Surgical Infections in Joints
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Causes of joint infections
192 horses
- Sepsis in foals 34%
- Wounds 24%
- Intraarticular Injections* 22%
- Recent joint surgery* 13%


Frequency of Joint Infection Following Intra-Articular Injections
- Humans - 0.037% or about 4 in 10,000
- Horses - NO STUDY to determine frequency of infection - but likely much higher than 4 in 10,000
- Joints infected following intraarticular injections
  - Lapointe et al: EVJ 1992
  - 15/15 horses
  - 9/13 horses
  - Schneider et al: EVJ 1992
  - 42/192 horses
Surgical Site Infections (SSI)
National Nosocomial Infections Surveillance System

- Superficial SSI - only skin and subcutaneous tissue
- Deep SSI - deep soft tissues
- Organ/space SSI - organs and spaces opened during the operation that are not part of primary incision

- Joint infections
  - Superficial
  - Deep (joint cavity)

Frequency of Surgical Site Infections in Humans following Arthroscopy

- Superficial SSI 0.01% to 0.48%
- Deep SSI 0.08% to 1.4% (0.15%)

Frequency of Surgical Site Infections in Horses following Arthroscopy

- 932 arthroscopies in 682 horses
- 8 joints infected - 0.9%
- Significant risks
  - Draft breeds
  - Tarsocrural joints
- No influence on risk
  - Perioperative and intra-articular antimicrobial administration
  - Breed and sex
Frequency of Surgical Site Infections in Horses following Arthroscopy

* Purdue Data* - unpublished
* 500 arthroscopies in 372 horses
  * 15 horses admitted for septic arthritis
* 2 joints had deep SSI – 0.41%
  * 2 horses
  * Both tarsocrural joints
* 5 joints had superficial SSI – 1.0%
  * 3 horses
  * 3 of the infected joints were tarsocrural joints
* All 7 horses received perioperative potassium penicillin IV one hour before and immediately after surgery

*Dr. Mohammed Elrashidy*

Although frequency of iatrogenic joint infections is low the number of procedures in horses is high and iatrogenic joint infections are commonly diagnosed in equine practices.

Bacteria commonly isolated from septic joints after surgery or injection

* Staph aureus
* Staph epidermidus (>50% of horses)
* Beta hemolytic and non-beta hemolytic streptococci
* Enterobacteriaceae
* Pseudomonas
* Anaerobes
Source of infecting bacteria

- Skin of the horse
  - “Equine skin is a veritable cesspool of bacteria”
    - Scott and Miller, Equine Dermatology
  - Complete disinfection of skin is not possible.
- Surgeon
  - 17% of veterinarians are positive for MRSA from nasal swabs – J. Weese, ACVS Study, 2008.
- Contaminated medication or surgical equipment
  - 18% of multidose vials in a veterinary hospital were contaminated with bacteria

Common susceptibility of bacteria isolated from iatrogenic septic joints

- Amikacin
  - Staph aureus
  - Staph epidermidus
  - All enterobacteriaceae
- Penicillin
  - Beta-hemolytic streptococcus
  - Anaerobes

Prevention of Joint Infections

- Post-injection sepsis
- Sepsis secondary to wounds
- Sepsis following arthroscopy
Preventing Injection Sepsis

- Skin disinfection with Povidone-iodine scrubs of 10, 5, or 0.5 minutes or with a commercial iodofor solution are equally effective. Zubrod et al. Vet Surg 2004

The effect of needle size and type, reuse of needles, insertion speed, and removal of hair on contamination of joints with tissue debris and hair following arthrocentesis

- Objective: To determine if unclipped hair contributes to contamination of joints following joint injection
- Background
  - Hair found in septic joints of 2 horses following intra-articular injection
  - 100% of needle insertions with 18 gauge spinal needle produced identifiable skin fragments in humans during arthroscopy

Methods

- Insertion of needle into joint
- Removal of hair
- Contamination of joint assessed
- Statistical analysis performed
Results

- Tissue contamination in 1145 of 1260 wells
- Hair in 384 wells
- Compared to 20 gauge needles used one time through unclipped hair, the odds ratios for contamination were significantly greater for:
  - 16 gauge needles
  - 20 gauge spinal needles
  - Clipped and shaven hair
  - Reuse of needles

Results – Spinal Needles

Remove hair with spinal needles

Prevention of sepsis following articular wounds

- Synovial cavities are often contaminated after sustaining open wounds and punctures
- 41/95 horses with wounds/punctures had foreign material in synovial cavity
  
  Wright IM et al., EVJ 2003

Adams, Moore, Elrashidy, Mohamed, Snyder
Prevention/treatment of contaminated synovial cavities

- Systemic Antibiotics
- Local Antimicrobial Therapy
- Anti-inflammatory drugs
- ARTHROSCOPY*
  **

Prevention of surgical infections following arthroscopy

- Perioperative antibiotics have not been proven to reduce postoperative infections in human or horses
- Post-operative infection rate in 3231 human patients – deep SSI
  - Prophylactic antibiotics 0.15%
  - No antibiotics 0.16%
  P value = .59
  Bert JM et al. Arthroscopy 2007

Prophylactic Antibiotics in Horses

- Olds et al: Illinois Study – Deep SSI
  - Perioperative antibiotics 0.5% 1/188
  - No antibiotics 2.2% 6/273
  p=0.19

- Purdue Study
  - All 5 horses (2 deep SSI and 5 superficial SSI) received K penicillin one hour before and immediately following surgery
  - Both deep SSI infections caused by Staph aureus
  - One deep SSI secondary to superficial SSI
Prophylactic Antibiotics Regime

- Perioperative antibiotics - Give within 1 hour of start of surgery and again in immediate post-op period. Intravenous route recommended
  - Select antibiotics with activity against staphylococcus
- Intraoperative antibiotics - Intra-articular medication of Amikacin at conclusion of surgery
  - Dose 250 mg Amikacin in 6-10 ml of 2% mepicicaine hydrochloride

Prevention of surgical infections following arthroscopy - Source of Infection

- Many post-operative joint infections are due to contamination of the joint after the surgery and not due to intra-operative contamination.
- Premature removal of bandages may predispose to postop infection
  - Goodrich & McIlwraith, VCNA 2008
- Perioperative prophylactic antibiotics will not protect against post-operative contamination

Prevention of arthroscopic surgical infections – surgical preparation

- Do not clip or shave skin prior to surgical procedure
  - Pustules and scratches form which increase bacterial load
- Use new antisepsics and sterile preparation materials
- Wear examination gloves or sterile gloves
Prevention of arthroscopic surgical infections – surgical draping

- Impervious drapes to prevent strike through of bacteria
- Antibiotic coated adhesive drapes have not been shown to reduce postoperative infections in humans.
- HORSES?
  - Coffin joint, navicular bursa
- Place drapes to reduce pooling of outflow arthroscopy fluids on abdomen

Prevention of arthroscopic surgical infections

- Close wounds with adhesive strips
  - Steri-Strip, 3M Health Care
- Maintain sterile bandages for 7 days
  - Use gloves when changing bandages
- Do not palpate wounds with bare hands
  - "Inspection Leads to Infection"
- Maintain clean environment

Diagnosis of arthroscopic surgical site infections

- Swelling – periarticular, intraarticular, incisional
- Incisional drainage
- Lameness
- Synovial Fluid Analysis
  - Turbid fluid
  - WBC count > 30,000 cells/µl
  - TP > 4 gm/dl
  - Isolation of Bacteria**
Diagnosis of arthroscopic surgical infections - imaging

- Standard radiographs
  - May miss subtle changes
  - Radiographic changes lag significant joint destruction
- CT/MRI

Treatment Principles

- Remove bacteria, fibrin, pannus and necrotic bone
- Remove inflammatory mediators and cytokines
- Reduce pain and inflammation
- Protect cartilage

Treatment

- Systemic antimicrobial drugs
  - Initial treatment with IV administration of drugs effective against *staphylococci* spp
    - Cephalosporin and amikacin
    - Moore et al. EVJ 1992
  - Followup treatment based upon culture and susceptibility
  - Doses of drugs
    - Doxycycline 10 mg/kg per os BID
    - Oxytetracycline 6 mg/kg IV BID
    - Imipenem 10-20 mg/kg IV QID (lower dose for foals)
    - Chloramphenicol 50 mg/kg per os QID
    - Vancomycin 7.5 mg/kg IV in 250 ml saline BID
Local Antimicrobial Therapy

- Direct intraarticular injections
  - Amikacin 500 mg once daily
  - Gentamicin 250 mg once daily

- Regional limb injections
  - Intravenous or Intraosseous
  - Lower limb use 250-500 mg amikacin or gentamicin in 70 ml BES

- Continuous intrasynovial antimicrobial infusion
  - Chronic and unresponsive septic joints

Surgical Procedures

- Needle lavage

- Closed suction drains
  - Jackson Pratt

- Arthrotomy

- Arthroscopy
  - Most effective method for flushing joint and removing debris

- Surgical Arthrodesis
  - Tarsometatarsal and Distal Intertarsal joints
Surgical Site Infection Case Report 375037

- 11 month old Standardbred colt
- Diagnosed with OCD in right tarsocrural joint
- Routine surgery D2

D6  Edema around hock, horse not lame. Edema migrated down limb over several days.

D14  Sutures removed. Incisions inflamed, irritated and swollen. HA and 250 mg Amikacin placed in the joint

Limb re-bandaged

D16  Horse lame. Marked effusion in joint. Hock flushed standing and antibiotics started. Synovial fluid submitted for culture

D 17 Arthroscopy
- Joint lavaged with 4 liters BES
- Marked fibrin accumulation removed
- Continuous intraarticular infusion system placed and infusion of amikacin/mepivicaine started
Culture Results  D21

- ISOLATE - Staphylococcus aur. ss aureus
  PCR (mecA) negative for MRSA

Chloramphenicol = 8 S
Enrofloxacin <= 0.5 S
Marbofloxacin = 0.5 S
Oxacillin + 2 NaCl > 4 R
Rifampin <= 1 S

Surgical Site Infection Case Report 375037  D21

- Enrofloxacin IV SID at 5mg/kg
- CIAI continued with Amikacin*
  - Animals - 39% of all Staphylococcus resistant to gentamicin at 4 µg/ml but all bacteria susceptible at 500 µg/ml (Purdue Univ)
  - Humans - 62% of Staphylococcus resistant to gentamicin were inhibited at 16 µg/ml and 95% of resistant Staphylococcus inhibited at 64 µg/ml
- Joint flushes continued every other day

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- D30 Radiographs show only soft tissue swelling
- D32 Arthroscopy to flush and evaluate joint. Cartilage fair condition. Second arthrotomy incision made and drains placed in both sites.
- D39 Culture isolates MRSA. Oral CHPC at 50 mg/kg per os QID started.
Surgical Site Infection Case Report
375037

- D42 Radiographs reveal physisis. Physis debrided. Regional perfusion with vancomycin, PMMA-vancomycin beads inserted
- Vancomycin 7mg/kg IV TID
- Lavages continue
- Horse grade 4 lame
- D48. Radiographs show joint collapse.

D0
D49

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- Horse euthanized
- Staph aureus not recovered.

Discussion