Nosocomial Infections

Nosocomial = “hospital-acquired” infection
- Also called HAI
- Significant health care cost in human medicine
- Little systematic study in veterinary medicine
  - Likely to be a problem in veterinary hospitals
  - Additional risk of zoonotic disease transmission

MRSA

Methicillin-resistant *Staphylococcus aureus*
- Very important HAI in human medicine
- Also can be community-acquired
- Also causes disease in veterinary patients

MRSP

Methicillin-resistant *Staphylococcus pseudintermedius*
- Can colonize healthy pets
- Can cause disease in pets
- Can infect humans
  - Less common than MRSA in humans

Staphylococci

Bacteria
- Gram-positive
- Facultative anaerobes
- Catalase-positive
- Pathogenic species usually coagulase-positive
**Staphylococci**

Common commensals of skin and mucous membranes
Can colonize individuals
- Transient
- Persistent
Can also cause infections
- Invade damaged epithelium

**Staphylococci**

*S. aureus*
- Coagulase positive
- Nasal carriage in humans
  - Transient – up to 60%
  - Persistent – up to 30%
  - MRSA < 15%
- Dogs and cats not typical reservoirs

**Staphylococci**

*S. pseudintermedius*
- Coagulase positive
- Most common one in dogs
- Formerly *S. intermedius*
- Most common cause of canine pyoderma

**Antibiotic Resistance**

*S. aureus* a significant cause of mortality in humans pre-antibiotics
Penicillins introduced
- Acquired resistance
- 90% of *S. aureus* resistant to penicillins
Methicillin introduced
- Acquired resistance
- 30-40% of *S. aureus* in US are MRSA

**Methicillin Resistance**

Mobile genetic element
- Staphylococcal cassette chromosome *mec* (SCCmec)
- Carries *mecA* gene
- Codes for altered penicillin-binding protein
  - PBP2a, PBP2’
- Low affinity for β-lactam antibiotics
  - Penicillins, cephalosporins, carbapenems

**Methicillin Resistance**

Mobile genetic element
- Can spread horizontally
  - To other *Staphylococci*
- Can acquire other antibiotic resistance markers
  - Can become resistant to other non-related antibiotics
  - Macrolides, fluoroquinolones
### Virulence

**MRSA and MRSP**
- NOT necessarily more virulent than other bacteria
- But are harder to treat, due to antibiotic resistance
- Can possess virulence factors
  - Panton-Valentine leukocidin
    - Neutropenia, impaired immunity
    - Tissue necrosis, abscesses

### MRSA Transmission

**Colonizes healthy humans**
- Higher rates in health care workers
- Higher rates in veterinarians
- Higher rates in some farm workers

**Colonizes animals**
- Low rates in dogs and cats
- Probably not natural hosts

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### MRSA Transmission

**Interspecies transmission**
- Human to pet very likely
  - Infections in pets often reflect the strains found in humans in the community
- Pet to human also possible

**Direct contact**
- Indirect contact
  - Environmental contamination
  - Equipment, cages, food bowls etc
  - Hands, clothing

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### MRSA Infection

**Risk Factors?**
- Surgery
- Trauma
- Immunosuppression
- Concurrent infections

### MRSA Infections

**Clinical signs in dogs and cats**
- Skin, wound, post-operative infections
- Less common:
  - Urinary tract infection
  - Respiratory infection
  - May be asymptomatic carriers
MRSA in the literature
Increasing reports over last 10 years
• Korea, UK, Ireland, Australia, Netherlands, N. America
• Laboratory in UK (2003-2006):
  • 561 isolates of MRSA from companion animals
    • Avian: 2
    • Canine: 388
    • Equine: 6
    • Feline: 156
    • Lagomorph: 7
    • Rodent: 2

MRSA in Dogs and Cats
Weese et al (2006) - Suspected transmission of MRSA between pets and humans in veterinary clinics and in the household
• Investigated incidents (6) of colonisation or infection of pets
• Characterised MRSA from dogs, cats, and humans contacts
• Cultures, PCR, PFGE

Weese et al, 2006
MRSA isolated from 8 small animal cases
• 5 dogs, 3 cats with clinical infections
• 1 in-contact cat
• 14/88 in-contact humans (at home or in the clinic)
• An indistinguishable MRSA was recovered from at least one human contact associated with each animal case
• All isolates were the predominant community-associated MRSA in humans

Weese et al, 2006 - Cluster of MRSA in a Small Animal ICU
• MRSA isolated from tracheostomy tube of a dog on a ventilator
  • Dog had no signs (colonized)
• MRSA isolated from 6/26 animals (4 dogs, 2 cats) over 14 days, in the ICU
  • None had clinical signs

MRSA in Dogs and Cats
Clinical Signs of Infection (Weese study)
• Post-operative infection (dogs)
  • 3 of these
• Rhinitis (cats)
  • Owners and another cat colonized
• UTI (1 dog, 1 cat)
  • Both owners colonized

Dogs and Cats
MRSP Transmission
Can colonize healthy dogs and cats
• 1.5-2% healthy dogs
• 4% healthy cats
Can cause skin infections
Risk factors for infection unknown
Direct and indirect transmission
• Environment
• Fomites
**MRSP Transmission**

Colonization uncommon in humans

Can spread from animals to humans

Pathogen in dog-bite wounds

Can spread between dogs/cats within a hospital (nosocomial)

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**MRSP Infections**

Clinical signs in dogs and cats

- Pyoderma
- Otitis externa
- Wound infections
- Abscesses
- Respiratory, oral, urinary tract infections

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**MRSA and MRSP in Humans**

ZOONOTIC DISEASES!

- Can be transmitted from humans to animals, and from animals to humans
- Skin and soft tissue infections
- Osteomyelitis
- Endocarditis
- Pneumonia
- Sepsis
- UTI

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**MRSA and MRSP Diagnosis**

Bacterial culture and sensitivity are essential

- Coagulase-positive *Staphylococcus*
- Identify species
- Test for oxacillin resistance

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**MRSA and MRSP Therapy**

Asymptomatic Carriers

- May clear infection on their own
- Unclear if they should be treated

Routine screening for colonization is not recommended

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**MRSA and MRSP Therapy**

Sick Animals (skin or wound infections etc)

- Topical therapies
  - Debridement and lavage
  - Mupirocin
  - Chlorhexidine
  - Silver sulphadiazine
  - Honey
  - Tea tree oil
MRSA and MRSP Therapy
Sick Animals (skin or wound infections etc)
- Systemic antibiotics
- Choice based on culture/sensitivity and location of infection
- Request extended panels
- Avoid:
  - Penicillins
  - Cephalosporins
  - Carbapenems
  - Fluoroquinolones

MRSA and MRSP Prognosis
May depend on:
- Antibiotic sensitivity
- Location of infection
- Severity of infection
- Strain of MRSA/P

Infection Control
Minimise Spread from Asymptomatic Carriers
- WASH HANDS between all patients
- Use hand sanitizers
- Wear protective clothing
- Thermometer covers
- Clean tables and surfaces after every patient

Infection Control
Confirmed infection
- Place in isolation
- Barrier nursing
- Gowns/gloves/shoe covers
- Disinfectant footbaths/mats
- Enforced HAND WASHING
- Disinfect or discard (and autoclave) equipment and supplies after patient is discharged

Communications
Owners of patients
- Contact their physician
- Minimize contact with the old, the young, and the immunocompromised

Questions?