Introduction
Pseudomycotic infections of the skin are a subset of bacterial infections that produce lesions with clinically fungal features. 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).

Histologic findings of these specimens were consistent with the diagnoses of botryomycosis, actinomycosis, and actinomycetoma pending the results of the tissue culture.

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

Table 1. Appearance and size of associated bacteria

<table>
<thead>
<tr>
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<th>Actinomycetoma</th>
<th>Actinomycosis</th>
<th>Botryomycosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Filamentous</td>
<td>Filamentous</td>
<td>Cocci</td>
</tr>
<tr>
<td>Grain Size</td>
<td>40-80 μm</td>
<td>1-3 mm</td>
<td>0.5-1 mm</td>
</tr>
<tr>
<td>Organism</td>
<td>Nocardia brasiliensis</td>
<td>Actinomyces israelii</td>
<td>Staphylococcus aureus</td>
</tr>
</tbody>
</table>

Multiple punch biopsies obtained from these lesions displayed areas of supplicative 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).

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.14

Management of this condition usually...
Staphylococcus aureus is the most common mycosis in Greek), and behaved like a fungus (\textit{botrys} together, resembling bunches of grapes (\textit{fungal infection.  The term was coined because disease that is often mistaken clinically for a 

Botryomycosis and clindamycin.8  

alternatives include tetracyclines, erythromycin, high-dose penicillin and amoxicillin. Acceptable 

requires prolonged courses of antibiotics such as 

Treatment of choice for actinomycoses often 

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 \textit{Pseudomonas aeruginosa}, \textit{Escherichia coli}, \textit{Serratia}, and \textit{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 

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Histologic findings typically reveal acute or 

chronic inflammatory granulation tissue with 

infiltration by neutrophils, foamy macrophages, 

plasma cells, and lymphocytes with a surrounding 

necrosis surrounded by a chronic inflammatory 

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 actinomyces or 

actinomyctomas by the variable sizes and 

shapes of the granules. These Gram-positive coccii 

are oftentimes larger than 1 micron in diameter, 

in contrast to the branching, filamentous bacteria 

less than 1 micron in size for actinomyces 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 cephalaxin can be used. For Gram-negative 

infections such as \textit{Pseudomonas aeruginosa}, 

intravenous ceftazidime, ciprofloxacin, aztreonam, 

or imipenem can be effective.11 

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