

Onychomycosis

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Onychomycosis, also known as **tinea unguium**, is a fungal infection of the nail.^[2] This condition may affect toenails or fingernails, but toenail infections are particularly common.

Treatment may be based on the signs.^[3] Treatment may be with the medication terbinafine.^[3]

It occurs in about 10 percent of the adult population.^[4] It is the most common disease of the nails and constitutes about half of all nail abnormalities.^[5] The term is from Ancient Greek ὄνυξ (ónux) nail + μύκης (múkēs) fungus + -ωσις (-ōsis) functional disease.

Contents

- 1 Signs and symptoms
- 2 Causes
 - 2.1 Dermatophytes
 - 2.2 Other
 - 2.3 Risk factors
- 3 Diagnosis
 - 3.1 Classification
 - 3.2 Differential diagnosis
- 4 Treatment
 - 4.1 Medications
 - 4.2 Other
- 5 Prognosis
- 6 Epidemiology
- 7 Research
- 8 See also
- 9 References

Signs and symptoms

The most common symptom of a fungal nail infection is the nail becoming thickened and discoloured: white, black, yellow or green. As the infection progresses the nail can become brittle, with pieces breaking off or coming away from the toe or finger completely. If left untreated, the skin can become inflamed and painful underneath and around the nail. There may also be white or yellow patches on the

Onychomycosis

Synonyms dermatophytic onychomycosis^[1] tinea unguium^[1]



A toenail affected by onychomycosis

Classification and external resources

Specialty	Infectious disease
ICD-10	B35.1 (http://apps.who.int/classifications/icd10/browse/2016/en#/B35.1)
ICD-9-CM	110.1 (http://www.icd9data.com/getICD9Code.ashx?icd9=110.1)
DiseasesDB	13125 (http://www.diseasesdatabase.com/ddb13125.htm)
MedlinePlus	001330 (https://medlineplus.gov/ency/article/001330.htm)
eMedicine	derm/300 (http://www.emedicine.com/derm/topic300.htm)
Patient UK	Onychomycosis (http://patient.info/doctor/fungal-nail-infections-pro)
MeSH	D014009 (https://www.nlm.nih.gov/cgi/mesh/2017/MB_cgi?field=uid&term=D014009)

nailbed or scaly skin next to the nail,^[6] and a foul smell.^[7] There is usually no pain or other bodily symptoms, unless the disease is severe.^[8] 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]

Dermatophytids are fungus-free skin lesions that sometimes form as a result of a fungus infection in another part of the body. This could take the form of a rash or itch in an area of the body that is not infected with the fungus. Dermatophytids can be thought of as an allergic reaction to the fungus.

Causes

The causative pathogens of onychomycosis are all in the fungus kingdom and include dermatophytes, *Candida* (yeasts), and nondermatophytic molds.^[10] Dermatophytes are the fungi most commonly responsible for onychomycosis in the temperate western countries; while *Candida* and nondermatophytic molds are more frequently involved in the tropics and subtropics with a hot and humid climate.^[11]

Dermatophytes

Trichophyton rubrum is the most common dermatophyte involved in onychomycosis. Other dermatophytes that may be involved are *T. interdigitale*, *Epidermophyton floccosum*, *T. violaceum*, *Microsporum gypseum*, *T. tonsurans*, *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.

Other

Other causative pathogens include *Candida* and nondermatophytic molds, in particular members of the mold genus *Scytalidium* (name recently changed to *Neoscytalidium*), *Scopulariopsis*, and *Aspergillus*. *Candida* species mainly cause fingernail onychomycosis in people whose hands are often submerged in water. *Scytalidium* mainly affects people in the tropics, though it persists if they later move to areas of temperate climate.

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.

Risk factors

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. Nail fungus tends to affect men more often than women, and is associated with a family history of this infection.



A case of fungal infection of the big toe

Other risk factors include perspiring heavily, being in a humid or moist environment, psoriasis, wearing socks and shoes that hinder ventilation and do not absorb perspiration, going barefoot in damp public places such as swimming pools, gyms and shower rooms, having athlete's foot (*tinea pedis*), minor skin or nail injury, damaged nail, or other infection, and having diabetes, circulation problems, which may also lead to lower peripheral temperatures on hands and feet, or a weakened immune system.^[12]

Diagnosis

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.^[10] The three main approaches are potassium hydroxide smear, culture and histology.^[10] 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,^[13] and nail plate biopsy using periodic acid-Schiff stain.^[14] To reliably identify nondermatophyte molds, several samples may be necessary.^[15]

Classification

There are four classic types of onychomycosis:^[16]

- Distal subungual onychomycosis is the most common form of *tinea unguium*^[10] and is usually caused by *Trichophyton rubrum*, which invades the nail bed and the underside of the nail plate.
- White superficial onychomycosis (WSO) is caused by fungal invasion of the superficial layers of the nail plate to form "white islands" on the plate. It accounts for around 10 percent of onychomycosis cases. In some cases, WSO is a misdiagnosis of "keratin granulations" which are not a fungus, but a reaction to nail polish that can cause the nails to have a chalky white appearance. A laboratory test should be performed to confirm.^[17]
- Proximal subungual onychomycosis is fungal penetration of the newly formed nail plate through the proximal nail fold. It is the least common form of *tinea unguium* in healthy people, but is found more commonly when the patient is immunocompromised.^[10]
- Candidal onychomycosis is *Candida* species invasion of the fingernails, usually occurring in persons who frequently immerse their hands in water. This normally requires the prior damage of the nail by infection or trauma.

Differential diagnosis

Other conditions that may appear similar to onychomycosis include: psoriasis, normal aging, yellow nail syndrome, and chronic paronychia.^[18]

Treatment

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] Screening cases diagnosed by signs and symptoms is not cost-effective and routine testing is not necessary for oral treatment with terbinafine but should be encouraged prior to topical treatment with efinaconazole.^[20]

Medications

Most treatments are topical or oral antifungal medications.^[4]

Topical agents include ciclopirox nail paint, amorolfine or efinaconazole.^{[21][22][23]} Some topical treatments need to be applied daily for prolonged periods (at least 1 year).^[22] Topical amorolfine is applied weekly.^[24] Topical ciclopirox results in a cure in 6% to 9% of cases; amorolfine might be more effective.^{[4][22]} Ciclopirox when used with terbinafine appears to be better than either agent alone.^[4]

Oral medications include terbinafine (76% effective), itraconazole (60% effective) and fluconazole (48% effective).^[4] They share characteristics that enhance their effectiveness: prompt penetration of the nail and nail bed,^[25] persistence in the nail for months after discontinuation of therapy.^[26] Ketoconazole by mouth is not recommended due to side effects.^[27] Oral terbinafine is better tolerated than itraconazole.^[28] For superficial white onychomycosis, systemic rather than topical antifungal therapy is advised.^[29]



A person's foot with a fungal nail infection ten weeks into a course of terbinafine oral medication. Note the band of healthy (pink) nail growth behind the remaining infected nails.

Other

Removing the affected part of the nail during treatment appears to improve outcomes.^[4]

As of 2014 Evidence for laser treatment is unclear as the evidence is of low quality.^[30] and varies by type of laser.^[31]

As of 2013 tea tree oil has failed to demonstrate benefit in the treatment of onychomycosis.^[10] A 2012 review by the National Institutes of Health found some small and tentative studies on its use.^[32]

Prognosis

Following effective treatment recurrence is common (10-50%).^[4] Nail fungus can be painful and cause permanent damage to nails. It may lead to other serious infections if the immune system is suppressed due to medication, diabetes or other conditions. The risk is most serious for people with diabetes and with immune systems weakened by leukemia or AIDS, or medication after organ transplant. Diabetics have vascular and nerve impairment, and are at risk of cellulitis, a potentially serious bacterial infection; any relatively minor injury to feet, including a nail fungal infection, can lead to more serious complications.^[33] Osteomyelitis (infection of the bone) is another, rare, possible complication.^[6]

Epidemiology

A 2003 survey of diseases of the foot in 16 European countries found onychomycosis to be the most frequent fungal foot infection and estimates its prevalence at 27%.^{[34][35]} Prevalence was observed to increase with age. In Canada, the prevalence was estimated to be 6.48%.^[36] Onychomycosis affects approximately one-third of diabetics^[37] and is 56% more frequent in people suffering from psoriasis.^[38]

Research

Research suggests that fungi are sensitive to heat, typically 40–60 °C (104–140 °F). The basis of laser treatment is to try and heat the nail bed to these temperatures in order to disrupt fungal growth.^[39] There is ongoing research as of 2013 which looks promising.^[4] There is also development into the use of photodynamic therapy which uses laser or LED light to activate photosensitisers that eradicate fungi.^[40]

See also

- Athlete's foot

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