A 2-year-old 5.8-kg castrated male domestic shorthair cat was referred for evaluation by a board-certified dermatologist because of a year-long history of waxing and waning, nonpruritic draining tracts on its left front and left hind paws. The cat had been a stray, adopted at approximately 1 year of age with the skin lesions already present, and tested negative for FIV and FeLV. Aerobic bacterial culture of samples obtained from the draining tracts shortly after adoption grew *Staphylococcus aureus*, susceptible to all antimicrobials tested. Two courses of marbofloxacin (5 mg/kg, PO, q 24 h, for 14 to 21 days [first course], then again for 42 days [second course]) and a single injection of cefovecin (8 mg/kg, SC) reduced drainage of the skin lesions; however, new lesions developed when antimicrobial treatment was discontinued. The cat was treated with prednisolone (1 mg/kg, PO, q 12 h for 14 days) without improvement, and new skin lesions arose on the paws during treatment. Thus, the cat was referred, and all medications were discontinued 1 week prior to referral examination.

**Clinical and Gross Findings**

On referral examination, the cat was bright, alert, and responsive and had multifocal firm erythematous and ulcerated dermal nodules (4 to 5 mm in diameter) between digits 4 and 5 on the left front and left hind paws and a papule on the lateral aspect of digit 5 on the left front paw. There was also a raised erythematous crust proximal to the left metatarsal pad. The nodules opened to the dorsal surface of the paws as draining tracts with serosanguinous fluid (Figure 1). The rest of the physical examination was unremarkable.

Formulate differential diagnoses, then continue reading.

**Figure 1**—Photographs of the dorsolateral aspects of the left front paw (A) and left hind paw (B) of a 2-year-old 5.8-kg castrated male domestic shorthair cat showing focal ulcerated dermal nodules (arrows) and a papule (arrowhead).
Histopathologic and Cytologic Findings

Cytologic examination of samples from the draining tracts revealed erythrocytes and neutrophils but no infectious agents. Three 6-mm-diameter and one 8-mm-diameter skin biopsy samples were obtained and submitted for histopathology as well as bacterial and fungal culture.

Microscopic examination of the biopsy specimens revealed a focally cavitated dermis infiltrated by a dense population of viable and degenerative neutrophils and macrophages mixed with edema and necrotic debris (Figure 2). Colonies (1- to 3-µm-diameter) of basophilic gram-positive cocci were mixed in the inflammation and encircled by hyalinized, eosinophilic material that resembled Splendore-Hoeppli phenomenon but lacked the classical radiating, club-like morphology. This focus was surrounded by fibrous connective tissue and a mixed inflammatory infiltrate comprised of lymphocytes, plasma cells, and macrophages that extended into the superficial dermis. The overlying epidermis was thickened by a diffuse, mild parakeratotic hyperkeratosis and acanthosis. There was a focal serocellular crust, composed of viable and degenerate neutrophils, lamellated keratin, karyorrhectic and cellular debris, and eosinophilic exudate. Ziehl-Neelsen acid-fast staining was negative for detection of *Mycobacterium* spp.

Microbiological Findings

Bacterial culture yielded moderate to heavy growth of *S aureus* susceptible to all antimicrobials tested. There was no growth on fungal culture.

Morphologic Diagnosis and Case Summary

Morphologic diagnosis: chronic, multifocal pyogranulomatous dermatitis with colonies of large gram-positive cocci.

Case summary: cutaneous botryomycosis caused by *S aureus* in a cat.

Comments

The medical history of this cat, clinical and histopathologic findings for its lesions, and isolation of *S aureus* led to the diagnosis of botryomycosis. Although the referring veterinarian’s differential diagnoses centered on plasma cell pododermatitis and feline eosinophilic granuloma complex, neither was supported on histologic examination, and the cat had no improvement during systemic glucocorticoid administration before referral.

Botryomycosis is a rare, chronic pyogranulomatous infectious condition that, to our knowledge, was first described as affecting surgical sites.

**Figure 2**—Photomicrographs of tissue sections from biopsy samples of the cutaneous lesions of the cat described in Figure 1. A—Fibrosis (pound sign) surrounds an area of focal cavitation (arrow) and viable and degenerate neutrophils, macrophages, edema, necrotic debris, and an aggregate of eosinophilic and basophilic material (bacterial colony; asterisk). H&E stain; bar = 200 µm. B—Higher magnification of the bacterial colony and surrounding material, consistent with the Splendore-Hoeppli phenomenon. H&E stain; bar = 10 µm. C—A cluster of 1- to 3-µm-diameter gram-positive cocci. Gram stain with Brown-Brenn stain modification; bar = 10 µm.
on cattle and horses in the late 1800s. Lesions are either cutaneous or disseminated throughout the abdomen, affecting multiple organs and have been documented in multiple species, including mice, hamsters, cats, dogs, pigs, cattle, and horses. In cats, the disseminated form of botryomycosis has been reported more commonly than the cutaneous form, and disseminated lesions have been observed in the spleen, adhered to the stomach and mesentery, and along the surface of the liver. A previous report describes cutaneous botryomycosis as a single extensive, pruritic, crusted area of erosion and ulceration, resembling the Splendore-Hoeppli phenomenon, whereas the cat in the present report had multifocal, small, nonpruritic lesions on the dorsal aspects of the affected paws.

The term botryomycosis is derived from the Greek botryo, or grape-like, referring to the grain-like granuloma formation that occurs in the disease. The bacterial etiology of botryomycosis was established in the early 1900s. In humans and animals, the causative agents of botryomycosis are frequently staphylococcal bacteria, most commonly *S. aureus*, and other bacteria (eg, *Pseudomonas, Escherichia coli, Streptococcus sp, Proteus sp, and Pasteurella sp*) have also been isolated. Similarly, *S. aureus* was isolated initially by the referring veterinarian when the cat was first presented and then later on referral examination, with bacterial culture performed on swab specimens of fluid from the draining tract lesions and tissue samples, respectively.

Histopathology, including special stains, is beneficial in identifying and differentiating botryomycosis from other infectious (eg, fungal [eg, histoplasmosis, blastomycosis, and zygomycosis], pythiosis, sporotrichosis, rapidly growing mycobacteriosis, or nocardiosis, actinomycosis) or noninfectious (eg, foreign body reactions) causes of pyogranulomatous reactions. The characteristic lesions in botryomycosis are intraleisional gram-positive cocci and the Splendore-Hoeppli reaction, which sets it apart from other infections causing a pyogranulomatous dermatitis.

The Splendore-Hoeppli phenomenon describes a histopathological finding of intensely eosinophilic material (radiating, star-like, asteroid, or club-shaped configurations) around microorganisms (fungi, bacteria, or parasites) or biologically inert substances. The type of inflammatory cell encapsulating the densely packed bacteria varies depending on the duration of the lesion but often involves a mixed population of neutrophils, lymphocytes, and multinucleated giant cells. The embedded eosinophilic material could result from a form of antigen-antibody complexes that prevent phagocytosis of the causative pathogens and resolution of the infection; the material may also prevent penetration of systemic antimicrobial therapies.

The pathogenesis of botryomycosis is unknown. In humans, botryomycosis has been attributed to diminished immunologic response to trauma-induced introduction of bacteria, and comorbidities, such as diabetes mellitus or human immunodeficiency virus infection, have been linked to increased probability of botryomycosis lesions. The relative amount of bacteria embedded in the lesion may also play a role, with an intermediate amount of bacteria being more likely to provoke this response. Botryomycosis lesions have been caused in mice through inoculation of *S. aureus* into artificially created wounds, and genetic B-cell deficiency has been identified as a predisposing factor for sentinel laboratory mice to develop botryomycosis. Although cutaneous botryomycosis was described in an FIV-positive cat, our patient tested negative for FIV and FeLV when evaluated by the referring veterinarian when the cat was adopted at approximately 1 year of age. The cat had since been kept as a single, indoor-only cat and had no other reported health concerns, which made FIV immune compromise unlikely to have contributed to the cat’s skin lesions. Thus, to the best of our knowledge, the present report was the first to describe cutaneous botryomycosis in an immunocompetent cat.

Treatment of botryomycosis has historically involved prolonged courses of antimicrobial treatment combined with complete surgical excision of any nonresolving lesions. In human patients, complete resolution of lesions with prolonged courses (>8 weeks) of antimicrobials alone administered IV or PO is common, and surgical remedies are used less frequently. In veterinary patients, antimicrobial treatment alone has not been effective in resolving botryomycosis lesions, and surgical excision is the mainstay of treatment, with systemic antimicrobials used as adjunctive treatment in some cases. Therefore, surgical excision was pursued for the cat of the present report, with two consecutive surgeries performed to remove all the botryomycosis skin lesions. The biopsy sites from the initial referral evaluation healed without complication; however, additional lesions then arose very close to those biopsy sites. After the second excision and on the basis of the susceptibility profile for the *S. aureus* isolated, cefovecin (8 mg/kg, SC, q 2 weeks, for 8 weeks) was administered by the referring veterinarian. The cat had received 8 weeks of cefovecin treatment when the present report was written; the owner reported that the lesions on the left hind paw had been gone for 4 weeks, the longest since the cat had been adopted, and that the lesions on the left front paw were still healing. The owner was advised to continue the antimicrobial treatment for an additional 2 to 4 months.

References


