

Correlation between clinical and mycological diagnosis of onychomycosis

Md Anwar Husain, Mohd. Nurul Alam, Yasmin Joarder*, Wahidujjaman**, Monalisa Ferdous***

Department of Dermatology & Venereology, Ibn-Sina Sina Medical College, Dhaka

* Department of Dermatology & Venereology, Northern Medical College, Dhaka.

** Department of Dermatology & Venereology, Khulna Medical College, Khulna.

*** Department of Dermatology & Venereology, National Medical College, Dhaka

Abstract

Objective To evaluate the correlation between clinical and mycological diagnosis of onychomycosis.

Methods It was a cross-sectional observational study carried out in the Department of Dermatology and Venereology, Ibn Sina Medical College and National Medical College, Dhaka during the period from January 2014 to December 2015. Total 200 samples were included in this study. Clinical diagnosis of onychomycosis was confirmed by KOH smear and fungal culture.

Results A total of 200 clinically diagnosed patients of onychomycosis were included in this study. Out of 200 patients of onychomycosis, total culture positive were 152 (76%). Both KOH and culture positive were 136 (true positive), KOH-ve but culture positive were 16 (false negative), KOH+ve but culture negative were 8 (false positive), both KOH and culture negative were 40 (true negative). Out of 152 culture positive cases, isolated fungi included *Trichophyton mentagrophytes* 72 (47%), *T. rubrum* 64 (42%) and *Candida* spp. 16 (10%).

Conclusion The study concluded that onychomycosis was predominant among the advance age with slight female preponderance. DLSO was the most common clinical type. Fingernail involvement was more common than toenail involvement. Dermatophytes were the common pathogens.

Key words

Onychomycosis, *Trichophyton mentagrophytes*, *T. rubrum*, *Candida*, distolateral subungual onychomycosis.

Introduction

Onychomycosis, a common fungal infection of nail is caused by dermatophytes, yeast and mould.¹ It constitutes an important public health problem because of its rising prevalence and underdiagnosis especially in developing countries.²

Onychomycosis traditionally referred to as nondermatophytic infection of the nail, is now used as a general term to denote any fungal nail infection.^{3,4,5} It accounts for upto 50% of nail disorders and 30% of all superficial fungal infections of the nails. This may occur as a primary event or a secondary infection of a previously diseased or traumatized nail.^{6,7}

Address for correspondence

Dr. Md Anwar Husain
Associate Professor & Head,
Department of Dermatology & VD,
Ibn-Sina Medical College, Dhaka
E-mail: anwarbd64@gmail.com

It can have four major types of clinical presentations: distal subungual (DLSO), the most common form of the disease; proximal subungual (PSO), the most common form found

in patients with human immunodeficiency virus infection; superficial white (SWO); and total dystrophic onychomycosis (TDO).

Onychomycosis, a mycotic infection of the nail unit, is caused by three groups of fungi, namely dermatophytes, yeasts, and nondermatophyte moulds. While the majority of onychomycosis is caused by dermatophytes (over 90% of cases are caused by two dermatophytes: *Trichophyton rubrum* and *T. mentagrophytes*), yeasts and nondermatophyte moulds are the pathogens in about 7% of fungal nail infections.^{8,9} Dermatophytes account for most (90%) cases of onychomycosis of the toenails and at least 50% of fingernail infections. Both dermatophytes and nondermatophytes, especially *Candida albicans*, have been identified as sole etiologic agent of onychomycosis; however, the incidence of true mixed infections (caused by dermatophytes plus nondermatophytes) is difficult to determine accurately.^{10,11}

Fungal cultures are of paramount importance because the clinical outcome of antifungal agents varies as to whether the etiological agent is a dermatophyte, yeast or mould. The antifungal agents with appropriate spectrum of activity can only be used if the underlying fungal pathogen is identified correctly. This study therefore sought to improve the current knowledge of the clinico-mycological correlation of onychomycosis.

Methods

It was a cross-sectional observational study carried out in tertiary level hospital, Dhaka, from January 2014 to December 2015 on patients suffering from onychomycosis attending the Departments of Dermatology and Venereology, Ibn Sina Medical College and National Medical College, Dhaka. Total 200 cases were included in this study. Data were collected by structured

questionnaire. The age, sex, and occupational status of each patient were recorded. A careful history was taken from each patient regarding the presence of nail infection. A thorough history was obtained and detailed clinical examination was performed for each of them regarding the dermatological condition and some associated comorbidities. Relevant past medical records were also analyzed, while the patients were screened for the presence of diabetes and immunosuppression.

At first the infected nail was washed with acetone and then was shaved with a blade. The superficial portion was discarded and sample was taken from the deep part. The shaved material was placed on the glass slide, 20% KOH poured on the material and then covered with coverslip. The slide was then heated in a flame for few seconds and examined under microscope. Culture was done in Sabouraud's dextrose-agar media (SDA). Formation of white to cream coloured powdery colonies were considered as positive for dermatophytes. Statistical analysis was performed with SPSS (Statistical package for social science) for windows version 20 (Chicago, USA).

Results

The mean age of the patients was 30.97 ± 11.7 years. The majority of patients (40%) was between 46-60 years of age, followed by age groups of 16-30 years (28%), 31-45 years 24% and ≤ 15 years (8%). 48% were males and 52% were females (**Table 1**).

Of the 200 cases with clinical onychomycosis, fingernails were affected in 120 (60%), toenails in 72 (36%), and both fingernails and toenails in 8 (4%) cases.

Table 1 Demographic and clinical data of patients (n=200).

	N (%)
<i>Age (years)</i>	
≤15	16 (8)
16-30	56 (28)
31-45	48 (24)
46-60	80 (40)
<i>Sex</i>	
Male	96 (48)
Female	104 (52)
<i>Site of onychomycosis</i>	
Fingernails	120 (60)
Toenails	72 (36)
Finger & toenails	8 (4)
<i>Clinical type of onychomycosis</i>	
Distal and lateral sublingual	108 (54)
Proximal sublingual	48 (24)
White superficial	32 (16)
Total dystrophic	12 (6)

Table 1 Mycologic results of the study population (n=200).

	N (%)
<i>Microscopy</i>	
Positive	144 (72)
Negative	56 (28)
<i>Culture</i>	
Positive	152 (76)
Negative	48 (24)
<i>Isolated fungi (n=152)</i>	
<i>Trichophyton mentagrophytes</i>	72 (47)
<i>T. rubrum</i>	64 (42)
<i>Candida spp.</i>	16 (10)

Table 3 Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV).

<i>Culture</i>	<i>Microscopy</i>	
	<i>Positive</i>	<i>Negative</i>
Positive	136 (True positive)	16 (False negative)
Negative	8 (False positive)	40 (True negative)

Sensitivity: 89.4%, specificity: 83.3%, PPV: 83.3, NPV: 71%.

The clinical presentation of onychomycosis was as follows: 108 (54%) presented as DLSO, 48 (24%) cases as PSO, 32 (16%) cases SWO and 12 (6%) cases with TDO (Table 2).

Of the 200 patients with clinical onychomycosis, culture positivity was seen in 152 (76%). Of the

200 patients, 144 (72%) were KOH positive and 56 (28%) were KOH negative. Table shows *Trichophyton mentagrophytes* was 72 (47%), *T. rubrum* was 64(42%), *Candida spp.* was 16 (10%).

Table 3 shows the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of KOH microscopy against mycologic culture.

Discussion

Onychomycosis is a chronic mycotic infection of fingernails and toenails that affects the quality of life in a significant proportion. There has been a recent increase in the incidence, as well as, the spectrum of causative pathogens associated with onychomycosis. This increase in the incidence can be attributed to various factors like aging population, an ever expanding number of immunocompromised patients and life style practices. Onychomycosis occurs worldwide and appears to be a variable entity presenting in different forms in different parts of the world with every country and every region of country having its own characteristics of presentation.¹²

The mean age of the patients was 30.97±11.70 years. Most number of patients (40%) was between 46-60 years of age, followed by age groups of 16-30 years (28%), 31-45 years 24% and ≤15 years (8%). This finding is consistent with Grag *et al.*¹³ which was 29.40 ± 13.61 years age. Another Gelotar *et al.*¹⁴ study found the mean age of the patients was 36.42 years. They found most numbers of patients (42.22%) were between 31-40 years of age, followed by an even distribution between the age groups of 21-30 years (26.67%) and 41-50 years (26.67%). This could be attributed to the fact that onychomycosis may be considered a cosmetic problem by the younger patients who are more conscious of their appearance, who come

forward for therapy. This increased incidence in younger population could also be because of their exposure to occupation related trauma, predisposing them to onychomycosis.

In the present study, females (52%) were more commonly affected than males (48%), which is consistent with the studies of Adhikari *et al.*¹⁵ Neupane *et al.*¹⁶, whereas Bokhari *et al.*¹⁷ reported higher prevalence in females (72%). Higher incidence of onychomycosis in females may be attributed to more exposure to kitchen physical activity.

Another study by Sanjiv *et al.*¹⁸ reported higher isolation rate among males (68.8%) than females (31.2%). Higher isolation rate in males might be contributed to the fact that they are more exposed to outdoor with greater physical activity.

In this study the isolation rate of onychomycosis was found to be 76%. This study was in concordance with a study from India⁴ which showed an isolation rate of 60% while studies from Bangalore¹⁹ and Dhaka²⁰ reported a lower isolation rate of 29% and 20%. The fact that not all patients affected by onychomycosis seek medical attention can also explain the difference in prevalence of onychomycosis observed worldwide.

The positive culture rate in onychomycosis varies from 41.2% to 72.0%^{21,22} and it was found to be 54% in this study. The variation in the figures quoted for the percentage of culture positive depends upon the different laboratory techniques used.

This may be due to increased exposure to wet work in females, as most of them were housewives. Onychomycosis was most commonly seen in house wives (42%), followed by businessmen (18%), student (16%), service

holder (10%), other (14%), which is comparable with the study of Veer *et al.*³ whereas Neupane *et al.*¹⁶ reported that students were more commonly affected (31.3%) followed by housewives (28.5%). High prevalence in student and businessmen may be due to increased outdoor physical activity and increased exposure to wet work, respectively. The higher incidence among the students may be due to the wearing of occlusive shoes throughout daytime. In a study conducted in Eastern Nepal, the study population mainly constituted of farmers.²³ This difference observed could be due to the difference in sampling population as this study was based in Dhaka, which is the capital city where young populations may have been concentrated for higher education. Housewives had predominated in the study conducted by Jesudanam *et al.*¹²

In our study, onychomycosis was more frequently observed in fingernails (60%), followed by toenails (36%) which is consistent with a study from India.²⁴ Toenail infection (66.6%) was commoner in males, while fingernail infection (60%) was common in females. This may be due to increased exposure to outside work in males and exposure to household works in female.

DLSO was the commonest presentation of onychomycosis which accounted for 54% cases in the present study as observed Lim *et al.*²² Bokhari *et al.*¹⁷ also reported DLSO as the most common manifestation of fungal infection.

This study found of the 200 cases with clinical onychomycosis, fingernails were affected in 120 (60%), toenails in 72 (36%), and both fingernails and toenails in 8 (4%) cases. This findings consisted with Agarwall *et al.*²³ which was 62% were fingernail and 34% were toenails and 4% were both fingernails and toenails. This study demonstrated a greater involvement of

finger nails compared to toenails. This finding is comparable with Bokhari *et al.*¹⁷ and Lim *et al.*²² 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.

This study shows range of duration of the disease was between 1 to 8 months. Majority of them (46%) had the disease of more than 6 months, which was similar to the findings of other studies.^{12,19} Another study Khondker *et al.*²⁰ showed range of duration of the disease was between 2 to 72 months. All patients had the disease of less than 12 months of the patients had involved in wet works, e.g. kitchen work, washing of cloths.

Conclusion

The study concluded that onychomycosis was predominant among the advance age with slight female preponderance. DLSO was the most common clinical type. Fingernail involvement was more common than toenail involvement. Future studies must include economical support, then large sample size could be ensured and study finding would be more reliable. There is a great need of epidemiological studies also, with sufficient follow-up, systematic reviews and meta-analyses on this issue. It is recommended that a longer study from a more representable population covering wider geographical areas, preferably by including non-dermatology out patients, could reinforce or remodulate the true picture of this fairly common condition.

Reference

1. Niranjan HP, Priyanka NP. Study of onychomycosis at a tertiary care hospital in South India. *J Evol Med Dent Sci.* 2012;**1**:823.

2. Grover S. Clinico-mycological evaluation of onychomycosis at Bangalore and Jorhat. *Indian J Dermatol Venereol Leprol.* 2003;**69**:284-6.
3. Veer P, Pathwardhan NS, Damle AS. Study of onychomycosis: Prevailing fungi and pattern of infection. *Indian J Med Microbiol.* 2007;**25**:53-6.
4. Malik NA, Raza N, Nasiruddin. Nondermatophyte molds and yeasts as causative agents in onychomycosis. *J Pak Assoc Dermatol.* 2009;**19**:74-8.
5. Ellis DH, Marley JE, Watson AB, Williams TG. Significance of non-dermatophyte molds and yeasts in onychomycosis. *Dermatology.* 1997;**194**(Suppl 1):40-2.
6. Gupta AK, Jain HC, Lynde CW, MacDonald P, Cooper EA, Summberbell RC. Prevalence and epidemiology of onychomycosis in patients visiting physicians offices: A multicentre Canadian Survey of 15000 patients. *J Am Acad Dermatol.* 2000;**43**:244-8.
7. Derby R, Rohal P, Jackson C, Beutler A, Olsen C. Novel treatment of onychomycosis using over-the-counter mentholated ointment: A clinical case series. *J Am Board Fam Med.* 2011;**24**:69-74.
8. Al-Mutairi N, Eassa BI, Al-Rqobah DA. Clinical and mycologic characteristics of onychomycosis in diabetic patients. *Acta Dermatovenerologica Croatica.* 2010;**18**(2): 84-91.
9. Yenisehirli G, Bulut Y, Sezer E, Gunday E. Onychomycosis infections in the middle black sea region, Turkey. *Int J Dermatol.* 2009;**48**:956-9.
10. Drakensjo IT, Chryssanthou E. Epidemiology of dermatophyte infection Stockholm, Sweden; A retrospective study from 2005-2009. *Med Mycol.* 2011;**49**:484-8.
11. Garcia-Doval I, Cabo F, Monteagudo B, Alvarez J, Ginarte M, Rodriguez-Alvarez MS *et al.* Clinical diagnosis of toenail onychomycosis is possible in some patients: cross-sectional diagnostic study and development of a diagnostic rule. *Br J Dermatol.* 2010;**163**:743-51.
12. Jesudanam MT, Rao GR, Lakshmi DJ, Kumari GR. Onychomycosis. A significant medical problem. *Indian J Dermatol Venereol Leprol.* 2002;**68**:326-9.
13. Grag A, Venkatesh V, Singh M, Pathak KP, Kaushal GP, Agrawal SK. Onychomycosis in central India: A clinicoetiologic

- correlation. *Int J Dermatol*. 2004;**43**:498-502.
14. Gelotar P, Vachhani W, Patel B, MaKWana N. The prevalence of fungi in fingernail onychomycosis. *J Clin Diag Res*. 2012;1-3.
 15. Adhikari L, Gupta AD. Clinico-aetiologic correlates of onychomycosis in Sikkim, *Indian J Pathol Microbiol*. 2009;**52**:194-7.
 16. Neupane S, Pokhrel DB, Pokhrel BM. Onychomycosis: A clinicoepidemiological study. *Nepal Med Coll J*. 2009;**11**:292-5.
 17. Bokhari MA, Hussain I, Jahnagir M, Haroon TS, Aman S, Khurshid K. Onychomycosis in Lahore, Pakistan. *Int J Dermatol*. 1999;**38**:591-5.
 18. Sanjiv A, Shalini M, Charoo H. Etiological agents of onychomycosis from a tertiary care hospital in Central Delhi, India. *Indian J Fundament Appl Life Sci*. 2011;**1(2)**:11-4.
 19. Sujatha V, Grover S, Dash K, Singh G. A clinical mycological evaluation of onychomycosis. *Indian J Dermatol Venereol Leprol*. 2000;**66**:238-40.
 20. Khondker L, Choudhury AM, Shahidullah M, Khan MSI, Ahamed ARS. Clinico-epidemiological profile of onychomycosis attending in a tertiary care hospital. *J Bangladesh Coll Physicians Surg*. 2012;**30**:78-84.
 21. Kiraz M, Yegenoglu Y, Erturan Z, Ang O. The epidemiology of onychomycosis in Istanbul, Turkey. *Mycoses*. 1999;**42**:323-9.
 22. Lim JT, Chua HC, Goh CL. Dermatophyte and non-dermatophyte onychomycosis in Singapore. *Australas J Dermatol*. 1992;**33**:159-63.
 23. Agarwalla A, Agrawal S, Khanal B. Onychomycosis in Eastern Nepal. *Nepal Med Coll J*. 2006;**8**:215-9.
 24. Dogra S, Kumar B, Bhansali A, Chakrabarty A. Epidemiology of onychomycosis in patients with diabetes mellitus in India. *Int J Dermatol*. 2002;**41**:647-51.