Bacterial Skin Infections

Stephen White, DVM, DACVD
University of California
Davis, CA

Dogs

Pyoderma in dogs occurs most commonly secondary to allergies (flea, atopic dermatitis, food) although endocrinopathies can also be an underlying problem. The clinical signs of superficial pyoderma are epidermal collarettes and or follicular papules (papules with a hair shaft coming out of them; close examination with a hand lens or an otoscope [without the cone] will help identify these papules). It is vital to treat pyodermas especially when secondary to allergies, as in most animals these are also contributing to pruritus. Deep pyodermas tend to present as draining, purulent tracks. *Staphylococcus pseudintermedius* is the most common cause of pyoderma in dogs, although *S aureus* and *S schleiferi* have also been isolated.Staphylococci may further exacerbate the atopic state by eliciting production of IgE specific for *Staphylococcus* sp, as well as by producing staphylococcal protein A (SPA), which may nonspecifically bind to IgE molecules on mast cells. In return, the atopic state may contribute to or enhance pyoderma, by the pruritus physically reducing the barrier the stratum corneum poses for infection, by the increased ability of *S pseudintermedius* to "stick" to atopic dogs' corneocytes, or by the degranulation of mast cells making the epidermis more permeable to staphylococcal antigens. In addition, atopic dogs' carriage of *S pseudintermedius* is greater than healthy dogs.

Diagnosis of superficial pyoderma is usually made by clinical signs. Diagnosis of deep pyoderma is made by clinical signs and, usually, by ruling out of differential diagnoses, such as demodicosis, deep fungal disease, etc.

The author uses the following antibiotics :

- Cephalexin 20-30 mg/kg q 8-12 h
- Cefpodoxime (Simplicef™) 5-10 mg/kg q 24 h
- Lincomycin (Lincocin ®)20 mg/kg q 12 h
- Clindamycin 11mg/kg q12 h
- Ciprofloxacin 30 mg/kg q24h
- Enrofloxacin (Baytril®) 5 - 10 mg/kg q 24 h
- Amoxicillin-Clavulanate (Clavamox®) 13.75 mg/kg q 12 h
- Marbofloxacin (Zeniquin®) 3- 6 mg/kg q 24 h
- Azithromycin 10mg/kg, q24h, 4 days/week
- Doxycycline 5mg/kg q12h
- TMS 30 mg/kg q12h
- Cephalexin 20-30 mg/kg q 8-12 h

With the increase in methicillin-resistant (MR) *S pseudintermedius, S aureus, and S schleiferi,* the author now strongly recommends culture of any dog with epidermal collarettes or deep draining tracks that fails to respond to one of the above antibiotics over a 3-4 week period of time. Epidermal collarettes may be cultured using a dry sterile culturette rolled across the collarettes. Note that the prevalence of seeing MR *Staphylococcus* species is equal in first-line and specialty referral hospitals, and that is more likely if the dog has been hospitalized and/or received antibiotics in the 6-12 months prior to presentation.

Shampoos may be helpful as adjunct treatment in pyodermas, particularly in superficial pyodermas. There are many good effective anti-bacterial shampoos available. The author's favorites are ethyl-lactate containing shampoo (Etiderm®, Virbac), which is effective, lathers well, and well-liked by owners. A 4% chlorhexidine – tris-EDTA shampoo has also shown very good results (Triz-chlor 4®, Dechra); this product also comes as a spray. In some cases of multi-drug resistant staphylococci, bathing on an every day or every other day basis, supplemented with spraying, has allowed the clinician to regain control of the infection without resort to potentially dangerous antibiotics and occasionally has resulted in the organism reverting to a strain less resistant to systemic treatment.

Cats

Clinical signs of *superficial* pyoderma are, similar to dogs, most commonly epidermal collarettes or follicular papules. These papules may become encrusted, in which case they present as 'military dermatitis'.Cats are most commonly infected with *S pseudintermedius* or *S aureus*.

Because epidermal collarettes frequently exfoliate, in long- or thick- coated cats they may present as scaling ('seborrhea sicca'); clipping a small section of the coat and examining with a hand lens will often identify the collarettes. Differential diagnosis of epidermal collarettes includes pemphigus folliaceus and erythema multiforme; differential diagnoses of follicular papules are dermatophytosis, demodicosis and, less commonly, pemphigus foliaceus or *Malassezia.*

Deep pyodermas (furunculosis) typically present as fistulous tracts and/or nodules. While staphylococcal infections may certainly cause this in the cat, an important differential diagnosis include other pathogens of the dermis, especially *Mycobacterium* species. Feline acne probably also belongs in this category.

Diagnosis of pyoderma is usually made by clinical signs and/or tape preparations of the superficial skin (as described below under *Malassezia* infections). Deep pyoderma in the cat is relatively uncommon, and biopsy for both histopathology and culture is indicated early in the work up of the disease.

Treatment of pyoderma

Feline acne is usually well controlled/treated with mupirocin (Muprocin®, Dechra. Contact reactions are rare. Frequency is q12-24h, until controlled, then lowest frequency possible.

For antibiotic treatment of pyoderma in cats, the author prefers the following antibiotics :

- Cephalexin 20-30 mg/kg q 8-12 h
- Cefpodoxime (Simplicef™) 5-10 mg/kg q 24 h
- Lincomycin (Lincocin ®)20 mg/kg q 12 h
- Amoxicillin-Clavulanate (Clavamox®) 13.75 mg/kg q 12 h
- Marbofloxacin (Zeniquin®) 3- 6 mg/kg q 24 h
- Clindamycin 11mg/kg q12 h
- Azithromycin 10mg/kg, q24h, 4 days/week
- Doxycycline 5mg/kg q12h
- TMS 30 mg/kg q12h

Deep pyodermas are usually diagnosed by clinical signs, response to antibiotics, and/or biopsy. Treatment is with the same antibiotics as for superficial pyoderma, but for at least 8 weeks.

Mycobacteria

Much of the recent work on mycobacterial infections in cats has been done by Dr. Richard Malik's group in Australia. Most mycobacteria species affecting cats could be divided into the 'rapidly growing' mycobacteria (RGM) identified as either *Mycobacteria smegmatis* or *M fortuitum* and feline leprosy (caused by *Mycobacterium lepraemurium* and another as yet unnamed species). The RGM are probably more common. In Australia, female cats are over-represented. RGM infections typically start in the inguinal area (although axilla and other areas are occasionally affected). The lesions will initially resemble a cat-bite abscess, but without much pus or the unpleasant odor. A nodule or nodules may be present at the initial injury (usually a cat fight) which introduced the organism. The infection will progressively affect the abdominal fat pad, and cause thickening of the subcutaneous tissues. In long-term cases, the limbs may be affected. Typical treatment of a cat-bite abscess (surgical drainage, synthetic penicillins) is followed by wound dehiscence and continual non-healing fistulous tracts. Histology reveals a granulomatous to pyo-granulomatous reaction. Special stains for mycobacteria are not always productive, although the organisms may sometimes be seen in macrophages or extracellular lipid vacuoles, and sometimes even on cytology of exudates. PCR may need to be used to support the diagnosis.

On the basis of minimum inhibitory concentration and/or disc diffusion susceptibility testing, all strains of *M smegmatis* were susceptible to trimethoprim while all strains of *M fortuitum* were resistant. *M smegmatis* strains were typically susceptible to doxycycline, gentamicin and fluoroquinolones but not clarithromycin. All *M fortuitum* strains were susceptible to fluoroquinolones, and often also susceptible to gentamicin, doxycycline and clarithromycin. Generally, *M smegmatis* strains were more susceptible to antimicrobial agents than *M fortuitum* strains. Treatment of mycobacterial panniculitis involves *long courses* of antimicrobial agents, typically of 3-6 months, chosen on the basis of *in vitro* susceptibility testing and often (usually) combined with extensive surgical debridement and wound reconstruction, especially total resectioning of the abdominal fat pad. These therapies will result in effective cure of the disease. One or a combination of doxycycline (25-50 mg q8-12 h), ciprofloxacin (62.5 q 8 h to 125 mg q12 h), enrofloxacin (25-75 mg q 24 h) or clarithromycin (62.5 mg q 12-24 h) were reported as the drugs of choice for long-term *oral* therapy of the average 5kg cat.

Feline leprosy refers to a condition in which cats develop granulomas of the subcutis and skin in association with intracellular acid-fast bacilli that do not grow on routine laboratory media. Cats may be divided into two groups on the basis of the patients' age, histology of lesions, clinical course and the sequence of 16S rRNA PCR amplicons. One group consists of young cats (less than 4 years) which initially develop localised nodular disease affecting the limbs. Lesions progress rapidly and sometimes ulcerate. Sparse to moderate numbers of acid-fast bacilli are identified using cytology and/or histology, typically in areas of caseous necrosis and surrounded by pyogranulomatous inflammation. *Mycobacterium lepraemurium* is diagnosed based on PCR. The clinical course is aggressive, with a tendency towards local spread, recurrence following surgery and development of widespread lesions over several weeks. These cats reside in suburban or rural environments. A second group consisted of old cats (> 9 years) with generalised skin involvement, multibacillary histology and a slowly progressive clinical course. Disease progression is protracted (compared to the first group of cats), typically taking months to years, and skin nodules do not ulcerate. Microscopically, lesions consist of sheets of epithelioid cells containing large to enormous numbers of acid-fast bacilli which stain with haematoxylin. PCR identified a different mycobacteria species than *M lepraemurium.* Affected cats are domicile in rural or semi-rural environments. These infections

generally may be cured using two or three of the following: rifampicin (10-15 mg/kg once a day), clofazimine (25 to 50 mg once a day or 50 mg every other day) and clarithromycin (62.5 mg per cat every 12 h).These findings suggest that feline leprosy comprises two different clinical syndromes, one tending to occur in young cats and caused typically by *M lepraemurium* and another in old cats caused by a single novel mycobacterial species

It should be pointed out that mycobacterial species can also infect dogs –particularly in the form of a leproid granuloma. Some of these will resolve spontaneously, most will respond to either surgical removal or antibiotics.

References

White SD. Pyoderma in 5 cats. J Am Anim Hosp Assoc, 27:141-146, 1991.

White SD, Bourdeau P, Blumstein P, et al. Feline acne and results of treatment with mupirocin: 25 cases (1994-1996). Vet Dermatol 8: 157-164, 1997.

White SD. Systemic treatment of bacterial skin infections of dogs and cats. Vet Dermatol 7: 133-143, 1996.

White SD, Ihrke PJ, Stannard AA et al: Cutaneous atypical mycobacteriosis in cats. J Am Vet Med Assoc 182:1218-1222, 1983.

Malik R, Wigney DI, Dawson D, et al. Infection of the subcutis and skin of cats with rapidly growing mycobacteria: a review of microbiological and clinical findings. J Feline Med Surg 2000; 2:35-48.

Malik R, Hughes MS, James G, et al. Feline leprosy: two different clinical syndromes. J Feline Med Surg 2002; 4:43-59.

Hughes MS, James G, Taylor MJ, et al. PCR studies of feline leprosy cases. J Feline Med Surg 2004 ; 6:235-243.

Fyfe JA, McCowan C, O'Brien CR, et al Molecular characterization of a novel fastidious mycobacterium causing lepromatous lesions of the skin, subcutis, cornea, and conjunctiva of cats living in Victoria, Australia. J Clin Microbiol. 2008;46:618-26.

Smits B, Willis R, Malik R, et al. Case clusters of leproid granulomas in foxhounds in New Zealand and Australia. Vet Dermatol. 2012;23:465-475.

Griffin CE, DeBoer DJ. The ACVD task force on canine atopic dermatitis (XIV): clinical manifestations of canine atopic dermatitis. Veterinary Immunology and Immunopathology 2001; 81: 255–269.

Frank LA, Kania SA, Hnilica KA, Wilkes RP, Bemis DA. Isolation of Staphylococcus schleiferi from dogs with pyoderma. J Am Vet Med Assoc 2003; 222:451-454.

Morris DO, Rook KA, Shofer FS, et al. Screening of Staphylococcus aureus, Staphylococcus intermedius, and Staphylococcus schleiferi isolates obtained from small companion animals for antimicrobial resistance: a retrospective review of 749 isolates (2003-04). Vet Dermatol 2006;17:332-337.

McEwan NA, Mellor D, Kalna G. Adherence by Staphylococcus intermedius to canine corneocytes: a preliminary study comparing noninflamed and inflamed atopic canine skin. Veterinary Dermatology 2006; 17: 151–154.

Fazakerley J, Nuttall T, Sales D, et al. Staphylococcal colonization of mucosal and lesional skin sites in atopic and healthy dogs. Vet Dermatol 2009;20:179-184.

Weese JS, van Duijkeren E. Methicillin-resistant Staphylococcus aureus and Staphylococcus pseudintermedius in veterinary medicine. Vet Microbiol. 2010 ;140:418-429.

Eckholm NG, Outerbridge CA, White SD, et al. Prevalence of and risk factors for infection with methicillin-resistant Staphylococcus spp. in dogs with pyoderma. Vet Dermatol 2013; 24: 154- 162.

White SD, Brown A, Chapman P, et al. Aerobic bacterial culture of epidermal collarettes in dogs. J Am Vet Med Assoc, 2005; 226:904-908.