

# ANKLE and FOOT MR Pearls and approach

PROFESSOR AND CHAIR OF RADIOLOGY  
UNIVERSITY OF STONY BROOK

# OUTLINE

- Technical approach
- Interpretive geographic approach
- Diabetic foot
- Cryptic symptoms
- Marrow edema
- Tendon pearls
  - PTT
  - peroneals
- Soft tissue pearls
- Foot pearls

# REALLY FOUR DIFFERENT EXAMINATIONS

- Ankle/hindfoot
  - most tendons, ankle sprains and typical sports
- Forefoot
  - Mortons, sesamoids, occasional tendon and occult osseous injuries
- Midfoot
  - somewhat unusual; peroneal longus, occult fracture, Lis-franc
- Diabetic foot/tumor
  - similar protocol with contrast focused on two planes on focal area of interest

# INTERPRETIVE APPROACH

- Regional/Geography approach
  - sx complexes and imaging ddx
  - Usually includes a combination of ST and marrow disorders
- Also use effusions to see if articular disease is present, and/or related

# INTERPRETIVE APPROACH

## Geography

- Achilles "tendonitis"
  - Hypoxic degeneration
  - Paratendonitis
  - Retrocalcaneal bursitis
  - Mucoid foci
  - Kager's edema
  - Proximal gastroc tear
  - Partial tears

# INTERPRETIVE APPROACH

## Geography

- Distal Achilles
  - Insertional tendonitis
  - Haglund's syndrome
  - Retrocalcaneal bursitis
  - Retroachilles bursitis
  - Stress fracture of calcaneus

# INTERPRETIVE APPROACH

## Geography

- Anterior
  - ATT
  - Deep peroneal nerve
  - Anterior impingement
  - Ankle OA
  - Talo-navic OA

# INTERPRETIVE APPROACH

## Geography

- Distal PTT
  - unstable accessory navicular
  - Cornaute navicular
  - marrow edema from PTT
  - Insertional PTT
  - Bone bruise from ankle sprain
  - Midfoot stress fx
  - Inflammatory arthropathy

# INTERPRETIVE APPROACH

## Geography

- POPS
  - Distal peroneal
  - Os peroneum
  - Lateral calcaneus

# INTERPRETIVE APPROACH

## Geography

- Plantar fascia
  - Fascitis
  - Fascial tear
  - Muscle tear
  - Lateral plantar nerve
  - Calcaneal stress fx
  - Enthesopathy from  
Reactive arthritis

# INTERPRETIVE APPROACH

## Geography

- Overlap of nerve entrapment
  - Tarsal tunnel
  - STS
  - Medial plantar nerve
  - Inferior calcaneal branch
  - Normal variant(?)

# INTERPRETIVE APPROACH

## Geography

- Query Morton's
  - Morton's
  - Intermetatarsal bursitis
  - MTP synovitis
  - Stress fx MT (neck > base)

# ARTICULAR or SYNOVIAL DISEASE

- Effusion
  - Criteria distention of anterior > posterior recess
  - Look within effusion for debris or synovitis
- cartilage
- OCD
- other arthritis including instability
- trauma; ligament/bone bruise/occult fracture
- Effusion tendon sheath-acute symptoms- peroneal > PTT

# SPECIFIC PEARLS

- Remember FHL is the Baker's cyst of the ankle
- Evaluate for heterogeneity of fluid
- Also non- gravitational or "compartmentized" localization

# INTERPRETIVE APPROACH

## Diabetic Foot

- Trick is to find ulcer
  - 2 planes  $\perp$ , follow ulcer to bone on T1W image-
- Look for 2<sup>nd</sup> signs/ complications
  - Abscess
  - Sinus tracks
  - Reactive changes as STIR exaggerates
  - Post-contrast (delayed) enhancement = antibiotic response to image for this)

# NEUROPATHIC DISEASE: MR Findings

- Bone

- If acute edema/enhance without disloc, disorganization
- If chronic D's
- Regional/articular epicentered

- Soft Tissues

- SQ edema
- Periarticular enhancement
- Effusions

# WHERE INFECTIONS?

## WEIGHTBEARING AREAS 2<sup>nd</sup> INOCULATORY TRAUMA

- 2<sup>nd</sup> MT head
- With Hallux Valgus
  - Medial 1<sup>st</sup>
- With metatarsus minimus varus
  - Lateral 5<sup>th</sup>
- With Hammertoe or other toe deformities
  - Dorsal toes
- When debilitated
  - Lateral malleolus/ calcaneus
- With rockerbottom
  - cuboid>calc>5<sup>th</sup> MT>4 MT

# HOW DO I KNOW IF IT IS INFECTED OR NEUROPATHIC?

- **Location**

- Midfoot infection unusual unless contiguous ulcer
- MT's, toes and heel unusual for NP
- 2<sup>nd</sup> infection in NP is rare unless there is an ulcer

- **Look for ulcer: 90%**

- **Follow sinus track**

- **If unsure use ghost sign:**

- See normal shaped bone on T2 or gad with infection or rare acute neuropathic joints



# COMMON CAUSES OF CRYPTIC ANKLE/FOOT PAIN

- ATT
- Cartilage
- Early RA or reactive arthritis
- Gout
- Plantar plate
- DDD from spine
- Other cranial compression neuropathies

# COMMON CAUSES OF CRYPTIC ANKLE/FOOT PAIN

- Denervation
  - Early diabetes
    - Check for intrinsic foot muscle fat, edema
  - Inferior calcaneal branch of lateral plantar nerve
  - Tarsal tunnel
  - Medial plantar
  - May be age related and "relatively" asymptomatic

# COMMON CAUSES OF CRYPTIC FOOT PAIN OR MASS

- ATT
- Cartilage
- Reactive arthritis  
(Reiter's)
- Spine DDD

# MARROW EDEMA LOCATION APPROACH

- Tibia-bone bruise vs PTT
- Talar dome-OCD, geode
- Talar medial/lateral- bone bruise, arthritis, PTT, peroneal
- Talar body and neck- AVN, fracture, sinus tarsi
- Talar head-bruise, cartilage
- Calcaneus-fracture (stress), reactive arthritis, plantar fasciitis

# TENDONS-Achilles

- Anterior and posterior margins parallel
- Anterior margin concave on axials, except where soleus inserts
- Minimal retrocalcaneal bursal fluid
- Tears easy to diagnose, r/o edema in soleus
- Beware normal variants
  - "chickenwire" internal architecture
  - Small amount of retro-calcaneal fluid
  - Penetrating vessel vs erosion

# ACHILLES II

- Degeneration can be very symptomatic and may only show enlargement without internal signal
- Internal signal may represent mucoid degeneration that has variable but most often minimal symptoms
- Partial tears tend to be posterior
- Can heal fairly quickly clinically but look like new tears on MR

# TENDONS-PTT

- Same volume origin to insertion
- Minimal nl fluid ex. for distal 1.5 cm
  - However, many disorders do not lead to effusion
- Elderly tears- peri-malleolar, younger/arthritis close to insertion
- Rare to see fluid, can also not uncommonly look "normal"
- Normal variants
  - Volume averaging with spring and tibial navicular ligaments
  - Ovoid shape around malleous
  - Small amounts of proximal fluid

# TENDONS-PTT

- 2<sup>nd</sup> signs
  - Excessive fluid
  - Subjacent marrow edema
  - Cornuate or accessory navicular
  - Plantar flexion of talus on sagittal/unroofing on axial
  - Anterior displacement of FDL + sublux of PTT
  - 2<sup>nd</sup> sinus tarsi + spring lig

# PTT con't

- Gaps are rare
- Occasional splits
- Beware insertional
  - Younger pts
  - Assoc with inflam arthropathies

# TENDONS-peroneals

- Fluid variable but usually  
> then FHL\ FDL
- Fluid and tendon size  
should be symmetric  
between PB + PL
- ✓ os peroneum
- ✓ level just below distal  
fibula for splits, calc-  
cuboid and "tunnel" for  
PL, and occasionally  
distally for both PL and  
PB
- vinculae

# TENDONS-peroneals

- Reactive marrow edema is uncommon
- Check peroneal groove
- Normal variants
  - peroneus quartus; mimics a split (inserts on calc)
  - fluid
  - ovoid shape at level of distal fibula

# Peroneal Pathology

- Splits, early on  
looks like  
boomerang
- Stenosing teno  
with adhesions
- Disloc

# SOFT TISSUES-fascia

- Perifascial edema, earlier and less severe stage then internal signal
- ✓ reactive marrow edema vs stress injury ( T1)
  - Also reactive (and other) arthropathies
- ✓ for denervation atrophy or edema
- ✓ for muscle edema, usually flex dig brevis
- Variants
  - spur, true true and usually unrelated
  - Vessel deep to fascia
  - Bad fat sat can mimic edema

# SOFT TISSUES

## tarsal tunnel and sinus tarsi

- Many false positives and false negatives
- Know your clinicians
- Masses most important
  - neuromas vs ganglia (usually lateral)
- Remember plantar nerve denervation, a not uncommon cause of cryptic foot pain
- Unless overt, or can identify ligament disruption, undercall sinus tarsi
- Varices in TTS rare, but evaluate for edema in nerve

# ANKLE AND FOOT BURSAE

- Only one anatomic bursa in the foot
- Retrocalcaneal
  - Best criteria = 6 mm C to C or > 2mm in A to P
  - Associated with Haglund's / insertional Achilles
- o/w any fluid is abnormal

# ANKLE AND FOOT BURSAE

- Most common bursitis are
  - HV bursa- usually not discrete fluid
  - Plantar (usually under 1<sup>st</sup>)-may present as mass
  - 5<sup>th</sup> MT laterally (Tailors bursa)
  - Retrocalcaneal- insertional Achilles vs Haglunds vs arthritic
  - Overlap/perhaps part of natural history with/or calluses

# FOREFOOT PEARLS

- Sesamoids- , plantar low signal variant; check T1, look for line on sagittal images  
prob all stress fx
- Mortons- make sure not fluid on T2, ✓ for synovitis + intermetatarsal bursitis
- Marrow-stress vs. diabetes
- Muscle injury vs. denervation

# OA

- ? True, true but unrelated
- Common locations
  - Ankle
    - Usually anterior
  - Hallux
    - Hallux rigidus if dorsal osteophyte
  - Talo-navicular
  - Lis-frank
    - Often cryptic
    - May be related to chronic instability

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