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Guidelines for the diagnosis and antimicrobial therapy of canine superficial bacterial folliculitis (Antimicrobial Guidelines Working Group of the International Society for Companion Animal Infectious Diseases)

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Background – Superficial bacterial folliculitis (SBF) is usually caused by *Staphylococcus pseudintermedius* and routinely treated with systemic antimicrobial agents. Infection is a consequence of reduced immunity associated with alterations of the skin barrier and underlying diseases that may be difficult to diagnose and resolve; thus, SBF is frequently recurrent and repeated treatment is necessary. The emergence of multiresistant bacteria, particularly meticillin-resistant *S. pseudintermedius* (MRSP), has focused attention on the need for optimal management of SBF.

Objectives – Provision of an internationally available resource guiding practitioners in the diagnosis, treatment and prevention of SBF.

Development of the guidelines – The guidelines were developed by the Antimicrobial Guidelines Working Group of the International Society for Companion Animal Infectious Diseases, with consultation and advice from diplomates of the American and European Colleges of Veterinary Dermatology. They describe optimal methods for the diagnosis and management of SBF, including isolation of the causative organism, antimicrobial susceptibility testing, selection of antimicrobial drugs, therapeutic protocols and advice on infection control. Guidance is given for topical and systemic modalities, including approaches suitable for MRSP. Systemic drugs are classified in three tiers. Tier one drugs are used when diagnosis is clear cut and risk factors for antimicrobial drug resistance are not present. Otherwise, tier two drugs are used and antimicrobial susceptibility tests are mandatory. Tier three includes drugs reserved for highly resistant infections; their use is strongly discouraged and, when necessary, they should be used in consultation with specialists.

Conclusions and clinical importance – Optimal management of SBF will improve antimicrobial use and reduce selection of MRSP and other multidrug-resistant bacteria affecting animal and human health.

Introduction

In dogs, superficial bacterial folliculitis (SBF) is the commonest form of canine pyoderma, which is in turn, the principal reason for antimicrobial use in small animal practice.[1–3] As we face the problem of increasing antimicrobial resistance in both human and veterinary medicine, there is a pressing need for prudent and more focused use of antimicrobial drugs (AMDs). In the human field, adoption of guidelines for antimicrobial use at the hospital level has been shown to improve prescribing practices significantly, both alone and as part of broader antimicrobial stewardship programmes.[4–6] Similar

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benefits can be expected in the veterinary field, where there is a need for improved antimicrobial stewardship both in veterinary hospitals and in veterinary practice.

This document presents guidelines developed in 2011–2013 by the Antimicrobial Guidelines Working Group of the International Society for Companion Animal Infectious Disease (ISCAID). These guidelines were developed because of increasing concerns regarding widespread antimicrobial resistance in bacteria infecting dogs and cats. The members of the Group were Scott Weese (chair), Joseph Blondeau, Dawn Boothe, Edward Breitschwerdt, Luca Guardabassi, Andrew Hillier, Michael Lappin, David Lloyd, Mark Papich, Shelley Rankin, Jane Sykes and John Turnidge. The group met in Miami (FL, USA) to develop the guidelines, then communicated by email and through telephone conferences to refine the wording of this document further. Input was also solicited from diplomates of the American College of Veterinary Dermatology (ACVD) and the European College of Veterinary Dermatology (ECVD). The guidelines are directed primarily at private small animal practitioners in primary care practice.

It should be noted that these guidelines are specific for SBF and apply only to dogs. Although the broad principles relating to AMD use in SBF are applicable to a variety of canine bacterial skin infections, significant differences exist amongst such infections that may be associated with the depth of the skin that is affected and the bacterial pathogens involved. These guidelines cannot be applied to other types of bacterial infections in canine skin without careful consideration. It is anticipated that guidelines for other bacterial skin infections in dogs will be developed in due course.

To the best of the authors' knowledge, there is only one published peer-reviewed article that provides similar guidelines.[7] Those guidelines differ from this document in that they are directed more generally at the treatment of skin and soft tissue infections in dogs and cats, they are directed at the use of systemic antibiotics only and do not address topical therapies, they suggest diagnosis and treatment of pyoderma according to an unpublished classification system based on the clinical appearance of lesions rather than the depth of the infection in the skin and they are authored by a group of European specialist dermatologists. Thus, apart from differences in content, we believe that our guidelines provide a different perspective from a broader international group of authors who also represent other pertinent areas of specialization in addition to dermatology.

Recommendations for the diagnosis of canine superficial bacterial folliculitis

The predominant pathogen that causes SBF is *Staphylococcus pseudintermedius* (previously known and referred to as *Staphylococcus intermedius*).[8] Although dogs may carry or be colonized and infected by *Staphylococcus aureus* and by the coagulase-variable species *Staphylococcus schleiferi*,[9,10] these are far less frequent pathogens in SBF. Coagulase-negative staphylococci (CoNS; such as *Staphylococcus epidermidis* and *Staphylococcus xylosus*) may rarely be cultured from lesions of SBF, usually in association with *S. pseudintermedius.* The clinical relevance of isolation of these species from SBF lesions is unclear. Other bacteria may, on rare occasions, cause lesions compatible with SBF. These include *Streptococcus canis*, *Pseudomonas aeruginosa* and other Gram-negative bacteria.[11,12]

Clinical signs

In practice, the diagnosis of most cases of SBF is based upon clinical signs and the presence of characteristic lesions; there is no evidence that these differ amongst infections caused by the different staphylococci. Common lesions of SBF are erythematous papules (Figures 1 and 2) and pustules (Figures 2 and 3), typically associated with hair follicles (Figure 3). However, follicular involvement may be difficult to appreciate macroscopically. Crusts of variable thickness (Figure 4) are common lesions but are sometimes absent. Variable alopecia, erythema and hypo- or hyperpigmentation are often present. Multifocal to coalescing patches of alopecia providing a 'moth-eaten' appearance may be the only visible lesions in some short-coated breeds (Figure 5). Epidermal collarettes (Figure 6) and target lesions (annular areas of alopecia, scaling, erythema and hyperpigmentation; Figure 7) may be the most obvious lesions in some cases.

Cytology

Demonstration of cocci from lesional skin by cytology is a powerful adjunctive diagnostic test and is strongly encouraged for proper diagnosis. Appropriate techniques need to be used for both specimen collection and examination to optimize the value of this diagnostic procedure.[13] Cytology is mandatory in the following circumstances: (i) typical lesions (pustules) are not present or scant and SBF is still suspected; (ii) typical lesions are present but there is a poor response to empirical antimicrobial therapy; or (iii) a bacterial culture is to be performed. This is because positive cytology in the face of a negative culture should prompt repeat culture rather than diagnosis of a sterile pustular disease.

Cytology is also essential for the diagnosis of co-infection with *Malassezia pachydermatis* (a frequent occurrence in dogs with SBF) or rod-shaped bacteria (a rare occurrence in dogs with SBF). The presence of coccoid bacteria in cytological specimens from typical lesions is highly supportive of bacterial infection; when associated with inflammatory cells and intracellular cocci from intact pustules, infection is confirmed. The absence or scarcity of bacteria and the absence of inflammatory cells or intracellular cocci do not rule out a bacterial infection. Inflammatory cells and phagocytosis may be absent in dogs with underlying immunosuppressive diseases or those being treated with immunosuppressive agents, such as glucocorticoids.

Tests to rule out differential diagnoses

Superficial bacterial folliculitis should be distinguished from other inflammatory follicular diseases and is differentiated from dermatophytosis by dermatophyte culture (or Wood's lamp evaluation or direct examination of hairs for spores) and from demodicosis by deep skin scrapings. Such testing is recommended, and is essential, when

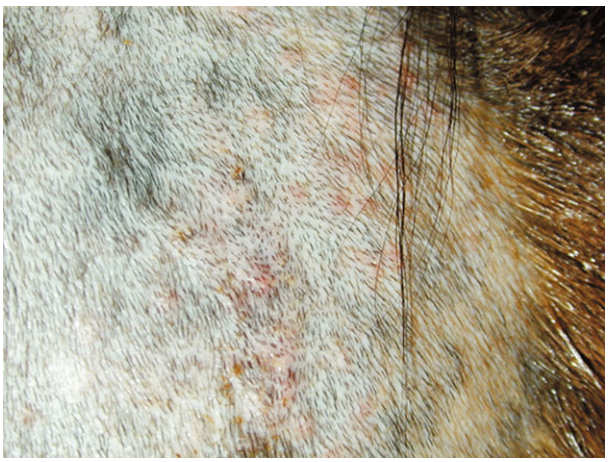

Figure 1. Erythematous papules caused by superficial bacterial folliculitis. Note that the dog's hair has been clipped for visualization of the papules.

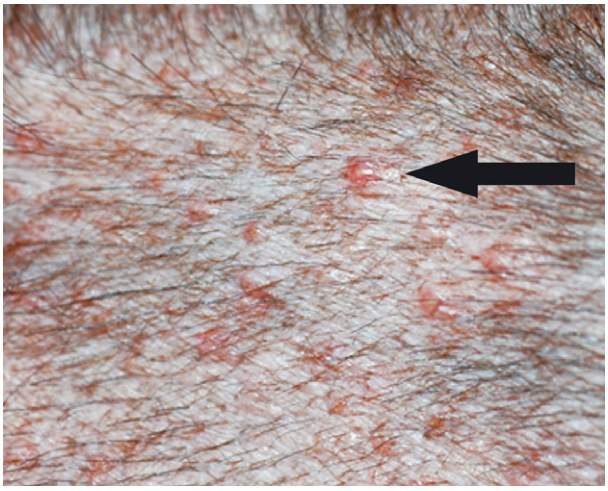

Figure 2. Erythematous papules and a pustule (arrow) caused by superficial bacterial folliculitis.

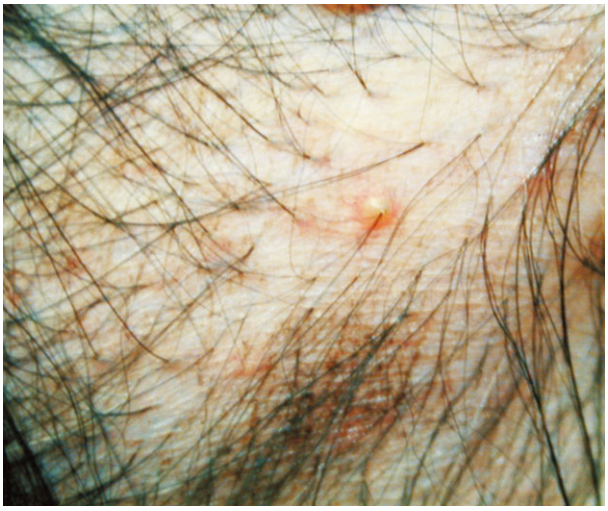

Figure 3. Folliculocentric pustule caused by superficial bacterial folliculitis.

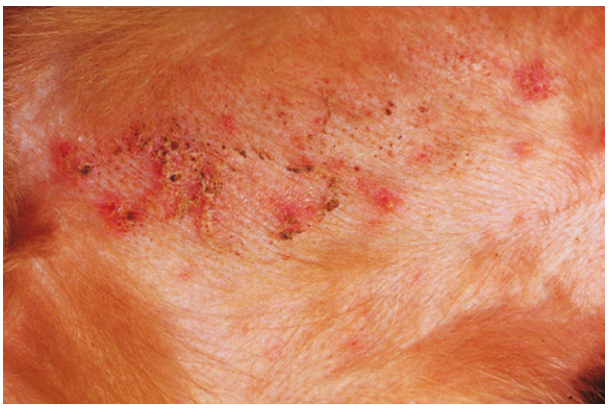

Figure 4. Erythematous papules and crusts on the ventral abdomen of a golden retriever caused by superficial bacterial folliculitis.

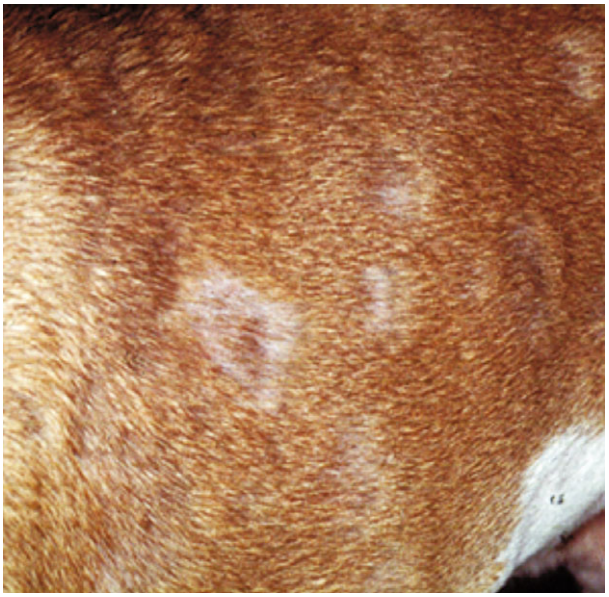

Figure 5. Patches of truncal alopecia on a short-haired dog caused by superficial bacterial folliculitis (so-called 'short-haired dog pyoderma').

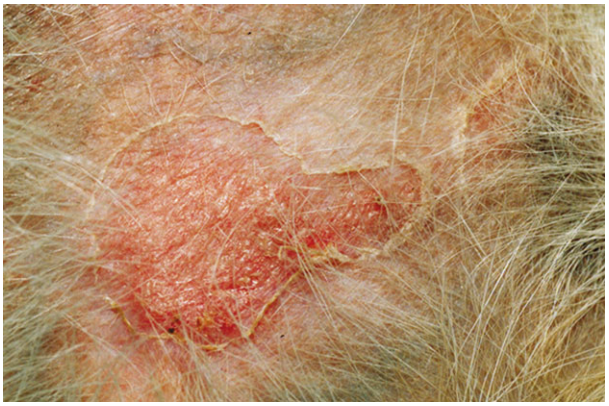

Figure 6. An epidermal collarette caused by superficial bacterial folliculitis.

history and clinical findings are atypical of SBF or the disease is refractory to AMD treatment. Sterile pustular diseases (such as pemphigus foliaceus and sterile neutrophilic or eosinophilic pustulosis) are uncommon to rare and are differentiated on the basis of cytology (absence of bacteria, presence of acantholytic cells),

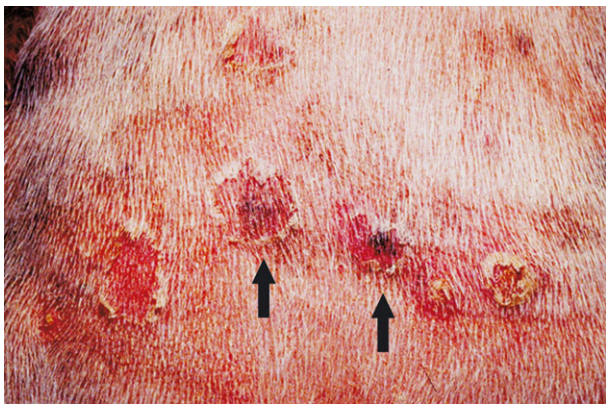

Figure 7. Epidermal collarettes and target lesions (arrows) caused by superficial bacterial folliculitis.

culture (no bacterial growth from sampled pustules), histopathology and lack of response to AMD therapy.

Culture and susceptibility testing

Bacterial culture of SBF is never contraindicated. There are primarily five situations which may indicate the likelihood of AMD resistance and mandate bacterial culture of apparent SBF, as follows: (i) less than 50% reduction in extent of lesions within 2 weeks of appropriate systemic antimicrobial therapy;[14,15] (ii) emergence of new lesions (papules, pustules, collarettes) 2 weeks or more after the initiation of appropriate AMD therapy; (iii) presence of residual SBF lesions after 6 weeks of appropriate systemic antimicrobial therapy together with the presence of cocci on cytology (while a typical course of therapy may be 21–28 days,[16] several studies indicate that therapy for up to 6 weeks may be necessary to resolve the infection in some cases);[17–22] (iv) intracellular rod-shaped bacteria are detected on cytology; and (v) there is a prior history of multidrug-resistant infection in the dog or in a pet from the same household as the affected dog.

As AMD use has been reported as a risk factor for infection with meticillin-resistant strains of *S. pseudintermedius* (MRSP) and *S. aureus* (MRSA),[23–25] careful consideration for bacterial culture should be given to dogs with a history of recurrent infections or repetitive AMD use. As colonization with MRSP may persist after treatment of MRSP infections[26] and MRSP may be isolated from dogs in contact with MRSP-infected pets, dogs with superficial bacterial folliculitis that have previously had MRSP infections or are from households with other pets that have had MRSP infections should have a bacterial culture performed prior to selection of treatment for their infection. In cases where initial treatment of SBF was limited to topical AMDs alone and the infections failed to resolve, it is acceptable either to perform bacterial culture and susceptibility testing or to institute empirical systemic AMDs.

Clinicians commonly rely on pet owners to report on the progress of treatment of SBF. Thus, education of owners on the identification of the specific lesions and what changes to expect is critical; distinction must often be made between lesions of SBF (including papules, pustules and crusts) and signs of the primary underlying dermatopathy (such as alopecia, scaling, excoriation, hyperpigmentation and lichenification). As systemic AMDs are suggested to be dispensed for a minimum of 3 weeks, it is important that veterinarians educate owners not to continue AMD therapy in the absence of improvement of SBF lesions during this time, or with the emergence of new lesions after 2 weeks of therapy, without veterinary advice.

Pustules are the preferred lesion for specimen collection, and a thorough search for pustules should be made. Clipping hair to facilitate examination of the skin surface and the use of a hand-held magnifying lens can be helpful in detecting pustules. In the absence of pustules, specimens may be obtained from beneath crusts (look for pus present under the crust), epidermal collarettes or papules. Specimen collection methods are summarized in Table 1. Immediate transport of the specimens to the laboratory is recommended, and transport medium should always be used (clinicians should consult with their laboratory if they are uncertain of how to transport their specimens). If delay in submission of specimens is unavoidable, advice on storage should be obtained from the relevant clinical microbiology laboratory.

To date, there are no published reports demonstrating that current use of AMDs has a significant effect on isolation of causative bacteria from dogs with persistent SBF; thus, it is acceptable to collect samples for bacterial culture and susceptibility testing from SBF lesions whenever indicated, regardless of the current use of topical or systemic AMDs.

Table 1. Sampling techniques for lesions of superficial bacterial folliculitis for bacterial culture and susceptibility testing

Lesion	Sampling procedure
Pustule	No surface disinfection. Clip hair with sterile scissors (avoid clippers). Lance pustule with sterile narrow-gauge needle. If purulent exudate is visible on the needle, apply to a sterile swab; if not, gently touch exudate expelled from pustule with sterile swab and place in transport medium or sterile container. Sometimes lancing of very small pustules results in haemopurulent exudate, which is still suitable for sampling
Crust	No surface disinfection. Use sterile forceps or a sterile needle to lift the edge of a crust. The presence of exudate under a crust indicates an ideal site for culture. Touch sterile swab to exposed skin surface and place in transport medium or sterile container
Epidermal collarette	No surface disinfection. Clip hair with sterile scissors (avoid clippers). Roll sterile swab across border of collarette two or three times and place in transport medium or sterile container[74]
Papule*	Sampling by biopsy is probably more reliable. Provide local anaesthesia by subcutaneous injection of 2% lidocaine. Clip hair with sterile scissors or clippers. Clean skin surface by a single wipe with 70% alcohol† (no additional surgical preparation). Allow alcohol to dry. Using a sterile 3 or 4 mm punch and sterile surgical instruments, collect tissue sample and place in sterile container or transport medium. Suture biopsy site Alternatively, papules may be prepared and disinfected† as above, then sampled by insertion of a sterile needle and culture of emerging or expressed blood or exudate

*There is no research to show which method is more appropriate.
†This method of disinfection is suggested to kill any surface bacteria. However, there is no research to indicate the value or necessity for any disinfection of the skin surface prior to sampling of papules.

Where possible, laboratories should be used that observe protocols, including updated breakpoints for animal species, such as those published by the Clinical and Laboratory Standards Institute (CLSI), including material from the CLSI subcommittee on Veterinary Antimicrobial Susceptibility Testing (CLSI-VAST),[28] or the European Committee on Antimicrobial Susceptibility Testing (EUCAST) and other internationally recognized public organizations.

The following AMDs should be tested with all staphylococcal isolates: erythromycin, clindamycin, tetracycline (for testing susceptibility to doxycycline), trimethoprim–sulfamethoxazole, gentamicin, cephalothin (or cefazolin, representing first generation cephalosporins), cefpodoxime (representing third generation cephalosporins), amoxicillin–clavulanate, oxacillin (meticillin) and enrofloxacin (for testing susceptibility to fluoroquinolones). Inclusion of other fluoroquinolones may be considered if enrofloxacin is not the fluoroquinolone drug of choice (CLSI breakpoints are available for difloxacin, enrofloxacin, marbofloxacin and orbifloxacin for dermal *Staphylococcus* spp.). If erythromycin resistance is determined in the presence of clindamycin susceptibility, the D-test should be performed (or molecular methods for detection of *erm* genes) to determine whether inducible clindamycin resistance is likely.[29] Additional AMDs that may be important for treatment of infections with meticillin-resistant staphylococci (MRS) include amikacin, chloramphenicol, minocycline and rifampicin (rifampin). Consultation with a specialist is recommended when treatment with these drugs is being considered. Other antimicrobial drugs which clinicians intend to consider for therapy should also be included. However, regional and national restrictions relating to the use of specific drugs in animals should be observed.

Clinical microbiology laboratories must perform tests to differentiate coagulase-positive staphylococci from CoNS; *S. aureus* should be distinguished from other coagulase-positive staphylococci. This is important for two reasons: (i) the CLSI-determined breakpoints for oxacillin differ for *S. aureus* and the other veterinary coagulase-positive staphylococci (*S. pseudintermedius*, *S. schleiferi* subsp. *coagulans*, etc.); and (ii) the potential public health risk from *S. aureus* is different from that of the other coagulase-positive staphylococci. It is not acceptable to limit the reporting of staphylococcal isolates as 'coagulase-positive' or 'coagulase-negative' *Staphylococcus* sp. or for a laboratory to assume that a coagulase-positive staphylococcus isolated from a dog is *S. pseudintermedius*. Specific biochemical tests or validated molecular techniques should be used for speciation.[30] Automated systems used in human medicine to speciate veterinary staphylococcal isolates are not always reliable, particularly in the identification of *S. pseudintermedius* and *S. schleiferi*.[31,32] Microbiology reports should always be interpreted with care, bearing in mind meticillin resistance and public health considerations, as well as the clinical disease status and therapeutic history of the patient (Table 2).

Recommendations for the treatment of canine superficial bacterial folliculitis

Veterinarians must consider the nature of the disease in each patient to determine the best mode of therapy. Traditional reliance on systemic AMDs and the expectation that empirical choices will always work are now being challenged by the growing frequency of MRS that are resistant to multiple classes of AMDs in addition to the β-lactams. The prevalence of MRS will vary in different localities, and it is important for veterinary practitioners to become familiar with typical local and regional resistance patterns so that they may be prepared to make appropriate selections of modes of treatment and AMDs.

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 perform topical or systemic therapy, all of which may affect the efficacy of the chosen therapy.

Owners' compliance with instructions and completion of treatments is critical to the resolution of infection and prevention of recurrence. Clinicians should maintain contact with owners and support them as far as possible to promote effective compliance. When recurrence of SBF occurs, veterinarians should present owners with a diagnostic plan for evaluation of underlying primary disease (allergic dermatitis, endocrinopathy, etc.) and make it

Table 2. Guidelines for interpretation of microbiology reports by clinicians

1	Note staphylococcal species isolated	*Staphylococcus aureus* is a human pathogen and therefore presents a higher public health risk
		Staphylococcus pseudintermedius is the predominant pathogen in bacterial infections of canine skin. It is a rare cause of human infection but presents enhanced risk if meticillin resistant
		Coagulase-negative staphylococci present a much lower level of risk but are often meticillin resistant. They are more likely to be involved in animals with reduced immunity and where implants are used. Low numbers of CoNS should be regarded as probable skin contaminants in patients that are not immunosuppressed, especially when isolated in mixed cultures. If quantitative information is not provided in the report, the laboratory should be consulted before initiating therapy against them
2	Is the isolate reported as meticillin resistant?	Oxacillin is equivalent to meticillin and used as a marker of meticillin resistance. Oxacillin-resistant staphylococci are reported as 'meticillin-resistant'
		Meticillin (oxacillin)-resistant staphylococci are by convention resistant to all β-lactam AMDs (cephalosporins, penicillins, carbapenems and monobactams), regardless of occasional apparent *in vitro* susceptibility. Clinical microbiology laboratories must report these isolates as resistant to all β-lactam AMDs
		Meticillin-resistant staphylococci are commonly resistant to multiple antimicrobials in addition to the β-lactam AMDs, but this is not always the case
3	Clinical disease status of patient and history of AMD use	Susceptibility results should always be interpreted in the context of the clinical disease and current and prior history of antimicrobial use in the patient, bearing in mind that susceptibility *in vitro* does not always parallel clinical response in infected animals

Abbreviations: AMD, antimicrobial drug; and CoNS, coagulase-negative staphylococci.

clear that this is the best means to control recurrence of SBF, reduce AMD use and reduce the likelihood of emergence of drug-resistant infections.

Topical antimicrobial therapy

Topical therapy of SBF is probably underused because of the perception that clients will find it more difficult to apply and that compliance may be poor. However, there are significant potential advantages for early and frequent use of the topical approach in this disease. These advantages include more rapid lesion resolution and a decrease in the duration of antimicrobial administration when combined with systemic AMD therapy,[33] removal of organisms and debris from the skin surface, minimal adverse effects and greatly reduced exposure to AMDs of bystander organisms in other organ systems (reducing risk of inadvertent emergence of resistant strains). In addition, resistance to the high concentrations of antiseptics and AMDs used in topical products is very uncommon,[34] and these agents are typically bactericidal to MRS. The emergence of highly multiresistant MRS with few or no options for systemic AMD therapy has provided a new stimulus for the topical approach, which is emerging as an important treatment for multidrug-resistant bacterial infections of the skin.[35]

The benefits and importance of topical antimicrobial therapy and topical therapies that help to restore normal skin structure and function (promoting recovery and enhancing resistance to infection) are likely to emerge as significant options as systemic therapy becomes more limited.

In general, topical therapy is helpful in all patients with SBF. Topical therapy alone (without co-administration of systemic AMDs) is encouraged as a desirable and recommended approach to the treatment of SBF unless precluded by owner and/or patient factors. This is particularly true in the following circumstances: (i) localized lesions of SBF; (ii) early stages of generalized SBF when lesions are mild; and (iii) to help prevent recurrence of SBF while diagnostic procedures for primary underlying skin disease are pursued.

Topical approaches for SBF are summarized in Table 3, which presents shampoos, sprays, rinses, conditioners and lotions with antiseptic agents for use in extensive or generalized disease, and also gels, creams, ointments, lotions and wipes containing both antiseptics and AMDs, which can be used in more localized infections. While it is difficult to estimate the concentrations of topical antimicrobial agents achieved at sites of application and difficult to assess the validity of *in vitro* antimicrobial susceptibility tests for topical agents [even when minimal inhibitory concentrations (MICs) are available], it is likely that high concentrations of these agents are achieved at sites of application.

One of the major problems is a lack of *in vivo* studies that assess the clinical efficacy and safety of topical therapy, either alone or in combination with systemic AMD therapy, and the absence of susceptibility interpretative criteria for topical agents. A recent systematic review found ample evidence for the efficacy of chlorhexidine for treatment of SBF, but to a lesser degree for the efficacy of benzoyl peroxide, fusidic acid and mupirocin.[36] Further studies are needed to evaluate optimal protocols (such as frequency of application, duration of treatment and optimal contact time of antimicrobial agents) for topical therapy in the treatment and resolution of SBF. In the absence of these studies, it is recommended that topical antimicrobial therapy be continued until 7 days beyond clinical resolution of all lesions associated with the infection, that contact time should be at least 10 min and that the hair coat be kept short to assist optimal contact of antimicrobial agents with the skin surface. Veterinarians are strongly encouraged to provide guidance to owners on topical therapy by thorough verbal communication, audiovisual demonstrations in the clinic or at home, handouts, in-hospital bathing services and the like. In addition, to promote compliance and assist in the delivery of AMDs and antiseptics to the skin surface at appropriate and sustained levels, there is a need for delivery systems and protocols that will be manageable for the average pet owner.

Table 3. Summary of topical antimicrobial treatment options for superficial bacterial folliculitis in the dog

Application	Formulations	Agents and modes of use
Extensive or generalized disease	Shampoos, lotions, sprays, rinses and conditioners	Antiseptics, including chlorhexidine (also in combination with miconazole), or benzoyl peroxide are preferred, although ethyl lactate, povidone iodine and triclosan may also provide benefit Commonly used two or three times weekly until 7 days after lesions resolve and then weekly for prophylaxis.* Can also be used for more localized disease For shampoos or conditioners that are rinsed from the skin, contact time of 10 min prior to rinsing is important
Focal and localized infections	Gels, creams, ointments, lotions and wipes	Antiseptics, including a variety of hydroxyl acids (e.g. acetic, lactic and malic acids), benzoyl peroxide and silver sulfadiazine Antimicrobial drugs, including novobiocin, pristinamycin, bacitracin, fusidic acid and mupirocin Mupirocin and fusidic acid are used in human medicine for meticillin-resistant *Staphylococcus aureus* treatment and decolonization; resistance is increasingly reported. Reports indicate that resistance to topical therapy with these agents in meticillin-resistant staphylococci causing canine superficial bacterial folliculitis is very rare; however, it is recommended that they be reserved for targeted application in dogs with infections where culture and susceptibility indicate no other suitable antimicrobial drugs and where topical antiseptics have failed to resolve the infection

*Extended treatment duration is based on clinical experience; further research is required to confirm the need for this.
Use of the agents listed should take account of local and regional restrictions on their use.

Systemic antimicrobial therapy

Selection of systemic AMDs is based on availability, safety, cost, local prevalence of resistant staphylococci and patient-specific factors (concurrent disease or drug administration, previous drug reactions, etc.). A recent systematic review found the evidence for efficacy of systemic AMDs for treatment of superficial pyoderma to be good for cefovecin, fair for amoxicillin–clavulanate, clindamycin, cefadroxil, trimethoprim–sulphamethoxazole and sulfadimethoxine–ormetoprim and insufficient for cefalexin, cefpodoxime, ibafloxacin, marbofloxacin and lincomycin.[37] Despite the value of such reviews, the relative dearth of published studies, lack of standardization of methods for diagnosis and assessment of treatment outcome, as well as the absence of studies with many commonly used AMDs, prevent generation of comprehensive guidelines based solely on their findings.

Choices of suitable AMDs that may be selected for empirical therapy of SBF when risk factors for likelihood of AMD resistance are not present (see indications for bacterial culture above) are grouped as first tier drugs (Table 4). Those AMDs that may be chosen when first tier drugs and topical agents are not appropriate and when culture and susceptibility results indicate susceptibility are grouped as second tier drugs (Table 4). Third tier drugs are also listed, but their use is strongly discouraged and it is recommended that cases be referred for specialist consultation if such AMDs are being considered. Suggested doses for antimicrobial drugs for systemic treatment of superficial bacterial folliculitis in the dog are given in Table 5.

In principle, it would be ideal if veterinarians had available a selection of AMDs for empirical therapy that were narrow spectrum, labelled for treatment of SBF in the dog and to which a majority of *S. pseudintermedius* were still susceptible. Unfortunately, this is rarely possible because some commonly used AMDs do not have a veterinary label in some countries, few of the commonly used AMDs are narrow spectrum, many AMDs that are registered and approved for use in the treatment of SBF may be associated with the emergence of multidrug-resistant infections, and there is distinct geographical variability in susceptibility of *S. pseudintermedius* to many of the available AMDs.[38,39]

Members of this working group have been unable to reach consensus on how the cephalosporins, including cefalexin, cefadroxil, cefpodoxime and cefovecin, should be distributed as first or second tier AMDs. All are approved (in at least one global region) for use in the treatment of skin wounds and abscesses, or pyoderma, in dogs and have demonstrated efficacy in clinical studies; furthermore, a systematic review has shown fair to good evidence for the moderate to high efficacy of cefadroxil and cefovecin in the treatment of SBF.[37,40–43] Simple consideration of clinical efficacy would support the inclusion of all these drugs as first tier AMDs. However, there is concern among some members of this panel about the potential selective effects of third generation

Table 4. Summary of systemic antimicrobial treatment options for superficial bacterial folliculitis in the dog

Category	When used	Suggested AMDs and comments
First tier	Primary choice empirical therapy of known or suspected SBF	Clindamycin or lincomycin First generation cephalosporins (e.g. cefalexin, cefadroxil), Amoxicillin–clavulanate
	Additional choices only if local regional susceptibility of *Staphylococcus pseudintermedius* is known	Trimethoprim- and ormetoprim-potentiated sulphonamides
First or second tier		Third generation cephalosporins (cefovecin, cefpodoxime). There is insufficient evidence for this working group to reach consensus on categorization of these agents as first or second tier drugs (see text under '*Systemic antimicrobial therapy*' and concerns about selection of ESBL-producing *Escherichia coli*)
Second tier	When empirical selection of first tier systemic AMD and topical therapy are not appropriate and when cultures indicate susceptibility	Doxycycline or minocycline Chloramphenicol Fluoroquinolones (such as enrofloxacin, marbofloxacin, orbifloxacin, pradofloxacin and ciprofloxacin) (should only be used when other feasible options are not available) Rifampicin. Commonly used in combination with another drug to which the causative organism is susceptible; however, this process may not reduce development of resistance in staphylococcal infection[75] Aminoglycosides, including gentamicin and amikacin. See Table 5 for comments on nephrotoxicity and ototoxicity First tier AMD (clindamycin, lincomycin and potentiated sulphonamides) may also be considered when cultures indicate susceptibility
Third tier	When first and second tier are not appropriate and cultures indicate susceptibility	Linezolid, teicoplanin, vancomycin. Regardless of the fact that most (or all) MRSP are susceptible, the use of these three AMDs is strongly discouraged. These drugs can be considered 'reserved for the treatment of serious MRSA infections in humans'.

Abbreviations: AMD, antimicrobial drug; ESBL, extended-spectrum β-lactamase; MRSA, meticillin-resistant *Staphylococcus aureus*; MRSP, meticillin-resistant *Staphylococcus pseudintermedius*; and SBF, superficial bacterial folliculitis.
Use of the agents listed should take account of local and regional restrictions on their use.

Table 5. Suggested doses for systemic antimicrobial drugs for treatment of superficial bacterial folliculitis in the dog

Drug	Dose	Comments
Amikacin	15–30 mg/kg i.v., i.m. or s.c. once daily	Useful for treatment of multidrug-resistant organisms. Potentially nephrotoxic and ototoxic. Avoid in animals with renal insufficiency*
Amoxicillin–clavulanate	12.5–25.0 mg/kg p.o. twice daily	
Cefalexin, cefadroxil	15–30 mg/kg p.o. twice daily	
Cefovecin	8 mg/kg single s.c. injection	Pharmacokinetic data are available to support the use in dogs with duration of 14 days. Repeat injection after 14 days in most cases if infection is not resolved and to meet the criterion for treatment to 7 days beyond resolution
Cefpodoxime proxetil	5–10 mg/kg o.o. once daily	
Chloramphenicol	40–50 mg/kg p.o. three times a day	Reserved for multidrug-resistant infections with few other options. Myelosuppression can occur, particularly with long-term therapy. Vomiting is frequently encountered. Avoid contact by humans because of rare idiosyncratic aplastic anaemia. Wearing of gloves by owners handling the drug is essential
Ciprofloxacin	25 mg/kg p.o. once daily	Sometimes used because of lower cost than enrofloxacin. Lower and more variable oral bioavailability than enrofloxacin, marbofloxacin and orbifloxacin[76]. Difficult to justify over approved fluoroquinolones. Dosing recommendations are empirical
Clindamycin	5.5–10 mg/kg p.o. twice daily	If there is erythromycin resistance with clindamycin susceptibility, the D-test should be performed (or molecular methods for detection of *erm* genes) to determine likelihood of clindamycin resistance
Doxycycline	5 mg/kg p.o. twice daily or 10 mg/kg once daily	
Enrofloxacin	5–20 mg/kg p.o. once daily	
Lincomycin	15–25 mg/kg p.o. twice daily	
Gentamicin	9–14 mg/kg i.v., i.m. or s.c. once daily	Potentially nephrotoxic. Avoid in animals with renal insufficiency*
Marbofloxacin	2.75–5.5 mg/kg p.o. once daily	
Minocycline	10 mg/kg p.o. twice daily	Pharmacokinetics and dose in dogs have not been evaluated;
Orbifloxacin	7.5 mg/kg p.o. once daily	
Ormetoprim–sulfadimethoxine	55 mg/kg on first day, then 27.5 mg/kg p.o. once daily	Concerns regarding idiosyncratic and immune-mediated adverse effects in some patients, especially with prolonged therapy. If prolonged (>7 day) therapy is anticipated, baseline Schirmer's tear testing is recommended, with periodic re-evaluation and owner monitoring for ocular discharge. Avoid in dogs that may be sensitive to potential adverse effects, such as keratoconjunctivitis sicca, hepatopathy, hypersensitivity and skin eruptions
Pradofloxacin	3.0 mg/kg p.o. once daily	
Rifampicin	5–10 mg/kg p.o. twice daily	May cause red/orange urine, tears and saliva. Hepatotoxic. Associated with rapid development of resistance.
Trimethoprim–sulfadiazine or sulfamethoxazole	15–30 mg/kg p.o. twice daily	See comments for ormetoprim–sulfadimethoxine above

Abbreviations: i.m., intramuscular; i.v., intravenous; p.o., per os; and s.c., subcutaneous.
*See IRIS: International Renal Interest Society guidelines for prevention of aminoglycoside-induced acute kidney injury; www.iris-kidney.com
Use of the agents listed should take account of local and regional restrictions on their use.

cephalosporins (cefpodoxime and cefovecin) on the Gram-negative microbiota, due to their broader spectrum of activity compared with first generation cephalosporins. Both drugs are marketed as extended-spectrum cephalosporins; in addition to approval for use in infections caused by *S. pseudintermedius*, cefpodoxime is regarded as a broad-spectrum AMD and has been approved in the USA for use in the treatment of skin infections associated with *Escherichia coli* and *Proteus mirabilis*, whilst cefovecin has been approved in the Europe for use in the treatment of skin infections associated with *E. coli* and for urinary tract infection associated with *E. coli* and *Proteus*. Cefovecin is significantly more active against *E. coli*, *Klebsiella pneumoniae* and *Proteus* spp. compared with cefalexin and cefadroxil, and its *in vitro* activity against *E. coli* and *Proteus* spp. is comparable to that of cefpodoxime.[44] Although cefovecin may be considered as a 'narrower-spectrum' drug due to the high-affinity protein binding (and subsequent low free plasma concentration), pharmacokinetic data provided by the manufacturer[45] indicate that the free plasma concentration exceeds the MIC_{90} of *E. coli* for 2 days following injection and exceeds the MIC_{50} of *E. coli* for 6 days. Thus, concentrations can be sufficient to kill susceptible Gram-negative bacteria, as opposed to only Gram-positive bacteria, which are killed by lower drug

concentrations. This raises concerns about possible selection of highly resistant extended-spectrum β-lactamase (ESBL)-producing *E. coli* by use of cefovecin. As for cefpodoxime, this extended-spectrum cephalosporin is administered as a prodrug, cefpodoxime proxetil, which is absorbed and de-esterified in the gastrointestinal tract to its active metabolite.[46] Thus, it is questionable whether the active metabolite may reach sufficient concentrations in the large intestine to select for ESBL-producing bacteria. These concerns notwithstanding, at least one member of the panel was not convinced that there is sufficient published evidence indicating that cefovecin or cefpodoxime produce active concentrations in the intestinal lumen of dogs that are sufficient to affect the microbial population.

A few recent studies in dogs have identified antimicrobial drug use in general as a risk factor for the emergence of MRSP[24,25] and, at present, it is reasonable to assume that any cephalosporin or amoxicillin–clavulanic acid could select for MRSP. One small report has associated misuse of unspecified fluoroquinolones, macrolides and third-generation cephalosporins with persistence of MRSP colonization in a breeding kennel.[47] The use of fluoroquinolones and extended-spectrum cephalosporins in humans,[48–50] and of fluoroquinolones in dogs, is a known risk factor for selection of MRSA.[51] Use of these AMDs is also a risk factor for selection of ESBL-producing *E. coli* in both humans and animals,[52–55] and guidelines in human medicine recommend prudent use of these broad-spectrum agents to prevent spread of multidrug-resistant bacteria.[56–58] These factors, along with the increasingly high prevalence of MRSP and ESBL-producing Enterobacteriaceae in dogs, support the promotion of precautionary principles and the limitation of extended-spectrum cephalosporins and fluoroquinolones as second tier AMDs. In accordance with this, the package insert for cefovecin in Europe specifies that 'A sample of the lesion should be obtained for culture and susceptibility testing prior to beginning antimicrobial therapy',[45] and the technical monograph states, in addition, 'It is prudent to reserve third generation cephalosporins for the treatment of clinical conditions, which have responded poorly, or are expected to respond poorly, to other classes of antimicrobials or first generation cephalosporins'.[59]

With regard to the fluoroquinolones, enrofloxacin, marbofloxacin, orbifloxacin and pradofloxacin are approved for use in dogs in some countries and have been shown to be effective for the treatment of superficial pyoderma. However, the use of this group of AMDs is a known risk factor for the emergence of MRSA in humans,[48–50] and guidelines also recommend limited use of these agents.[56–58]

When recurrence of SBF occurs, careful consideration of culture and susceptibility testing is encouraged because previous exposure to AMDs is a risk factor for resistance[24,25] and may be especially important in patients with previous MRSP infections or from households with other pets that have previously been diagnosed with an MRSP infection.[26,27] Veterinarians should present a plan for evaluation of underlying primary disease to owners of dogs with recurrent infections. If culture is not performed on recurrence of the infection, the same AMD should be used that successfully resolved the previous infection. Most studies evaluating the efficacy of AMDs indicate that SBF infections are resolved after 3 weeks or more of systemic AMD treatment; rapid improvement over the first 1–2 weeks is typically observed, but resolution of all lesions and prevention of rapid recurrence of disease requires 3–6 weeks of treatment.[17–22,28] Although there is no significant difference in the likelihood of resolution of MSSP after 3–4 weeks of systemic AMD treatment compared with MRSP infections, it has been reported that MRSP infections took longer to treat compared with MSSP infections.[60]

In a minority of patients, resolution of lesions may be achieved with 2 weeks of systemic AMDs. However, the assessment of complete resolution cannot be left to pet owners, and all patients should ideally be re-evaluated to ensure resolution of the infection. In particular, if attending veterinarians dispense <3 weeks of AMDs, they should anticipate and be confident that the patient will be presented for re-evaluation to determine whether additional antimicrobial therapy is indicated or the infection has resolved on completion of this period. Furthermore, patients with a history of recurrent SBF must be re-evaluated at the conclusion of AMD treatment.

In the absence of evidence to the contrary, continuation of treatment for at least 7 days beyond clinical resolution of lesions is recommended in all cases,[14] because the inflammatory process and lesions will subside and become inapparent as the infection is eliminated. This extended duration of treatment is based on clinical experience. Further research is required to confirm the need for such additional therapy, whether a 7 day period is sufficient, and to determine methods that will confirm whether infection has been eliminated when clinical lesions have resolved. Concurrent glucocorticoid use during therapy of SBF is strongly discouraged because it may improve the clinical appearance of the lesions and result in premature discontinuation of AMD administration whilst also reducing the patient's innate and adaptive immune response to infection.

Prevention of superficial bacterial folliculitis

The most effective measure to prevent recurrence is to identify and control the underlying primary disease. Protocols for the use of systemic AMDs to aid in the prevention of SBF, or to delay recurrence, have been published and advocated in public prior to the widespread emergence of MRS and have included pulse therapy (intermittent administration of therapeutic doses of AMD) and continuous use of subtherapeutic dosing.[61,62] However, there is significant concern for the selection of resistance with these protocols. Accordingly, their use is strongly discouraged. The use of autogenous bacterins[62,63] or commercial bacterial antigens[64] is encouraged. However, very few studies of the efficacy and usefulness of these measures have been reported and further research is necessary. If pulse or subminimal AMD therapy is being considered for prevention of SBF, it is recommended that the patient be referred to a specialist for further evaluation and treatment.

Decolonization of carriage sites has been demonstrated to reduce the recurrence of MRSA infections in humans.[65,66] Although recurrent MRSP infections are

common, there are currently no controlled studies in dogs that would indicate potential effective methods of decolonization, nor the need for such procedures. Therefore, at this time, routine decolonization of carriage sites of dogs with recurrent MRSP infections is of questionable value and not recommended.

Public health considerations

Staphylococci can be transferred in both directions between animals and humans.[67] Whilst the risk of infection with *S. pseudintermedius* and *S. schleiferi* is very low in healthy humans, infections by pathogenic staphylococci acquired from pets have been documented.[68,69] Such infections are a much greater hazard in the case of MRS, particularly with MRSA.[70]

Precautions need to be taken to limit the possibility of transfer of staphylococci from infected animals to owners and veterinary staff in the clinic. Owners and veterinary staff need to be aware of this potential hazard and advised on measures to minimize the risk of transfer, particularly when susceptible individuals (elderly people, those with lesions or diseases rendering them more susceptible to infection and those receiving immunosuppressive therapy) are likely to come into contact with the affected animals.

Infection control measures

Hygiene should be maintained rigorously in the clinic when animals suspected of having staphylococcal infections are admitted. This should involve the development and display of hygiene protocols specific for each clinic environment. Staff should be trained to recognize risk factors for multiresistance and observe such protocols; compliance should be monitored and enforced. Materials likely to have been contaminated should be disinfected after such animals are seen, and effective hand cleansing with alcohol sanitizers must be carried out before and after touching the animal. Owners of animals with suspected staphylococcal infections should also be advised of the importance of hygiene. Detailed recommendations on hygiene in the clinic are beyond the scope of this article, and readers are advised to refer to other published material on this topic.[71–73]

Summary of recommendations

See Appendix 1.

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Appendix 1: Summary of guidelines for the diagnosis and antimicrobial therapy of canine superficial bacterial folliculitis

Superficial bacterial folliculitis in dogs is typically caused by *Staphylococcus pseudintermedius*.

Diagnosis: Initially based on clinical signs of papules, pustules, crusts, patchy alopecia or epidermal collarettes. Cytological demonstration of cocci and inflammatory cells is strongly encouraged to support the diagnosis. Bacterial culture and susceptibility testing is encouraged with recurrent infections and is essential when there is <50% reduction in lesions after 2 weeks of therapy, new acute lesions emerge after 2 weeks of therapy, infection has not resolved after 6 weeks of therapy, intracellular rods are detected on cytology or there is a history of prior multidrug-resistant infection. Pustules are the preferred lesion to culture, but crusts, epidermal collarettes and papules may also be sampled.

Application	Formulations	Agents	Treatment recommendations
Topical therapy*			
Extensive or generalized disease	Shampoos, lotions, rinses, sprays, conditioners	Antiseptics, including chlorhexidine (also with miconazole) and benzoyl peroxide, are preferred, but ethyl lactate, povidone iodine and triclosan may also be helpful	Two or three times weekly. Shampoos or conditioners: 10 min contact time prior to rinsing
Focal and localized infections	Gels, creams, ointments, lotions and wipes	Antiseptics, including hydroxyl acids (e.g. acetic, lactic and malic acids), benzoyl peroxide and silver sulfadiazine. Antimicrobial drugs, including novobiocin, pristinamycin, bacitracin, fusidic acid and mupirocin	Use one or two times daily

Category	When used	Suggested antimicrobial drugs	Dosing
Systemic antimicrobial therapy*†			
First tier	Empirical therapy of known or suspected superficial bacterial folliculitis	First generation cephalosporins (e.g. cefalexin, cefadroxil)	15–30 mg/kg p.o. twice daily
		Amoxicillin–clavulanate	12.5–25 mg/kg p.o. two to three times a day
		Clindamycin	5.5–10 mg/kg p.o. twice daily
		Lincomycin	15–25 mg/kg p.o. twice daily
		Trimethoprim–sulphonamides	15–30 mg/kg p.o. twice daily
		Ormetoprim–sulphonamides	55 mg/kg on first day then 27.5 mg/kg p.o. once daily
First or second tier		Cefovecin	8 mg/kg s.c. once every 2 weeks
		Cefpodoxime	5–10 mg/kg p.o. once daily
Second tier	First tier systemic antimicrobial drug and topical therapy ineffective. Selection based on culture and susceptibility testing	Doxycycline	5 mg/kg p.o. twice daily; or 10 mg/kg p.o. once daily
		Minocycline	10 mg/kg p.o. twice daily
		Chloramphenicol	40–50 mg/kg p.o. three times a day
		Fluoroquinolones:	
		enrofloxacin	5–20 mg/kg once daily
		marbofloxacin	2.75–5.5 mg/kg p.o. once daily
		orbifloxacin	7.5 mg/kg p.o. once daily
		ciprofloxacin	25 mg/kg p.o. once daily
		pradofloxacin	3 mg/kg p.o. once daily
		Rifampicin	5–10 mg/kg p.o. twice daily
		Aminoglycosides:	
		gentamicin	9–14 mg/kg i.v., i.m. or s.c. once daily
		amikacin	15–30 mg/kg i.v., i.m. or s.c. once daily
Third tier		Vancomycin, teicoplanin and linezolid	Use strongly discouraged

Abbreviations: i.m., intramuscular; i.v., intravenous; p.o. per os; and s.c., subcutaneous.
*Therapy must be administered for at least 3 weeks or until 7 days beyond resolution of lesions.
†Use of the agents listed should take account of local and regional restrictions on their use.

Résumé

Contexte – La folliculite bactérienne superficielle (SBF) est généralement due à *Staphylococcus pseudintermedius* et traitée avec des agents antimicrobiens systémiques. L'infection est la conséquence d'une baisse de l'immunité associée à des altérations de la barrière cutanée et de maladies sous-jacentes qui peuvent être difficiles à diagnostiquer et à résoudre; ainsi, la SBF est fréquemment récidivante et des traitements répétés sont nécessaires. L'émergence de bactéries multirésistantes, en particulier *S. pseudintermedius* résistante à la méticilline (MRSP) a attiré l'attention sur le besoin d'une gestion optimale de la SBF.

Objectifs – Fournir un guide de recommandations international disponible pour les praticiens pour le diagnostic, le traitement et la prévention de la SBF.

Développement des recommandations – Les recommandations ont été développées par le groupe de travail des recommandations antimicrobiennes de l'ISCAID (International Society for Companion Animal Infectious Diseases) avec la collaboration des diplômés des collèges américain et européen de dermatologie vétérinaire. Ils ont décrit les méthodes optimales de diagnostic et de gestion de la SBF, y compris l'isolement de l'organisme incriminé, les tests de sensibilité antimicrobiens, le choix de la molécule antimicrobienne, les protocoles thérapeutiques et les conseils sur le contrôle de l'infection. Une conduite est donnée sur les voies systémiques et topiques ainsi que les approches appropriées pour MRSP. Les molécules systémiques sont classées en trois groupes. Le premier groupe est utilisé quand le diagnostic est évident et les facteurs de risque pour la résistance antimicrobienne est absente. Sinon, les médicaments du deuxième groupe sont utilisés et des tests de sensibilité antimicrobienne sont nécessaires. Le troisième groupe inclus les molécules réservées pour les infections hautement résistantes, leur utilisation est fortement déconseillée et si nécessaire, elles doivent être utilisées en concertation avec des spécialistes.

Conclusions et importance clinique – La gestion optimale e SBF doit améliorer l'usage des antimicrobiens et diminuer la sélection des MRSP et d'autres bactéries multirésistantes affectant l'animal et la santé humaine.

Resumen

Introducción – la foliculitis superficial bacteriana (SBF) esta generalmente causada por *Staphylococcus pseudintermedius* y de forma rutinaria tratada con antimicrobianos sistémicos. La infección es consecuencia de la reducida inmunidad asociada con alteraciones de la barrera de la piel y debido a enfermedades primarias que pueden dificultar el diagnostico y el tratamiento; así pues SBF es con frecuencia recidivante y se necesitan tratamientos repetidos. La aparición de multiresistencia bacteriana, particularmente *S. pseudintermedius* resistente a meticilina (MRSP), ha centrado la atención en la necesidad de un manejo optimo de la SBF.

Objetivos – la provisión de un recurso disponible a nivel internacional que guíe a veterinarios en el diagnostico, tratamiento y prevención de SBF.

Desarrollo de las directrices – las directrices fueron desarrolladas por el Grupo de Trabajo de Directrices Antimicrobianas de la Sociedad Internacional de Enfermedades Infecciosas de Pequeños Animales, consultando y recibiendo consejos de diplomados de los colegios Americano y Europeo de Dermatología Veterinaria. Estas directrices describen los métodos óptimos para el diagnostico y manejo de SBF, incluyendo aislamiento del agente causal, pruebas de susceptibilidad antimicrobiana, selección de fármacos antimicrobianos, protocolos terapéuticos y consejos para el control de la infección. Se aportan directrices para las modalidades de tratamiento tópico y sistémico, incluyendo pautas adecuadas para MRSP. Los fármacos sistémicos se clasifican en tres niveles. Los fármacos del nivel uno se usarían cuando el diagnóstico es claro y no existen factores de riesgo para el desarrollo de resistencia antimicrobiana. En caso contrario, se utilizarían fármacos del nivel dos y son obligatorios el cultivo y pruebas de susceptibilidad. En el nivel tres se incluyen fármacos reservados para infecciones altamente resistentes; su uso no es recomendable y cuando sean necesarios, deben utilizarse tras consulta con un especialista.

Conclusiones e importancia clínica – el manejo optimo de SBF mejorará el uso de antimicrobianos y reducirá la selección de MRSP y otras bacterias multiresistentes que pueden afectar a la salud humana y animal.

Zusammenfassung

Hintergrund – Die superfizielle bakterielle Follikulitis (SBF) wird üblicherweise von *Staphylococcus pseudintermedius* verursacht und routinemäßig mit systemischen Antibiotika behandelt. Eine Infektion ist die Konsequenz einer reduzierten Immunität, die mit Änderungen der Hautbarriere und zugrundeliegender Erkrankungen, deren Diagnose und Heilung manchmal schwierig sind, einhergeht; daher kehrt die SBF häufig wieder und eine Behandlung ist wiederholt nötig. Durch das Aufkommen von multiresistenten Bakterien, vor allem Methicillin-resistentem *S. pseudintermedius* (MRSP), konzentriert sich die Aufmerksamkeit auf den Bedarf einer optimalen Behandlung der SBF.

Ziele – Bereitstellung einer international verfügbaren Quelle, die PraktikerInnen bei der Diagnose, der Behandlung und der Vorbeugung einer SBF unterstützt.
Entwicklung der Richtlinien – Die Richtlinien wurden von der Antimicrobial Guidelines Working Group der International Society for Companion Animal Infectious Diseases entwickelt, unter Beratung und mit Empfehlungen durch Diplomates der American und European Colleges für Veterinärdermatologie. Sie beschreiben optimale Methoden zur Diagnose und für das Management der SBF, die Folgendes beinhalten: Isolierung der verursachenden Keime, Kultur und Antibiogramme, Auswahl der antimikrobiellen Wirkstoffe, therapeutische Protokolle und Empfehlungen bezüglich Infektionskontrolle. Es werden Richtlinien erstellt für topische und systemische Modalitäten, die auch eine passende Herangehensweise für einen MRSP beinhalten. Die systemischen Wirkstoffe werden in drei Stufen klassifiziert. Die Wirkstoffe der Klasse eins werden eingesetzt, wenn die Diagnose eindeutig ist und keine Risikofaktoren für eine antimikrobielle Multiresistenz bestehen. Ansonsten werden Wirkstoffe der Stufe zwei verwendet, wobei Kultur und Antibiogramm obligatorisch durchgeführt werden sollten. Die Wirkstoffe der Stufe drei beinhalten Medikamente für hochresistente Infektionen; von ihrer Verwendung wird strengstens abgeraten und wenn nötig, sollte ihr Einsatz mit Spezialisten besprochen werden.
Schlussfolgerungen und klinische Bedeutung – Ein optimales Management von SBF wird die Verwendung von antimikrobiellen Wirkstoffen verbessern und die Selektion von MRSP und anderen multiresistenten Bakterien, die die tierische und die menschliche Gesundheit beeinträchtigen, reduzieren.

要約

背景 – 表在性細菌性毛包炎(SBF)は一般的に *Staphylococcus pseudintermedius* により生じ、通常全身性抗菌性物質を用いて治療される。感染は 皮膚バリアと診断や解決が困難である基礎疾患の変化に関連した免疫力の減少の結果であり、そのため SBF は頻繁に再発し、繰り返した治療が必要とされる。多剤耐性細菌の発生、特にメチシリン耐性 *S. pseudintermedius* (MRSP)は SBF の最適な管理法の必要性に注意が集まっている。

目的 – SBF の診断、治療および予防に関して臨床家を指導する国際的に入手可能な資料の提供

ガイドラインの開発 – ガイドラインは Antimicrobial Guidelines Working Group of the International Society for Companion Animal Infectious Diseases により、American および European Colleges of Veterinary Dermatology の免状を有する者のコンサルティングや助言と共に開発された。ガイドラインでは原因微生物の分離、抗菌剤の感受性試験、抗菌剤の選択、治療プロトコールならびに感染のコントロールについての助言を含む SBF の診断および管理に関する最適な方法を説明する。アドバイスとして MRSP に対して適切なアプローチを含む外用および全身性の方法を示している。全身薬は 3 つの段階に分類される。段階1の薬剤は診断が明確で抗菌剤の耐性に対するリスク因子が存在しないときに使用する。一方では、段階 2 の薬剤は抗菌剤の感受性試験が必須として使用する。段階 3 は重度の耐性感染症の為に確保しておいた薬剤を含み、それらの使用は極めて奨励されず、もしも必要である場合は、専門家との相談のもとに使用するべきである。

結論および臨床的な重要性 – SBF の最適な管理は抗菌剤の使用を改善し、動物やヒトの健康に影響を及ぼす MRSP および他の多剤耐性細菌の選択を減少する。

摘要

背景 – 浅表细菌性毛囊炎（SBF）病因通常是假中间型葡萄球菌，常规使用全身抗生素进行治疗。感染是免疫力减低的结果，这可能与皮肤屏障的改变，以及难以诊断和解决的潜在病因有关，因此，SBF 经常复发，需要必要的治疗。随着多重耐药菌的出现，特别是耐甲氧西林假中间型葡萄球菌(MRSP)，更要集中精力于 SBF 的优化管理。

目的 – 现有国际条款可指导医师对于SBF的诊断、治疗和预防。

指导方针的发展 – 指导方针由伴侣动物感染性疾病国际社会抗菌剂指导方针工作组完善，并经过咨询和征求美国或欧洲兽医皮肤学专科医生的意见。他们描述SBF诊断和管理的最优化方法，包括对病原菌的隔离、药敏测试、抗生素的选择以及控制感染的治疗方案和建议。指导方针指出了局部和全身的形式，包括对MRSP的合适处理方法。全身用药分为三级。一级药物用于诊断明确、不存在抗生素耐药性风险时。二级药物使用时必须进行药敏测试。三级药物为高度耐药感染保留；强烈建议不要轻易使用这些药物，使用时需要咨询专家意见。

总结与临床意义 – SBF的优化管理需要改善抗生素的使用，减少MRSP和多耐药菌的出现，以及对动物和人类健康的影响。