MSK US Ankle: Achilles, Plantar Fascia and Procedures

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Disclosures

- Grants: NBA/GE, Mitek
- Research: SuperSonic Imagine
- Royalties: Elsevier

Objectives

- Review the normal anatomy
- Show that ultrasound is well-suited to evaluate tendon and ligament injuries of the ankle
- Introduce ultrasound-guided interventions involving the ankle

Outline

- US versus MRI
  - Evidence-based
- Normal Anatomy
- Common Pathology
  - Achilles Tendon
  - Medial and Lateral Ankle Ligaments
  - Plantar Fascia
  - Tarsal Tunnel
  - Morton’s Neuroma

US Evaluation

1. Answers a specific question
2. Superficial Structures
   - Achilles Tendon/others
   - Ligaments
   - Plantar Fascia
3. Dynamic

MRI Evaluation

1. Ankle pain – fracture, tendon, ligament
2. Bone marrow evaluation
3. Talar dome
4. Cartilage eval, loose bodies
5. Mass/tumor
6. Rheumatologic

Accuracy of US vs. MRI

Ankle Tendon Tears

	US	MRI
Achilles tendon	92%	
Peroneal tendons	90%	
PTT		96%
ATFL	100%	94%

Grant et al. JBJS Am 2005;87:1788
Rockett et al. Foot Ankle Int 1998;19:604
Hartgerink et al. Radiology 2001;220:406
Rosenberg et al. Radiology 1988;169:229
Jacobson JA. AJR 2009;193:619.

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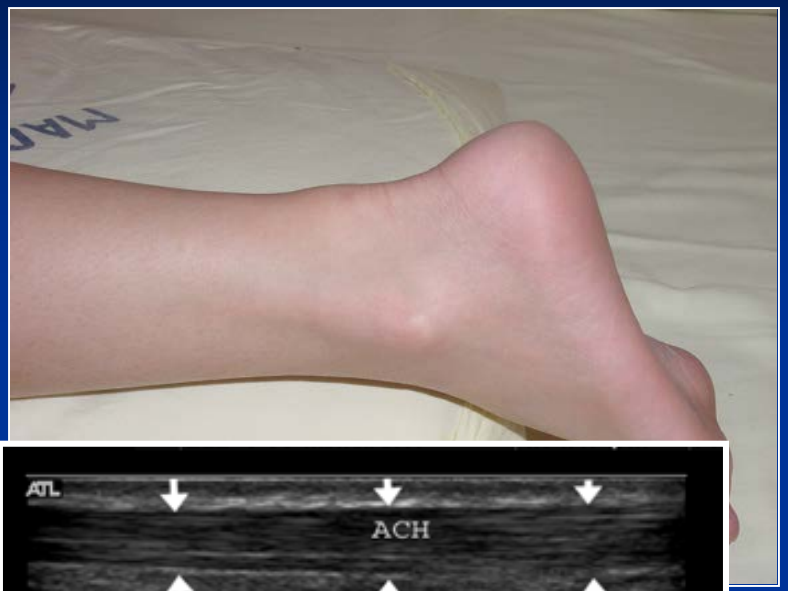
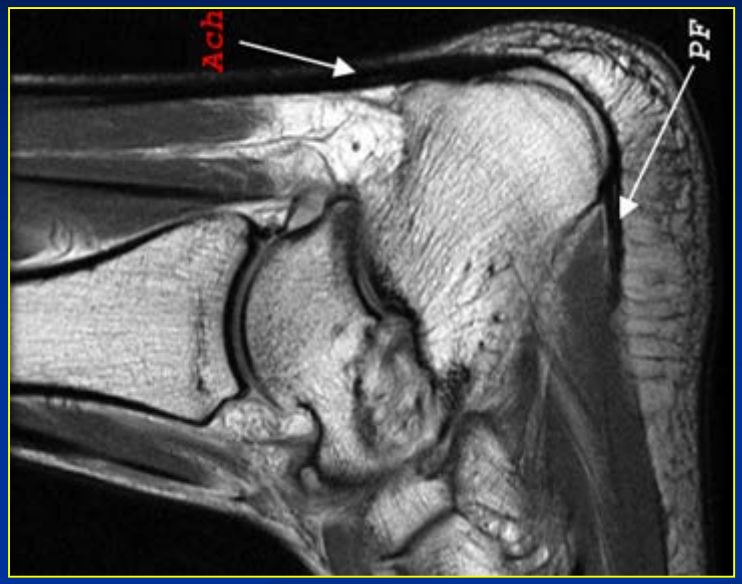
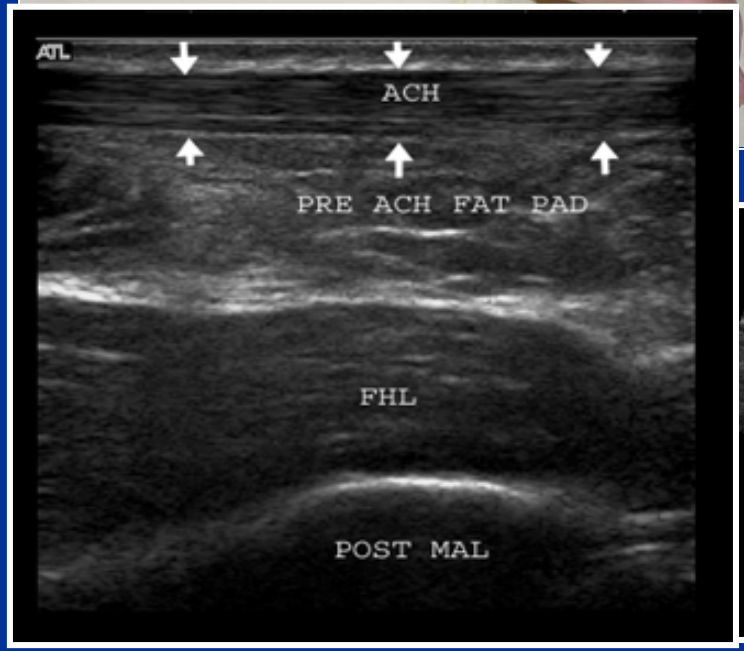
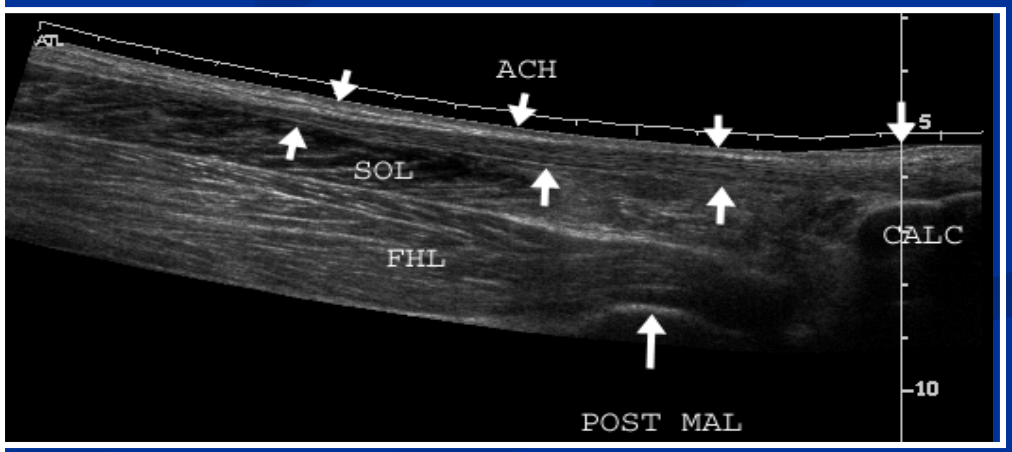
Achilles

Achilles Tendon

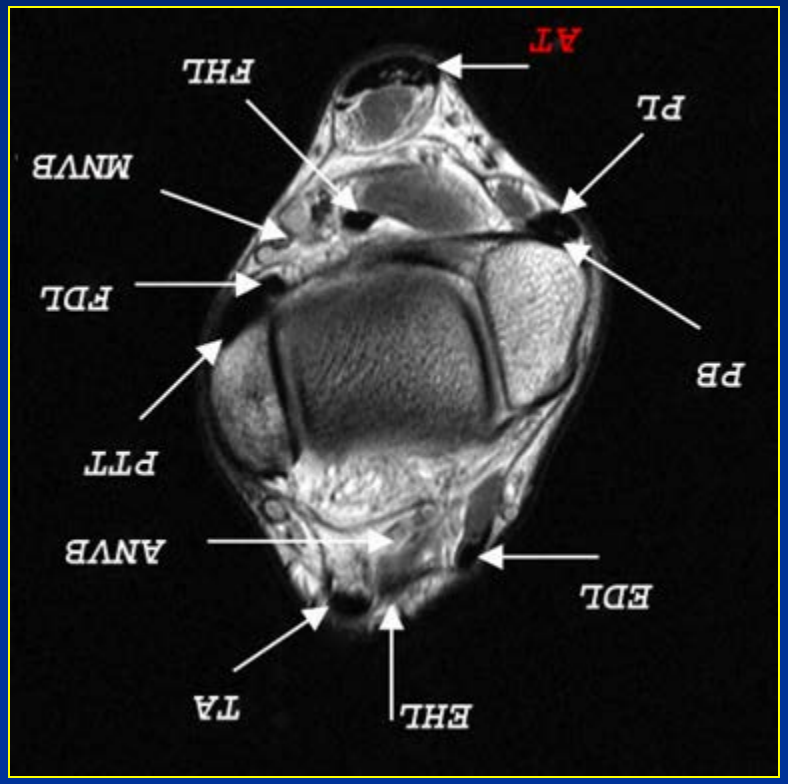




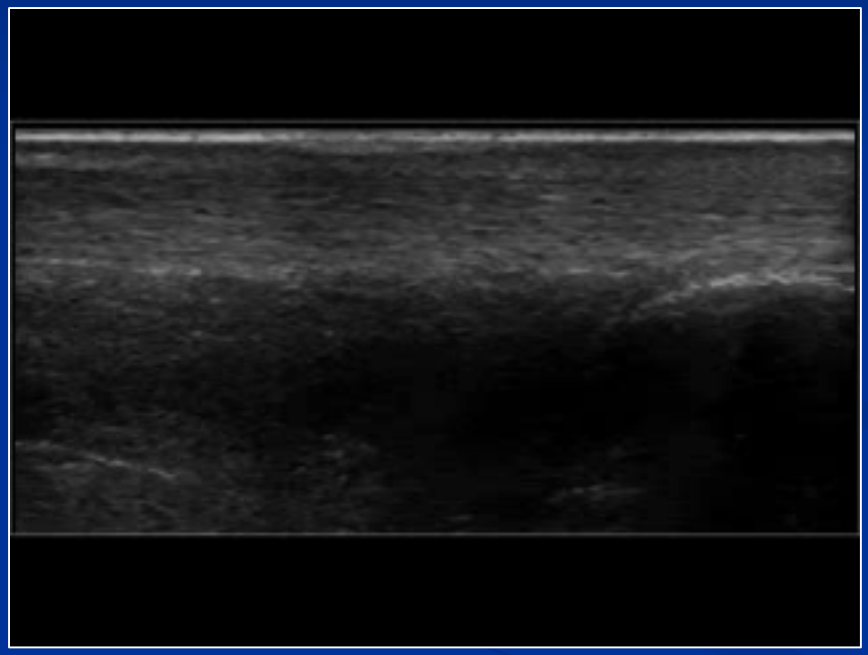




Achilles Tendon

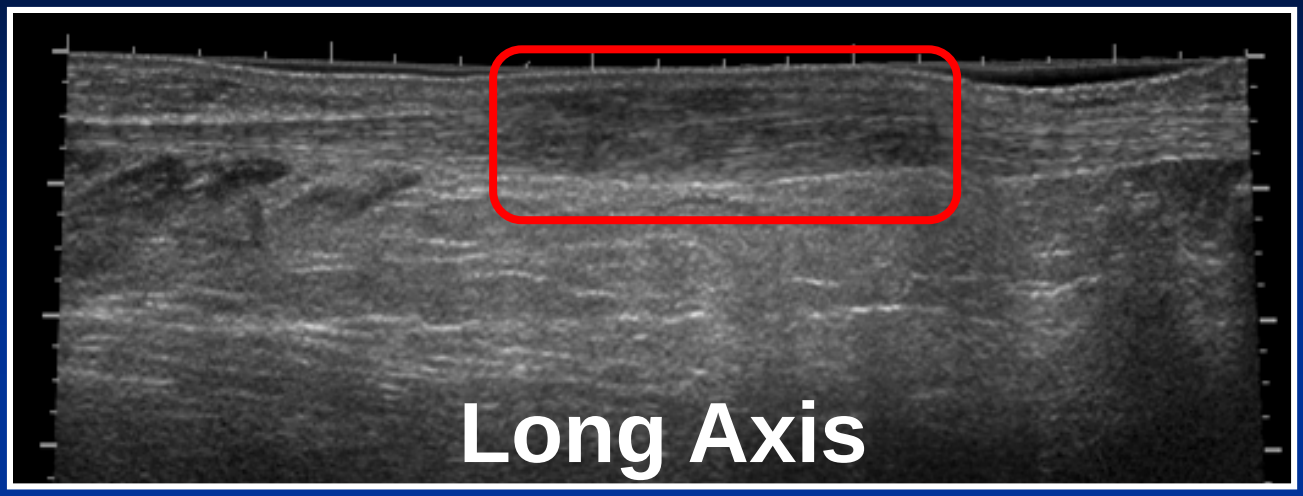


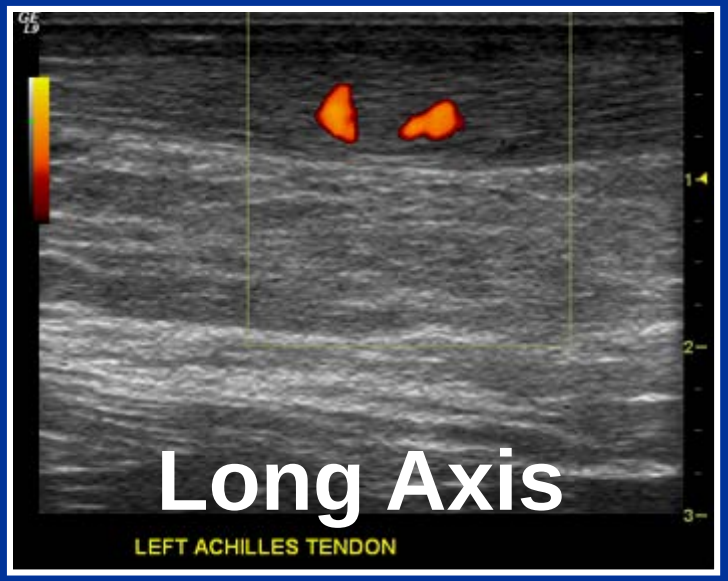
US – Dynamic of Achilles



Long axis

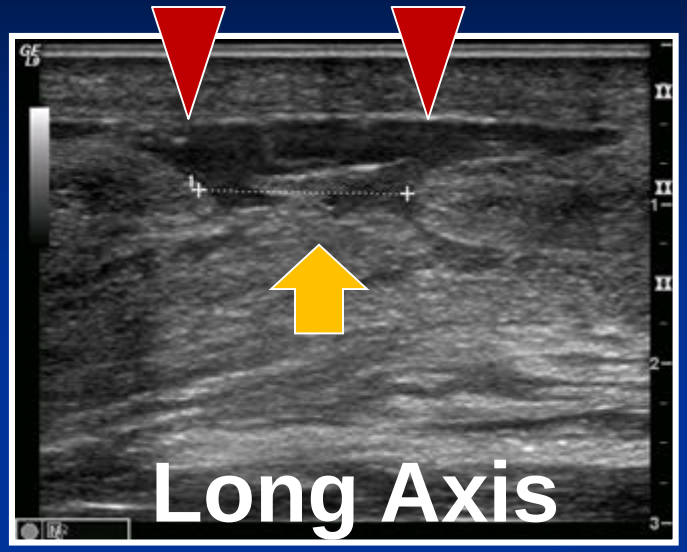
Achilles Tendinopathy



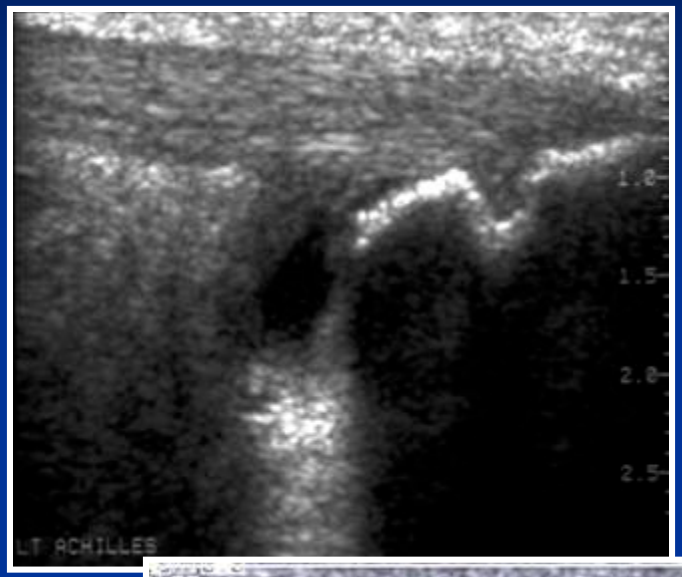


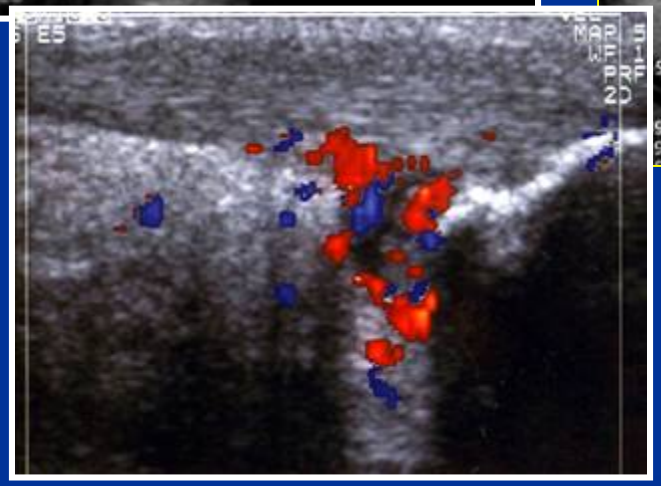
Achilles Tendon Tear

Sagittal T1

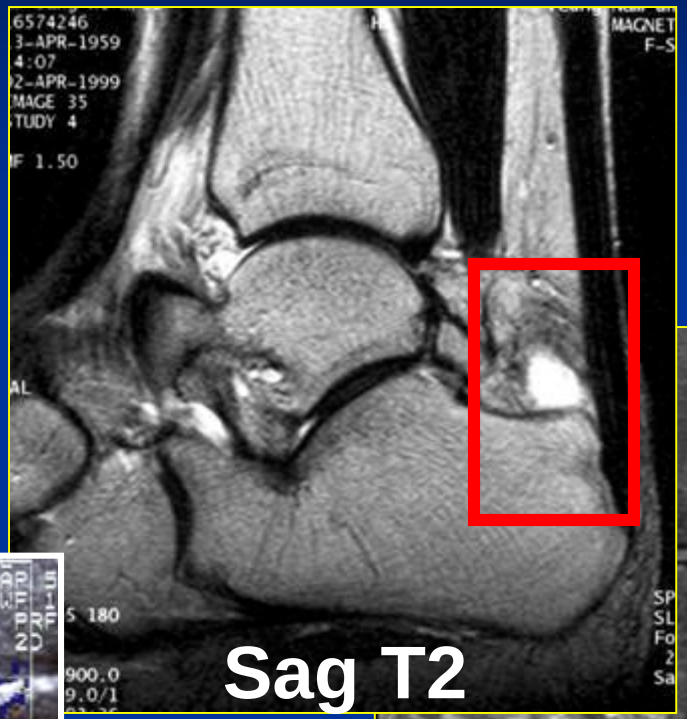


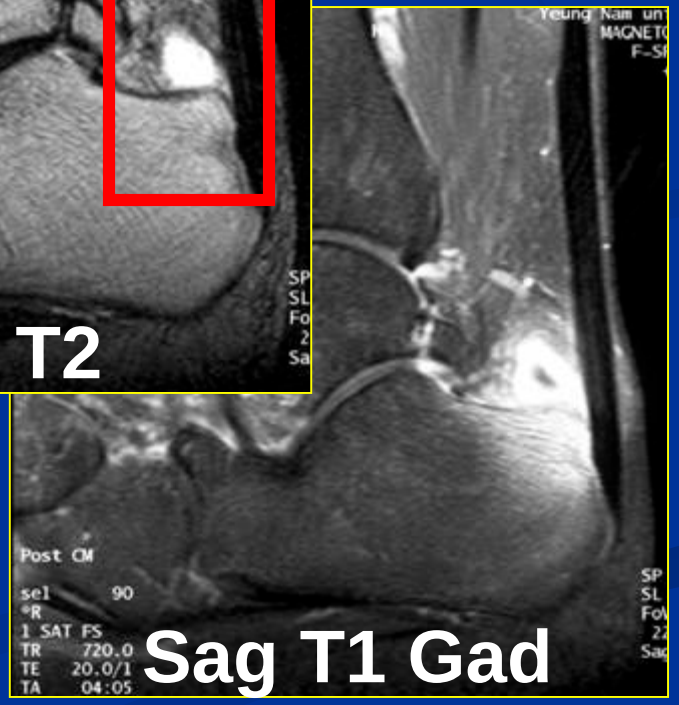
Retro-Calcaneal Bursitis





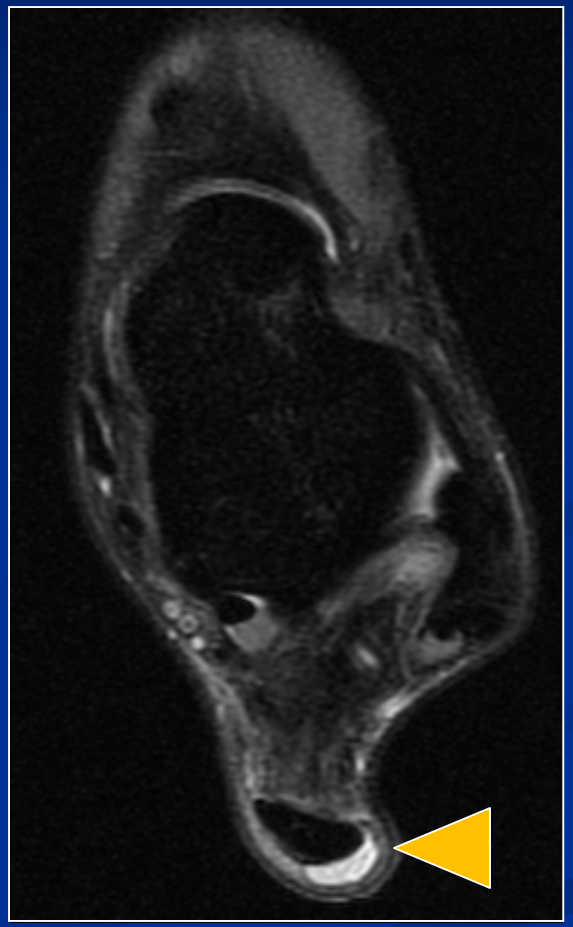
Long Axis





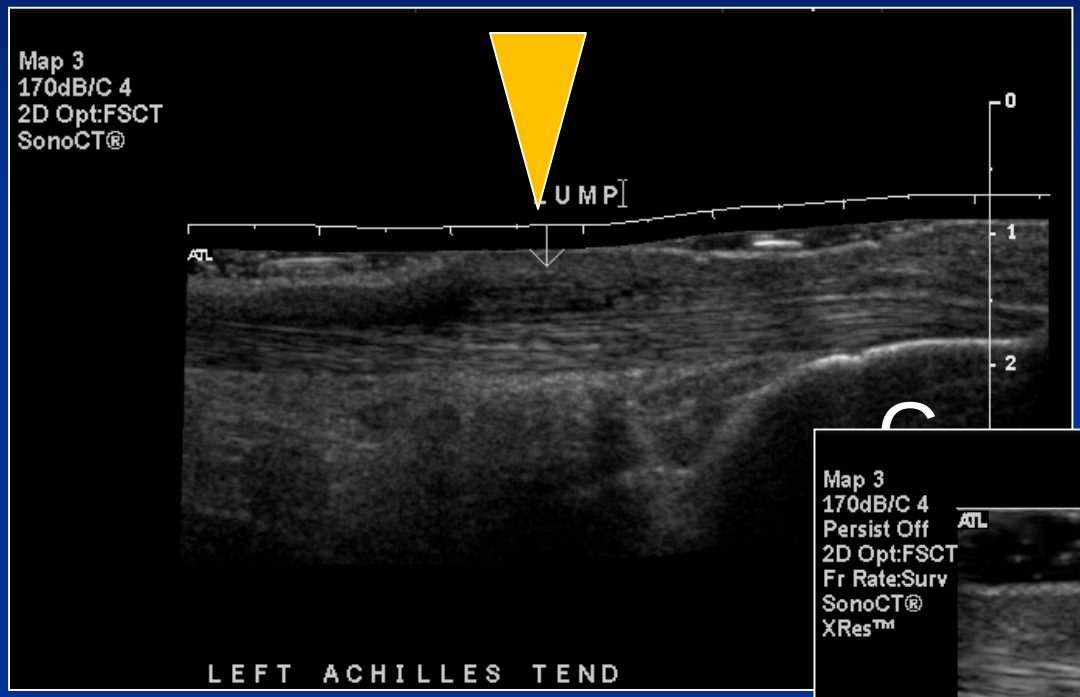
Retro-Achilles Bursitis

Sagittal T2

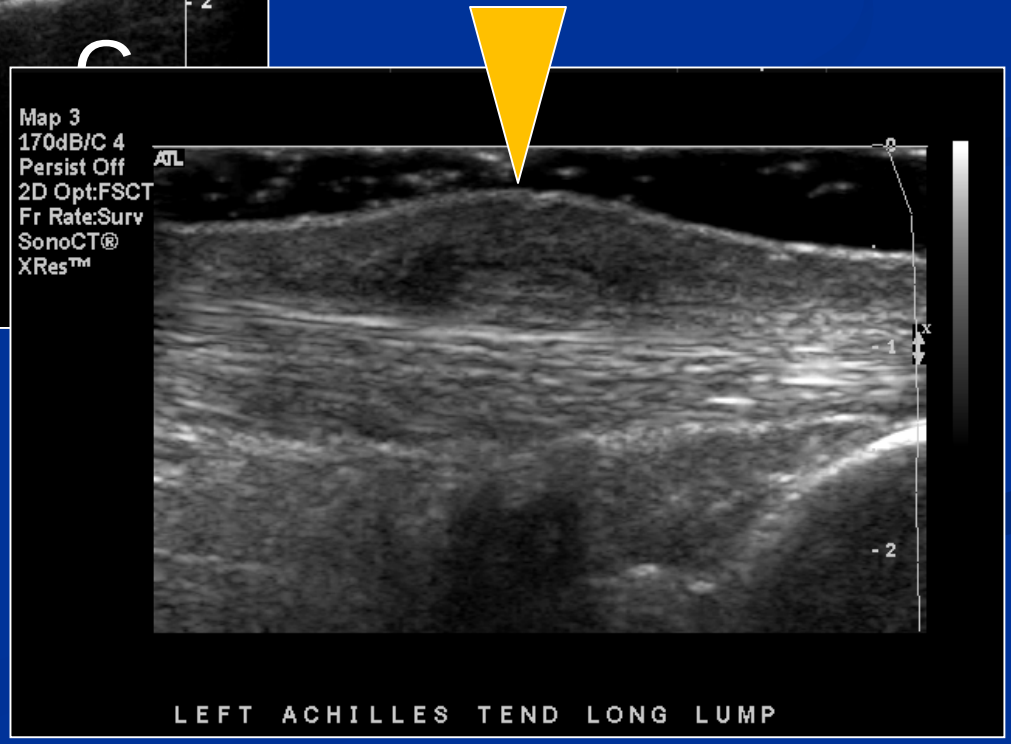


Axial

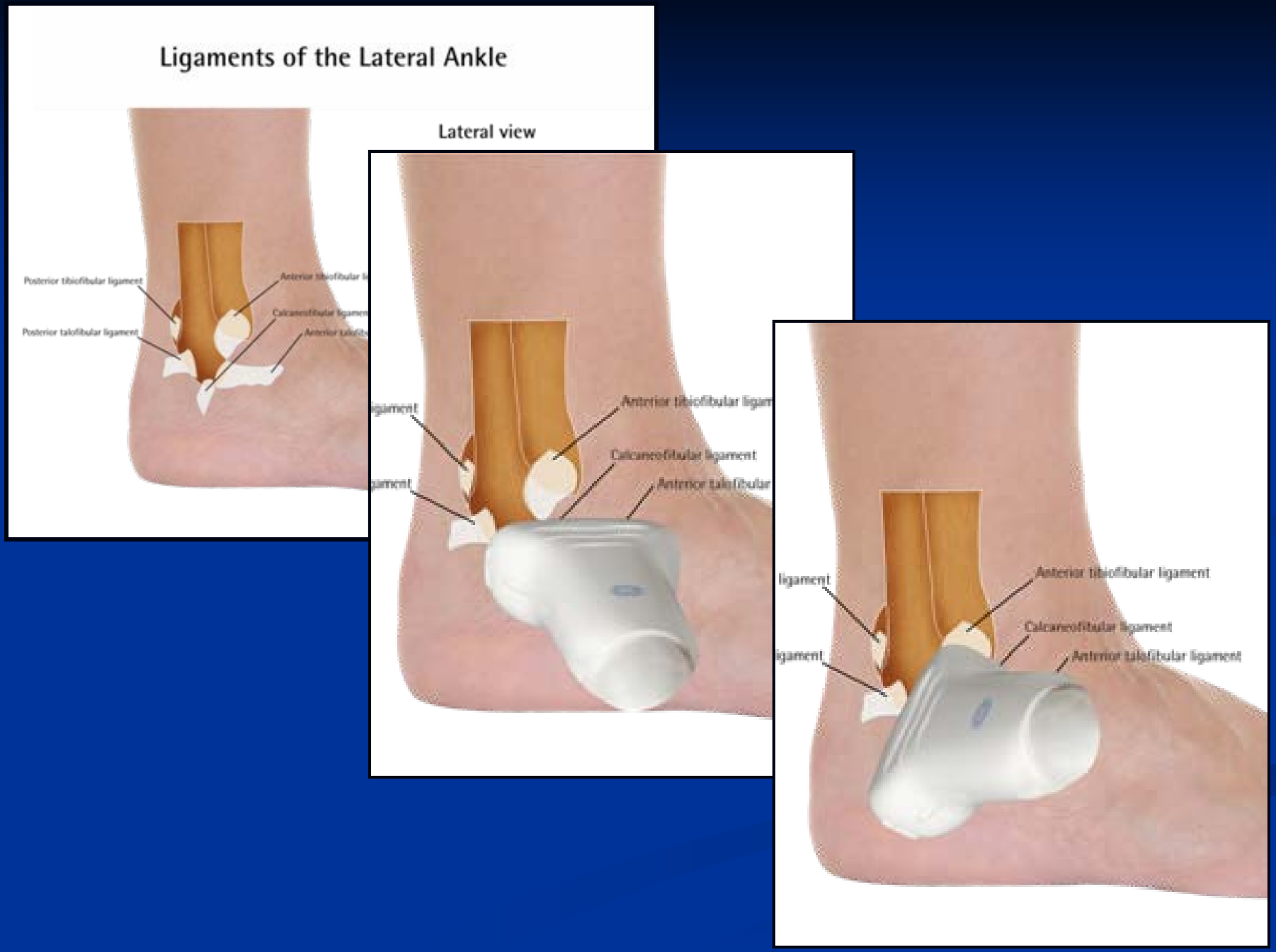
Retro-Achilles Bursitis



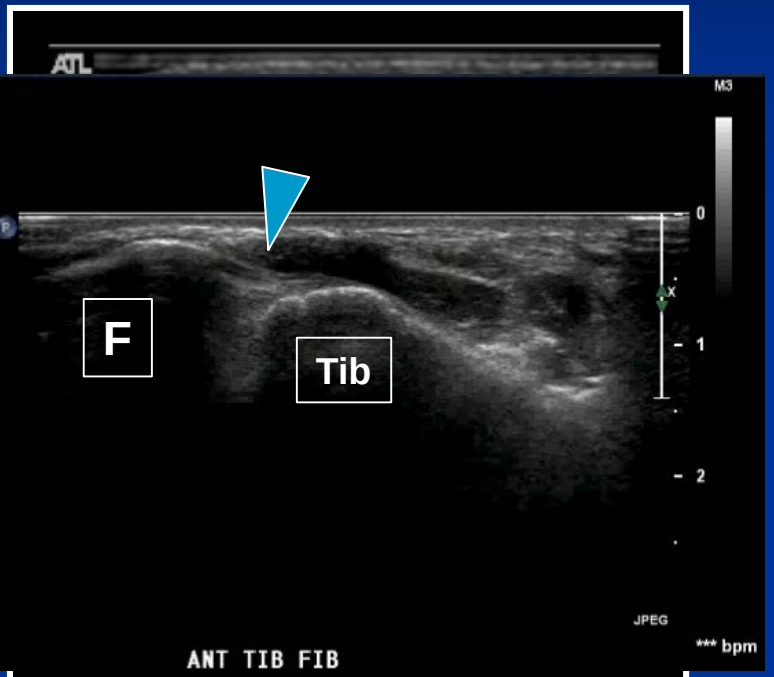
Long Axis



Ligaments of the Lateral Ankle

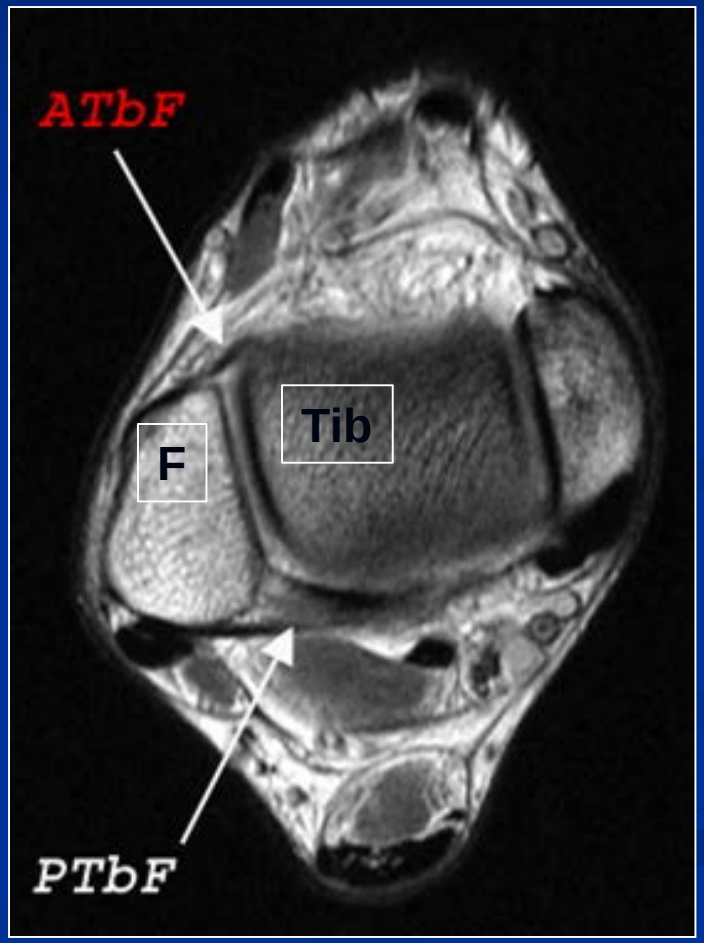


Anterior Tibiofibular Ligament

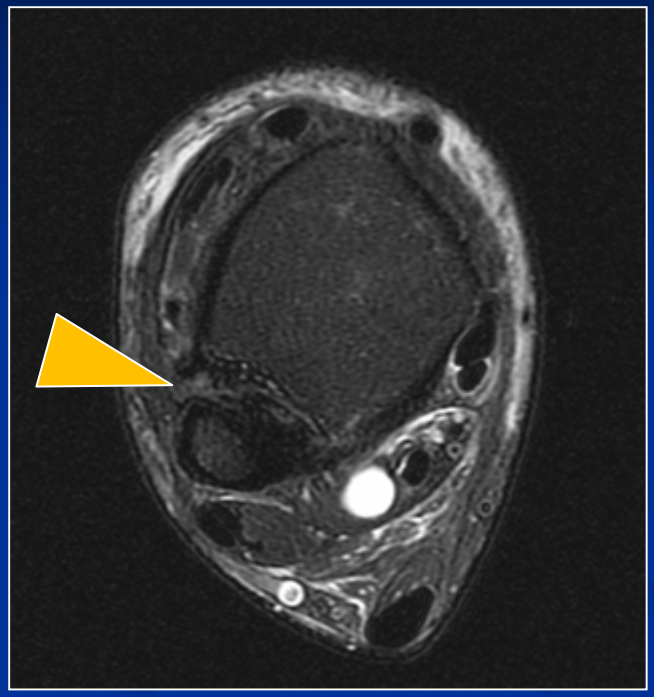


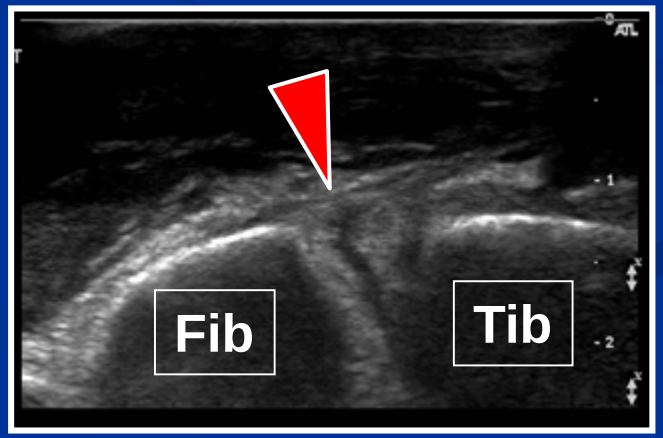
Dynamic assessment with dorsiflexion

ANT TIB FIB

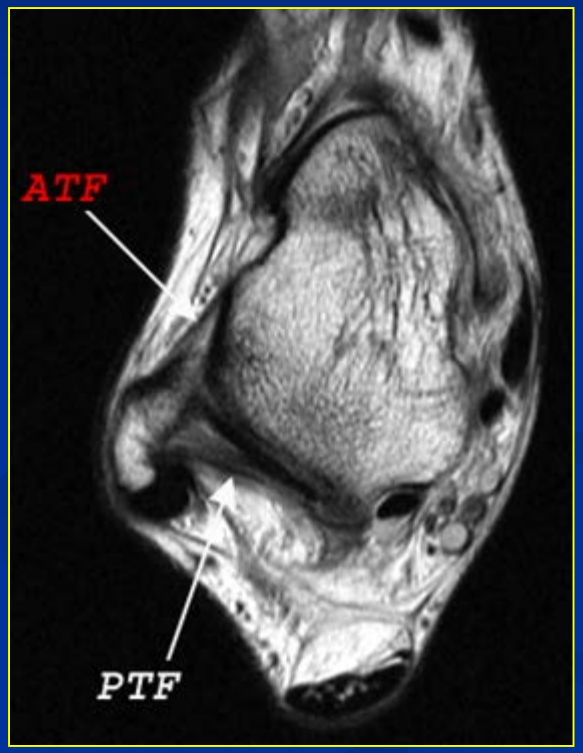


High Ankle Sprain – ATibF





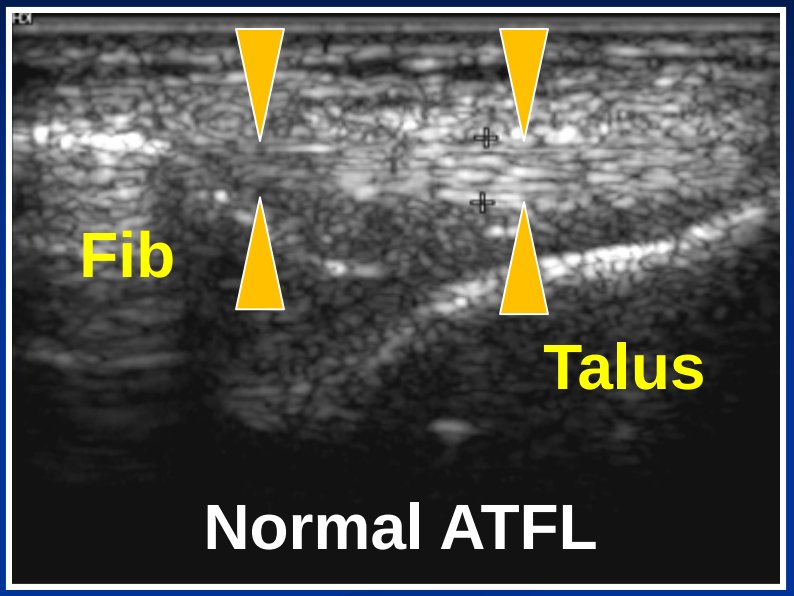
Anterior Talofibular Ligament

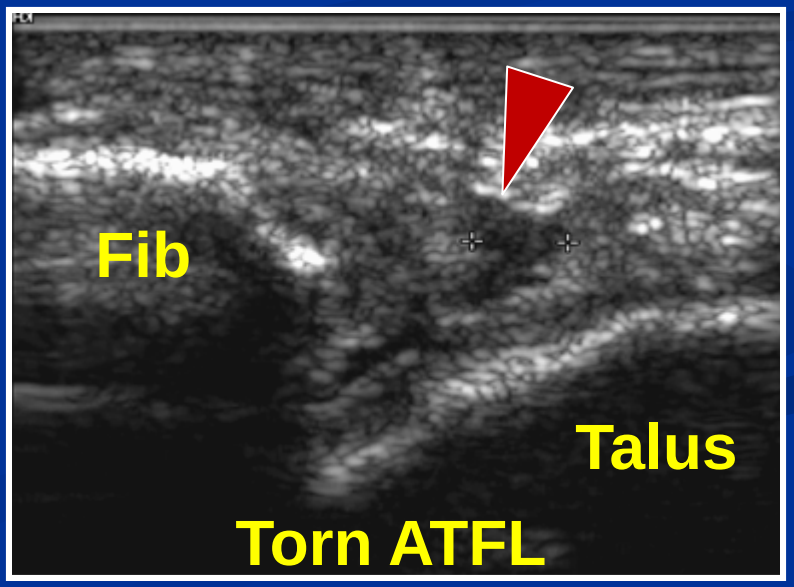


Lateral Ankle Sprain- ATFL

Netter

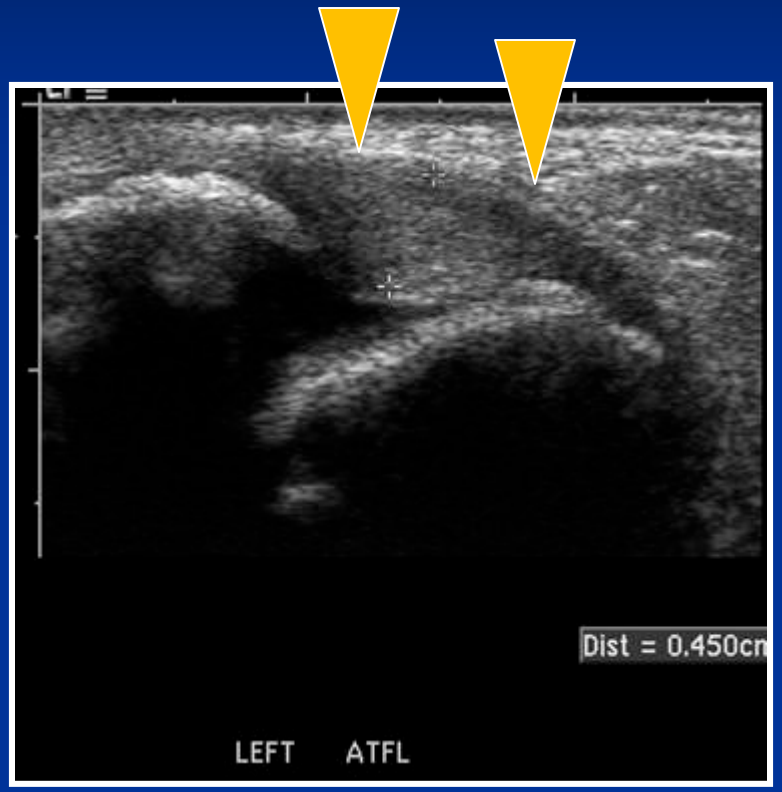
US can show tears of the ATFL.





Courtesy Dr. A. Bouffard

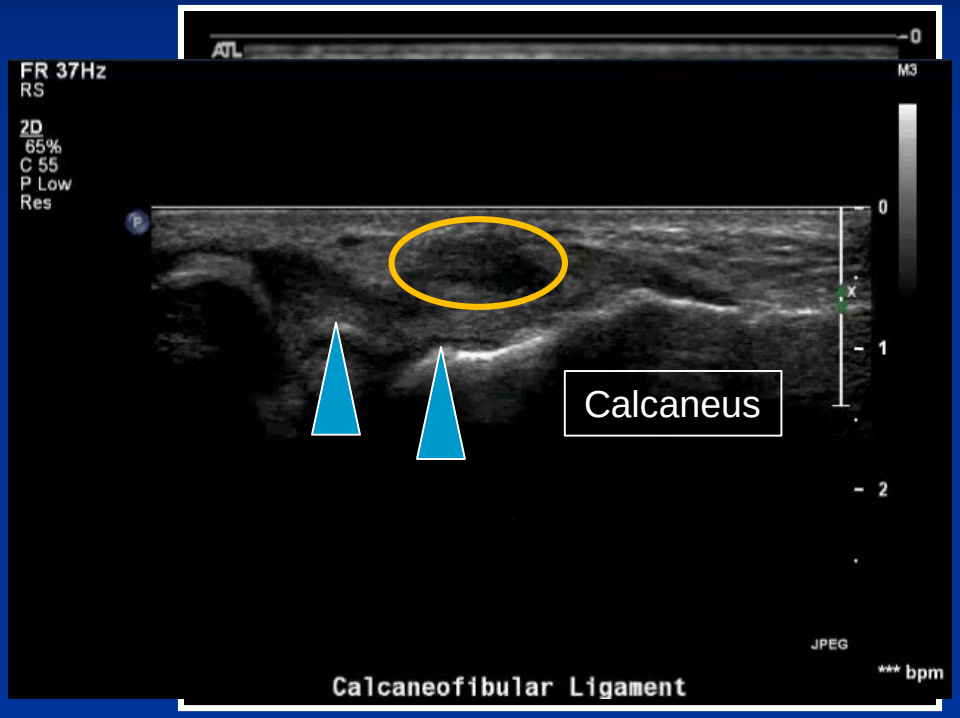
Old ATFL Tear



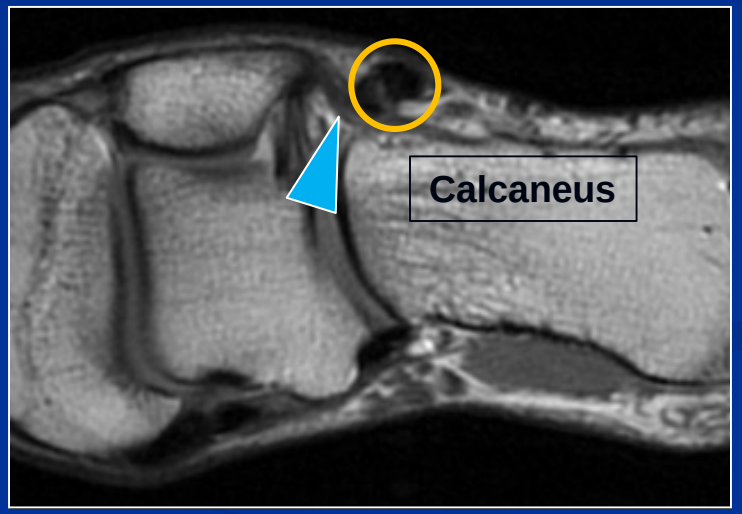
Long Axis

Doppler

Calcaneofibular Ligament



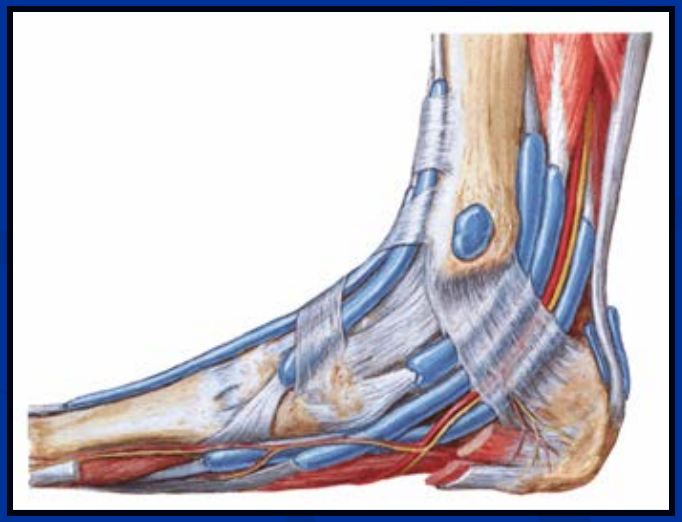
Dynamic assessment with plantar flexion



MRI

The Tarsal Tunnel

- Fibro-osseous canal
- Roof : flexor retinaculum (thin fascia)
- Floor : medial aspect of talus
  sustentaculum tali
  medial wall of calcaneus
- Content : posterior tibial nerve
  and its branch
  posterior tibial artery & vein
  three tendon (TP, FDL, FHL)



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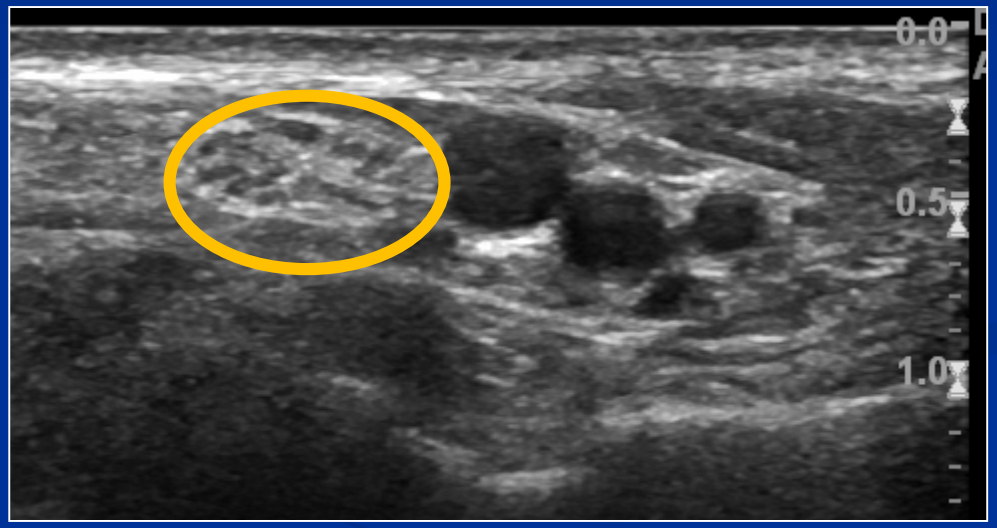
Tarsal Tunnel Ultrasound

- NL Post Tibial Nerve
  - Hyperechoic
  - Fascicular pattern
  - High Sens / Spec
    - Masses
    - Neuromas



Short Axis

Background: PF

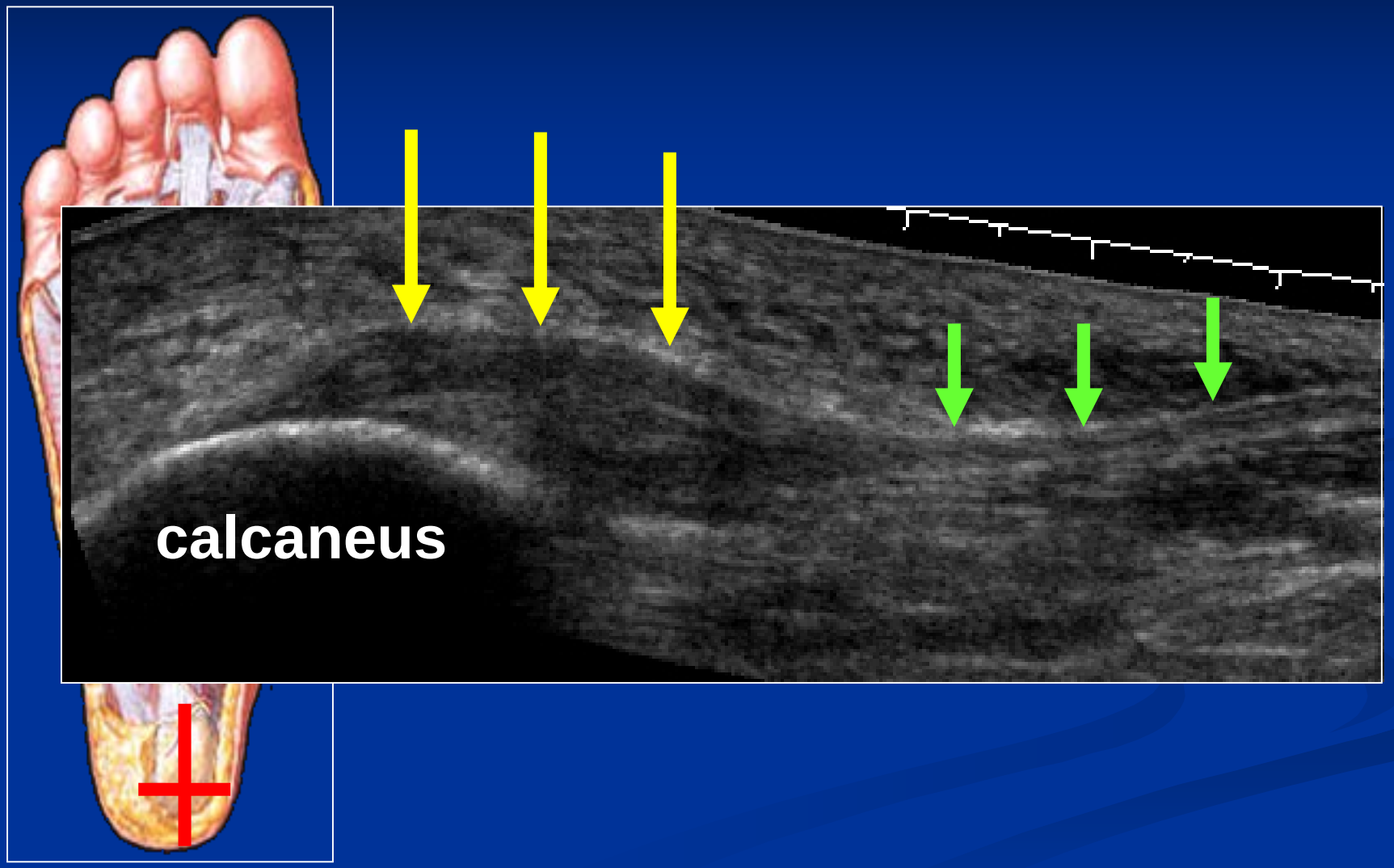
- Affects 2 million Americans per year
- 10% of the U.S. population over a lifetime
  - $376 million (2007)

- Associated with:
  - Long periods of weight bearing
  - Sedentary: large body habitus
  - Flat feet/high arch
- No SOC treatment

www.ayrespodiatry.com

Riddle DL. JBJS 2003;85(5):872
McPoil TG. J Orthop Sports Phys Ther 2008; 38(4)

Plantar Fascia



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Prior PF Studies

- Barrett S, et al. *Podiatry Today* 2004;17:37
  - N=9, 78% better with PRP
  - Thickness and echotexture improved
  - Disclosure: Speaker for Harvest Technologies

- Monto R. *Foot & Ankle Inter* 2014;35:313
  - N=40, RCT (Level 1), 24 mo. follow-up
  - PRP >> Steroid
  - Disclosure: Speaker for Exactech, Inc.

Prelim Study: PRP for PF

- Prospective Case Series – Level 4
- 16 Plantar Fascia (15 subjects)

UW Health
University of Wisconsin Sports Medicine

	Baseline (mean)	32-Weeks Post-Injection (mean)	Significance
FAAM - Activities of Daily Living	59.5±17.1	80.0±18.6	p=0.002
FAAM – Sports	36.7±21.8	63.3±28.7	p=0.008
SANE	49.6±20.9	65.3±25.9	p=0.004

2012 AMSSM Annual Meeting
Wilson JJ. *Foot Ankle Spec.* Feb 2014

Madison Ironman

www.wsj.com

Purpose

- To investigate the effectiveness of PRP for chronic refractory plantar fasciopathy compared to Steroid
- To evaluate conventional US and elastography as a longitudinal imaging-based assessment tool in subjects receiving PRP or Steroid

Methods

Inclusion Criteria

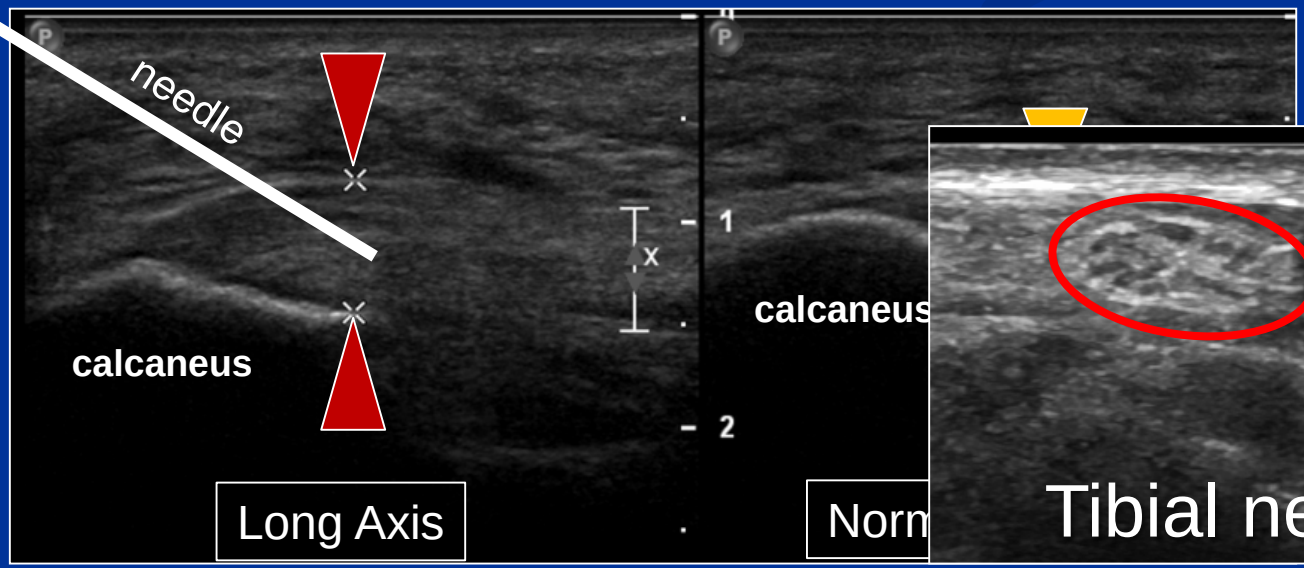
- Pain ≥ 5 out of 10
- Pain duration > 6 mo.
- Age range 18-65 yo
- Unilateral PF
- Failed 2 of 3 conserv. Rx
  - Rest/ice/taping
  - NSAIDS
  - Eccentric exercise

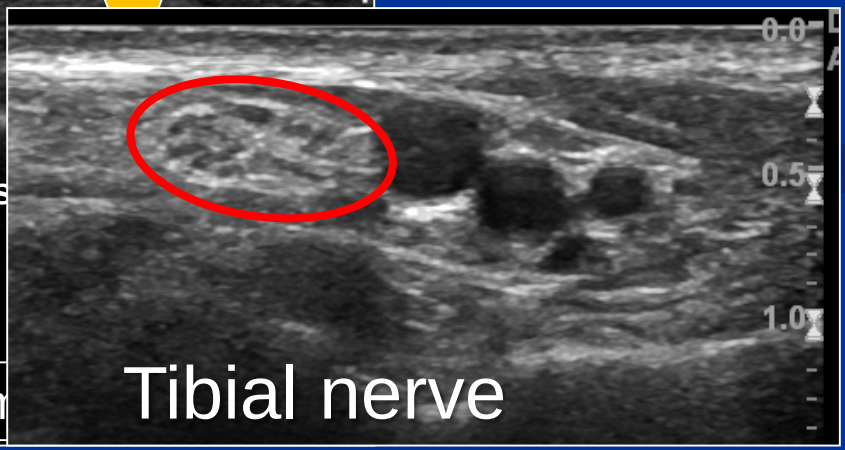
Exclusion Criteria

- Bilateral PF symptoms
- Systemic disorders
  (e.g. DM, RA, SLE)
- Trauma
- Prior surgery
- Anticoagulation
- Neuropathy
- Chronic use of NSAIDS/steroids/opioids

Methods: Technique

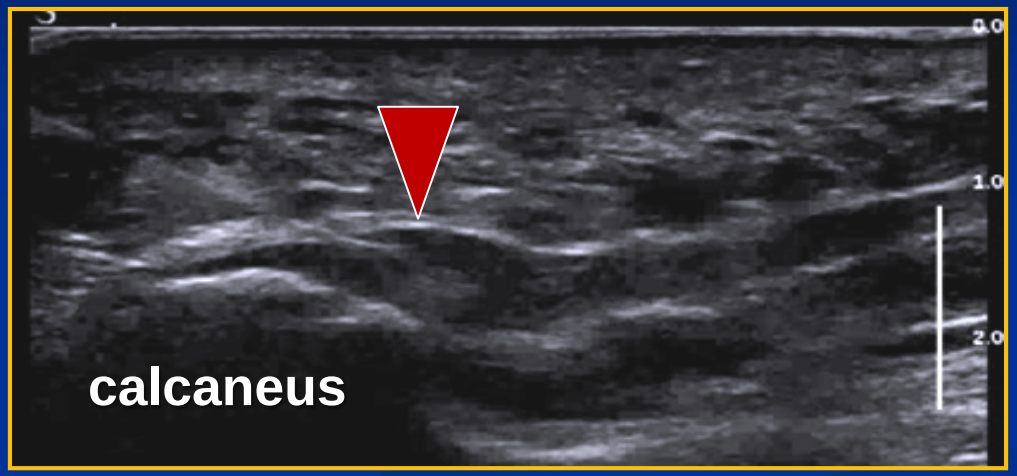
www.threestooges.net



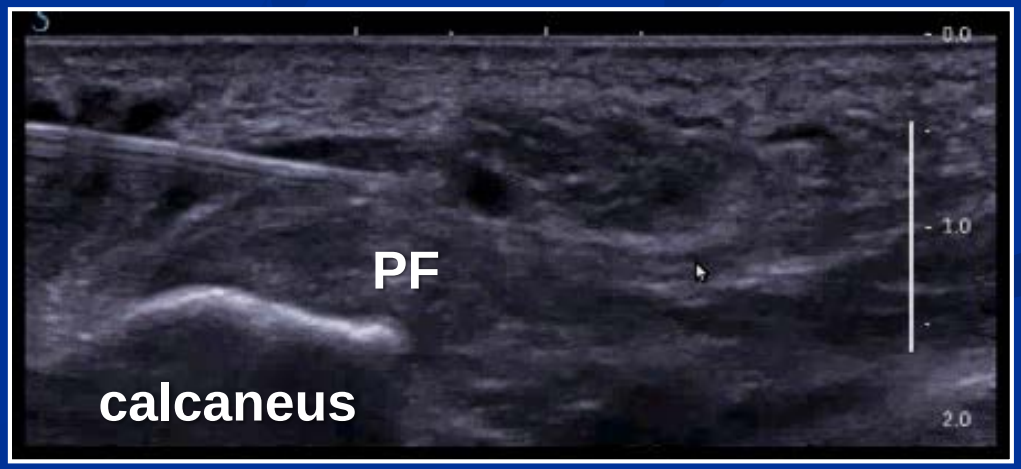


Methods: Technique

- PRP
  - 22G, 1.5 inch
  - Needle abn area
  - 3ml of PRP
  - Inject into the PF



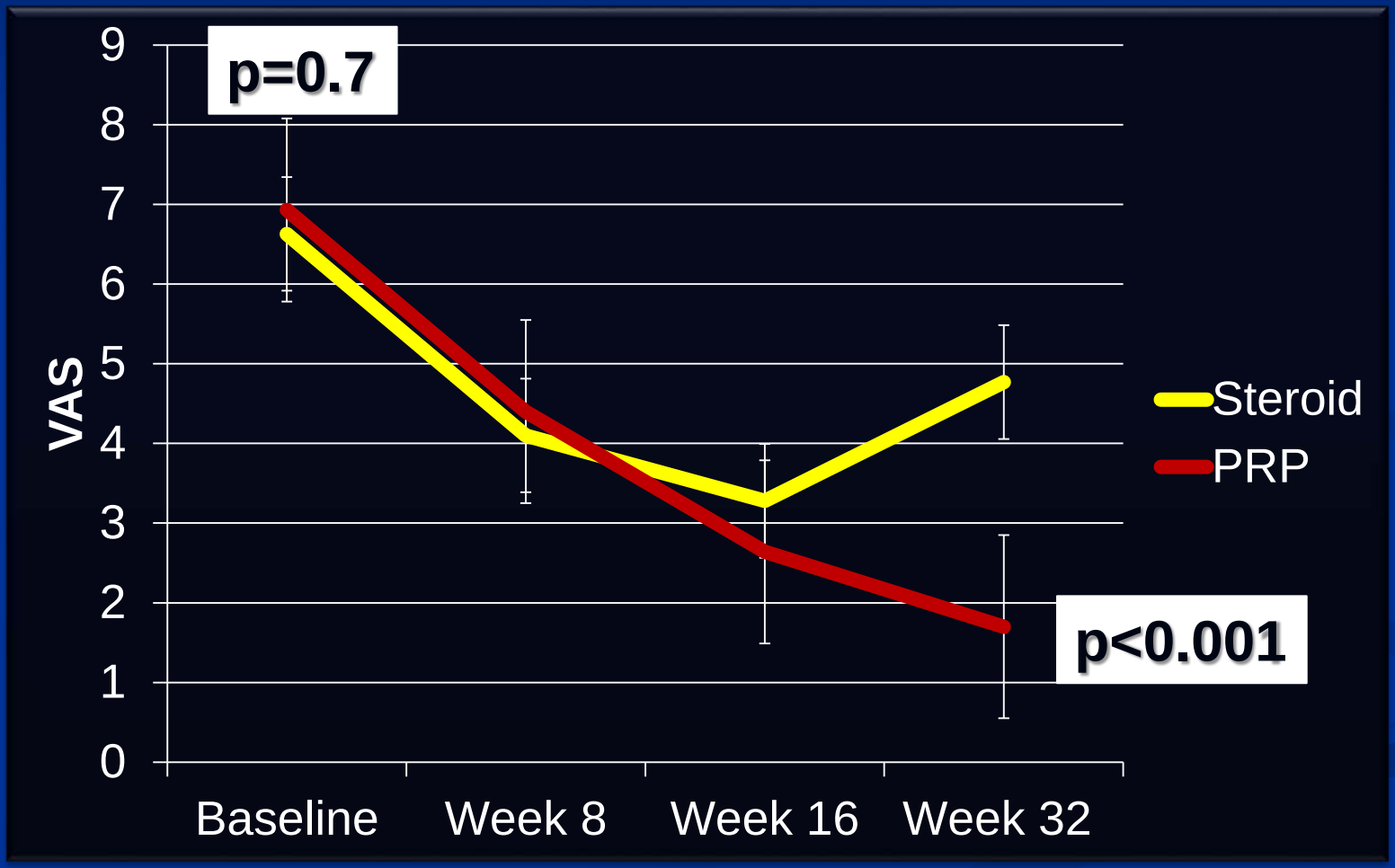
- Steroid
  - 22G, 1.5 inch
  - 1 ml triamcinolone + 1 ml 1% pf-Lido
  - Superficial to PF



Results

- 44 subjects block randomized
- March 2011 – July 2014
- 132 US performed
  - PRP Group (N=21)
    - Mean age 47.8 yo (range 30-64 yo)
    - M:F (4:17)
  - Steroid Group (N=23)
    - Mean age 49.2 yo (range 30-64)
    - M:F (7:16)

Results: VAS Pain



Example PRP Subject

Thickness 6.1mm
Echotexture Grade 2
VAS 6

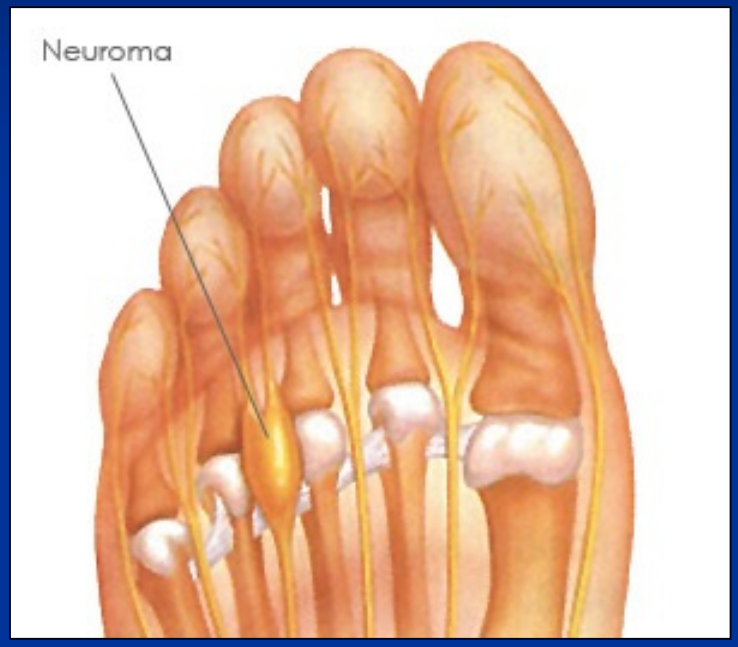
Thickness 5.5mm
Echotexture Grade 2
VAS 4

Thickness 4.5mm
Echotexture Grade 1
VAS 0

Limitations

- Not double blinded
- Relatively small N
- Only 32 weeks
- Did not control for needle

Morton's Neuroma



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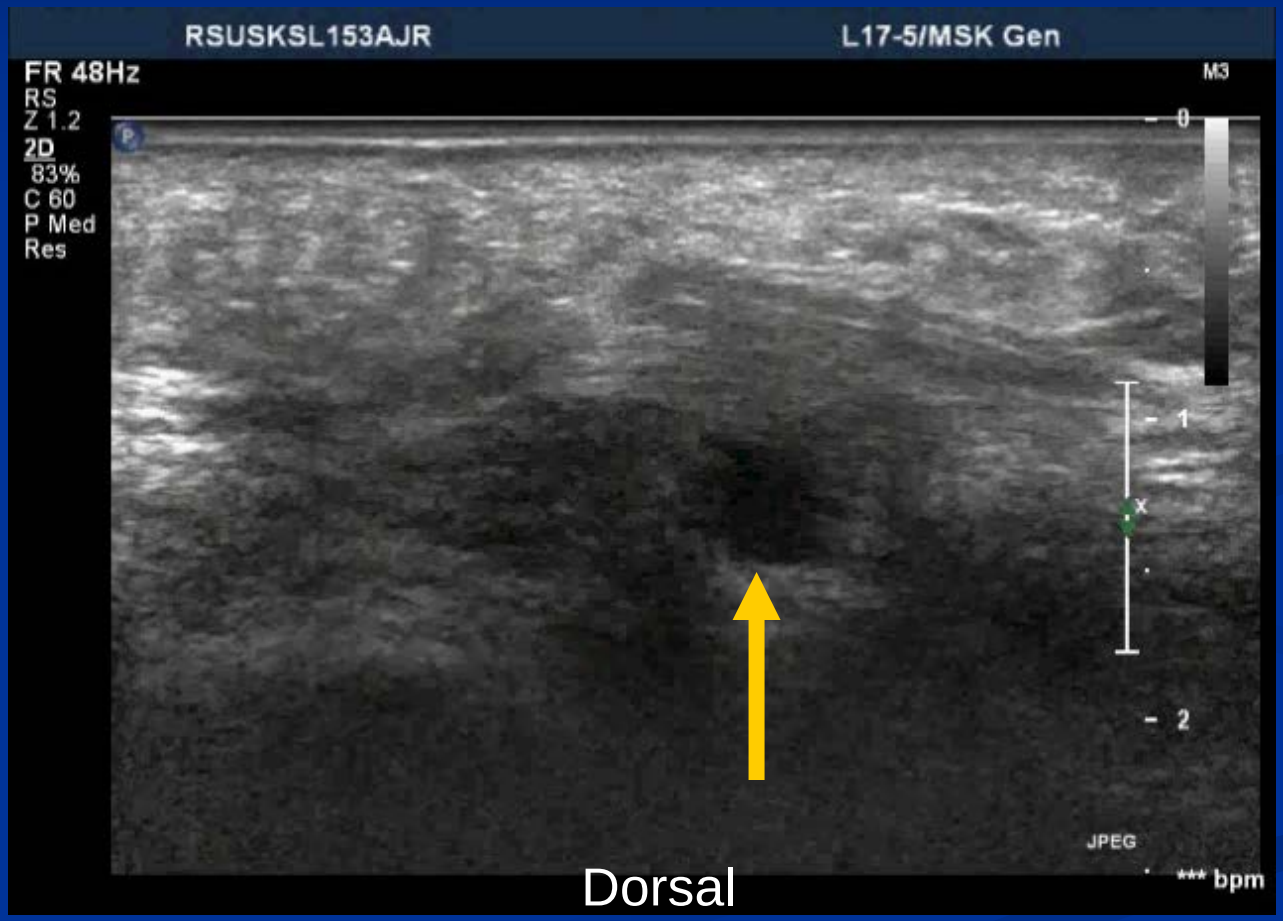
Neuroma: Compression test

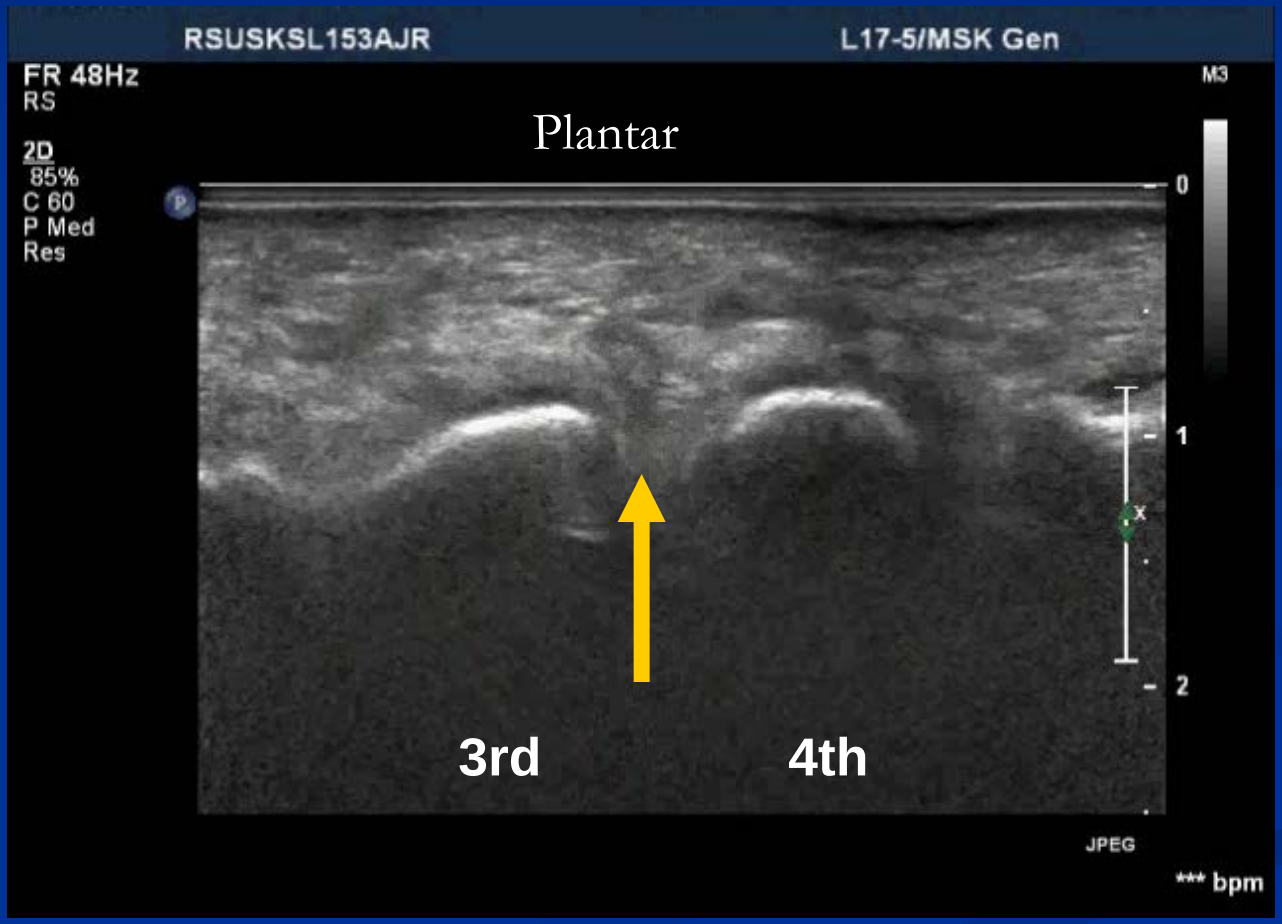
Distal



Dorsal

Mulder's Sign

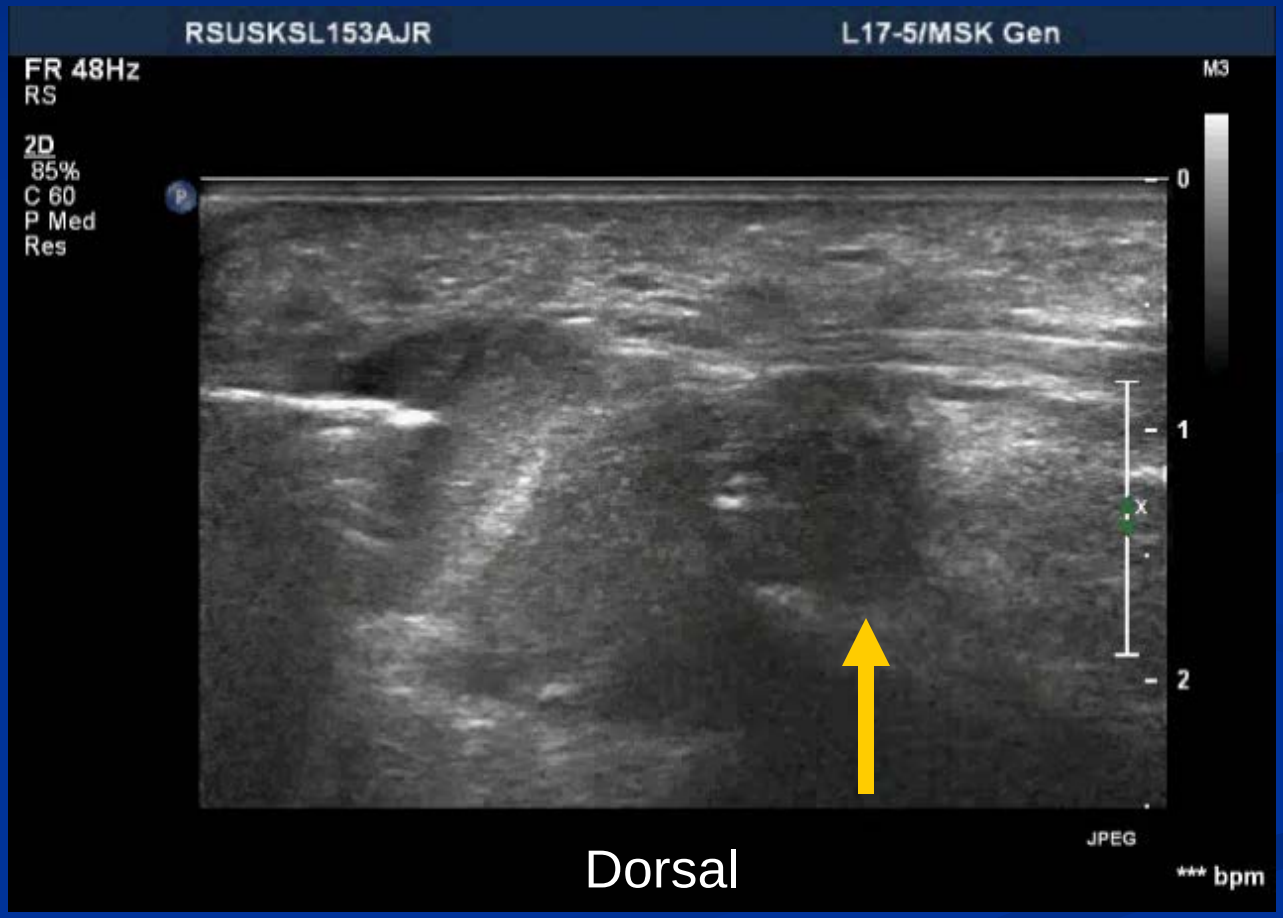
Medial



Transverse: 3rd interspace

Needle Placement – Plantar Approach

Distal



Dorsal

US-Guided Injection

Distal

Summary

- US is well-suited for evaluating the soft tissue structures of the ankle
  - Achilles Tendon
  - Ankle Ligaments
  - Plantar Fascia
- US is useful for guiding injections and aspirations involving the ankle and foot

References

1. Grant et al. *JBJS Am* 2005;87:1788
2. Rockett et al. *Foot Ankle Int* 1998;19:604
3. Hartgerink et al. *Radiology* 2001;220:406
4. Rosenberg et al. *Radiology* 1988;169:229
5. Jacobson JA. *AJR* 2009;193:619
6. De Maeseneer et al. *AJR* 2009;192:487
7. Dong Q et al. *AJR* 2009;193:696
8. Allison S et al. *AJR* 2010;194: W514
9. Lee KS et al. *AJR* 2011;196:628
10. Nazarian LN. *AJR* 2008;190:1621