



## Clinical Case Reports

# Onychogryphosis due to *Aspergillus niger* in a poorly controlled type 2 diabetes mellitus

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## Background

Onychogryphosis mostly affects the big toes. The nail plate rises upwards at first then deviates laterally, elderly patients, and homeless with marks of neglect are more commonly affected by this condition.

Here, we report a case of onychomycosis caused by *Aspergillus niger* in a 74-year-old female with type 2 diabetes mellitus discovered 8 month earlier, and managed by oral hypoglycemic. The patient presented with a black discoloration and a milky white base and onychogryphosis of the right big toenail.

Direct microscopic examination of scrapings after potassium hydroxide (KOH) preparation revealed dichotomous septate hyphae. Repeated cultures on Sabouraud's dextrose agar (SDA) without cycloheximide produced the same black velvety colonies.

Onychogryphosis is a particular nail condition to recognize and treat due to pain and consequences. Our patient was started on oral itraconazole at 500 mg twice daily, associated to amorolfine 5% lacquer for 3 months, which lead to partial remission after 8 weeks.

A careful clinical examination combined with mycological tests can be decisive in the diagnosis of fungal onychogryphosis, especially for patients with diabetes mellitus.

**Key words:** diabetes mellitus, onychogryphosis, *Aspergillus niger*, onychomycosis

## Introduction:

Ram's horn nails formerly known as onychogryphosis, is a nail disease that causes one side of the nail to grow faster than the other, the nails are thick and curvy, like horns or claws.

Onychogryphosis mostly affects the toes, specifically the big toes.

The nail plate initially grows upwards and thereafter deviates laterally towards the other toes [1,2].

The prevalence of onychogryphosis is highest in the elderly population [3]. Acquired onychogryphosis is more common. It is more often observed in older people, people with poor personal care, and patients with senile dementia [3].

In one cross-sectional observational study on 173 patients in 3 nursing homes in Tokyo, the prevalence of onychogryphosis was 17.9% [4].

It is considered that chronic hyperglycemia in diabetes mellitus patients affects cellular immunity and leucocytes [5]. Moreover, it has been shown that age of diabetic patients, and complications such as peripheral circulatory failure and diabetic foot ulcer were factors facilitating onychomycosis [5].

Onychogryphosis disorder may be confused clinically with onychomycosis, and fungal studies can be used to rule out the latter. It should be noted, however, that onychomycosis and onychogryphosis can coexist [3]. Moreover, Some common complications of onychogryphosis include ingrown toenails, paronychia, secondary onychomycosis, and the inability to cut the toenail due to increasing hypertrophy of the nail plate [6].

The incidence of onychomycosis by *Aspergillus* has shown an increase in recent years, representing 34–60% of onychomycosis due to non-dermatophyte molds [7].

Of the non-dermatophytic filamentous fungi, agents implicated in onychomycosis include members of *Scopulariopsis* (particularly *S. brevicaulis*) and *Scytalidium* (the two most common genera), which are both thought to digest keratin in vivo, which are both thought to digest keratin in vivo, as well as members of the genera *Alternaria*, *Aspergillus*, *Acremonium*, and *Fusarium* [8,9,10].

Onychomycosis due to nondermatophyte molds is difficult to diagnose, as these organisms are common contaminants of diseased nails [11].

Since they are widespread in nature and are often cultured from diseased body surfaces, it may be difficult to assess whether a fungus found during disease is a pathogen or a transient environmental contaminant [12].

In general, 6 major criteria suggest the pathogenic nature of the non-dermatophyte fungus (observation on direct examination, positive culture, repeated isolation, inoculum count, the exclusion of dermatophyte fungi, and histology), with 3 criteria being necessary to exclude simple colonization [11].

The treatment of onychomycosis due to molds is often unsatisfactory [13,14], The onychomycoses associated with global nail pigmentation are considered difficult to treat [15]. It has been reported that *Aspergillus niger*, has shown a good response to topical ciclopirox, oral terbinafine, and oral itraconazole [11,13,16,15,17].

### Case Presentation:

A 74 year-old, female presented to our institution with a 3-year history of thickened toenails especially the right big toenail. The past medication was unremarkable, but she was newly diagnosed with type 2 diabetes mellitus discovered 8 month earlier, and managed by oral hypoglycemics, she was from socio-economic deprived status.

At admission her fasting capillary glucose was 201 mg/dl, HbA1c: 12%, weight: 57 kg, height: 1,68m.

No presences of animals were reported to explain dermatophytic affection, and there was no history of nail trauma. She denied any episode of periungual inflammation.

Physical examination revealed subungual hyperkeratosis, toenails were thickened, distorted, deformed, discoloured with an accumulation of debris beneath them [Figure 1](#)

Mycological direct examination and culture of nail clippings were performed. Specimens were inoculated onto duplicate tubes Sabouraud's Dextrose Agar, SDA and incubated at 25°C. The results of direct examination (KOH) and Sabouraud's culture after 3 days were compatible with *Aspergillus niger*, revealing hyaline septate branching mycelium with conidiophores [Figure 2](#) and the search for dermatophytes and bacterial culture was negative. Based on these findings, diagnostic was confirmed by cultures from samples, which repeatedly yielded several

colonies of *Aspergillus niger*.

On day +7, after laboratory tests (histology and mycology), the treatment was initiated, she was prescribed itraconazole 500mg per day for 1 week every month for at least 3 months, associated to amorolfine 5% lacquer for 3 months, which lead to partial remission after 8 weeks.



Figure 1: Big toenail alterations (thick, curvy, with brown-black pigmentation) in a type 2 diabetes mellitus patient

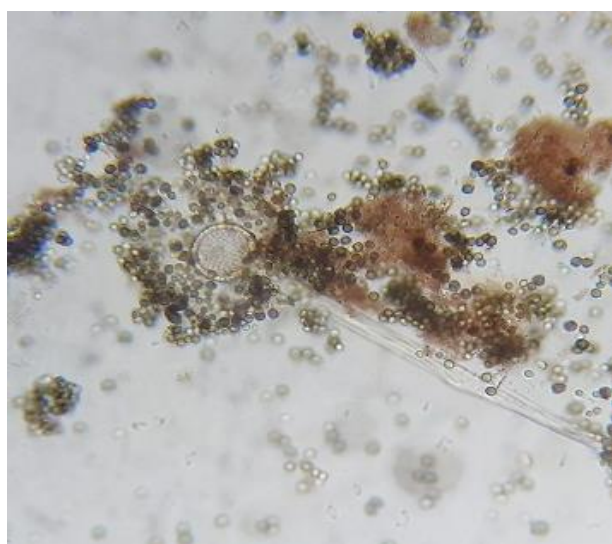


Figure 2: *Aspergillus niger* microscopic features (X40)

## Discussion:

Onychogryphosis is a disorder of nail plate growth that is clinically characterized by an opaque, yellow-brown thickening of the nail plate with associated gross hyperkeratosis, elongation, and increased curvature [3,18,19,20].

The great toenail is most often affected, but the fingernail may be involved in rare cases [3].

Onychogryphosis is common on the great toenail of elderly patients and can be associated with self-neglect (dementia, psychiatric diseases), old age, trauma, peripheral circulation disorders, lymphatic disorders (elephantiasis), diseases of the central nervous system, and anatomic abnormalities, such as hallux valgus [1].

Onychomycosis is a common fungal infection of the toenails, followed by the fingernails; nails become thick, brittle and crinkly. Dystrophic nails harbour a large flora of saprophytes and secondary invading fungi black pigmentation may be observed in the nails due to conidia of *Aspergillus niger* [16], furthermore, *Aspergillus niger* (complex) is the commonest species group of *Aspergillus* isolated from abnormal nail specimens [21].

Authors reported that gender-related factors such as differences in professional activities, habits, and sport practices would have effects on foot nail's structure [21].

Diabetic patients more than 50 years old are more prone to nail's fungal infection especially in toenails due to blood circulation issues, increased thickness of the nail plate, the low nail's growth rate, and the diminished foot hygiene [22].

Therefore, the risk of having *Aspergillus* onychomycosis among diabetics increases, with age and duration of diabetes [21].

In contrast to the dermatophytes, *Aspergillus sp* is a non keratophilic fungus causing secondary infection in nails damaged by underlying diseases or trauma [14,16]. Unlike other species causing nail infection, *Aspergillus* species have no direct spread to the surrounding skin [22].

Many risk factors of developing onychomycosis have been identified, including wearing tight shoes, anatomy of the toes feet, peripheral vascular disease is occasionally implicated, those factors are also contributing for nails colonization by *Aspergillus niger*.



The diagnostic criteria of onychomycosis due to non-dermatophyte molds are not well-established [23].

Fungi usually use both virulence mechanisms (e.g., capsule and ability to grow at 37 °C) and morphologic forms (e.g., yeasts, hyphae, spherules, and sclerotic bodies) that accelerate their multiplication within the host [12].

The majority of onychomycoses are caused by dermatophytic fungi or yeasts; However, many nondermatophyte filamentous fungi are usually isolated as commensals from altered nails, mainly from the toenails of elderly [14].

Major causes of onychomycosis are including *Aspergillus* ( [9]. This case revealed the presence of *Aspergillus niger* in poorly controlled diabetic patient; clinical features include thickening and brownish discoloration of the toes nail. Part of the difficulty in estimating the role of non-dermatophyte fungi isolated from the nail arises because the same fungi that can be both laboratory contaminants or pathogens [8], Sometimes fungal elements must be identified in tissues taken from the lesion, to prove the fungal origin [12].

For *Aspergillus*-induced onychomycosis, oral itraconazole is required because topical medications have reduced efficacy in eradicating fungus from the nails. However, topical efinaconazole treatment could have successful results [24]. The fungal melanonychia characterized by brown or black pigmentation of the nail unit is relatively rare and resemble to subungual melanoma [15]. The severity of onychomycosis depends on multiples factors such as inoculum, degree of tissue destruction, ability of fungus to progress in the tissue, and the immune status of the host [12].

In onychogryphosis the nail bed may offer a greater quantity of keratin to the nail than is normally seen, inducing nail deformity [25].

Our patient fulfilled 2 mycological criteria (positive culture and the exclusion of a dermatophyte), in contrast histological criteria, and inoculum were not assessed. In addition, the

characteristic melanonychia was predictive of *Aspergillus niger* as the causative agent.

Onychogryphosis therapy depends on the cause and the patient comorbidities [6], we can consider both palliative therapy or surgery [6].

Adequate clinical diagnosis, efficient laboratory identification combined to a proper antifungal therapy is mandatory in the treatment of *Aspergillus* nail infections [21,22].

The rarity of this case is conditioned by the fungal origin of onychogryphosis in a type 2 diabetes mellitus patient, further studies are necessary to find the relationship between *Aspergillus* species and onychogryphosis.

### Conflicts of Interest

The authors declare that they have no conflict of interest.

### Authors' Contribution

The authors contributed equally to the work.

### Highlights

- Onychogryphosis remains largely a clinical diagnosis based on characteristic appearance, it is more common in older or homeless people with signs of neglect
- Gryphotic, or curved thickened toenails, can be caused by chronic fungal infection, trauma, peripheral vascular disease impairing the blood circulation to the feet, or underlying disease such as psoriasis, diabetes mellitus
- Before specific fungi can be confirmed as the main cause of an onychogryphosis, the same fungi must be isolated by laboratory tests from serial specimens, especially in patients with diabetes mellitus.

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