

## Original Research Article

# Onychomycosis in onychodystrophy: a hospital-based clinico-mycological study

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### ABSTRACT

**Background:** Onychomycosis and onychodystrophy are both characterised clinically as disruption of nail plate characterised by thickening, disfiguration and discolouration. Onychomycosis in onychodystrophy is a diagnostic challenge. Similarly, onychodystrophy could also be treated unwarrantedly for fungus. Hence this study was carried out to determine the prevalence of onychomycosis in patients with onychodystrophy and to study the risk factors associated with the same.

**Methods:** This descriptive study was done in 50 patients with onychodystrophy attending DVL OPD in a tertiary care hospital. After getting informed consent the nails were cleansed with absolute alcohol and nail clipping was taken for KOH and culture. The results were entered in a master sheet and analyzed.

**Results:** Onycholysis, onychomadesis, chromonychia, thickened nail plate and loss of cuticle were the common features observed. Culture from 13/50 (26%) patients were found to be positive for fungal growth. In 13 patients with onychomycosis, 5 patients belonged to more than 50 years, seven patients (53.8%) were housewives. Three patients with onychodystrophy had psoriasis of which 2 (15.4%) patients proved positive for onychomycosis. *Aspergillus niger* 10 (76.9%) was the most common organism followed by *Rhizopus* 2 (15.4%) patients and 1 (7.7%) patient with *Geotrichium candidum*.

**Conclusions:** We concluded that prevalence of onychomycosis in patients with onychodystrophy was 26%. Male gender, age >50, household activities and wetworks were associated risk factors of onychomycosis. Since clinical diagnosis of onychomycosis in onychodystrophy is difficult, appropriate lab investigations like KOH mount and fungal culture should be made mandatory to enable better patient care and clinical outcome.

**Keywords:** Onychodystrophy, Onychomycosis, Nail dystrophy

### INTRODUCTION

Onychomycosis is a term used to describe fungal infection of one or more of the nail units. It can be caused by dermatophytes, yeasts or non-dermatophyte moulds (NDM).<sup>1</sup> It is found that it affects approximately 5% of the world population. It accounts for 20-40% of all the

nail diseases and about 30% of fungal cutaneous infections.<sup>2,3</sup> Various studies conducted among the Indian population have reported the incidence of onychomycosis to vary from 0.5 to 5%.<sup>1</sup> NDM like *Aspergillus* species, *Fusarium*, *Acremonium* which were earlier considered as contaminants are being increasingly proven to be the primary pathogenic organism in various studies.<sup>4</sup>

Onychodystrophy is the partial or complete disruption of the nail plate. There are several underlying aetiology for onychodystrophy such as fungal and non-fungal infections, non-infectious inflammatory conditions, systemic diseases, trauma, drugs and rarely tumors.<sup>5</sup> Studies show that trauma is the most common cause of onychodystrophy.<sup>6</sup>

Onychomycosis can be differentiated from other conditions causing onychodystrophy by obtaining nail material for microscopic examination and culture.<sup>2</sup> Factors like age, occupation, H/O trauma and comorbidities like diabetes mellitus and immunosuppression should be considered.

Onychodystrophy is often empirically treated as onychomycosis with antifungals due to its clinical similarities.<sup>3</sup> This could warrant various adverse effects arising from antifungal therapy which is often administered for prolonged duration and also adds to unnecessary economical burden. Rampant usage of antifungals could further lead to antifungal resistance.<sup>7</sup> Hence this study was carried out to identify the prevalence of onychomycosis among the patients with onychodystrophy and to study the risk factors associated with it.

## METHODS

This was a hospital-based descriptive observational study, which was conducted at a tertiary care hospital in Pondicherry. After approval by the institutional human ethics committee, every consecutive patient with onychodystrophy attending DVL OPD over a period of 18 months from April 2019 to September 2020 who agreed for a written informed consent was taken into the study. Based on the prevalence in previous studies, the sample size was calculated to be 50 patients.

Fifty consecutive patients with discolouration and disruption of nail plate involving one or more finger/toe nails were included in the study, whereas patients with congenital nail diseases and those who were treated for nail fungal infection in the past 6 months were excluded. After obtaining informed consent, all patients who satisfied the inclusion criteria were subjected to thorough history and clinical examination. Clinical photographs of the affected nails were taken. 2 nail clippings of approximately 5×2 mm were taken from the dystrophic nails with the help of a sterile nail clipper. Patients were counselled and advised to review after 1 month for further management. A portion of the nail clipping was placed on a glass slide and few drops of 40% KOH added over it, covered with a cover slip and examined under microscope for hyphae, spores or yeast forms after half an hour. Nail clippings were sent to the department of microbiology for mycological study. Culture was done in Sabourauds dextrose agar in duplicate tubes. The inoculated tubes were incubated at 25°C and another at 37°C and observed daily for fungal growth for a period of

upto 6-8 weeks. Microscopic examination of fungal growth observed in SDA were performed by lactophenol cotton blue mount and slide culture was done to identify filamentous fungi. Gram staining was done for yeast and yeast-like colonies grown in SDA. To differentiate *Candida albicans* from non albicans *Candida*, chlamydo-spore formation and germ tube tests were carried out. No growth even after 4 weeks was considered as negative. If NDMs were grown, culture was repeated to exclude contamination.<sup>8</sup> Positive findings in either KOH mount or culture was considered as positive for onychomycosis and the patient was treated with antifungals during follow-up.

All data obtained was entered into a data collection proforma sheet and digital master sheet, using microsoft excel (MS excel 2010). Statistical analysis was carried out using SPSS version 22.0 (IBM SPSS, US) software. Categorical variables were reported as frequency and percentage. Statistical association was analyzed using chi-square test. For continuous variables non-parametric test such as Mann-Whitney U test was used for statistical analysis.  $p < 0.05$  was assumed as statistically significant in our study.

## RESULTS

Fifty patients with finger or toe nail onychodystrophy who fulfilled the inclusion and exclusion criteria were enrolled in the study which included 23 (46%) males and 27 (54%) females. Culture from 13 (26%) patients were found to be positive for fungal growth.

With regard to the epidemiological characteristics (Table 1), of the 13 (26%) patients who had positive fungal culture, 7 (53.8%) were males and 6 (46.2%) were females. 3 out of 13 patients (23%) were in the age group <30 years, 5 (21%) in the age group between 31 and 50 years and 5 (35%) patients were in the age group >50 years. Majority (7) were housewives who accounted for 53.8%, followed by 3 agricultural workers (23.1%) and 3 others were skilled worker, small business owner and professional, 1 each (7.7%).

Out of the 50 patients, 4 patients were diabetic, 2 patients were hypertensive, 1 patient had both diabetes and hypertension and 1 patient was an asthmatic on inhalational steroids for a long time. 11 out of 13 (84.6%) patients who tested positive for fungal culture did not have any comorbidities, 1 patient (7.7%) was a diabetic and 1 patient (7.7%) was an asthmatic on inhalational steroids for a long time. 10 patients in the study population had skin diseases like psoriasis, psoriatic arthritis, *Lichen planus*, *Tinea corporis*, hand eczema and chronic paronychia of which 2 (15.4%) with psoriasis, 1 (7.7%) with *L. planus*, *T. corporis* and chronic paronychia each had onychomycosis.

Toe or fingernails were involved in 5 (38.5%) patients each and both finger and toe nails were involved in 3

(23.1%) patients. 5 (38.5%) patients had unilateral and 8 (61.5%) patients had bilateral toe or finger nail onychomycosis. In the patients with onychomycosis, 7/13 (53.8%) patients had nail changes for 6 or <6 months duration, 2 (15.4%) patients had nail changes for 7 to 12 months duration and 4 (30.8%) had nail changes for 1 to 2 years.

In our study, 13 (26%) out of 50 patients showed positive fungal culture. However only 1 (7.7%) patient had positive findings in KOH mount and microscopy. The culture showed 10 (76.9%) patients with *A. niger*, 2 (15.4%) with *Rhizopus* and 1 (7.7%) patient with *G. candidum* (Table 2). Of the 13 patients with positive fungal culture, 12 (92.3%) patients had onycholysis and 1 (7.7%) had onychomadesis. One patient in the study population presented with trachyonychia and had positive fungal culture. All the 13 patients were found to have loss of cuticle, chromonychia and thickened nail plate.



**Figure 1: Bilateral toenail dystrophy with negative fungal culture.**



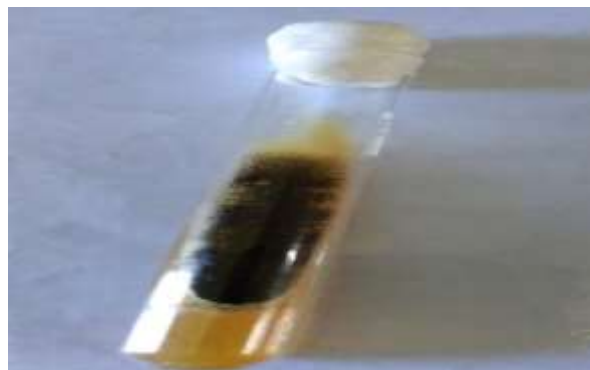
**Figure 2: Bilateral toenail dystrophy with negative fungal culture.**



**Figure 3: Bilateral fingernail dystrophy with negative fungal culture.**



**Figure 4: Isolated toenail dystrophy with positive fungal culture.**



**Figure 5: Growth of *A. niger* on SDA medium.**



**Figure 6: LPCB mount of *A. niger*.**

**Table 1: Demographic profile in onychomycosis.**

Variables		Negative (%)	Positive (%)	P value
<b>Gender</b>	Male	16 (43.2)	7 (53.8)	0.50
	Female	21 (56.8)	6 (46.2)	
<b>Age group</b>	<30 years	10 (27.0)	3 (23.0)	0.61
	31-50 years	18 (48.6)	5 (38.4)	
	>50 years	9 (24.3)	5 (38.4)	
<b>Occupation</b>	Housewife	13 (35.1)	7 (53.8)	0.60
	Agricultural worker	5 (13.5)	3 (23.1)	
	Others	19 (51.3)	3 (23.1)	



**Figure 7: Fingernail onychodystrophy with positive fungal culture.**



**Figure 8: Isolated toenail onychodystrophy with positive fungal culture.**

**DISCUSSION**

Our study was done to find out the prevalence of onychomycosis in patients with onychodystrophy attending DVL OPD. The study included 50 patients with onychodystrophy involving one or more finger or toe nails, of which 13 patients showed positive findings in fungal culture and 1 patient showed positive findings in both KOH mount and culture. The culture showed 10

patients (76.9%, p value 0.01) with *A. niger*, 2 patients (15.4%) with *Rhizopus* and 1 (7.7%) patient with *G. candidum* (Table 2).

**Table 2: Organisms grown in culture.**

Organisms grown	Number of patients	Percentage
<i>A. niger</i>	10	76.9
<i>Rhizopus</i>	2	15.4
<i>G. candidum</i>	1	7.7
<b>Total</b>	13	100

Hence in our observation, *A. niger* was the commonest organism causing onychomycosis in dystrophic nails. This was similar to a study conducted by Borah et al in Assam where out of 100 suspected cases of onychomycosis, NDM (47.5%) was the commonest etiological agent.<sup>4</sup> Similarly, in a study conducted by Shenoy et al in 101 patients with clinically diagnosed onychomycosis, 63% of the culture positive cases were NDM, out of which *Aspergillus* was the most common isolate.<sup>9</sup> NDMs which were earlier considered to be pure contaminants are increasing proven to be primary causative agent of onychomycosis.<sup>7-9</sup> This could be due to the environmental change and the predisposing factors.<sup>4</sup> Other NDMs causing onychomycosis are *Scopulariopsis berricaulis*, *Aspergillus terreus*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Absidia*, *Rhizopus*, *Acremonium*, *Fusarium*, *Penicillium*, *Mucor*, and *Scytalidium dimidiatum*.<sup>4,10</sup> No specific relationship was observed between the fungal species, comorbidities or associated skin diseases in our study.

From our study, the prevalence of onychomycosis was found to be 30.4% in males and 22.2% in females. A slightly high prevalence of onychomycosis in males in our study could be attributed to the working pattern in the lower socioeconomic group which included barefoot walking. Prolonged contact with moisture among farmers and daily labourers and also increased perspiration among skilled workers and professionals owing to prolonged wearing of shoes could also be the attributing factors.<sup>11</sup> Among the females, onychomycosis is commonly prevalent in housewives and this could be explained by the fact that wet environment favours fungal growth.<sup>12</sup>



This study included any patient with onychodystrophy >12 years of age. Our study findings showed that onychodystrophy in patients greater than 50 years of age is most probably associated with onychomycosis. This finding is in concordance with the study conducted by Adekhandi et al in India in which they concluded that onychomycosis was more common with people >40 years of age and discordant with a study in which they conducted by Kumar et al in Rajasthan in which they concluded that onychomycosis was common in the middle age group (31-40 years) due to their working environment involving prolonged contact with moisture.<sup>13</sup>

Also from our study, onychomycosis was more common in patients presenting with onychodystrophy for ≤6 months duration. All the 50 patients with onychodystrophy were found to have loss of cuticle, chromonychia and thickened nail plate out of which only 13 were culture positive. Hence, we found that it is quite difficult to diagnose onychomycosis in a dystrophic nail which shares similar clinical characteristics. KOH and fungal culture should be done in patients with onychodystrophy so that onychomycosis does not go undiagnosed. Identification of the cause of onychodystrophy and the correct etiologic agent in onychomycosis can definitely improve the patient's treatment profile. However, it was not possible to identify if onychomycosis was the primary cause of onychodystrophy or a secondary colonization.

### Limitations

The limitations of the study were that the histopathology could have been considered as an additional investigation but was not done considering it to be less specific. A larger sample size could have added more relevance to the study.

### CONCLUSION

Based on our observation, we conclude that the prevalence of onychomycosis in patients with onychodystrophy was 26%. Factors like male gender, age >50, household and wet works are associated risk factors of onychomycosis. NDM, *A. niger* was the commonest fungal organism isolated from dystrophic nails. It is clinically cumbersome to diagnose onychomycosis in dystrophic nails. Hence KOH and microscopy should be routinely done to diagnose onychomycosis in all patients presenting with onychodystrophy. Since KOH is less sensitive, fungal culture should be made mandatory. This helps in starting the correct antifungal spectrum relevant to the etiologic organism. Initiation of antifungal therapy in all cases of onychodystrophy could also be prevented by a KOH mount and fungal culture thus reducing the complications of unwarranted antifungal therapy and also the financial strain. This also helps to differentiate between treatment failure in onychomycosis and an incorrect diagnosis of onychodystrophy. Other causes of

onychodystrophy if identified, should be treated accordingly. NDM which were considered only as contaminants may also be considered as the primary causative agent in cases of onychomycosis.

### Recommendations

Community-based studies should be done involving individual groups of people with similar comorbidities, dermatological conditions and age group so as to avoid bias in prevalence rate according to the group. Considering the false negative results in KOH and culture, PCR should be considered.

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