

# Topical Treatment of Canine Superficial Pyoderma

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Topical antibacterials alone can be as effective as systemic therapy if established guidelines are followed and the underlying causes are identified and treated.

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## Abstract

Superficial pyoderma is a common bacterial skin infection often caused by *Staphylococcus*

*pseudintermedius* secondary to an underlying disorder. The current surge in antimicrobial resistance has led to more judicious use of systemic antimicrobial drugs. For superficial (and surface) pyoderma, topical therapy can be as effective as systemic therapy and can be used as the sole antibacterial treatment. Treatment success depends on frequency of application, contact time, duration of therapy, choice of active ingredient, client compliance, and identification and treatment of the underlying cause. This article answers several of the top questions general practitioners have about the topical treatment of canine superficial pyoderma.

## Take-Home Points

- In dogs, superficial pyoderma is a common bacterial skin infection affecting the epidermis and hair follicles.
- For superficial (and surface) pyoderma, topical therapy can be the sole antibacterial treatment.
- Topical antibiotics and antiseptics are bactericidal for methicillin-susceptible and methicillin-resistant *Staphylococcus* species.
- The most commonly used topical antiseptics are chlorhexidine and benzoyl peroxide; another antiseptic of interest is diluted sodium hypochlorite (available as shampoo).
- Shampoo therapy is generally used 2 to 3 times weekly but can be used more frequently; contact time should be least 10 minutes.
- Mousse or spray formulations can be used daily.
- Topical antibiotics can be used on localized lesions at least twice daily.
- Identifying and treating the underlying condition will help resolve skin infection and may help prevent recurrence.

Canine superficial pyoderma is a frequent diagnosis in small animal practice.<sup>1</sup> Development of pyoderma can occasionally be primary (e.g., mutations in cutaneous innate immunity, idiopathic recurrent pyoderma) or more commonly secondary to an underlying disease.

Dogs are particularly predisposed to pyoderma secondary to ectoparasitism (e.g., [demodicosis](#), [sarcoptic mange](#)), endocrinopathies (e.g., hypothyroidism, hyperadrenocorticism), autoimmune erosive/ulcerative skin diseases (e.g., [pemphigus foliaceus](#)), disorders of keratinization, and especially cutaneous hypersensitivity disorders (e.g., [atopic dermatitis](#), adverse food reaction, [flea bite hypersensitivity](#)). Successful treatment and prevention of recurrence depend on identifying and treating any underlying comorbidity.

In dogs with superficial pyoderma, the bacterial infection involves the epidermis and the infundibular part of hair follicles. The term encompasses several clinical forms, such as impetigo (i.e., puppy pyoderma) and bacterial folliculitis characterized by erythematous papules, pustules, and round lesions with peripheral erosions and crusting (i.e., epidermal collarettes) (**FIGURE 1**). Superficial pyoderma differs clinically from deep pyoderma, in which infection extends to the dermis and the panniculus and skin lesions are characterized by erosive to ulcerated nodules, draining sinuses, fistulae, and hemorrhagic bullae with crusts.<sup>1,2</sup>

Figure 1. Papules, pustules, and a collarette on the neck and dorsum of a dog with superficial pyoderma secondary to atopic dermatitis.

The predominant pathogen that causes superficial pyoderma in dogs is *Staphylococcus pseudintermedius*<sup>2</sup>; *Staphylococcus schleiferi* and *Staphylococcus aureus* can also be primary pathogens, although *S aureus* is primarily a pathogen of humans and is not as adapted to canine skin as *S pseudintermedius* and *S schleiferi*.<sup>3,4</sup> Clinical isolates of all 3 *Staphylococcus* species are commonly methicillin and multidrug resistant, especially after exposure to multiple courses of systemic antibiotics (e.g.,  $\beta$ -lactams, fluoroquinolones, lincosamides).<sup>5,6</sup> Pyoderma can also be caused by other bacteria such as streptococci, gram-negative *Pseudomonas aeruginosa*, and *Escherichia coli*.<sup>7</sup> As the veterinary and human medicine communities are challenged with the rise of [antimicrobial resistance](#), judicious use of systemic antibiotics is an ongoing effort. Topically applied antiseptics and antibiotics are recognized as bactericidal for methicillin-susceptible and methicillin-resistant *Staphylococcus* species.<sup>7-10</sup>

According to the Clinical Consensus Guidelines of the World Association for Veterinary Dermatology, the recommended treatment modality for cases of superficial pyoderma, regardless of multidrug-resistance status, is topical therapy using antibacterial agents with proven antistaphylococcal efficacy, which can be used as the sole topical antibacterial treatment.<sup>4</sup> The guidelines are based on a study that showed that daily topical chlorhexidine shampoo and solution can resolve canine superficial pyoderma as effectively as systemic amoxicillin–clavulanic acid.<sup>11</sup> The guidelines should apply to most patients, although topical application of therapy may not be feasible for some clients due to the patient's size or temperament. Additionally, some clients may object to the size of the area that needs to be clipped before topical antimicrobial application; however, the size of the affected area should not preclude topical therapy as long as client compliance is anticipated and any underlying cause is addressed.

## Which Topical Formulations Will Best Reach the Site of Infection?

Among the many topical formulations for use in veterinary dermatology are shampoos, rinses, sprays, ointments, creams, lotions, mousses, gels, and wipes. One of the most commonly recommended therapies for canine superficial pyoderma is shampoo because it can treat large areas of fully haired skin (**TABLE 1**). Localized lesions will benefit from sprays, lotions, creams, and ointments (**TABLE 2**).

Shampoo helps mechanically remove debris and bacteria, providing immediate relief to the patient.<sup>12</sup> In general, the outcome of shampoo therapy depends on the dog's temperament, breed, pet-owner relationship, climate/season, shampoo technique, and client compliance.<sup>7</sup> Lotions are more viscous than solutions and are intended to be soothing and moisturizing; they are usually indicated for acute oozing lesions. Gels are semisolid emulsions that are easy to apply and readily absorbed. Creams are occlusive agents that prevent water loss from the skin and are more suitable for, but not limited to, glabrous areas (i.e., hairless or sparsely haired) in addition to the nasal planum and footpads. Ointments are also occlusive and have a moisturizing effect, thus being a good option for dry skin.<sup>7</sup>

When topical formulations are used, the patient must be prevented from licking the product off. Moreover, to prevent treatment failures, it is recommended (with client consent) that hairs be clipped and the affected area(s) cleaned to ensure that the active ingredient reaches the site of infection (**FIGURE 2**). However, glabrous areas may not require hair clipping due to the normal low density of hairs in those areas.

Figure 2. Superficial spreading pyoderma on the clipped, cleaned dorsum of a dog. The lesion is characterized by a large epidermal collarette with erythema, small multifocal erosions, and peripheral exfoliation.

## How Often/Long Should Topical Therapy Be Applied?

Well-designed clinical studies to determine the optimal contact time and frequency of topical therapy application for canine superficial pyoderma are needed. Nonetheless, it seems that the longer the exposure to antiseptics, the more potent the antimicrobial activity.

The frequency of shampoo therapy will depend on each case. In general, shampooing 2 to 3 times per week until 7 days after resolution of clinical signs and then weekly thereafter may help prevent recurrence.<sup>3,13</sup> Daily shampooing could be considered for patients with generalized methicillin-resistant *Staphylococcus* and/or multidrug-resistant infections but is impractical for most clients. When client compliance is an issue, an alternative is application of antiseptic mousse or spray formulations daily or on nonbathing days. For most patients, shampoo should be allowed to stay in contact with the skin for at least 10 minutes,<sup>14</sup> during which time the active ingredient can exert its effect and the water can hydrate the stratum corneum.<sup>11</sup> Mousse and sprays should be allowed to air dry and do not require rinsing. Lotions, ointments, creams, gels, wipes, and some of the mousse and spray formulations can be applied twice daily until lesions are resolved.

## Which Topical Antiseptic Ingredients Are Effective?

There are multiple topical products with varying active ingredients and effectiveness (**BOX 1**), but 1 of the preferred topical antiseptics is chlorhexidine due to its potent in vivo antimicrobial activity, especially at higher concentrations (e.g., 3% to 4%).<sup>11,15,16</sup> Lower-concentration chlorhexidine (e.g., 2%) is available in combination with miconazole.<sup>13,14</sup> In 1 in vitro study, the zone of inhibition of bacterial growth was larger with shampoos containing 2% and 3% chlorhexidine than those containing 0.8% and 4% chlorhexidine; thus, higher concentration did not guarantee greater bacterial inhibitory effect.<sup>17</sup> Due to the variability of shampoo formulations, these results can be applied only to the products tested and cannot be extrapolated to predict residual antimicrobial activity of other products of the same chlorhexidine concentration.<sup>17</sup>

### BOX 1 Topical Product Ingredients for Treatment of Superficial Pyoderma

- Chlorhexidine (2%–4%)
- Benzoyl peroxide (2%–3%)
- Ethyl lactate
- Acetic acid/boric acid
- Povidone iodine
- Triclosan
- Sodium hypochlorite
- Hypochlorous acid

The effectiveness of a shampoo depends not only on the concentration of the active ingredient but also on the shampoo formulation. Formulation factors that play a role in the residual antibacterial activity of medicated shampoos include type of surfactant, preservatives, solubility of the active ingredients, therapeutic effects of the vehicle, additive or synergistic effect of ingredients, efficient release of the active ingredient when contained within microvesicles, and pH of the formulation. Note that the pH of canine skin is approximately neutral.<sup>14</sup>

One study demonstrated that shampoo therapy with 4% chlorhexidine digluconate twice weekly and 4% chlorhexidine solution twice daily for 4 weeks may be as effective as systemic therapy with amoxicillin–clavulanic acid.<sup>11</sup> That study used contact time of 3 to 5 minutes and allowed the solution to air dry without rinsing.

According to other in vitro and in vivo studies, benzoyl peroxide at 2.5% to 3% also has antimicrobial activity, although less than chlorhexidine.<sup>9,17,18</sup> In addition, benzoyl peroxide is keratolytic, comedolytic, anti-inflammatory, and degreasing; however, for some patients it can be drying and irritating to the skin, necessitating use of moisturizers.<sup>7,12,13</sup>

Other products containing ethyl lactate, povidone iodine, or triclosan may also be beneficial.<sup>3</sup>

Sodium hypochlorite (bleach) is another antiseptic of interest. Diluted sodium hypochlorite solution at 0.05% or 0.005% is a well-tolerated antiseptic that also exhibits anti-inflammatory properties.<sup>19</sup> One study evaluated a commercially available shampoo formulated with sodium hypochlorite and salicylic acid as the sole therapy for dogs with superficial pyoderma associated with *S pseudintermedius*, including methicillin-resistant strains. The shampoo was used 3 times a week for 4 weeks. No skin dryness or other adverse effects were reported.<sup>20</sup> The researchers concluded that the sodium hypochlorite–salicylic acid shampoo was an effective treatment for canine pyoderma.

Another compound is hypochlorous acid, a broad-spectrum antimicrobial against gram-positive and gram-negative bacteria, fungi, and viruses.<sup>21</sup>

New alternatives include essential oils, sodium oxychlorosene, nanosulfur, accelerated hydrogen peroxide, and silver compounds. However, few studies of the effects of those compounds have been published, and not all are commercially available.<sup>13</sup>

## Which Topical Antibiotics Are Effective?

Topical antibiotics (e.g., mupirocin, gentamicin, fusidic acid, silver sulfadiazine) can be an excellent option for localized lesions and are available as sprays, gels, ointments, and creams (**BOX 2 AND TABLE 3**).

### BOX 2 Topical Antibiotics for Treatment of Superficial Pyoderma

- Mupirocin (2%) ointment
- Gentamicin (+ antifungal, glucocorticoid) otic
- Gentamicin (+ betamethasone) spray
- Fusidic acid (in Canada and Europe)
- Silver sulfadiazine (0.1% to 1%)
- Orbifloxacin (+ antifungal, glucocorticoid) otic
- Neomycin, polymyxin B, bacitracin (alone or in combination)

Mupirocin 2% ointment can be used for localized superficial and deep pyoderma in dogs.<sup>3,7,12,14,15</sup> However, because the ointment base is propylene glycol, which can pose a risk for systemic absorption leading to nephrotoxicity, it should not be used on the mucosa or extensive deep lesions.<sup>12,15</sup>

Gentamicin, a broad-spectrum antibiotic, is available in many otic formulations and is usually associated with an antifungal and glucocorticoid. The off-label use of otic antibiotic formulations can be feasible for patients with localized lesions. Gentamicin combined with betamethasone is also available as a spray.<sup>12,15</sup> Some spray formulations may contain alcohol, which can be painful on eroded or ulcerated skin; thus, use alcohol-containing products with caution.

Fusidic acid is highly effective against *S pseudintermedius* and can be recommended for the treatment of skin infections; however, there are no fusidic acid products labeled for veterinary use in the United States.<sup>3,7,14,15</sup>

Topical silver sulfadiazine at concentrations of 0.1% to 1% is useful for treating localized pyoderma caused by *Pseudomonas* species or other susceptible bacteria.<sup>12,15</sup>

Other topical antibiotics include neomycin, polymyxin B, and bacitracin, or combinations thereof; however, efficacy of these products may be limited as they do not penetrate the skin well and can be inactivated by purulent exudates.<sup>22</sup>

Bacterial resistance to topical therapy with the agents mentioned above are considered rare, especially for mupirocin and fusidic acid.<sup>3</sup> The author recommends applying topical antibiotics to localized lesions at least twice daily.

## Are There Any New Approaches to Canine Superficial Pyoderma?

[Photobiomodulation](#) has been gaining momentum as an adjuvant treatment of inflammatory dermatoses. One in vitro study showed that blue light phototherapy significantly reduced the colony counts of methicillin-resistant *S aureus* but not of methicillin-resistant or methicillin-susceptible *S pseudintermedius*.<sup>23</sup> However, the most common pathogen causing canine superficial pyoderma is *S pseudintermedius*, not *S aureus*. Preliminary results of an in vivo prospective, randomized, nonblinded study showed that photobiomodulation treatment reduced the need for systemic antibiotics and accelerated the time to clinical resolution of canine superficial pyoderma.<sup>24</sup> Although photobiomodulation seems to be safe and promising as an adjuvant treatment for many inflammatory skin conditions, more studies are needed to evaluate its use for treatment of canine superficial pyoderma.

## Summary

Because of increasing antimicrobial resistance, topical antimicrobial therapy is a beneficial alternative to systemic therapy that can be implemented and monitored at the general practice level. For patients with superficial pyoderma, topical antibacterials alone can be as effective as systemic therapy if guidelines for frequency of application, contact time, duration of therapy, and choice of active ingredient are followed and the underlying causes are identified and treated.

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