

Role of Tinea Unguium and Other Factors in Chronic and Recurrent Dermatophytosis: A Case Control Study

Abstract

Context: There is an alarming rise in the incidence of chronic and recurrent dermatophytosis (CRD) in India. Many factors including tinea unguium may be responsible for it. **Aims:** To evaluate various epidemiological and clinical factors including the presence of tinea unguium as a risk factor for CRD. **Settings and Design:** This was a case-control study in which patients attending the dermatology outpatient department of a tertiary care hospital in February–March 2019 were recruited. A total of 80 consecutive clinically diagnosed patients with CRD as per the case definition (cases) were selected. Another 80 consecutive patients with dermatophytosis other than CRD (controls) were also selected. Patients were clinically evaluated with special attention for the presence of tinea unguium. **Results:** Among the total of 80 cases, 44 (55%) and 36 (45%) were diagnosed to have chronic dermatophytosis and recurrent dermatophytosis respectively. CRD was relatively uncommon in patients younger than 20 years. Sharing of linen, family history, and topical corticosteroid abuse were also frequent among patients with CRD. Tinea unguium was present in six cases (7.5%) and two controls (2.5%) which was not statistically significant ($P = 0.27$). **Conclusions:** The current epidemic of CRD may be primarily due to a pathogen with certain specific epidemiological and clinical determinants. It may be primarily a skin pathogen with less or no affinity toward the hair and nail.

Keywords: Chronic dermatophytosis, recurrent dermatophytosis, tinea unguium

Introduction

Dermatophytosis affects approximately 20–25% of the world's population.^[1] About 30–70% of adults are known to be asymptomatic carriers of dermatophytes, and the incidence increases with age. Climatic factors along with social practices and population migration are among the external factors responsible for the infection. Individual characteristics such as immune status facilitate dermatophytosis. Additionally, various other risk factors have also been associated with onychomycosis, such as age, morphological abnormalities in the nails, genetic factors, poor hygiene conditions, and some diseases such as diabetes mellitus and immunodeficiency which contributes to the existing epidemiological scenario of dermatophytosis.

Currently, we are facing an onrush of chronic and recurrent dermatophytosis (CRD) at a level never encountered before. These cases make up to 5–10% of all the

new cases in India.^[2] In addition to this distress, there is no standard definition of CRD.^[3] Chronic dermatophytosis can be referred to as a disease continuing for more than 6 months to 1 year with or without recurrence in spite of being treated. Recurrent dermatophytosis has been defined as cutaneous dermatophytosis in which the infection recurred within 6 weeks of stopping the adequate antifungal treatment with at least two such episodes in the last 6 months.^[4] Several factors are associated with chronicity such as the site of infection, poor penetration of the drug in the nail keratin, and drug resistance. The reasons for recurrence include immunosuppression such as diabetes mellitus, incomplete/noncompliance to treatment, cross-infection from other family members, and poor personal hygiene. There are a limited number of studies on CRD and factors associated with recurrence. A study conducted by Prasad *et al.* found onychomycosis in 28% of patients with chronic dermatophytosis which was statistically significant.^[5] We

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conducted this study to evaluate various epidemiological and clinical factors including the presence of tinea unguium as a risk factor for CRD.

Materials and Methods

This was a case-control study whose study population included patients with a clinical diagnosis of dermatophytosis from the dermatology outpatients of a tertiary care hospital during February–March 2019 after obtaining approval from the ethics committee. A total of 80 consecutive clinically diagnosed cases and controls were selected as per the definitions.

Operational definitions

Chronic dermatophytosis

Glabrous tinea (tinea corporis, tinea cruris, tinea faciei) continuing for more than 6 months in spite of being treated with antifungals.

Recurrent dermatophytosis

Glabrous tinea (tinea corporis, tinea cruris, tinea faciei) which has recurred within 6 weeks of the clinical cure and stopping the adequate antifungal treatment (complete resolution of itching and inflammatory signs) at the same or adjacent site.

Cases

All cases of glabrous tinea (tinea corporis, tinea cruris, and tinea faciei) which are chronic and/or recurrent, and positive for microscopy with potassium hydroxide mount of the skin scrapings.

Controls

All cases of glabrous tinea (tinea corporis, tinea cruris, and tinea faciei) other than CRD and positive for microscopy with potassium hydroxide mount of the skin scrapings.

Tinea unguium

Patients with a clinical diagnosis of tinea unguium and positive for microscopy with potassium hydroxide mount of the nail clippings/scrapings of subungual hyperkeratosis for dermatophytes.

Sociodemographic details, clinical history such as age, sex, occupation, duration of the disease, hygiene, sharing of articles, presence of comorbidities and other associated conditions, treatment history, family history were elicited and recorded in all the cases and controls. All patients were subjected to a detailed cutaneous examination to look for the extent of lesions, clinical type, and signs of topical steroid usage. Investigations like complete hemogram, liver function test, and blood sugar were done if deemed necessary.

Nail examination was carried out in every patient to identify onychomycotic changes such as discoloration, subungual

hyperkeratosis, onycholysis, white patches on the nail plate, and total dystrophy.^[6] Dermoscopy was also performed to aid the diagnosis.^[7] Direct microscopy examination with 20% potassium hydroxide (KOH) was done for the patients with a clinical diagnosis of tinea unguium. Nail scrapings/clippings were placed on a slide and a drop of 20% KOH was added and covered with a coverslip. Gentle pressure was applied to remove the excess KOH. The slide was kept for 2 hours and was then evaluated for the presence of hyaline branching septate hyphae or beaded spherical structures (arthrospores).^[8] Chicago sky blue staining was also performed for increasing the sensitivity of the diagnosis.^[9] Patients with other dermatological disorders that are likely to cause similar nail changes such as psoriasis, lichen planus, and erythroderma were excluded. Patients with tinea unguium associated with paronychia were not counted so that the possibility of candida and non-dermatophyte mold (NDM) onychomycosis was eliminated.

Statistical analysis

The data were entered in Microsoft Excel sheet and analyzed using SPSS version 22 software. The categorical data were represented in the form of frequency and percentage. Chi-square/Fisher's exact test was used to test the significance of qualitative data. Continuous data were represented as mean and standard deviation. *P* value < 0.05 was considered as significant.

Results

A total of 80 cases and 80 controls were enrolled in the study. Among the total of 80 cases, 44 patients (55%) had chronic dermatophytosis and 36 patients (45%) had recurrent dermatophytosis. The commonest age group in both cases and control groups was 21–40 years with 43.8% and 40% patients, respectively. The mean age was 41.14 (SD ± 15.47) years and 29.37 (SD ± 16.37) years for the case and control group, respectively. There were 7 (8.8%) and 27 (33.8%) patients among cases and controls, respectively, belonging to the age group of 0–20 years. The detailed age group distribution is represented in Table 1. Among the cases, 50 patients (62.5%) were females

Table 1: Age distribution among cases and controls

Age group (years)	Cases (n=80)	CD (n=36) RD (n=44)	Controls (n=80)
0-20	7 (8.8%)	CD-1 (2.8%) RD-6 (13.7%)	27 (33.8%)
21-40	35 (43.8%)	CD-18 (50%) RD-17 (38.7%)	32 (40%)
41-60	25 (31.2%)	CD-12 (33.3%) RD-13 (29.6%)	19 (23.8%)
61-80	13 (16.3%)	CD-5 (13.9%) RD-8 (18.1%)	2 (2.5%)

CD: Chronic dermatophytosis; RD: Recurrent dermatophytosis

and 30 (37.5%) were males, whereas among controls, 52 patients (65%) were females and 28 (35%) were males. The gender distribution among cases and controls along with age distribution is depicted in Table 1a.

A majority of the patients both cases and control groups belonged to various occupations with predominant indoor work (60% and 43.75%, respectively). 38.75% of the patients in the control group were students in contrast to only 10% among cases. The distribution of cases and controls based on occupation is depicted in Figure 1.

Different variables such as hygiene, sharing of articles, family history, and comorbidities were noted. Among the cases and controls, 71.3% and 37.5% of patients, respectively, gave a history of sharing linen which was statistically significant ($P = 0.001$). A total of 72.5% and 57.5% among cases and controls, respectively, gave a history of dermatophytosis in other family members which was statistically significant ($P = 0.047$). Comorbidities noted among cases were hypertension (10%); diabetes mellitus (8.8%); ischemic heart disease (1.2%); and bronchial asthma (1.2%), and among controls diabetes mellitus (6.2%); hypertension (5%); and bronchial asthma (1.2%). Forty-two cases (52.5%) and 34 controls (42.5%) gave history of using topical steroid in some form ($P = 0.205$). Mixed tinea corporis with tinea cruris (73.8% and 53.8% in cases and controls, respectively) was the commonest clinical type observed in both the groups [Figure 2]. Tinea faciei was seen in five patients. Two cases had tinea manuum and one had tinea pedis. No case of tinea capitis was seen among our patients. Table 2 shows the factors and their significance.

Table 1a: Age and sex distribution

Variables	Cases (n=80)	Controls (n=80)
Age (years) mean±SD	41.14±15.47	29.37±16.36
Female	50 (62.5%) CD-20 (40%) RD-30 (60%)	52 (65%)
Male	30 (37.5%) CD-16 (32%) RD-14 (28%)	28 (35%)

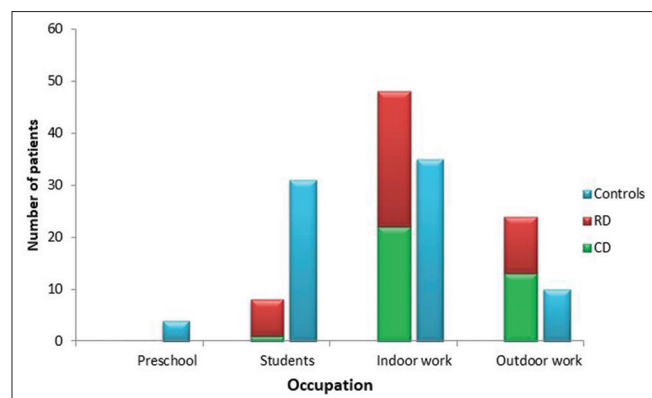


Figure 1: Distribution of occupation among cases and controls

Among the cases, the commonest age group affected was 21-40 years with 50% and 38.7% belonging to chronic dermatophytosis and recurrent dermatophytosis respectively. This is represented in Table 1. Among the chronic dermatophytosis patients, 20 (40%) were females and 16 (32%) were males, and among the recurrent dermatophytosis patients, 30 (60%) were females and 14 (28%) were males [Table 1a].

Six (7.5%) cases and two (2.5%) controls had tinea unguium and this difference was not statistically significant ($P = 0.27$). Figures 3-5 show the presence of tinea corporis with tinea unguium. Recurrent dermatophytosis (four cases) outnumbered chronic dermatophytosis (two cases) with respect to the frequency of tinea unguium. Fingernail involvement (five cases) was more frequent among the cases. Both cases of tinea unguium among the controls were having fingernail involvement. Tinea unguium of toenail was also associated with tinea pedis in one patient [Figure 5]. All tinea unguium patients were KOH positive [Figure 6a and b]. The type of onychomycosis has been depicted in Table 3.

Discussion

The present study was conducted in Mangalore, which is situated on the western coast of south India having a hot and humid climate. These conditions are favorable for the development of superficial dermatophytosis. Our study is intended to delineate the factors responsible for the development of chronic and recurrent tinea in our population. This is with regard to the high incidence of these conditions in the current scenario.

We conducted a case-control study in order to understand the pathogenesis of the CRD. We grouped the tinea patients with CRD and those without CRD and compared the epidemiological and clinical aspects. We found two major demographic factors that need discussion.

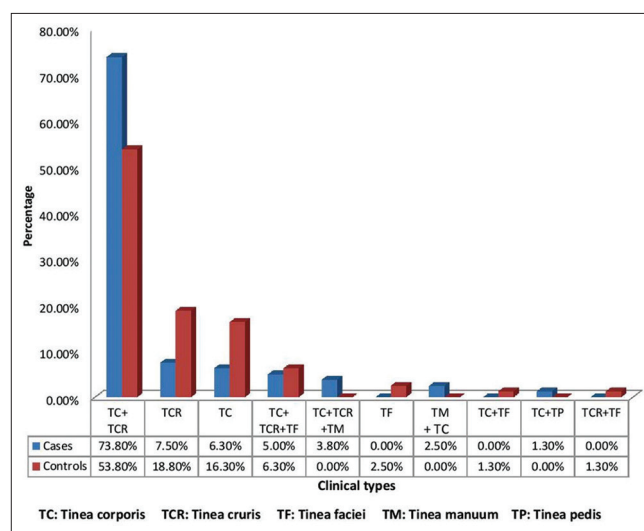


Figure 2: Clinical types of dermatophytosis

Table 2: Suspected risk factors responsible for chronic and recurrent dermatophytosis (CRD) with its significance

Variable	Case (n=80) (CRD)	Control (n=80) (Other cases of Dermatophytosis)	P
Common age group	>20 years	<20 years	-
Gender frequency	Female	Female	-
Sharing of linen	57 (71.3%)	30 (37.5%)	0.001
Topical corticosteroid usage	42 (52.5%)	34 (42.5%)	0.205
Family history of tinea	58 (72.5%)	46 (57.5%)	0.047
Diabetes mellitus	7 (8.8%)	5 (6.2%)	0.54
Tinea corporis with cruris	59 (73.8%)	43 (53.8%)	0.32
Tinea unguium	6 (7.5%)	2 (2.5%)	0.27

$P < 0.05$ is considered significant



Figure 3: Extensive tinea corporis with tinea unguium of thumbnails



Figure 4: Tinea manuum, tinea corporis with tinea unguium



Figure 5: Tinea pedis, tinea corporis with tinea unguium

The first factor was that CRD was relatively less common among the younger patients (<20 years of age) with a

frequency of 8.8% whereas it was 33.8% among controls. Out of the 7 patients in the former group, the majority of the patients had recurrent dermatophytosis (13.7%). In this age group, fewer patients were diagnosed to have CRD as compared to patients above 60 years where the majority of the cases of tinea were CRD. The mean age of CRD was also higher as compared to other cases of tinea. Lower incidence of CRD in younger individuals was also reported by Zacharia and Kunjukunju in their study among chronic dermatophytosis patients.^[10] This could be due to age-related suppression of CMI in the elderly and better care given to children by their parents.

The second factor was that tinea was more common in females; however, the ratio of CRD in both genders remained the same in both groups. There seems to be no variation in the prevalence of CRD in both genders. Although there are many studies on dermatophytosis, there is a scarcity of studies pertaining to CRD in India.^[10] Various studies have reported different gender prevalence of dermatophytosis.^[11-17]

Dermatophytosis is said to be more common in people working outdoors; however, in our study equal incidence was found in people working indoors in both groups. This indicates that contact and sweating may be associated with a higher incidence of dermatophytosis but these factors may not be significant contributors to CRD. Manual laborers were frequently affected by chronic dermatophytosis according to one study and in many other studies on dermatophytosis.^[10-12] The prevalence of dermatophytosis may depend upon variables such as hygiene, sharing of linen, and family history of tinea.^[18] Sharing of linen was found in 71.3% of the cases as compared to 37.5% of controls which was highly significant ($P = 0.001$). Some cases of CRD may be related to repeated acquisition of infection from family members. The presence of dermatophytosis among the family members may produce economic constraints leading to inadequate treatment. This aspect highlights the significance of treating all family members with special attention toward cost-effective therapy. Damp house, physical activity leading to sweating, frequency of washing clothes, frequency of bathing, and wearing tight shoes maybe the other factors which have been described.^[18,19]

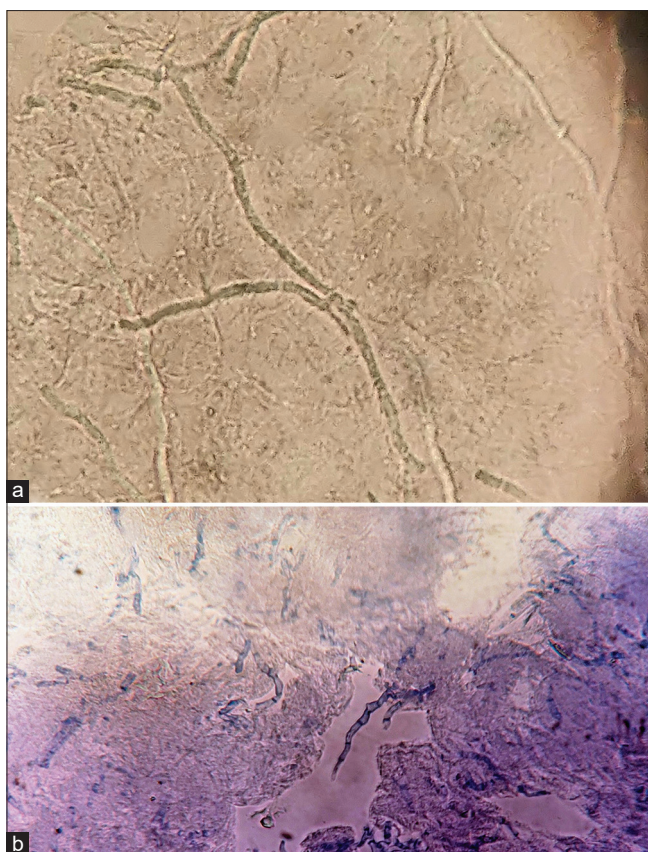


Figure 6: Potassium hydroxide preparation of tinea unguium without (a) and with (b) Chicago Sky Blue stain ($\times 40$)

Table 3: Frequency of tinea unguium

	Case		Control (other cases of dermatophytosis)
	CD	RD	
Total patients	36	44	80
Total number of tinea unguium	2 (2.5%)	4 (5%)	2 (2.5%)
DLSO	1	4	2
TDO	-	1	-
Mixed type	1	2	-

DLSO: Distal lateral subungual onychomycosis; TDO: Total dystrophic onychomycosis

A higher frequency of dermatophytosis was found in the family members of CRD (72.5% and 57.5% in cases and controls, respectively). This indicates that the presence of CRD increases the chance of other family members acquiring the infection. Similar results were noted by Singh *et al.* which significantly increased the risk of exposure of a family member to the pathogen and transfer of fomites within individuals in a closed space, either directly or indirectly.^[19] It may also be due to factors related to the cell-mediated immunity which may be deficient in all family members.

Diabetes mellitus has been considered a cofactor but we did not find a significant difference in the presence of diabetes or any other concomitant illnesses among the case

and control. Comorbidities may not influence the chances of developing CRD.

There was a high frequency of current or recent past (within 6 weeks) usage of Topical corticosteroid (TCS) in both groups but was higher in the CRD group. TCS abuse may contribute to the higher incidence of both common dermatophyte cases and CRD. TCS abuse may lead to a situation where the local CMI is suppressed leading to the inability of the host to eliminate the infection.

Tinea corporis with cruris was the commonest type of tinea in both cases and controls. Tinea faciei was commoner than tinea capitis, tinea pedis, and tinea manuum. There was no statistically significant difference in the type of tinea in both groups. The current clinical scenario of dermatophytosis across India in various studies appears to be the same.^[18,19] There is a low incidence of tinea manuum, tinea pedis, tinea capitis, and tinea unguium.^[10] These features indicate that the current scenario of dermatophytosis primarily affects glabrous skin.

Chronic dermatophytosis (45%) and recurrent dermatophytosis (55%) were found in nearly equal frequency among the cases. We intended to study the frequency of dermatophytic onychomycosis (tinea unguium) in CRD because only this has relevance in CRD. Paronychia is usually associated with non-dermatophyte onychomycosis and, hence, we did not consider the cases and controls with paronychia as tinea unguium. Although there were six cases (7.5%) and only two controls (2.5%) with tinea unguium, this difference was not statistically significant. Similar results were obtained in a study from Zacharia and Kunjukunju (8%).^[10] Higher values were seen in a study by Prasad *et al.* (28%) but in this study, diagnosis of onychomycosis was clinical leading to the possible misdiagnosis of other nail disorders as onychomycosis.^[5] The current epidemic of recalcitrant CRD in India is probably not contributed by the autoinoculation of the organisms from the nails. It is also possible that the commonest agent associated with the current epidemic is not an onycho-pathogen.

There are a few limitations to our study. We have not consistently cultured the agent responsible for the tinea and tinea unguium in our patients and, hence, we decided to focus more on clinico-epidemiology than microbiology. Culture yields in tinea unguium are generally low.^[6,8] However, the value of this study would have been higher if the isolation of the agents was also done. We also feel that a higher sample size was desirable.

Conclusion

The confusing scenario of CRD has led to many speculations regarding its epidemiology and pathogenesis. Very few studies have been published and it is difficult to draw conclusions based on them. Our study design seems ideal to learn the epidemiology of CRD in the current

scenario. There seems to be a newer genotype responsible for the majority of the cases in the current epidemic.^[20,21] There may be some important epidemiological determinants such as higher chances of CRD with increasing age and high fomite transmission. Linen may play an important role in the transmission of the infection. There may be higher chances of the persistence of such infections in people with TCS abuse. There is a strong relationship with the host immunity and persistence/recurrence of the infection. The dominant pathogen responsible for the epidemic is primarily a skin pathogen with less or no affinity toward the hair and nail. However, this does not undermine the significance of hair and nail examination since a multitude of agents are responsible for dermatophytosis. Management of the cases in the current scenario requires a longer duration of treatment with comprehensive care including general measures such as counseling and boosting immunity.

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Conflicts of interest

There are no conflicts of interest

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