Superficial pyoderma or, more specifically, superficial bacterial folliculitis is one of the most common problems dermatologists face in private practice. This situation can be explained by the fact that most skin diseases become secondarily infected at one point in time during the disease course. Because of the widespread and, often inappropriate use of systemic antibiotic therapy to treat this common skin problem, clinicians in most parts of the world are dealing with methicillin-resistant and multidrug-resistant (i.e. resistance to at least three antibiotic classes) infections. Therefore, specific guidelines to treat superficial pyoderma were developed to help veterinarians prescribe antibiotic therapy judiciously and appropriately when treating these infections. The adherence to these guidelines will certainly prevent the dissemination of bacterial resistance.

Knowing the bacterium or bacteria causing any infection is important for antibiotic selection because some bacteria are inherently resistant to certain classes of antibiotic. The bacterium that most frequently causes superficial pyoderma in dogs is Staphylococcus pseudintermedius (previously called S. intermedius). Other bacteria much less frequently isolated from superficial pyoderma lesions include: S. aureus, S. schleiferi subsp. coagulans, and S. schleiferi subsp. schleifiri. In addition, the coagulase-negative bacteria, S. epidermidis and S. xylosus, and Streptococcus canis and Pseudomonas aeruginosa, are rarely associated with superficial pyoderma lesions of dogs and, their clinical relevance is unknown at this time.

**Diagnosing the superficial bacterial folliculitis**

The first step in appropriately treating a superficial bacterial folliculitis is to make sure you are treating the correct disease. Signs of superficial pyoderma include one or more of the following lesions: erythematous papules, pustules, yellow-brown crusts, epidermal collarettes (round to oval lesions with a scaly edge), and moth-eaten alopecia (seen typically in short-coated breeds). Because sterile skin diseases can also present with these lesions, it is important to demonstrate the presence of bacteria by performing cytology (intra- and extra-cellular cocci bacteria and degenerated neutrophils indicate infection) and bacterial culture and susceptibility (C&S).

With the advent of frequent methicillin and multidrug resistant infections, bacterial C&S tests moved higher in the priority list of specialists and, hopefully, general practitioners. It is never wrong to perform a C&S but the following are the situations where this test is indicated: (i) lack of response to appropriate empirical treatment (e.g. less than 50% improvement and/or appearance of new lesions 2 weeks or more after initiating therapy), (ii) history of methicillin or multidrug resistant infections, (iii) presence of rod-shaped bacteria on cytology, and (iv) history of recurrent infections or frequent antibiotic use. The best lesion to culture is a pustule. When pustules are not present, collect the exudate from under a fresh crust, or from the edges of an epidermal collarette. Frequently, papules are the only lesions present and they are not easy to sample for culture. In these cases, wipe the papule surface with 70% alcohol and allow it to dry. Thereafter, open the papule surface with a sterile 25 gauge needle and collect the emerging blood or exudate for culture. Place samples for culture in transport medium and submit them immediately to the laboratory. If there is any question on how to transport a sample or, a sample cannot be transported at once to the laboratory, the clinician should ask the laboratory for advice.

Ideally, laboratories that follow the Clinical and Laboratory Standards Institute (CLSI) protocols should be used. Make sure the laboratory uses updated antibiotic breakpoints established for dogs and reports the species of the isolated *Staphylococcus* and, not merely “Staphylococcus spp.” or “*Staphylococcus* coagulase positive”, for example. Remember, oxacillin is the surrogate for methicillin in the susceptibility panel. If the *Staphylococcus* sp. isolate is resistant to oxacillin by convention it will be resistant to all B-lactam antibiotics (i.e. cephalosporins, penicillins, carbapenems, and monobactams).

When lesions typically present in superficial bacterial folliculitis are seen in unusual sites such as, the face, ear pinna, and feet, you have to consider demodicosis, dermatophytosis, and pempigus foliaceus as possible differentials. In these cases the following diagnostic tests have to be performed and chosen according to each case: deep skin scrapings (demodicosis), examination of abnormal looking hairs under the microscope (i.e. trichoscopy [dermatophytosis]), cytology (pempigus foliaceus – presence of acantholytic keratinocytes) fungal culture (dermatophytosis), and biopsy (pempigus foliaceus).

**Managing the superficial bacterial folliculitis**

It is important to remember that the treatment has to be tailored for each patient. The extent and severity of the disease, antimicrobial resistance, the ability of the owner to perform topical therapy, and the owner’s compliance and monetary situation should all be taken into consideration when planning a treatment regimen.

To prevent frequent recurrences of the superficial bacterial folliculitis, it is crucial to try to identify and control underlying primary diseases (e.g. allergies, endocrinopathies, etc.) that typically predispose dogs to bacterial infections.

**Appropriate use of systemic antibiotic**

An empirical antibiotic selection can be considered for mild and non-recurrent infections when the clinician is not practicing in a geographic area where antibiotic resistance is a concern (review the reasons for performing C&S, mentioned above). In these
circumstances, first-tier antibiotics (i.e. first generation cephalosporins [e.g. cephalexin, cefadroxil], amoxicillin-clavulanate, trimethoprim/ormetoprim potentiated sulfa, clindamycin, and lincomycin) should be used. Most dermatologists will first select cephaloxin or cefadroxil for empirical treatment of superficial bacterial folliculitis, with the second choice being typically amoxicillin clavulanate. Potentiated sulfa are often efficacious against *Staphylococcus pseudintermedius* but, they can cause many side effects (e.g. induce hypothyroidism, keratoconjunctivitis sicca, and hypersensitivity reaction in certain breeds) especially when given for a long period of time. *Staphylococcus* sp. tends to develop resistance to clindamycin and lincomycin fairly easily; therefore, these antibiotics should be ideally selected based on C&S tests.

Second tier antibiotics should only be used when the C&S results indicate that the bacterial isolate is not susceptible to any of the first tier antibiotics or, when topical antimicrobial use is not feasible or efficacious as sole therapy. Moreover, in the rare situation where the patient does not tolerate any of the first tier antibiotics, second tier drugs can be selected but, based exclusively on C&S tests. They include the following antibiotics: cefovecin, cefpodoxime, chloramphenicol, doxycycline, minocycline, rifampicin, aminoglycosides (e.g. gentamicin and amikacin), and fluoroquinolones (e.g. enrofloxacín, marbofloxacin, difloxacin, orbifloxacin, and pradofloxacin)

Third tier antibiotics should only be used when susceptibility is demonstrated by C&S, when first and second tier antibiotics are not effective and, when topical antimicrobial use is not feasible or efficacious as sole therapy. They include the following antibiotics: linezolid, teicoplanin, vancomycin, azithromycin, cefazidime, clarithromycin, florphenicol, imipenem, phosphomycin, piperacillin, tiamphenicol and ticarcillin. However, the use of linezolid, teicoplanin, and vancomycin is strongly discouraged because these antibiotics should be reserved for the treatment of severe methicillin-resistant *Staphylococcus aureus* (MRSA) infections in humans.

Using the correct dose, frequency of administration, and duration of therapy are all crucial for a successful outcome when treating any infection.

The skin is a very large organ; however, its blood supply is comparatively poor. For this reason, when treating a bacterial skin infection, use the high end of the antibiotic dose range and never under dose. Make sure to weigh the patient before determining the correct dose and to refer to a drug handbook for the recommended dosage ranges of the various antibiotics.

Some antibiotics are administered twice, thrice, or four times a day, and others once a day. Antibiotics given more frequently than once a day are called “time dependent” such as, cephalexin or cefadroxil. The concentration of these antibiotics at the infection site has to be above the minimal inhibitory concentration (MIC) of the bacteria, ideally, for the duration of the administration interval but, at least 75% is acceptable. Time-dependent antibiotics should not be given less frequently than the recommended interval and, increasing their dose does not necessarily increase efficacy. Antibiotics given only once daily are referred as “dose dependent”. The important consideration when using these antibiotics is how much their concentration at the infection site is above the bacterial MIC. For these antibiotics, increasing the dose will increase efficacy but, this is not the case if you increase the frequency of administration.

Most uncomplicated superficial bacterial folliculitis cases will resolve after 2-3 weeks of appropriate antibiotic therapy. However, recurrent or resistant infections may take longer (e.g. 4-6 weeks). The widespread rule of thumb currently adopted by dermatologists, is to treat a superficial infection for 7 days and a deep infection for 14 days past complete clinical resolution. The assessment has to be made by the clinician and not the pet owner. Reevaluations should be scheduled, ideally, every 2 to 3 weeks during treatment.

**Use of topical antimicrobials**

Topical therapy can be used solely in mild cases of superficial bacterial folliculitis or as an adjunct to systemic antibiotics. When used concurrently with systemic antibiotics, topical antimicrobials will likely contribute to a faster resolution of the infection which will lead to a shorter duration of systemic antibiotic use and, consequently, reduce the risk for development of bacterial resistance. Topical antimicrobials can be applied in the form of shampoos, lotions, sprays, rinses, wipes, gels, creams, and ointments. Common antiseptic ingredients in shampoos, sprays, wipes and lotions include: chlorhexidine, benzoyl peroxide, ethyl lactate, acetic acid, lactic acid, malic acid, and triclosan. Common ingredients present in gels, ointments, and creams include: novobiocin, bacitracin, gentamycin, neomycin, silver sulfadiazine, fusidic acid (only in Europe), and mupirocin. Ideally, only use topical antibiotics based on C&S and, mupirocin and fusidic acid should be avoided, if at all possible, because they are frequently used for cases of MRSA in humans.

The choice of which topical antimicrobial to use and its frequency of administration should be based on the following: (i) extent and severity of lesions, (ii) location of the lesions (area with hair vs area without hair), (iii) owner ease of application, and (iv) history of previous adverse reaction to the product. When prescribing shampoos, it is important to tell owners to massage the shampoo gently into the skin for about 10 minutes and, then rinse it off thoroughly. It is also important to dry the skin well.

**Prevention of recurrences**

The most important measure to prevent recurrences is to determine and control the underlying primary disease (e.g. allergic diseases, endocrinopathies, etc.). The maintenance use for topical antiseptics in the form of shampoos, sprays, lotions, and/or wipes can also be beneficial. Moreover, the use of bacterins such as, Staphage Lysate can be beneficial; however, the use of antibiotic pulse therapy should be discouraged because this practice may predispose the patient to develop bacterial resistance.
**Owner compliance**
The owner adherence to the recommended treatment regimen is crucial for treatment success and prevention of bacterial resistance. Educating clients well about their pets’ problem has shown to improve compliance. Other measures that can be adopted to ensure owners’ adherence to treatment include: (i) use of palatable drugs, (ii) use of drugs that owners can administer safely and easily, (iii) use of precise terminology (e.g. every 12 hours instead of twice daily), (iv) provide owner with clear and detailed instructions, (v) communicate clearly and frequently with the owner during treatment, (vi) minimize the number of different treatments or drugs prescribed.