



Review Article

Review on Onychomycoses: Definition, Causes, Treatment and Prevention

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ABSTRACT

Onychomycosis is a fungal infection of the nail unit, more common in toenails than in fingernails, There are 4 to 5 subtypes related to the method of fungal invasion of the nail unit, the most common being distal lateral subungual onychomycosis. Onychomycosis can cause pain, discomfort, and disfigurement and may produce serious physical and occupational limitations, as well as reducing quality of life. *Trichophyton rubrum* is the most common dermatophytes involved in onychomycosis. Other dermatophytes that may be involved are *T. interdigitale*, *Epidermophyton floccosum*, *T. violaceum*, *Microsporum gypseum*, *T. tonsurans* and *T. soudanense*. *Candida spp.* mainly causes fingernail onychomycosis in people whose hands are often submerged in water. Other molds more commonly affect people older than 60 years, and their presence in the nail reflects a slight weakening in the nail's ability to defend itself against fungal invasion.

Keyword: Onychomycosis; dermatophytes; *Candida*; antifungals and fungal infection

INTRODUCTION

Onychomycosis is the most common nail disease, accounting for about half of nail pathologies [1], if untreated, it can lead to pain, discomfort in shoes, infection, and subungual ulceration. There may also be increased self-consciousness of the disfigured nails, which can have psychosocial and emotional effects [2]. Onychomycosis (OM) refers to a fungal

infection that affects the toenails or the fingernails. Onychomycosis may involve any component of the nail unit, including the nail matrix, nail bed, or nail plate. Such infection is not life threatening, but it can cause pain, discomfort, and disfigurement and may produce serious physical and occupational limitations. Psychosocial and emotional effects

resulting from onychomycosis are widespread and may have a significant impact on quality of life [3]. Onychomycosis in patients who are immunocompromised is associated with increased severity and morbidity. Lesions may appear atypical and require more aggressive management compared with the healthy population. Proximal subungual (proximal subungual onychomycosis) involvement is much more prevalent in patients with HIV infection than in those without HIV infection. In this population, white superficial onychomycosis is more commonly caused by *Trichophyton rubrum*, rather than *Trichophyton mentagrophytes*. [4]. Diabetic patients are at increased risk of infectious complications. The diabetic foot may lead to serious complications associated with onychomycosis. Peripheral neuropathy and sensory loss may lead to increased trauma without pain in patients with diabetes. Bacterial colonization and vascular insufficiency may exacerbate the problem and may lead to serious sequelae [2].

Aging is the most common risk factor for onychomycosis due to diminished blood circulation, longer exposure to fungi, and nails which grow more slowly and thicken, increasing susceptibility to infection. Onychomycosis in elderly people is complicated by diseases (eg, poor vision, arthritis) that prevent optimal foot care. Nail changes are much more common in elderly persons and often involve the fingernails and the toenails. The potential for drug-drug interactions is more evident and must be addressed before initiating oral therapy [5]. Onychomycosis accounts for half of all nail disorders, and it is the most common nail disease in adults. Toenails are much more likely to be infected than fingernails.

Thirty percent of patients with a cutaneous fungal infection also have onychomycosis. The incidence of onychomycosis has been increasing, owing to such factors as diabetes, immunosuppression, and increasing age [6]. The incidence of onychomycosis has been

reported to be 2-13% in North America [7]. A multicenter survey in Canada showed the prevalence of onychomycosis at 6.5% [8]. Studies in the United Kingdom, Spain, and Finland found prevalence rates of onychomycosis to be 3-8% [4]. Onychomycosis affects persons of all races, and it affects males more commonly than females, and is associated with a family history of this infection. However, studies indicate that adults are 30 times more likely to have onychomycosis than children. Onychomycosis has been reported to occur in 2.6% of children younger than 18 years but as many as 90% of elderly people [4].

The main subtypes of onychomycosis are distal lateral subungual onychomycosis (DLSO), white superficial onychomycosis (WSO), proximal subungual onychomycosis (PSO), endonyx onychomycosis (EO), and candidal onychomycosis.

Patients may have a combination of these subtypes. Total dystrophic onychomycosis refers to the most advanced form of any subtype [4]. The pathogenesis of onychomycosis depends on the clinical subtype. In distal lateral subungual onychomycosis, the most common form of onychomycosis, the fungus spreads from plantar skin and invades the nail bed via the hyponychium. Inflammation occurring in these areas of the nail apparatus causes the typical physical signs of distal lateral subungual onychomycosis. In contrast, white superficial onychomycosis is a rarer presentation caused by direct invasion of the surface of the nail plate. In proximal subungual onychomycosis, the least common subtype, fungi penetrate the nail matrix via the proximal nail fold and colonize the deep portion of proximal nail plate. Endonyx onychomycosis is a variant of distal lateral subungual onychomycosis in which the fungi infect the nail via the skin and directly invade the nail plate. Total dystrophic onychomycosis involves the entire nail unit [4]. People with onychomycosis may experience significant psychosocial

problems due to the appearance of the nail, particularly when fingers – which are always visible – rather than toenails are affected [9].

Diagnosis of onychomycosis is generally made based on its typical clinical appearance. When the diagnosis is in doubt, laboratory testing with potassium hydroxide (KOH 10%) preparation and also periodic acid Schiff testing of the nail is recommended [10].

CAUSES

The causative pathogens of onychomycosis include dermatophytes, *Candida*, and nondermatophytic molds [11]. Dermatophytes are the fungi most commonly responsible for onychomycosis in the temperate western countries, the most common dermatophytes species are *Trichophyton rubrum*. Other dermatophytes that may be involved are *T. interdigitale*, *Epidermophyton floccosum*, *T. violaceum*, *Microsporum gypseum*, *T. tonsurans*, and *T. soudanense*. A common outdated name that may still be reported by medical laboratories is *Trichophyton mentagrophytes* for *T. interdigitale*. The name *T. mentagrophytes* is now restricted to the agent of favus skin infection of the mouse; though this fungus may be transmitted from mice and their danders to humans, it generally infects skin and not nails. While *Candida* and nondermatophytic molds particular members of the mold generation *Scytalidium* (name recently changed to *Neoscytalidium*), *Scopulariopsis*, and *Aspergillus*, are more frequently involved in the tropics and subtropics with a hot and humid climate [12]. *Candida spp.* mainly causes fingernail onychomycosis in people whose hands are often submerged in water. Furthermore the process of nail invasion by *Candida* is not common because the yeast needs an altered immune response as a predisposing factor to be able to penetrate the nails. Despite the frequent isolation of *Candida* from the proximal nail fold or the subungual space of patients with chronic paronychia or

onycholysis, in these patients *Candida* is only a secondary colonizer. In chronic mucocutaneous candidiasis, the yeast infects the nail plate and eventually the proximal and lateral nail folds [4]. Other molds more commonly affect people older than 60 years, and their presence in the nail reflects a slight weakening in the nail's ability to defend itself against fungal invasion [6]. On the other hand onychomycosis may occur without tinea pedis in only a couple of scenarios: if a pedicure has inoculated the fungus directly into the nail, or if the patient has used infected clippers. Older patients will often tell you that they don't have tinea pedis, until you ask them to take their socks off. They assume incorrectly that foot dryness is normal [13].

DIAGNOSES

To avoid misdiagnosis as nail psoriasis, lichen planus, contact dermatitis, nail bed tumors such as melanoma, trauma, or yellow nail syndrome, laboratory confirmation may be necessary [11]. The three main approaches are potassium hydroxide smear, culture and histology [11]. This involves microscopic examination and culture of nail scrapings or clippings. Recent results indicate the most sensitive diagnostic approaches are direct smear combined with histological examination [14], and nail plate biopsy using periodic acid-Schiff stain [15]. To reliably identify nondermatophyte molds, several samples may be necessary [16].

TREATMENT

Treatment of onychomycosis may consist of either topical or oral antifungal medications according to the severity of infection [17]. In general, topical agents should be used as monotherapy only in cases involving less than half of the distal nail plate [10]. Although topical agents improve the cure rate and shorten the duration of treatment when used alongside to oral antifungal therapy, they are rarely sufficient when used as monotherapy, as

a result; patients treated with oral antifungal therapy for onychomycosis report significantly higher satisfaction and clinical improvement than patients treated with topical therapy [18]. In approximately half of suspected nail fungus cases there is actually no fungal infection, but only nail deformity [19]. Because of this, a confirmation of fungal infection should precede treatment [19]. Avoiding use of oral antifungal therapy in persons without a confirmed infection is a particular concern because of the side effects of that treatment, and because persons without an infection should not have this therapy [19]. Treatment of onychomycosis is challenging because the infection is embedded within the nail and is difficult to reach. It may take a year or more, since new nail growth must entirely replace old, infected growth [20]. The most common oral antifungals medications include terbinafine (76% effective), itraconazole (60% effective) and fluconazole (48% effective) [17]. All of these antifungals share characteristics that enhance their effectiveness: prompt penetration of the nail and nail bed [21], persistence in the nail for months after discontinuation of therapy [22]. Oral terbinafine is better tolerated than itraconazole [23], for superficial white onychomycosis, systemic rather than topical antifungal therapy is advised [24].

As for Topical agents they include ciclopirox nail paint, amorolfine or efinaconazole [25- 26]. Topical treatments need to be applied daily for prolonged periods (at least 1 year) [27]. Topical ciclopirox results in a cure in 6% to 9% and amorolfine might be more effective [11, 27]. Ciclopirox when used with terbinafine appears to be better than either agent alone [11]. As a result, patients treated with oral antifungal therapy for onychomycosis report significantly higher satisfaction and clinical improvement than patients treated with topical therapy [18]. In many cases the removal of the affected part of the nail during treatment appears to improve outcomes [11]. Furthermore, treatment

processes of advanced onychomycoses are time-consuming, cost-intensive, and subject to relatively high failure rates. Even drug courses of potent systemic antimycotics, delivered over a period of several months, have cure rates of only 40 to 80% [28-30]. Recently; a new effective line for nail fungal therapy was invented, Laser treatment, such treatment consist of four sessions with one week interval, during which all infected nails were irradiated three times with laser light so that the nail plate was fully covered each time[31]. The primary aim of this treatment regime was to restore the nail to full health at 12 months. The secondary aim of treatment was to render the nail free of fungi at 3 months [31]. The successful clinical use of lasers largely depends upon the wavelength, output power, pulse duration ,exposure time, spot size, type, and color of the targeted tissue[32-33]. One of the main advantages for laser surgery is its bactericidal effect, in which laser light causes local hyperthermia, destruction of pathogenic microorganisms, and stimulation of the reparative process [34].

PREVENTION

In order to avoid an inflamed, discomfort, and embarrassing toe nail, there are few simple steps everyone should follow. Decrease our risk by following good hygiene practice. If an accidental contact with the skin of an infected person occurs, immediately wash the area of contact with soap and warm water and dry thoroughly with a clean towel and high heat because fungi cannot survive laundering in high temperatures [35].

Keeping both hands and feet clean and dry, Clipping your fingernails and toenails short and keep them clean. Don't walk barefoot in areas like locker rooms or public showers. Doesn't share nail clippers with other people?, Wearing comfortable, well-fitting shoes and clean hosiery every day, and allowing your shoes to

dry thoroughly between wearing's and change socks more than once daily, wear shoes that fit well and are made of materials that breathe, and finally avoid applying layers of nail polish [36].

CONFLICT OF INTEREST STATEMENT

None Declared

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