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Canine superficial pyoderma and therapeutic considerations

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Superficial bacterial folliculitis (SBF), or superficial pyoderma, is a bacterial infection confined to the superficial portion of the hair follicle (1). Bacteria may cause an infection secondary to local trauma, scratching, contamination due to poor grooming, seborrhea, parasitic infestation, hormonal factors, local irritants, or allergies (1). In dogs, SBF is the most common form of pyoderma, and is also the principal reason for antimicrobial use in small animal practice (2,3). The predominant pathogen that causes superficial pyoderma is *Staphylococcus pseudintermedius* (1) (formerly *S. intermedius*), a commensal bacterium that resides on the mucosal and skin surfaces of dogs (4,5). These resident strains may act as opportunistic pathogens and cause infection, primarily involving the skin. Infection results from an interaction between genetic, environmental, and immunological factors. Various predisposing factors and primary causes of infection contribute to the switch of *S. pseudintermedius* from commensal to pathogen (4,5). Less commonly, dogs may also be colonized and infected by other *Staphylococcus* species and other bacteria (1).

While SBF is generally a straightforward diagnosis, observing changes suggestive of follicular inflammation (folliculitis) in a patient is not confirmatory for bacterial involvement in the disease. Follicular inflammation also occurs with other conditions, including demodicosis, dermatophytosis, and a variety of immune-mediated skin disorders. To confirm the diagnosis of SBF, diagnostic tests must be performed to obtain cytological evidence of bacteria and inflammation while ruling out other common causes of folliculitis (1). Superficial bacterial folliculitis can often become a chronic and/or recurrent condition if the primary underlying cause is not identified and adequately resolved or controlled. Causes for the persistence or recurrence of pyoderma include inappropriate therapy (drugs used, duration of treatment), lack of diagnostics, methicillin resistance, client compliance. These and other factors such as bacterial carriage on individual dogs, immune suppression, and persistent underlying disease can lead to selection of methicillin-resistant staphylococci in a patient.

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Methicillin-resistant *Staphylococcus pseudintermedius* (MRSP)

While *S. pseudintermedius* is often likened to *Staphylococcus aureus,* and follows similar resistance patterns to *S. aureus,* the mechanisms of drug resistance are different. *Staphylococcus pseudintermedius* seems to prefer transposon-borne resistance genes, which are then incorporated into the chromosomal DNA, over plasmid-borne resistance genes (6). Besides phenotypic oxacillin resistance, the gene *mecA* has to be present to classify an isolate as methicillin-resistant *Staphylococcus pseudintermedius* (MRSP) (6).

Staphylococcus pseudintermedius is primarily identified in dogs and is rare in other species, although it has been identified in other species, including cats, horses, and humans (7–9). While *S. pseudintermedius* is regarded as a canine-specific pathogen that is restricted to skin infection, there are reports of postoperative infections in dogs, and infections in humans (10,11). Presence of indistinguishable isolates in pets and their owners has also been confirmed (12). Identification of the bacterium in other species and the known potential for selection for drug resistance highlight the need for veterinarians to pursue best practices while treating superficial pyoderma in dogs.

Best practices in SBF therapy

Recently, guidelines for antimicrobial therapy for canine superficial bacterial folliculitis were published (2). These recommendations emphasized the need for demonstration of cocci from lesional skin by cytology as a powerful adjunctive diagnostic test (2). It is good practice to perform impression cytology as an in-clinic test while diagnosing skin infections. Appropriate techniques have been described for both specimen collection and examination to optimize the value of this diagnostic procedure (13).

Bacterial culture for canine pyoderma is never contraindicated and is, in fact, encouraged in patients with chronic or recurrent pyoderma due to the increased frequency of isolation of antibiotic resistant staphylococci in veterinary medicine over the past decade. Careful consideration for bacterial culture should also be given to dogs that have received repetitive antibiotic therapy. When bacterial culture is indicated for a patient, generally a 48- to 72-hour washout period after antibiotic therapy is desirable. It is, however, acceptable to collect samples for bacterial

culture and susceptibility testing from pyoderma lesions at any time, regardless of the current use of topical or systemic antibiotic (2).

Historically, canine pyoderma has been treated in primary practice using empirical systemic antibiotics and minimal topical therapy. This approach is no longer reliable, especially in localities where staphylococcal resistance patterns have been reported. Minimizing resistant infections in companion animals is one of the biggest challenges faced by veterinary practitioners, pushing the profession to become familiar with non-traditional, yet appropriate, approaches to treating pyoderma. Factors that impact therapy, in addition to antimicrobial resistance, include the severity and extent of lesions, patient factors (such as hair coat, temperament, and environment), concurrent disease and the owner's ability to administer topical or systemic therapy, all of which may affect the efficacy of the chosen therapy (2).

While veterinarians have been progressively using more topical treatments for pyoderma than in the past, topical therapy of SBF is probably still underused because of the perception that client compliance may be poor. This concern is not completely unfounded as some pet owners are unable to pursue topical therapy due to the effort and time involved, as well as due to practical factors such as patient stress, patient temperament, and availability of bathing facilities. These pet owners will often express this concern when treatment options are discussed. However, for pet owners who are committed to topical therapy, there are significant potential advantages for early and frequent use of a topical approach. These advantages include more rapid lesion resolution, a decrease in the duration of antimicrobial administration, minimal adverse effects and greatly reduced risk of inadvertent emergence of resistant strains in other organ systems (2). Shampoo therapy further provides non-biocidal benefits such as mechanical removal of crusts, debris, and bacteria from the skin (1,14) regardless of the active ingredient in the shampoo.

Topical therapy alone (without systemic antibiotic therapy) is a desirable approach for localized lesions of SBF; early stages of generalized SBF when lesions are mild; and to help prevent recurrence of SBF while diagnostic procedures for primary underlying skin disease are pursued (2). In a study conducted in Italy, treatment with chlorhexidine products resulted in resolution of clinical signs in all dogs including those infected with MRSP (2,14). The study found that topical therapy with 4% chlorhexidine digluconate products (shampoo and solution) was as effective as systemic therapy with amoxicillin–clavulanic acid in dogs affected with superficial pyoderma. Clinical examination on day 28 did not reveal any signs of bacterial infection in any dog that completed the study, regardless of the treatment group. Significantly, no differences in clinical efficacy and time-to-resolution were observed between MRSP and methicillin-sensitive *S. pseudintermedius* (MSSP) infections, suggesting that the proposed topical treatment protocol may be effective in superficial pyoderma caused by MRSP. Widespread topical therapy may be administered by spraying with solutions containing chlorhexidine and/or by washing the patient with shampoos containing antiseptics, such as chlorhexidine, benzoyl peroxide, and ethyl lactate (1,14).

Systemic antibiotic therapy is required to treat widespread pyoderma, deep pyoderma, and recurrent pyoderma. Such antimicrobial therapy should be selected based on impression cytology with culture and sensitivity result findings, and should be combined with topical therapy where possible. Most superficial pyoderma therapy should be instituted for at least 3 to 4 weeks, irrespective of the selected mode of administration of antimicrobials. Typically, a rapid improvement in the lesions and patient comfort is expected within the first 2 weeks of appropriate therapy. While such an improvement is suggestive of a treatment plan that should help resolve the infection, it should not be considered as a guideline for determination of the length of an antibiotic course. The assessment of complete resolution of canine pyoderma should not be left to pet owners either. Ideally, towards the conclusion of antimicrobial therapy, all patients should be re-evaluated by the clinician in order to ensure resolution of the infection. Re-evaluation of the patient provides the clinician with an opportunity to assess patient comfort, ensure complete lesion regression, and determine possible need for follow-up testing. The differential diagnoses for the underlying primary disease should be reassessed and long-term management plans established, in association with the pet owner. In the event of evidence suggestive of need for further therapy for pyoderma, continuation of treatment for at least 7 days beyond expected clinical resolution of lesions is recommended in all cases (1). It has been reported that MRSP infections take longer to treat compared with MSSP infections (15), although this may not always be the case as multiple factors that determine the length of antimicrobial therapy required for resolution of pyoderma are at play in each patient.

Therapeutic options for canine superficial pyoderma may also include topical ceramides, topical creams and lotions (ideally without corticosteroids added to them), and commercial bacterial antigens (16). While very few studies on the efficacy and usefulness of these options have been reported, it can be beneficial to combine these approaches with the more traditional systemic and topical antibiotic therapy. As antimicrobial drug use has recently been identified as a risk factor for the emergence of MRSP (17), pulse therapy with systemic antibiotics is not advised currently and this approach has been replaced with intermittent shampoo baths or other topical approaches, in order to help keep bacterial loads on the skin in check. If pulse therapy or low dose therapy using systemic antibiotics is being considered for prevention of SBF, it is recommended that the patient be referred to a veterinary dermatologist for further evaluation and treatment (2).

Future considerations

Studies have shown that both direct and indirect transmission of *S. pseudintermedius* may occur between humans (12) and pets living in the same household (18). These findings highlight the need to adequately treat SBF as early as possible, so as to avoid the development in the coming years of infections in the canine population that are more difficult to treat. Although the risk of infection associated with *S. pseudintermedius* in healthy humans is low, infections by pathogenic staphylococci acquired from pets

have been documented in humans (19,20). The possibility of transfer of staphylococci between animals and humans should be considered while formulating a therapeutic plan, and good hygiene practices should be advised for pet owners (21).

The most effective measure to prevent recurrence of SBF and selection of resistant strains of bacteria is to rapidly identify and control the underlying primary disease. Such an outcome may not always be straightforward in clinical practice, as dermatologic disease can often be multidimensional. Nevertheless, the increased incidence of drug resistance in veterinary medicine has put the emphasis on cytology and culture-based treatment of superficial pyoderma and on early diagnosis of the associated underlying primary disease. A topical approach to early SBF is preferred, taking into account client and patient compliance. Because MRSP and MSSP are susceptible to chlorhexidine, products that contain chlorhexidine are recommended as sole therapy or part of combined therapy for canine SBF (14).

Cleaning practices within veterinary hospitals, use of appropriate antiseptics, and hand washing by staff members are important from a public health standpoint and are usually easily implemented in practice. Detailed recommendations on hygiene in the veterinary clinic are available (22).

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