

Case of the Month August 2026

A 4-year-old neutered male Golden Doodle dog from Pennsylvania presented with recent development lesions on the paw pads. Discrete ulcers were located in the central paw pad of the right forepaw (2-cm) and right hindpaw (3-cm). Each ulcer contained a bed of pink granulation tissue. The larger ulcer had firm rounded edges and was located adjacent to a hyperkeratotic plaque. The entire paw pads were swollen and hyperkeratotic with yellow adherent crusts. Aerobic culture yielded Methicillin-resistant *Staphylococcus epidermidis*. Anaerobic culture, fungal culture, and mycobacterium culture yielded no growth. The patient had a history of a firm nodule on the left hip (9 months prior). Punch biopsy samples of the paw pads were submitted for histopathologic examination.

Figure 1. Right front paw pad



Figure 2. Right hindpaw



Figure 3. H&E, 2x magnification

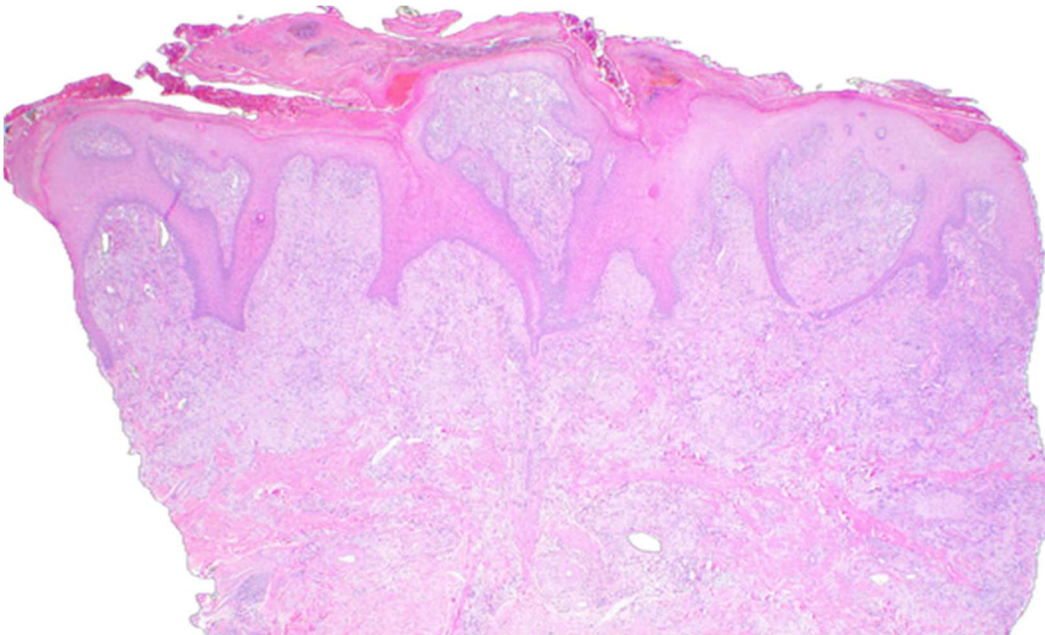


Figure 4. H&E, 10x magnification

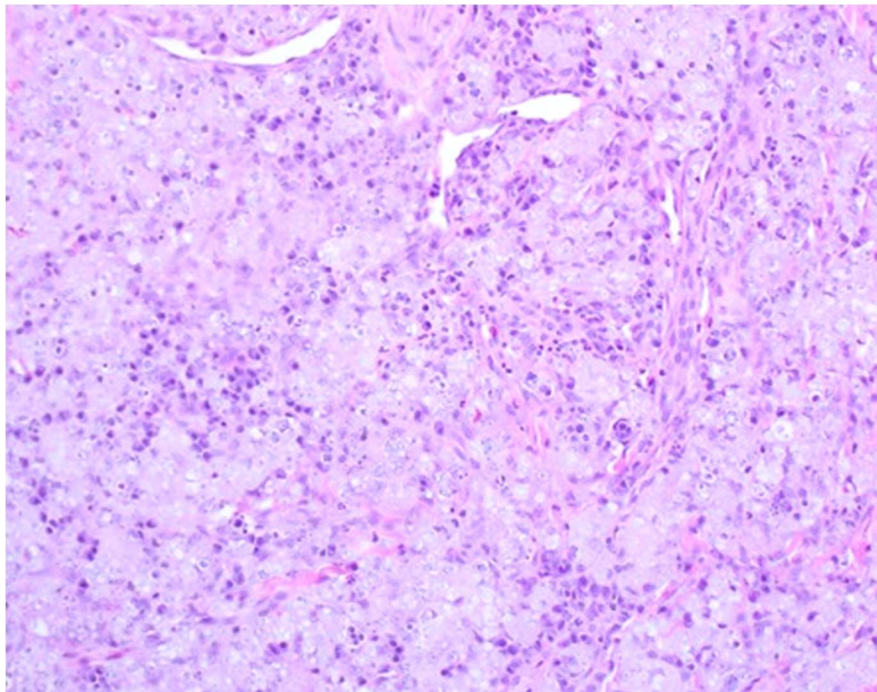
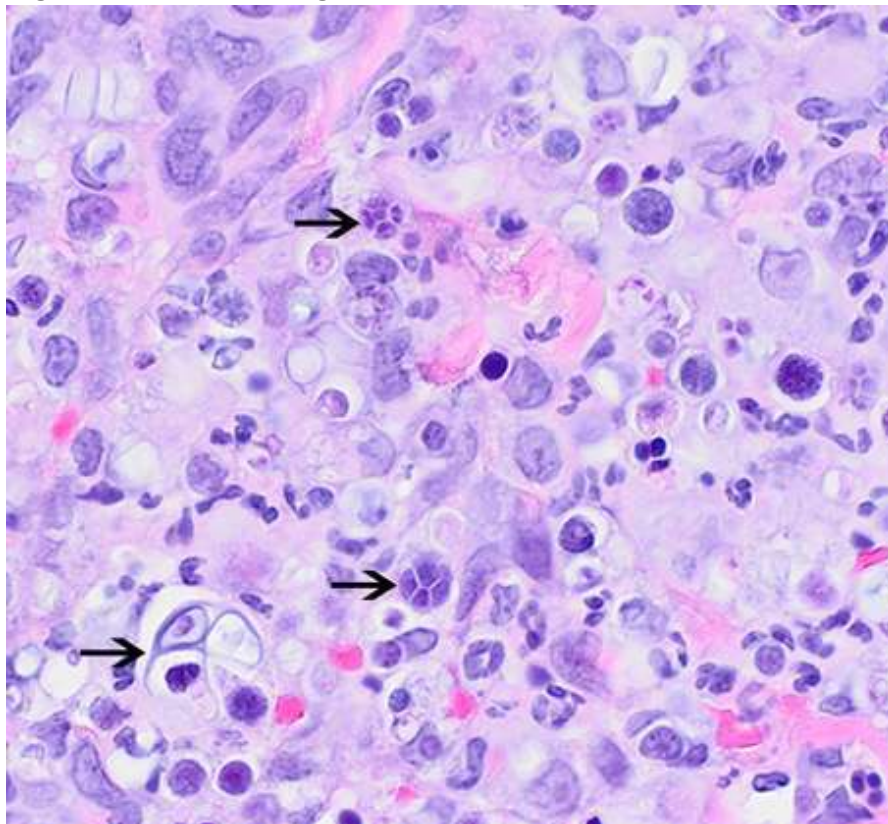


Figure 5. H&E, 40x magnification



What is the most likely etiologic agent?

- A. *Cryptococcus* spp.
- B. *Pythium* spp.
- C. *Coccidioides* spp.
- D. ***Prototheca* spp.**

Histopathologic Description

Punch biopsies from both sites are similarly affected and are described together. Diffusely effacing the dermis and normal dermal structures is a dense inflammatory infiltrate composed of epithelioid macrophages, multinucleated giant cells, and neutrophils. Within this inflammatory infiltrate, macrophages often contain numerous spherical to ovoid, basophilic to negatively staining sporulating microorganisms. These organisms measure up to 25 µm in diameter, are often surrounded by a 2-5 µm clear halo, and consist of a thick-walled sporangium containing multiple endospores (black arrows, Figure 5), as well as free endospores resulting from rupture of mature sporangia. The overlying epidermis is hyperplastic with rete pegs, hyperkeratosis and serocellular crusts.

Morphologic Diagnosis

Haired skin and paw pads, canine: Severe diffuse chronic pyogranulomatous pododermatitis with myriad intracellular sporulating organisms (Protothecosis)

Comment

Prototheca are saprophytic, achlorophyllous, unicellular algae found widely in the environment, particularly in soil and water. Protothecosis is reported worldwide but is seen frequently in the southeastern United States. The two most common species associated with infection in veterinary and human medicine are *Prototheca wickerhamii* and *P. zopfii*. The individual species cannot be differentiated by light microscopy alone; definitive identification requires culture followed by molecular tools such as polymerase chain reaction (PCR) or matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS).

A recent study described 124 cases of protothecosis in dogs and identified six major clinical presentations, listed in decreasing frequency: systemic, enteric, ocular, cutaneous, nervous and myocardial. Common gross findings in the cutaneous form include papules or nodules over pressure points, nodules or ulceration at mucocutaneous junctions, or depigmentation and ulceration of the nasal planum.

Prototheca organisms reproduce asexually by endosporulation, producing spherical sporangia containing numerous endospores (black arrows, Figure 5), a characteristic feature for histologic diagnosis. Rupture of mature sporangia releases endospores into the surrounding tissue, where

they eventually grow to form new sporangia. The mode of infection for cutaneous cases is not well understood, but the extensive environmental reservoir of the algae in the water and soil is considered a likely source of infection.

Histologically, *Prototheca* organisms can be readily identified by their thick-walled sporangia with variably sized endospores arranged in a morula-like pattern. Fungal stains such as Gomori methenamine silver (GMS) or periodic acid-Schiff (PAS) may help visualize the cell wall and internal contents. Organisms generally range from 3-30 µm and lack large PAS or GMS positive starch granules characteristic of *Chlorella* algae. The surrounding inflammatory response is usually pyogranulomatous to granulomatous consisting of epithelioid macrophages, multinucleated giant cells, neutrophils, lymphocytes, and variable foci of necrosis.

Cases of protothecosis have been reported in numerous domestic animal species. In cats, disease most commonly manifests as cutaneous lesions; in cattle, mastitis is best recognized; and in horses, rhinitis and sinusitis have been described. In humans, cutaneous infection is the most common presentation. Most cases of cutaneous protothecosis in both animals and humans are caused by *Prototheca wickerhamii*. This patient had a previous left hip nodule diagnosed as *P. wickerhamii* by PCR.

Despite traditionally being considered an uncommon opportunistic infection, the number of reported cases of protothecosis has increased in dogs and other species over the past decade, making protothecosis an emerging disease that may pose a challenge to veterinary and human medicine.

References

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