



Prevalence of Onychomycosis in Rural Bangalore

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Abstract

Background: Onychomycosis is a common fungal infection of the nail which can be caused by both dermatophytic and nondermatophytic etiologies. Treatment of Onychomycosis involves long duration antifungal therapy. As the long treatment duration without identifying the causative agents may lead to the development of resistance. Confirmation of diagnosis and speciation by culture before administering antifungal therapy is very important.

Materials & Methods: A total of 100 patients clinically suspected to have Onychomycosis were studied for the presence of fungi from the nails of finger and toe nails of patients. The fungi were isolated and identified by standard protocol using potassium hydroxide (KOH) and appropriate isolation media.

Results: The mean age of the study group was 32.22 (± 17.6 SD) years. In the present study males were more affected followed by females with 51% and 49% respectively. The yeasts predominated the list of isolates

followed by dermatophytes and there moulds with 47.5%, 37.5% and 12.5 % respectively. Candida species were predominant among the years with 90.5%.

Conclusion: The nondermatophyte molds appear to be more common causative agents of onychomycosis compared to usual dermatophyte species in the present study.

Keywords: Onychomycosis, Dermatophytes, Yeasts, other moulds, KOH mount, SDA culture, Itraconazole, nail discoloration.

Introduction

Onychomycosis is a superficial fungal infection and describes all fungal infections of the nails, whether finger or toe nails. Onychomycosis is an infection of the nail unit caused by fungi (dermatophytes, non-dermatophyte molds, and yeasts), presenting with discoloration of the nail, onycholysis, and nail plate thickening. Any component of the nail unit, including the nail plate, nail matrix, and nail bed can be affected.

The term “onychomycosis” is derived from the Greek words “onyx” meaning nail and “mykes” meaning fungus. Onychomycosis is the most common disorder affecting the nail unit and accounts for at least 50% of all nail diseases. Laboratory confirmation of the clinical diagnosis of onychomycosis prior to initiating treatment is cost effective and is recommended. In recent years, newer techniques enabling accurate and sensitive diagnosis of onychomycosis and novel treatments of this condition have emerged.^[1,2,3]

Onychomycosis was initially thought to be predominantly caused by dermatophytes; however, new research has revealed that mixed infections and those caused by non-dermatophyte moulds (NDMs) are more prevalent than previously thought. Microscopy and fungal culture are the gold standard techniques for onychomycosis diagnosis, but high false-negative rates have pushed for more accurate methods, such as histology and molecular methods. here are several treatment options available, including oral antifungals, topicals and devices. Oral antifungals have higher cure rates and shorter treatment periods than topical treatments, but have adverse side effects such as hepatotoxicity and drug interactions. Terbinafine, itraconazole and fluconazole are most commonly used. Recurrence rates for onychomycosis are high; once infected, patients should seek medical treatment as soon as possible and sanitize their shoes and socks.^[4,5]

Prophylactic application of topicals and avoiding walking barefoot in public places may help prevent recurrence. (Vlahovic TC. Onychomycosis. *Clin Podiatr Med Surg* 2016; **33**: 305–318.)^[45]

Clinical manifestations include discoloration of the nail, subungual hyperkeratosis, onycholysis, and onychauxis. The diagnosis can be confirmed by direct microscopic

examination with a potassium hydroxide wet-mount preparation, histopathologic examination of the trimmed affected nail plate with a periodic-acid-Schiff stain, fungal culture, or polymerase chain reaction assays. Laboratory confirmation of onychomycosis before beginning a treatment regimen should be considered. Currently, oral terbinafine is the treatment of choice, followed by oral Itraconazole. In general, topical monotherapy can be considered for mild to moderate onychomycosis and is a therapeutic option when oral antifungal agents are contraindicated or cannot be tolerated. Recent patents related to the management of onychomycosis are also discussed.

Oral antifungal therapies are effective, but significant adverse effects limit their use. Although topical antifungal therapies have minimal adverse events, they are less effective than oral antifungal therapies, due to poor nail penetration.

Laboratory confirmation of the clinical diagnosis of onychomycosis prior to initiating treatment is cost effective and is recommended.

Patients with chronic mucocutaneous candidiasis and immunodeficiency are more likely infected with the yeast organism, especially in the fingernails.

Nail discoloration was observed in most cases (70%) followed by nail dystrophy, subungual hyperkeratosis, onycholysis, nail plate thickening, crumbling and pitting.

Onychomycosis is acquired through direct contact of the nail with dermatophytes, non-dermatophyte molds, or yeasts. Because the nail unit does not have effective cell-mediated immunity, it is susceptible to fungal infection. Fungal production of enzymes that have proteolytic, keratinolytic, and lipolytic activities help to degrade the keratin in the nail plate and facilitate fungal invasion of

the nail. Factors that compromise barriers to fungal infection may increase the risk for fungal infection.

Typically, onychomycosis presents as a white or yellow-brown discoloration of the nail. Violaceous, green, and black discoloration of the nail plate have also been observed.

In general, toenails are affected seven to ten times more frequently than fingernails. The big toenails are most often affected [8]. Generally, several toenails are affected and tinea Pedis is often present. Based on the pattern of invasion, onychomycosis can be divided into the five clinical subtypes described below. It should be noted that patients may have a combination of these subtypes: Distal Lateral Subungual Onychomycosis, White Superficial Onychomycosis, Proximal Subungual Onychomycosis, Endonyx Onychomycosis and Total Dystrophic Onychomycosis. Depending on the clinical presentation, nail clippings, nail plate scrapings, nail bed scrapings, and subungual scrapings may be necessary for sample collection. The diagnosis can be confirmed by direct microscopic examination with a Potassium Hydroxide (KOH) wet-mount preparation, histopathologic examination of the trimmed affected nail plate with a Periodic-Acid-Schiff (PAS) stain, fungal culture, or Polymerase Chain Reaction (PCR) assays. The ideal test would identify the fungus and the species, determine its viability, be easy to perform with rapid result and low cost, and be highly specific and sensitive. [12,13]

Aims & Objectives

To study the clinical and epidemiological aspects of onychomycosis and the prevalence of Onychomycosis in rural Bangalore and identify various mycological strains and predisposing factors contributing to onychomycosis.

Materials & Methods

A total of 100 patients with clinically suspected onychomycosis were enrolled during the one-year study period from Feb 2020 to Jan 2021 after approval from the Institutional ethics committee. Patients who had taken either topical or oral antifungal medication within six months were excluded from the study. Informed consent was taken. Demographic data and relevant medical history was recorded for each patient, followed by physical examination and nail clippings / scrapings from the undersurface of nails were collected and processed in the department of Microbiology.

Microscopy:

Direct examination of the nail clipping/scrapings were incubated in 40% Potassium Hydroxide for 30 minutes and microscopic examination was done for the presence of fungal elements. A potassium hydroxide preparation is a useful screening test to rule out the presence of fungi which provides almost immediate results at low cost. The test is performed by adding a drop of 10 to 20% potassium hydroxide, to the nail specimen which is placed on a glass slide for examination by light microscopy. The potassium hydroxide dissolves the keratin, leaving behind easily visualized septate hyphae. The specimen can be gently heated if no dimethyl sulfoxide is added to accelerate keratin dissolution. A positive test demonstrates fungal hyphae, spores, and yeasts cells. The test, however, does not provide information on the species of the fungus or fungus viability. A potassium hydroxide preparation is expertise dependent. The sensitivity has been reported as 48 to 60%. The specificity ranges from 38 to 78% [Medical Mycology-Jagdish Chander 4th Edn].

Culture and Isolation

The samples were inoculated on Sabouraud’s dextrose agar with chloramphenicol and cycloheximide. These tubes were incubated at room temperature and examined every week. The isolates were identified by standard techniques used for isolation and identification of fungal etiological agents. Based on colony morphology, fungi were broadly identified as yeasts or molds. The species were identified using lactophenol cotton blue preparation and appropriate identification tests.

The criteria used to report the moulds as pathogens were direct microscopy positive and isolation of the same fungi in three consecutive samples at intervals of 7 days.

Results

Among the 100 patients, 51 were males, 49 were females. The mean age of the study group was 32.22 (±17.6 SD) years.

The prevalence of Onychomycosis in the age group of 20-40 yrs was 43%.

In the present study males were affected predominantly (51%) followed by women (49%).

Among the various fungi, the yeasts were isolated in greater numbers 19/40 (47.5%) followed by dermatophytes 15/40 (37.5%) and other moulds 5/40 (12.5%) respectively.

Among the yeasts, Candida species were predominant isolates with 90.5%.

Table 1 - shows the sex distribution and the nails involved. Two of the male patients with toe onychomycosis presented with HIV infection. Three of the male patients with toe nail onychomycosis presented with diabetes mellitus.

Table 2 - Shows the comparison of direct microscopy with culture and isolation results.

Table 3 - shows the distribution of the fungi isolated in 40 patients with onychomycosis.

Confirmed cases were treated with antifungal agent Itraconazole (400mg/day) for 7 days in a month, 1% cases required repeat therapy with antifungal agents both oral and topical agents.

Table 1: Sex distribution and nail involvement in the study group.

Sex	Total No.	Toe	Finger	Both nails
Male	51	40	08	03
Female	49	06	42	01
Total	100	46	50	04

Table 2: Comparison of direct microscopy with culture of the isolates.

KoH Positive (30)		KoH Negative (70)	
Culture positive	Culture Negative	Culture positive	Culture Negative
24	06	16	54

Table 3: Distribution of the various fungi isolated in the study group.

	Finger nail No (%)	Toe nail No (%)	Finger + Toe nail No (%)
Yeasts (19/40) 47.5% Candida albicans	7 (36.9%)	3 (15.8%)	-
Candida tropicalis	5 (26.3%)	1 (5.3%)	1 (5.3%)
Trichosporon beigelli	-	1 (5.3%)	-
G. candidum	-	-	1 (5.3%)
Dermatophytes (15/40) 37.5% T. rubrum	4 (26.7%)	4 (26.7%)	2 (13.3%)
T. mentagrophytes	2 (13.3%)	2 (13.3%)	-
E. floccosum	1 (6.7%)	-	-
Other Moulds (5/40) 12.5% Cephalosporium	-	1 (20%)	-
Alternaria	-	1 (20%)	-
Fusarium	-	2(40%)	-
Curvularia	-	1 (20%)	-
Mixed growth (1/40) 2.5% Rubrum + C. albicans	1 (100%)	-	-

Discussion

Onychomycosis is one of the commonest nail disorders encountered by dermatologists. Onychomycosis impairs normal functions, causes considerable pain, interferes with daily activities and causes psychological effects.

Onychomycosis is found worldwide and in all age groups. In the present study, the commonest age group was 20-40 years (43%) in comparison with Kai Man Kam MB study.^[4]

In the present study, males were more affected (51%) than females (49%) which is in comparison with the report of Reddy BSN.^[5] Increased participation in physical activity, exposure to wet work and shoe wearing habit in males of this age group could be some of the contributing factors for the increased prevalence in the male preponderance. Madhuri et al has reported a higher prevalence in females.^[6]

Toe nail infection (78.43%) was common in males as in the study of N Sauze H (76%)^[6,8]

Finger nail infection found in 85.71% of females is in comparison with N Sauze H report (78%), as the patients were housewives who used to do household work and their hands were frequently used to be in water.

Yeasts predominated (47.5%) followed by dermatophytes (37.5%) and moulds (12.5%) in comparison with the study of various researchers.

Candida species (90.5%) predominated among the yeasts. Candida albicans (52.3%) was the commonest species isolated followed by Candida tropicalis (37.2%) in the present study, whereas in the study of Kai Man Kam other species of candida were the commonest.

Trichosporon beigelii (4.8%) and Geotrichum candidum (4.8%) isolated one in each case in the present study as reported by Man Heuihan.^[9]

Trichophyton rubrum (68.8%) was the commonest dermatophyte followed by Trichophyton mentagrophytes (25%) and Epidermophyton floccosum (6.3%) which is in comparison with Kai Man Kam and Williams HC.^[7]

The moulds isolated from toe nail as a causative agent of onychomycosis has also been reported by various studies, is compared in Table 4.

Techniques of molecular biology and immunohistochemistry has shown the presence of moulds inside the nail plate.^[13]

Fusarium oxysporum isolated from toe nails of HIV patients in the present study has also been reported by Madhuri and Virendra N Sehgal.^[10]

Curvularia isolated from toe nails of diabetic patients has also been reported by Rama Ramani.^[11]

Alternaria and cephalosporium as causative agent of onychomycosis has been reported by De Doneker & Virendra.^[10]

Conclusion

To conclude, candida species were the most common cause of onychomycosis in the present study. The present study shows that nondermatophyte moulds and yeasts can invade the nail tissue causing onychomycosis. Identification of the fungal species is essential for the effective management of onychomycosis.

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