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RECURRENT CANINE PYODERMA

Peter J. Ihrke, VMD, Diplomate ACVD
School of Veterinary Medicine
University of California, Davis, CA

Recurrent pyoderma are infections that respond completely to appropriate systemic and topical antibacterial therapy leaving the dog apparently normal between episodes of infection. Many canine pyoderma occur only once with affected dogs responding appropriately to initial therapy without recurrence. Other dogs with pyoderma recrudesce after apparent complete recovery. Many apparent cases of recurrent deep pyoderma referred to dermatologists are in fact dogs where complete cure was never achieved. Poor owner compliance may be an underappreciated cause of incomplete cure or seeming recurrence. The term, idiopathic recurrent pyoderma is used if appropriate diagnostic tests have failed to reveal an underlying cause. Underlying and ongoing other skin diseases usually are responsible for recurrence of infection.

Possible underlying causes of recurrent canine pyoderma can be categorized as persistent underlying skin disease, bacterial hypersensitivity, immunodeficiency, resistant strains of Staphylococcus spp., and non-Staphylococcal pyoderma. The most commonly documented persistent underlying skin diseases include non-parasitic allergic diseases (atopic dermatitis, food allergy), parasitic allergic diseases (flea allergy, scabies, cheyletiellosis), demodicosis, endocrine diseases (hypothyroidism, hyperglucocorticoidism or iatrogenic), diseases of cornification (primary keratinization defects, secondary "seborrhea"), other infectious skin diseases (Malassezia dermatitis), genodermatoses (follicular dysplasia, color dilution alopecia, sebaceous adenitis), occult neoplasia (solar-induced-squamous-cell-carcinoma), and immune deficiency (congenital, acquired).

Bacterial hypersensitivity remains controversial. It is likely that some of the severe, self-perpetuating inflammation and pruritus seen with pyoderma is due to hypersensitivity. Fadok has speculated that hypersensitivity to bacterial superantigens such as Protein A may play a role in the severe inflammation seen with some canine pyoderma. Preliminary data by Halliwell demonstrated higher levels of anti-staphylococcal IgE in dogs with recurrent pyoderma and erythematous spreading lesions. Morales, Schultz and DeBoer substantiated an association between anti-staphylococcal antibodies and various subgroups of canine pyoderma.

Despite its attractiveness as a concept, immunodeficiency is a rare cause of recurrent pyoderma. Chronic, deep pyoderma due to cellular immune dysfunction is rare. Severe circulating IgA deficiency also is a rare cause of skin and respiratory infections.

Multi-resistant strains of Staphylococcus intermedius are quite rare. However, they commonly are over-diagnosed. Resistance commonly can occur to "first line of defense" antibiotics. Staphylococcus intermedius has a remarkable propensity not to develop resistance to antibiotics such as the cephalosporins, beta lactamase-resistant penicillins and the fluoroquinolones. "Common wisdom" has been expressed frequently that differences in strains of S. intermedius or differences in antibiotic usage will lead to different susceptibility patterns globally leading to the prediction that antibiotic-resistant S. intermedius will preclude the use of many antibiotics. In reality, remarkably little change in antibiotic susceptibility patterns has been noted. For the most part, canine S. intermedius is no more resistant to antibiotics than it was two decades ago. Other Staphylococcal species occasionally may cause canine pyoderma; resistance may be more common in these other organisms. Staphylococcus schleiferi is seen occasionally and may be resistant to methicillin and some fluoroquinolones.

Non-Staphylococcal pyoderma is exceedingly rare. Culture of organisms other than Staphylococcus intermedius usually indicates the presence of secondary invaders or environmental contamination of the culture. However, primary infection caused by Pseudomonas, Proteus, E. coli, and Enterobacter is seen on occasion. 'Post-grooming furunculosis' may be seen in conjunction with contamination during shampooing.

Pruritus in recurrent pyoderma is a key feature in the prioritization and differentiation of underlying causes. If pruritus disappears after antibiotic therapy, this is indicative that the pyoderma caused the pruritus. If pruritus remains, one must look for underlying pruritic skin disease.

Common pruritic, persistent underlying skin diseases include non-parasitic allergic skin diseases (atopic dermatitis, food allergy), allergic parasitic skin diseases (flea allergy dermatitis, sarcoptic acariasis), primary cornification defects, and coexistent secondary Malassezia dermatitis. Relatively non-pruritic persistent underlying skin diseases include actinic skin disease and genodermatoses such as color dilution alopecia and sebaceous adenitis.

Problems in the appropriate dosing of systemic antibiotics for pyoderma lead to the unwarranted assumption that bacterial resistance is occurring. Skin perfusion is less than ideal for establishing adequate dosages of antibiotics, in comparison to other body tissues (only 4% of cardiac output reaches the skin in contrast to 33% of cardiac output reaching muscles). Dosages of most antibiotics still are largely empirical. Special problems exist in deep pyoderma. These include sequestered foci of infection and foreign body granulomatous response. Antibiotic inactivation by inflammatory products further compromises effective antibiotic dosing. Antibiotics where dosing can safely be increased in deep pyoderma include fluoroquinolones, cephalosporins, oxacillin and clavulanic acid-potentiated amoxicillin.

The goals of long-term management of recurrent pyoderma include the prevention of recurrent episodes of pyoderma, or diminishing the frequency of recurrent episodes. This requires long-term consistent management of underlying skin diseases or other predisposing causes. Most dermatologists affirm that canine atopic dermatitis is the most commonly diagnosed underlying cause of recurrent pyoderma. Rigorous investigation for underlying skin diseases or other predisposing causes should be initiated if a dog does not respond completely to appropriate therapy. Dogs with either recurrent infections or infections that do not respond completely to appropriate therapy should have antibacterial shampoo twice weekly. Shampoo therapy, if beneficial, should be continued indefinitely in cases of idiopathic recurrent pyoderma. Immunomodulatory therapy may be helpful adjunctively. Killed bacterial preparations or non-bacterial immunostimulants may be utilized in dogs with confirmed or suspected defects of the immune system or in dogs with idiopathic recurrent pyoderma. The use of extended regimens of antibiotic therapy should be considered if other therapy has not prevented recurrence.

The rationale for antibacterial shampoo therapy includes a decrease in surface bacteria, an attempt to limit re-colonization
in an attempt to diminish the frequency of recurrence. Active agents in antibacterial shampoos include benzoyl peroxide, benzoyl peroxide and sulfur, chlorhexidine, triclosan and ethyl lactate. Unfortunately, the ideal frequency probably is 2 or 3 times weekly allowing 15 minutes of contact time. Additional benefits include improvement in patient attitude and owner encouragement. One substantial difficulty encountered in the use of regular, repetitive antibacterial shampoo therapy is that modern spot-on types of flea prevention therapy cannot be used for adjunctive flea control.

The rationale for immunomodulatory therapy includes the stimulation of enhanced immune surveillance, an altered response to bacterial allergen, leading to diminished recurrence. Commercially available bacterial products contain *Staphylococcus* or *Propionibacterium* (*Corynebacterium*). Autogenous bacterins also may be made for the dog. The only killed bacterial product supported by double-blind placebo-controlled data is Staphage Lysate® - SPL - (Delmont Laboratories, Swarthmore, Pennsylvania, USA). This product is made from human strains of *Staphylococcus aureus*, serotypes I and III and contains large quantities of protein A. Either .5 c.c. is injected twice weekly or 1 c.c. is injected weekly subcutaneously. Non-bacterial products that have been advocated include levamisole and cimetidine. Levamisole may alter lymphocyte and phagocyte immune function by modifying leukocyte intracellular cyclic nucleotides. Cimetidine theoretically reduces immunosuppression my modulating cytokine production. Dosages of 3 to 4 mg/kg orally twice daily have been recommended.

Extended regimens of antibiotics should be considered if underlying causes either are not identified or cannot be managed, antibacterial shampoo therapy is not successful, immunomodulatory therapy is either not successful or has been rejected. Extended antibiotic regimens should be considered as a last resort.

The rationale behind extended antibiotic regimens includes diminished recurrence by preventing re-infection. Theoretical risks include side effects in the patient (predominantly gastrointestinal), antibiotic resistance in the patient and the formation of resistant strains of bacteria that may be disseminated in the environment. The author's favored dosing options include two or three consecutive days per week dosing at the full daily dose or every-other-week dosing with an attempt at extending the "off" period to 2 and then 3 weeks. Antibiotic choices include cephalexin, fluoroquinolones such as enrofloxacin or marbofloxacin, oxacillin, and clavulanate-potiated amoxicillin. However, extended regimen dosing should be considered an admission of partial defeat.

Long-term owner compliance is required for extended antibiotic regimens to be successful at preventing recurrence. Compliance is the study of recommended therapy versus delivered therapy. Compliance is relatively poorly studied in veterinary medicine. Studies in human medicine indicate that up to 40% of prescriptions are never filled and of those that are filled, up to 40% are taken incorrectly. Drugs requiring once a day dosage may lead to better owner compliance.

Treatment failure with extended regimen antibiotic therapy may be caused by lack of recognition or successful management of underlying disease, inadequate duration of curative antibiotic therapy prior to switching to extended regimens, inadequate owner compliance, or resistance to the antibiotic.

**SUGGESTED READINGS**