

Study and Identification of the Etiological Agents of Onychomycosis in Tehran, Capital of Iran

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Abstract

Onychomycosis is the fungal infection of the nails with worldwide occurrence, caused by various species of dermatophytes, yeasts and molds. In addition, of pain and physical effect of onychomycosis that may interfere with individual's personal and professional life, it may also causes negative psychosocial consequences in patients. Concerning increase of onychomycosis during recent decades and effect of different climates, professional and socio-economic conditions in prevalence of onychomycosis, local investigation for defining of incidence and causative agents of onychomycosis seems necessary.

In the present study, 252 patients suspected to onychomycosis were examined by direct microscopy and cultural methods. 28.3% of patients were male and the rest were female. Specimens were tested by direct microscopic examination using potassium hydroxide 20% and culturing on Sabouraud's dextrose agar (S) and Sabouraud's containing cyclohexamide and chloramphenicol (Sec mediums). Direct microscopy test were negative in 61.1% nail specimens and positive in rest of them. Among these positive cases, 12.3%(n=31) specimens presented branching mycelium with arthroconidia, and 21%(n=53) specimens presented blastoconidia and pseudohyph. Beside, saprophytic mycelium has been observed in 5.6 % (n=14) of positive cases. The isolated causative agents from culture of specimens according to their frequencies were as follows: *Candida albicans* (13.7%), *Trichophyton mentagrophytis* (8.3%), *Candida* species (6.9%), *Aspergillus flavus* (2.9%), *Aspergillus niger* (1.5%), *Scopulariopsis* (1%), *Trichophyton rubrum* (1%) and *Fusarium* (0.5%).

The majority of the patients were women and in both sexes, the most cases of infections were observed in the individuals who were 60-70 year old. The rate of effected fingernails and toenails were almost equal. Concerning the results of culture of specimens, *Candida* was the most prevalent causative agent in the fingernails such as *Trichophyton* (esp. *Trichophyton mentagrophytis*) in toenails. The most prevalent none dermatophytic moulds were *Aspergillus* species in particular in toe nails.

Key word: Onychomycosis, Dermatophyte, Yeast, Saprophyte, Tehran

Introduction

Onychomycosis is the fungal infection of the nail, which is caused by various species of dermatophytes, yeasts and moulds. In addition to the physical effects of onychomycosis, psycho-social consequences may interfere with individual's personal and professional life (1, 6, 13). Fungal infections of the nail may not only promote secondary bacterial infection, cellulites, Id reaction and chronic urticaria, but also it will be able to act as a fungal reservoir and infect other part of the body as well as transmitted to other individuals (6).

In onychomycosis, some factors such as diabetes, aging, atopy, immunodeficiency virus, immunosuppressive therapy, psoriasis, trauma, tinea pedis, hyperhidrosis and genetic considered as a predisposing factors and should be paid more attention (27,29). Moreover, dermatoses such as psoriasis, lichen planus and melanoma can also cause nail alterations similar to onychomycosis, therefore diagnosis and treatment of fungal nail infections is critical. Diagnosis and confirming of this infection depends on laboratory identification, which is based on direct microscopy and culture of specimens.

There are considerable differences in prevalence of onychomycosis in various geographical areas. Dermatophytes are evolving as major causative pathogens in countries such as Pakistan (3), Korea (12), Canada (11), India (4), and United Kingdom (14), while the yeasts are most frequently reported in Spain (26), Italy (17) Saudi Arabia (2) and Iran (19, 24). Besides, saprophytic moulds are common cause of

toenail infections in some region as Korea (12) and Thailand (16). According to increase of prevalence of onychomycosis during the last decades as well as the role of various types of climate, socio-economical and occupational situations, regional investigations for determining causative fungal agents and its prevalence is necessary.

Materials and Methods

During a period of one year (2001-2002), 252 patients with suspected onychomycosis were examined in Tehran, capital of Iran. 71% of patients were female. The average age of patients was 36.8 ± 16.94 (Figure 1). The affected areas of the nails were primarily cut away to border of healthy parts. Appropriate specimens were collected, by scrapping of the nail plats and beds. The materials closest to proximal and lateral nail edges were also collected if paraonychia was suspected. The direct mount from specimens was made by 20% potassium hydroxide and the remaining samples were cultured on Sabouraud's glucose agar and Sabouraud's containing chloramphenicol and cycloheximide. All plates were incubated in 30 °C for four weeks and examined at daily intervals for developing colonies. The fungi were identified by routine laboratory methods, in particular, the slide culture techniques, microscopic and macroscopic characteristics, germ tube test as well as chlamydospore formation.

Results

From 252 cases of suspected onychomycosis, 50.4% (n=127) were positive based on laboratory findings. The patients comprised 71.7 % (n=91) female and 28.3 % (n=36) male. The highest prevalence of onychomycosis was seen in patients with 60-70 years of age. (Figure 2) Direct microscopy tests were positive in 38.9% of nail specimens. Among these positive cases, 12.3 % (n=31) presented branching mycelium with arthroconodia, while 21 % (n=53) demonstrated blastoconidia and pseudohyphes.

Besides, saprophytic myceliums were observed in 5.6 % (n=14) of positive cases (Table 1).

Table 1- Results of direct examination of specimens from patients suspected to onychomycosis.

| Direct exam | Frequency | Percent |
|---|-----------|---------|
| Dermatophytosis (Branching mycelium with arthroconidia) | 31 | 12.3 |
| Candidiasis (Blastoconidia and pseudohyphes) | 53 | 21 |
| Saprophyte (septated mycelium) | 14 | 5.6 |
| Negative | 154 | 61.1 |
| Total | 252 | 100 |

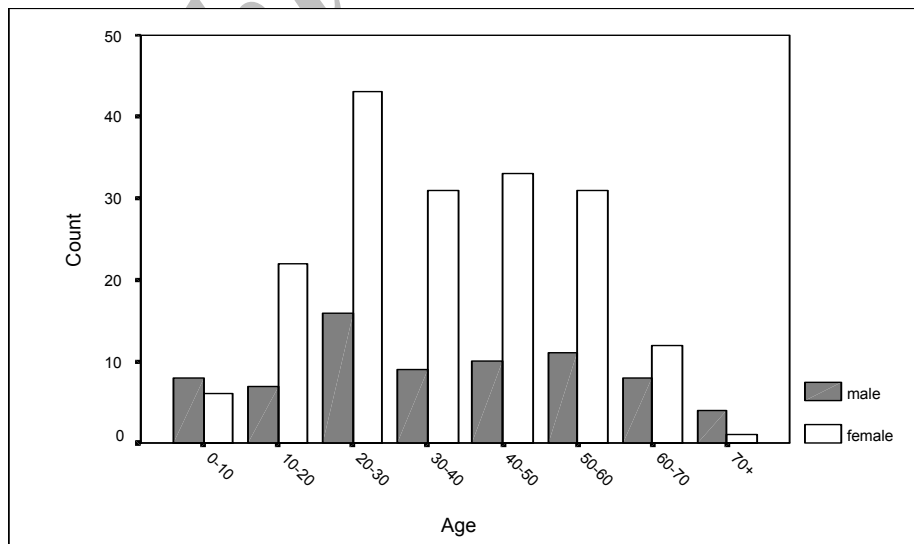


Figure 1- Frequency distribution of suspected patients with fungal nail infections according to age and sex .

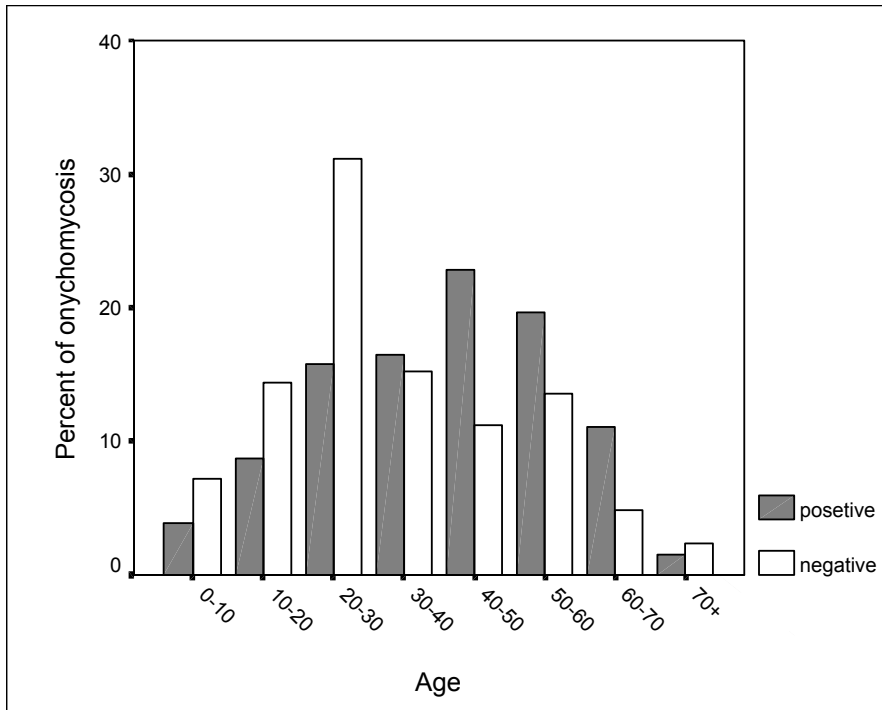


Figure 2- Distribution of patients with fungal nail infections according to age.

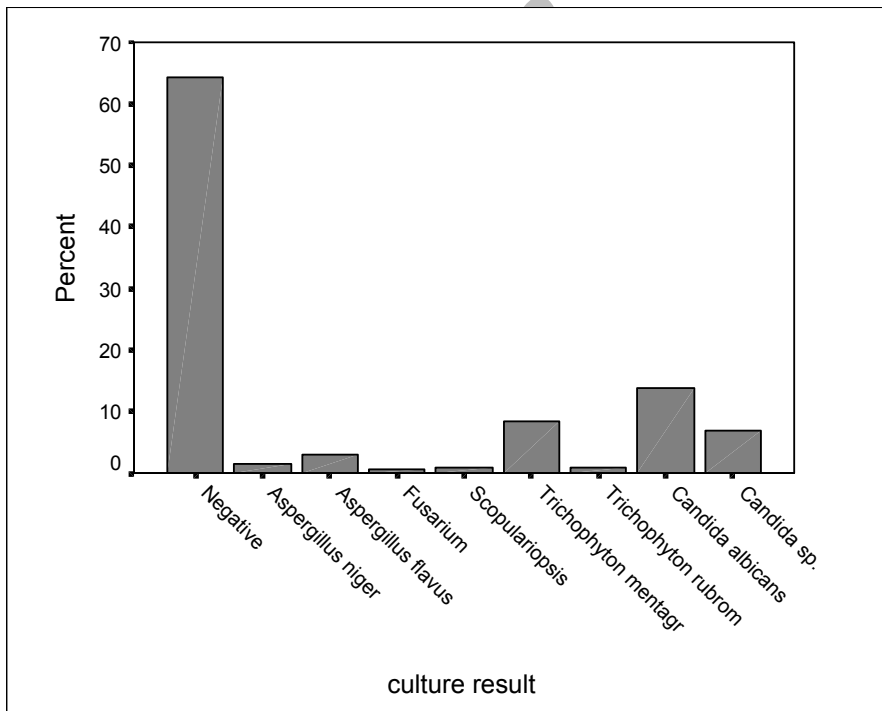


Figure 3 - Relative prevalence of fungal species isolated from nail infections .

The isolated causative agents from culture of specimens according to their frequencies were as follows: *Candida albicans* (13.7%), *Trichophyton mentagrophytis* (8.3%), *Candida species* (6.9%), *Aspergillus flavus* (2.9%), *Aspergillus niger* (1.5%), *Scopulariopsis* (1%), *Trichophyton rubrum* (1%) and *Fusarium* (0.5%) (Figure 3).

Women were mostly infected in the age range of 40-50 years (72.2%), while men, in contrast, were infected in the age range of 60-70 years. The rate of effected fingernails was higher in females in which yeasts were predominant isolated agent (71.9% females, 28.1% males), while the rate of affected toenails, mainly by dermatophytes, and were almost equal in both sexes.

The isolated none dermatophytic moulds were *Aspergillus*, *Scopulariopsis* and *Fusarium* with frequency of 4.4%, 1% and 0.5% respectively.

Discussion

Onychomycosis is one of the most common nail diseases, in which 18 to 40 percent of all nail diseases and approximately 30 percent of all dermatomycosis are due to fungal nail infections (1). In the past, they were considered to be very rare affecting, mainly those caring for children with tinea capitis, but their prevalence has increased dramatically during the last few decades. Approximately 1.5% to 15% of persons presenting to a dermatologist have onychomycosis (6).

Although it has worldwide occurrence, but its frequency is variable which depends on different climatic, professional and socio-economic conditions. For example, a comprehensive survey from North Malawi found no onychomycosis though there was a 1.5 to 2.5% prevalence of dermatophytosis (20), while the estimated prevalence of onychomycosis in United Kingdom is 1.3 to 4.7% (21).

The frequency of onychomycosis increases with age. This infection is very rare in young children, common in young adults and very frequent in elderly (6, 17, 20). In this study, the rate of onychomycosis was 67.4% in age range of 40- 50 years (29 positive cases from 43 suspected patients) but the highest prevalence was seen in the age range of 60-70 years (70%, 14 positive cases from 20 suspected patients).

In spite of other studies that mentioned higher incidence of onychomycosis in men than women (3, 5, 6, 11), based on the findings in this study and some other investigations, women affected more than men (17, 22).

During the last decades, some variation in the pattern of causative agents of fungal nail infections was observed (6). Resembling the majority of the reports from Tehran (19, 23, 24), we have also found yeasts and yeast-like fungi as predominant causative agents of onychomycosis. However, this finding is not in agreement with one of the observation from Tehran (13) in which dermatophyte were pointed out as the dominant cause of onychomycosis.

Among isolated species, *Trichophyton rubrum* is reported as a causative agent of 50-75% cases in Western Europe, North America and Asia. Besides *Trichophyton rubrum* and *Trichophyton mentagrophytes* together make up at least 80% of onychomycosis in Central Europe (10). In the 1970s, the most common agents of onychomycosis in Iran were *T. schoenleinni* and *T. violaceum* respectively (4,14). However, dermatophyte profile in Iran follows the world pattern since

1980 for onychomycosis. In the most part of Iran, these species were replaced by *T. mentagrophytes* and *T. rubrum* (19, 24). In this survey, the most isolated dermatophyte was *Trichophyton mentagrophytes*, which is concordant with the majority of studies from Iran (7, 19, 24). Although Khosravi *et al* (13) reported *T. violaceum* as the second prevalent isolated agent of onychomycosis; we found no case of onychomycosis due to this species.

The reported prevalence of onychomycosis due to yeast are very variable in different locations. In this investigation, yeasts were the most frequent causative agent of onychomycosis, which mainly involved women's fingernails. Similar to other investigations (9, 30), we found *Candida albicans* as the predominant isolated yeast (66% of cases).

Based on several studies, none-dermatophyte moulds are considered pathogenic in about 5% of cases, but significant differences were seen in various geographical regions (8, 25, 28). In this investigation, the causes of 5.6% of positive cases were moulds, which were isolated mainly from females (5% females, 1% males) and toenails. Similar to previous studies in Iran, we found *Aspergillus sp.* as the most common non-dermatophytic molds. This was in contrast to observation of Khosravi *et al* (13), in which *Scopulariopsis brevicaulis* was the dominant species.

Considering our results, which revealed high frequency of onychomycosis in elders and women, study of high-risk groups to improve their sanitary and health is recommended. Moreover, regarding high prevalence of yeast as a major cause of onychomycosis and its variation in different climatic condition, determining causative agents is so imperative in rapid diagnosis and appropriate treatment.

References:

1. Achten G, Wanet-Rouard J (1981). Onychomycosis (Mycology No.5). Brussels; cilag
2. Al-Sogair SM, Moawad MK, Al-humaidan YM (1991). Fungal infections as cause of skin disease in eastern province of Saudi Arabia: Prevaling fungi and pattern of infection. *Mycosis*; 34: 333-337
3. Aman S, Haroon TS, Hussain I, Bokhari MA, Khurshid K (2001). Tinea unguium in Lahore, Pakistan. *Med Mycol*; 39(2): 177-80
4. Ardehali M (1973). dermatophytic agents of tinea unguium in Iran. *Int J Dermatol*; 21(5): 322-323
5. Banerjee U, Sethi M, Pasricha JS (1990). Study of onychomycosis in India. *Mycoses*; 33(7-8): 411-5
6. Baran R., Hay R., Hankeke E., et al (1999). Onychomycosis: the current approach to diagnosis and therapy. Martin dunitz Ltd. Publishers UK
7. Chadegani M, Momeni A, Shadzi S, Javaheri MA (1987). Study of dermatophytoses in Esfahan. *Br Med J*; 89(2): 101-104
8. Clayton YM (1992). Clinical and mycological diagnostic aspects of onychomycosis and dermatomycosis. *Clin Exp Dermatol*; 17: suppl 1: 37-40
9. Cohen J, Scher RK, Pappert A (1992). The nail and fungus infections. In Elewski B, ed cutaneous fungal infections. New York, Igaku Shion: 106-123

10. Gill D, Marks R (1999). A review of the epidemiology of tinea unguium in the community. *Australas J Dermatol*; 40(1): 6-13
11. Gupta AK, Jain HC, Lynde CW, Wateel GN, Summerbell RC (1997). Prevalence and epidemiology of unsuspected onychomycosis in patients visiting dermatologists' offices in Ontario, Canada--a multicenter survey of 2100 patients. *Int J Dermatol*; 36(10): 783-7
12. Han MH, Choi JH, Sung KJ, Moon KC, Koh JK (2000). Onychomycosis and *Trichosporon beigelii* in Korea. *Int J Dermatol*; 39(4): 266-9
13. Haneke E (1989). Epidemiology and pathology of onychomycoses. In : Nolting S, Korting HC, Onychomycoses. Berlin, Springer: 1-8
14. Khosravi AR, Mansouri P (2000). Onychomycosis in Tehran, Iran: Prevailing fungi and treatment with itraconazole. *Mycopathologia*; 150:9-13
15. Khosravi A, Kordbacheh P, Bokae S (1994). An epidemiology approach to zoophilic dermatophytoses in Iran. *Med J Islam Rep Iran*; 7: 253-257
16. Kotrajaras R, Chongsanthien S, Rojanavanich V, et al. (1988). *Hendersonula toruloidea* infection in Thailand. *Int J Dermatol*; 27: 391-395
17. Mercantini R, Marsella R, Moretto D (1996). Onychomycosis in Rome, Italy. *Mycopathologia*; 136(1): 25-32
18. Midgley G, Moor MK, Cook JC, Phan QG (1994). Mycology of nail disorders. *J Am Acad Dermatol*; 31: S68-S74
19. Moghaddami M, Shidfar MR (1989). A study of onychomycosis in Tehran. *Med J Islam Rep Iran*; 3(3-4): 143-149
20. Ponninghaus JM, Clayton Y, Warndorff D (1996). The spectrum of dermatophytes in northern Malawi (Africa). *Mycosis*; 39:293-297
21. Roberts DT (1992). Prevalence of dermatophyte onychomycosis in the United Kingdom: results of an omnibus survey. *Br J Dermatol*; 126 Suppl 39:23-7
22. Sais G, Jucgla A, Peyri J (1995). Prevalence of dermatophyte onychomycosis in Spain: a cross-sectional study. *Br J Dermatol*; 132(5): 758-61
23. Shidfar MR (1992). Onychomycosis among patients referring to Mycology Laboratory of Health School. *PhD Thesis*. Tehran: Tehran University: 30-188
24. Shokouhi T (1991). Epidemiological and mycological study of dermatophytoses in Mycology Laboratory of Health School. *PhD Thesis*. Tehran: Tehran University: 30-188
25. Summerbell Rc, Kane J, Krajden S (1989). Onychomycosis, tinea pedis and tinea manuum caused by non-dermatophytic phylamentous fungi. *Mycoses*; 32: 609-619
26. Velez A, Linares MJ, Fenandez-Roldan JC, Casal M (1997). Study of onychomycosis in Cordoba, Spain: prevailing fungi and pattern of infection. *Mycopathologia*; 137(1): 1-8
27. Walshe MM, English MP (1966). Fungi in nails. *Br J Dermatol*; 11:198-207
28. Williams HC (1993). The epidemiology of onychomycosis in Britain. *Br J Dermatol*; 129: 101-109
29. Zaias N, Tosti A, Rebell G, Morelli R, Bardazzi F, et al. (1996). Autosomal dominant pattern of distal subungual onychomycosis caused by *Trichophyton rubrum*. *J Am Acad Dermatol*; 34: 302-304
30. Zaini F (1986). Onychomycosis due to yeast and yeast like fungi. *Iranian J Pub Hlth*; 15(1-4): 55-72