

Chapter 16

Why Onychomycosis Can Be a Life-Threatening Condition

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Onychomycosis is often mistaken by both physicians and patients as being not only a cosmetic entity but also of secondary or tertiary importance in the patient's list of concerns. This book has strived to show that it is an infection which affects a wide range of patients. It may not present itself as a carbuncle or a circumscribed area of cellulitis, but its simple presence can indicate something more sinister such as the link to carotid atherosclerosis in diabetics or create an environment where a dermatophyte can infect the interdigital space leading to a possible bacterial superinfection [1, 2].

Cellulitis, commonly seen on the lower extremity in older adults with diabetes, is a diagnosis that requires a hospital admission in cases that are potentially limb and life threatening [3]. The link to lower extremity cellulitis from a mycotic toenail may not seem logical at first, but in some cases, that fungal foot infection provided the initial spark for a problematic chain reaction.

The presence of onychomycosis generally co-presents with tinea pedis, specifically interdigital tinea pedis. It can be difficult to know which caused the other, but a general statement can be made that the same dermatophyte, whether starting from the nail or the interdigital space, is creating both the infection in the nail bed and the plantar/toe-web skin. When examining a patient with onychomycosis, it is worthwhile for the practitioner to examine the skin around the nail, interdigital space, and plantar foot for the serpiginous scale characteristic of tinea pedis. The patient may not have symptoms of pruritus, but in some cases, the skin will not only present with the characteristic scale but may also present with mild inflammation and fissuring [3]. The fissures can act as a portal for bacteria to invade and create an infectious and inflammatory cascade.

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Bristow and Spruce reviewed the literature to determine the potentiality of a fungal foot infection causing cellulitis, especially in the diabetic population [3]. One of the articles they reviewed was Roujeau et al.'s case-controlled study of 243 patients with acute bacterial cellulitis of the leg that aimed to find any association with mycology-proven foot dermatomycosis (i.e., both tinea pedis and onychomycosis) [4]. The presence of a fungal foot infection was a significant risk factor in developing cellulitis with an odds ratio of 2.4, $p < 0.001$, confidence interval 95 % [4]. Another prospective case-controlled study of 100 subjects concluded that risk factors for acute bacterial cellulitis in hospitalized patients were sites of pathogen entry on legs and toe webs. Therefore, management and treatment of toe-web intertrigo may reduce cellulitis incidence [5]. Likewise, Dupuy et al. assessed risk factors for erysipelas of the leg, cellulitis, through seven hospital centers in France [6]. One hundred and sixty seven patients were admitted for erysipelas of the leg, and through multivariate analysis, they showed that disruption of the cutaneous barrier secondary to a macerated interdigital space was a risk factor in developing cellulitis (odds ratio 6.6, 95 % confidence interval). A site of entry through the skin was found in almost all cases. In the same study, the risk of developing leg cellulitis increased when more than one interdigital space was affected (odds ratio 19.5, 95 % confidence interval).

Ultimately, Bristow and Spruce found 16 studies that supported the presence of a fungal foot infection as a risk factor for cellulitis. This included examining patients with toe-web tinea pedis, onychomycosis, and plantar tinea pedis (moccasin type). More specifically, the association of interdigital tinea pedis was consistently a predictive factor in developing cellulitis; however, the more sites fungally infected increased the risk even more as in Dupuy et al.'s article. Some of the studies, most of them involving hospital patients, grouped nail disease with the general term "fungal foot infection." Population-attributable risk (PAR) of bacterial cellulitis was highest for toe-web intertrigo at 60 %. The PAR is the percentage of cases of bacterial cellulitis that could possibly be avoided if the risk factor was removed. Tinea pedis and concomitant mycological infection of the nail, onychomycosis, are the components of the highly prevalent condition of toe-web intertrigo.

Therefore, even though interdigital tinea pedis is associated with a slightly higher risk to develop cellulitis than plantar tinea pedis or onychomycosis alone, the presence of onychomycosis whether currently or in that patient's future can't be ruled out. These are skin manifestations that present together and must be joined in the practitioner's mind.

In addition to the toe-web spaces acting as a portal of entry for bacteria, an ulceration from the pressure of the thickened, mycotic nail in shoe gear must also be considered. Sharp edges of onychauxic toenails that are often unnoticed in a neuropathic diabetic patient can create ulcerations and abrasions that may become superinfected with bacteria, a perfect storm created by lack of sensation and the humid nature of wearing shoes colonized with various flora for most of the day. The jagged or sharp edges of the nail plate that are abutting onto the surrounding digits could lead to an ulceration [7]. Depending on the vascular status of the

patient, this ulceration may become gangrenous and may develop osteomyelitis or cellulitis which in theory could lead to a possible amputation of not just the digit but also the limb. In addition to the surrounding digits being affected, the nail bed of the mycotic toenail may break down with repeated trauma and pressure. Again, this ulceration may prove to be a limb-threatening situation if it becomes infected or if the patient's health and vascular status do not support a healthy healing environment. A potential patient population to illustrate this scenario is the diabetic. Chadwick et al. made a link between diabetes and the development of a fungal infection contributing to the pathogenesis of ulceration and cellulitis in a diabetic foot [8]. He encourages that fungal foot infections in a diabetic should not be ignored or considered cosmetic, and as consistent in the literature, they have a high risk of secondary bacterial infection. Also, the consequences of fungal foot infections for those with peripheral neurological and/or vascular status are exacerbated in addition to their diabetic condition and sequela. Therefore, treatment for the fungal infection should be initiated immediately, and preventative measures (such as managing environment, socks, and shoes) should be discussed.

Lastly, Doyle et al. state that there is a higher incidence of foot ulceration and gangrene in diabetic patients with onychomycosis versus those who do not [9]. These scenarios support the periodic physician-based examination of the lower extremity as well as the diabetic patient's daily inspection of their feet (and socks) for any drainage, cuts, tears, or redness.

Overall, the presence of onychomycosis, which can lead to interdigital tinea pedis that morphs into a bacterially superinfected toe web, may create a potentially limb and life-threatening situation, especially in the diabetic population. Onychomycosis itself is a visually displeasing entity but, for a certain subset of patients, may prove to be something much more problematic. It is an infection and should be treated with the same care and respect that similar maladies are managed.

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