

1 ☐ **Orthopedic Infection: Diagnosis, Treatment, and Recent Literature**

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3 ☐ **Methods of Joint/Synovial Infection**

- Hematogenous
 - Mostly foals, rare in adults
 - synovial infection is secondary
 - Gram negative > gram positive bacteria
- Percutaneous
 - Trauma, arthrocentesis
 - Gram positive > gram negative bacteria
- Adjacent Invasion
 - From physis, other bone infection, cellulitis, subarticular abscess

5 ☐ **Diagnosing Orthopedic Infection**

- History
 - Foals
 - Failure of passive transfer
 - Pneumonia
 - Umbilical abnormalities (infection)
 - Adults
 - Recent wound
 - Open fracture
 - Recent orthopedic procedure
- Physical exam
 - Lameness (grade 4+)
 - Swelling, heat, effusion
 - Wounds or draining tracts
 - Sometimes small wounds are worse
 - Fever not always reliable in adults

8 ☐ **Diagnosing Orthopedic Infection**

- Arthrocentesis + cytology
 - TNCC > 10,000/uL

- TP > 3.0-3.5 g/dL
- 90% degenerative neutrophils (PMNs)
- +/- intracellular bacteria
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- Sterile skin preparation and needle placement
- 18 gauge needle
- Sterile EDTA tube (purple)
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9 ☐ Diagnosing Orthopedic Infection

- Culture (& sensitivity)
 - Synovial Fluid
 - Positive → yes there is an infection
 - Negative → still might be an infection (50/50 for positive culture results)
 - Place in blood culture tube (or red top tube)
 - Blood (foals)
 - Can be helpful but can have multiple bacteria
 - Taken under sterile conditions while placing IVC
 - Best taken prior to antimicrobial treatment
 - Bone or tissue
 - Can be helpful in osteomyelitis cases
 - Decreased positive cultures if antibiotics have been started but should still submit

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10 ☐ Diagnosing Orthopedic Infection

- Bloodwork
 - CBC not always reliable in adults, should always be done in foals with risk of systemic sepsis
 - Fibrinogen >900 indicative of osteomyelitis

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11 ☐ Diagnosing Orthopedic Infection

- Imaging
 - Ultrasound

- Effusion with flocculent material
- Swollen synovium
- Abscess, other soft tissue infection
- Guide sampling
- Radiographs (examples next slides)
 - Effusion, osteolysis, osteoarthritis
 - Limitations
 - Several days to detect boney changes
 - Ossification centers in foals are irregular, subtle changes are hard to detect
 - Good to get baseline rads to compare to future rads if treatment doesn't go as planned
 - Progression of OA, lysis, collapse of joint space
- CT (examples next slides)
 - Great when radiographs aren't clear-cut, upper limb/pelvis
 - More detail

17 ☐ General Guidelines for Treatment

- Lavage
- Debride
- Antimicrobials
- Anti-inflammatories
- Usually need multiple modalities of treatment
- Aggressive early treatment essential
- Kill bacteria at presentation
- Resolve inflammation following resolution of infection

18 ☐ Lavage: Arthroscopy

- Pro
 - Higher volume fluids
 - Assess joint surface
 - Visualize debridement
 - Removal of fibrin, foreign

bodies

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- Requires anesthesia
- Large open wounds → inability to extend joint, decreased visualization

–Not required in every septic joint but good option if suspicious of foreign material

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20 ☐ **Needle Lavage Supply List**

- Clippers (if associated with wound)
- Sterile scrub
- 14-18 gauge needles (2-3/joint)
- Syringes
 - 3ml: collect joint fluid for testing
 - 12-20ml: confirm communication
 - 3ml: post lavage antibiotic
- Sterile fluids (isotonic, 1L/joint)
- 10 drop set
- Pressure bag or high volume fluid pump
- Post lavage antibiotic (amikacin most common)

24 ☐ **Arthrotomy/Thecotomy**

- Provides continuous drainage
- Option for synovial structures with high volume fibrin
- Must have sterile bandage
 - Difficult in stifle/upper limb

25 ☐ **Debridement**

- Debridement of dead surfaces is essential
 - Biofilm formation
 - Must be removed for resolution of infection
 - Removal of sequestrum
 - “clean out” involucrum
 - Removal of necrotic tendons, ligaments, skin
 - Must be careful in foals
 - Must preserve growth and articular cartilage

- Not always necessary

27 **Antimicrobials**

- Methods of administration
 - Systemic (IV, IM, PO)
 - Local
 - Intra-articular/synovial
 - Regional
 - Bone
 - Artery or vein
 - Repository (beads)
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29 **Systemic Antimicrobial Application**

- Appropriate application of antimicrobials essential for elimination of infection
 - Use correct drugs
 - Administer correctly
- Initial treatment
 - IV and broad spectrum
- Bactericidal
- Standard protocols
 - Adults: penicillin, gentamicin
 - Foals: penicillin & amikacin
 - Or Penicillin & Gentamicin (12mg/kg, q36h)
 - Current KSU combo due to backordered amikacin

30 **Systemic Antimicrobial Application**

- Oral antibiotics (only after improvement)
 - Chosen based on culture/sensitivity results
 - Trimethoprim/Sulfa
 - Chloramphenicol (if bone penetration is needed)
 - Tetracyclines: Doxycycline or Minocycline (not in foals)
- Duration of antibiotics?

- IV: at least 5 days, depends on clinical signs
- Switch to oral for 14 days after IV
- Total duration 3+ weeks
- Avoid compounding drugs
 - Unreliable concentrations
 - Now need a medication justification for the use of compounded medications

31 ☐ **Local Injection**

Intra-articular/Intra-synovial

- Directly into joint or tendon sheath
- Repeat daily or every other day
- Concentration dependent
- Bactericidal
- Amikacin most common
 - Dose?
 - 125-500mg
 - New study 30mg
 - Pezzanite (CSU), ACVS Abstract

32 ☐ **Regional Perfusion- IO**

- Achieves higher drug concentrations in tissues than possible with systemic administration
- Intra-osseous (IO)
 - Hole drilled distal to site of sepsis
 - Drill or 14G needle (works well in foals)
 - 1:9 antibiotic dilution

33 ☐ **Regional Perfusion**

- Intra-venous
 - Achieved high concentrations of drug in synovial structures and surrounding tissue
 - Reduced drug expense and toxicity
 - Good when there is significant soft tissue trauma
 - Tourniquet placed proximal to site of infection
 - Small butterfly catheter (23G)
 - 500 mg-1 gram amikacin QS to 35-60ml (depending on location and foal vs. adult)

- 20-30 minutes for diffusion
- Every other day or until satisfied infection is eliminated
- Standing or under anesthesia during surgical procedure
- Avoid arteries due to risk of thrombosis or phlebitis

35 ☐ **Antibiotic Beads**

- Temporary high concentrations of antibiotic at local site
- Fill dead space
- Materials
 - Polymethyl methacrylate (PMMA)
 - Plaster of Paris (POP)
 - Biodegradable matrix or collagen
 - Expensive \$\$\$\$

36 ☐ **Antibiotic Beads**

- Do NOT use >1 antibiotic
 - Decreased elution of both drugs
- Time dependent theoretically are best
 - Usually heat sensitive, PMMA creates exothermic reaction possibly inactivating beta-lactams
- Used prophylactically or therapeutically
 - Place along implant on in debrided area
 - Best if tissue can be closed
- PMMA can be made table side
- Pre-made with gas sterilization (POP or PMMA)

39 ☐ **Anti-inflammatories**

- Limit inflammation → limit destruction
- - Medications
 - NSAIDs
 - Systemic
 - Phenylbutazone
 - Flunixin Meglumine
 - Firocoxib (usually not enough)

- Local/Topical
 - Diclofenac
- Coaptation
 - Compression bandage
 - Sweat bandage