Challenges & New Developments in CANINE PYODERMA
Topical & Systemic Treatment

Kimberly S. Coyner, DVM, Diplomate ACVD

As discussed in Part 1 of this series (Disease Overview & Diagnosis), canine pyoderma can be classified by depth of infection as:

- Superficial or surface pyoderma
- Deep pyoderma.

Treatment decisions for canine recurrent pyoderma include consideration of the:

- Distribution of lesions (localized versus generalized)
- Underlying cause of recurrent infections.

TREATMENT OPTIONS
The classifications above help determine the treatment regimen for each case of pyoderma:

- **Very superficial or localized cases** of canine pyoderma may be treated with topical antibacterial medications alone (Table 1, page 38).

- **Generalized or deep cases** are usually best treated with a combination of oral antibiotics and topical antibacterial therapies (Table 2, page 40).

- **In very pruritic patients**, a short (1–2 week) course of oral anti-inflammatory doses of prednisone may be helpful; however, antibiotics should always be continued beyond steroid discontinuation. Long-acting, injectable steroids should never be used in cases of canine pyoderma, as they will make healing difficult to assess, impair immune response to infection, and potentially have a harmful effect on the hypothalamic–pituitary–adrenal (HPA) axis.

This is the second article in a 3-part series discussing the latest information available regarding canine pyoderma. The first article, Challenges & New Developments in Canine Pyoderma: Disease Overview & Diagnosis, can be found at todaysveterinarypractice.com under Article Lists.
In recurrent cases of canine pyoderma it is essential to identify and treat the underlying cause. Depending on clinical presentation, age of onset, seasonality, and other clinical signs, this may include:
- Stringent flea control
- Deep scrapings for Demodex
- Triam treatment for scabies
- Hypoallergenic diet trial
- Intradermal allergy testing and desensitization
- Laboratory analysis to identify endocrinopathies
- Skin biopsy for keratinization disorders.

TOPICAL THERAPY

Localized or Superficial Infection
For localized areas of infection, topical antimicrobial ointments or creams containing 2% mupirocin or silver sulfadiazine applied twice daily can be very helpful.
- Although helpful in some cases for short-term therapy, sprays and ointments that contain combinations of steroids and antibiotics are NOT recommended for long-term use due to potential for cutaneous atrophy (Figures 1 and 2).
- Neomycin has more potential for allergic sensitization compared to other topical antibiotics, and susceptibility is variable for gram-negative organisms.
- Polymyxin B and bacitracin in combination may be effective for both gram-negative and gram-positive organisms; however, they are rapidly inactivated by organic debris, including pus, and do not penetrate well.

Generalized or Deep Infection
Unless skin infection is very mild or shampoo therapy is done every 1 to 2 days, topical therapy alone is unlikely to resolve a more generalized or severe pyoderma, but it can be very helpful in abbreviating infection when used in combination with systemic antibiotics.
- Most clinicians prefer chlorhexidine products as first-line therapy.
- Antibacterial shampoos need contact with the skin for 5 to 15 minutes to provide the desired therapeutic effect (label recommendations should be followed and clients should receive specific instructions on use).
- In dogs with deep pyoderma or heavily crusted lesions, clipping of lesions or whirlpool therapy may be beneficial.

Shampoo Therapy
Shampoo frequency depends on severity of infection:
- In severe cases or in cases of methicillin-resistant pyoderma, shampoo therapy every 1 to 2 days is recommended.
- In milder pyoderma cases, twice weekly shampoo therapy may be sufficient.
- For maintenance prophylactic therapy, minimum once weekly antibacterial shampoo therapy is recommended; leave-on antibacterial conditioners are also very helpful.

Other Therapy
Vetericyn All Animal Wound and Infection Treatment (vetericyn.com), an oxychlorine compound, has had anecdotal success and safety in the treatment of canine pyoderma. See todaysveterinarypractice.com/resources.asp to view and download a comprehensive table outlining Topical Antibacterial Products.

SYSTEMIC ANTIMICROBIAL THERAPY
Systemic antibiotics are used for bacterial skin infections that may not be treatable with topical therapies alone. Antibiotic choice for a particular case is dependent on multiple factors, including:
- Depth of infection
- Culture and sensitivity results (if applicable)
- Potential drug side effects (ie, avoiding cephalaxin-induced gastrointestinal adverse effects in a dog with a historically sensitive stomach or sulfa drugs in a dog with pre-existing dry eye or keratoconjunctivitis sicca)
- Age- or breed-related predisposition for side effects
- Drug cost
- Frequency of administration, which affects client compliance.

Antibiotic Action
Antibiotics are either time dependent or concentration dependent in their action.

1. In recurrent cases of canine pyoderma it is essential to identify and treat the underlying cause. Depending on clinical presentation, age of onset, seasonality, and other clinical signs, this may include:
   - Stringent flea control
   - Deep scrapings for Demodex
   - Triam treatment for scabies
   - Hypoallergenic diet trial
   - Intradermal allergy testing and desensitization
   - Laboratory analysis to identify endocrinopathies
   - Skin biopsy for keratinization disorders.

2. Neomycin has more potential for allergic sensitization compared to other topical antibiotics, and susceptibility is variable for gram-negative organisms.

3. Polymyxin B and bacitracin in combination may be effective for both gram-negative and gram-positive organisms; however, they are rapidly inactivated by organic debris, including pus, and do not penetrate well.
• **Time-dependent antibiotics** must be given at their specified dosing interval for maximal efficacy, as the duration of time that the antibiotic level remains above the minimum inhibitory concentration (MIC) is essential. These antibiotics include:
  » Cephalosporins
  » Beta–lactam-resistant penicillins
  » Macrolides

» **Lincosamides.**

• **Concentration-dependent antibiotics** include fluoroquinolones and aminoglycosides. With these drugs, the rate and extent of the bacterial killing increases as the antibiotic concentration increases. The peak serum concentration, not the time above MIC, is correlated with treatment efficacy; the drugs are best given at a higher dose once daily.² ³

<table>
<thead>
<tr>
<th>Pyoderma</th>
<th>Clinical Signs</th>
<th>Treatment</th>
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<tr>
<td><strong>SURFACE PYODERMA</strong></td>
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<tr>
<td>Impetigo</td>
<td>• Nonpruritic pustules not associated with follicles</td>
<td>• Apply topical antibacterial therapy (ie, chlorhexidine)</td>
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<td></td>
<td>• On sparsely haired areas of the skin, such as inguinal area</td>
<td>• Rarely, refractory lesions may require oral antibiotics for 10 to 14 days¹</td>
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<td>• Pustule results in epidermal collarettes and scaling</td>
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<td></td>
<td>• Often seen in young puppies¹ ²</td>
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<tr>
<td>Intertrigo (Fold Dermatitis/Pyoderma) (Figure 3)</td>
<td>• Dermatitis occurs in areas of skin folding, such as face, lip, and tail folds and vulvar area</td>
<td>• Cleanse area every 1 to 3 days with antibacterial wipe, flush, or shampoo</td>
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<td></td>
<td>• Lesions are areas of moist, inflammatory dermatitis with surface bacterial overgrowth¹ ²</td>
<td>• Apply topical antibiotic cream or solution daily for 5 to 7 days</td>
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<td>• Refractory cases may require surgical excision of excessive folds²</td>
</tr>
<tr>
<td>Mucocutaneous Pyoderma (Figures 4–6)</td>
<td>• Dermatitis occurs on lip margins, eyelids, nares, or anus²</td>
<td>• Apply topical antibacterial therapy (ie, mupirocin Q 12 H for 14 days)</td>
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<td></td>
<td>• Erythema, inflammation, and crusting +/- depigmentation</td>
<td>• For severe cases, systemic antibiotics should be administered for 3 to 4 weeks²</td>
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<tr>
<td>Pyotraumatic Dermatitis (Acute Moist Dermatitis) (Figure 7)</td>
<td>• Areas of acute, painful, moist, exudative, inflammatory dermatitis created by self trauma</td>
<td>• May need sedation to clip/clean</td>
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<td>• Often occurs in thick-coated dogs with underlying flea allergy or atopic dermatitis</td>
<td>• Follow with a 1- to 2-week course of oral steroid and topical astringents/antibacterial products +/- topical steroids or pramoxine; avoid products containing alcohol</td>
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<td>• Peripheral papules/pustules or thickened lesions indicate pyotraumatic folliculitis¹ ²</td>
<td>• If peripheral papules/pustules noted or lesion is thickened, a 2- to 4-week course of systemic antibiotics is indicated.¹</td>
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</table>

| **SUPERFICIAL PYODERMA** |                                                                                |                                                                          |
| Bacterial Folliculitis (Figures 8–10) | • Primary lesions: Papules (1–2 mm raised and/or crusted, pink or red bumps) and pustules | • Apply antibacterial shampoos, conditioners, and/or sprays |
|                           | • Secondary lesions: Expanding areas of alopecia; surrounding scaling (epidermal collarettes), crusts, hyperpigmentation, and lichenification¹ ² | • Administer 3-week minimum course of systemic antibiotics¹ |
| Bacterial Overgrowth Syndrome (Figure 11) | • Erythema, scaling, lichenification, hyperpigmentation, odor, pruritus, and eventual alopecia | • Apply antibacterial shampoos, conditioners, and/or sprays |
|                           | • Often present on ventral trunk, axillary, and inguinal areas                | • Administer 3-week minimum course of systemic antibiotics² |
|                           | • No papules, pustules, or epidermal collarettes present¹                     |                                                                          |

**Note:** All oral antibiotic treatment should be continued 1 to 2 weeks past clinical resolution; a recheck visit is needed prior to discontinuation of therapy.

**References**
Antibiotic Selection

When choosing empiric antibiotics, it is first important to avoid antibiotics to which staphylococcal bacteria are usually intrinsically resistant, including amoxicillin, ampicillin, penicillin, tetracycline, and nonpotentiated sulfonamides.

• **Antibiotic classes** that are usually effective for canine pyoderma include:
  » Cephalosporins
  » Macrolides
  » Lincosamides
  » Potentiated sulfonamides
  » Beta–lactamase-resistant penicillins
  » Fluoroquinolones
  » Aminoglycosides
  » Chloramphenicol.²

• **For first-line therapy** for canine pyoderma, most veterinary dermatologists use:
  » Cephalosporins
  » Clavulated penicillin
  » Potentiated sulfonamides.

• **For second-line therapy** for deep, fibrotic infections and/or *Pseudomonas* infections and when no other reasonable antibiotic choices are available, fluoroquinolones are used when indicated by culture and sensitivity. Veterinary-labeled fluoroquinolones (which have near complete bioavailability)³ are preferred over generic ciprofloxacin due to marked variability of ciprofloxacin absorption in dogs.⁴

• In one study, the oral absorption of generic ciprofloxacin tablets in dogs ranged from 98% to 29% and even at a high oral dose of 20 to 30 mg/kg, the area-under-the-curve (AUC) did not attain a high enough level for bacteria considered “susceptible.” This may result in therapeutic failure and increased selection of resistant bacteria, particularly when low doses are used.⁵
### Table 2. Deep Pyoderma: Clinical Signs & Treatment

<table>
<thead>
<tr>
<th>Deep Pyoderma</th>
<th>Clinical Signs</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Acral Lick Dermatitis (Figure 12)</td>
<td>• Alopecic, firm, raised, thickened plaque or nodule that may become ulcerated</td>
<td>• Administer 8-week minimum course of systemic antibiotics</td>
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<td></td>
<td>• Often found on the dorsal carpus or dorsolateral metatarsus</td>
<td>• Prevent licking with Elizabethan collar or bandaging</td>
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<tr>
<td></td>
<td>• Multifactorial, self-inflicted (by licking) disorder often associated with</td>
<td>• Identify and treat underlying cause(s)</td>
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<td></td>
<td>underlying atopic dermatitis, food allergy, trauma, endocrinopathy, bone pain,</td>
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<td></td>
<td>neuropathy, or behavioral causes</td>
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<td></td>
<td>• Perpetuated by secondary deep pyoderma</td>
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<td>Bacterial Furunculosis (Figure 13)</td>
<td>• Focal to multifocal areas of thick crusting, alopecia, inflamed bullae, and/</td>
<td>• Administer 6- to 12-week course of systemic antibiotics</td>
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<td></td>
<td>or ulcerative draining skin lesions, often pruritic and/or painful</td>
<td>• Apply antibacterial shampoos/sprays frequently</td>
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<tr>
<td></td>
<td>• Often associated with underlying atopic dermatitis, food allergy, endocrinopathy, demodiconis, etc</td>
<td>• Identify and address underlying cause(s)</td>
</tr>
<tr>
<td>Callus Furunculosis</td>
<td>• Inflammation, swelling, ulceration, and draining tracts affecting pressure</td>
<td>• Treat infection with mupirocin Q 12 H and 6-week minimum course of systemic antibiotics</td>
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<td>points, such as lateral elbows/ hocks or sternal callous in deep-chested breeds</td>
<td>• Use hydrotherapy (see Physical Rehabilitation for Veterinary Practices, page 14) and bandaging for open lesions</td>
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<td></td>
<td>• Most commonly affects giant breeds</td>
<td>• Ensure dog lays on padded bedding or has padded dressings placed over wound (ie, DogLeggs, doglegs.com)</td>
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<tr>
<td>Canine Acne (Figure 14)</td>
<td>• Nonpainful/nonpruritic papules, pustules, bullae +/- draining tracts on the</td>
<td>• Administer mupirocin Q 12 H or benzoyl peroxide gel Q 24 H until lesions resolve; then 1 to 2 times weekly as needed for maintenance</td>
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<td></td>
<td>chin or muzzle; variably painful and pruritic</td>
<td>• For severe cases, administer a 4-week minimum course of systemic antibiotics</td>
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<td>• More common in large, young, short-coated dogs</td>
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<td></td>
<td>• May be induced by friction or trauma to the chin, which pushes the short hairs</td>
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<td></td>
<td>under the skin</td>
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<tr>
<td>Pedal Folliculitis/ Furunculosis (Figures 15 and 16)</td>
<td>• Interdigital erythema, pustules, bullae, nodules, fistulas, alopecia, and</td>
<td>• Administer mupirocin Q 12 H or benzoyl peroxide gel Q 24 H until lesions resolve; then 1 to 2 times weekly as needed for maintenance</td>
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<tr>
<td></td>
<td>swelling; variably painful and pruritic</td>
<td>• For severe cases, administer a 4-week minimum course of systemic antibiotics</td>
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<td>• Often seen in large, short-coated dogs</td>
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<td></td>
<td>• May be associated with regional lymphadenopathy and/or swelling of</td>
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<td></td>
<td>associated metacarpus or metatarsus</td>
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<tr>
<td></td>
<td>• Often associated with underlying atopic dermatitis, food allergy, endocrinopathy, demodiconis, etc</td>
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<td>• In some cases isolated lesions are associated with abnormal weight bearing and</td>
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<td>formation of interdigital cysts, often between P4 and P5</td>
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<td>Post-Grooming Furunculosis (Figure 17)</td>
<td>• Usually occurs within 24 to 48 H after grooming</td>
<td>• Obtain swab or biopsy for culture/sensitivity and, pending culture results, use cytology to determine initial systemic antibiotic therapy:</td>
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<td></td>
<td>• Areas of intense localized erythema and swelling that evolve into punctuate foci of erythema, erosion, painful hemorrhagic bullae, and drainage</td>
<td>» Fluoroquinolone if rod bacteria are found</td>
</tr>
<tr>
<td></td>
<td>• Lesions are usually on the dorsal trunk and occur more commonly in short-coated dogs. Affected dogs may be lethargic or febrile.</td>
<td>» Cefaloheporin if cocci are found</td>
</tr>
<tr>
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<td>• Staphylococcus pseudintermedius, Pseudomonas, Proteus, and Escherichia coli</td>
<td>• Sedation usually needed for clipping and cleaning of lesions</td>
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<td>have been grown in pure or mixed culture from lesions.</td>
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<td>• Causal factors include contaminated shampoos or grooming apparatus and</td>
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<td>over-zealous scrubbing of short hairs “against the grain”</td>
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</table>

Notes: • In deep pyoderma, all oral antibiotic treatment should be continued 2 to 3 weeks past clinical resolution; a recheck visit is needed prior to discontinuation of therapy. • Ideally, antibiotic selection should always be based on culture and sensitivity for any case of deep pyoderma.

References
• Due to side effects and toxicity potential, aminoglycosides and chloramphenicol are only used, based on culture/sensitivity data, as a last resort and with careful laboratory monitoring in cases of methicillin-resistant infections.

Antibiotic Administration
After an antibiotic has been selected, it should be dispensed at the correct dosage, administered at the correct dosing interval, and used for a sufficient period. Underdosing an antibiotic due to client concerns about cost will only be more expensive in the long run due to increased time to cure and increased chance of inducing bacterial resistance, necessitating more expenses, such as cultures and additional antibiotic courses.

The duration of antibiotic therapy depends on several factors, including depth of pyoderma, underlying diseases, and use of concomitant topical therapies.
• In general, superficial pyoderma usually resolve with a 3-week course of an antimicrobial; treatment should continue 1 to 2 weeks beyond healing/resolution of cutaneous lesions.
• For deep pyoderma, a 6- to 12-week course of treatment (3 weeks beyond resolution of cutaneous lesions) or even longer may be required to resolve deep pockets of infection.
• Regular rechecks are important to determine response to therapy and need for medication refills or therapy modifications.

See todaysveterinarypractice.com/resources.asp to view and download a comprehensive table outlining Commonly Used Antibiotics for Canine Pyoderma.

IMMUNOSTIMULANTS
When an underlying cause cannot be found in cases of canine recurrent pyoderma, use of immunostimulants may be of benefit. Two commercial bacterins are currently available.

Staphage Lysate
Staphage lysate (SPL, delmont.com) is derived from lysed-killed S aureus and is given subcutaneously. In one study of 21 dogs with idiopathic superficial recurrent pyoderma treated with either bacterin or placebo (and an initial 6-week course of oral antibiotics), dogs given antibiotics plus the bacterin (n = 13) had a significantly better response after 18 weeks of treatment than those given antibiotic plus placebo. Although there is no published supportive data, staphage lysate may also be helpful as adjunctive therapy in atopic dogs that continue to develop recurrent pyoderma despite appropriate management of their atopic dermatitis.

ImmunoRegulin
ImmunoRegulin (neogen.com) is an immunostimulant derived from killed Propionibacterium acnes and administered IV. In one study, dogs with chronic recurrent pyoderma were treated with antibiotics plus IV injections of either P acnes or placebo. Eighty percent (12/15) of the dogs treated with antibiotics and P acnes responded with significant improvement or complete remission of lesions at the end of the 12-week treatment schedule compared with 38% (5/13) of the dogs treated with antibiotics and placebo.
Other Immunostimulants

A more recent, blinded study of an autogenous *S. intermedius* (pseud-intermedius) bacterin (prepared by culturing the individual dog's pyoderma lesions) compared the bacterin versus placebo in 10 dogs with idiopathic recurrent pyoderma; all were initially treated with a 4-week course of oral antibiotics. After 5 weeks, clinical scores were not significantly different between groups; however, at week 10, the placebo treated group had statistically higher lesion scores compared to the treatment group.\(^1\)

Unfortunately, this product is not commercially available.

Finally, genome sequencing technology and proteome approaches to identify surface-exposed staphylococcal bacterial proteins may lead to development of vaccines to induce protective immunity; the entire genome sequence of *S. pseudintermedius* has recently been determined, and this may lead to new and effective approaches for the prevention and treatment of canine pyoderma.\(^2\) [ ]

**FLUOROQUINOLONES: USE WITH CAUTION**

Use of fluoroquinolones should be carefully assessed in view of associations found between:

- Fluoroquinolone use in hospitals and methicillin resistance in *S. aureus* (MRSA) resistance, when they are used in cases of heteroresistant MRSA, they can select for high-level methicillin resistant mutants (which are not only resistant to fluoroquinolones but also to most other antibiotics).\(^3\)

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**MOMETAMAX® (MENGTAMICIN SULFATE, USP; MEMOTAMUS FURARO MONOHYDRATE, AND CLOTRIMAZOLE, USP, OTIC SUSPENSION) VETERINARY FOR Otic Use in Dogs Only**

**BRIEF SUMMARY** (For full prescribing information, see package insert)

**CAUTION** Federal law restricts this drug to use by or on the order of a licensed veterinarian.

**WARNING** Use of this component has been associated with deafness or partial hearing loss in a small number of sensitive dogs (e.g., geriatric). The hearing loss is usually temporary. If hearing or vestibular dysfunction is noted during the course of treatment, discontinue use of MOMETAMAX® Otic Suspension immediately and flush the ear canal thoroughly with a normal saline solution.

Corticosteroids administered to dogs, rabbits, and rodents during pregnancy have resulted in stillbirth or abortion. Other congenital anomalies including deformed lungs, placenta, and anesthesia have been reported in offspring of dogs that received corticosteroids during pregnancy.

Fluoroquinolones are known mutagens that have been shown to cause cartilage erosions of weight bearing joints and other signs of arthropathy in immature animals of various species.

**INDICATIONS**

POSATEX® Otic Suspension is contraindicated in dogs with known or suspected hypersensitivity to quinolones, mometasone furoate monohydrate, or posaconazole.

Do not use in dogs with known tympanic perforation (see PRECAUTIONS).

**PRECAUTIONS**

The use of POSATEX® Otic Suspension in dogs used for breeding purposes, during pregnancy or in lactating bitches, has not been evaluated. The systemic administration of quinolones has been shown to produce cartilage erosions of weight bearing joints and other signs of arthropathy in immature animals of various species.

**WARNINGS:**

**Human Warnings:** Not for use in humans. Keep out of reach of children.

**Animal Warnings:** Do not administer orally. Immediately discontinue use of POSATEX® Otic Suspension if hearing loss is observed during treatment (see ADVERSE REACTIONS).

**ADVERSE REACTIONS**

In the field study, 143 dogs were treated with POSATEX® Otic Suspension. Of those, 1 dog with bilateral otitis developed transient hearing loss. POSATEX® Otic Suspension treatment was discontinued and the condition resolved after one week.

**HOW SUPPLIED**

POSATEX® Otic Suspension is available in 7.5 g, 15 g, and 30 g plastic bottles.

Made in Germany

Intervet/Schering-Plough Animal Health.


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**NADA #141-177. Approved by FDA.**

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Fluoroquinolones are known mutagens that have been shown to cause cartilage erosions of weight bearing joints and other signs of arthropathy in immature animals of various species.

**INDICATIONS**

POSATEX® Otic Suspension is indicated for the treatment of otitis externa in dogs associated with susceptible strains of yeast (*Malassezia pachydermatis*) and bacteria (coagulase positive staphylococci, *Enterococcus fecalis*, *Propionibacterium acne*, and *alpha-hemolytic streptococci*).

**CONTRAINDICATIONS**

POSATEX® Otic Suspension is contraindicated in dogs with known or suspected hypersensitivity to quinolones, mometasone furoate monohydrate, or posaconazole.

Do not use in dogs with known tympanic perforation (see PRECAUTIONS).

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01/10
The final article in this series will focus specifically on methicillin-resistant canine pyoderma.

HPA = hypothalamic–pituitary–adrenal; MIC = minimum inhibitory concentration

Correction
In this series’ first article, Disease Overview & Diagnosis, a reference was missing from the text. Visit todaysveterinarypractice.com to view the corrected article and references.

References