Common infectious diseases in veterinary dermatology: Pyoderma and Malassezia dermatitis

Dr. Joseph Cordonier
BVetMed, DACVD
North West Veterinary Dermatology Services

Learning Outcomes

- Understand the predisposing factors and breed predilections for Malassezia dermatitis in cats and dogs
- Identify appropriate sampling techniques and interpretation of results for Malassezia dermatitis
- Review the key points from the World Congress of Veterinary Dermatology consensus guidelines for management of Malassezia dermatitis
- Identify the morphology of coccoid and rod-shape bacteria on cytology
- Identify clinical features and various presentations of bacterial pyoderma
- Understand predisposing factors for the development of canine pyoderma
- Review key principles of antimicrobial therapy and antimicrobial stewardship
- Understand appropriate use of oral antimicrobials and bacterial culture

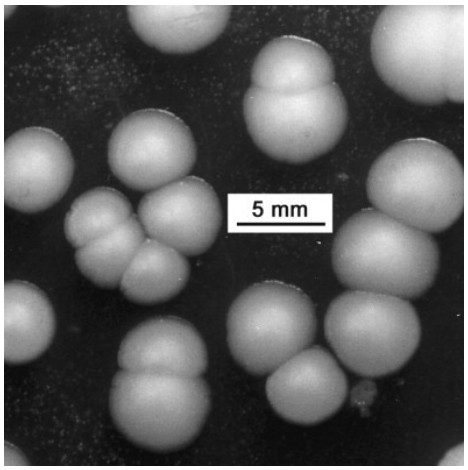
Malassezia Dermatitis

- What is Malassezia
- Molecular characteristics
- Ecology
- Virulence factors
- Malassezia dermatitis
- Diagnosis
- Treatment
- Resistance

What is Malassezia?

- Lipophilic fungi living almost exclusively on the skin and mucosal sites of warm-blooded vertebrates
- Undergo asexual reproduction with unipolar broad based budding

- Characterized by
  - Low carbohydrate-degrading capacity due to reduction in hydrolase-encoding genes
  - Lipid dependence for growth due to lack of a fatty acid synthase gene
  - Concomitant expansion of lipid hydrolyzing enzymes that allow collection and use of fatty acids from skin of hosts



Malassezia Species

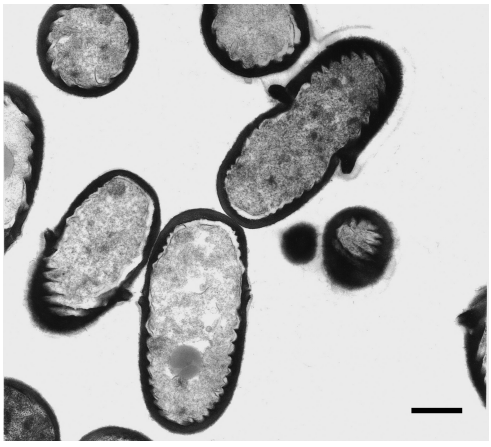
TABLE 1 | *Malassezia* species and main mammalian hosts.

***Malassezia* species**	**Synonyms**	**Presence on healthy skin**	**Presence in lesions**
M. furfur	*Pityrosporum ovale*	In humans Sometimes in animals	In humans (PV, FG)
M. pachydermatis	*P. pachydermatis*, *P. canis*	In dogs, cats, many others (mostly canids) Sometimes in humans (dog contact)	In dogs, cats, others (SD, OT) Sometimes in humans (FG)
M. sympodialis	*M. furfur* serovar A	In humans and animals	In humans (AD, SD) Sometimes in cats (OT)
M. globosa	*P. orbiculare* *M. furfur* serovar B	In humans and animals	In humans (PV, SD, AD) Sometimes in cats (OT)
M. obtusa		In humans	In humans
M. slooffiae		In pigs, cats (claws) In humans	In humans
M. restricta	*M. furfur* serovar C	In humans	In humans (SD)
M. dermatis		In humans	In humans (AD)
M. japonica		In humans	In humans (AD, SD)
M. nana		In cats, horses	In cats, cattle (OT)
M. yamatoensis		In humans	In humans (SD)
M. caprae		In goats	
M. equina	*M. equi*	In horses	In horses
M. cuniculi		In rabbits	
M. arunalokei		In humans	In humans
M. brasiliensis		In parrots	–
M. psittaci		In parrots	–
M. vespertilionis		In hibernating bats	–

–, not reported; PV, pityriasis versicolor; FG, fungaemia; AD, atopic dermatitis; SD, seborrheoic dermatitis; OT, otitis.

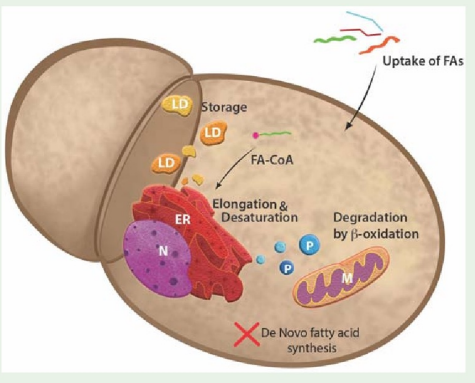
Cell Wall

- The cell wall is:
  - Unusually thick (90–150 nm)
  - Has characteristic inner spiral/corrugation morphology
  - Is composed predominantly of (1-›6)-ß-D-glucan with traces of mannan & unusual polysaccharide assembly
  - There is chitin prominent in bud-scar and a lipid-rich wall and capsule



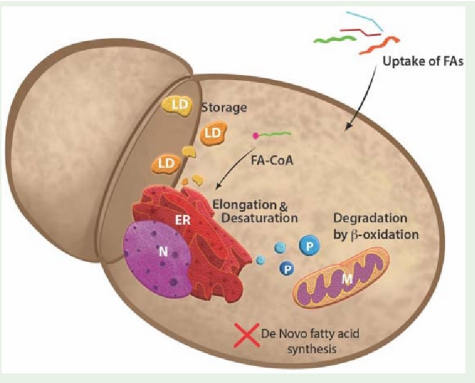
Lipid dependence

- *M.pachdermatis* lacks fatty acid synthase gene but uniquely is able to use lipid fractions within Sabouraud's dextrose agar for growth
  - **Lipid dependent**
- Lipid hydrolysing enzymes (lipases, phospholipases and acid sphingomyelinases) = access to fatty acids from the skin or mucosal surfaces



Lipid dependence

- Acquire lipids from:
  - Triglycerides and free fatty acids produced by sebaceous glands
  - Cholesterol and cholesterol esters produced in keratinocyte turnover
  - Assimilation of phospholipids and organic/inorganic nitrogen

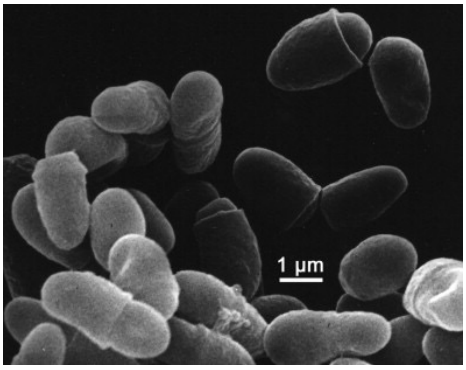


Ecology

- Skin commensals in warm-blooded vertebrates
- Require lipid source
- Proliferation enhanced with favourable environmental conditions (heat and humidity) and changes to host susceptibility
- Some lipid dependent species of Malassezia are host specific
- Both anatomical site and breed affect population size
- More prevalent in warm, tropical climates

Malassezia pachydermatis

- *M. pachydermatis* is a nonmycelial saprophytic yeast
- Commonly found on skin, in ear canals, on mucosal surfaces (oral, anal), and in the anal sacs and vagina of normal dogs and cats.
- Most common yeast colonizing normal canine skin
- Common commensal with symbiotic relationship to commensal Staphylococci spp.
  - Increased *Staphylococcus intermedius* and *pseudintermedius* with dogs with Malassezia



From commensal to criminal

- Many predisposing factors hypothesized to allow commensal become pathogenic
  - Heat and humidity
  - Increase availability of yeast nutrients and growth factors
    - Change in quantity and quality of sebum
    - Increased population of Staphylococci
  - Change in pH
    - Optimal at 4.0-8.0 pH
  - Immunologic dysfunction

Clinical Relevance

Malassezia pachydermatis in dogs

- By far most important and prevalent species in dogs
  - Other species rarely reported
- Colonization occurs in the first few days of life
- Likely transferred rom the bitch's flora following removal of amniotic membrane, licking or nursing
- Highest number in chin, inguinal and axillary zones
  - Differences in breeds

Predisposed Breeds

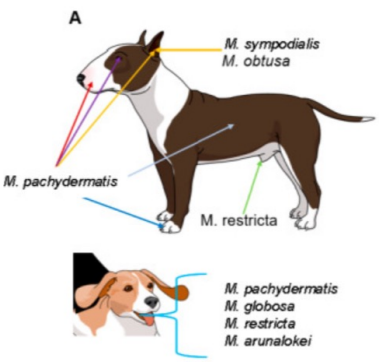
West highland white terrier
Basset hound
Cocker spaniel
Shih Tzu
English Setter
Toy poodles
Boxer
CKCS
Silky terriers
German shepherd dogs
Dachshund

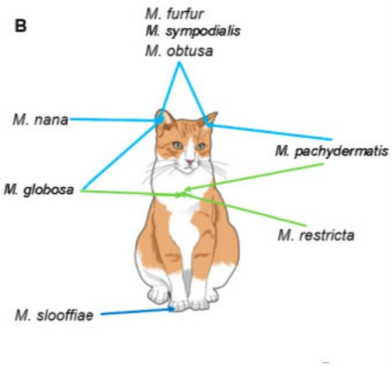
Predisposing diseases in Dogs

- Seborrheic disorders shown to have statically higher carriage
- Ichthyosis commonly associated with overgrowth
- Although no shown increase in prevalence with atopic dermatitis, generally accepted there is an association
- Reports of concurrent increase with endocrinopathies or other skin diseases with altered stratum corneum

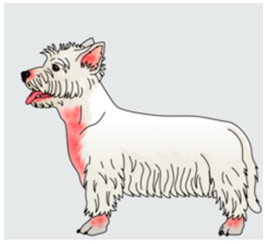
Predilection Sites of Various Species

- Predilection sites (lipid rich areas): Ear canals, anal sacs, interdigital skin, mucocutaneous junctions





M. Pachydermatis Sites in Dogs

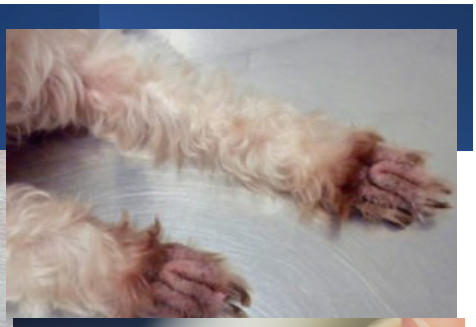


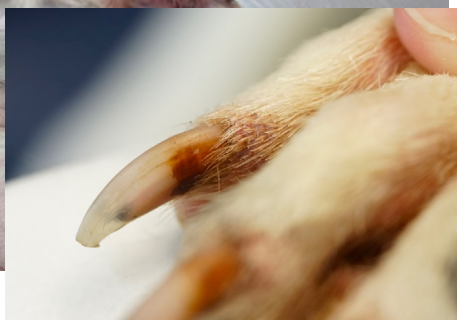
- *M. pachydermatis* colonizes:
  - peri-oral/ lip region (81%)
  - interdigital skin (60–70%)
  - axilla (12.5% of 40)
  - groin (23% of 91)
  - dorsum (4% of 73)
  - perianal skin and anal mucosa (~55% of 73 dogs)
  - nasal and oral carriage is less frequent

Clinical Signs in Dogs

- May be seasonal
  - Warm, humid months
- Pruritus or variable severity
- Facial hyperesthesia with Malassezia cheilitis
- Can be localized or generalized
- Erythema
- Paronychia
- Brown/Yellow/Grey keratosebaceous scale
- Staining of hair
- Greasy coat
- Lichenification and hyperpigmentation when chronic
- Offensive odour
- Ears
  - Ceruminous brown discharge, erythema

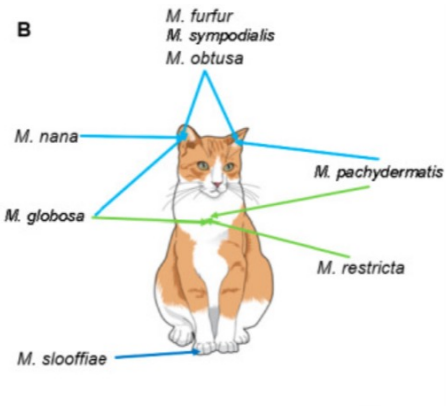
Clinical Signs in Dog





Malassezia in cats

- Colonized by diversity of species
- *M pachydermatis* is the most common species in cats
- *M pachydermatis*, *M furfur*, *M sympodialis*, *M globosa*, *M nana*, *M slooffiae*
  - *M nana* most common lipid dependent species isolated
  - *M slooffiae* mostly in claw folds



Malassezia in cats

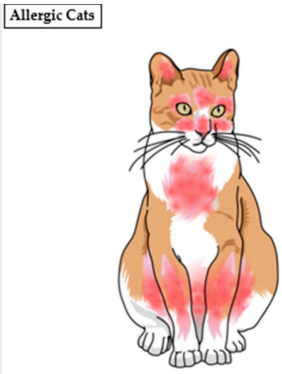
Breed predilections

- Devon rex (not Cornish) and Sphynx are prone to high yeast carriage and seborrheic dermatitis

Predilection Sites in Cats

Most common affected areas:

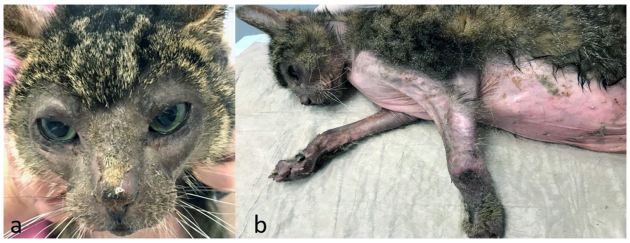
- Most breeds
  - Pinnae
  - Chin
  - Neck
  - Limbs
  - Abdomen
  - Sometimes generalized
- Devon Rex/Sphinx
  - Axillae
  - Groin
  - Paws
  - Ventral neck



Predisposing diseases in Cats

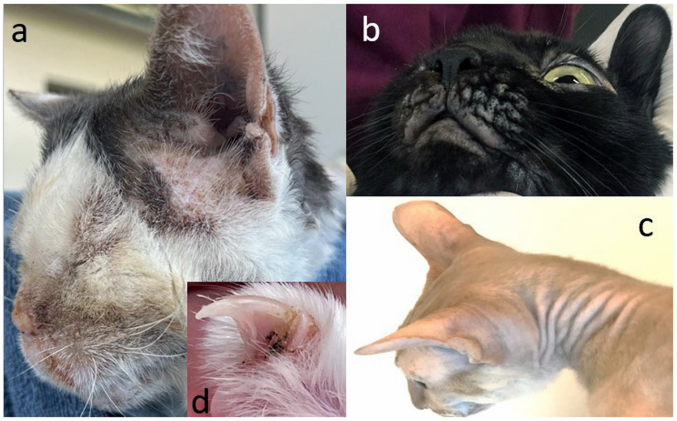
Can be associated with:

- thymoma-associated exfoliative dermatitis
- paraneoplastic syndrome
- FIV
- Idiopathic facial dermatitis
- Feline acne

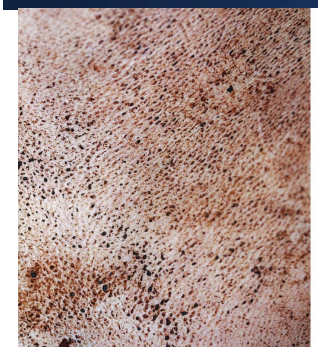


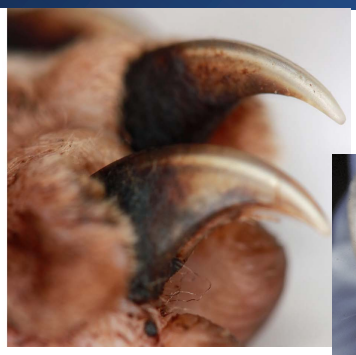
Clinical Signs in Cat

- Varies with underlying disease
- Greasy seborrhea or seborrhea sicca
- Paronychia
- Reddish-brown hair discolouration
- Erythema
- Alopecia
- Typically non-pruritic



Clinical Signs in Cat

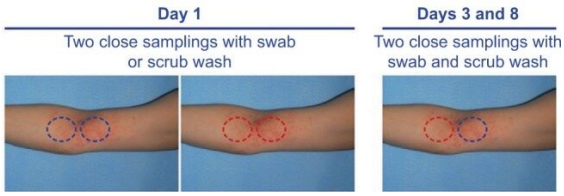




Diagnosis

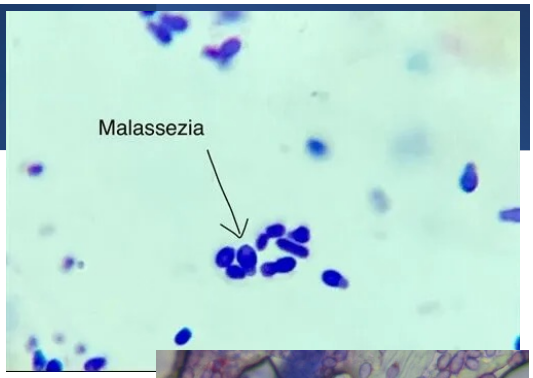
Detection techniques

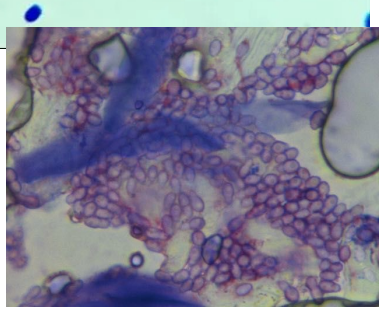
- Impression cytology
  - Tends to under report
- Tape impression
- Dispersal methods
  - Cup-scrub
    - Wash with 0.075M phosphate buffered saline and 0.1% Triton X-100
    - Conisdered gold standard for quantitative culuter
    - Mainly research
  - Swab-wash



Detection techniques

- Impression cytology (direct/tape)
  - No published definition for overgrowth
  - Normal skin has shown to have less than one organism per HPF, but also found in affected skin
  - Normally 0.44 organisms/HPF in normal dog claws versus 7.9/HPF in affected dogs
  - Number significantly higher In Bassets, beagles and Irish setters
    - Possibly more breeds, but reflects research





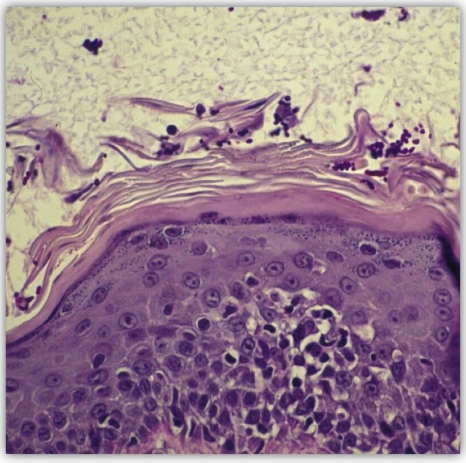
Detection Techniques

- Culture
  - Modified Dixon's agar is preferred for both cats and dogs
  - No consistent guidelines for sensitivity
  - Sabouraud dextrose agar can be used for dogs
    - Will grow *M pachydermatis*

Histopathology

Features in dogs:

1. pronounced irregular epidermal and infundibular hyperplasia
2. prominent epidermal and infundibular parakeratotic hyperkeratosis
3. diffuse epidermal and infundibular intercellular oedema (spongiosis)
4. diffuse epidermal and infundibular lymphocytic exocytosis
5. superficial perivascular to interstitial dermatitis wherein lymphocytes are a prominent inflammatory cell type
6. presence of unipolar budding yeast in the surface and/or infundibular keratin. May not be present in all cases



Treatment Dogs

- Azole antifungals
  - Topical: miconazole, climbazole, clotrimazole
  - Oral: ketoconazole, itraconazole, posaconazole, fluconazole
- Terbinafine
  - Less effective than azoles
- Nystatin
- Chlorhexidine

- Personal preference
  - Topical therapy as first line
  - Addition of systemic if overwhelming infection, bathing not controlling infection or bathing not possible

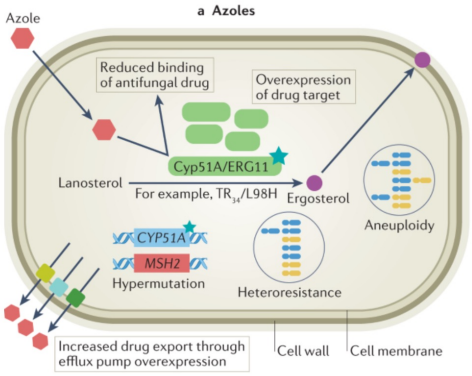
Treatment in cats

- Itraconazole oral of choice
- Topical products likely to be successful
  - Topical mousses may be better tolerated than bathing

Antifungal resistance

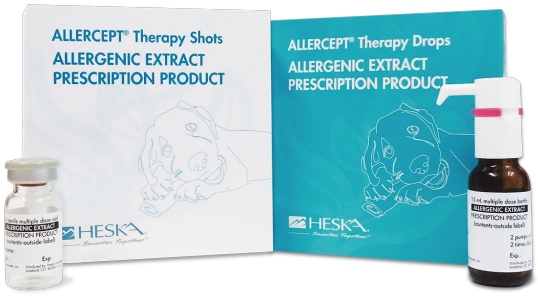
- Testing for resistance impeded by unsuitability of current CLSI and EUCAST reference methods
  - Lacks breakpoints
- Current data suggests that M pachydermatis are susceptible to most relevant azoles, but evidence that reduced susceptibility may develop

- Reduced susceptibility to azoles possibly a result of reduced affinity to lanosterol demethylase via:
  - increased expression of the target gene (*ERG11*) encoding this enzyme
  - increased efflux by overexpression of genes encoding membrane transport proteins
    - ABC transporter *(CDR1/CDR2)*
    - major facilitator (*MDR1*)



Prevention

- Control underlying disease
- Topical therapy (chlorhexidine/miconazole)
- Pulse oral antifungal therapy
  - 2 consecutive days per week
- Malassezia ASIT



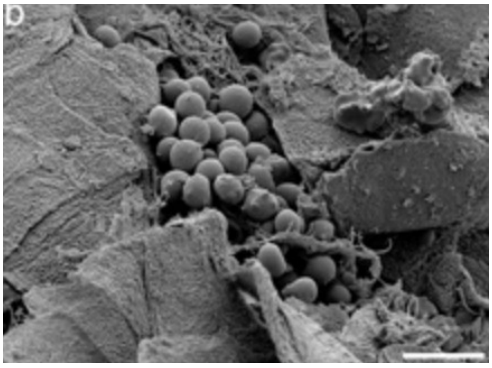
Staphylococcus and Bacterial Pyoderma

Staphylococcus and Bacterial Pyoderma

- Staphylococcus Biology
- Underlying Conditions
- Virulence Factors
- Clinical Signs
- Diagnosis
- Treatment
- Methicillin resistance

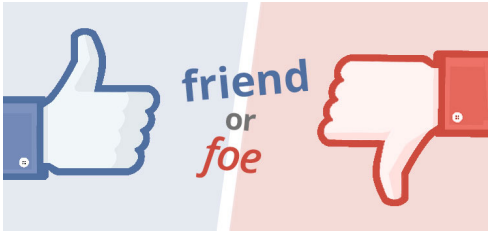
Staphylococcus

- Gram-positive, facultative anaerobic cocci
- Part of the normal cutaneous and mucosal microbiota
- Colonization occurs immediately after birth
- Cats and dogs will have multiple strains of *Staphylococcus* on their body
  - Clinical signs only develop when opportunistic infection



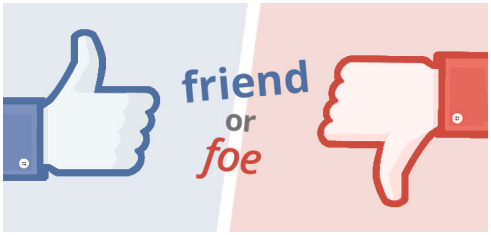
Staphylococcus: Friend or Foe?

- Both a commensal and opportunistic pathogen
- Coagulase-positive more associated with skin and ear infections
- Part of the normal flora in the skin, hair coat and mucocutaneous sites
  - Nose, mouth, anus
  - Variable amounts at different body sites
  - Differences between breeds



Staphylococcus: Friend or Foe?

- Bacterial overgrowth occurs secondary to an underlying skin/systemic disease
  - Not a primary cause of skin disease
- Adheres to corneocytes of atopic dogs compared to healthy animals
- Bacterial skin infection= Pyoderma
  - *Staphylococcus pseudintermedius* is the major cause of canine pyoderma



Underlying Causes of Pyoderma

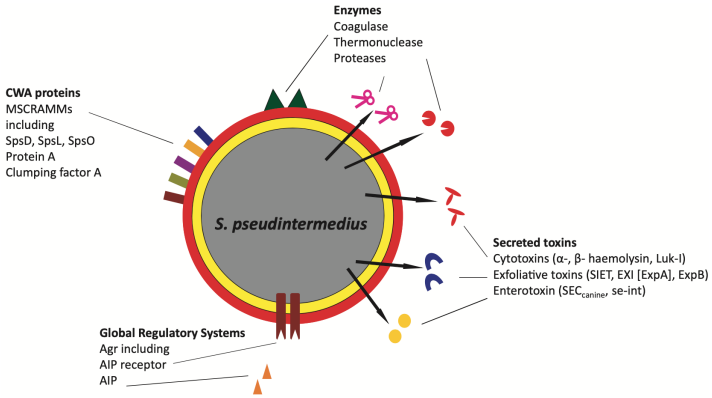
TABLE 3 Typical underlying causes and commonly associated types of canine pyoderma.

Disease group	Disease	Most common type of pyoderma
Allergic skin disease	Atopic dermatitis	SBF, ExP
	Adverse food reaction	Pyotraumatic dermatitis particularly frequent with flea bite hypersensitivity
	Flea bite hypersensitivity	
Ectoparasitic diseases	Sarcoptic mange	SBF, rarely localised DP
	Demodicosis	DP, SBF
	Cheyletiellosis	SBF, ExP
Infectious diseases	Dermatophytosis	SBF, DP
	Leishmaniosis	DP, SBF
Endocrine disorders	Hypothyroidism	SBF, ExP, rarely DP
	Hyperadrenocorticism	
	Sex hormone imbalances	SBF, ExP
Autoimmune diseases	Pemphigus foliaceus	SBF, ExP
Follicular dysplasias	Colour dilution alopecia	SBF, ExP
Keratinisation/ cornification disorders	Ichthyoses	SBF, ExP
Others	Sebaceous adenitis	SBF, ExP
	Acne	DP

Abbreviations: DP, deep pyoderma; ExP, exfoliative superficial pyoderma; SBF, superficial bacterial folliculitis

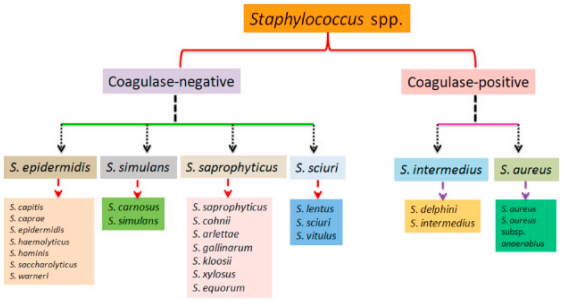
Virulence Factors

- Coagulase
- Thermonuclease
- Proteases
- Surface proteins
- Cytotoxins
- Exfoliative toxins
- Enterotoxins
- Superantigens
- Biofilm formation



Staphylococcus

- Coagulase
  - Major virulence factor involved in determining pathogenicity
  - Promotes a fibrin clot scaffold for tissue invasion
  - Associated with abscess formation
  - Protects against neutrophils
- Coagulase positive in veterinary medicine
  - *S intermedius*
  - *S aureus*
  - *S schleferi (coagulase variable)*

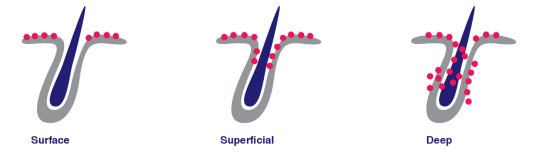


Clinical Signs

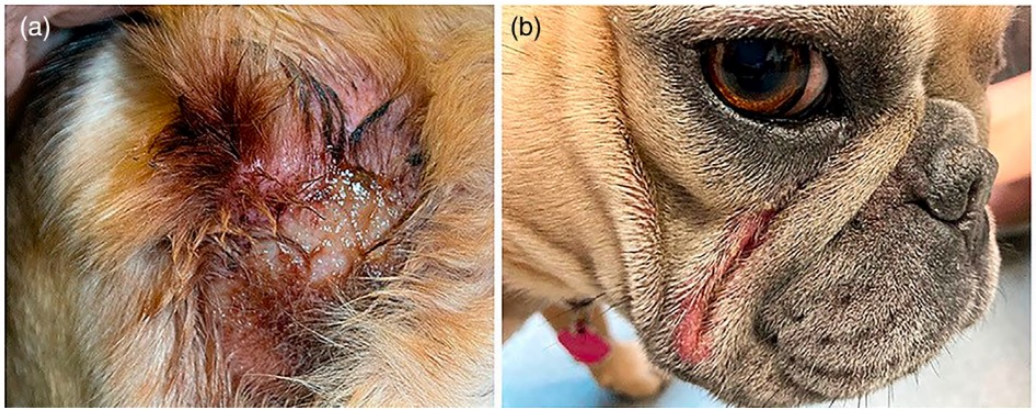
- Can be variable
- Skin odour
- Pruritus is common
- Alopecia; Moth eaten appearance
- Erythema
- Patterns of skin lesions often depends on level of penetration into the different skin structures
  - Surface pyoderma
  - Superficial pyoderma
  - Deep pyoderma

Different Types of Pyoderma

- Surface
  - Intertrigo (skin fold pyoderma), Hot spots
  - Topical therapy
- Superficial
  - Crusts, pustules, epidermal collarettes, papules
  - Topical therapy preferred, +/- systemic antibiotics
- Deep pyoderma
  - Furunculosis, fistulae, swelling
  - Always requires systemic antibiotics based on bacterial culture



Surface Pyoderma



Superficial Pyoderma

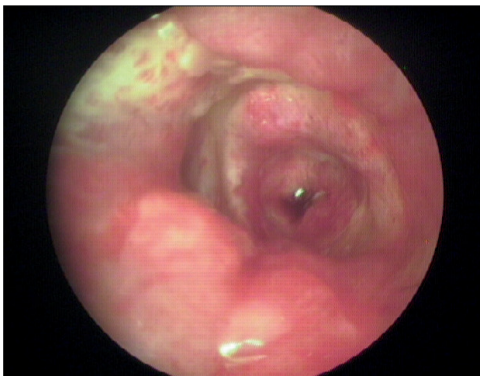
Deep Pyoderma

Different Types of Pyoderma

Depth/type of pyoderma	Clinical presentations	Most common lesions and frequent clinical findings
Surface	• Pyotraumatic acute moist dermatitis ('hot spot') • Intertrigo (skin-fold dermatitis) • Bacterial overgrowth syndrome (see Section 'Clinical presentations' for controversy over inclusion as an infection)	• Erythema, exudation, alopecia, pruritus • Erythema, malodour • Erythema, surface exudate
Superficial	• Superficial bacterial folliculitis (SBF) • Exfoliative superficial (spreading) pyoderma • Impetigo • Mucocutaneous pyoderma	• Papules, follicular pustules, epidermal collarettes, crusts • Epidermal collarettes, scales, crust • Papules, interfollicular pustules, epidermal collarettes • Erythema, crusting, hypopigmentation

Deep	• Widespread furunculosis/cellulitis
	• Localised furunculosis/cellulitis, for example:
	  • Pyotraumatic folliculitis and furunculosis
	  • Acral lick dermatitis
	  • Infected interdigital nodules
	  • Callus pyoderma
	  • Chin pyoderma/chin 'acne'
	• Postgrooming furunculosis
		Can be present in any presentation of deep pyoderma:
		• Haemorrhagic crusts, haemopurulent discharge, fistulae (sinuses), ulcers, nodules, plaque, ill-defined swelling
		• Pain, lymphadenomegaly

Bacterial Otitis Externa



Post-Grooming Furunculosis

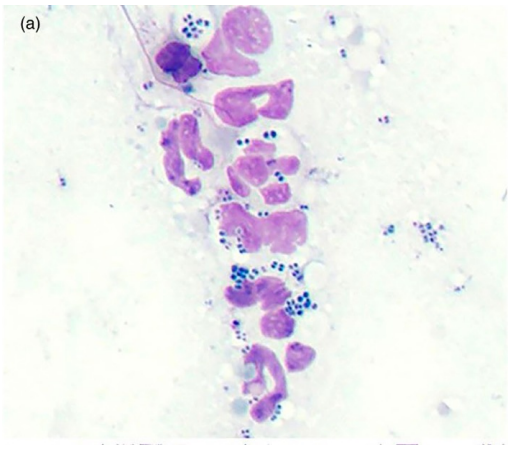
Necrotizing Fasciitis

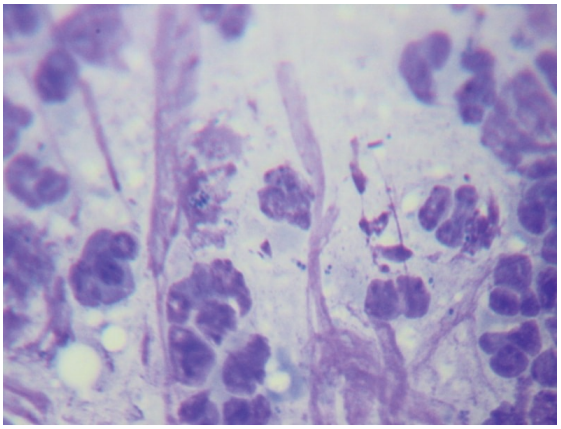
Diagnosis

Cytology

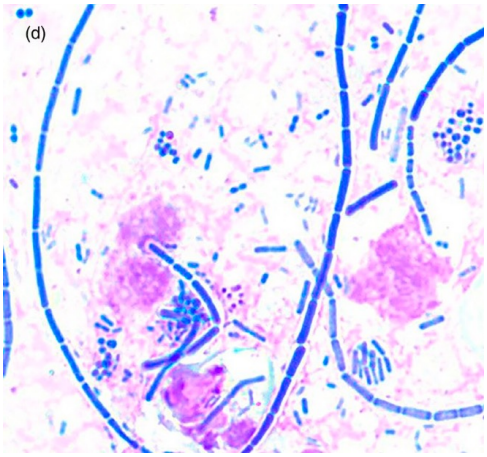
- Should be done in all cases prior to prescribing antibiotics (either topical or systemic)
- Guides anti-microbial therapy
- Confirms diagnosis so you aren't guessing if the clinical signs are caused by bacterial overgrowth
- Sampling techniques
  - Direct impression
    - Better for pustules, moist lesions, crusts
  - Tape strip
    - Better for very dry skin
    - Harder to quantify and assess with microscopy

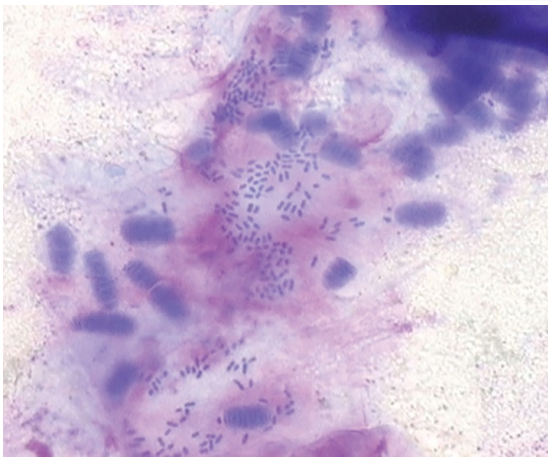
Cytology- Cocci





Cytology- Rods

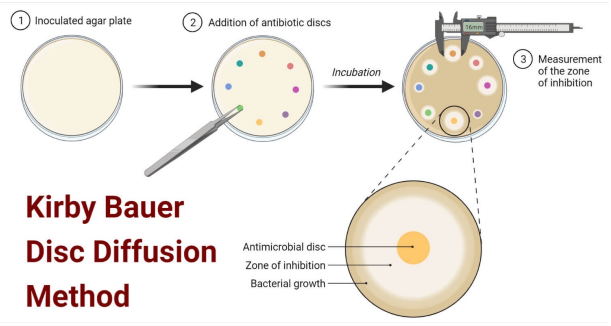




Bacterial Culture

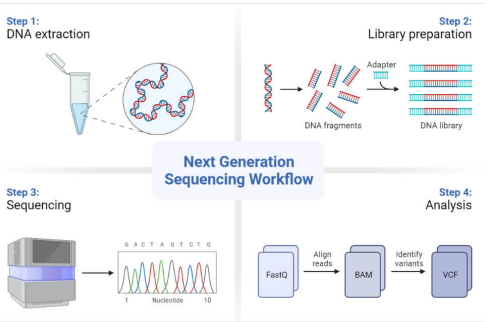
- Should always be accompanied by cytology for interpretation
- Useful for guiding systemic antimicrobial therapy
- Two testing techniques:
  - Broth Microdilution
  - Disc diffusion (Kirby-Bauer)
    - Cheaper
    - Semiquantitative (S/I/R)

- I would recommend treating intermediate susceptibility as resistant
- Topical therapy may overcome resistance based on culture

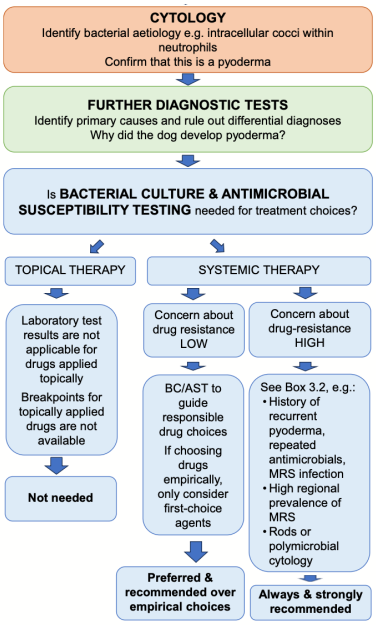


Next Generation Sequencing (NGS)

- New technology used for bacterial isolation and identification
- No difference in detection between NGS and bacterial culture for Staphylococcal species
- Poor agreement with methicillin resistance with bacterial culture among all labs tested
- Currently not recommended for use over standard culture techniques

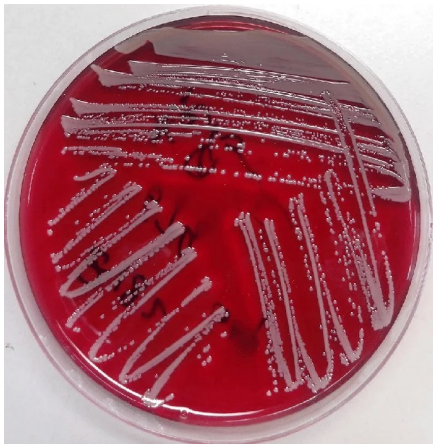


Treatment



When to Culture?

- Its never a wrong time to culture the bacteria
  - Added cost but increases likelihood of effective therapy
- Lack of response to empirical antibiotics
- Recurrent antibiotic use
- Deep pyoderma



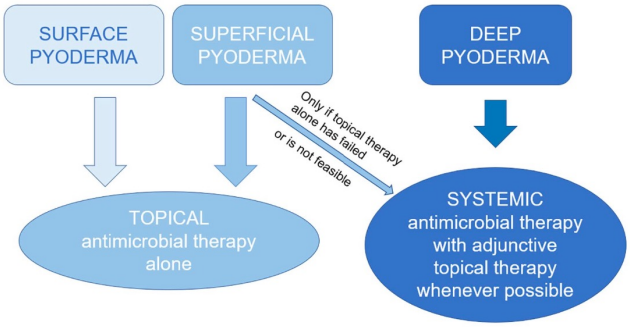
Topical Therapy

Topical Therapy

- Preferred first line
- Does not build up antibiotic resistance

Systemic Therapy

- When topical therapy fails or is not able to be administered
- Deep infections



Topical Therapy

- Many different options
- Use the mode of administration which works for your client (shampoos, mousse, spray)
  - Efficacy is important
  - Owners often will be more compliant if they choose
- Topical antibiotics may overcome breakpoints set by bacterial culture
  - Higher concentration delivered to the site of activity

Topical Therapy

Antiseptics
- Chlorhexidine (2-4%)
- Benzoyl Peroxide

Antibiotics
- Mupirocin
- Fusidic Acid
- Miconazole (antifungal w/ antibiotic action)
- Polymyxin B (better for Gram -)
- Neomycin

Antimicrobials
- Silver sulfadiazine

Staphylococcus

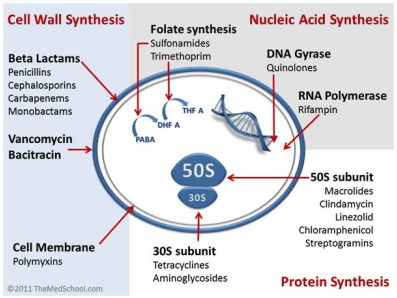
Group	Active ingredient	Strength of recommendation (SOR) for use as a sole therapy in: Surface pyoderma	Superficial pyoderma	Comments
Antiseptic	Benzoyl peroxide 2.5%	SOR A[64]	Not recommended[96]	Can be irritant
	Chlorhexidine 2%–4% (possibly less effective against *Pseudomonas* spp. or ESBL-producing *E. coli*)[146]	SOR A[64,76]	SOR A[89,94,97–99]	Also antifungal
	Chlorhexidine 2%/ Miconazole 2%	–	SOR A[98]	Both agents are anti-staphylococcal and antifungal
	Olanexidine	–	SOR A[94]	Molecule related to chlorhexidine
	Sodium hypochlorite (NaOCl, bleach)/salicylic acid	–	SOR B[93]	Commercial preparation, concentration unknown

Systemic Therapy

- Always based on cytology
  - Use cytology to interpret importance of bacteria grown on culture
- Always prescribe lowest effective tier antibiotic for empirical therapy
- Use concurrently with topical therapy
- Guideline recommendations: Start with 2 week oral course and re-evaluate
- Effective resolution of clinical signs expected in 3-4 weeks, but can be seen sooner
- For deep pyoderma, treat until resolution of clinical signs and negative cytology

Systemic Therapy

- First Tier Antibiotics
  - Cephalexin, Amoxicillin-Clavulanic Acid, Clindamycin
- Second Tier Antibiotics
  - Use should be based on bacterial culture
  - When unable to use First Tier Antibiotics
  - Fluoroquinolones, Doxycycline, Third generation cephalosporines (Cefpodoxime, Cefovecin), TMPS
- Third Tier Antibiotics
  - Use should be based on bacterial culture
  - When unable to use First and Second Tier Antibiotics
  - Rifampin, Amikacin, Chloramphenicol



Chronic Therapy

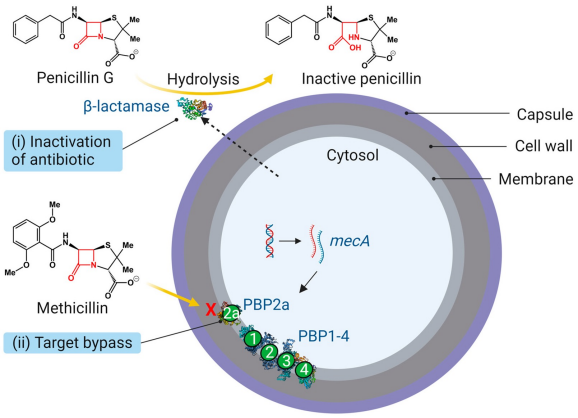
- Identify underlying skin disease to reduce incidence
- Institute regular medicated bathing, mousses or sprays
- Do not make use of regular oral antibiotics

Methicillin Resistance

- 2 main mechanisms:
  1. Penicillinases
     - Deactivate natural penicillins and aminopenicillins by breaking structure of the beta-lactam ring of these antibiotics
  2. mecA/mecC genes
     - Encode a different penicillin binding protein (PBP2a)
     - Reduced affinity of penicillin binding
     - Reduced affinity of all beta-lactam antibiotics, including cephalosporines

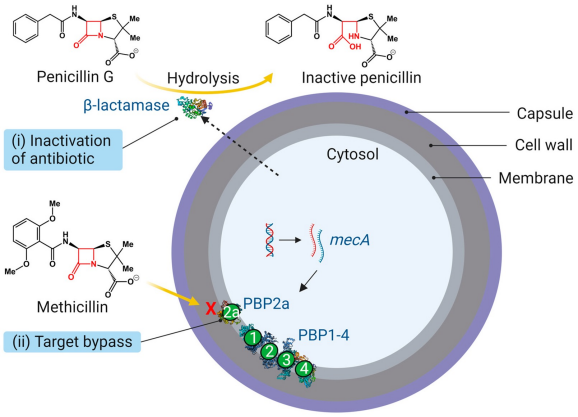
Methicillin Resistance

- 2 main mechanisms:
  - Penicillinases
    - Deactivate natural penicillins and aminopenicillins by breaking structure of the beta-lactam ring of these antibiotics



Methicillin Resistance

- 2 main mechanisms:
  - mecA/mecC genes
    - Encode a different penicillin binding protein (PBP2a)
    - Reduced affinity of penicillin binding
    - Reduced affinity of all beta-lactam antibiotics, including cephalosporines



Thank you again to our sponsor!

Hill's Pet Nutrition

Hill's

Transforming Lives

References

- Bannoehr J, Guardabassi L. Staphylococcus pseudintermedius in the dog: taxonomy, diagnostics, ecology, epidemiology and pathogenicity. Vet Dermatol. 2012. 23(4),253-e52. doi: 10.1111/j.1365-3164.2012.01046.x
- Bond R, Morris DO, Guillot J, Bensignor EJ, Robson D, Mason KV, Kano R, Hill PB. Biology, diagnosis and treatment of Malassezia dermatitis in dogs and cats. Clinical consensus guidelines of the World Association for Veterinary Dermatology. VetDermatol. 2020. 31(1),27-e4. doi: 10.1111/vde.12809.
- Guillot J, Bond R. Malassezia yeasts in veterinary dermatology: An updated overview. Frontiers in Cellular and Infection Microbiology. 2020. 10(79),1-11. doi: 10.3389/fcimb.2020.00079
- Hobi S, Bęczkowski PM, Mueller R, Tse M, Barrs VR. Malassezia dermatitis in dogs and cats. The Veterinary Journal. 2024. 304. https://doi.org/10.1016/j.tvjl.2024.106084
- Hobi S, Cafarchia C, Romano V, Barrs VR. Malassezia: Zoonotic implications, parallels and differences in colonization and disease in humans and animals. J Fungi. 2022. 8(7),708. doi: 10.3390/jof8070708.
- Khurso A, Aarti C. Metabolic heterogeneity and techno-functional attributes of fermented foods-associated coagulase-negative staphylococci. Food Microbiology. 2022. 105. doi: 10.1016/j.fm.2022.104028.
- Loeffler A, Cain CL, Ferrer L, Nishifuji K, Varjonen K, Papich MG, Guardabassi L, Frosini SM, Barker EN, Weese JS. Antimicrobial use guidelines for canin pyoderma by the International Society for Companion Animal Infectious Diseases (ISCAID). Vet Dermatol. 2025. 36(3),234-282. doi: 10.1111/vde.13342
- Miller WH, Griffin CE, Campbell KL. Bacterial Skin Diseases. In: Miller WH, Griffin CE, Campbell KL, editors. Muller & Kirk's Small Animal Dermatology, 7th edn. St. Louis: Elsevier; 2013. p. 184-222
- Miller WH, Griffin CE, Campbell KL. Fungal and Algal Skin Diseases. In: Miller WH, Griffin CE, Campbell KL, editors. Muller & Kirk's Small Animal Dermatology, 7th edn. St. Louis: Elsevier; 2013. p. 223-283
- Morrise DO, Loeffler A, Davis MF, Guardabassi L, Weese JS. Recommendations for approaches to methicillin-resistant staphylococcal infections of small animals: diagnosis, therapeutic considerations and preventative measures. Clinical consensus guidelines of the World Association for Veterinary Dermatology. Vet Dermatol. 2017. 28(3),304-e69. doi: 10.1111/vde.12444
- Smart K, Pieper JB, Viall AK, Noxon JO, Berger DJ. Comparison of commercial next-generation sequencing assays to convention culture methods for bacterial identification and antimicrobial susceptibility of samples obtained from clinical cases of canine superficial bacterial folliculitis. Vet Dermatol. 2025. 36(1),14-23. https://doi.org/10.1111/vde.13299

Questions