Pyoderma

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Learning Objectives

- Understand the mechanisms preventing skin infection
- Recognize the importance of underlying causes of infection
- Common etiologic agent(s)
- Identify lesions associated with surface, superficial and deep pyoderma
- Understand indications for performing culture and sensitivity (C&S) testing
- Selection of empirical first line antibiotic therapy and treatment duration

Canine Pyoderma

- Primary defense mechanisms against pathogenic bacteria
  - Hair coat
  - Stratum corneum
  - Exfoliation of stratum corneum
  - Epidermal lipids and sebum
  - Immunoglobulins, interferon, AMP
  - Normal flora – skin bacterial microbiome

Canine Pyoderma

- Bacterial skin diseases should be considered secondary until proven otherwise
- **Rarely** a predisposing condition will not be identified
- The pyoderma is then called:
  - "Idiopathic, primary, recurrent superficial pyoderma"

Canine Pyoderma

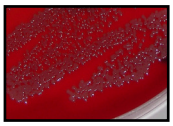
- Common predisposing conditions
  - Allergies
  - Endocrinopathies
    - Hyperadrenocorticism, hypothyroidism, sex hormone imbalances
  - Ectoparasites
    - Demodicosis, sarcoptic mange, fleas, Cheyletiellosis, other

Canine Pyoderma

- Common predisposing conditions
  - Cornification defects
    - Seborrhea
  - Anatomic defects
    - Skin folds
    - Body condition
  - Environmental factors
    - High temperature and humidity

Canine Pyoderma

- Usually caused by Staphylococci spp.
  - *S. pseudintermedius*
  - *S. aureus*
  - *S. schleiferi*
- Less frequently by *Streptococci*, *Pseudomonas, Proteus, E. coli*

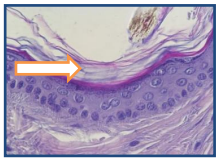


Canine Pyoderma

- Classification by depth of infection
  - Surface pyoderma
    - Pyotraumatic dermatitis (mild cases)
    - Skin fold infection (intertrigo)
    - Bacterial overgrowth
  - Superficial pyoderma
  - Deep pyoderma

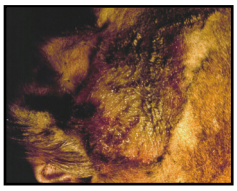
Surface Pyoderma
Pyotraumatic Dermatitis

- Acute moist dermatitis or "hot spot"
- Typically rapid onset with moisture, matting of fur and intense pruritus
- Predisposing factors
  - Breed?
  - Pruritic dermatoses
  - Thick haircoat
  - Hot and humid weather
  - Skin moisture (swimming)



Pyotraumatic Dermatitis

- Common predisposing conditions
  - Allergies, ectoparasites, otitis externa
  - Bacterial folliculitis, anal sac disease, husbandry, coat condition (matting)



Pyotraumatic Dermatitis

- Diagnosis
  - History, clinical signs, cytology
- Treatment
  - Identify underlying cause when possible
  - Treat lesion and manage pruritus

Pyotraumatic Dermatitis

- Treat the lesion
  - Clip and clean +/- sedation
  - Topical steroid/antibiotic cream, lotion or solution
  - Oral glucorticoids or oclacitinib for short term relief of inflammation and pruritus
  - Systemic antibiotics if not amenable/responsive to topical therapy

Surface Pyoderma - Intertrigo

Intertrigo

- Pathogenesis
  - Anatomic defect
    - Constant skin friction
    - Poor air circulation
    - Moisture
  - Moisture + skin friction → maceration + removal of stratum corneum → poor air circulation → bacterial overgrowth

Intertrigo

- History
  - Malodor +/- pruritus, pain
- Clinical signs
  - Alopecia, erythema, malodorous exudate +/- erosions and crusts
  - Lip, facial, vulva, tail fold

Intertrigo

- Diagnosis based on history, clinical signs and cytology
- Treatment
  - Clip and clean with antiseptic solution
  - Topical antimicrobial/steroid cream, lotion or solution
  - Oral glucocorticoids if severe inflammation/pain
  - Weight management
  - Evaluate for incontinence or treatment trial
  - Surgery (episioplasty, tail amputation)

Important Points

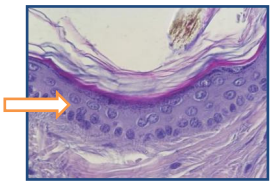
1. Bacterial skin infections should be considered secondary → look for an underlying cause
2. Most common agent is *S. pseudintermedius*
3. Perform cytology when suspect pyoderma
4. Manage pruritus in cases of acute moist dermatitis
5. Moisture and skin friction are the main predisposing causes for intertrigo or fold pyoderma
6. Bacterial skin infections commonly recur
7. Recheck the patient before discontinuing therapy

Canine Pyoderma

- Classification by depth of infection
  - Surface pyoderma
  - Superficial pyoderma
    - Classic form
    - Folliculitis
    - Impetigo
    - Mucocutaneous pyoderma
  - Deep pyoderma

Superficial Pyoderma

- Bacteria infect the superficial layers of the epidermis and/or the hair follicle
- Usually a secondary problem
- Frequently recurs



Superficial Pyoderma

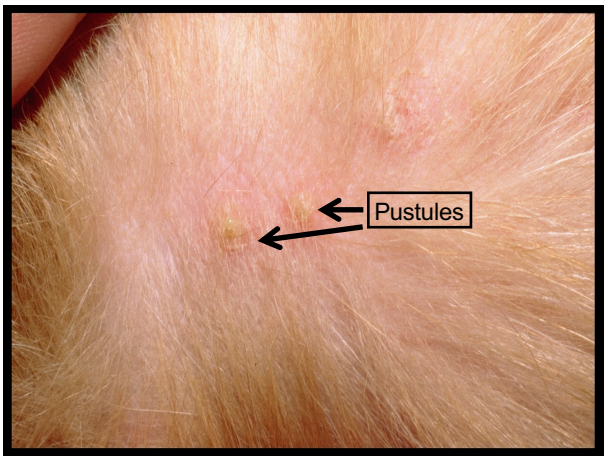
- History
  - Pruritus (often present)
    - Try to determine the sequence of events to help identify the underlying cause
    - Pruritus before lesions → allergies and pruritic parasitic diseases
    - Lesions before pruritus → endocrinopathies, follicular demodicosis

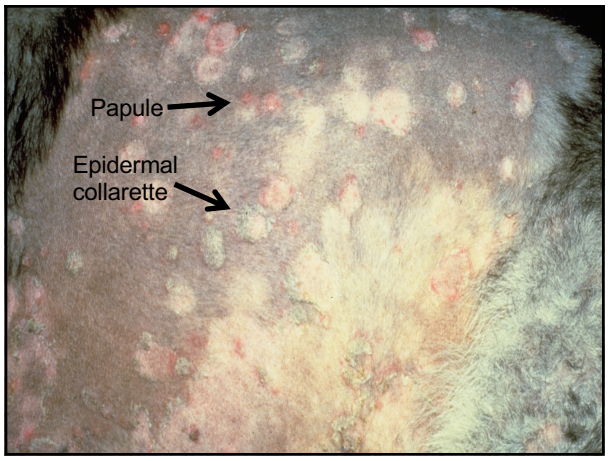
Superficial Pyoderma

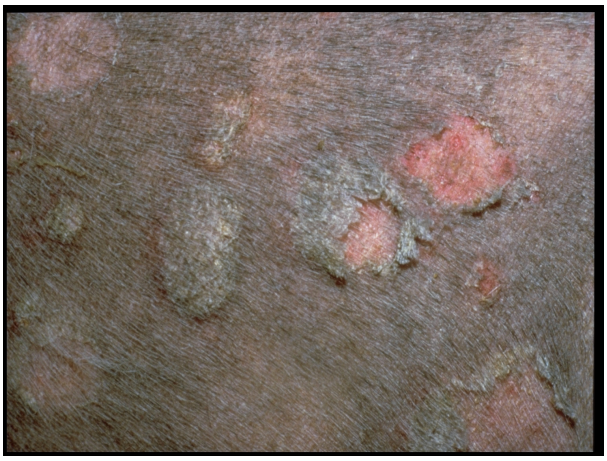
- Underlying conditions
  - Pruritic
    - Allergies
    - Sarcoptic mange
    - Cheyletiellosis
    - Demodicosis
  - Non-pruritic
    - Hormonal imbalances
    - Follicular dysplasias
    - Idiopathic seborrhea
    - Follicular demodicosis

Superficial Pyoderma

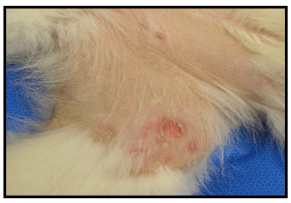
- Clinical signs – classic form
  - Any breed
  - Papules, pustules, crusts, epidermal collarettes
  - Circumscribed areas of alopecia often with central pigmentation → healing collarette
- Differential diagnosis
  - Pemphigus foliaceus
  - Cutaneous lymphoma

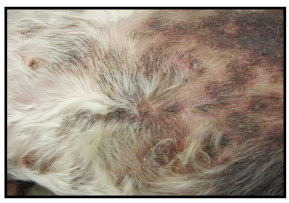


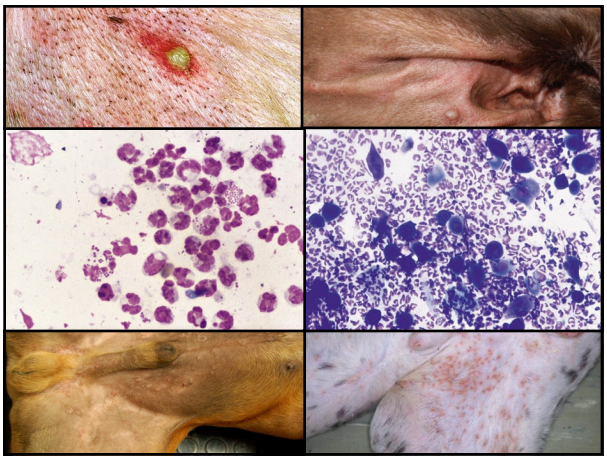


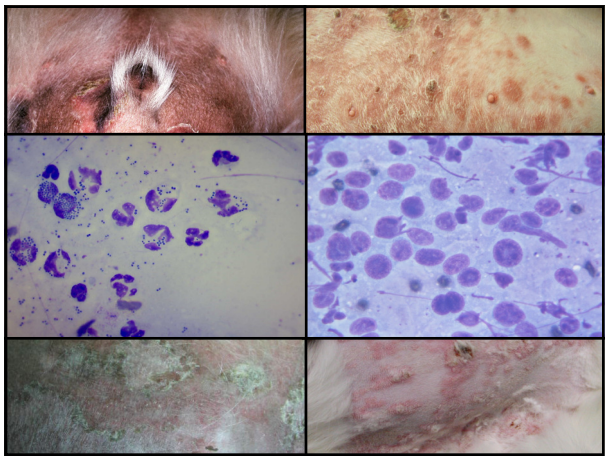


Superficial Pyoderma



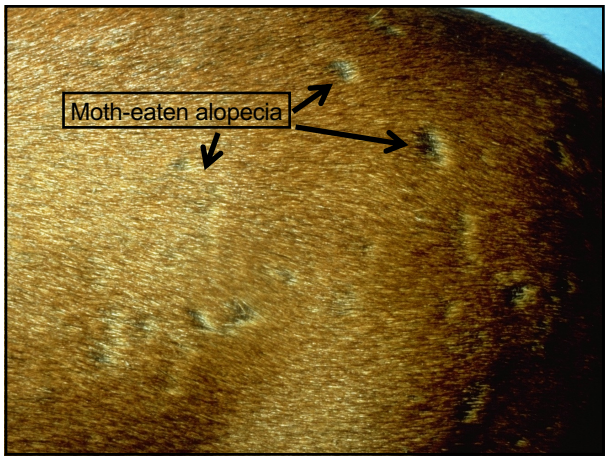


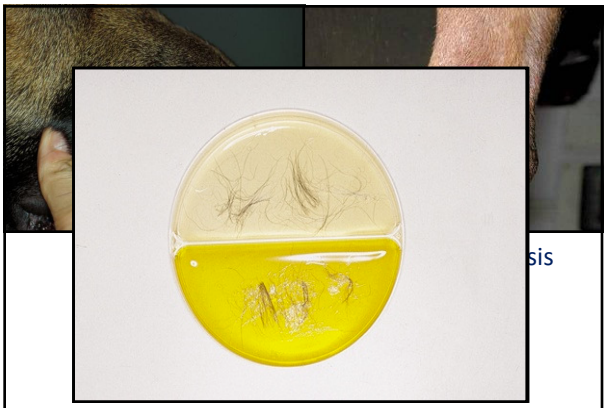




Superficial Pyoderma

- Clinical signs
  - Folliculitis
    - Common in short coated dogs
    - "Moth-eaten" alopecia
    - Small tufts of hair lifting from skin surface
    - +/- pruritus
    - Differential diagnosis
      - Demodicosis
      - Dermatophytosis
  - Impetigo
    - Fine papules and pustules on axillae/abdomen/groin of dogs < 1 year of age





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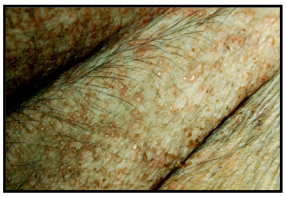
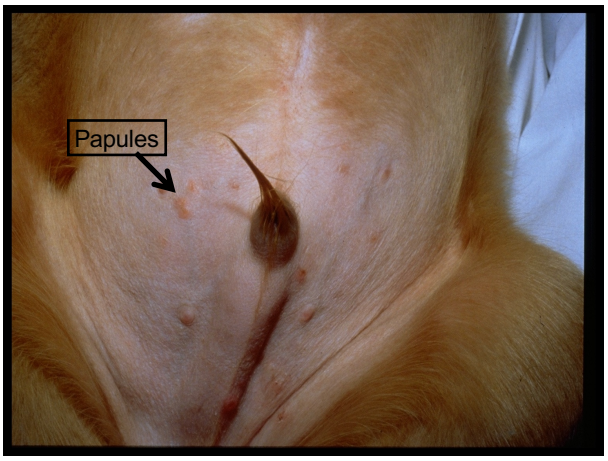
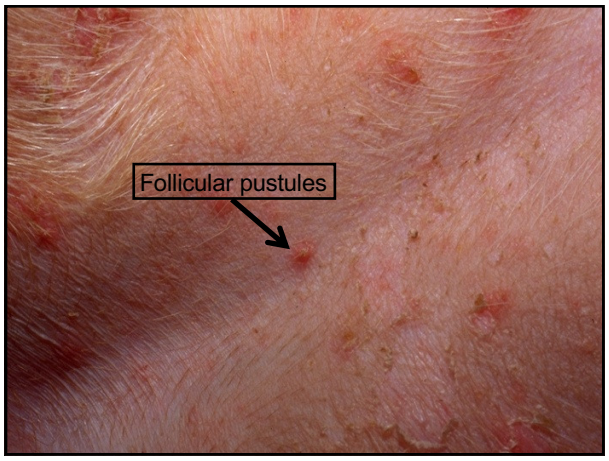
Impetigo







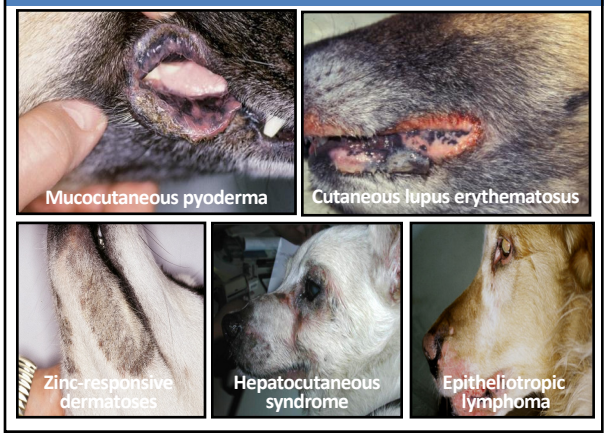
Superficial Pyoderma

Mucocutaneous Pyoderma

- Predisposition for German shepherd dogs
- Erosive, crusted, depigmented lesions
- Nose, eyelids, lips, genitals
- Mimics immune-mediated disease
- Resolves completely with antibiotics

Mucocutaneous Pyoderma

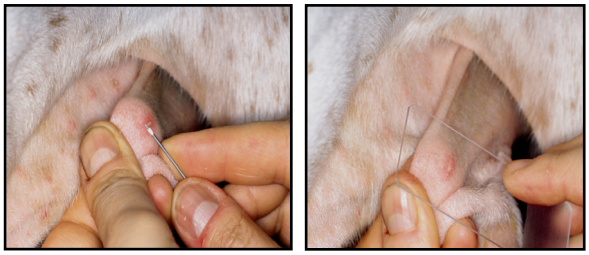
- Differential diagnoses with ulcers, erosions and crusts
  - Pemphigus foliaceus/erythematosus
  - Cutaneous lupus erythematosus
  - Zinc responsive dermatoses
  - Hepatocutaneous syndrome
  - Epitheliotropic lymphoma



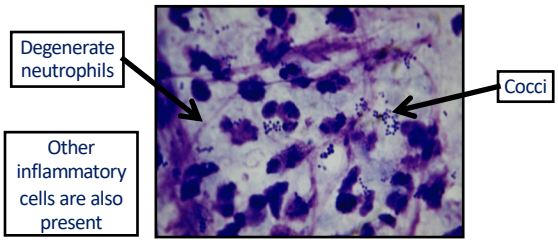
Superficial Pyoderma

- Diagnosis
  - History and clinical signs
  - Skin scrapings to evaluate for parasitic diseases
  - Cytology
  - ± Bacterial culture and susceptibility
  - Dermatophyte culture

Diagnosis - Impression Smear



Cytology



General Guidelines

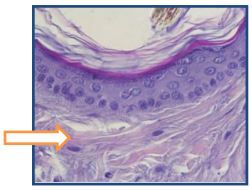
- Bacterial culture indications
  - Recurrent pyoderma
  - Pyoderma previously treated with multiple antibiotics
  - Pyoderma unresponsive to empirical treatments
  - Deep pyoderma
  - Pyoderma with cytological evidence of rod bacteria
  - History of drug resistant pyoderma

Canine Pyoderma

- Classification by depth of infection
  - Surface pyoderma
  - Superficial pyoderma
  - Deep pyoderma

Canine Deep Pyoderma

- Infection is associated with rupture of the hair follicle (furunculosis) and involvement of the dermis and subcutis



FURUNCULOSIS

Canine Deep Pyoderma

- Localized
  - Chin and lips: acne/furunculosis
  - Nose: nasal pyoderma
  - Feet: interdigital pyoderma/furunculosis
  - Limbs: acral lick granuloma and callus pyoderma
- Generalized
  - Most common in German shepherd dog

Deep Pyoderma

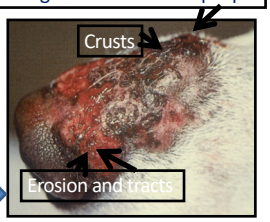
- Clinical signs
  - Papules, nodules, hemorrhagic bullae, erosion/ulceration, draining tracts, crusts
  - ± Pruritus
  - Lymphadenopathy or systemic signs (fever, hyporexia, lethargy) may be present in the generalized form
  - Scarring may result

"ACNE" (chin furunculosis) - typically seen in young, short-coated breed dogs

Nodule draining blood

Coalescing nodules formed a plaque

Crusts



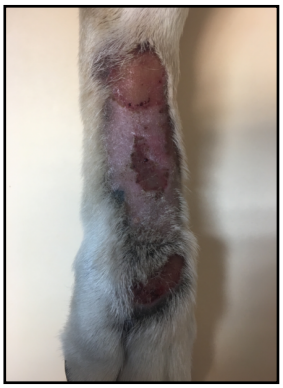
Erosion and tracts

NASAL PYODERMA

Nodules draining blood

INTERDIGITAL PYODERMA/ FURUNCULOSIS

- Most common in short-coated dogs
- One or more feet can be affected

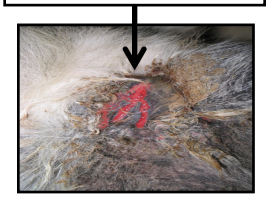


ACRAL LICK GRANULOMA

CALLUS PYODERMA – large breed short-coated dogs are predisposed

GENERALIZED DEEP PYODERMA - German Shepherds are predisposed

Eroded to ulcerated skin draining blood

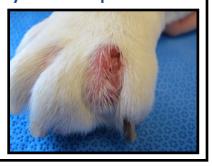


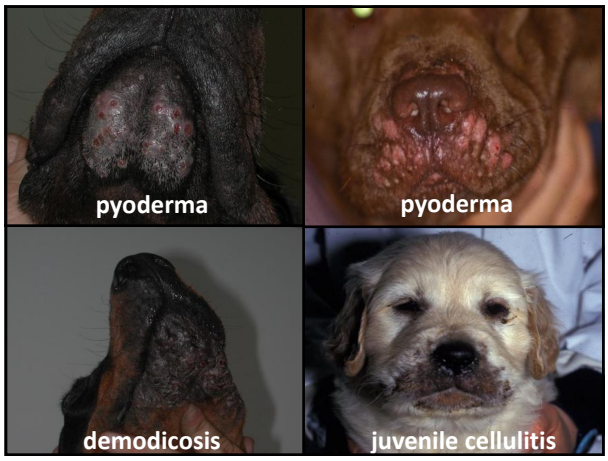
Deep Pyoderma

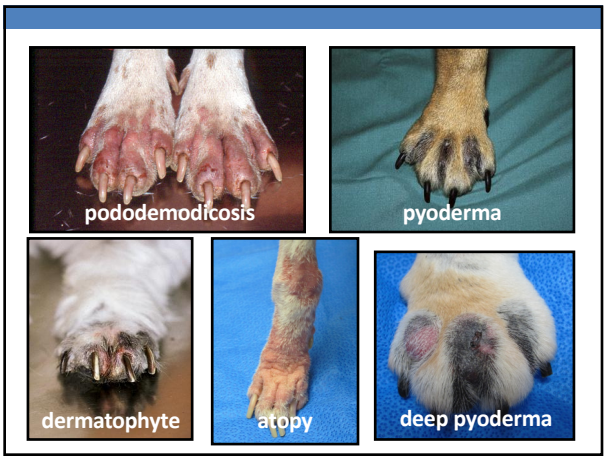
- "German shepherd pyoderma"
  - Immune deficiency or immune-mediated?
  - Dogs over 4-5 years of age
  - Underlying diseases
    - Allergy
    - Hypothyroidism
    - Leishmaniosis, ehrichiosis
  - May be idiopathic

Deep Pyoderma

- Differential diagnosis
  - Demodicosis with furunculosis
  - Deep or subcutaneous fungal infection or atypical bacterial infections
  - Localized lesions→ foreign body or neoplasia

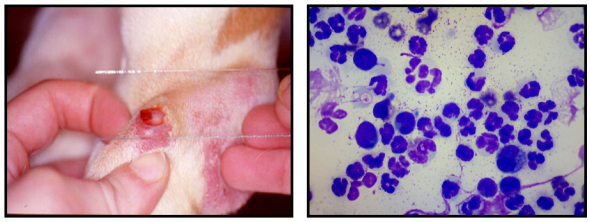






Deep Pyoderma Diagnosis

- Cytology – *always!*
- Skin scrapings and trichogram
- Bacterial culture and sensitivity
  - Select antibiotic based on C&S
  - ± Fungal culture/PCR
    - If suspecting of kerion or systemic fungal infection
  - ± Biopsy and histopathology
    - If not responding to therapy as expected
    - If lesions appear unusual



Pyogranulomatous Inflammation

Important Points

1. Lesions that indicate a deep process
   - ✓Nodule, draining tract, hemorrhagic bulla, erosion/ulceration
2. Diagnosis
   - ✓History + clinical signs, cytology, bacterial C&S, ± other diagnostic tests
3. Treatment
   - ✓Search for an underlying cause
   - ✓Choose systemic antibiotic based on C&S
   - ✓Treat for 2 weeks passed clinical resolution
   - ✓RECHECK!

Therapy of Pyoderma

General Guidelines

- Surface pyoderma
  - Topical therapy alone
- Superficial pyoderma
  - If localized, topical therapy first for 2 weeks
  - If generalized or poor response to topicals alone
    - Add oral antibiotic
    - Reconsider diagnosis and identify/manage underlying disease
    - Treat for minimum of three weeks (one week beyond clinical resolution)

General Guidelines

- Deep Pyoderma
  - Systemic antibiotics following sensitivity testing
  - Treat for a minimum of 6-8 weeks (two weeks beyond clinical resolution)
  - May require 8-12 weeks of treatment and intensive topical treatments
- Re-examine all cases 3-4 weeks after initiation of therapy
  - If not improved or new lesions → repeat bacterial culture and sensitivity testing

Deep Pyoderma

- For pododermatitis, furunculosis and severe callus pyoderma
  - Prednisone 1 mg/kg/day PO for 7-10 days
  - Cyclosporin 5mg/kg/day PO for minimum of one month, then try to lower to every other day
  - Antibiotic therapy based on C&S x 4-6 weeks minimum
  - Daily chlorhexidine based shampoo and/or wipes
  - Mupirocin ointment every 12 hours
  - Weight management
  - Limit trauma

First Line Oral Antibiotics for Pyoderma

Good first line antibiotics

Clindamycin, lincomycin, cephalexin, cefadroxil, amoxicillin/clavulanic acid, TMP-sulfonamides

Good first line antibiotics if there are compliance or administration problems

Cefovecin, cefpodoxime

Second Line Antibiotics for Pyoderma

- Broad spectrum drugs important for animals and humans; may not be licensed for animals
  - Development of resistance of greater concern
- Should only be used if there is culture evidence that first line drugs will not be effective

Second line antibiotics

Enrofloxacin, marbofloxacin, pradofloxacin, azithromycin, clarithromycin, doxycycline, minocycline

Third Line Oral Antibiotics for Pyoderma

- Drugs very important to animals and humans
  - Treatment of multi-drug resistant organisms
  - Resistance of great concern
- Most drugs are not licensed for animals
  - Safety and efficacy data very limited
- Only use when there is culture evidence of sensitivity, no second line antibiotics or topical antimicrobials are effective

Third line antibiotics

Aminoglycosides, chloramphenicol, florfenicol, thiamphenicol, imipenem, rifampin, fosfomycin, piperacillin, ceftazidime, ticarcillin

Suggested guidelines for using systemic antimicrobials in bacterial skin infections: part 2— antimicrobial choice, treatment regimens and compliance

L. Beco, E. Guaguère, C. Lorente Méndez, C. Noli, T. Nuttall, M. Vroom

Veterinary Record January 2013

Vet Dermatol 2014; **25**: 163–e43 DOI: 10.1111/vde.12118

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)

Andrew Hillier*, David H. Lloyd†, J. Scott Weese‡, Joseph M. Blondeau§, Dawn Boothe¶, Edward Breitschwerdt**, Luca Guardabassi††, Mark G. Papich**, Shelley Rankin‡‡, John D. Turnidge§§ and Jane E. Sykes¶¶

Veterinary Dermatology June 2014

Antibiotic Therapy – Poor Choices

- Beta-lactamase sensitive penicillins
  - Penicillin, ampicillin, amoxicillin
- Antibiotics with poor cutaneous distribution
  - Streptomycin, tetracycline
- Antibiotics important for human health
  - Vancomycin, linezolid, teicoplanin, carbapenems

Correct Dosing is Important

- Always weigh the animal
- Always round the dose up to the nearest ½ or ¼ tablet
  - Never round down and never underdose
- Make sure the owner understands the dosing interval
  - Use "every 12 hours" instead of "twice daily"
- Don't give out more pills than required

Poor Response to Treatment

- Is there a bacterial skin infection present?
  - Perform cytology!
- Are resistant organisms present?
  - Perform culture!
- Poor compliance?
- Under dosing?
- Too short of a treatment duration?
- No concurrent topical therapy?
- Underlying disease?

Topical Therapy - Formulations

Shampoo

- Removes bacteria, yeast, debris, crusts, allergens
- Cool water with 10 min contact time
- Rinse very well; consider medicated conditioner
- 2-3 times per week initially
- Once weekly maintenance may prevent recurrence

Topical Therapy – Active Ingredients

- Chlorhexidine 2-4%
- Ethyl lactate 10%
- Sulphur 2% and salicylic acid 2%
- Benzoyl peroxide 0.5%+
- Mupirocin 2%
- Silver sulfadiazine 1%
- Multiple antibiotic/antifungal/glucocorticoid combinations

Topical Therapy - Formulations

- Lotion/spray/mousse for sparsely haired areas
- Cream/ointment/wipes for localized lesions
  - Intertrigo, hot spot, acne, pododermatitis
  - Avoid licking for 10 minutes

Recurrent Pyoderma

- Pyoderma is most often secondary to allergies, which are incurable and may be difficult to manage
- 30% of pyodermas have an unknown underlying cause with frequent relapse
- Repeated antibotic courses are necessary → increased risk of bacterial resistance

Bacterial Culture and Sensitivity Testing

- Important due to increase in antibiotic (AB) resistance by *Staphylococci* that continues to increase world wide
- 20-50% in second and third opinion dermatology practice
- 1-5% in first opinion general practice

MRSP – MRSA - MDR

- MRSP – methicillin*-R *S. pseudintermedius*
  - Resistant to all penicillins, cephalosporins, carbapenems
- MRSA – methicillin-R *S. aureus*
  - Resistant to all penicillins, cephalosporins, carbapenems
  - Public health concern – should be reported to human physician
  - MDR – multi-drug resistant
  - Resistant to at least 3 antibiotic families

*Methicillin is often represented by oxacillin on sensitivity panels

Acquisition of AB Resistance During AB Therapy

- Acquisition of resistance during therapy seems to be frequent
- Colonization with resistant bacteria persists even after the resolution of the pyoderma

Prevalence of MRSP post therapy	Skin	Nose/rectum
Dogs with non-MRSP pyoderma	28.3%	26.7%
Dogs with MRSP pyoderma	45.2%	47.6%

Beck et al. Vet Derm 2012

Contributing Factors to MDR

Veterinarians

- Frequent use of "last generation" or "big gun" antibiotics as first line therapies
- Frequent use of fluoroquinolones
- Low rate of bacterial culture and sensitivity testing
- Inadequate duration or dosing

Animals

- History of antibiotic therapy in the past year
- Veterinary visit in the last year

Therapeutic Challenges

- The majority of methicillin-R *Staph pseudintermedius* are also multi-drug resistant
  - Penicillins, cephalosporins, fluoroquinolones, lincosamides, macrolides, TMP-sulphonamides
- Extended susceptibility panel:
  - Chloramphenicol, rifampin, phosphomicin, amikacin and other aminoglycosides

Therapeutic Challenges

- Necessary clinical monitoring
  - Hepatotoxicity of rifampin
  - Nephro and ototoxicity of aminoglycosides
- Lack of veterinary (and human) formulations
- Difficult oral TID or SC administration
- Increasing resistance to chloramphenicol and rifampin

Public Health Concerns - MRSPI

- *S. pseudintermedius* is adapted to canids
- Dog-human transmission is possible, however humans are transient carriers
- Rare cases of infection involve close contact with dogs
- Human-human transmission reported

Public Health Concerns - MRSA

- *S. aureus* is adapted to humans
- Human-dog transmission is possible (reverse zoonosis)
  - Affected dogs are carriers of the same MRSA strains as humans
  - Dogs can re-transmit MRSA to humans, serving as a reservoir of the infection
- Veterinarians and physicians have higher carriage rate than average population

MRSP For Pet Owners

Worms & Germs
Promoting Safe Pet Ownership

What Are MRSP & *Staphylococcus pseudintermedius*?

- *Staphylococcus pseudintermedius* is a bacterium that is commonly found on the skin or in the mouth, nose or intestinal tract of 50% of more of healthy dogs, and a smaller percentage of healthy cats. Typically it causes no problems at all, but it is an **opportunistic pathogen** - if an animal gets injured or sick for another reason, *S. pseudintermedius* can take advantage of the body's weakened defenses and cause infection and illness.
- This bacterium can infect almost any tissue, but **skin and soft tissue infections** are more common, particularly when the skin has been damaged by something else (e.g. allergies, scratching, chronic wetness, wounds, surgery). **Skin and ear infections** are also very commonly caused by *S. pseudintermedius*. Infections of other body sites and organs are much less common, but can be very severe.
- *Staphylococcus pseudintermedius* can also be found in the nose of up to 4% of healthy pet owners.
- **MRSP** stands for methicillin-resistant *S. pseudintermedius*, which is a form of *S. pseudintermedius* that is highly **resistant to many antibiotics**, including most of the drugs that are commonly used to treat bacterial infections in dogs and cats. Non-MRSP forms of *S. pseudintermedius* are methicillin-susceptible (MSSP).
- People and animals that carry MRSP without any signs of infection at all are said to be **colonized**. When **infection** with *S. pseudintermedius* (either MRSP or MSSP) occurs, this causes signs of inflammation (e.g. heat, pain, swelling, discharge, fever).

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MRSA For Vets

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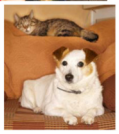
General Information

Staphylococcus aureus is a Gram-positive, aerobic commensal bacterium of humans that is carried in the anterior nares of approximately 30% of the general population. It is primarily an opportunistic pathogen - it takes advantage of breaks in the hosts normal defensive barriers. It can infect almost any tissue, but skin and soft tissue infections are most common.

- Strains of *S. aureus* can be either methicillin-resistant (**MRSA**) or methicillin-susceptible (MSSA). Methicillin-resistance in staphylococci is usually acquired through the *mecA* gene. This gene confers **resistance to all beta-lactam antimicrobials** (i.e. penicillins, cephalosporins, carbapenems, monobactams).
- Some strains of MRSA, particularly those found in hospitals, also carry genes for resistance to other types of antimicrobials. Infection with these highly resistant strains can be extremely difficult to treat.
- Some strains of MRSA can also carry genes for the Panton-Valentine leukocidin (PVL), which tends to be associated with more virulent, invasive strains.
- People and animals can carry MRSA without showing any clinical signs. This is known as **colonization**, which may be transient or persistent. **Infection** with MRSA is accompanied by signs of inflammation (e.g. heat, pain, swelling, discharge).
- Colonization or infection with MRSA has been reported in numerous animal species.
- Pets such as dogs and cats do not commonly carry MRSA. It is suspected that **MRSA found in pets typically originates from humans**. However, once colonized or infected, dogs and cats can pass the bacterium on to other animals and people.



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MDR Staph Pyoderma - Management

- Topical therapies!
  - 4% chlorhexidine formulations
  - Dilute sodium hypochlorite and sodium bicarbonate mixture (Dakin's solution) as rinse
  - Mupirocin ointment
- Staphylococcal bacterins
- Identify and manage underlying disease
- Choose therapy based on culture and use appropriate dose and duration
- Frequent re-exams to access treatment response, cytology +/- repeat culture

Veterinary Dermatology

Scientific Paper | Open Access

Effectiveness of a combined (4% chlorhexidine digluconate shampoo and solution) protocol in MRS and non-MRS canine superficial pyoderma: a randomized, blinded, antibiotic-controlled study

Stefano Borio, Silvia Colombo, Giuseppe La Rosa, Michela De Lucia, Peter Damborg, Luca Guardabassi

- Amoxicillin and clavulanic acid (Group1) or chlorhexidine 4% shampoo and solution (Group 2) for 28 days in dogs with superficial pyoderma
- No significant statistical differences between the two treatment groups
- Topical therapy alone equally effective in MSSP and MRSP