

Can we Prevent Onychomycosis?

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Abstract

Onychomycosis is a fungal infection involving the nail unit. Distal lateral subungual onychomycosis (DLSO) is the most common subtype and usually results from untreated tinea pedis. Once fungus has invaded the nail unit, it can be a challenge to treat. Though onychomycosis has been historically viewed as a cosmetic concern, treating this disease is important due to potential complications, especially in elderly and immunocompromised individuals. As the incidence continues to increase, it is vital for health professionals to understand that onychomycosis may be prevented by treating tinea pedis.

Introduction

Onychomycosis is a fungal infection involving fingernails and toenails. It is the most common infection of the nails and affects approximately 13% of the US population [1,2]. This is a surprising figure considering onychomycosis caused by *Trichophyton rubrum* was first reported in the US in Birmingham, Alabama, only one hundred years ago [3]. Unfortunately, the incidence is likely to continue to increase making this condition a public health concern. Untreated, complications such as pain, wide spread dermatophytosis, and secondary bacterial infections, including cellulitis, may occur. Persons at greatest risk include the elderly, those with diabetes mellitus, immunodeficiency, and psoriasis. Although no cure or vaccine is available, with proper education onychomycosis can still be prevented in most people. Prevention of infection could save significant health care dollars. The foundation for prevention is understanding that distal lateral subungual onychomycosis (DLSO) begins with tinea pedis, and the other subtypes of onychomycosis are less common and may be unrelated to tinea pedis.

Onychomycosis Overview

Onychomycosis is usually categorized into four subtypes named by the pattern of fungal invasion into the nail unit. The most common subtype is distal lateral subungual onychomycosis (DLSO) (Figure 1). It occurs when the dermatophyte extends from the plantar surface (tinea pedis) to the distal region of the nail bed. Distal onycholysis with subungual hyperkeratosis develops over time. Almost all persons with DLSO have, or have had tinea pedis [4-7]. One exception would be direct inoculation of the fungus into the nail during a pedicure or other nail procedure.

Less common onychomycotic subtypes include superficial white onychomycosis (SWO), proximal white subungual onychomycosis (PWSO), and Candida nail infections. Superficial white onychomycosis affects the nail plate and results in a characteristic white chalky discoloration. It may be caused by dermatophytes, non-dermatophyte molds, or other fungi. Proximal subungual onychomycosis results from proximal nail fold invasion and is associated with immunodeficiency. Candida nail infections may also occur resulting in onycholysis and paronychia. Finally, total

dystrophic onychomycosis may be the end result of any subtype [8,9]. The vast majority of infections are of the DLSO variety, and all the medications used to treat onychomycosis are specified for this indication only.



Figure 1: Distal Lateral Subungual Onychomycosis (DLSO). Note distal involvement of the nail bed.

Trichophyton rubrum is currently the most common dermatophyte causing both tinea pedis and onychomycosis. Other dermatophytes frequently isolated are *T. mentagrophytes*, *T. tonsurans* and *Epidermophyton floccosum* [2].

Tinea Pedis Overview and Relationship to Onychomycosis

Tinea pedis is dermatophytosis of the plantar surface and is easily recognizable by the pruritic, red, scaly, sometimes painful, and often fissured eruption most commonly found in the space between the toes or on the soles of the feet (Figure 2). Self-diagnosis is common and consequently there are a variety of over-the-counter (OTC) remedies. Treatments include antifungal creams, sprays, or powders (Table 1).



Figure 2: Collarettes of scale indicative of tinea pedis

Drug	OTC options
Allylamines	Terbinafine, Butenafine
Azoles	Miconazole, Clotrimazole
Tolnaftate	Tolnaftate
Undecanoates	Undecylenic Acid, Zinc Undecylenate

Table 1: Topical Over the Counter Medications for Tinea Pedis

With the exception of direct inoculation of the nail plate, tinea pedis precedes DLSO onychomycosis. Studies have shown concurrent active tinea pedis in the majority of onychomycosis cases; undoubtedly, the remaining cases either had treated tinea pedis or non-DLSO subtypes 4-7 Dermatophytes invade the stratum corneum via keratinolytic proteases with hyphae growing in multiple directions [10,11]. Left untreated (or only partially treated), the infection extends from the plantar surface to the distal nail bed causing DLSO [12]. Failure to treat the toenails when treating tinea pedis will likely result in onychomycosis. Proper treatment of tinea pedis would prevent the majority of dermatophyte nail infection.

Other Risk Factors for Developing Onychomycosis

Advanced age is a major risk factor for onychomycosis, possibly due to diminished cell-mediated immunity. Hypothetically, untreated or ineffectively treated tinea pedis smolders until nail infection is evident. The prevalence of onychomycosis may be up to 50% in those over the age of 70 [13]. There is a slight male predominance [9]. Immunocompromised patients are also at a higher risk, which is not surprising since this is an infection. Thirty percent of diabetics and 20% of HIV-positive individuals have onychomycosis [14,15]. Other risk factors include psoriasis, nail trauma, genetics, and family history; however, tinea pedis is likely the most common precipitating factor for onychomycosis.

Prevention and Early Treatment of Onychomycosis

In addition to aggressively treating tinea pedis, patient education regarding nail care and hygiene may help prevent these fungal infections. Recommendations include keeping feet cool and dry, wearing absorbent socks, clipping nails short, wearing appropriate foot wear in public places and showers, and disinfecting or discarding old shoes. Other strategies include frequent application of antifungal products to the nails and feet in those at highest risk for infection. Once nails are infected with fungi, they will provide a reservoir to re-infect the skin surface and cause dermatophytosis.

Onychomycosis is a public health concern and treatment remains a challenge to clinicians and patients. As the incidence of onychomycosis continues to increase, the importance of disease prevention cannot be overemphasized. The relationship between tinea pedis and onychomycosis is an important topic and health care providers should encourage strategies to prevent onychomycosis including protective and prophylactic measures in patients presenting with tinea pedis.

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