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## Onychomycosis

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Article History:	Abstract
<p>Received on: 11-10-2020 Accepted on: 22-12-2020 Published on : 31-12-2020</p> <p><b>*Corresponding Author</b> Simhavalli Godavarthi Avanthi Institute of Pharmaceutical Sciences, Tagarapuvalasa, Andhrapradesh E-mail: <a href="mailto:godavarthi555@gmail.com">godavarthi555@gmail.com</a></p>	<p>Onychomycosis is the most common nail disorder. It is caused by variety of organisms mainly by dermatophytes. This fungal infection of nails leads to discolouration, thickening and separation from the nail bed. The clinical suspect of onychomycosis must be confirmed by mycology. Onychoscopy is the new technique that help physician in diagnosis of onychomycosis. Its treatment depends upon the modality of nail invasion, fungus species and the number of affected nails. Oral treatments are often combined by drug interactions, while topical antifungal lacquers have less efficacy. A combination of both oral and systemic treatment is the best choice.</p> <p><i>Keywords:</i> Onychoscopy, onychomycosis, nail invasion, antifungal lacquers.</p>

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## INTRODUCTION

Onychomycosis is a fungal infection of the toenails or fingernails that include any component of the nail unit, including the matrix, bed or plate [1]. It is caused by various organisms, most often dermatophytes of the genus trichophyton. Other organism like candida is more common in finger nail infections and in patients with chronic mucocutaneous candidiasis [2]. Onychomycosis has been reported as a gender and age-related disease, being more frequent in males and increasing with age factors as diabetes mellitus, peripheral arterial disease, immunosuppression due to HIV or immunosuppressive agents [5] onychomycosis can have significant negative effects on patients emotional, social and occupational functioning [6].

## CLINICAL TYPES

1. Distal and lateral subungual onychomycosis
2. White superficial onychomycosis
3. Proximal subungual onychomycosis

4. Endonyx onychomycosis
5. Total dystrophic onychomycosis

## DISTAL AND LATERAL SUBUNGUAL ONYCHOMYCOSIS

Distal and lateral subungual onychomycosis (DLSO) is distinguished by build-up of soft yellow keratin between the nail plate and nail bed (subungual hyperkeratosis), detachment of the nail from nail bed (onychosis) and skin infection around the nail (paronychia). DLSO spreads proximally to the nail matrix [7]. Differential diagnosis of DLSO is traumatic onycholysis and nail psoriasis that is diffuse hyperkeratosis, in all toenail involved, others skin and nail signs of psoriasis (figure 01).



**Figure 01: distal and lateral subungual onychomycosis**

#### **WHITE SUPERFICIAL ONYCHOMYCOSIS**

White superficial onychomycosis (WSO) mainly affects toenails and is characterized by superficial white patches of the nail plate. The nail becomes rough, soft and crumbly. It is mainly seen in patients with immunosuppression or in young children with thin toe plates [8]. Differential diagnosis is superficial nail fragility due to continued wearing of nail polish and transverse toenail leukonychia due to trauma (figure 02)



**Figure 02: white superficial onychomycosis**

#### **PROXIMAL SUBUNGUAL ONYCHOMYCOSIS**

This is the rarest form of onychomycosis. The pathogenic fungus invades the nail Matrix and spreads distally in proximal subungual onychomycosis (PSO) [9]. PSO initially presents as whitish patches on the proximal side of the nail plate [10]. Differential diagnosis includes acute bacterial paronychia and pustular psoriasis of the nail (figure 03)



**Figure 03: proximal subungual onychomycosis**

#### **ENDONYX ONYCHOMYCOSIS**

It is characterized by massive nail plate invasion in the absence of nail bed involvement. Clinically, the affected nail may show lamellar splitting and a milky white discoloration. The nail plate is firmly attached to nail bed, and there is no nail bed hyperkeratosis or onycholysis [11] (figure 04)



**Figure 04: endonyx onychomycosis**

#### **TOTAL DYSTROPHIC ONYCHOMYCOSIS**

Total dystrophic onychomycosis (TDO) is the most severe stage of onychomycosis and it can result from a long standing DLSO or PSO. The nail plate is diffusely thickened, friable and yellowish (figure 05)



**Figure 04: Total dystrophic onychomycosis**

#### **DIAGNOSIS OF ONYCHOMYCOSIS**

50% of nail problems are caused by onychomycosis [12]. Clinical diagnosis by physical examination alone can be other causes must also be considered [13]. The clinical doubts of onychomycosis should be confirmed by mycology. The mycological examination is composed by two parts: direct microscopic exam and culture- the nail material, is collected from affected nail and immersed in KOH 40% solution, is put on the slide and then observed under the optical microscope to look for hyphae and spores. KOH does not allow one to recognize the type of fungus causing the onychomycosis, therefore, a culture is needed for a more specific diagnosis. The histopathology of nail clipping can be employed for diagnosing onychomycosis, with periodic acid-schiff (PAS) stain that allows easy conception of fungal hyphae [14].

The peculiar features of DLSO, not seen on traumatic onycholysis and nail psoriasis are [14]:

1. Proximal margin of the onycholytic area showing jagged edge, with sharp structures directed to the proximal fold (figure 06)
2. Longitudinal striae of different colours in the onycholytic nail plate; and
3. The overall appearance of the colour of the affected nail plate in a matted variable discolouration resembling the aurora borealis.



**Figure 06: Onychoscopy of DLSO**

Confocal laser-scanning microscopy (CLSM) is a new diagnostic method in which the blue laser excites acridine orange, which is applied as a fluorophore on the nail specimens to highlight the fungal hyphae [15,16]. The dermatophyte test strip is an immunochromatography test that uses a monoclonal antibody which counteracts with trichophyton species and gives a clear signal when in contact with one of the dermatophytes, after 15 minutes [17]. Fluorescence microscopy involves examining under a fluorescent microscope a nail clipping from the suspected onychomycosis stained with PAS. This method does not allow one to distinguish between the different species of fungi or between the different species of fungi or between alive or dead hyphae [18]. Raman spectroscopy is a vibrational spectroscopic technique that allows the investigation of the molecular specificity of spectral bands in a vibration spectrum [19].

## MANAGEMENT

Treatment of onychomycosis depends on the clinical type, the number of fingers affected and severity of the infection. The disadvantages of the oral treatments are often confined by drug interactions and potential hepatotoxicity, while topical antifungals have a limited efficacy if used without nail plate debridement. Treatment including combination of both topical and systemic is the best choice.

## TOPICAL TREATMENT

penetration of topical antifungal through the nail plate requires a vehicle that is specifically formulated for transungual delivery [20]. A merger with systemic

antifungals, debridement or nail avulsion in severe onychomycosis reduces the duration of treatment and increases the cure rate [21]. Nail lacquers are potent in monotherapy in the treatment of WSO and of DLSO limited to less than 50% of the distal nail [22]. Treatment duration is 6 – 12 months. Hypothetical options involve amorolfine 5% or ciclopirox 8% in non-water-soluble lacquers and ciclopirox in water-soluble nail lacquer. Amorolfine nail lacquer is applied once a week, while ciclopirox nail lacquer is applied daily [23]. Ciclopirox has fungicidal, anti-inflammatory and anti-allergic activity. It is applied daily. Two formulations are there: ciclopirox 8% in non-water-soluble lacquers and ciclopirox in water-soluble nail lacquer, which improved the nail permeability [24]. Efinaconazole 10% solution and tavaborole 5% solution are new topical antifungals for the treatment of dermatophyte-induced onychomycosis. Efinaconazole 10% nail solution is a promising drug, approved by the FDA in June 2014, for toenail onychomycosis [25]. Tavaborole is formulated as a lightweight, water-soluble topical nail lacquer for the treatment of toenail onychomycosis [26]. Luliconazole is an imidazole molecule which has fungicidal and fungistatic action, which has completed phase 1 and 2a for the cure of moderate to severe distal subungual onychomycosis with positive results [27]. The other alternative treatments for onychomycosis include laser, like the carbon dioxide laser, the Nd:YAG laser and the diode 870-nm, 930-nm laser due to their minimally – invasive nature and the few number of requested treatment sessions. The carbon dioxide laser and is infrequently used today thanks to the advent of less invasive laser [28].

## SYSTEMIC TREATMENT

Fluconazole, itraconazole and terbinafine have improved treatment success [29]. Terbinafine can be incorporated as a continuous therapy at 250 mg per day for 12 weeks or as a pulse therapy at the dosage of 500 mg/day for four weeks off [30]. Fluconazole is also used in dermatophyte onychomycosis at the dosage of 150-300 mg weekly for more than six months, but is less effective [31].

## CONCLUSION

Onychomycosis is a common fungal infection, which needs a targeted treatment. Therapy requires many months, as the nail grows very slowly, specially in the elderly ones. Drug choice depends on the type and severity of onychomycosis and the patient's comorbidities. For DLSO extending to the proximal nail, PSO due to dermatophytes and deeply infiltrating or terbinafine.

## AUTHOR CONTRIBUTION

the authors contributed equally to this work.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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