Primary Lesions of DDF Tendon w/in the Hoof Capsule

- Can occur secondary to navicular disease or it may be a primary lesion
- Primary lesions have only recently recognized as a major cause of foot pain
  - Use of MRI has increased recognition
  - Observed in 1/3 to 2/3 of horses w/ foot pain examined using MRI
- Etiopathogenesis is uncertain
- May occur alone or w/ other soft-tissue injuries

Primary Lesions of DDF Tendon w/in the Hoof Capsule

- 4 different types of primary lesions:
  - Core lesions
  - Dorsal abrasions
  - Almost invariably accompanied by degenerative changes of palmar surface of navicular bone
  - Splits, sagittal & oblique
  - Insertional lesion at facies flexoria
- Lesion types may occur alone or in combination with others
Primary Lesions of DDF Tendon w/in the Hoof Capsule

- DDFT inserts on palmar processes & central portion of distal phalanx (facies flexoria)

Sagittal Split

Oblique Split
Primary Lesions of DDF Tendon w/in the Hoof Capsule

Dorsal surface erosions
Note lesion on navicular bone

Primary Lesions of DDF Tendon w/in the Hoof Capsule

• Core lesion

Primary Lesions of DDF Tendon w/in the Hoof Capsule

• Most lesions are at level of navicular bone
• Occur less commonly at insertion of DDFT to distal phalanx (i.e., facies flexoria)
• Core lesions most commonly occur at level of PIP joint & proximal phalanx
  • On medial or lateral lobe - not usually both
Primary Lesions of DDF Tendon w/in the Hoof Capsule

- May be result of:
  • Acute fiber tearing at end of stance phase
  • Repetitive overload
  • Combination of both
- In 1 study, horses w/ a lesion in DDFT in a foot had a significantly more acute angle in DDFT around navicular bone than matched controls
  • Is it a risk factor?
  • Or, does it occur after injury?

Primary Lesions of DDF Tendon w/in the Hoof Capsule

- Most commonly seen in jumping horses
  • Risk increases w/ height & intensity of jumping
  • Occurs most commonly in horses between 5 & 14 yrs old
  • No breed predilection
  • 70% unilateral – 30% bilateral
  • Onset:
    • 50% acute
    • 50% insidious
  • Lameness is moderate to severe

Primary Lesions of DDF Tendon w/in the Hoof Capsule

- Lameness is usually worse when horse is lunged w/ affected foot to the inside
  • May be worse when affected foot is on the outside if a core lesion in the medial lobe of the DDFT
  • No response to hoof testers
  • Usually no palpable abnormalities
    • Rarely, may be able to palpate enlarged DDFT at bulbs of heel
    • Rarely, may be able to elicit signs of pain by deep palpation
    • Occasionally, DFTS is distended if lesion extends proximally to the level of the sheath
  • No Response
Primary Lesions of DDF Tendon w/in the Hoof Capsule

- Response to flexion varies
- PD nerve block, DIP joint block, or navicular bursal block often improves lameness
  - About 2/3rds of affected horses
- Anesthesia of DFTS alleviates pain in that portion of the DDFT w/in the foot
- Abaxial sesamoid block always resolves lameness

Primary Lesions of DDF Tendon w/in the Hoof Capsule

- Radiographic exam
  - May see entheseous new bone, cortical bone loss, or osseous cyst-like lesion on facies flexoria (attachment of DDFT tendon on distal phalanx) if lesion is at the insertion
  - Otherwise, no radiographic changes

Primary Lesions of DDF Tendon w/in the Hoof Capsule

- Ultrasonographic exam
  - DDFT can be observed only as far distally as proximal border of the navicular bone
  - Hoof capsule interferes
  - Hard to align transducer perpendicular to tendon fibers
  - Only 10% of lesions are visible ultrasonographically
Primary Lesions of DDF Tendon w/in the Hoof Capsule

- Nuclear scintigraphy
  - Focal increase in radionuclide only for horses w/ associated enthesiopathy at facies flexoria
  - Negative result does not rule out injury to the DDFT

Primary Lesions of DDF Tendon w/in the Hoof Capsule

- Primarily diagnosed by MRI!
  - MRI has made this the most common diagnosis in horses w/ foot lameness w/o radiological abnormalities!

Primary Lesions of DDF Tendon w/in the Hoof Capsule

- Endoscopy
  - May see lesion(s) in DDFT during endoscopic exam of navicular bursa
Primary Lesions of DDF Tendon w/in the Hoof Capsule

Treatment
• 6-12 months of confinement w/ slowly ascending increase in walking
• Only the dorsal border lesions appear to heal
• Splits, insertional, & core lesions do not heal well
• Pastern cast for 1st 6 weeks
• Inferior check ligament desmotomy
• Shoes
  • Raised heels
  • Uncommonly, elevating the heels may increase lameness
• Egg-bar shoes
• Endoscopic debridement, if visible through navicular bursa
  • Tx of choice if lesion can be approached through the navicular bursa

Surgical Debridement

Primary Lesions of DDF Tendon w/in the Hoof Capsule

• Intralesional or intrabursal injection of a biological therapeutic drug:
  • Acell - porcine-derived, extracellular matrix
  • PRP - platelet-rich plasma
  • IRAP - interleukin 1 receptor antagonist protein
  • Stem cells
• Intrabursal injection of a corticosteroid
  • Controversial
  • Needle placement is guided into lesion by using CT or radiography
Primary Lesions of DDF Tendon w/in the Hoof Capsule

**Outcome**

- Prognosis for soundness is poor
  - Persistent lameness - 50%
  - Sound at pasture/light work - 25%
  - Sound in competitive work - 25%

Collateral Desmitis of the DIP Joint

**Incidence**

- 2nd most important single injury responsible for foot lameness in horses w/o radiographic abnormalities
- Behind primary lesions in DDFT w/in the hoof capsule
- Only recently recognized as a major cause of foot pain
- Use of MRI has increased recognition

Collateral Desmitis of the DIP Joint

**Anatomy**

- Origin
  - Medial & lateral epicondyles of middle phalanx
- Insertion
  - Depressions on dorsoproximomedial & dorsoproximolateral aspects of distal phalanx
    - Just dorsal to cartilage of the foot
    - Close to joint margin
Collateral Desmitis of the DIP Joint

Pathology

- Injury can occur at bone ligament interphase (i.e., entheseopathy):
  - At origin on distal condyles of middle phalanx
  - At insertion on distal phalanx
- Injury can occur at midportion of ligament (i.e., desmitis)
- Medial ligament is most frequently injured (about ¾ of CL injuries)
- Osteoarthritis as a sequel is uncommon
- Often, concurrent soft-tissue injuries

Signalment

- Horses of all breeds or disciplines can be affected
- Horses used for jumping appear to be at an increased risk
  - Same for primary lesions in the DDFT
- Knowledge of an acute injury is rarely reported
  - In one study, 20% of horses had a history of being treated for a foot abscess prior to referral

Clinical Signs

- Mild to moderate, chronic foot lameness w/o radiological abnormalities
- Occasionally an acute onset
- Lameness in invariably worse when horse is lunged w/ affected limb on the inside
- Usually a fore limb injury
- Often bilateral
- Usually no localizing signs
  - May see firm enlargement of pastern proximal to coronary band
  - May see distention of DIP joint
Regional analgesia of horses w/ foot lameness w/o radiographic abnormalities

<table>
<thead>
<tr>
<th>Block</th>
<th>ASNB</th>
<th>PDNB</th>
<th>DIPJ</th>
<th>NAV BURSA</th>
<th>DFTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL Desmitis</td>
<td>100%</td>
<td>72%</td>
<td>24%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>DDFT Tendinitis</td>
<td>100%</td>
<td>72%</td>
<td>68%</td>
<td>67%</td>
<td>100?</td>
</tr>
</tbody>
</table>

Difference in response to IC anesthesia of the DIP joint & NB gives a strong indication of the likely cause of lameness in horses w/ foot lameness w/o radiographic abnormalities.

Collateral Desmitis of the DIP Joint

**Imaging**

- Usually no abnormalities seen on radiographs
- Only 2/18 in 1 study
- May see decrease in radiopacity at insertion site of CL
- Best identified on a dorsoproximal-palmarodistal oblique projection
- 1.e., high coronary or upright pedal view
- Area of decreased radiopacity maybe surrounded by sclerosis
- Stress radiographs may show subluxation of DIP joint

Collateral Desmitis of the DIP Joint

**Ultrasonography**

- Can image only the proximal 25% of ligament
- Normal cross-sectional area < 0.70 cm²
- Assessment is difficult
- Prone to false negative results
- Only 10 of 62 (16%) horses w/desmitis of CL had ultrasonographic abnormalities of CL
Collateral Desmitis of the DIP Joint

**Scintigraphy**

- May see increased uptake of radiopharmaceutical at origin on middle phalanx or insertion on distal phalanx

---

Collateral Desmitis of the DIP Joint

**MRI**

- Normal CLs appear as well-delineated, banana-shaped structures & are symmetrical (medial & lateral)
- Abnormalities:
  - Increased cross-sectional area
  - Irregular contour
  - Increased signal density
  - Osseous changes
  - 40% of affected horses
- Often, concurrent soft-tissue injuries are seen

---

Collateral Desmitis of the DIP Joint

**Treatment**

- Rest (3 to 6 months)
  - If walked, avoid circling & horse walkers
  - Immobilization in a cast maybe indicated for the 1st 4 to 6 weeks of the period of rest if injury is severe
  - Medication of DIP joint
    - W/ interleukin-1 receptor antagonist protein (IRAP)
    - Corticosteroid
Collateral Desmitis of the DIP Joint

**Treatment**

- Extracorporeal shockwave therapy
- 3 applications, 2 weeks apart
- Denoix shoe w/ wide web on affected side & narrow web on unaffected side (optional)
- Relieves stress on ligament

Denoix shoe

**Prognosis**

- In a report of 54 horses treated w/ 6 mos w/ stall confinement & walking exercise, only 33% made a complete recovery.
- In one review, 85% of horses w/ primary collateral mid-body desmitis treated w/ rest, shock wave therapy, & medication of DIP joint w/ IRAP made a complete recovery

**Thrush**

**Definition**

- Degenerative condition of frog & surrounding tissues caused by infection w/ keratolytic organisms
- Infection may penetrate horny tissues to involve sensitive structures
- May involve digital cushion & skin at bulbs of heel
Thrush

**Definition**

- Characterized by black, necrotic, foul-smelling material in central sulcus or collateral sulci of frog
- Many keratolytic organisms are involved, but *Fusobacterium necrophorum* appears to be the most important

**Thrush

**Causes**

- Poor sanitation
- Persistent wet conditions
  - Sole pads!
    - Keep the sole moist
- Confinement –
  - Results in poor sanitation & wet conditions

**Thrush

**Causes**

- Associated w/ poor foot conformation
  - Deep sulci of frog
    - Saddlebreds, Tennessee Walking Horses, & other gaited horses have naturally deep sulci & are predisposed to thrush
  - Sheared heels
    - Caused by mediolateral imbalance
**Thrush**

**Clinical Signs**
- Foul-smelling, black material in sulci of frog
- Sulci of frog, especially central sulcus, are deep (both a cause & a result)
- Frog may be atrophied
- Lameness, if sensitive tissues are involved

**Thrush**

**Treatment**
- Clean feet daily
- Remove necrotic tissue
- Apply drying agent to foot
  - Formalin
  - Tincture of iodine
  - Tincture of iodine & formalin
  - Tincture of iodine, formalin, & phenol (Sole paint)
  - New methylene blue
  - 2% benzoyl peroxide

**Thrush**

**Treatment**
- Foot soaks in chlorine bleach [30 mL (1 oz) of bleach in 5L water]
- Miconizole (Lotrimin) plus neomycin (50:50 mixture)
- May need to temporarily protect foot w/ bandage
- Improve foot conformation, if indicated
- Improve sanitation
**Thrush**

**Prognosis**

- Good for complete recovery

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**Subsolar Abscess**

**Incidence**

- Most common cause of *acute* lameness in horses
- No age, sex, breed, or sport predilection

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**Subsolar Abscess**

**Cause**

- May originate from a penetrating wd, nail hole, or deep sub-solar bruise
- *Cause is usually not identified*
**Subsolar Abscess**

**Clinical Signs**

- Sudden, severe lameness
  - Varies from barely perceptible to non-weight-bearing
  - Owner may believe horse has fixed its limb
- Bounding digital pulse
- Affected foot is warmer than contralateral foot
- Distal portion of limb, especially pastern, is often swollen

**Subsolar Abscess**

**Clinical Signs**

- Coronary band may have draining sinus from migration of infection
  - Solar infection tracking up hoof wall lamellae to the coronet discharges at the hair line
  - Referred to as a "gravel"
  - Infection from other causes, such as quittor, may discharge proximal to hair line

**Subsolar Abscess**

**Diagnosis**

- Clinical signs, e.g., bounding digital pulse
- Application of hoof testers
  - May elicit pain at site of subsolar infection
  - May be able to squeeze exudate from infected area by applying hoof testers
  - Exudate is usually grey or black
**Subsolar Abscess**

**Diagnosis**

- If area of infection is difficult to locate:
  - Lightly pare sole &/or
  - Poultice foot
  - Warm foot baths w/ Epsom salts (softens horn, making paring easier)

- Radiography
  - May see gas
  - Used to rule out other causes of lameness localized to foot, eg., fx of distal phalanx, laminitis
  - To identify complications of subsolar infection, e.g., osteitis of distal phalanx

**Treatment**

- Aim of tx is to open abscess for drainage
- Can usually be done w/ horse standing, w/ or w/o regional anesthesia
- Tract should be opened just enough to establish drainage
  - Discontinue debridement if blood or pink tissue is encountered
**Subsolar Abscess**

**Treatment**

- Tetanus prophylaxis
- Bandage
- Soak foot in warm Epsom salt solution
- If distal phalanx is involved (i.e., osteitis), then bone must be curetted
  - Regional (or general) anesthesia & tourniquet are required
  - Most easily done through trephine hole in hoof wall rather than through the sole (my opinion)
  - Horse is more comfortable

**Subsolar Abscess**

**Aftercare**

- Extent of aftercare depends on extent of infection & environment
- Antimicrobial & analgesic therapy is seldom required
  - Administer if deep structures are involved
- May need to protect bottom of foot w/ bandage
- If a large area of corium has been exposed, a shoe w/ removable hospital (boiler or medicine) plate

**Subsolar Abscess**

**Prognosis**

- Usually excellent w/ uncomplicated subsolar abscess
Hoof Wall Separation (Seedy Toe; White Line Disease)

Definition

• White line disease, or seedy toe, describes destruction of the zone of epidermis between the sole & the hoof wall
  • White line is junction between wall & sole
  • Opening occurs w/in white line, allowing infection to invade stratum medium
  • Causes cavities to develop between laminae & outer hoof wall

Hoof Wall Separation (Seedy Toe; White Line Disease)

Definition

• Keratinolytic process w/in deep layer of stratum medium

Hoof Wall Separation (Seedy Toe; White Line Disease)

Definition

• See thickened, stretched white line
  • Often associated w/ chronic laminitis
Hoof Wall Separation
(Seedy Toe; White Line Disease)

Causes

• Long toes & under run heels may predispose
• Creates shearing forces at toe

Clinical signs

• May cause lameness
• Clinician should look for other causes of lameness, as well
  - Especially if not associated w/ laminitis
• See separation of hoof wall at white line
• Can probe cavity
• Probing does not cause pain
• Cavity is filled w/ necrotic debris
• Radiographic evaluation helps determine extent of hoof wall separation

Treatment

• Remove separated outer hoof wall
• Apply antiseptic or drying agent to exposed laminae
• Heart-bar or full-support shoe if a large section of hoof wall is removed
• Wall can be reconstructed w/ acrylic
Canker

**Definition**

- Proliferative pododermatitis
- Usually of frog
- May extend to undermine sole & heel bulbs
- Can occur in 1 or all feet
- More commonly seen in draft horses than in light horses
- Associated w/ same conditions that cause thrush

---

Canker

**Clinical signs**

- May at first resemble severe thrush
- Sometimes a foul odor
- Granulation-like tissue that bleeds easily
- Lameness varies according to degree of severity

---

Canker

**Treatment**

- Debridement (i.e., excision)
- Radical & may need to be repeated
- Application of metronidazole to lesion
- Application of drying agents, e.g., 2% benzoyl peroxide
- Administration of a corticosteroid seems to be important
- Application of a hospital plate (medicine plate)
- After radical debridement exposing sensitive corium

---

From Pollit, The Horse's Foot
**Canker**

*Prognosis*

- Recurrence is common

---

**Keratoma**

*Definition*

- Uncommon
- Aberrant, hyperplastic mass of keratin
- Comprised of concentric sheets of squamous epithelial cells
- Typically originate from the keratinocyte-producing *stratum germinativum* of coronary band
- Mass is interposed between stratum medium of hoof wall & underlying distal phalanx

(From Pollitt, *The Horse's Foot*)

---

**Keratoma**

*Etiology*

- Unknown
- No breed, age, or sex predilection
Keratoma
Clinical Signs

• May be incidental finding
  • Grow slowly; may cause no clinical signs if it remains small
• May produce mild, intermittent lameness
  • If it impinges on sensitive laminae or distal phalanx or if infection develops around mass

Keratoma
Clinical signs

• Hoof may appear normal
• Or hoof wall may develop an abnormal shape or bulge at site of mass, usually in toe region
  • White line may be deviated toward center of foot, usually in toe region
• Keratoma may be visible at sole
• Horse may react to hoof tester applied over affected area
• Typically not visible radiographically

Keratoma
Diagnosis

• Clinical signs
• Radiographic appearance
  • Distal phalanx may appear normal
  • Usually pressure necrosis caused by tumor results in distinctive appearance of distal phalanx
    • See focal loss of bone, usually in toe region
    • Has a distinct margin
    • Do not confuse w/:
      • Crena
      • Septic osteitis
Keratoma Treatment

- Only tx is excision
  - W/ horse standing or anesthetized
  - Can use, saw, burr, or trephine centered over tumor
  - Use tourniquet
  - Two techniques:
    - Complete hoof wall resection
    - Partial hoof wall resection

Keratoma Treatment

- Complete hoof wall resection
  - Two parallel vertical cuts are made using a cast-cutting saw on either side of the keratoma
  - Hoof wall is grasped distally & levered towards the coronary band exposing the keratoma for surgical excision
  - Or, a horizontal cut is made proximal to the abnormal tissue

Keratoma Treatment

- Partial hoof wall resection
  - A cast saw or a trephine is used to create a window in hoof wall centered over the keratoma
  - Can enlarge window if necessary
  - More difficult to remove keratoma than w/ complete hoof wall resection but complications are less

Keratoma

Treatment

- After excision
  - Foot is bandaged until exposed sensitive laminae are keratinized
  - Acrylic can be used to repair hoof wall defect
  - After laminae are keratinized

Keratoma

Prognosis

- Good for return to soundness
  - More rapid return to function & fewer complications w/ partial hoof wall resection than w/ complete hoof wall resection*

Sidebone

- **Definition:**
  - Term used to describe extensive ossification of one or both cartilages of foot

**Sidebone**

**Anatomy:**
- Cartilages of the foot referred to as:
  - Collateral cartilages
  - Lateral cartilages
  - Ungual cartilages
  - Ungual cartilages
- Attach to proximal border of palmar (plantar) process of distal phalanx & to navicular bone
- Those of fore limbs are thicker than those of hind limbs
- Hyaline in young horses
- Fibrocartilage in adults

**Function:**
- Probably dissipation of energy

**Causes of Ossification:**
- Natural process
  - Greater in mature & old horses than in young horses
  - More extensive in heavy breeds than in light-weight breeds
- Excessive ossification has been associated w/ mediolateral foot imbalance

**Diagnosis:**
- Palpation:
  - Palpating cartilages provides unreliable indication of both size & degree of ossification
- Radiography
  - Degree of ossification can be established only by radiography
**Sidebone**

*Significance*

- Ossification is not directly associated with lameness
- Occasionally, fx of an ossified cartilage may be associated with lameness
- Ossification may occur from more than 1 center
- Radiolucent line may look like a fx

---

**Quittor**

*Definition*

- Necrosis of ungular cartilage (cartilage of foot) caused by infection

---

**Quittor**

*Etiology*

- Injury to coronary band at region of cartilage
- Laceration
  - Such as from an overreach injury
- May be secondary to subsolar abscess
**Quittor**

**Signs**
- Swelling, heat, & pain over coronary band, in region of the affected cartilage
- Sinus tract formation & purulent discharge at or proximal to coronary band in proximity of ungular cartilage
- Sinus tracts tend to heal & then break open at intervals
- At some time, horse is lame

**Diagnosis**
- Based on clinical signs
  - Drainage at coronary band may occur w/ subsolar infection (gravel), & this condition can be confused w/ quittor
  - Ultrasonographic exam - may reveal enlargement & irregularity of the cartilage
  - Radiographic exam
    - May see gas in laminae if from gravel

**Treatment**
- Surgical removal of infected cartilage
  - Usually performed w/ horse anesthetized
  - Cartilage is exposed through a curved incision created at proximal extent of cartilage
**Quittor Treatment**

- Because much of the cartilage lies below coronary band, a portion of hoof wall may need to be removed, w/ a trephine, to expose infected cartilage & to establish ventral drainage

**Avoid:**
- Incision through the coronary band
- Inadvertent penetration of DIPJ
- DIPJ is best avoided by performing sx w/ DIPJ extended
- Defect in hoof wall can be obliterated w/ acrylic after tissue at base of defect has keratinized

**End**
Solar Bruising

**Definition**

- A contusion caused by impact that results in focal or generalized damage with subsequent hemorrhage of the solar corium.

---

**Solar Bruising Causes**

- Most common location is junction between bar & wall of heel (i.e., angle of sole).
  - Termined a corn in this area.
  - Can be caused by improper shoeing.
    - Most common on medial angle of sole.
    - Farmers sometimes bend medial branch toward frog.
    - To prevent horse from stepping on shoe.

---

**Solar Bruising Causes**

- Shoe that is too small or does not extend far enough back under heels.
- Long-toe/low-heel conformation may cause toe-bruising.
  - Horse tends to land on toe.
- Excessive impact or weight-bearing on toe secondary to another cause of lameness, e.g., heel pain.
Solar Bruising

Causes

- Flat feet
- Thin-soled feet
- Congenital
  - Equ. TBs
- Excessive pining
- Riding on a hard or rocky ground
- Improperly balanced feet
- Loose shoe
- Foot that has overgrown its shoe
  - Shoe rides on sole

Solar Bruising

Clinical Signs

- Severity of lameness varies from acute, severe to chronic mild or intermittent,
- Often affects several feet
  - May resemble laminitis if both fore feet are affected
- Removing shoe may increase lameness
- Increased digital pulses
- Painful response to application of hoof testers
  - May resemble subsolar infection!

Solar Bruising

Diagnosis

- Clinical signs
- Discoloration of sole
  - May be difficult to identify if bruise is deep or if foot is pigmented
- Should be able to alleviate lameness w/ palmar digital nerve anesthesia
Solar Bruising

Treatment

- Phenylbutazone
- Eliminate shoeing problems
- Apply caustic agent to toughen sole, such as:
  - Iodine, formalin, & phenol (i.e., sole paint)
- Application of a wide-web shoe

Wide-web shoe