In collaboration with the American College of Veterinary Pathologists

Pathology in Practice

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History

A 12-year-old castrated male Collie was presented for evaluation of a progressive nodular dermatosis that had first appeared 1 month earlier. Lesions had initially developed on the dorsal aspect of the head as areas of alopecia and erythema. Since that time, the lesions had progressed to crusted and ulcerative nodules that were moderately pruritic. The patient had no history of illness other than Otodectes cynotis infestation as a puppy. Six weeks prior to evaluation, the client had heard vocalizations of a cat in the yard when the patient was outside, and the patient was noted to have had several small puncture wounds on the head. Results of clinicopathologic testing and thoracic radiography performed prior to referral were reported to be normal. Cefpodoxime proxetil (5.2 mg/kg, PO, q 24 h) had been administered for 10 days prior to evaluation, but the lesions had continued to progress.

Clinical Findings

On physical examination, the patient was bright, alert, and well hydrated, with a body condition score of 5/9. Lesions were restricted to the head and muzzle. There were multifocal, well-demarcated, raised, alopecic nodules with various degrees of hemorrhagic crusting and ulceration. The nodules are present on the dorsal and lateral aspects of the muzzle, dorsal to the right eye, and on the dorsal and caudal aspects of the head.

Histopathologic Findings

Tissue samples were processed routinely, and sections were stained with H&E, periodic acid–Schiff, and acid-fast stains. Histologically, the epidermis contained focal areas of serocellular to suppurative crusting with foci of erosion and ulceration. Marked underlying acanthosis. All sections exhibited variable degrees of hair follicle involvement with areas of folliculitis as well as ruptured hair follicles, keratin fragments, and deeper pyogranulomatous nodules. Several hair follicles and free keratin fragments were filled with approximately 2-µm fungal hyphae and approximately 2- to 3-µm-diameter spores that were readily identifiable (Figure 2). Fungal elements

Figure 1—Photographs of the face and muzzle (A) and the caudodorsal aspect of the head (B) of a 12-year-old Collie that was examined because of progressive nodular dermatosis. There are multifocal, well-demarcated, raised, alopecic nodules with various degrees of hemorrhagic crusting and ulceration. The nodules are present on the dorsal and lateral aspects of the muzzle, dorsal to the right eye, and on the dorsal and caudal aspects of the head.

Figure 2—Photographs of the face and muzzle (A) and the caudodorsal aspect of the head (B) of a 12-year-old Collie that was examined because of progressive nodular dermatosis. There are multifocal, well-demarcated, raised, alopecic nodules with various degrees of hemorrhagic crusting and ulceration. The nodules are present on the dorsal and lateral aspects of the muzzle, dorsal to the right eye, and on the dorsal and caudal aspects of the head.

Trenton S. Ewing, DVM; Wayne S. Rosenkrantz, DVM

1Animal Dermatology Clinic, Pasadena, CA
2Animal Dermatology Clinic, Tustin, CA
*Corresponding author: Dr. Ewing (tewing@adcmg.com)
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were accentuated with periodic acid–Schiff staining (Figure 3). Focal accumulations of eosinophils were seen in some tissue sections with more abundant free keratin. Results of acid-fast staining were negative. Subsequent dermatophyte culture and testing with a PCR assay definitively identified the organism as *Microsporum canis*.

**Morphologic Diagnosis and Case Summary**

Morphologic diagnosis: multifocal, chronic, severe, ulcerative epidermis, folliculitis, and furunculosis with fungal elements.

Case summary: fungal kerions in a 12-year-old Collie.

**Comments**

Dermatophytes are a group of generally superficial fungal pathogens that invade the keratinized tissue of humans and animals and belong to the genera *Microsporum*, *Tricophyton*, and *Epidermophyton*. The fungi can be further classified on the basis of their reservoir. Humans are the reservoir for anthropophilic fungi, and various animal species are the reservoirs for zoophilic fungi; for geophilic fungi, the reservoir is decomposing material in the environment.

In veterinary patients, dermatophyte infection is usually attributed to organisms from 1 of 3 species: *Microsporum canis*, *Microsporum gypseum*, and *Trichophyton mentagrophytes*. The primary reservoir of *M canis* is cats and dogs, whereas *T mentagrophytes* is found on rodents and lagomorphs, and *M gypseum* is a geophilic fungus. The most common causative agent of dermatophytosis in dogs and cats is *M canis*, as was the case for this patient.

Transmission of dermatophytes can occur through a variety of means, including direct contact with infected animals and contact with shed keratin debris. The organism can be transmitted on various fomites, and spores can remain infective in the environment for > 1 year. The present case was somewhat unique in that inoculation was suspected to be traumatic. It is important to consider that dermatophytes are zoonotic and may pose a public health risk through interspecies transmission.

The clinical appearance of dermatophytosis can vary considerably. The more typical presentation includes slowly expanding annular areas of alopecia with various degrees of scale, crusting, and inflammation. Signs may be as vague as mild alopecia. Follicular pustules may be observed. The face and forelimbs are common initial sites of infection. Onionyphomycosis may occur, and signs typically include paronychia and onychodystrophy. Two distinct clinical presentations of dermatophytosis are pseudomycetoma and fungal kerion. Pseudomycetomas occur in the deep dermis or subcutis and are a nodular form of dermatophytosis characterized by tissue grain formation. Fungal kerions, as demonstrated in the present case, are more superficial nodules and often associated with intense inflammation and swelling. Differential diagnoses for fungal kerions may include nodular neoplasms, foreign body reactions, and infection with other agents, such as *Mycobacterium* spp.

Diagnosis of dermatophytosis is generally straightforward. Organisms can be routinely cultured on specialized dermatophyte test media under a variety of conditions. A PCR assay is also readily available through commercial laboratories. Sample collection for both tests can be completed with a hair
pluck or use of a sterile toothbrush to gather hair and scale.\textsuperscript{12,13} Physical examination techniques include use of a Wood lamp to assess for fluorescence in cases of \textit{M canis} infection (although results will not always be positive), dermoscopy to visualize abnormal hair structures (comma hairs), and trichoscopy to visualize fungal elements within hairs (with or without additional staining).\textsuperscript{12,14–16} Histologic examination of biopsy specimens shows variable degrees of acanthosis and hyperkeratosis with dermatophyte spores and hyphae often visible within hairs or hair follicles.\textsuperscript{17} Perifolliculitis, folliculitis, and furunculosis are common.\textsuperscript{17} Acanthosis may be seen in epidermal pustules and within hair follicles.\textsuperscript{17} Periodic acid-Schiff and Grocott methenamine silver stains can be used to highlight fungal elements.\textsuperscript{17} Biopsy is often helpful in the diagnosis of nodular dermatophytosis when results of other tests are negative.\textsuperscript{9,10}

In cases in which treatment of dermatophytosis is required, one must consider environmental decontamination along with topical and systemic treatments.\textsuperscript{12,18,19} In consensus guidelines from the World Association of Veterinary Dermatology, therapeutic recommendations include lime sulfur dips, enilconazole, or bathing with a miconazole- or chlorhexidine-based shampoo twice a week for topical treatment and itraconazole or terbinafine for systemic treatment.\textsuperscript{12} Griseofulvin is not recommended owing to the potential for adverse events, and ketoconazole and fluconazole are noted as less effective therapeutic options.\textsuperscript{12}

The prognosis for animals, particularly young animals, with dermatophytosis is generally considered good.\textsuperscript{12} Spontaneous remission may occur in some cases over a period of weeks to months.\textsuperscript{12} Deep lesions such as pseudomycetomas may be more difficult to resolve and may require surgical intervention.\textsuperscript{20} All cases of dermatophytosis may be complicated by underlying disease processes or medications that reduce the function of the immune system.\textsuperscript{12,21}

References