“What is that hole in the coffin bone?”
Diagnosis and Treatment of Septic Pedal Osteitis and Keratomas in the Horse

ASHLEIGH OLDS-SÁNCHEZ, DVM
DABVP-EQUINE PRACTICE
KEYSTONE VETERINARY CONFERENCE
2019

Septic Pedal Osteitis
- Infectious and inflammatory process of the third phalanx, also known as P3, or the coffin bone
- By definition this process involves:
  - Presence of an infectious organism (bacteria)
  - Demineralization of bone
  - Accompanied by purulent exudate

Why Not Osteomyelitis?
- Coffin bone has no medullary cavity and is all cortical bone
- Osteomyelitis requires infection of medullary cavity
- When only the cortex is involved = osteitis

Septic Pedal Osteitis vs Pedal Osteitis
- Presence of purulent exudate = septic pedal osteitis
- Demineralization of bone and osteolysis without infection = pedal osteitis

Septic Pedal Osteitis: Causes
- Trauma to the bone or small fractures that lose vascularity can predispose to infection if bacterial colonization occurs
- Penetrating wounds and foreign bodies
- Street nail etc.

Septic Pedal Osteitis: Causes
- Subsolar abscesses and soft tissue infections that are not treated with adequate drainage and debridement
  - Deep solar abscesses seem to be most common route
  - Untreated synovial infections can lead to infection of articular cartilage and spread to cortical bone
Septic Pedal Osteitis: Causes

- Laminitis with ischemia to regions of P3
- Hematogenous route due to systemic bacteremia in foals
  - Hematogenous spread has not been documented in adult horses

Septic Pedal Osteitis: Presentation

- Usually present with a history of acute onset lameness that is not resolving similar to “foot abscess”
- May have an abscess tract that continues to drain and is refractive to standard treatment and drainage
  - Often seems to “resolve” and then comes back in the same spot
- Lameness may wax and wane and may be 3-5/5 AAEP scale

Septic Pedal Osteitis: Diagnosis

- Presenting clinical sign of lameness
- Localize to the foot with regional anesthesia
  - Sometimes block to palmar digital, often to an abaxial sesamoid or basisesamoid block
- Radiographs**

Septic Pedal Osteitis: Causes

- Often no known cause or obvious draining tract
  - 44% unknown cause of infection
  - 66% have a draining tract (34% don’t)
- Take home – horses can have septic pedal osteitis without an obvious abscess or draining tract!!!
Septic Pedal Osteitis: Diagnosis

- Radiographic changes:
  - Bone resorption or “cyst like” lesions in the bone surrounded by sclerotic bone
  - Resorption/osteolysis may be focal or diffuse along the solar margin
  - Crena is normal and usually central and bilateral – if not sure, radiograph the other foot

- Moderate to severe lameness & Radiographic evidence of osteolysis

- DDX include:
  - Septic osteitis
  - Non septic osteitis
  - Osseous cysts
  - Keratoma
  - Neoplasia

- Presence of purulent exudate would suggest septic process
- Neoplasia and keratomas can have purulent exudate associated with them

- Keratomas and neoplasia usually have much more smoothly margnated circular or semi-circular lucencies compared to septic osteitis
- Keratomas are usually not lame in early stages and become more lame as the mass grows towards the weight bearing surface of the hoof wall.

- MRI can be useful in cases without specific radiographic changes, but is very insensitive
- MRI may not distinguish between infection, keratoma or neoplasia
- More helpful for planning surgical approach for keratomas or neoplasms
- CT may be more sensitive for diagnosis of septic pedal osteitis than MRI but still not sensitive – detects inflammation and bone loss
- CT more useful for planning surgery for keratomas
- **Most cases of septic pedal osteitis can be diagnosed with radiographs alone or confirmed with surgical exploration**
Keratoma

Are relatively uncommon, benign, keratin-containing soft tissue masses that develop between the hoof wall and distal phalanx.

The etiology of keratomas is unknown, but trauma, chronic inflammation, and infection have all been implicated as potential initiating factors.

AKA: Horn tumor, horn cyst, keratin cyst

Keratomas typically do not cause lameness in the early stages, or they tend to cause an intermittent increasing lameness as the mass grows down towards the weight-bearing surface of the hoof.

Can have multiple in one foot
Can recur

Keratomas are usually solitary masses, although multiple keratomas have been removed from a single hoof.

Keratomas are treated by surgical removal through the hoof wall.
Can be quite large in some cases.

Keratomas often appear as a cylindrical or circular loss of bone on x-rays.

In some cases the farrier will have noted abnormalities or separation at the white line in a focal spot before any lameness or drainage develops.

May also see distortion of the hoof capsule or drainage at the corona band.

Some keratomas are subsolar.

Keratomas and neoplasms usually have much more smoothly margined bone defects (very circular or semicircular, cylindrical).

In early stages may be difficult to distinguish from septic pedal osteitis.

**Regardless of cause, both keratomas and septic pedal osteitis are treated with surgical debridement of the foot – so often diagnosis is official at surgery.**
Surgery: Septic Pedal Osteitis

**Goals:**
- Provide drainage
- Remove infected soft tissues
- Remove devitalized bone
- Currette or dremmel bone to healthy, non-infected margins

Surgery can be performed standing or anesthetized depending on temperament of the patient.

Type of lesion may determine if approach is through the solar margin or the hoof wall, or both.

If a draining tract is present, this can be useful as a landmark for surgical approach.

If no draining tract is present, you can drill three small holes in the hoof wall and place metal BB’s, take several radiographs and obliques and use BB’s as landmarks to plan surgical approach.

Sedation or anesthesia
- Placement of abaxial sesamoid block
- Place tourniquet above the level of the fetlock – wide esmarch
- Withhold antibiotics 24 hours prior to surgery so that you can obtain a culture of purulent exudate (aerobic/anaerobic) if desired.
  - Foals always (salmonella, r.equi, etc?)
  - Pre-op NSAIDS – Bute 4.4 mg/kg IV

Instruments for Surgery:
- Hoof knives (sharp!) – sterilized or cold sterile
- Nippers (I like sharp half-rounds in addition to regular nippers)
- Bone currette
- Dremmel with sterilized drill bits and dental burr attachments
- Wooden block to place foot on

Dremmel Accessories:
- $10 on Amazon!
- Carbide dremmel bits
- Sterilize in autoclave pouches

Aseptic prep of foot
- Trim hoof capsule in area of surgical approach
- Prep again
- Using nippers and hoof knives, remove hoof capsule over the area of concern until purulent exudate and bone are encountered
- Obtain culture sample
Surgery: Septic Pedal Osteitis

- Often the infection extends significantly further than pre-op radiographs would suggest.
- Often more lateral and medial along the solar margin.
- Sometimes tracking up the white line.
- Large amount of bone may be affected! Studies have shown up to 25% of the coffin bone can be removed safely with complete return to soundness.
- Possible much more can be removed.

- Remove all devitalized tissue.
- Curette and/or dremmel bone to remove any soft or friable bone [Saline rinse while dremmeling to reduce heat].
- Saline rinse +/- antibiotic afterwards (ampicillin, gentamicin).
- Sterile bandage with sterile saline soaked gauze on the bone.
- Bandage tightly! Will bleed extensively when tourniquet is removed!!!
- Try to keep surgery time/tourniquet time to less than 45 minutes. Usually a 10-15 minute procedure.

Post-Operative Care: Septic Pedal Osteitis

- Placement of a shoe will reduce hoof wall instability and may improve comfort.
- Can be placed several days post-operatively.
- Type of shoe depends on surgery site, but goal is to stabilize the hoof capsule and reduce need for bandaging, sole support.
- Bar shoe with treatment plate?
- I have glued on Epona shoes and had farrier come reset/nail them on several days post-op.

- Keep bandaged with saline soaked gauze on the surgery site (+/- antibiotics in saline).
- Change bandage daily or every other day at first.
- Sterile bandaging until there is a healthy bed of granulation tissue covering the coffin bone that it starting to cornify.
- Granulation tissue should cover bone in 7-10 days.
- Plan on sterile/clean bandaging for 2-4 weeks.
- Bandaging and complete healing may take 12 weeks.
- Owner compliance with post-op bandaging is critical to success!

- NSAID administration is important to keep pain controlled.
- Reduce risk of colic or support limb laminitis.
- Bute 4.4 mg/kg BID x 3-5 days, then 2.2 mg/kg BID x 3-5 days.
- Systemic antibiotics.
- Questionable efficacy and penetration to infected bone, but typically used to “cover bases”.
- Consider RLP daily for 3 days post-op if you have significant concerns about remaining infection.
- Recent study showed tourniquet for 15 minutes adequate after amikacin injection.
- Theoretically surgery is curative and should have removed all infected tissue, but may not be true.

- Antibiotic selection:
  - Penicillin + Gentamicin for 3-5 days or Ceftiofur 4.4 mg/kg IM q24hrs x 3-5 days.
  - Follow up with 10-14 days of oral sulfa antibiotics.
  - Culture results and how the surgical site is healing may change antibiotic selection.
  - 20% of cases require a second debridement.

Photo credit: Dr. Teresa Crocker & Dr. Larry Galuppo.
Septic Pedal Osteitis: Prognosis

- Excellent prognosis post-operatively
  - so long as inciting cause was not laminitis
  - 88% horses sound 3 months post-op
  - Slightly worse for foals with hematogenous spread but 68% of foals treated in one study went on to successfully race as adults

Surgical Treatment: Keratoma

- Main differences from septic pedal osteitis:
  - Surgical approach is almost always performed standing
  - Place foot on wooden block to elevate it from the ground
  - Approach through the hoof wall unless subsolar
  - Surgical debridement proximally/vertically along the white line until all affected tissue removed (rather than medial-lateral along solar margin with infection)

Keratoma surgery

- If partial hoof wall resection can be performed rather than complete hoof wall resection, horses heal faster and return to work more quickly with less complications. (7 months vs 10 months)
- Requires knowing exactly where the keratoma is – which often can’t be determined with x-rays
- MRI or CT can be helpful to plan surgical margins if available

Keratoma Surgery

- Contrast studies may be helpful to show a keratoma “filling defect” if you have a draining tract to inject

Surgical Treatment: Keratoma

- Shoe to stabilize the hoof can be important important due to the vertical instability in the hoof wall if extensive hoof wall is removed
- Often the coffin bone is smooth and does not require extensive debridement – mostly removing soft tissues and laminae.
- Don’t seem to have issues with infection post-operatively

Post-operative Care: Keratoma

- Same management as septic pedal osteitis with bandaging, NSAIDS, +/- antibiotics.
- Potential complications:
  - Pain/lameness
  - Hoof cracking
  - Recurrence
- Excessive granulation tissue formation
  - Consider amikacin impregnated PMMA plate across defect

Extreme shoe!
Photo Credit: Dr. Brent Barnett, C.J.F

Post-operative Care: Keratoma

- Same management as septic pedal osteitis with bandaging, NSAIDS, +/- antibiotics.
- Potential complications:
  - Pain/lameness
  - Hoof cracking
  - Recurrence
- Excessive granulation tissue formation
  - Consider amikacin impregnated PMMA plate across defect
Prognosis: Keratoma

- Excellent for soundness with appropriate treatment
- May take longer to get back into “work” due to hoof wall instability, but usually require a shorter period of bandaging than septic pedal osteitis
- 7-10 months reported before back to full work in most cases
- Can recur in the same or other locations

Other Considerations: Medical Maggot Usage

- Surgical margins may not be clear
- Bacteria and infection may persist
- Phanicia serata = medical grade blowfly maggots
  - Sterilized
  - Won’t reproduce
  - Will only feed on necrotic tissue and will not invade healthy tissue

Medical Maggots:

- Selective, non-traumatic, minimally invasive debridement of any remaining necrotic tissue left in surgery site
- May reduce need for further debridements
- FDA approved
- Published reports of use in septic pedal osteitis
- Client cost $300-400
- Less than repeat surgery?

Medical Maggots

- Speed healing?
- Reduce pain at surgical site – salivary secretions from maggots may reduce pain
- The salivary secretions of blow fly larvae contain proteolytic enzymes and disinfecting compounds that kill bacteria and break down necrotic tissue. The maggots then ingest the breakdown products, removing all debris.
- The salivary secretions are also believed to stimulate fibroblastic activity inhibit the formation of biofilms and promote angiogenesis all of which may speed healing

Medical Maggots: Practical Applications

- Monarch Labs – ship overnight
- Place into wound bed 2-3 days post-operatively
  - Can’t place into the wound when there is still a lot of active bleeding
- No caustic solutions on antibiotics on wound bed
  - No betadine, chlorhexidine or topical antibiotics 48 hours prior to maggots application
- Systemic antibiotics and RLP still OK.
Medical Maggots:

- Apply to wound bed and bandage with sterile materials and damp sterile saline soaked gauze over the maggots.
- Bandage needs to be breathable or will suffocate the maggots. I usually place gauze and elastikon and leave a “window” in the duct tape as a “breathing” hole.
- Change bandage every 1-2 days.
- Maggots will GROW!
- Usually feed 5-7 days and then start to drop off.
- Theoretically will die sooner if nothing left to feed on.
- Proteus infections seem to be one thing maggots can’t survive in.

References: