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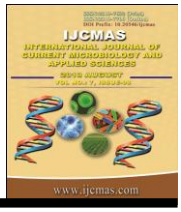

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A Prospective Study on the Epidemiology of Onychomycosis in Tertiary Care Hospital

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A B S T R A C T

Fungal infection of nails or onychomycosis is non-life threatening disease commonly caused by dermatophytes. The infection is also caused by non dermatophytes like yeasts and non dermatophytic moulds. There are various factors which play an important role in causation of onychomycosis. These predisposing factors are aging, fall in the immune status, diabetes, immunosuppressive therapy for cancer and organ transplantation, HIV, long term antibiotics, occlusive footwear, immune deficiency diseases and occupations involving continuous contact with water, for instance swimmers, fishermen, clothes and dish washers. Climatic conditions also play an important role in the causation of onychomycosis. The present study was carried out in a tertiary care hospital for a period of 8 months. The aim of the study was to determine various predisposing factors and causative agents of onychomycosis. The sample was placed in a sterile petridish and transported to microbiology laboratory. The sample was then divided into two parts, one for direct microscopy under high power objective using 20-25% KOH and the other part for culture on Sabouraud's dextrose agar (SDA) with cyclohexamide. The cultures were kept at 25°C and 37°C for up to six weeks. Confirmation of the organism was done based on morphology of fungus in LPCB (Lactose phenol cotton blue) mount, culture of fungus on SDA and slide culture. Among the 68 patients selected based on clinical presentation, 26 yielded fungal pathogens in culture. A total of 15 (57.6%) isolates were dermatophytes and 11 (42.3%) were non dermatophytes. Among the dermatophytes, 7 (26.9%) cases yielded Trichophyton which was the most commonly isolated fungus followed by Microsporum 5 (19.2%), Epidermophyton 3 (11.5%). Among the non dermatophytes, candida was isolated from 3 (11.5%) cases, *Aspergillus* was isolated from 2 (7.6%), *Pyrenochaeta* from 2 (7.6%) cases, *Curvularia* from 2 (7.6%) cases and only 1 (3.8%) case yielded Fusarium. It was seen that males were more prone to onychomycosis compared to females. Incidence of toe nail onychomycosis was higher compared to finger nail onychomycosis. This study suggests that the isolation of the organism with culture is very important as it will aid the clinician to rule out bacterial causes and choose appropriate antifungal therapy.

Introduction

Fungal infection of nails or onychomycosis is non-life threatening disease commonly caused by dermatophytes. The infection is also caused by non dermatophytes like yeasts and non dermatophytic moulds. There are various factors which play an important role in

causation of onychomycosis. These predisposing factors are, aging, fall in the immune status, diabetes, immunosuppressive therapy for cancer and organ transplantation, HIV, long term antibiotics, wearing of occlusive footwear, immune deficiency diseases and occupations involving continuous contact with water, for instance swimmers, fishermen, clothes and dish washers Kaur *et al.,* (2007).Climatic conditions also favour onychomycosis. It was concluded that the prevalence of onychomycosis was low in tropical countries (3.8%) than in subtropical and temperate zones (18%) (Bramono *et al.,* 2001).

Although onychomycosis is merely a cosmetic problem, it can cause a more serious health problem in HIV infected patients. Onychomycosis in non immunocompromised patients can cause negative effects like social and emotional embarrassment, non-willingness to let their hands and feet to be seen and patients may fear that they might transmit the infection to their family members, relatives and co-workers. Differential diagnosis to onychomycosis infection includes psoriasis, lichen planus, onychogryphosis and nail trauma. Onychomycosis represents upto 20% of nail disorders (Charif *et al.,* 1997; Bronson *et al.,* 1983). The prolonged therapy with its adverse effects may discourage the patients.

The dermatophyte *Trichophyton rubrum* is the major cause of onychomycosis (Charif *et al.,* 1997). The second most commonly isolated fungal pathogen from onychomycosis patients is the dermatophyte *Trichophyton tonsurans* (Bronsonet *et al.,* 1983). Other dermatophytes causing onychomycosis are *Trichophyton mentagrophytes*, *Trichophyton megninii, Trichophyton schoenleinii, Microsporum gypseum* and *Epidermophyton floccosum.* Non dermatophytic fungi like *Fusarium oxysporum* (Zaias *et al.,* 1972), *Scytalidium, Scopulariopsis, Candida, Acremonium, Fusarium solani, Aspergillus, Arachnomyces, Pyrenochaeta unguis hominis* have also been isolated from cases of onychomycosis.

Classification of onychomycosis

According to the clinical presentation and the route of invasion, onychomycosis can be classified into four types.

1) Distal lateral subungual onychomycosis (DLSO): This is characterised by invasion of the nail bed and the underside of the nail plate, beginning at the hyponychium and leading to hyperkeratosis or onycholysis with thickening of the subungual region. The nail may appear yellowish brown in colour (Cohen *et al.,* 1992).

2) Proximal subungual onychomycosis (PSO): also known as proximal white subungual onychomycosis is a condition where the organism invades the nail from the proximal nail fold through the cuticle area. It may present with hyperkeratosis, proximal onycholysis, leukonychia and destruction of the proximal nail plate, involving all the layers of the nail (Dompmartin *et al.,* 1990).

3) White superficial onychomycosis (WSO): which occurs when the fungi invades the superficial layer of the nail plate leading to formation of opaque white patches on the external nail plate which coalesce and spreads as the disease progresses finally causing the nail to become rough, soft and crumbly (Cohen *et al.,* 1992).

4) Candida infection of the nail: In this condition the organism invades the entire nail plate causing onycholysis and paronychia. Candida infection is more commonly seen in women than in men (Andre *et al.,* 1987) and over the middle

finger of women which frequently comes in contact with the organism residing in the vagina or intestine (Zaias *et al.,* 1996).

The present study was carried out in a tertiary care hospital for a period of 8 months. The aim of the study was to determine various predisposing factors and causative agents of onychomycosis.

Materials and Methods

Inclusion criteria: Patients presenting with distal subungual onychomycosis, proximal subungual onychomycosis, white superficial onychomycosis, paronychia, onycholysis, hyperkeratosis, yellowish brown discoloration and dystrophy were selected for the study.

Collection and transport of Sample: The nails of the selected patients were cleansed with 80% ethanol to remove contaminating bacteria from the site. The sample was then obtained by vigorous scraping on nail bed, underside of nail plate and hyponychium. The sample was placed in a sterile petridish and transported to microbiology laboratory (Kaur *et al.,* 2007).

Processing of the sample: The sample was then divided into two parts, one for direct microscopy under high power objective using 20% KOH and the other part for culture on Sabouraud's dextrose agar (SDA) with cyclohexamide, as it prevents the growth of non dermatophytic fungi. SDA without cyclohexamide and with 5% chloramphenicol was used to grow non dermatophytic fungi. The cultures were kept at 25°C and 37°C for up to six weeks. No growth in the media after six weeks was reported as negative (Boni *et al.,* 1998). Confirmation of the organism was done based on morphology of fungus in LPCB (Lactose phenol cotton blue) mount done from the material obtained from the culture of fungus on SDA and slide culture (Ramudamu *et al.,* 2018). Urease test and India Ink staining was performed to differentiate candida from Cryptococcus as Cryptococcus shows positive reaction for urease test and it is a capsulated organism unlike candida which is non-capsulated and shows negative reaction for urease test. The capsule can be demonstrated by negative staining with India ink or Nigrosin (Jagdish Chander, 2017).

Results and Discussion

Based on the clinical presentation 68 patients were selected among which fungus was isolated from 28 (38.2%) cases. Male patients were more prone to onychomycosis18 (69.2%) compared to female patients 8 (30.7%) (Chart 1). It was seen that 16 (61.5%) isolates were from the toe nails, 7 (26.9%) isolates were from finger nails and only 3 isolates (11.5%) were from both toe and finger nails(Chart 2).Out of the 26 isolates, 13 (50%) isolates were from Proximal subungual onychomycosis, 8 (30%) were from distal lateral subungual onychomycosis, 2 (7.6%) from white subungual onychomycosis and 3 (11.5%) cases were from candida infection (Table 1). A total of 15 (57.6%) isolates were dermatophytes and 11 (42.3%) were other than dermatophytes (Table 2). Among the dermatophytes, *Trichophyton* was most commonly isolated 7 (26.9%), followed by *Microsporum* 5 (19.2%), *Epidermophyton* 3 (11.5%). Among the non dermatophytes, Candida was isolated from 3 (11.5%) cases, *Aspergillus* was isolated from 2 (7.6%), *Pyrenochaeta* from 2 (7.6%) cases, *Curvularia* from 2 (7.6%) cases and only 1 (3.8%) case yielded *Fusarium*. Comparison of various predisposing factors for Onychomycosis in males and females is depicted in Table 3. Onychomycosis is a cosmetic problem and a chronic disease which has a long duration of treatment (Fig. 1 and 2).

Table.1 Table depicting distribution of various types of onychomycosis based on clinical presentation

Clinical presentation	Isolates (n=26)
Proximal subungual onychomycosis	13 (50%)
Distal lateral subungual onychomycosis	8 (30%)
White subungual onychomycosis	2 (7.6%)
Candidal	3 (11.5%)

Table.2 Various fungal pathogens isolated from 26 onychomycosis cases

Dermatophytes	
Trichophyton	7 (26.9%)
Microsporum	5 (19.2%)
Epidermophyton	3 (11.5%)
Total	**15 (57.6%)**
Non dermatophytes	
Candida	3 (11.5%)
Aspergillus	2 (7.6%)
Pyrenochaeta	2 (7.6%)
Fusarium	1 (3.8%)
Penicilium	1 (3.8%)
Curvularia	2 (7.6%)
Total	**11 (42.3%)**

Fig.1 Gender wise distribution of Onychomycosis

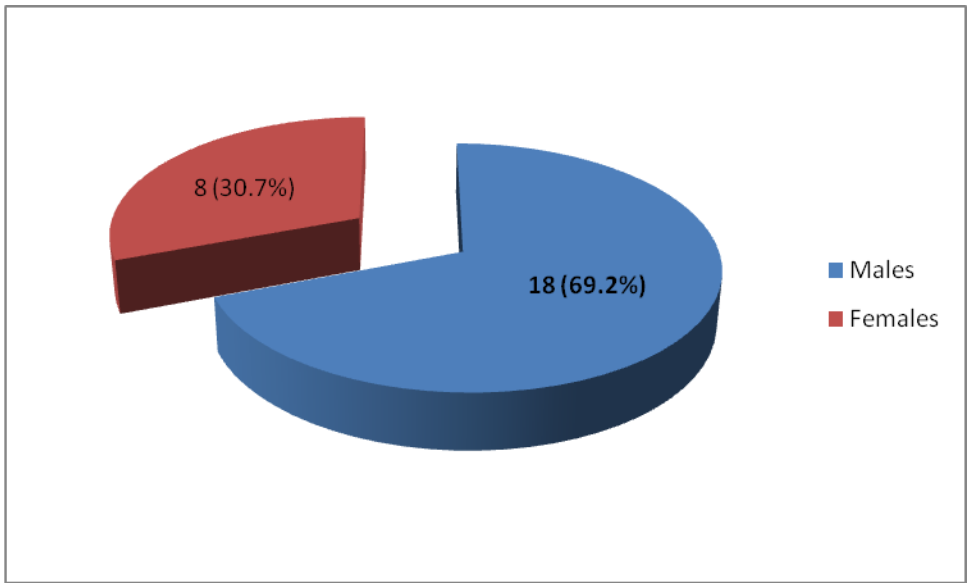
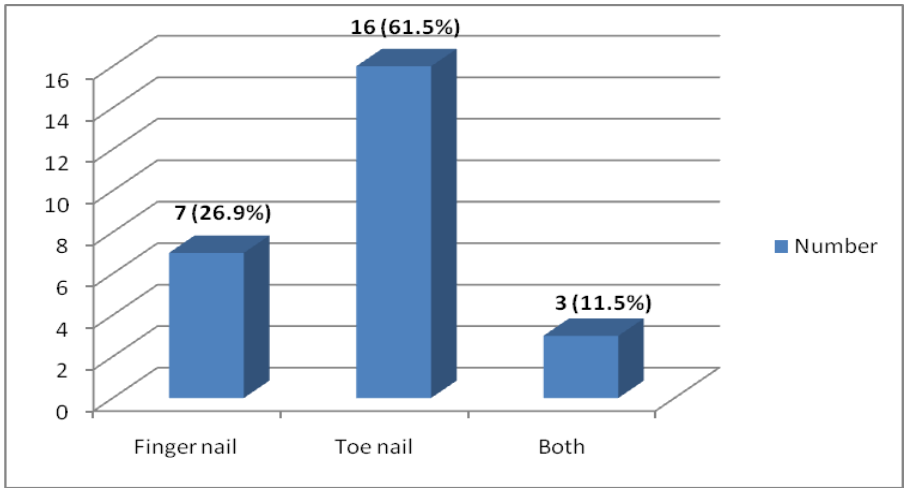


Table.3 Comparison of various predisposing factors among Onychomycosis cases (n=26)

Risk factors	Males	Females
Trauma	8 (30.76%)	4 (15.38%)
Immunocompromised	3 (11.53%)	-
Diabetes	1 (3.84%)	3 (11.53%)
Occupations not involving trauma	5 (19.23%)	2 (7.69%)

Fig.2 Fungal isolation from different sites



Our study showed an isolation rate of 38.2% which was low when compared to Heikkila *et al.*, (1995), who isolated fungus from 91 (56.17%) clinical samples among the 162 patients selected based on clinical presentation.

In the present study it was seen that males were very prone to onychomycosis compared to females which correlates with the study conducted by Sigurgeirsson *et al.*, (2014). In our study, fungus was more commonly isolated from cases presenting with proximal subungual onychomycosis which was in contrary to study by Adekhand *et al.*, (2015) who isolated fungus more commonly from distal lateral subungual onychomycosis. In comparison to Aditya *et al.*, (2000), our study also showed a higher incidence of toe nail onychomycosis. Dermatophytes were the most common organisms isolated. Our results were almost similar to the findings of Gupta *et al.*, (2000) who also showed a higher incidence of onychomycosis by dermatophytes. Among the dermatophytes, *Trichophyton* was most commonly isolated. Our study had similar results with Mugge *et al.*, (2006). Verylittle is known about the risk factors for onychomycosis. Trauma is the major cause of onychomycosis accounting for 8 (30.76%) in males and 4 (15.38%) in females, followed by occupations not involving trauma such as fisher men, clothes and utensil washers, swimmers etc. Even in this group men are predominantly infected. The incidence of onychomycosis in diabetes and immunocompromised patients was less.

In conclusion, onychomycosis is a growing public health concern. Dermatophytes are the primary cause of onychomycosis when compared with non-dermatophytes. Onychomycosis occurs more commonly in men compared to women. The cause may be related to the occupations where the incidence of trauma is more like carpentry, agriculture, wood cutting, iron smith and in some instances it may

be non-occupational like using occlusive footwear and many other such factors. Diabetes and immune compromised conditions promote onychomycosis. Isolation of the organism with culture is very important as it will aid the clinician to rule out bacterial causes and choose appropriate antifungal therapy.

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