A Study of Onychomycosis at a Tertiary Care Hospital in Eastern Bihar

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Abstract

Background: Onychomycosis (OM) is a major public health problem which is increasing worldwide. It is associated with high morbidity and causes physical, psychological, and occupational problems in patients. Aims: This study aims to study the pattern of etiological agents, clinical features, and severity assessment of OM in this part of India. Materials and Methods: Sixty eight clinically suspected patients with positive potassium hydroxide and fungal culture were studied. Results: Males were infected more often than females (1.61:1). The most common age group affected was 21–40 years. Finger nails were affected more frequently than toe nails. Distal and lateral subungual OM was the most common (48 cases, 70.59%) clinical pattern. For most of the patients (66.18%), nail involvement was severe. Discoloration was the most common (67 cases, 98.53%) change, followed by subungual hyperkeratosis (51 cases, 75%). Principal causative agents were dermatophytes (55 cases, 80.88%) with Trichophyton rubrum being the most common one (35 cases, 51.47%). In 9 (13.23%) cases, Candida albicans, in 6 (8.82%) Aspergillus niger and in 1 (1.47%) case Acremonium sp. (AC) have been isolated as the sole causative agent. In 2 (2.94%) cases, mixed infection with dermatophyte and Aspergillus and in 1 (1.47%) case dermatophyte and Candida were noted. Conclusion: Although dermatophytes were the most common causative agent of OM, nondermatophytic molds, and yeasts were also encountered. The genus and species identification helps in the proper diagnosis and management. Morphological changes in nail may help in presumptive diagnosis of OM.

Key Words: Fungal culture, onychomycosis, potassium hydroxide, Trichophyton rubrum

Introduction

The term onychomycosis (OM) is derived from the Greek word onyx meaning nail and mykes meaning fungus.[1] It describes fungal infection of the nail caused by dermatophytes, yeasts, or nondermatophytic molds.[2] It constitutes 50% of all nail-related diseases.[3] Till the late 1990, OM was not in the limelight as an important health problem and is getting focussed only in the last decade.[4] At present, the worldwide incidence of OM is increasing and the prevalence rate ranges from 2% to 50%.[5] A number of factors contribute to the occurrence of this disease, namely, the age, sex, occupation, chronic health problem, immunity of the patient, type of footwear used, bathing in communal swimming pool, procedure of trimming nail, climatic condition, frequency of travel, etc.[6,7] OM can be caused by dermatophytes, yeasts (Candida albicans [CA]) and nondermatophytic molds (Aspergillus [AC], Fusarium, Onychchola canadensis, Scopulariopsis brevicaulis, Scytalidium dimidiatum). Dermatophytes are the most common agent and among them Trichophyton rubrum (TR) and Trichophyton mentagrophytes (TM) constitute 90% of toenail and 50% of finger nail infections.[8] Clinically, OM can be classified into distal and lateral subungual OM (DLSO), proximal subungual OM (PSO), white superficial OM (WSO), and total dystrophic OM (TDO).[9] Endonyx and mixed patterns of OM have also been described.[10] Nail changes associated with OM are onychodystrophy, onycholysis, subungual hyperkeratosis, discoloration, thickening of nail plate, etc. However, these changes are not specific of fungal infection. Similar changes are also observed in psoriasis, lichen planus, and following trauma.[11] Therefore, mycological examinations (direct microscopy...
Materials and Methods

This study was carried out over a 13 months period from February 2015 to February 2016 in a tertiary care hospital in eastern Bihar, after obtaining institutional ethical committee clearance. One hundred and fifty-two patients with clinical suspicion of fungal nail infection, attending the dermatology outpatient department were subjected to mycological investigations in the Department of Microbiology of this hospital after obtaining written informed consent from them. Out of them, 68 (44.73%) patients showing positive results with both KOH and fungal culture were included in the present study. Detailed histories were taken from the patients regarding age, sex, occupation, education, associated comorbidities, method of trimming nail, and history of trauma. Elaborate clinical examinations were made regarding the site of nail involvement, the number of involved nails, the type of involvement, morphological changes, and also any associated dermatological disorder. The severity of nail involvement was assessed by OM severity index (OSI).\(^1\)\(^2\) The OSI score is obtained by multiplying the score for the area of involvement (range 0–5) by the score for the proximity of disease to the matrix (range 1–5). Ten points are added for the presence of a longitudinal streaking or a patch (dermatophytoma) or for >2 mm of subungual hyperkeratosis. Patients who gave a history of intake of systemic antifungal or use of topical antifungal within the last 6 months were not included in the study. For sample collection, the affected nail was first cleaned with 70% alcohol to remove contamination and then nail clipping was done, and scrapings were collected from the distal portion of the nail plate, the nail bed and undersurface of the nail with the help of sterile scalp blade. In case of multiple nail involvement, the nail that was most severely affected was selected for sample collection. A portion of each sample was subjected to direct microscopic examination using 20% KOH and the remaining portion was put to culture in both Sabouraud Dextrose Agar (SDA) and SDA with chloramphenicol and cycloheximide. The culture tubes were put to incubation at 25°C in biological oxygen demand and were observed for 6 weeks period for the presence of growth before being discarded as negative. The growth on primary culture tubes was subjected to slide cultures on Corn Meal Agar for detailed morphological identification to species level. The colony character, surface color, color on reverse, and presence of any diffusible pigment were also noted from the primary culture tubes. Urease test and hair perforation test were also done for the identification of dermatophytes. For confirmation of yeast to species level germ tube test and color production on Chromagar candida media were also used. To report a nondermatophytic fungus as the causative agent, a combination of a positive direct microscopic finding was correlated with isolation of same fungus in a second sample that was collected from the patient some days later.

Results

Among 152 clinically suspected cases of OM, 92 (60.52%) patients showed positive results with KOH. Out of them, 68 showed positivity in culture and were included in this study. Male outnumbered female, the number is 42 (61.76%) and 26 (38.23%), respectively. Age of the patients in this study ranged from 12 to 75 years with a mean (±SD) of 38.85 (±15.22) years. Majority of the patients belonged to 21–40 year age group (54, 79.4%). Only 17 (25%) patients were literate. Majority of our patients (85.29%) were from rural background. Regarding the occupation, 22 (32.35%) patients were farmer, 19 (27.94%) housewife, 18 (26.47%) laborer, and 9 (13.23%) were student. All the patients belonged to the below poverty line income group. Family history of fungal infection was there in 2 patients. There was history of trauma over the involved nail in five patients. Ten patients gave a history of repeated contact with detergents. Majority (75%) of the patients were used to wearing chappal. Sixteen patients gave a history of trimming nail with barber and the rest used to do self-trimming. Associated comorbidities were as follows –12 patients had diabetes, two had hypertension. Paronychia was the most common (20 cases, 29.41%) associated cutaneous finding, followed by dermatophytic infections of palms, soles or other areas (16 cases, 23.53%). Other associated skin disorders were dermatitis (5 cases, 7.35%), psoriasis (2 cases, 2.94%) and leprosy (1 case, 1.47%).

Fingernails were more commonly affected than toe nails. The sites of involvement are shown in Table 1. Majority of our patients (48 cases, 70.59%) had DLSO [Figure 1] and eight (11.76%) had TDO [Figure 2] as sole clinical pattern. Twelve patients (17.65%) had mixed types. Among them, ten patients (14.71%) had both DLSO and TDO types in their nails, one patient (1.47%) had both

| Site(s) involved       | n (%)     |
|------------------------|-----------|
| Left hand              | 12 (17.64)|
| Right hand             | 10 (14.70)|
| Left foot              | 5 (7.35)  |
| Right foot             | 5 (7.35)  |
| Both hands             | 12 (17.64)|
| Both feet              | 22 (32.35)|
| All hands and feet     | 2 (2.94)  |
| Total                  | 68 (100)  |
DLSO and WSO [Figure 3], and one (1.47%) had both TDO and WSO patterns. We did not find any cases of PSO or endonyx type. The distributions of the types are shown [Table 2].

We selected the most severely involved nail for the assessment of grading by OSI. According to this scoring, 45 patients (66.18%) had severe OM (score 16–35). Moderately (score 6–15) affected nails were seen in 19 patients (27.94%) and the remaining four patients (5.88%) had mild (score 1–5) nail involvement.

Color change of nail plate or nail bed, the most common change, was seen in all but one patient (98.53%). Single or mixed discoloration was seen in different nails of them. Brownish pigmentation (40 cases, 58.82%) was the most common among these. Apart from the color change, subungual hyperkeratosis was the most common structural change (75%) followed by distal onycholysis (52.94%), total nail plate dystrophy (27.94%), partial nail plate dystrophy (23.53%), nail plate thickening (19.12%), transverse ridges (16.18%), nail plate thinning (11.76%), and longitudinal ridges (8.82%) [Table 3].

Of the causative agents, sole infection by dermatophytes [Figure 4] was identified in 52 (76.47%) patients, yeast (CA) in 8 (11.76%) [Figure 5], nondermatophytic molds including *Aspergillus niger* (AN) in 4 (5.88%) patients and AC in 1 (1.47%) patient [Figure 6]. Among the dermatophytes, 35 (63.63%) patients had TR infection, and 20 (36.36%) had TM infection. Mixed infections were found in 3 (4.41%) patients – one had yeast (CA) and dermatophyte (TR) infection and the...
other two had dermatophyte and nondermatophyte mould infection (AN and TR, AN and TM). The various types of isolates are shown [Table 4].

Among the sole isolates (65 cases), 44 patients had severe nail involvement, and the rest (21) had mild-to-moderate involvement. Dermatophytes were isolated in 36 patients with severe disease and in 16 cases with mild-to-moderate involvement. Remaining cases in these groups had nondermatophyte isolates. Statistical analysis failed to show any significant correlation between the severity of the disease and the type of mycological isolates.

Discussion

OM is a major public health problem. Because of the existence of many diseases with high mortality and morbidity, people especially of developing countries are unaware of OM which is not life-threatening. However, it has a significant impact on the social, emotional, and occupational life of the patient.

In our study, 44.73% of the clinically suspected patients showed positive results both in KOH and culture. This is at par with findings from many places, for example, 43.7% in Poland, 50.6% in Turkey, and 45.53% in some other parts of India. The male preponderance seen in our study was also noted in other studies from India. In our study, young adults, and middle-aged people were mostly affected (mean age 38.85 years) similar to that mentioned in other studies. Majority of our patients (70.59%) had DLSO type of OM as also described in other studies from India. A considerable number (17.65%) of our patients had multiple nail involvement with different types or overlapping features, we also looked for the color and structural changes of the affected nails. Color change was the most common (98.53%) nail change. Subungual hyperkeratosis (75%), distal onycholysis (52.94%), and nail plate dystrophy (51.47%) were common structural changes. These features, as well as nail plate thickening were also previously described in an Indian literature. In addition, nail plate thinning and transverse or longitudinal ridges were also found in our study. Although these morphological changes are not specific for OM, they can be helpful to suspect those cases. We assessed the severity of nail involvement and found that most of our patients (66.18%) had severely affected nails which definitely needed long-term antifungal therapy. Dermatophytes have been identified.
as the major cause of OM constituting 80.88% of the cases in which TR has been identified in 51.47%. Similar result has been obtained worldwide and also from India.[16,22,23] Candida sp.[14,24] and AN[25] have been found as the main causative agents in some studies. However, in our study, 13.23% patients had CA only as causative fungus, and 8.82% had AN as the only causative agent.

Severity of nail involvement failed to show any significant correlation with the etiological agent.

Conclusion

Morphological changes of nails, though many are nonspecific, may be helpful to suspect a case of OM. However, mycological identification of clinically suspected cases of OM should be done for genus and species level identification for confirmation of diagnosis and also to provide appropriate treatment to the patient. A continuous monitoring for the change in etiological agent should be carried out. The severity of each case should also be assessed for the therapeutic purpose.

In this study, due to absence of control group, we could not establish the significance of morphological nail changes with mycological findings.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

Table 4: Mycological types of isolates

| Type                  | Solo (n) | Mixed (n) | Total (n) |
|----------------------|----------|-----------|-----------|
| Dermatophyte         |          |           |           |
| TR                   | 33       | 2         | 35        |
| TM                   | 19       | 1         | 20        |
| Yeast                |          |           |           |
| CA                   | 8        | 1         | 9         |
| Nondermatophytic mould |         |           |           |
| AN                   | 4        | 2         | 6         |
| AC                   | 1        | 0         | 1         |

TR: Trichophyton rubrum, TM: Trichophyton mentagrophytes, CA: Candida albicans, AN: Aspergillus niger, AC: Acremonium sp.

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