

Infections

Pyoderma



Basics

DEFINITION

Bacterial infection of the skin

PATHOPHYSIOLOGY

Skin infections occur when the surface integrity of the skin has been broken, the skin has become macerated by chronic exposure to moisture, normal bacterial flora have been altered, circulation has been impaired, or immunocompetency has been compromised.

SYSTEMS AFFECTED

Skin/Exocrine

GENETICS

N/A

INCIDENCE/PREVALENCE

- Dogs—very common
- Cats—uncommon

GEOGRAPHIC DISTRIBUTION

N/A

SIGNALMENT

Species

Dogs and cats

Breed Predilections

- Breeds with short coats, skin folds, or pressure calluses
- German shepherds develop a severe, deep pyoderma that may only partially respond to antibiotics and frequently relapses.

Mean Age and Range

Age of onset usually related to underlying cause

Predominant Sex

N/A

SIGNS

General Comments

- Superficial—usually involves the trunk; extent of lesions may be obscured by the hair coat.
- Deep—often affects the chin, bridge of the nose, pressure points, and feet; may be generalized

Historical Findings

- Acute or gradual onset
- Variable pruritus—underlying cause may be pruritic or the staphylococcal infection itself may be pruritic

Physical Examination Findings

- Papules

- Pustules
- Hemorrhagic bullae
- Crusts
- Epidermal collarettes
- Circular erythematous or hyperpigmented spots
- Target lesions
- Alopecia, moth-eaten hair coat
- Scaling
- Lichenification
- Abscess
- Furunculosis, cellulitis

CAUSES

- *Staphylococcus intermedius*—most frequent
- *Pasteurella multocida*—an important pathogen in cats
- Deep—may be complicated by gram-negative organisms (e.g., *E. coli*, *Proteus* spp., *Pseudomonas* spp.)
- Rarely caused by higher bacteria (e.g., *Actinomyces*, *Nocardia*, *Mycobacteria*, *Actinobacillus*)

RISK FACTORS

- Allergy—flea; atopy; food; contact
- Parasites—especially *Demodex*
- Fungal infection—dermatophyte
- Endocrine disease—hypothyroidism; hyperadrenocorticism; sex hormone imbalance
- Immune incompetency—glucocorticoids; young animals
- Seborrhea—acne; schnauzer comedo syndrome
- Conformation—short coat; skin folds
- Trauma—pressure points; grooming; scratching; rooting behavior; irritants
- Foreign body—foxtail; grass awn



Diagnosis

DIFFERENTIAL DIAGNOSIS

- Allergy—pruritus usually precedes the rash; pruritus will not resolve with resolution of the pyoderma.
- Endocrine problem causing a relapsing pyoderma—consider if pruritus resolves with resolution of the pyoderma; reports of polydipsia, polyuria, pendulous abdomen, lethargy, weight gain, and/or signs of feminization
- Flea allergy or atopy—may be seasonal
- Pustular disease—superficial staphylococcal pyoderma; dermatophytosis; demodicosis; pemphigus foliaceus; and subcorneal pustular dermatosis

- Furunculosis—deep staphylococcal pyoderma; higher bacterial infection; demodicosis; dermatophytosis; opportunistic fungal infections; deep fungal infections; panniculitis; and zinc-responsive dermatosis
- Superficial pyoderma in short-coated breeds is often misdiagnosed as urticaria, because of the acute onset of pruritic papules misdiagnosed as hives.

CBC/BIOCHEMISTRY/URINALYSIS

- Superficial—normal or may reflect the underlying cause (e.g., anemia owing to hypothyroidism; stress leukogram and high serum alkaline phosphatase owing to Cushing disease; eosinophilia owing to parasitism)
- Generalized, deep—may show leukocytosis with a left shift and hyperglobulinemia; also changes related to the underlying cause

OTHER LABORATORY TESTS

N/A

IMAGING

N/A

DIAGNOSTIC PROCEDURES

- Skin scrapings, dermatophyte culture, intradermal allergy testing, hypoallergenic food trial, endocrine tests—identify the underlying cause
- Skin biopsy
- Direct smear from intact pustule—neutrophils engulfing bacteria
- Cytology—differentiate pemphigus foliaceus (acantholytic keratinocytes) and deep fungal infections (blastomycosis, cryptococcosis) from pyodermas; of tissue grains may identify filamentous organisms characteristic of higher bacteria

Culture

- Usually positive for *S. intermedius*
- Other gram-negative organisms besides staphylococci and higher bacteria may be cultured from deep pyodermas.
- Contents of an intact pustule—most reliable results
- Punch biopsy obtained by sterile technique—if no pustules are noted; more likely to get false-negative results
- Freshly expressed exudate from a draining tract or beneath a crust—may yield the pathogen or a contaminant; least reliable method

PATHOLOGIC FINDINGS

- Subcorneal pustules
- Intraepidermal neutrophilic microabscesses
- Perifolliculitis
- Folliculitis
- Furunculosis
- Nodular to diffuse dermatitis
- Panniculitis
- Inflammatory reaction—suppurative or pyogranulomatous
- Tissue grains within pyogranulomas—observed most often with *Staphylococcus*, *Actinomyces*, *Actinobacillus*, and *Nocardia*

- Special stains—identify gram-negative bacteria or acid-fast organisms



Treatment

APPROPRIATE HEALTH CARE

Usually outpatient, except for severe, generalized deep pyodermas

NURSING CARE

- Severe, generalized, deep—may require IV fluids, parenteral antibiotics, or daily whirlpool baths
- Benzoyl peroxide or chlorhexidine shampoos—remove surface debris
- Whirlpool baths—deep pyodermas; remove crusted exudate; encourage drainage

ACTIVITY

No restriction

DIET

- Hypoallergenic if secondary to food allergy; otherwise a high-quality, well-balanced dog food
- Avoid high-protein, poor-quality “bargain” diets and excessive supplementation.

CLIENT EDUCATION

N/A

SURGICAL CONSIDERATIONS

Fold pyodermas require surgical correction to prevent recurrence.



Medications

DRUGS OF CHOICE

- *S. intermedius* isolates—usually susceptible to cephalosporins, cloxacillin, oxacillin, methicillin, amoxicillin-clavulanate, erythromycin, and chloramphenicol; somewhat less responsive to lincomycin and trimethoprim-sulfonamide; frequently resistant to amoxicillin, ampicillin, penicillin, tetracycline, and sulfonamides
- Amoxicillin-clavulanate—most isolates of *Staphylococcus* and *P. multocida* susceptible; generally effective for skin infections in cats
- Superficial—initially may be treated empirically with one of the antibiotics listed above
- Recurrent, resistant, or deep—base antibiotic therapy on culture and sensitivity testing
- Multiple organisms with different antibiotic sensitivities—choose antibiotic on basis of staphylococcal susceptibility

CONTRAINDICATIONS

Steroids—will encourage resistance and recurrence even when used concurrently with antibiotics

PRECAUTIONS

- Erythromycin, lincomycin, and oxacillin—vomiting; administer with small amount of food
- Gentamicin and kanamycin—renal toxicity usually precludes their prolonged systemic use.
- Trimethoprim-sulfa—associated with keratoconjunctivitis sicca, fever, hepatotoxicity, polyarthritis, and hematologic abnormalities
- Chloramphenicol—use with caution in cats; may cause mild, reversible anemia in dogs

POSSIBLE INTERACTIONS

Trimethoprim-sulfa—may lead to low thyroid test results

ALTERNATIVE DRUGS

Staphage lysate, staphoid AB, or autogenous bacterins—may improve antibiotic efficacy and decrease recurrence in a small percentage of cases



Follow-Up

PATIENT MONITORING

Administer antibiotics for a minimum of 2 weeks beyond clinical cure; this is usually about 1 month for superficial pyodermas, and 2–3—months for deep pyodermas.

PREVENTION/AVOIDANCE

- Routine bathing with benzoyl peroxide or chlorhexidine shampoos—may help prevent recurrences
- Some cases that continue to relapse may be managed with subminimal inhibitory concentrations of antibiotics (long-term/low-dose).
- Padded bedding—may ease pressure point pyodermas
- Topical benzoyl peroxide gel or mupirocin ointment may be helpful adjunct therapies

POSSIBLE COMPLICATIONS

Bacteremia and septicemia

EXPECTED COURSE AND PROGNOSIS

Likely to be recurrent or nonresponsive if underlying cause is not identified and effectively managed



Miscellaneous

ASSOCIATED CONDITIONS

N/A

AGE-RELATED FACTORS

- Impetigo—affects young dogs before puberty; associated with poor husbandry; often requires only topical therapy
- Superficial pustular dermatitis—occurs in kittens; associated with overzealous “mouthing” by the queen
- Pyoderma secondary to atopy—usually begins at 1–3 years of age
- Pyoderma secondary to endocrine disorders—usually begins in middle adulthood

ZOONOTIC POTENTIAL

- Cutaneous tuberculosis—rare
- Feline leprosy—unknown

PREGNANCY

N/A



IMAGES



Staphylococcal Infections



Basics

OVERVIEW

- *Staphylococcus*—gram-positive, facultatively anaerobic, spherical bacteria; *staphyle* (Greek; “bunch of grapes”) from characteristic microscopic arrangement in clusters; produces a variety of infections characterized by pus formation involving all tissues of the body; can produce toxins (superantigens) that exert profound systemic signs (fever, hypotension, shock, multiorgan failure, death)
- Ubiquitous; live free in environment and as commensal parasites of skin and upper respiratory tract
- Pathogenic and nonpathogenic strains; wide spectrum of virulence, host range, and site specificities; not strictly host or site specific
- Pathogenic strains—possess extracellular toxins and enzymes (e.g., coagulase, staphylokinase, hemolysin, epidermolysins); staphylocoagulase in more pathogenic strains (e.g., *S. aureus*, *S. intermedius*)

SIGNALMENT

- Dogs and cats
- Very young—susceptible because of incomplete, developing immunity
- Old, debilitated—susceptible because of impaired host defenses
- Immunocompromised—more susceptible

SIGNS

- Fever
- Anorexia
- Pain
- Can affect every organ system
- Abscesses and infections of the skin, eyes, ears, respiratory system, genitourinary tract, skeleton, and joints—common
- Dogs—pyoderma; otitis externa; cystitis; prostatitis; pneumonia; abscesses; osteomyelitis; discospondylitis; arthritis; mastitis; bacteremia; endocarditis; wound infections; toxic shock syndrome
- Cats—abscesses; oral infections; otitis externa; conjunctivitis; metritis; cholangiohepatitis; cystitis; bacteremia

CAUSES & RISK FACTORS

- Opportunistic pathogens
- Disease—from disturbance of the natural host–parasite equilibrium when local and general defense mechanisms are significantly lowered (e.g., chronic debilitating diseases)
- Secondary infection—allergies (atopy, food, fleas); endocrinopathies (hypothyroidism, hyperadrenocorticism); parasites (demodicosis); seborrhea
- Burns or wounds—complications
- Transmission—airborne organisms; carriers; and direct contact (droplet nuclei)



Diagnosis

DIFFERENTIAL DIAGNOSIS

- Dermatitis—allergies, seborrhea, immune-mediated
- Other infectious causes—viruses, bacteria, fungi, *Rickettsia*, protozoa
- Neoplasia
- Immune-mediated diseases

CBC/BIOCHEMISTRY/URINALYSIS

- Normal or high WBCs
- Biochemistry—may suggest underlying cause (e.g., hypothyroidism, hyperadrenocorticism)
- Urinalysis—pyuria (with or without bacteruria) with cystitis

OTHER LABORATORY TESTS

- Direct microscopy
- Gram stain
- Cytology—neutrophils and cocci singly or in pairs, short chains, or irregular clusters
- Culture—avoid superficial contamination; collect samples by aspiration, wash, or biopsy; do not overinterpret a positive isolation; organisms can be isolated from normal animals.
- Organisms survive up to 48 hr in clinical specimens when kept cool (4°C; 40°F), particularly on swabs containing a holding medium
- Antibiotic susceptibility testing

IMAGING

Radiology—osteolytic and osteoproliferative lesions with osteomyelitis; interstitial or alveolar pulmonary pattern with pneumonia; radiodense uroliths (struvite)

DIAGNOSTIC PROCEDURES

CSF—if meningitis or discospondylitis suspected

PATHOLOGIC FINDINGS

Characteristic abscess lesion—necrotic tissue, fibrin, and a large number of neutrophils



Treatment

- Properly handle and dispose of contaminated objects.
- Organism resistant to many environmental insults and common disinfectants

- Topical antibacterial cleaning of wounds and pyoderma—may be beneficial



Medications

DRUGS

- Antibiotic resistance—great propensity owing to production of β -lactamase, which inactivates penicillins; may carry plasmids (segments of genetic material that may carry genes for antimicrobial resistance) that can be transferred to other strains of staphylococci or species of bacteria
- History of previous antimicrobial therapy for staphylococcal infection—culture and antibiotic susceptibility testing indicated
- Nonpenicillinase-producing strains—penicillin G at 10,000–20,000 U/kg IM, SC q12–24h or penicillin V at 8–30 mg/kg PO q8h
- Penicillinase-producing strains—use penicillinase-resistant drugs
- First-generation cephalosporins—rarely resistant; cephalexin at 22 mg/kg PO q8h; cefadroxil at 22 mg/kg PO q8–12h
- β -lactamase-resistant synthetic penicillins—rarely resistant; oxacillin at 22–40 mg/kg PO q8h; dicloxacillin, and clavulanic acid-potentiated amoxicillin at 12.5–25 mg/kg PO q8–12h
- Gentamicin—rarely resistant; 2–4 mg/kg IV, IM, SC q8h
- Enrofloxacin—rarely resistant; 2.5–5 mg/kg PO, IM q12h
- Trimethoprim-potentiated sulfonamides—infrequently resistant; 30 mg/kg IV, PO q12h
- Chloramphenicol—infrequently resistant; 40–50 mg/kg IV, IM, SC, PO q8–12h
- Penicillin allergy—try cephalosporin, clindamycin, or vancomycin

CONTRAINDICATIONS/POSSIBLE INTERACTIONS

Avoid immunosuppressive drugs.



Follow-Up

N/A



Miscellaneous

ZOONOTIC POTENTIAL

- Possible
- Most people and pets carry their own pathogenic staphylococcal flora; disease not caused by mere exposure

ABBREVIATION

CSF = cerebrospinal fluid