Bacterial Pseudomycoses of the Skin: A Case Report

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Abstract

Clinicians in all scopes of medicine are no strangers to misnomers. The inaccurate naming of diseases and organisms oftentimes results from their resemblance to other entities and has been known to mislead physicians regarding etiologies and histopathologies. In the field of dermatology, certain skin infections have been mislabeled to be fungal when they are actually bacterial in nature. In order to further understand the origins and development of these infectious misnomers, we present a patient diagnosed with an unusual condition involving three different pseudomycotic skin infections. We also discuss the clinical features shared between these three bacterial pseudomycoses and identify the features that differentiate them from one another histopathologically.

Introduction

Pseudomycotic infections of the skin are a subset of bacterial infections that produces lesions with clinically fungal features.[1] Often, additional tests would be required to isolate the causative organism, thus delaying appropriate treatment. In order to increase the dermatologic awareness of these infections, we present an unusual case of a patient with three different bacterial pseudomycoses of the skin and discuss the clinical features, microbiology, histology, and treatment of these rare entities.

Case Presentation

A 66-year-old Hispanic male presented with a 12-year history of multiple dark nodules to his body that appeared to be getting progressively worse. Despite receiving treatment with various antibiotics, antifungals, and topical creams, his condition persisted without any signs of improvement. Physical examination revealed several non-tender, erythematous, firm nodules mixed with some largely indurated plaques diffusely wrapped around his lower abdomen and back (**Figure 1**).

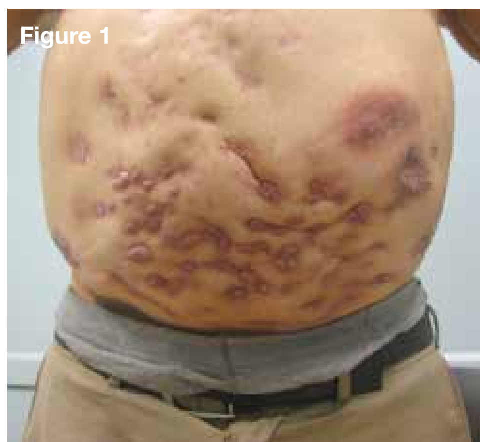

Figure 1

Multiple punch biopsies obtained from these lesions displayed areas of suppurative granulomatous fibro-inflammatory response consistent with an infectious process. Gram staining performed on these lesions revealed several foci of admixed Gram-positive bacterial cocci in addition to numerous filamentous rods in the deep dermal tissues (**Figures 2 and 3**). Histologic findings of these specimens were consistent with the diagnoses of botryomycosis, actinomycosis, and actinomycetoma pending the results of the tissue culture.

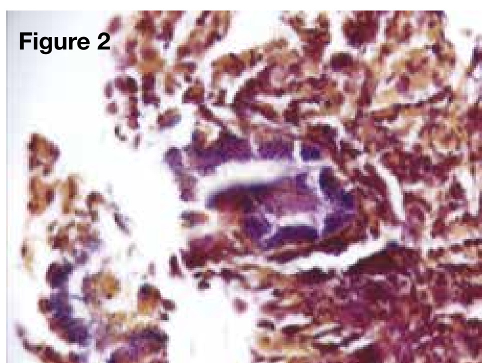

Figure 2

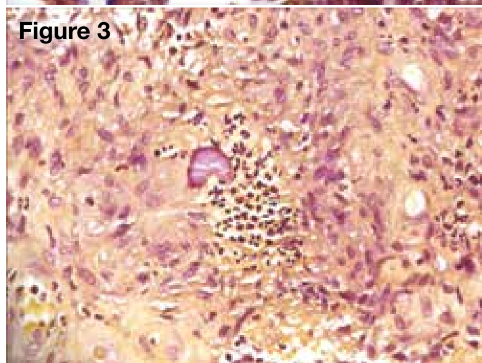

Figure 3

In order to cover for all bacterial species involved, the patient was placed on a prolonged course of amoxicillin with clavulanic acid for at least six months until complete resolution of his condition. He responded very well to treatment without any signs of recurrence to this date.

Discussion

Despite the presence of fungal nomenclature in the diagnosis of actinomycetoma, actinomycosis, and botryomycosis, all are infections of the skin caused by specific types of bacteria. These conditions are differentiated from one another depending on the appearance and size of the bacteria associated with the disease (**Table 1**). If histologic findings prove to be inconclusive, then additional stains and studies can be performed depending on the species of bacteria involved (**Table 2**).[2]

Actinomycetoma

Actinomycetoma is a chronic cutaneous infection of the skin caused by aerobic, Gram-positive Actinomycetales order of bacteria such as Nocardia brasiliensis. These organisms are phylogenetically diverse but morphologically similar, exhibiting characteristic filamentous branching into both bacillary and coccoid forms. Nocardia can be differentiated from Actinomyces by the acid-fast staining and aerobic properties of Nocardia.[3]

After the organism is inoculated into the skin, a pyogenic response ensues with formation of a painless nodule at the site of entry. As the nodule enlarges, a chronic inflammatory response occurs, which can remain localized or extend to involve muscle and bone.[4]

Diagnosis of actinomycetoma is made histologically with skin biopsy or by culturing of infected lesions. Histopathologic appearance of this condition is characterized by the appearance of delicate, filamentous Gram-positive branching. These organisms were once considered fungi because of their hyphal-like appearance, but molecular analysis of their cell wall has confirmed their classification as bacterial.[3,4]

Management of this condition usually

Table 1. Appearance and size of associated bacteria

	Actinomycetoma	Actinomycosis	Botryomycosis
Appearance	Filamentous	Filamentous	Cocci
Grain Size	40-80 µm	1-3 mm	0.5-1 mm
Organism	Nocardia brasiliensis	Actinomyces israelii	Staphylococcus aureus

Table 2. Additional diagnostic stains and studies

	Actinomycetoma	Actinomycosis	Botryomycosis
Hematoxylin and eosin	Basophilic mass of microfilaments	Basophilic mass of microfilaments	Eosinophilic periphery and basophilic center
Grocott-Gomori	Positive	Positive	Negative
Periodic acid-Schiff	Positive	Positive	Positive
Gram	Positive filaments	Positive filaments	Positive and negative clusters
Ziehl-Neelsen	Partially positive	Negative	Negative

involves antibiotics alone. Trimethoprim-sulfamethoxazole with or without dapsone is commonly used for disease of short duration, of limited extent, and with low risk of dissemination. For patients with more severe disease, longer-duration disease, or disease that is refractory to sulfonamides, consideration should be given to intravenous imipenem alone or in combination with amikacin.[5]

Actinomycosis

Actinomycosis is a chronic cutaneous infection characterized by abscess formation, draining sinus tracts, fistulas, and tissue fibrosis. This condition is most commonly caused by Gram-positive, anaerobic bacteria such as Actinomyces israelii. The name reflects its characteristic filamentous, fungal-like appearance in infected tissues. However, Actinomyces are true bacteria, with filaments much narrower than fungal hyphae noted for forming discrete, macroscopic grains of hard consistency, anywhere from 1 mm to 3 mm in diameter, visible to the naked eye. While these species capitalize on tissue injury to invade the skin, pain is generally an uncommon feature, particularly in chronic cases.[6]

Histologic findings typically reveal acute or chronic inflammatory granulation tissue with infiltration by neutrophils, foamy macrophages, plasma cells, and lymphocytes with a surrounding dense fibrosis. Filaments of Nocardia and Actinomyces species are next to impossible to differentiate by conventional methods such as Grocott-Gomori and hematoxylin-eosin staining. However, Nocardia species are typically acid-fast aerobic organisms, while Actinomyces are not.[7]

Treatment of choice for actinomyces often requires prolonged courses of antibiotics such as high-dose penicillin and amoxicillin. Acceptable alternatives include tetracyclines, erythromycin, and clindamycin.[8]

Botryomycosis

Botryomycosis is a rare, chronic, suppurative disease that is often mistaken clinically for a fungal infection. The term was coined because the infection granules appeared to be grouped together, resembling bunches of grapes (*botrys* in Greek), and behaved like a fungus (*mycosis*). Staphylococcus aureus is the most common organism cultured from lesions of botryomycosis, although it is not the only organism that can cause this particular type of condition. These pathogens may include, but are not limited to, organisms such as Pseudomonas aeruginosa, Escherichia coli, Serratia, and Proteus. Cutaneous botryomycosis is the most common form of botryomycosis and usually occurs following cutaneous inoculation of bacteria due to trauma, surgery, or presence of a foreign body. Lesions typically develop very slowly and may evolve to form multiple large, subcutaneous nodules for several months to years.[9]

Diagnosis of botryomycosis can be established histopathologically with skin biopsy or by culturing the bacteria from ulcers of infected lesions. Histopathologic appearance of this condition is characterized by a central focus of necrosis surrounded by a chronic inflammatory reaction containing histiocytes, epithelioid cells, multinucleated giant cells, and fibrosis. Gram staining or silver-nitrate staining is the preferred method of identifying these causative pathogens, which may be distinguished from actinomycosis or actinomycetomas by the variable sizes and shapes of the granules. These Gram-positive cocci are oftentimes larger than 1 micron in diameter, in contrast to the branching, filamentous bacteria less than 1 micron in size for actinomycosis and actinomycetoma.[10]

Treatment of this condition is dependent on the causative organism and severity of the infection. For Gram-positive infections such as Staphylococcus aureus, oral trimethoprim-sulfamethoxazole, clindamycin, doxycycline, or cephalexin can be used. For Gram-negative infections such as Pseudomonas aeruginosa, intravenous ceftazidime, ciprofloxacin, aztreonam, or imipenem can be effective.[11]

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