

Macerated Foot Dermatitis Related to Occlusive Footwear

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Abstract

Gram-negative bacterial toe-web infections (GNBTWI's) are relatively under-recognized among physicians. Even though skin infections are usually thought to involve gram-positive bacteria, gram-negative organisms have a particular affinity for the toe-web. We present two patients with GNBTWI's who presented with maceration of the toe-webs, vesiculopustules and a hyperkeratotic rim. Treatment includes using both oral and topical antibiotics along with antifungals to treat co-existing dermatophyte infections. Awareness of this condition is particularly important for primary care physicians in West Virginia, as a few of the potential risk factors include wearing occlusive footwear, such as work boots, and type II diabetes mellitus.

Introduction

Gram-negative bacterial toe-web infections (GNBTWI's) are relatively under-recognized among physicians. GNBTWI's were first described in 1973 by Dr. Amonette and Dr. Rosenberg, upon isolation of gram-negative bacilli from patients with macerated toe-webs.¹ Risk factors for these infections include: preexisting dermatophyte infection, hyperhidrosis secondary to closed toed shoes, auto-medication, and male gender. GNBTWI's are included in the differential diagnosis of interdigital toe-web maceration along with *erosio blastomyces interdigitalis*, interdigital tinea pedis,

eczematous dermatitis and gram-positive bacterial infections such as corynebacterium. Even though skin infections are usually thought to involve gram-positive bacteria, gram-negative organisms have a particular affinity for the toe-web. This paper serves to increase awareness of GNBTWI's since significant morbidity can be associated with these infections when they are misdiagnosed and mistreated.

Case Presentation

Case 1:

A 39-year-old white male with a history of type II diabetes mellitus presented to the hospital with a 4-day history of rash on the feet. He complained of itchy painful blisters between his toes and peeling of the skin with associated discharge from the right heel. Examination revealed an interdigital focus of white macerated plaques (Figure 1).

Case 2:

A 53-year-old white male with type II diabetes mellitus presented to the clinic with a 6-week history of cellulitis of his right foot, which was unresponsive to antibiotics. His medical history included chronic untreated onychomycosis and tinea pedis. Examination revealed macerated erythematous to white plaques with malodorous yellow-green purulent discharge involving the toe-webs as well as the right plantar and dorsal foot, respectively (Figures 2 and 3).

Both patients wore steel-toed boots to work. They were subsequently diagnosed with gram-negative bacterial toe-web infections. *Acinetobacter baumannii* was isolated from the wound culture of Case 1. The patient was successfully treated

with trimethoprim-sulfamethoxazole (160-800 mg/q12h) for 14 days, based on culture sensitivities. Case 2 had a complicated hospital course secondary to multi-drug resistant *Pseudomonas aeruginosa* isolated from the wound culture, but finally had improvement with 7 days of IV tigecycline (50mg/q12h) and a 6 month course of oral terbinafine (250 mg/d).

Discussion

The delicately balanced colonizing polymicrobial flora of toe-webs can be disrupted by various external factors, namely hyperhidrosis secondary to closed toed shoes, antimicrobial peptides produced by dermatophytes, and auto-medication applied by the patient.² In a review of 123 cases of GNBTWI's, *Pseudomonas aeruginosa* was the most commonly isolated pathogen, representing 46.4% of infections.² Gram-negative bacteria such as *P. aeruginosa* are capable of resisting antibacterial substances produced by fungi, providing an opportunity for increased colonization of the toe-webs with concomitant dermatophyte infection. Auto-medication with antifungals, antibiotics, or cortisone proved to be a risk factor in 56% and 82% of patients with GNBTWI's in two previous studies.^{2,6} Thus, subtle changes to the milieu of toe-web colonizing bacteria can create an environment that allows pathogenic gram-negative bacteria to proliferate.

Toe-web infections are much more common in males, who are more likely to wear close-toed shoes for occupational or recreational purposes. The typical presentation of GNBTWI's involves erythematous erosions, vesiculopustules, and maceration associated with malodorous exudate.²

Figure 1. Interdigital focus of white macerated plaque.



Treatment regimens consist of a combination of oral and topical antibiotics, such as quinolones, third-generation cephalosporins, and aminoglycosides. Antifungals, including local application of Castellani's paint, are used to treat co-existing dermatophytosis.^{1,8} In severe cases, patients may require superficial debridement prior to treatment with medication.⁴

The patients presenting in Case 1 and Case 2 demonstrated similar risk factors including: male gender, jobs requiring the use of steel-toe work boots, and preceding dermatophyte infection. Both patients presented with GNBTWI's; *Acinetobacter baumannii* in Case 1, *Pseudomonas aeruginosa* in Case 2. On physical exam, both patients had maceration of the toe-webs with a hyperkeratotic rim, a finding noted in other reports of gram-negative toe-web infections.³ The hyperkeratotic rim is thought to act as a protective barrier for the gram-negative bacterium, making it more difficult to eradicate the

infection.³ Both patients also had type II diabetes mellitus, suggesting a relatively immunocompromised state may contribute to risk for GNBTWI's. Awareness of these risk factors is particularly important for patients in West Virginia, as many wear occlusive footwear and the population of patients with diabetes mellitus continues to grow. Workers who wear steel-toe boots should be educated about the importance of keeping their feet dry.

Conclusions

Awareness of GNBTWI's is essential to reduce morbidity. Proper prevention and treatment of underlying dermatophyte infections, which increases the risk of secondary bacterial infection, is key. Early recognition of secondary bacterial infection is critical. Appreciation of the affinity of gram-negative organisms for the toe-webs is important for selection of appropriate antibiotic therapy.

Figure 2. Plantar surface of foot with white macerated plaque and green exudate.



Figure 3. Dorsal surface of foot with white macerated plaque and green exudate.



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