Section: DVL

Original Research Article

DIAGNOSIS AND MANAGEMENT OF FINGERNAIL ONYCHOMYCOSIS

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ABSTRACT

Background: Onychomycosis is a common nail ailment associated with significant physical and psychological morbidity. Candida onychomycosis affects fingernails more often and is accompanied by paronychia. Diagnosis is primarily based upon KOH examination, culture and histopathological examinations of nail clippings and nail biopsy. Various treatment modalities including topical, systemic and surgical have been used. Topically, drugs (ciclopirox and amorolfine nail lacquers) are delivered through specialized transungual drug delivery systems ensuring high concentration and prolonged contact. Commonly used oral therapeutic agents include terbinafine, fluconazole, and itraconazole.

Materials and Methods: This is a prospective study was conducted among Patients suffering from onychomycosis randomly selected from Dermatology Outpatient Department. Patients age group from 18 to 60 years with Toenail or fingernail fungal infection were included. Clinical types of onychomycoses can be: Total dystrophic onychomycosis, proximal subungual onychomycosis, Distal and lateral subungual onychomycosis, Superficial white onychomycosis.

Results: Patients included in the study were 81 (90%) females and 9 males (10%). Nine of our patients (40%) were found to have onychomycosis associated with chronic paronychia. Nine of our patients (10%) were found to have onychomycosis associated with chronic paronychia. Other predisposing factors such as family history of fungal nail infection were detected in 8 patients (8.9%) and patients who received intermittent short courses of topical and/or systemic antifungal treatment over the long course of their disease were 5 (5.6%). As regards the different clinical presentations, the most prevalent was distal-lateral subungual onychomycosis (90%) followed by total dystrophic onychomycosis accounting for (8.9%) and the least common was proximal subungual onychomycosis representing only one (1.1%) patient. Fungal isolates in the present study were grouped into Yeast 91.1% (82/90), non-dermatophyte mould infection in 4.4% (4/90) while dermatophyte infection was detected in 4.4% (4/90) only. The results revealed mycological clearance (by culture and KOH) in 72 out of 90 (80%) patients at one month followup while no response to treatment was detected in 18 patients (20%).

Conclusion: Onychomycosis prevalence worldwide and the ineffectiveness of conventional treatments have led current research to focus on novel approaches to enhance drug diffusion trough the nail plate. Many important results have already been achieved either by modifying topical formulations or by applying physical techniques that modify the nail plate itself. However, many challenges still exist and further researches are necessary for the development of effective and safe treatments for onychomycosis.

Keywords: Onychomycosis, fungal infection, nail, ungual penetration.

INTRODUCTION

Onychomycosis is a common condition affecting 5.5% of the population worldwide and represents 20–40% of all onychopathies and about 30% of cutaneous mycotic infections.[1] Onychomycosis of fingernails may lead to pain, discomfort, and impaired/lost tactile functions. Toenail dystrophy can interfere with walking, exercise, or proper shoe fit. In addition, onychomycosis has both psychosocially and physically detrimental effects.[2]

The prevalence of onychomycosis is determined by age, occupation, climate, and frequency of travel. Increase in the aged population, HIV infection or immunosuppressive therapy, avid sports participation, commercial swimming pools, and occlusive foot wear are responsible for an increased incidence.[3] Men are affected more frequently possibly due to more frequent nail damage from sports and leisure activities. Toe nails are about seven times more frequently affected than fingernails due to three times slower growth rate.[4] Walking barefoot, wearing ill-fitting shoes, nail biting (onychophagia), and working with chemicals further predispose Indian patients to onychomycosis.[5] Other predisposing factors include nail trauma, peripheral vascular disease (PVD), smoking, and psoriasis.[6]

There is a wide variety of fungi causing onychomycosis which varies from one geographic area to another primarily due to different climatic conditions.[7] Dermatophytes are the most frequently implicated causative agents in onychomycosis (approximately 90% in toenail and 50% in fingernail). Dermatophyte invasion of the nail plate is termed tinea unguium. Trichophyton rubrum (T. rubrum) is the most common causative agent followed by T. mentagrophytes.[8]

Nondermatophyte molds (NDM) mainly affect toenails and occasionally fingernails. NDM account for 1.5–6% of all onychomycosis that fall into two main categories: first group encompasses fungi that are nearly always isolated from nails as etiologic agents, such as Scytalidium dimidiatum and Scytalidium hyalinum; the second group is formed by opportunistic fungi that may also be isolated as contaminants, such as Scopulariopsis brevicaulis, Aspergillus sydowii, and Onychocola canadensis. Certain NDM such as Acremonium species can invade the nail surface, while others such as Scytalidium species are more often associated with distal and lateral subungual onychomycosis.[9]

MATERIALS AND METHODS

This is a prospective study was conducted among Patients suffering from onychomycosis randomly selected from Dermatology Outpatient Department.

Inclusion Criteria

- Age group from 18 to 60 years.
- Toenail or fingernail fungal infection.
- Clinical types of onychomycoses can be: Total dystrophic onychomycosis, proximal subungual onychomycosis, Distal and lateral subungual onychomycosis, Superficial white onychomycosis.

Exclusion Criteria

- Age less than 18 years and more than 60 years.
- Usage of topical or systemic anti-fungal therapy in the preceding 6 months.
- Use of drugs inducing photosensitivity e.g. tetracyclines, systemic retinoids.
- Permanent or semi-permanent discoloration of the nail plate (e.g. topical therapeutics, cosmetics or professional dye exposure) as they can cause various physiological changes to the nail plate in addition to discoloration.
- Subungual hematoma, nevoid subungual formation, bacterial nail infections, and concomitant nail disorders such as psoriasis of nail plate, lichen planus and atopic dermatitis.
- Any generalized skin disease.
- Immunodeficiency e.g. HIV infected patients, patients with organ transplantation and currently on immunosuppressive drugs for long periods or patients under chemotherapy or radiotherapy.

Our patients were subjected to

1. Detailed history.
2. Thorough Clinical and dermatological examination to exclude skin diseases with associated nail disorders.
3. Photographing of affected nails before treatment, during the follow up and after 3 months.
4. Mycological examination by direct examination of nail scrapings in 20% KOH and mycological cultures.
5. Four sessions of Long pulsed Nd: YAG 1064 laser treatment.
6. Follow up visits after one month of the final laser session and three month after.

Materials

Chemicals used

a. KOH:

20% KOH solution was done by dissolving 20 gm KOH in 100 ml distilled water, and then slowly mixed until KOH is completely dissolved and kept at 2-8 C.

b. Culture media

Sabouraud's dextrose agar medium (SDA) with chloramphenicol: Composition (SDA +C): Dextrose 40 gm Peptone 10 gm Agar 20 gm Distilled water (D.W) 1 Liter Chloramphenicol 100 mg dissolved in 3 ml alchol Alcohol 3 cc.

The ingredients were mixed in 1 liter of distilled water and dissolved by heat. The pH was adjusted to (5.6). It was autoclaved at 115ºC for 15 minutes and poured into 10 ml tubes as slopes. They were kept at 2-8 C. The addition of chloramphenicol is to inhibit the growth of bacteria. This medium was used for yeast and non dermatophytic moulds isolation.

- **Sabouraud's dextrose agar with cyclohexamide and chloramphenicol (SDA +C+C)**

It was the same as the previous medium with the addition of Dermasil supplement (Oxoid) company contains cyclohexamide and chloramphenicol dissolved in 3 ml alcohol was used for 500 ml of the medium. It was used for isolation of dermatophytes and Candida albicans.

- **Chromgenic Candida Agar (Oxoid)**

Glucose 20 gm Peptone 10 gm Agar 15 gm Chromgenic mix 2 gm Distilled water (D.W) 1 Liter The ingredients were boiled then poured in tubes as slopes.

Other material: Waxy carver/ Nail clipper Plastic petridishs Glass slides Sterile glass cover Bacteriological loop Glass tubes

Devices used Long pulsed Nd:YAG laser 1064 nm.

RESULTS

Patients included in the study were 81 (90%) females and 9 males (10%). [Table 1]

Nine of our patients (40%) were found to have onychomycosis associated with chronic paronychia. [Table 2]

Nine of our patients (10%) were found to have onychomycosis associated with chronic paronychia. Other predisposing factors such as family history of fungal nail infection were detected in 8 patients (8.9%) and patients who received intermittent short courses of topical and/or systemic antifungal treatment over the long course of their disease were 5 (5.6%). [Table 3]

As regards the different clinical presentations, the most prevalent was distal-lateral subungual onychomycosis (90%) followed by total dystrophic onychomycosis accounting for (8.9%) and the least common was proximal subungual onychomycosis representing only one (1.1%) patient. [Table 4]

Fungal isolates in the present study were grouped into Yeast 91.1% (82/90), non-dermatophyte mould infection in 4.4% (4/90) while dermatophyte infection was detected in 4.4% (4/90) only. [Table 5]

The results revealed mycological clearance (by culture and KOH) in 72 out of 90 (80%) patients at one month followup while no response to treatment was detected in 18 patients (20%). [Table 6]

Table 1: Sex distribution of patients in the study

Sex		
	N	**%**
Female	81	90.00
Male	9	10.00
Total	90	100.00

Table 2: Age distribution of patients in the study

Age		
	N	**%**
(Young) <40y.	54	60
(middle age) >40y.	36	40
Total	90	100.00

Table 3: Predisposing factors of onychomycosis in patients of the study

Predisposing factors		
	N	**%**
Immersion of fingers in water for long times	45	50
Associated Tinea pedis	14	15.6
Associated chronic paronychia	9	10
Long history of intermittent short courses of treatment	5	5.6
Positive family history	8	8.9
Using chemicals & detergents in washing or work	9	10
Total	90	100.00

Table 4: Clinical presentations of onychomycosis in the total number of fingernails and toenails

Clinical presentations						
Type of onychomycosis	**Toenail**		**Fingernail**			
	N	**%**	**N**	**%**	**Total**	**%**
DLSO	36	40	45	50.00	81	90
PSO	----	--	8	8.9	8	8.9
TDO	---	--	1	1.1	1	1.1
Total	36	40	54	60	90	100.00

Table 5: Identification of fungi into genera and species of the 20 fungal isolates obtained from cases of onychomycosis

Fungi classification			
Fungal group	**Genera & Species**	**N**	**%**
Yeast	**C.krusei**	19	21.1

	C.albicans	46	51.1
	C.parapsilosis	4	4.4
	C.tropicalis	9	10
	Trichosporon	4	4.4
Dermatophytes	**T.mentagrophyte**	4	4.4
Non-dermatophyte mould	**Aspergellus flavus**	4	4.4
Total		90	100.00

Table 6: Mycological response to treatment at the first follow up

1st follow up one month after treatment		
	N	**%**
Mycologically Negative patients	72	80
Mycologically Positive patients	18	20
Total	90	100.00

DISCUSSION

Despite the efforts in the search for new drugs, formulations and approaches, some challenges must be solved in the development of new treatments for onychomycosis. Some in vitro experiments limitations are described by Elkeeb, as follow. The use of animal hooves to study drug permeability may not be appropriate to evaluate diffusion, once their composition is quite different from human nails, presenting different permeation to drugs.[10] Also, the modified diffusion cells used to perform the study provides super hydration of the nail matrix resulting in a more soft, flexible, and elastic nail, with increased pore size, which promotes a greater permeation. Therefore, the correlation of in vitro to in vivo studies may not be enough achieved.[11]

Recently, Sleven, developed a novel in vitro onychomycosis model able to predict both drug penetration and drug activity. It is consisted of a screw vial cap, where the nail is mounted with its opening space positioned above a plate with inoculated growth media, in place of the nail bed.[12] Since the use of water is not necessary, it prevents super hydration, and consequent overrated permeation. The new model was successfully tested for terbinafine, amorolfin, fluconazole, and intraconazole against T. mentagrophytes and T. rubrum, demonstrating potential use for testing novel formulations and onychomycosis drugs.[13]

Regarding the in vivo experiments, a significant challenge is the limited number of patients on past clinical trials, which also limits the power of the studies. These data are extremely relevant for decisions on the interruption of ongoing studies, as well as for the improvement of strategies already in use or development of new substances and approaches.[14]

Another important challenge that must be considered is the rising problem of antimicrobial resistance, which increases morbidity and health-care costs. Therefore, it is absolutely essential to establish microbiologic surveillance protocols.8 Although there are increasing research focusing on susceptibility of infectious yeasts, fungi, and mould to antifungal agents, little research has been made on in vitro and clinical fungal resistance.[15] In this way, the use of physical therapies, by themselves or in combination with drugs, seems to be an attractive approach. Their effectiveness is more improbable to be associated with the development of microbial resistance due to the rather nonspecific nature of the targets in these strategies.[16] However, considering especially light-based therapies, it is mandatory to take into account the radiation development of skin cancers due to mutagenic effect on healthy human cells.

Also in this sense, it is important that the concern of adverse effects is considered in the development of any treatment, aiming the selective targeting of microbial cells in preference to host mammalian cells. Thus, the safety of the treatment may be improved by the use of drug delivery technology or more specific physical strategy application. Throughout above, there are many challenges to be solved and an indication of a clear need for further research on effective and safe therapies to achieve the cure and eradication of onychomycosis.

CONCLUSION

Onychomycosis prevalence worldwide and the ineffectiveness of conventional treatments have led current research to focus on novel approaches to enhance drug diffusion trough the nail plate. Many important results have already been achieved either by modifying topical formulations or by applying physical techniques that modify the nail plate itself. However, many challenges still exist and further researches are necessary for the development of effective and safe treatments for onychomycosis.

REFERENCES

1. Ghannoum M, Isham N. Fungal nail infections (onychomycosis): a never-ending story? PLoS Pathog. 2014;10: 1–5.
2. Roberts DT, Taylor WD, Boyle J. Guidelines for treatment of onychomycosis. J Trauma Stress. 2000; 13: 539–588.
3. Rodgers P, Bassler M. Treating onychomycosis. Am Fam Physician. 2001; 63: 663–672.
4. Summerbell RC, Cooper E, Bunn U et al. Onychomycosis: a critical study of techniques and criteria for confirming the etiologic significance of nondermatophytes. Med Mycol. 2005; 43: 39–59.
5. Onychomycosis Elewski BE.: pathogenesis, diagnosis and management. Clin Microbiol Rev. 1998; 11: 415–429.

6. Barot BS, Parejiya PB, Patel HK et al. Drug delivery to the nail: therapeutic options and challenges for onychomycosis. Crit Rev Ther Drug Carrier Syst. 2014; 31: 459–494.
7. Lipner SR, Scher RK. Prognostic factors in onychomycosis treatment. Infect Dis Ther. 2015; 3: 1–6.
8. Pfaller MA. Invasive fFungal infections and approaches to their diagnosis. In: Sails A, Tang Y-W, eds. Methods in Microbiology - Current and Emerging Technologies for the Diagnosis of Microbial Infections. New York: Elsevier; 2015: 219–287.
9. Hay RJ, Baran R. Why should we care if onychomycosis is truly onychomycosis? Br J Dermatol. 2015; 172: 316–317.
10. Ameen M, Lear JT, Madan V et al. British Association of Dermatologists' guidelines for the management of onychomycosis 2014. Br J Dermatol. 2014; 171: 937–958.
11. Hay RJ. The future of onychomycosis therapy may involve a combination of approaches. Br J Dermatol. 2001;145 (Suppl): 3–8.