete's foot, unsanitary nail conditions, and sweating are some of the factors associated with an increased risk of infection. Even though it is not fatal, onychomycosis can end up causing secondary infections leading to symptomatic disease which can be a cause of morbidity with a negative impact such as pain and can potentially sabotage social lives. [(2)] Due to inadequate medical facilities in especially rural areas, onychomycosis is considered as a persistent fungal infection leading to increasing morbidities. It is necessary to understand the pathogenesis and etiology in order treat the recurrence of infection. The aim of the present study was to examine the various fungal agents responsible for causing onychomycosis in patients.

MATERIALS AND METHODS

This study was conducted over a period of two years, from December 2021 to February 2023, in the Department of Microbiology, MGM Medical College and Hospital, Kamothe, Navi Mumbai. A total of 118 nail specimens were collected from clinically suspected cases of onychomycosis, out of which 50 fungal organisms were isolated.

All samples were processed according to standard microbiological guidelines. [3]

1. Microscopy

a) KOH Mount: The nail samples were subjected to potassium hydroxide (KOH) mount for preliminary identification of fungal elements. KOH helped in dissolving the keratinized nail material and facilitated the detection of refractile fungal hyphae.

b) Gram's Staining: Gram's staining was performed on the samples to identify budding yeast cells with or without pseudohyphae, aiding in the detection of candidal infections.

2. Culture on SDA and DTM

The nail specimens were cultured on Sabouraud's Dextrose Agar (SDA) and Dermatophyte Test Medium (DTM) and incubated at temperatures of 25°C and 37°C. The cultures were examined daily during the first week and subsequently twice weekly for a total duration of six weeks. Colony characteristics such as growth pattern, texture, and pigmentation were observed for fungal identification.

3. Slide Culture

Slide culture was performed for further classification of fungal isolates based on microscopic morphology and colony characteristics, including obverse and reverse appearances.

4. Species Identification

a) Urea Hydrolysis Test: This test was carried out for the identification of *Trichophyton mentagrophytes*.

b) Germ Tube Test and CHROM agar: The germ tube test and CHROM agar were used for differentiation and identification of various *Candida* species.

Statistical Analysis

All data were initially entered into Microsoft Excel and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0 (SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Numerical variables were expressed as mean ± standard deviation, while categorical variables were summarized using frequencies and percentages. Comparisons between independent groups were performed using the two-sample *t*-test, whereas paired *t*-tests were applied for

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correlated observations. Associations between categorical variables were assessed using the Chi-square test, with Fisher's exact test employed when expected cell counts were small. A p-value ≤ 0.05 was considered statistically significant.

RESULT

Table 1. Age-wise Distribution of Patients with Onychomycosis (n = 50)

Age Group (Years)	Number of Patients	Percentage
26–35	6	12%
36–45	8	16%
46–55	15	30%
56–65	11	22%
66–75	9	18%
76–85	1	2%
Total	**50**	**100%**

Table 2. Gender Distribution of Patients with Onychomycosis (n = 50)

Gender	Number of Patients	Percentage
Male	33	66%
Female	17	34%
Total	**50**	**100%**

Male: Female ratio = 2.2: 1

Table 3. Distribution of Clinical Nail Changes in Onychomycosis (n = 50)

Clinical Feature	Number of Patients	Percentage
Brown-black discoloration	25	50%
Yellow discoloration	19	38%
Onycholysis	11	22%
Paronychia	8	16%
White discoloration (Leukonychia)	8	16%
Dystrophic nail	6	12%
Ridges	4	8%
Loss of cuticle	3	6%

Table 4. Fungal Isolates Identified in Onychomycosis Cases (n = 50)

Organism Isolated	Number of Isolates	Percentage
Trichophyton rubrum	21	42%
Trichophyton mentagrophytes	8	16%
Aspergillus niger	12	24%
Candida albicans	9	18%
Total	**50**	**100%**

Table 5. Clinical Types of Onychomycosis and Associated Organisms

Clinical Type	No. of Patients (%)	Predominant Organism(s)
Distal & Lateral Subungual Onychomycosis (DLSO)	21 (42%)	*T. rubrum*, *A. niger*
Proximal Subungual Onychomycosis (PSO)	12 (24%)	*T. rubrum*, *A. niger*
Candidal Onychomycosis (CO)	9 (18%)	*Candida albicans*
White Superficial Onychomycosis (WSO)	8 (16%)	*T. mentagrophytes*

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Table 6. Distribution of Co-morbidities in Patients with Onychomycosis (n = 50)

Co-morbidity	Number of Patients	Percentage
Diabetes Mellitus	18	36%
Hypertension	12	24%
Thyroid disorders	6	12%
No co-morbidity	14	28%
Total	**50**	**100%**

Figure: 1. Distribution of Clinical Nail Changes in Onychomycosis

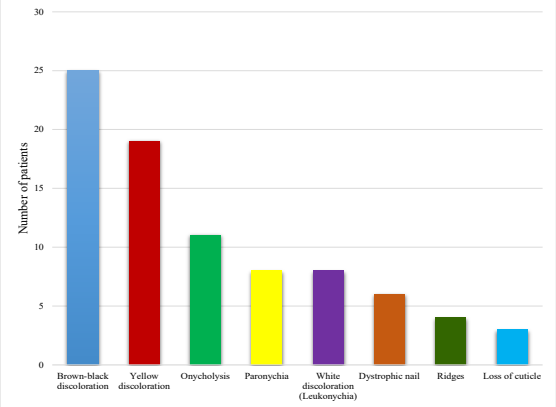
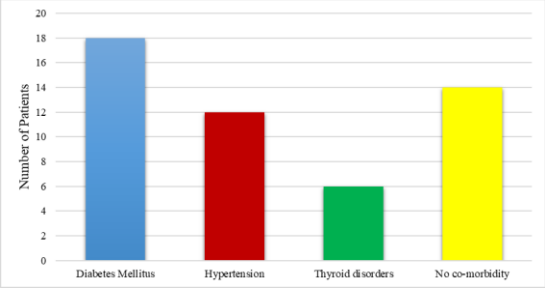


Figure: 2. Distribution of Co-morbidities in Patients with Onychomycosis



The age-wise distribution of patients with onychomycosis showed that the highest prevalence was observed in the 46–55-year age group, accounting for 30% of cases. This was followed by the 56–65-year age group (22%) and the 66–75-year age group (18%). The least affected age group was 76–85 years, contributing to only 2% of cases. These findings indicate that onychomycosis predominantly affects middle-aged and elderly individuals.

Among the 50 patients diagnosed with onychomycosis, males constituted the majority with 66% of cases, while females accounted for 34%. The male-to-female ratio was 2.2:1, indicating a higher prevalence of onychomycosis among males in the study population.

Analysis of predisposing factors revealed that prolonged exposure to water and the use of tight-fitting footwear were commonly associated with onychomycosis. Occupational analysis showed that male labourers were more frequently affected than males in other occupations. Among females, housewives constituted the most affected group, suggesting an association between occupational exposure and the development of onychomycosis.

The most common clinical nail change observed was discoloration, with brown-black discoloration seen in 50% of patients and yellow discoloration in 38%. Onycholysis was noted in 22% of cases, followed by paronychia and leukonychia in 16% each. Dystrophic nail changes and ridging were less frequently observed, while loss of cuticle was the least common finding, present in only 6% of patients.

Dermatophytes were the predominant causative agents of onychomycosis. *Trichophyton rubrum* was the most frequently isolated organism, accounting for 42% of cases, followed by *Aspergillus niger* (24%) and *Candida albicans* (18%). *Trichophyton mentagrophytes* was the least frequently isolated dermatophyte, seen in 16% of cases.

Distal and lateral subungual onychomycosis was the most common clinical presentation, observed in 42% of patients, with *T. rubrum* and *A. niger* identified as the principal causative organisms. Proximal subungual onychomycosis accounted for 24% of cases and was caused by similar organisms. Candidal onychomycosis constituted 18% of cases, predominantly caused by *Candida albicans*, while white superficial onychomycosis was the least common type, observed in 16% of patients and primarily associated with *T. mentagrophytes*.

Among patients with onychomycosis, diabetes mellitus was the most frequently associated co-morbidity, present in 36% of cases, followed by hypertension in 24%.

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Thyroid disorders were observed in 12% of patients, while 28% of patients did not have any associated co-morbid conditions. This highlights the significant association of metabolic disorders with onychomycosis.

DISCUSSION

Onychomycosis is a persistent fungal infection of the fingernails and toenails that significantly affects the quality of life. Onychomycosis was common since ages but has been diagnosed more commonly now. This has shown high prevalence nowadays. The current study aimed to assess the microbial profile of clinically suspected onychomycosis cases, considering various factors that influence the disease.

In our study, the rate of microbial isolation in onychomycosis was determined to be 42.3%. In a similar study, Rupali S. Suryawanshi *et.al* [4] from Mumbai have reported the microbial isolation rate 58.41%. Eleonora Dubljanin *et al* [5] et.al, conducted a study on Epidemiology of Onychomycosis in Serbia that included 374 patients out of which diagnosis of onychomycosis was confirmed by culture in 50.8% of them. This indicates that the prevalence of onychomycosis was less in one area which is a semi-rural area.

It was observed that a large number of the patients were affected with onychomycosis were in the age group of 46–55(Figure 2). Similar findings were reported by Nourchene Toukabri *et.al* [6] who studied about 392 patients and the most infected patients were in the age group of 41-50 followed by those between 51-60. In our study, the majority of nails affected were fingernails with a rate of 66%. Toenails were affected in 17(34%) patients. Our study aligned with a study from Uttarakhand in India by Adekhandi S, *et.al* [7], however study of Gupta M *et.al* [8] from Himachal pradesh have reported that toenails were more frequently affected than fingernail. This shows that prevalence of onychomycosis varies from place to place which may be governed by the temperature, humidity in particular area.

The predominant nail changes observed in our study are depicted in Table 1 among which brownish-black (50%) and yellow discoloration (38%) were the major symptoms whereas onycholysis turned out to be the second most observed nail deformity in 11 (25%) patients. Study done by Kaur R *et al* [9] showed similar results where Discoloration was the most frequently observed symptom. Findings by Reddy KN *et.al* [10] revealed 100% i.e 60/60 patients were seen with discoloration of nails as the common clinical presentation.

In this study the predisposing factors of onychomycosis were checked. It was observed that patients with a history of prolonged contact with water were identified as the most significant cause followed by history of wearing tight footwear accounted for 29% of the infection. Similar results were presented by Sen A *et.al* [11] in a study done in Eastern Bihar with exposure to water as a common factor. More exposure to water makes a suitable condition for fungi to grow and infect the nails. This can be avoided by guiding the patients to keep the nails dry after exposure to water.

The correlation of occupation with the cases of onychomycosis was studied. It was observed that majority of sufferers amongst males were labourers (27%) and servicemen (18%) followed by farmers at a rate of 13% and Drivers (7%). Amongst Females, housewives (18%) were found to have more chances of having onychomycosis. Study done by Reddy KN *et.al* [10] shows that amongst 60 patients, housewives were in majority at a rate of 26.6% followed by laborers (16.6%) which is similar to our study. In contrast the study done by Gupta M *et.al* [8] has reported that farmers were majorly affected by onychomycosis. This could be attributed to the basic hygiene level of an individual.

The associated comorbidities with onychomycosis found in this study are depicted in Figure 4 which shows majority of the patients were being treated for diabetes (36%) and hypertension (25%). Arenas R *et.al* [12] conducted a survey in Mexico which presented diabetes mellitus and arterial hypertension as the major underlying comorbidity in patients suffering from onychomycosis. Both the studies done by Elewski BE *et.al* [13] and Papini M *et.al* [14] reveals that patients with diabetes are more prone to the disease. This shows that the patients having diabetes mellitus & hypertension should take care of nails as they are more prone to onychomycosis.

Table 2 shows Isolates found in onychomycosis cases in our study. In our study, dermatophytes were the primary cause of onychomycosis cases. T. rubrum was the most prevalent dermatophyte responsible for Distal and Lateral Subungual Onychomycosis (DLSO) in 23% of

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patients and Proximal Subungual Onychomycosis (PSO) in 18% of cases. T. mentagrophytes, found in 20% of cases, was the second most common dermatophyte identified. Additionally, C. albicans was the most frequently isolated yeast, present in 16% of the samples. Isolation of Non-dermatophyte molds is seen in 25% of the cases. *Aspergillus niger* was isolated amongst 25% of all cases. It showed the symptoms of DLSO in 18% of the cases and PSO in 7% cases. Study done within Canadian Population by RB Vender *et.al* [15] reveals dermatophytes as the most commonly cultured organism which appeared in 71-91% of nails. In contrast, a study by M. Soltani *et al*. [16] conducted in Iran on onychomycosis in 140 patients visiting the dermatology department found that 79 patients tested positive for onychomycosis. Yeasts were the most frequently isolated pathogens, accounting for 71.4%, followed by non-dermatophytic molds in 17.1% of cases. Dermatophytes were the least commonly isolated organisms, found in only 11.5% of patients. Table 3 shows the spectrum of organism in various clinical types. In the present study, Distal and Lateral Subungual Onychomycosis (DLSO) was the most common clinical presentation seen in 21 (42%) patients in which T.rubrum (26%) & Aspergillus niger (16%) were grown followed by Proximal Subungual Onychomycosis(PSO) in 12 (24%) patients in which T. rubrum was isolated in 16% patients & Aspergillus niger in 8% patients. Candidal Onychomycosis (CO) was observed as paronychia in five (37.5%) patients and nail plate discoloration in two (25%) of these patients and was observed next in frequency in 16% patients. White Superficial Onychomycosis (WSO) was the most infrequent form with 8 (16%) patients with T. mentagrophytes (16%) as major isolates. A Study done in North East India by Marak A et.al [17] 68 out of 80 were affected by onychomycosis. The majority of which was clinically presented as DLSO at a high rate of 73.52%, similar to our study. However the study conducted by TM Jesudanam [18] et al indicates Candidal Onychomycosis (CO) with high isolation rate. Proximal Subungual Onychomycosis (PSO) was the next clinical type found in majority of patients as seen in studies from Uttarakhand and Bangalore which were found similar to our study. The least common clinical type was White Superficial Onychomycosis (WSO) with similar results from the study done by Reddy KN. [19] The spectrum of fungi varies in different geographic areas.

CONCLUSION

Hence, baseline epidemiological studies conducted across different geographic regions are essential to identify the common etiological agents responsible for onychomycosis in those areas, which in turn would facilitate the standardization of empiric treatment protocols. Although onychomycosis does not constitute a major public health concern, accurate determination of its etiological agents is crucial for improving patient outcomes and enhancing quality of life. Furthermore, increasing awareness about the disease is particularly important, as individuals in rural areas often tend to ignore the condition, leading to delayed diagnosis and potential complications. Timely and appropriate diagnosis ultimately aids in achieving optimal treatment outcomes, including complete clinical recovery and restoration of the affected nails.

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