INSIGHTS IN DERMATOLOGY

Diagnosis and Treatment of Bacterial and Parasitic Dermatologic Emergencies in Dogs

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Dermatologic complaints are common in veterinary medicine, and some require or prompt owners to seek emergency treatment. Common infectious canine dermatologic diseases seen in emergency practice include deep pyoderma, furunculosis, post-grooming furunculosis, necrotizing fasciitis, toxic shock syndrome (TSS)–like disease, demodicosis, and sarcoptic mange. This article presents the approach to these diseases from the emergency clinician perspective.

BACTERIAL DISEASES

Deep Pyoderma

Etiology and Clinical Signs

Deep pyoderma is an infection of the lower skin layers (i.e., dermis, subcutis), typically with *Staphylococcus* species, and is usually secondary to underlying disease. Draining tracts are common and often associated with nodules (**FIGURE 1**). Papules and nodules may be topped by bullae that rupture to release hemorrhagic to purulent fluid. The skin may appear thickened, edematous, or friable. As exudate from ulcers and draining tracts dries, crusts form. Cellulitis and furunculosis may occur. Localized pain and regional lymphadenopathy may occur with severe lesions.

Diagnostic Testing

Cytology reveals pyogranulomatous inflammation with coccoid bacteria, and samples should be carefully examined for bacterial and fungal organisms, although inflammatory exudate may dilute the bacteria such that they are not seen. Samples for culture should be collected from draining tracts or underneath crusts. In most cases, waiting for culture results to prescribe antimicrobials is more appropriate than initiating

Abstract

Emergency clinicians commonly see patients with dermatologic complaints. This article discusses the approach to diagnosis and treatment of common infectious canine dermatologic diseases from the perspective of the emergency clinician, including deep pyoderma, furunculosis, post-grooming furunculosis, necrotizing fasciitis, toxic shock syndrome–like disease, demodicosis, and sarcoptic mange.

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Take-Home Points

- Dermatologic examination is an important component of evaluation for patients presenting for fever, lethargy, or pain. Cytology should be performed if cutaneous lesions are noted.
- Deep pyoderma is markedly more inflammatory than superficial pyoderma, and treatment requires effective management of the infection, inflammation, and any predisposing conditions.
- Pododermatitis with furunculosis is a common manifestation of severe allergy in short-coated breeds and can cause lameness.
- Necrotizing fasciitis should be considered in patients presenting with lameness and edema. Early identification and aggressive management are crucial for survival.
- Hospitalization is indicated for necrotizing fasciitis and toxic shock syndrome–like disease, which are life-threatening dermatologic emergencies.

empiric antibiotics. Current recommendations are to administer culture-based antimicrobials for a minimum of 6 weeks and until at least 2 weeks after resolution.[1] Future recommendations may call for ending treatment upon clinical resolution. To increase drug penetration to the infection site, antimicrobials should be prescribed at the high end of the dosing range. If the disease persists after 6 to 8 weeks of therapy, a repeat culture may be necessary. Biopsy for histopathology and tissue culture may exclude similar differentials (**BOX 1**).

Treatment

Chlorhexidine-based topical therapies help with surface

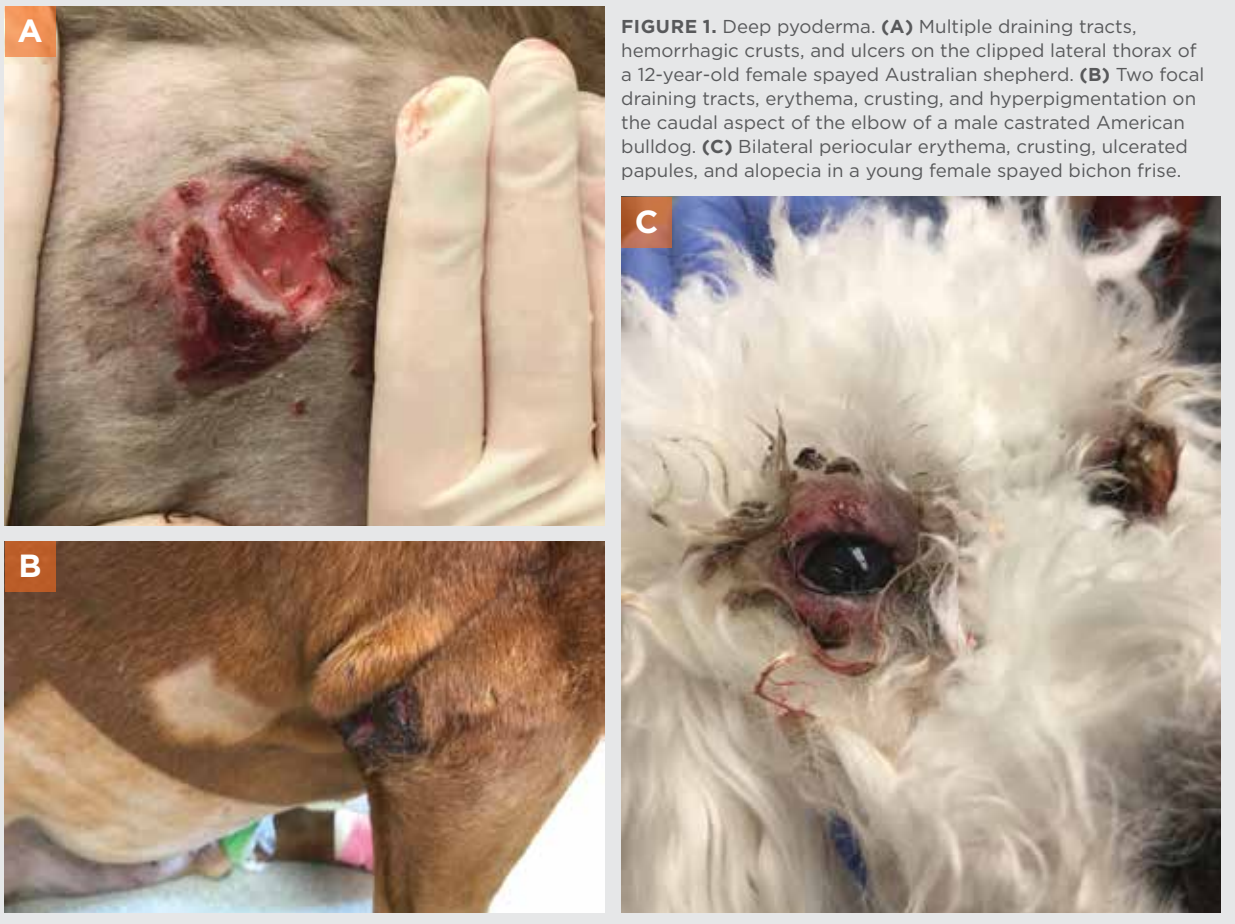

FIGURE 1. Deep pyoderma. **(A)** Multiple draining tracts, hemorrhagic crusts, and ulcers on the clipped lateral thorax of a 12-year-old female spayed Australian shepherd. **(B)** Two focal draining tracts, erythema, crusting, and hyperpigmentation on the caudal aspect of the elbow of a male castrated American bulldog. **(C)** Bilateral periocular erythema, crusting, ulcerated papules, and alopecia in a young female spayed bichon frise.

BOX 1 Diagnostic Approach to Nodules With Draining Tracts

Infectious and immune-mediated differentials include:

- Atypical bacterial infections
  - *Mycobacterium* species
  - *Nocardia* species
  - *Actinomyces* species
- Fungal infections
  - *Blastomyces dermatitidis*
  - *Histoplasma capsulatum*
  - *Cryptococcus neoformans*
  - *Coccidioides* species
  - Oomycosis (*Pythium* species, *Lagenidium* species)
  - *Sporothrix schenckii*
  - Mycetoma
  - Phaeohyphomycosis
  - Dermatophytic kerion
- Immune-mediated conditions
  - Sterile nodular panniculitis
  - Sterile pyogranuloma syndrome
  - Histiocytosis
  - Foreign body reactions
  - Neoplasia (numerous)
  - Amyloidosis (rare)

When deep pyoderma is suspected, but the patient has failed to respond to culture-based antibiotics, biopsy and tissue culture should be performed. Aerobic, anaerobic, fungal, and mycobacterial culture and polymerase chain reaction testing are recommended. Ideally, histopathology samples should be submitted to a dermatopathologist. A diagnosis of sterile nodular disease requires all cultures and special stains to be negative for causative organisms.

infection. Ointments help address focal lesions, and mupirocin is often used due to its tissue penetration, particularly in nonintact skin.[2,3] However, this medication is most commonly used for human methicillin-resistant infections and should be prescribed judiciously in veterinary patients for the sake of antimicrobial stewardship.

Controlling inflammation is critical to management of deep pyoderma. Glucocorticoids are most effective for reducing skin inflammation, and extended tapers at anti-inflammatory doses may be required. Underlying causes and comorbidities should be considered when prescribing glucocorticoids for deep pyoderma, and patients should be monitored for response to therapy. Nonsteroidal anti-inflammatory drugs (NSAIDs) do not adequately reduce inflammation in deep pyoderma; therefore, alternative pain management strategies should be used. Topical corticosteroids may be helpful for focal lesions or when systemic glucocorticoids are contraindicated. Referral for fluorescent light energy therapy can be considered.[4] Once infection has been controlled, additional work-up for the underlying disease can be performed.

Furunculosis

Etiology and Clinical Signs

Furunculosis, or rupture of the hair follicle underneath the skin, is often associated with deep pyoderma. Keratin released underneath the skin provokes a foreign body response with robust pyogranulomatous inflammation. Furunculosis due to allergic skin disease commonly occurs on the paws and chin. Pedal and chin furunculosis are more common in short-coated breeds, especially bulldogs (i.e., English, French, and American), pit bull terriers, and bull terriers.

In the case of pododermatitis with furunculosis, it is thought that abnormal weightbearing combined with the short haircoat puts pressure on the interdigital hairs and predisposes follicles to rupture. Pododermatitis with furunculosis affects the interdigital skin (**FIGURE 2A**), and deep pyoderma is a common feature. It is often due to allergic skin disease but also develops secondary to demodicosis (**FIGURE 2B**), which is important to exclude.

Affected patients may present with lameness and regional lymphadenopathy. Over time, scarring, fibrosis, and false paw pad formation may cause permanent changes (**FIGURE 2C**). In very severe cases, surgery may be necessary.

Treatment

Deep pyoderma should be addressed if present. Multiple species may be cultured from samples taken from the paws. In these cases, antimicrobial therapy should target β-hemolytic *Staphylococcus* species, especially *Staphylococcus pseudintermedius* and *Staphylococcus schleiferi*.

Soaking with dilute sodium hypochlorite or magnesium sulfate may be helpful.

FIGURE 2. Pododermatitis with furunculosis. **(A)** Interdigital erythema, edema, draining tracts, and a few small interdigital nodules on the paw of a 5-year-old female spayed pit bull terrier. **(B)** Digital edema, erythema, comedones, alopecia, and ulceration on the paw of a moderately affected 8-year-old male castrated Shih Tzu with demodicosis caused by *Demodex injai*. **(C)** Interdigital fibrosis and scarring alopecia with false paw pad formation in a chronically affected 6-year-old male castrated English bulldog after control of active disease.

Figure 2A: courtesy Jennifer Clegg, University of Illinois. Figure 2B: courtesy Lindsey Citron, University of Pennsylvania.

Post-Grooming Furunculosis

Etiology and Clinical Signs

Post-grooming furunculosis is a painful deep pyoderma associated with recent grooming, particularly bathing. Risk factors include diluting the shampoo ahead of time, using old shampoo, and brushing or coat stripping just before or after bathing.[5] *Pseudomonas aeruginosa* can be found in water and is thought to overgrow in old or diluted shampoo and enter the skin via microtrauma to hair follicles.[5]

Typical lesions are crusts, erythematous papules, nodules, and dorsal draining tracts.[5] Systemic signs, such as fever, lethargy, and anorexia, may precede development of cutaneous lesions.[5] The associated pain can be misinterpreted as acute back pain, particularly in long-haired breeds where lesions may be hidden.

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Treatment

Post-grooming furunculosis is the only dermatologic condition for which empiric fluoroquinolones may be recommended, although empiric therapy should be reserved for systemically ill patients when it is not feasible to wait for culture results. This is due to the acute presentation and the fact that *P aeruginosa* is the most commonly cultured organism.[5] Because veterinary-labeled fluoroquinolones are expensive, it can be tempting to use lower doses, but it is important to prescribe at the high end of the dosing range. Culture is recommended, and antimicrobial therapy can be adjusted pending results.

Clipping may allow visualization of the lesions and application of topical therapy. Chlorhexidine 2% solution can be applied as a spray. Bathing should be delayed for a week, after which chlorhexidine shampoo

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may be prescribed. Any recently used shampoo should be discarded. Grooming tools should also be discarded or, at the least, thoroughly disinfected before use.

Hospitalization may be warranted for pain management and initial intravenous antimicrobial therapy. Most dogs respond well to fluoroquinolone antibiotic therapy.

Necrotizing Fasciitis

Etiology and Clinical Signs

Necrotizing fasciitis is a bacterial infection of the subcutis and underlying fascia, sometimes reported to occur after recent trauma. *Streptococcus canis* is the most commonly implicated organism, but other species of bacteria may also be isolated.[6] Necrotizing fasciitis is often fatal; therefore, rapid identification of affected patients is critical. In a recent study, the only dogs with necrotizing fasciitis to survive to discharge were treated with both antibiotics and surgery.[6] Systemic inflammation can be severe enough to be fatal, with patients developing disseminated intravascular coagulation (DIC) and multiple organ dysfunction syndrome (MODS).

FIGURE 3. Well-demarcated burgundy to black patches with surrounding erythema on the ventral abdominal skin of an adult male castrated American bulldog with necrotizing fasciitis. On palpation, the skin was markedly colder than the surrounding unaffected skin.

Patients may present with fever, pain, lethargy, or loss of appetite. In a recent case series, the most common presenting complaint was lameness, with edema noted on physical examination.[6] In acute cases, pitting edema is common and heat may be noted on palpation. In advanced cases where necrosis has developed, the tissue may feel colder and there may be an area of the skin that appears dark burgundy to black (**FIGURE 3**). Draining tracts may develop. Thorough dermatologic examination is indicated in any patient with fever without an obvious cause.

Diagnostic Testing

Clinicopathological abnormalities may include a left shift, lymphopenia, hyponatremia, hypocalcemia, decreased bicarbonate, hypoalbuminemia, and elevated liver enzymes.[6] Cytology performed on aspirates of the tissue may reveal septic suppurative inflammation with bacteria. Chains of cocci support the diagnosis.

Treatment

Treatment of necrotizing fasciitis should involve a combination of antimicrobial therapy and surgical management for debridement. Amputation may be required. Hospitalization for intravenous antimicrobial therapy, aggressive wound management, and monitoring is advised. Appropriate empiric antibiotics include ampicillin/sulbactam and clindamycin. Patients receiving fluoroquinolones may have a worse outcome; therefore, it is recommended to avoid fluoroquinolones when necrotizing fasciitis is a differential.[6] Culture results should be obtained. Pain management is often required, but NSAID use is controversial.

Toxic Shock Syndrome–Like Disease

Etiology and Clinical Signs

There are reports of TSS-like diseases in dogs, usually associated with streptococcal or staphylococcal infections. Patients with this condition have skin infection that causes marked systemic inflammation, which is thought to result from release of antigenic

substances by bacteria. TSS-like disease is rapidly progressive; affected dogs may develop hypotension, increased vascular permeability, and vasculitis.[7] Ultimately, DIC and MODS may develop.

Dogs with TSS-like disease may present with fever, lethargy, and anorexia or skin lesions. Affected dogs have significant erythema and edema of the skin, either localized or generalized (**FIGURE 4**). The skin may be painful, and vesicles or pustules may develop.

FIGURE 4. Toxic shock syndrome–like disease associated with methicillin-resistant *Staphylococcus pseudintermedius* in an adult female spayed mixed-breed dog. **(A)** Moderate to severe generalized erythema, most apparent over the thinly haired ventrum, with slight exudation of clear fluid. **(B)** Moist, exudative erythematous dermatitis of the lateral head and neck with marked erythema of the pinna and multifocal papules affecting the concave pinna. The 2 dark hemorrhagic crusts are biopsy sites.

Figure 5C: courtesy Peter Canning, MedVet Cincinnati

FIGURE 5. Canine demodicosis. **(A)** Diffuse alopecia, scale, and lichenification in an 8-year-old female spayed Chihuahua with generalized adult-onset demodicosis due to *Demodex canis*. **(B)** Patchy alopecia in an adult American Staffordshire terrier with demodicosis. **(C)** Focal alopecia, erythema, edema, comedones, and pinpoint ulcers on the paw of a 14-year-old male neutered Maltese with localized demodicosis.

Demodicosis can be clinically severe when it results in furunculosis and deep pyoderma, causing edema, erythema, crusts, nodules, and draining tracts, often affecting the paws, muzzle, and periocular regions.

Diagnostic Testing

Skin cytology reveals suppurative inflammation with numerous cocci. Chains of cocci may increase the level of concern for TSS-like disease. Common clinicopathological abnormalities include an inflammatory leukogram with a left shift and hypoalbuminemia.[7] Culture (superficial or tissue) should be performed in all cases. Biopsy for histopathology is recommended, which allows for tissue culture. The surface of the skin should not be clipped or scrubbed prior to biopsy.

Treatment

Hospitalization is recommended for supportive care and prompt treatment with intravenous antibiotics. Ampicillin/sulbactam and clindamycin are rational choices for empiric therapy. If methicillin-resistant staphylococcal infection is suspected, use of a higher-tier antimicrobial can be considered, with a plan to de-escalate pending culture results. Pain management may be needed. Judicious use of glucocorticoids may be necessary to address systemic inflammation.

PARASITIC DISEASES

Demodicosis

Etiology and Clinical Signs

Demodex canis, the most common *Demodex* species in dogs, inhabits hair follicles. Typical lesions include alopecia, scale, papules, and comedones. Demodicosis is typically nonpruritic, though secondary infection with bacteria or yeast may cause pruritus. Demodicosis can be clinically severe when it results in furunculosis and deep pyoderma, causing edema, erythema, crusts, nodules, and draining tracts, often affecting the paws, muzzle, and periocular regions (**FIGURE 5**).

Diagnostic Testing

Demodicosis is usually diagnosed via deep skin scraping, but this may be challenging if only the paws and periocular areas are affected. Trichography can be used but may not be as sensitive diagnostically as scraping.[8] Sampling techniques using acetate tape and exudate from draining tracts have also been described.[8] Biopsy may be required for definitive diagnosis.

Treatment

Isoxazolines, including afoxolaner, fluralaner, lotilaner, and sarolaner, are rapidly becoming the preeminent treatment for demodicosis.[8] Empiric therapy with isoxazolines can be considered. Topical amitraz is the only treatment for canine demodicosis that is approved by the U.S. Food and Drug Administration, but it has fallen out of common use due to the risk of adverse effects. When isoxazolines are contraindicated, such as in patients with epilepsy, therapy with daily ivermectin

FIGURE 6. Sarcoptic mange in a 7-year-old male castrated Pembroke Welsh corgi, resulting in diffuse scale, erythema, and self-induced hair loss. Note that the most erythematous region is the lateral elbow.

Figure 6: courtesy Lindsey Citron, University of Pennsylvania

can be considered. Prior to prescribing daily ivermectin, dogs should be screened for *MDR1* (multidrug resistance 1 or *ABCB1* [adenosine triphosphate–binding cassette subfamily B member 1]) gene mutations. In the emergency setting, if an isoxazoline cannot be safely prescribed, the patient should be referred to its primary care veterinarian for screening and ivermectin therapy.

The patient should be evaluated for deep pyoderma, superficial pyoderma, and yeast overgrowth, and these conditions should be treated if present. Systemic glucocorticoids should not be used, nor should oclacitinib or cyclosporine. Lokivetmab can be administered to pruritic patients. Shampoos containing benzoyl peroxide may be helpful.

Patients with adult-onset demodicosis should be referred to their primary care veterinarian for ongoing management and evaluation for predisposing diseases. Treatment should continue until negative results are obtained from 2 consecutive skin scrapings.

Sarcoptic Mange

Etiology and Clinical Signs

Sarcoptes scabiei var *canis*, the canine scabies mite, burrows in the epidermis. Although the mites are highly contagious, lesion and pruritus severity can differ between individuals, which is thought to be due to variable hypersensitivity to the mites. Affected patients are intensely pruritic. Acutely, few papules may be present. Over time, crust, scale, alopecia, and lichenification develop. Initially, sarcoptic mange affects the pinnal margins, lateral elbows, hocks, and ventrum, but it generalizes over time (**FIGURE 6**). Sarcoptic mange is diagnosed by superficial skin scraping; however, false-negative results are common.

Treatment

Once *Sarcoptes* mites are diagnosed or clinically suspected, treatment should be implemented. Isoxazolines are highly effective. Macrocyclic lactones are effective, but care should be taken with off-label use in patients with *MDR1*/*ABCB1* gene mutation. Treatment should be continued for at least 6 weeks.[9] All dogs in the home should be treated. If there is no veterinarian-client-patient relationship for the other pets in the home, the client should be referred to their primary care veterinarian for those pets.

All patients should be evaluated cytologically for secondary infection with bacteria or yeast and treated accordingly with topical therapy. Pruritus may worsen following treatment as the mites die off rapidly. Short-term glucocorticoids may be helpful to provide pruritus relief in the first week of treatment.

Owners should be informed of the potential for zoonosis and directed to consult their physician if any lesions develop. TVP

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