

# A cross-sectional study of clinico-mycological profile of onychomycosis at a tertiary hospital

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## Abstract

**Background:** Onychomycosis results from invasion of the nail plate by dermatophytes, yeasts, or mold species of Fungi and represents about 30% of mycotic cutaneous infections. Early diagnosis and treatment is important to prevent distortion of the nails which can prevent loss of working efficiency of the commonly affected population of this region. Present study was aimed to study clinico-mycological profile of onychomycosis at a tertiary hospital. **Material and Methods:** Present study was, prospective and observational study, conducted in patients 16-70 years, either gender, with clinically diagnosed or suspicious of onychomycosis, willing to participate in study. After a brief history, a detailed clinical examination of the nails was done, and the clinical type of onychomycosis was identified. Nail clippings and subungual debris sent for potassium hydroxide (20% KOH) mount and inoculated on SDA agar. **Results:** In present study, 168 clinically diagnosed or suspicious cases of onychomycosis were studied. Most common age group was <20 years (38.69 %) followed by 21-30 years (20.24 %) and 31-40 years (13.10 %). Mean age was 33.16 ± 11.68 years. In present study male (52.98 %) outnumbered female (47.02 %). Common sites involved in study were fingers (56.55 %), Toes (27.98 %) and both (15.48 %). Unilateral (62.50 %) involvement was common than bilateral (37.50 %). Total No. of nails involved were one only (38.10 %) and 2-5 (51.79 %). Common predisposing factors were history of trauma (36.31 %), occlusive foot ware (8.93%), diabetes mellitus (6.55 %), tinea pedis (5.36 %), steroid intake (2.38 %) and nothing suggestive (32.14%). In present study, distal subungual onychomycosis (DSO) (66.67 %) type was most common clinical variety of onychomycosis. Other less common clinical types were endonyx onychomycosis (EO) (16.67 %), white superficial onychomycosis (WSO) (7.74 %), candida paronychia (7.74%) and proximal subungual onychomycosis (PSO) (1.19 %). In present study, on detail microbiological assessment results were, KOH positive and/or culture positive (69.05 %), KOH positive culture negative (64.88%), KOH negative culture positive (18.45 %), Culture positive (58.33 %) and both positive (39.88 %). In present study dermatophytes (58.16 %) was most common type, in which *Trichophyton rubrum* (48.98 %) was most common species, followed by *Trichophyton verrucosum* (6.12 %), *Trichophyton mentagrophytes* (3.06 %). **Conclusion:** In present study, dermatophytes were the most common aetiological agents of onychomycosis and the combined sensitivity of direct microscopy and culture was greater than those of direct microscopy and culture alone. Distolateral subungual onychomycosis was the common clinical pattern.

**Keywords:** dermatophytes, onychomycosis, Distolateral subungual onychomycosis, *T. rubrum*

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## INTRODUCTION

The term onychomycosis (OM) is presently used to describe nail infection caused by dermatophytes, yeast and nondermatophytic moulds.<sup>1</sup> Onychomycosis results from invasion of the nail plate by dermatophytes, yeasts, or mold species of Fungi and represents about 30% of mycotic cutaneous infections. Onychomycosis is a chronic nail disease which if left undiagnosed and untreated leads to unsightly appearance and sometimes complications. Although onychomycosis is not life threatening, its high incidence and prevalence and associated morbidity makes

it an important public health problem, and it is the major cause of nail disease. In India the incidence of it ranges from 0.5% to 5% in the general population.<sup>2</sup> Onychomycosis is often associated with chronicity, therapeutic difficulties, recurrence after healing and serves as reservoir for infection leading to clinical failure.<sup>3</sup> Several factors such as reduced peripheral circulation, diabetes, nail trauma, difficulty to maintain proper nail hygiene, chronic smoking, and communal bathing have been implicated in the increase in the prevalence rates of onychomycosis.<sup>4</sup> The incidence of onychomycosis is high in Indian sub-continent because warm and humid climate, poverty, overcrowding and lack of medical facilities contribute to high prevalence of disease. Early diagnosis and treatment is important to prevent distortion of the nails which can prevent loss of working efficiency of the commonly affected population of this region. Present study was aimed to study. clinico-mycological profile of onychomycosis at a tertiary hospital

## MATERIAL AND METHODS

Present study was, prospective and observational study, conducted in department of dermatology, at XXX medical college and hospital, XXX, India. Present study period was from January 2019 to December 2020(2 years). Study was approved by institutional ethical committee.

**Inclusion criteria:** Patients 16-70 years, either gender, with clinically diagnosed or suspicious of onychomycosis, willing to participate in study

**Exclusion criteria:** Patients who had received systemic/topical antifungal therapy in the last six months and concurrently having cutaneous or nail lesions of psoriasis, lichen planus or other dermatoses were excluded After a brief history, a detailed clinical examination of the nails was done, and the clinical type of onychomycosis was identified.

Clinically, the disease was classified as: Distal and lateral subungual onychomycosis (DLSO), proximal subungual onychomycosis (PSO), white superficial onychomycosis (WSO), candida onychomycosis (CO), endonyx onychomycosis (EO), total dystrophic onychomycosis (TDO).

The nails were cleaned with 70% isopropyl alcohol and samples were taken. Sterile nail clippers and No. 15 surgical blades were used to collect nail clippings and subungual debris in sterile petri dishes and labelled. Potassium hydroxide (20% KOH) mounts were prepared to look for the fungal elements and examined directly under a light microscope for fungal elements.

The remainder was inoculated on

- (i) Sabouraud dextrose agar (SDA) supplemented with cycloheximide (100 µg/ml) and chloramphenicol (50 µg/ml) and

- (ii) SDA without cycloheximide supplement.

The pathogenic organisms were identified by gross colony morphology and microscopic examination of lactophenol cotton blue (LCB) mounts. *Trichophyton rubrum*. Samples were inoculated on two plates of Sabouraud's dextrose agar with chloramphenicol and Derm agar. One plate was incubated at 37°C and one at 25°C along with the Derm agar plate. *Candida* species were differentiated on Chromogenic candida agar. For dermatophytes, KOH and/or culture positive samples were considered positive. For non-dermatophyte molds, both KOH and culture positive samples were considered positive. Also, a second sample was taken and if both KOH and culture were positive, it was considered positive. Patients with only positive direct microscopy and negative culture were excluded.

The criteria for the diagnosis of onychomycosis caused by non-dermatophyte molds was as

- a. Fungal elements seen in KOH preparation on microscopy
- b. Growth of the same mold in all duplicate culture
- c. No growth of a dermatophyte or yeast in all the cultures

When the filaments were seen on the light microscopy but showed a non-dermatophyte growth on culture, then another nail specimen was examined by light microscopy and culture to confirm nondermatophyte mold. Lacto phenol Cotton blue (LPCB) mounts were prepared in order to study the microscopic structures in details. The standard basic tests such as urease and in vitro hair perforation test were performed for the differentiation of *T. interdigitale* and *T. rubrum*.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

## RESULTS

In present study, 168 clinically diagnosed or suspicious cases of onychomycosis were studied. Most common age group was <20 years (38.69 %) followed by 21-30 years (20.24 %) and 31-40 years (13.10 %). Mean age was 33.16 ± 11.68 years. In present study male (52.98 %) outnumbered female (47.02 %). Common sites involved in study were fingers (56.55 %), Toes (27.98 %) and both (15.48 %). Unilateral (62.50 %) involvement was common than bilateral (37.50 %). Total No. of nails involved were one only (38.10 %) and 2-5 (51.79 %). Common predisposing factors were history of trauma (36.31 %), occlusive foot ware (8.93 %), diabetes mellitus (6.55 %), tinea pedis (5.36 %), steroid intake (2.38 %) and nothing suggestive (32.14%).

**Table 1: Clinical Features of Onychomycosis patients**

Characteristic	No. / %	
Age (years)		
<20	65	38.69
21-30	34	20.24
31-40	22	13.10
41-50	17	10.12
51-60	14	8.33
61-70	13	7.74
Mean $\pm$ SD	33.16 $\pm$ 11.68	
Gender		0.00
Male	89	52.98
Female	79	47.02
Sites involved		0.00
Fingers	95	56.55
Toes	47	27.98
Both	26	15.48
Side involved		
Unilateral	105	62.50
Bilateral	63	37.50
Total No. of nails involved		
One only	64	38.10
2-5	87	51.79
6-10	11	6.55
>10	6	3.57
Predisposing factors		
H/O trauma	61	36.31
Nothing suggestive	54	32.14
Occlusive foot ware	15	8.93
Diabetes mellitus	11	6.55
Tinea pedis	9	5.36
Steroid intake	4	2.38
Commercial swimming pool	4	2.38
Tinea manuum	4	2.38
Family history	3	1.79
Contact with fungal infection person	3	1.79

In present study, distal subungual onychomycosis (DSO) (66.67 %) type was most common clinical variety of onychomycosis. Other less common clinical types were endonyx onychomycosis (EO) (16.67 %), white superficial onychomycosis (WSO) (7.74 %), candida paronychia (7.74 %) and proximal subungual onychomycosis (PSO) (1.19 %).

**Table 2: Clinical pattern of onychomycosis**

Clinical types	Number of cases	Percentage
Distal Subungual Onychomycosis (DSO)	112	66.67
Endonyx Onychomycosis (EO)	28	16.67
White Superficial Onychomycosis (WSO)	13	7.74
Candida paronychia	13	7.74
Proximal Subungual Onychomycosis (PSO)	2	1.19

In present study, on detail micro-biological assessment results were, KOH positive and/or culture positive (69.05%), KOH positive culture negative (64.88%), KOH negative culture positive (18.45%), Culture positive (58.33%) and both positive (39.88%)

**Table 3: Correlation of direct microscopy with culture (n=129)**

Test procedure	Number of cases	Percentage
KOH positive and/or culture positive	116	69.05
KOH positive culture negative	109	64.88
KOH negative culture positive	31	18.45
Culture positive	98	58.33
Both positive	67	39.88

In present study dermatophytes (58.16 %) was most common type, in which *Trichophyton rubrum* (48.98 %) was most common species, followed by *Trichophyton verrucosum* (6.12 %), *Trichophyton mentagrophytes* (3.06 %). Yeast/Yeast-like (22.45 %) species were also seen and *Candida albicans* (19.39 %) was most common of them followed by *Candida parasilosis* (3.06 %). Non-dermatophyte (19.39 %) were least common and organisms found were *Fusarium sp.* (5.10 %), *Aspergillus niger* (5.10 %), *Aspergillus fumigatus* (3.06 %), *Aspergillus flavus* (3.06 %), *Alternaria sp.* (1.02 %), *Curvularia sp.* (1.02 %), *Scopuloropsis* (1.02 %).

**Table 4:** Fungal Isolates on Culture (n=98)

Diagnosis	Number of cases	Percentage
Dermatophytes	57	58.16
<i>Trichophyton rubrum</i>	48	48.98
<i>Trichophyton verrucosum</i>	6	6.12
<i>Trichophyton mentagrophytes</i>	3	3.06
Yeast/Yeast-like	22	22.45
<i>Candida albicans</i>	19	19.39
<i>Candida parasilosis</i>	3	3.06
Non-dermatophyte	19	19.39
<i>Fusarium sp.</i>	5	5.10
<i>Aspergillus niger</i>	5	5.10
<i>Aspergillus fumigatus</i>	3	3.06
<i>Aspergillus flavus</i>	3	3.06
<i>Alternaria sp.</i>	1	1.02
<i>Curvularia sp.</i>	1	1.02
<i>Scopuloropsis</i>	1	1.02

## DISCUSSION

Onychomycosis have not been extensively studied partly because it has been considered more of a cosmetic problem than a health problem.<sup>5</sup> In spite of the general awareness among people to improve personal hygiene and living conditions, this problem continues to persist and spread. The prevalence of onychomycosis increases with immunosuppression (HIV/AIDS, diabetes, use of immunosuppressive therapies, cancer chemotherapy or antibiotics), increasing age, repeated injuries on nail, poor hygiene of nails and foot including occlusive foot wears, poor peripheral circulation, repeated exposure to pathogenic fungi and increasing use of health clubs for sports, swimming pools.<sup>6</sup> Onychomycosis is caused by three groups of fungi, namely dermatophytes, nondermatophytic molds and yeasts.<sup>7</sup> Overall, dermatophytes are most commonly implicated, accounting for 90% of toenail infections and 50% of fingernail infections, and *T. rubrum* is responsible for most cases worldwide.<sup>1</sup> Dermatophytes cause 90% of toenails and 50% of the fingernail onychomycosis.<sup>1</sup> Non-dermatophyte moulds are rare, although few species are described as etiological agent of onychomycosis.<sup>8</sup> Among the dermatophytes, the most common fungi reported is *Trichophyton rubrum* followed by *T. mentagrophyte var interdigitale* and *Epidermophyton floccosum*. The non-dermatophytic fungi causing onychomycosis are *Scopulariopsis brevicaulis*, *Acremonium species*, *Aspergillus flavus* and *Aspergillus fumigatus*, *Fusarium oxysporum*, *Scytalidium dimidiatum*, *Onychocola canadensis* and *Geotrichum candidum*.<sup>9</sup> Treatment outcome depends on the treatment regime, type and degree of nail involvement and the type of infecting fungus especially the non-dermatophytes such as *Fusarium spp.* which are difficult to treat. In present

study the commonest age group affected was 16-30yrs. This increased incidence in the younger population could be because they are more often exposed to occupation-related trauma, predisposing them to onychomycosis and in addition they may also be cosmetic conscious than the older age group thereby seeking medical care.<sup>10</sup> In present study, Males (52.98 %) were affected more than females (47.02%). A higher isolation rate in males worldwide may be due to common use of occlusive footwear, more exposure to outdoor conditions, and increased physical activity, leading to an increased likelihood of trauma. The importance of trauma to the nails as a predisposing factor for onychomycosis is well established.<sup>11</sup> Attar F I *et al.*<sup>12</sup> studied 204 patients clinically suspected of onychomycosis. 38.2% were diagnosed having onychomycosis, out of them 92.3% patients were positive by direct microscopy and 57.7% by culture. In culture positive cases, isolation of dermatophytes was most common (42.2%), followed by *Candida* species (31.1%) and nondermatophytes (26.7%). Similar findings were noted in present study. In study by Asifa N *et al.*, microscopic and/or culture examination was positive in 64.34% of cases. The most common clinical type was distal lateral subungual onychomycosis in 42 (50.60%) *Candida sp.* was the most common fungal agent among yeasts, followed by *Trichophyton sp* among dermatophytes and *Aspergillus* among nondermatophytic molds. Females were affected more than males and fingernails were affected more frequently than toenails. Similar findings were noted in present study. Ashokan C *et al.*<sup>14</sup>, noted that females (67.3%) were more commonly affected than males (32.7%). The most common age group affected was 20-40 years(47%). Majority of patients demonstrated both finger and toe nail involvement (43.6%). Distal and lateral subungual onychomycosis

(55.4%) was the most common clinical variant of onychomycosis identified in our study. Out of the 101 patients in our study, 86 demonstrated a positive fungal growth on culture. Non-dermatophyte moulds (NDM) (58.1%) were the most common fungal isolate followed by *Candida* species (36%) and dermatophytes (5.8%).

Gupta M *et al.*, studied 130 patients (M:F 98:32), between 8-76 years of age (mean  $41.35 \pm 14.98$  years). The prevalence of onychomycosis was higher among farmers and office workers (20% each). Finger or toe nails were exclusively involved in 56.9 and 32.3% patients respectively while these were involved concurrently in the rest of the 10.8% patients. Distal and lateral subungual onychomycosis seen in 73.1% of the specimens was the most common clinical type. KOH- and culture-positivity were recorded in 59.2 and 37.6% cases respectively. Dermatophytes and yeast (*Candida albicans*) were isolated in 40.8% each of the cultured nail specimens while nondermatophytic molds (NDM) were cultured in 18.6% of the samples. Various dermatophytes cultured were *Trichophyton rubrum* (32.6%), *T. mentagrophytes* (6.1%) and *T. verrucosum* (2.1%) respectively. *Aspergillus* spp. (6.1%) was the most commonly isolated NDM while other detected molds were *Acremonium* spp., *Fusarium* spp., *Scopulariopsis* spp., *Curvularia* spp. and *Penicillium marneffei*. Peripheral vascular disorders (7.69%), occupational trauma (13.8%), close association with animals (60.78%) and a family history of onychomycosis (26.15%) were a few of the predisposing factors identified. In study by Borah N *et al.*,<sup>16</sup> maximum number of OM cases belonged to the age group 21-30 years with a male preponderance (M:F=1.7:1). The commonest clinical type of OM was distal lateral subungual onychomycosis (DLSO) (51%). Toe nails OM was the most common presentation (54%). Trauma (35%) was the most common predisposing factor. Farmers (23%) were found to be the most commonly affected group. Non-dermatophyte moulds (NDM) accounted for 38(47.5%) of OM cases followed by yeast 27(33.8%) and dermatophytes 15(18.8%). Both clinical and mycologic examinations are important for establishing the diagnosis and selecting the most suitable antifungal agent, which is possible only if the underlying pathogen is correctly identified. The clinico-epidemiological data can be helpful for creating public awareness and for the development of diagnostic, preventive and treatment strategies.

## CONCLUSION

In present study, dermatophytes were the most common aetiological agents of onychomycosis and the combined sensitivity of direct microscopy and culture was greater

than those of direct microscopy and culture alone. Distolateral subungual onychomycosis was the common clinical pattern.

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