Onychomycosis in eastern Nepal

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ABSTRACT

Onychomycosis, a fungal infection of the nail is responsible for up to 50.0% of all nail diseases. Though, dermatophytes are most frequently implicated as the causative agents in onychomycosis, yeast and molds are increasingly recognized as causative pathogens. This study was aimed to know the clinical and mycological pattern of onychomycosis in eastern Nepal. Eighty-two clinically diagnosed patients of onychomycosis attending the Dermatology Outpatient department of a tertiary hospital over a period of one year were enrolled in this study. Clipping from the severely affected nail and skin scrapping from active border of the skin lesions if associated were collected from each patient and subjected to microscopy and culture for identification of fungi. The commonest affected age group was 21-40 years. The male: female ratio was 2.7:1. Fifty-one patients had isolated fingernail involvement, while involvement of toenails was seen in 15 patients. Distolateral subungual onychomycosis (67%) was the commonest clinical type followed in decreasing order by superficial white onychomycosis (14.6%), proximal subungual onychomycosis (9.8%), candidal onychomycosis (7.4%) and total dystrophic onychomycosis (1.2%). *Trichophyton mentagrophytes* (28.8%) was the most common pathogen isolated followed by *Trichophyton rubrum* (21.2%), *Trichophyton tonsurans* (11.5%), *Candida albicans* (11.5%), *Trichospron beigelii*, (9.6%), *Epidermophyton floccosum* (7.7%), *Trichophyton violaceum* (5.8%), and *Aspergillus flavus* (3.9%). Distolateral subungual onychomycosis was the most common clinical presentation and *T. mentagrophytes* and *T. rubrum* were the most frequently isolated fungi for onychomycosis in eastern Nepal.

Keywords: Onychomycosis, Clinico-mycological, Eastern Nepal

INTRODUCTION

Onychomycosis refers to a common fungal infection of fingernails and toenails, caused by three groups of fungi, namely dermatophytes, nondermatophyte molds and yeasts.[1,2] It may occur as primary onychomycosis caused by nail pathogens that invade the healthy nail plate, or represent a secondary invasion of nail with pre-existing disease. It represents up to 50.0% of onychopathies and about 30.0% of all mycotic cutaneous infections.[3] The incidence of onychomycosis varies from 3.0% to 5.0% and it may reach up to 20.0% in miners, sportsmen etc.[4] Clinically, onychomycosis is classified into distolateral subungual onychomycosis (DLSO), superficial white onychomycosis (SWO), proximal subungual onychomycosis (PSO), candidal onychomycosis (CO) and total dystrophic onychomycosis (TDO).[5]

The etiological agents of the disease may show geographic or temporal distribution.[5,6] Dermatophytes are the most frequently implicated causative agents in onychomycosis. A number of species of nondermatophyte molds and candida are now increasingly recognized as the causative organisms of onychomycosis.[3,7,8] This study was undertaken to know the clinical and mycological pattern of onychomycosis in eastern Nepal.

MATERIALS AND METHODS

This cross sectional study was carried out in the department of dermatology, B.P. Koirala Institute of Health Sciences, Dharan, Nepal, over a period of one year. Eighty-two clinically diagnosed cases of onychomycosis constituted the study population. Patients on systemic anti-fungal therapy within the last six weeks or topical anti-fungal therapy within the last 1 week were excluded. The demographic

data, detailed history, predisposing factors, family history, clinical examination, and investigations were recorded in a preset proforma. The clinical diagnosis of the disease was classified as follows: (1) DLSO if there was onycholysis, discoloration, subungual hyperkeratosis, and nail thickening affecting the distal and /or lateral nail plate; (2) PSO: if discoloration and onycholysis affected the proximal part of the nail; (3) SWO: when white opaque spots were seen on the nail surface; (4) CO: when there was paronychia and lateral onycholysis, distal and lateral onycholysis without paronychia or total nail dystrophy due to candida; (5) TDO: if there was involvement of the entire nail bed and nail plate. Clipping from the severely affected nail and skin scrapping from active border of the skin lesions if associated were collected from each patient. All the samples were dissolved in 10.0% potassium hydroxide (KOH) overnight and subjected to direct microscopy and fungal culture. For culture, the specimen was inoculated on Sabouraud's dextrose agar with 0.05% chloramphenicol and 0.5% actidione at 28^0C. The tube was examined for growth of fungi every week for up to 6 weeks. Macroscopic characteristic such as form, texture and color of the colony were observed. Identification of dermatophytes, nondermatophyte molds and yeast up to species level from culture growth was done on Lactophenol cotton blue mount (LPCB) by examination of micro and macro aleurospore, chlamydospore, arthrospore, special hyphae (bizarre hyphal branching, pectinate hyphae etc). Slide culture was performed whenever strain could not be identified by the above procedure (9). Nondermatophyte molds and yeasts were considered to be significant using the criteria suggested by English (10) that is positive microscopy and repeated cultures with isolation of the same fungus on three different occasions at an interval of 7 days.

The data were entered in the computer for tabulation and to test the significance, Chi-square test was applied and P value of < 0.05 was considered to be significant.

RESULTS

The demographic data of the 82 onychomycosis patients are shown in Table-1. Male outnumbered females (2.7:1, $P< 0.05$). The commonest affected age group was 21-30 years followed by 31-40 years with a total mean age 35.5 ± 13.9 years. The youngest patient was 7 years old female while the oldest was 68 years old male. A survey of patients according to geographical distribution found that 54.8% of patients were from Sunsari district and the rest were from other districts of eastern Nepal. Onychomycosis was seen in all the occupation groups. However, farmers were the commonest affected group followed by office workers, housewives and students. The duration of the disease was less than 1 year in 30.0%, 1 year to 2 year in 40.0% and more than 2 year in 30.0%. A positive family history was obtained in 4.8% of cases. Only 3 patients had associated diabetes mellitus. Approximately forty-four percent patients reported wearing occlusive footwear. A history of frequent exposure with water during works was recorded in 68.3% patients and it was statistically significant among females. Three patients had history of receiving immuno-suppression drugs.

Table-2 shows morphology of nail lesion. Discoloration of nail and subungual hyperkeratosis were the common presentation in this study. Fifty-one patients had fingernail involvement alone, while 15 showed toenails involvement only. Sixteen cases had both finger and toe nail involvement. The number of nails involved ranged 1-18 with an average of 3 nails. Clinical types and sites of involvement are shown in Table-3. Distolateral subungual onychomycosis (DLSO) was the most common clinical presentation (67.0%) followed by superficial white onychomycosis (14.6%), proximal subungual onychomycosis (9.8%), candidial onychomycosis (7.4%) and total dystrophic onychomycosis (1.2%).

Of the 82 patients with clinical onychomycosis, both KOH and culture positivity were seen in 42 patients (51.2%), positive KOH alone in 30 patients (36.6%) and culture alone in 10 patients (12.2%). The overall direct microscopy of nail in KOH preparation revealed fungi in 72 patients (87.8%) and the fungi was identified on culture in 52 (63.4%) cases.

The various isolated fungi are shown in Table-4. Dermatophytes (75%) were the most common fungi isolated followed by yeasts (21.2%) and nondermatophytes (3.8%). Among the dermatophytes (39/52) isolated, the species according to decreasing order of frequency were *T. mentagrophytes* (28.8%), *T. rubrum* (21.2%), *T. tonsurans* (11.5%), *E. floccosum* (7.7%), and *T. violaceum* (5.8%). Among the yeasts (11/52), *candida albicans* (11.5%) and *Trichosporon beigelii* (9.6%) were isolated. Nondermatophyte molds (2/52) caused infections of the nails in 3.9% and *Aspergillus flavus* was the

only isolate identified in this group. Dermatophyte onychomycosis was seen more in male patients whereas candidal onychomycosis in female patients (Table-5).

The correlation between various clinical types and isolated fungi is depicted in Table-6. Associated fungal infection at other sites was noted in 26 cases of onychomycosis; tinea manuum (30.8%) was the most common association followed by tinea corporis (26.9%), tinea pedis (23.1%), mixed (15.4%) and tinea cruris (3.8%). A total of 3 different dermatophyte species were isolated from these sites. These were *T. mentagrophytes*, *T. rubrum* and *T. tonsurans*. The species isolated from the specimens taken from nail and other sites were same.

DISCUSSION

Now a day, there has been a noticeable worldwide increase in the incidence of onychomycosis. The disease can occur at any age, but is more common between 40 to 60 years of age.[6,11,12] In contrast to this commonly affected age group, the majority of our patients were between 21-40 years. This is in accordance with the reports by Vinod *et al* [13] and Roberts *et al*.[14] The increased incidence in younger age group could be because they are more often exposed to occupation related trauma, predisposing themselves to onychomycosis. They may be more concerned cosmetically than the older age group. There was only one child in the present study. This highlights that the disease is unusual prior to puberty.[6] The low prevalence in children may be due to a difference in nail plate structure, a lack of cumulative trauma, and increased growth rate of the nails with subsequent elimination of the fungus. Various studies have shown no sex predilection in the prevalence of onychomycosis.[14-17] The predominance of male was observed in the present study. This observation is also in agreement with other reports,[11,13] but contrast to the reports by Bokhari *et al* from Pakistan[12] and Banerjee *et al* from India.[16] It may be the result of increased trauma and longer use of occlusive footwear in males compared to females. The majority of cases were farmers, students, office workers and housewives. Maceration from wet work and contact with carbohydrates probably contribute to onychomycosis in farmers and housewives, whereas office workers and students are more conscious about their health and report early to the physician.[12]

This study demonstrated a greater involvement of fingernails compared to toenails. This finding is comparable with Bokhari *et al*[12] and Lim *et al*[17] while a high incidence of toenails involvement reported by other authors.[18-20] The increase in fingernail involvement may be because of increased incidence of occupation related trauma or the fingernail infection is more likely than toenail infection to arouse patients concern driving them to seek medical attention. Nails of thumb and big toes were more commonly involved; this is comparable with the previous report.[13] Discoloration was the commonest presentation of nail in the present study as observed Lim *et al*.[17]

Similar to previous studies,[11-13] DLSO was the most common clinical type in this study. The second common clinical presentation was WSO type. Higher KOH positivity (87.8%) was reported in our study and is comparable with previous reports.[13,21] The positive culture rate in onychomycosis varies from 41.2% to 72.0%[15,17] and it was found to be 63.0% in our study. The variation in the figures quoted for the percentage of culture positive depends upon the different laboratory techniques used.[10]

On contrary to previous studies,[12,17] dermatophytes were the commonest isolates accounting 75.0% of all cultures, which is comparable with the result of Gupta *et al*.[11] Bokhari *et al* reported candida as the most common isolates accounting 46.0% followed by dermatophytes (43.0%) and non-dermatophyte molds (11.0%). Their study population comprises of more number of female patients.[11] Among the dermatophytes, the commonest species was *T mentagrophytes* followed by *T. rubrum*, which is in contrast to other reports,[14, 21] where *T. rubrum* was the commonest isolate. Kai- Man *et al* [22] and Man-Heui *et al*[23] have suggested *Trichosporon beigelii* as a causative fungus of onychomycosis. In the present study, it was isolated in 9.6% patients. *Trichosporon beigelii* is a soil and water inhabiting yeast. The patients had a history of frequent exposure of water and soil during works may be responsible for high prevalence of this fungus in our study. The prevalence of onychomycosis caused by nondermatophyte molds varied from 1.5 to 22.0% in different studies.[24, 25] It was 7.7% in the present study. Current research techniques of molecular biology such as dual flow cytometry[26] have produced new and convincing evidence to differentiate fungal species and for quantitating the fungal pathogen in nails. Presently, these procedures are not available in Nepal.

The clinico-etiological correlation revealed that single fungi could give rise to more than one clinical type. The most common presentation of dermatophyte infection was DLSO followed by SWO and PSO. Bokhari *et al*[12] also reported DLSO as the most common manifestation of dermatophyte infection followed by TDO. PSO and SWO were infrequently noted. In the present study, none of the patients with dermatophyte infection presented as TDO and CO; *Candida albicans* presented as CO only and *Trichosporon beigelii* presented as DLSO, PSO and TDO.

As compared with Kiraz *et al*[15] in our study, the associated fungal infection at other site was seen in 31.7% cases. Among the associated fungal infection, tinea manuum was the commonest type followed by tinea corporis and tinea pedis, which is in contrast to Vinod *et al* where tinea pedis was the commonest.[13]

The present study concludes that onychomychosis is common in young adult in 21-40 years age group; fingernail involvement is more common than that of toenail; the most common clinical presentation is DLSO; and *T. metagraphytes* and *T. rubrum* are the major pathogens of onychomycosis in eastern Nepal.

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Table-1: Demographic data of patients having onychomycosis

Demographic data	Males N=60	Females N=22	Total N=82	P value
Age (Years)				
Range	15- 68	7-63	7-68	
Mean	34.3±10.2	39.3±12.6	35.5±13.9	NS*
	4	0	4	
Family history of disease				
Occupation	24	2	26	
Farmers	18	1	19	
Office workers	13	2	15	
Students	0	17	17	
House wives	5	0	5	
Miscellaneous				
Precipitating factors	3	0	3	
Diabetes mellitus	31	5	36	NS*
Occlusive footwear	34	22	56	NS*
Frequent exposure with water	3	0	3	<0.05
Immuno-suppression				NS*

NS*: Not significant

Table-2: Morphology of nail lesions

Morphology of lesion	No. of patient
Discoloration	82
Subungual hyperkeratosis	37
Onycholysis	18
Dystrophy	18
Thickening	11
Paronychia	15

Table-3: Clinical types and sites of involvement (n= 82)

Clinical type	Fingernails (n=51)	Toenails (n=15)	Fingernails and toenails (n=16)	Total (n=82)
DLSO	32	10	13	55
CO	5	0	1	6
SWO	8	3	1	12
PSO	5	2	1	8
TDO	1	0	0	1

DLSO: Distolateral subungual onychomycosis; SWO: Superficial white onychomycosis; PSO: Proximal subungual onychomycosis; CO: Candidal onychomycosis; TDO: Total dystrophic onychomycosis

Table-4: Culture results of onychomycosis according to site of involvement

Pathogens	Fingernails (n=32)	Toenails (n=12)	Fingernails and toenails (n=8)	Total (n=52)
Yeasts				
Candida albican	4	0	2	6
Trichosporon beigelii	3	1	1	5
Dermatophytes				
Trichophyton mentagrophytrs	9	4	2	15
Trichophyton rubrum	8	2	1	11
Trichophyton violeceum	2	1	0	3
Trichophyton tonsurans	3	3	0	6
Epidermophyton floccosum	2	1	1	4
Nondermatophytes molds				
Aspergillus spp.	1	0	1	2

Table-5: Culture results of onychomycosis according to sex

Pathogens	Male	Female	Total
Yeasts			
Candida albican	1	5	6
Trichosporon beigelii	3	2	5
Dermatophytes			
Trichophyton mentagrophytrs	12	3	15
Trichophyton rubrum	10	1	11
Trichophyton tonsurans	6	0	6
Trichophyton violeceum	1	2	3
Epidermophyton floccosum	3	1	4
Nondermatophytes molds			
Aspergillus spp.	1	1	2
Total	37	15	52

Table-6: Mycological findings of different clinical type

Pathogens	DLSO	PSO	SWO	CO	TDO	Total
Yeasts						
Candida albican	0	0	0	6	0	6
Trichosporon beigelii	3	1	0	0	1	5
Dermatophytes						
Trichophyton mentagrophytrs	12	2	1	0	0	15
Trichophyton rubrum	9	1	1	0	0	11
Trichophyton violeceum	1	0	2	0	0	3
Trichophyton tonsurans	4	0	2	0	0	6
Epidermophyton floccosum	1	1	2	0	0	4
Nondermatophytes molds						
Aspergillus spp.	2	0	0	0	0	2
Total	32	5	8	6	1	52

DLSO: Distolateral subungual onychomycosis; PSO: Proximal subungual onychomycosis; SWO: Superficial white onychomycosis; CO: Candidial onychomycosis; TDO: Total dystrophic onychomycosis.