CLINICO-MYCOLOGICAL STUDY OF ONYCHOMYCOSIS

V. RAMESH, * RATAN SINGH, † B. S. N. REDDY ‡ AND SUDARSHAN KUMARI §

Summary

Onychomycosis constitutes one of the major causes of nail dystrophy and is of serious concern to the clinician because of its chronicity and recalcitrance to therapy. The clinical and mycological features were studied in 45 cases of onychomycosis. The disease was more common in adult males. Subungual hyperkeratosis (95.5%) and discolouration of the nail plate (100%) were the most consistent findings observed. Among the 4 clinical types seen, distal subungual onychomycosis was the commonest. The finger nails were more commonly involved than toe nails. The culture positivity rate was observed to be 68.8%. The predominant isolates obtained were *T. rubrum* (52.9%), *T. mentagrophytes* (20.1%) *T. tonsurans* (5.9%), *Aspergillus* species (8.8%) and *C. albicans* (11.8%).

KEY WORDS: Onychomycosis, Clinical types, Mycology, Clinico-Mycologic correlation.

Onychomycosis, literally means infection of the nail apparatus by a fungus. It has been described as the most persistent and intractable condition in which spontaneous remissions are rare. Undoubtedly, it constitutes one of the major causes of nail dystrophy and occupies a significant place among nail disorders. Although onychomycosis is asymptomatic, its importance lies in the fact that it forms a chronic reservoir of infection and can give rise to repeated mycotic infections of the skin.

Ajello[1] pointed out that the causative organisms in onychomycosis vary from place to place depending upon several factors. Nevertheless, it is generally believed that the fungi implicated in the etiology of this condition fall under three groups – the dermatophytes, the moulds and the yeasts. The dermatophytic species most commonly implicated are *T. rubrum*, *T. mentagrophytes* and *E. floccosum*[2]. Candidal nail invasion is said to be more common in the presence of paronychia[3]. A variety of moulds have been reported to have been isolated from nails and almost all these reports are from the western countries[4, 5]. Benedek[6] emphasized the importance of trauma in increasing the susceptibility of the nails to fungal infections. Moore and Weiss[7] stressed the necessity of knowing the etiologic agent in onychomycosis because, the moulds and the yeasts, unlike the dermatophytes, are insensitive to griseofulvin. Zaias[8] described four distinct clinical types of onychomycosis, each type being associated with a certain species of fungi. Scant attention has been paid to this problem in our country where the incidence is notably high. With the

* Resident
† Professor
‡ Asstt. Professor
Department of Dermatology & Venereology
§ Lecturer
Department of Microbiology
Maulana Azad Medical College,
New Delhi-110002.

Received for publication on 22—10—1981

exception of a single study by Puri et al[9], almost all the reports from India studied onychomycosis, only as a part of superficial mycotic skin infections. Since, this problem is quite common in Delhi, we thought it was important to study in detail the clinical types seen here in relation to the age, sex, occupation, personal habits and hobbies of the patients as well as the etiologic agents isolated in culture.

Material and Methods

45 cases of clinically suspected and microscopically confirmed (KOH+ve) cases of onychomycosis in both sexes constituted the clinical material for this study. The cases were selected at random from the patients attending the out-Patient Skin clinic of LNJP Hospital for common skin ailments as well as nail abnormalities. In all the cases data related to the age, sex, duration of the lesions, occupation, personal habits and hobbies, family history of fungal infections etc were obtained. After a detailed clinical examination, the physical features of the nails were recorded. Associated systemic or skin diseases were noted. Care was particularly taken to record the presence of superficial mycotic infections on other parts of the body.

Scrapings, clippings were collected from the deepest part of the nail (junction of the healthy and diseased portion of the nail) as described by Davies[10]. When both toe and finger nails were affected, scrapings were collected from both the sites. Similarly, scrapings were collected from other fungal lesions on the body, if present. The specimens in 10% KOH were examined under direct microscopy to note the morphologic pattern of the fungal elements. In all KOH positive cases, small portion of the samples were inoculated on to Sabouraud's dextrose agar media (Plain and Actidione). The cultures were incubated at 25°C and examined at weekly intervals. Tubes were discarded if no growth was observed within 4 weeks and in all these cases repeat cultures were done using fresh specimens at three consecutive times. Subcultures were undertaken whenever there was suspicion of contamination. Lactophenol cotton blue preparations were made from the positive cultures and examined under microscope to study the mycological details. Slide cultures were performed as detailed by Ferguson and Prazek[11], whenever needed. Identification of the fungi was based on the manual of Conant et al[12] and the monogram by Raper and Fennell[13]. Following criteria were employed before reporting a mould as an isolate from the nails :— (1) Presence of fungus from the nail scrapings under direct microscopy (KOH + ve). (2) Isolation of the same fungus in culture on three consecutive occasions at minimum intervals of 7 days each. (3) No systemic or local anttfungal treatment given during the period of investigations.

Results

Clinical :

45 cases of onychomycosis were investigated. Males (68.9%) outnumbered the females (31.1%). The commonest age group affected was 21–30 years (Table I). The duration of the lesions varied from 3 months to 30 years but in majority of cases (35.5%) it was less than one year. 16 (35.6%) of patients were skilled workers, 9 (20%) were house wives, 8 (17.8%) were students, 6 (13.3%) were farmers, 4 (8.9%) were unskilled workers and 2 (4.4%) were involved in occasional light work. 7 patients had hobbies which included gardening, tailoring and outdoor games. 8 (14.4%) patients gave history of having nails pared by barbers. 2 patients had intrafamilial history of fungal infections of the skin and nails. Recurrent episodes of mycotic infections of the skin was recorded in 14 (31.1%) patients. Obesity was noted in 4 (8.9%) cases and superficial fungal

TABLE 1
Age and Sex distribution in 45 cases of Onychomycosis

Age in years	Number of Cases			
	Males	Females	Total	%
10-20	4	3	7	15.6
21-30	12	3	15	33.3
31-40	4	1	5	11 1
41-50	1	4	5	11.1
51-60	4	3	7	15.6
61-70	6	–	6	13.3
Total	31	14	45	100

infections of the skin were observed in 20 patients (44.4%). These included T. corporis in 9, T. pedis in 3, T. cruris in 2 and combined infections in 6 cases.

Out of 45 cases studied, the finger nails were affected in 29 (64.4%) cases. toe nails in 9 (20%) cases and both toe and finger nails in 7 (15.6%) cases. The predominant clinical abnormalities observed were discolouration of the nail plates, subungual hyperkeratosis, leuconychia, onycholysis, total nail dystrophy, paronychia and pitting in that order of frequency (Table 2.)

TABLE 2
Clinical signs in 45 cases of Onychomycosis.

Clinical Sign	No. of cases	%
Discolouration	45	100
Subungual hyperkeratosis	43	95.5
Leuconychia	15	33.3
Onycholysis	12	26.6
Total nail dystrophy	6	13.3
Paronychia	4	8.9
Pitting	2	4.4

The common clinical types of nail involvement recorded were distal subungual onychomycosis in 43 cases, proximal subungual leuconychia in 4 cases, white superficial onychomycosis in 1 case and paronychia with nail lesion in 4 cases (Table 3).

Mycological :

The features on direct microscopy of KOH examination of nail scrapings in relation to the presence of superficial mycotic infections of the skin is summarized in Table 4. Hyphae were predominant when the nails and skin were affected, signifying that the infection was in active phase. 31 isolates were obtained on culture from the nails in the 45 patients giving a positivity rate of 68.8%. Positive cultures were obtained only from the skin lesions in 3 patients. The predominant organisms identified were *T. rubrum* in 18 (52.9%) ; *T. mentagrophytes* in 7 (20. 6%); *T. tonsurans* in 2 (5.9%); *Aspergillus* (A. flavus in 1 + A. fumigatus in 2) species in 3 (8.8%) and *C. albicans* in 4 (11.8%). (Table 5)

Discussion

The present study revealed that as high as 40% (18) of the patients came to the hospital not primarily for the nail complaints but for the associated skin problems. This is in accordance with long held observation that onychomycosis is asymptomatic and more so in a population that is

TABLE 3
Clinical types and Cultural isolates in 45 eases of Onychomycosis

Clinical types of onychomycosis	No. of Cases	T. rubrum	T. mentagrophytes	T. tonsurans	Aspergillus Species	Candida albicans
Distal subungual onychomycosis	43	13 30.2%	6 13.9%	2 4.6%	3 6.9%	—
Proximal subungual onychomycosis	4	3 75%	—	—	—	—
White superficial onychomycosis	1	—	—	—	—	—
Paronychia with nail lesions	4	—	—	—	—	4 100%

TABLE 4

Mycological forms seen in KOH examination from nail scrapings and their relation to mycotic skin lesions.

Predominant forms seen in nail scrapings	No. of Cases	Cases with mycotic skin lesions	%
Hyphal forms	20	15	75.0
Spore forms	15	12	13.3
Both	10	3	30.0
Total	45	20	44.4

hardly cosmetic conscious. The maximum incidence of the disease was noted in the 21–30 years age group and in nearly all the age groups the males outnumbered the females. This pattern of distribution has been noted commonly by many workers and could be due to more varied environmental exposures of males[14]. The relative rarity of this condition in children was attributed to their faster linear nail growth and consequent inability of the fungus to get a proper hold in the nail substance[15].

and it is important to note that the white superficial type was seen only in one case. This type has been reported to occur in the toe nails of a predominantly shoe-clad population[16]. In our country where a major section of the people go barefooted or use open footwear like strappers and sandals, this tybe of onychomycosis is uncommon. Among all the clinical types, candidal onychomycosis alone showed a predominance in females (75%). Further, onycholysis was seen in 50% of the females whose occupation was exclusively domestic work. It is likely that domestic work is associated with constant trauma to the nails which hastens the destruction of an already diseased nail, resulting in onycholysis.

The nail scrapings showing hyphal forms were invariably associated with mycotic skin lesions. The hyphal forms in fungus are necessary for active uptake of nourishment from the host and when conditions are favourable the fungi assume such forms and infect the skin. The recovery rate of culture

TABLE 5

Cultural Isolates in relation to the site of involvement

Fungus isolated	Finger nails	Toe nails	Both toe & finger nails	Skin & nails	Skin only	Total	%
T. rubrum	8	1	1	6	2	18	52 9
T. mentagrophytes	3	1	–	2	1	7	20.6
T. tonsurans	1	–	–	1	–	2	5.9
Aspergillus species	1	2	–	–	–	3	8.8
Candida albicans	4	–	–	–	–	4	11.8
Total	17	4	1	9	3	34	100

The most common nail abnormalities observed in the present study were subungual hyperkeratosis and discolouration of the nail plate. The presence of these signs should arouse a clinical suspicion of onychomycosis. The distal and proximal subungual onychomycoses were the most common clinical types observed in this study

from microscopically positive nail clippings in this study was 68.8%. This is in sharp contrast to the usual range of 50% by several workers [17, 18, 19]. The high recovery rate in this study could be due to the following reasons :

(1) The nail samples were taken from the junction of the healthy with

diseased nail and as close as possible to the matrix when the entire nail was dystrophic. This method was suggested by Davies[10] and the fungus is most likely to be in its viable form at these areas than at the distal end.

(2) The scrapings were subjected to culture more than once in some cases. This has led to better isolation of the pathogen.

The cultural isolates revealed a predominance of *T. rubrum* over all other species. This may be explained on the basis of a rising trend in the incidence of T. rubrum infections with a decline in other species, particularly after the world wars, throughout the globe[20]. Further, T. rubrum is unique among others in its special affinity for hard keratin such as the nails[21]. *T. mentagrophytes* was the second common isolate (20%). Similar findings have been observed by many others also[18] although a predominance of T. mentagrophytes was reported from the nails by a few workers[9,22]. T. tonsurans was isolated from two cases in the present study. There are sporadic reports of its isolation in this country[23]. In no case was cither the Microsporum or Epidermophyton species isolated. The former is not generally accredited with attacking nails[24] and the latter rarely invades the nails[25].

Among the moulds, the *Aspergillus* species was isolated in 3 cases. In two of these cases, it was grown from the great toe nails of female patients who were accustomed to fashionable high-heeled footwear. According to Rosman[21], such factors could lead to a constant pressure on the great toe nails decreasing their normal resistance to the invasion by moulds. In the third case, the mould was isolated from the finger nail of a patient who had culture positive dermatophytic skin infection. It is likely that the dermatophyte reduced the resistance of the finger nail keratin, paving the way for a mould. In all the 3 cases of mould infection, the moulds were seen to grow parasitically; showing both hyphal forms and arthrospores in KOH preparation. Thus, using only direct microscopy it may not be possible to say whether the fungus is a mould or a dermatophyte and culture alone could solve this problem. Among the yeasts, C. albicans was isolated in all the 4 cases seen with paronychia and nail changes.

It may be concluded that when many nails are involved, in association with mycotic skin lesions, the likely etiologic agent is a dermatophyte, commonly T. rubrum. In cases, where only a few nails are involved, or nails are involved in the absence of mycotic skin lesions, it is reasonable to suspect a mould. When the nail lesions are seen in the presence of paronychia, the causative agent is likely to be candida albicans.

Reference

1. Ajello L : Quoted in, Fungous diseases and their treatment by Hildick-Smith, Blank H and Sarkany I, Churchill, London, 1964; p. 32.
2. English MP and Atkinson R : Onychomycosis in elderly chiropody patients, Br J Derm, 1974; 91 : 67-72.
3. Baxter DL : Superficial and deep mycotic infections. Dermatology, Vol. I, Editors, Moschella SL, Pillsbury DM and Hurley HJ, W B Saunders, Philadelphia, 1975; p. 621.
4. Walshe MM and English MP : Fungi in Nails. Br J Derm, 1966; 78 : 198-207.
5. Onsberg P : The fungal flora of normal and diseased nails. Curr Therap Res, 1977, 22 : 20-23.
6. Benedek T : Handbook of Tropical Dermatology & Med Mycology. Edr Simons RDGP, Vol. II, Elsevier, 1953; p. 1035.
7. Moore M and Weiss R : Onychomycosis due to Aspergillus terreus. J Invest Derm, 1948; 11 : 215-223.

8. Zaias N : Onychomycosis (A Review). Arch Dermatol, 1972 ; 105 : 263-274.

9. Puri DKK, Sarin RC and Arora S : Pattern of dermatophytes affecting the nails. Ind J Derm Ven & Lep, 1978 ; 44 : 91-94.

10. Davies RR : Mycological tests and Onychomycosis. J Clin Path, 1968 ; 21 : 729-730.

11. Ferguson JS and Prazek G : The Slide Culture. Arch Dermatol, 1960 ; 81 : 974-977.

12. Conant NF, Smith DT, Callaway JL and Baker RD : Manual of Clinical Mycology, 3rd Ed, W B Saunders Philadelphia, 1971.

13. Raper KP and Fennell DI : The Genus Aspergillus. Williams and Wilkins, Baltimore, 1965.

14. Philpot CM : Some epidemiological aspects of tinea. Mycopathologia, 1977 ; 62 : 3-13.

15. Roberts SOB and Mckenzie DWR : Textbook of Dermatology. Edrs Rook A, Wilkinson DS and Ebling FJG, 3rd Ed, Blackwell, London, 1979 ; p. 767.

16. English MP : Nails and Fungi. Br J Derm, 1976 ; 94 : 697-701.

17. Zaias N, Obertel I and Elliott DF : Fungi in toe nails. J Invest Derm, 1969 ; 53 : 140-142.

18. Gentles JC : Laboratory investigations of dermatophyte infection in nails, Sabouraudia, 1971 ; 9 : 149-153.

19. English MP and Lewis L : Ringworm in South of England, 1960–1970 with special reference to onychomycosis. Br J Derm, 1974 ; 90 : 67-75.

20. Maskin IL, Taschdjian CL and Franks AC : The etiology of dermatophytosis. Arch Dermatol, 1957 ; 75 : 66-69.

21. Rosman N : Infections with Trichophyton rubrum. Br J Derm, 1966 ; 78 : 288-212.

22. Behl PN and Sharma MD : Incidence of mycotic infections in Delhi. Ind J Derm, 1957 ; 3 : 5-7.

23. Kandhari KC and Sethi KK : Dermatophytosis in Delhi area. J Ind Med Ass, 1964 ; 42 : 324-326.

24. Hodges RS : Ringworm of the Nails. Arch Derm Syph, 1921 ; 4 : 1-26.

25. Findlay GH : Superficial Fungal infections. Dermatology in General Medicine, 2nd Ed, Editors Fitzpatrick TB et al, McCraw Hill, New York, 1979 ; p. 1509.

Acknowledgment

We are grateful to the Dean, Maulana Azad Medical College, New Delhi-2, for providing the facilities for this study.