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- Devans0123

# HEEL PAIN: Diagnosis & Conservative Treatment



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The American College of  
FOOT & ANKLE  
ORTHOPEDICS  
& MEDICINE



# DISCLOSURES

- Drs. Evans, Albert and Harrill are Officers of the American College of Foot and Ankle Orthopedics and Medicine.
- There are no commercial or financial conflicts of interest pertaining to this presentation.

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## DIRECTIONS

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- 3. Enter your Name (Make one up).

■ *So.....*

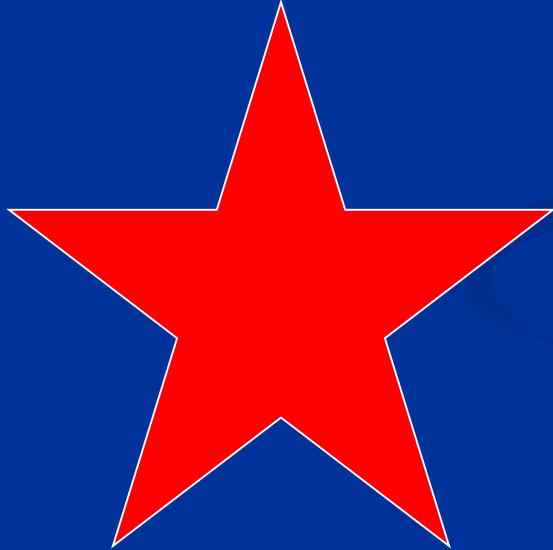
*What do we really  
know about Heel  
pain?*

Dr. Daniel Evans

Imaging Options for the

Assessment of the Complicated

Heel



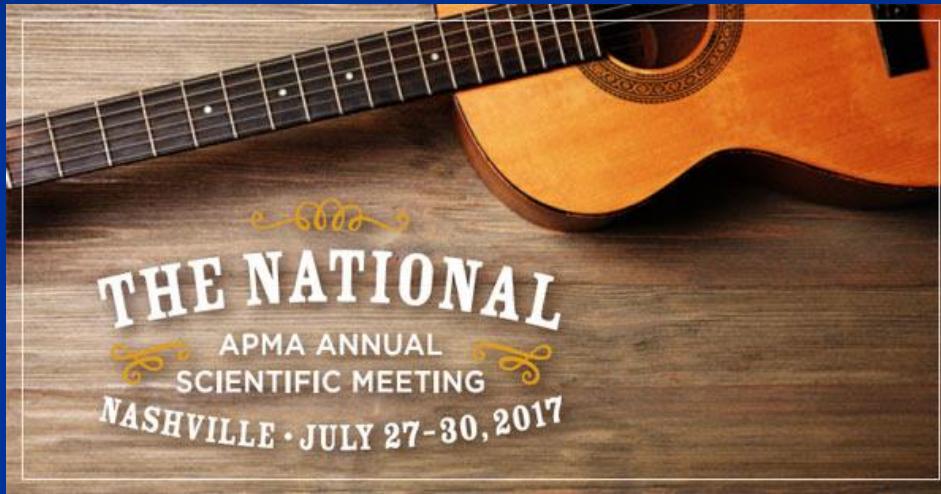
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QUBWHYJK # 8-10

# Differential Diagnosis

- Plantar fasciitis/fasciosis.
- Infracalcaneal enthesis.
- Retrocalcaneal bursitis.
- Skin fissure.
- Stone bruise.
- Tendonitis.
- Apophysitis.
- Calcaneal ftrature.
- Os trigonum syndrome.
- Posterior tibiotalar impingement.
- Infection.
- Radiculopathy
- Neuropathy.
- Plantar facial rupture or tear.
- Calcaneal stress fracture.
- Infracalcaneal bursitis.
- Heel mass.
- Arthropathy
- Local nerve impingement
- Insertional tendinopathy of Tendo Achilles.
- Tumor.
- Coalition
- Atrophy of fat pad.
- Collagen vascular disease.
- Iatrogenic

# Imaging Options for the Assessment of the Complicated Heel



Daniel P. Evans, DPM, FACFAOM  
President, ACFAOM

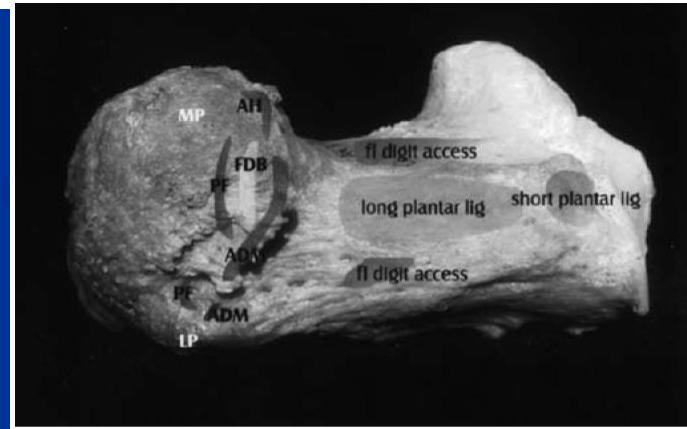
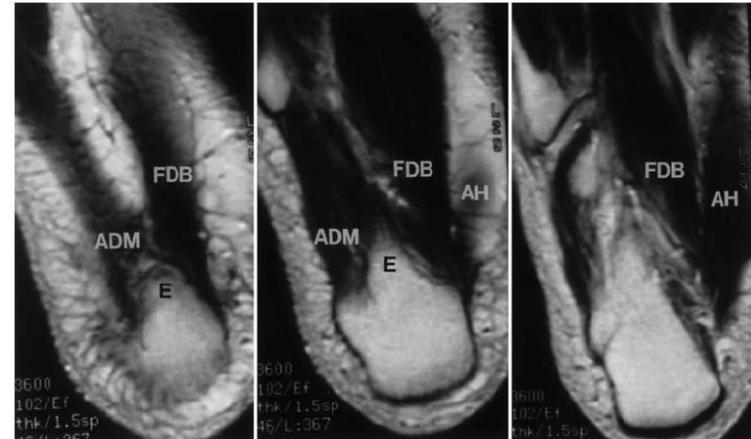
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# Heel Spur Locations

- Deep to the Plantar Fascia (50%)
- Between PF and Abductor Digiti Minimi, FDB and Abd Hallucis Muscles (40%)
- Within the Plantar Fascia (3%)
- Undetermined (8%).

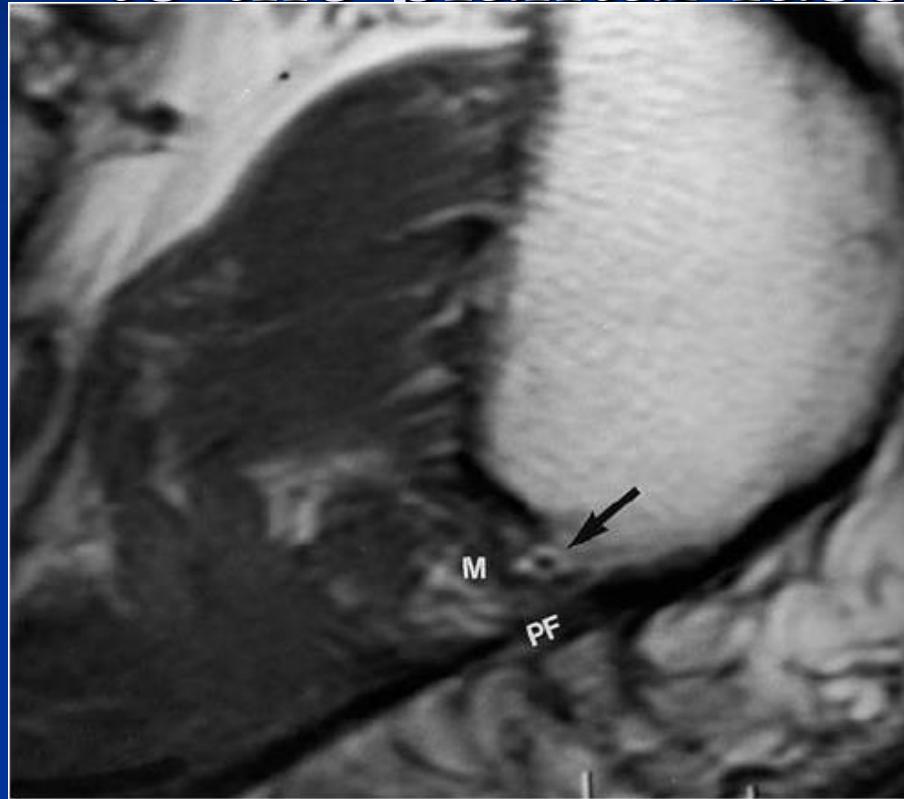
**Fig. 1** Inferior view of the muscles of the first layer of the foot. Axial T2-weighted SE MR images (3600/102) demonstrate abductor hallucis (AH), flexor digitorum brevis (FDB), and abductor digiti minimi (ADM) muscles inserting into the calcaneus. Note the calcaneal enthesophyte (E)



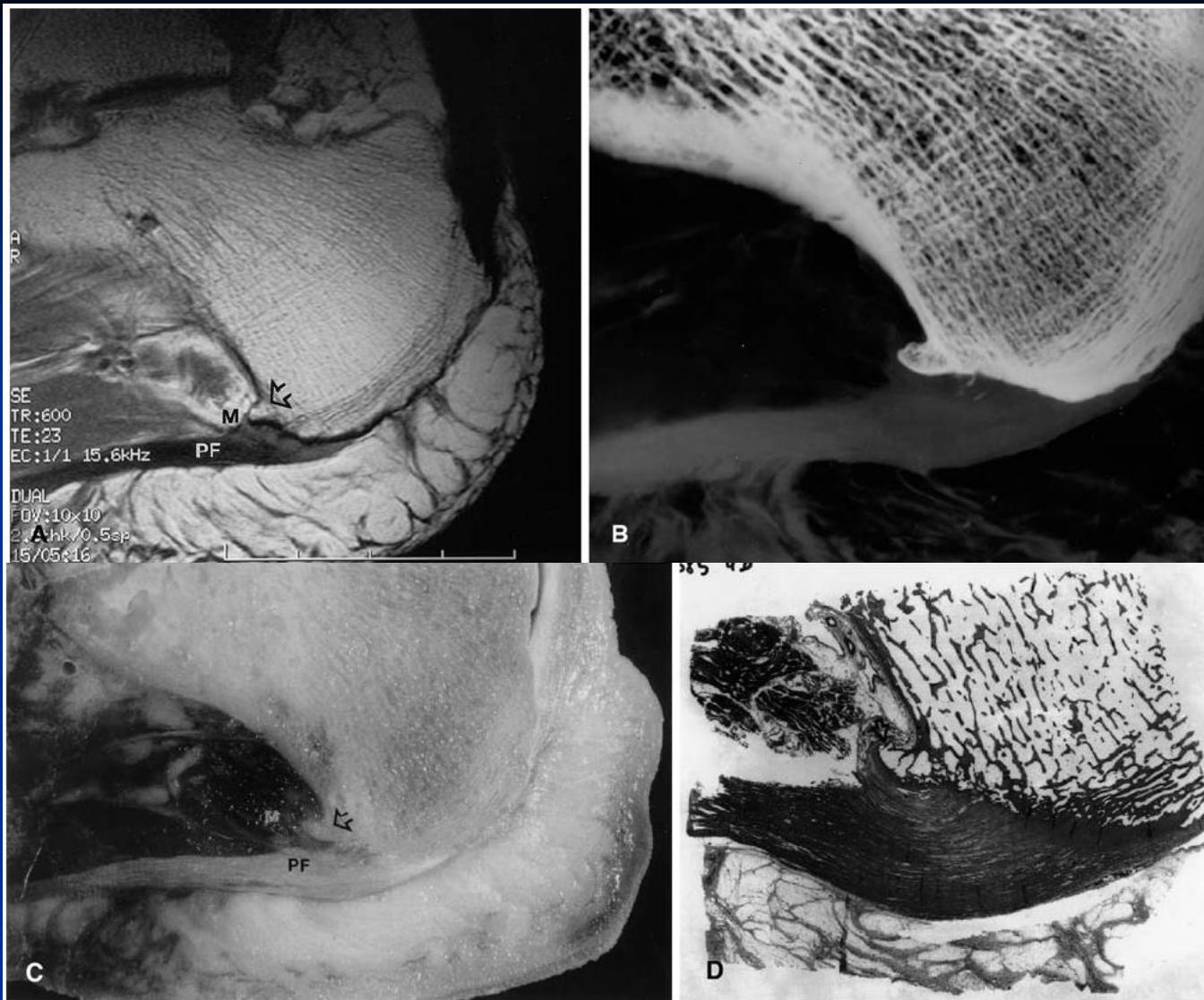
**Fig. 2** Schematic drawing superimposed on a paleopathologic specimen showing the insertion sites of the muscles, ligaments, and fascia in the calcaneal bone. HA abductor hallucis muscle, FDB flexor digitorum brevis, ADM abductor digiti minimi, PF plantar fascia, MP medial process and LP lateral process of the calcaneal tuberosity, fl dig access flexor digitorum accessories

Skeletal Radiology (2004) 32:13-21. Abreu MR, Chung CB, Mendes L: Plantar calcaneal enthesophytes: New observations regarding sites of origin based on radiographic, MR imaging, anatomic, and paleopathologic analysis.

# Spur most commonly located deep to the plantar fascia



**Fig. 3** Sagittal T1-weighted SE MR image (500/14) in a patient with foot pain reveals a plantar enthesophyte (arrow) arising at the site of origin of the muscles (M) of the first layer of the foot. PF plantar fascia



**Fig. 4A–D** Correlation of MR imaging with gross anatomic findings in a cadaveric specimen with a plantar enthesophyte arising just above the plantar fascia. **A** Sagittal T1-weighted MR image (600/20, 512×256 matrix, 10 cm FOV), **B** corresponding histologic specimen (sagittal slice, H&E), **C** anatomic slice, and **D** histologic specimen (sagittal slice, H&E). Arrow enthesophyte, *PF* plantar fascia, *M* muscle

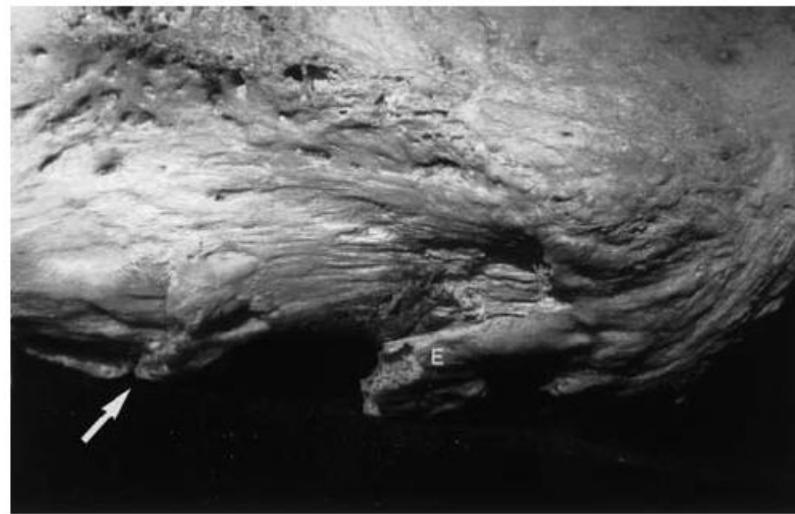
insertion more superficially than the FDB muscle and had a broader insertion site, extending from the middle of the medial process to the lateral process of the calcaneal tuberosity. The AH muscle had a very small insertion site in the bone, and its location was much more me-

# Multiple Spur Locations

Abductor Digiti Minimi



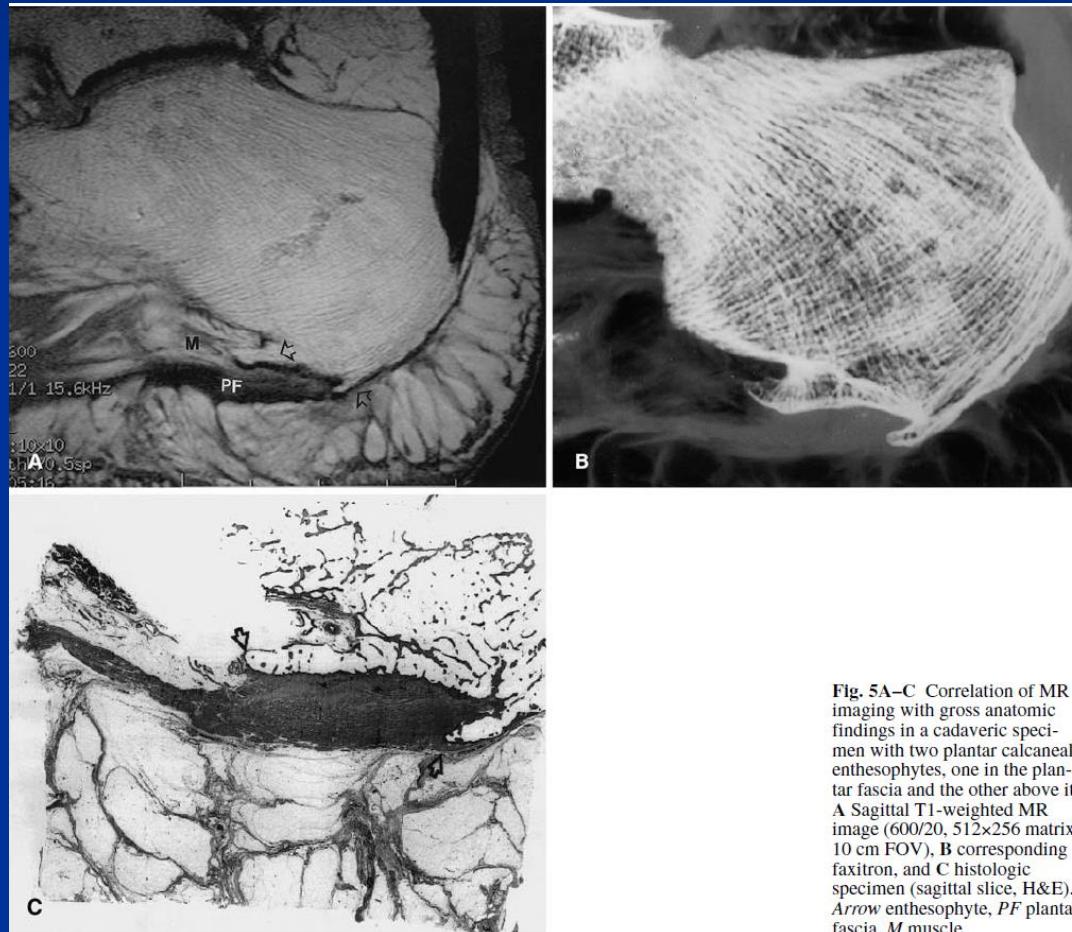
Short Plantar Ligament



**Fig. 6** Paleopathologic specimen with a plantar enthesophyte (*E*) oriented in the direction (arrow) of the fibers of the abductor digiti minimi

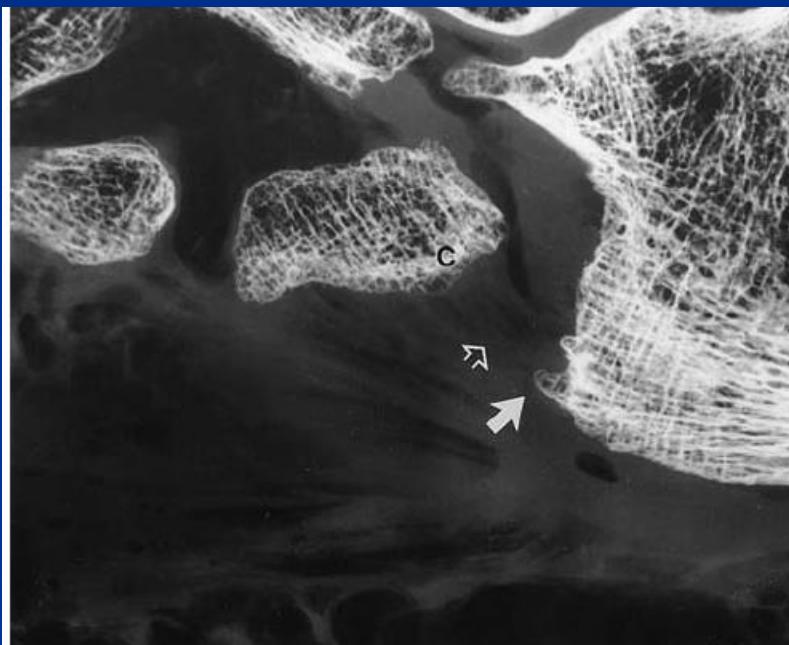
**Fig. 7** Paleopathologic specimen with two plantar enthesophytes, one located at site of attachment of the short plantar ligament (arrow). *E* enthesophyte at the calcaneal tuberosity

# Spurring at deep and superficial aspects of P.F.



**Fig. 5A–C** Correlation of MR imaging with gross anatomic findings in a cadaveric specimen with two plantar calcaneal enthesophytes, one in the plantar fascia and the other above it. A Sagittal T1-weighted MR image (600/20, 512×256 matrix, 10 cm FOV), B corresponding faxitron, and C histologic specimen (sagittal slice, H&E). Arrow enthesophyte, PF plantar fascia, M muscle

# Short Plantar (Calc-Cuboid Lig)



**Fig. 8** Faxitron of one cadaveric specimen showing a plantar enthesophyte (arrow) arising at the short plantar ligament (open arrow) insertion site. C cuboid bone

# Long Plantar Ligament

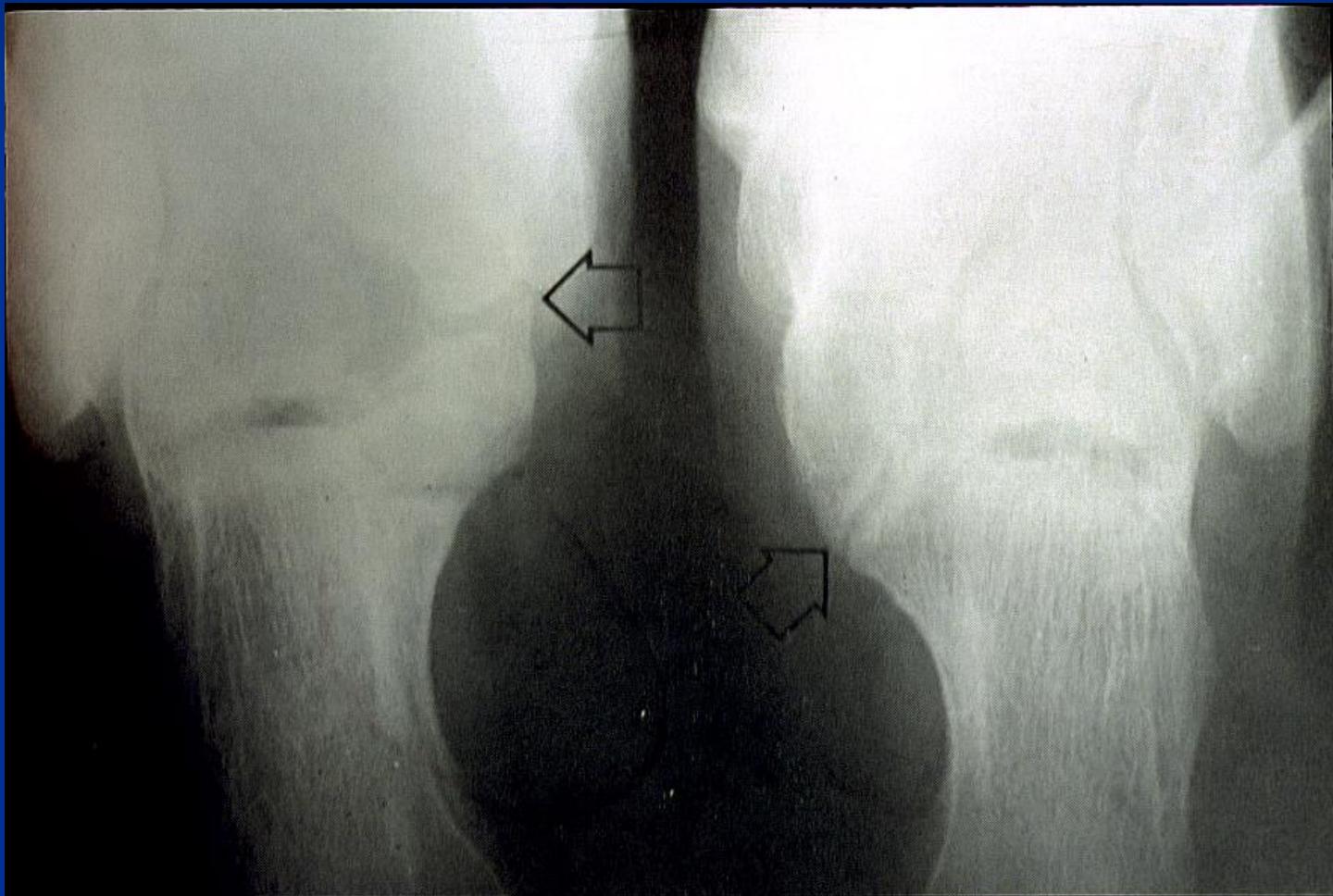


# **PLAIN FILM ANALYSIS**

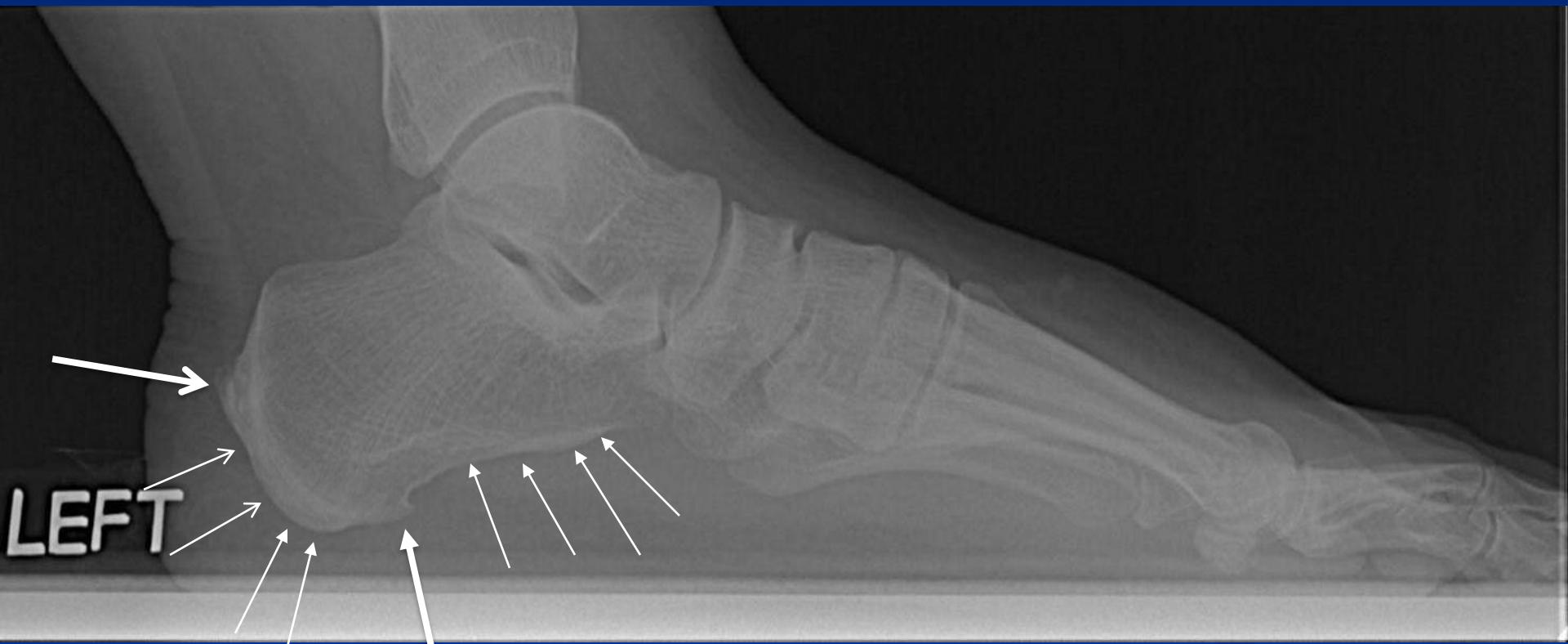
# PLAIN FILM ANALYSIS

- LATERAL PROJECTION
- LATERAL OBLIQUE
- MEDIAL OBLIQUE
- AXIAL CALCANEAL
- HARRIS & BEATH

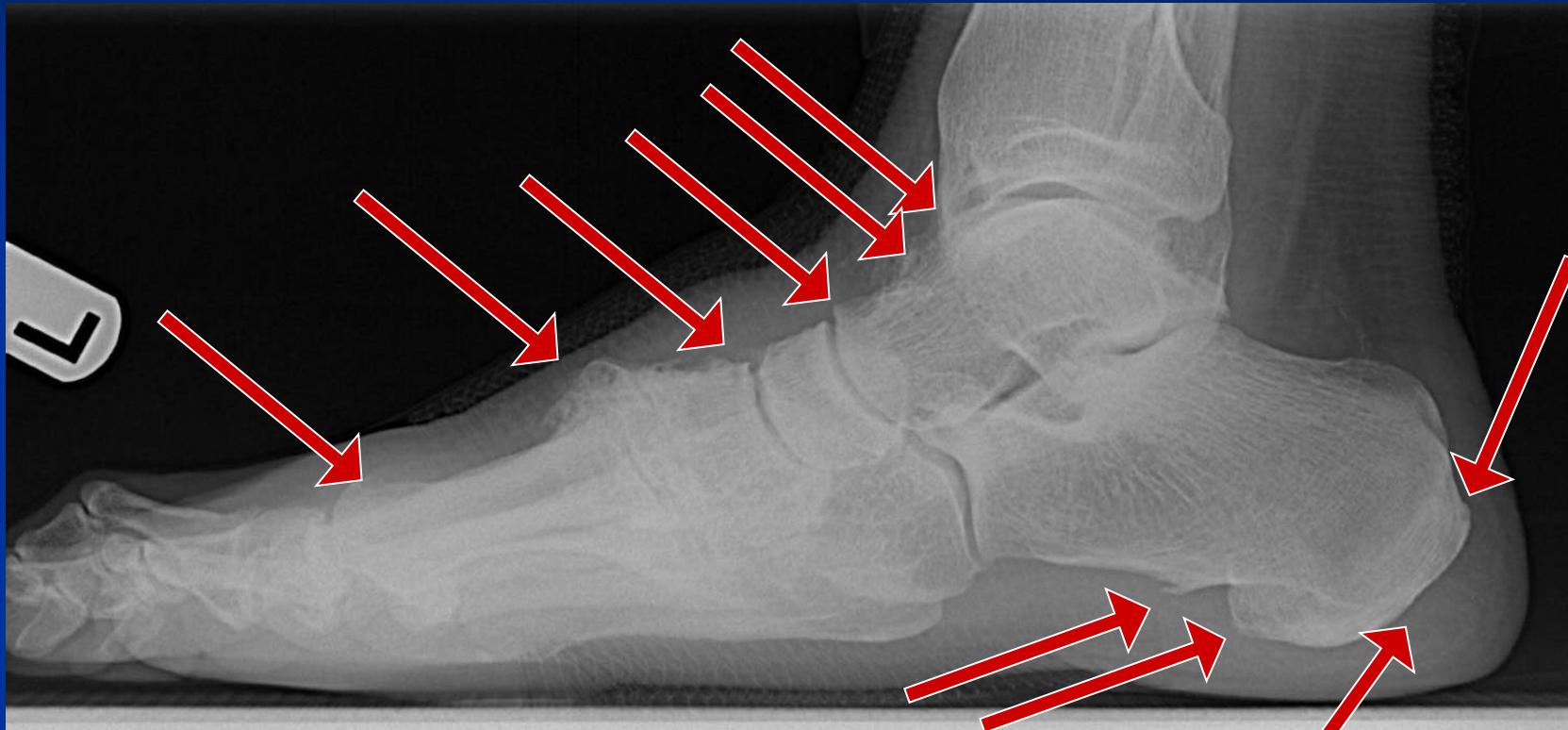
# Middle Facet STJ Coalition



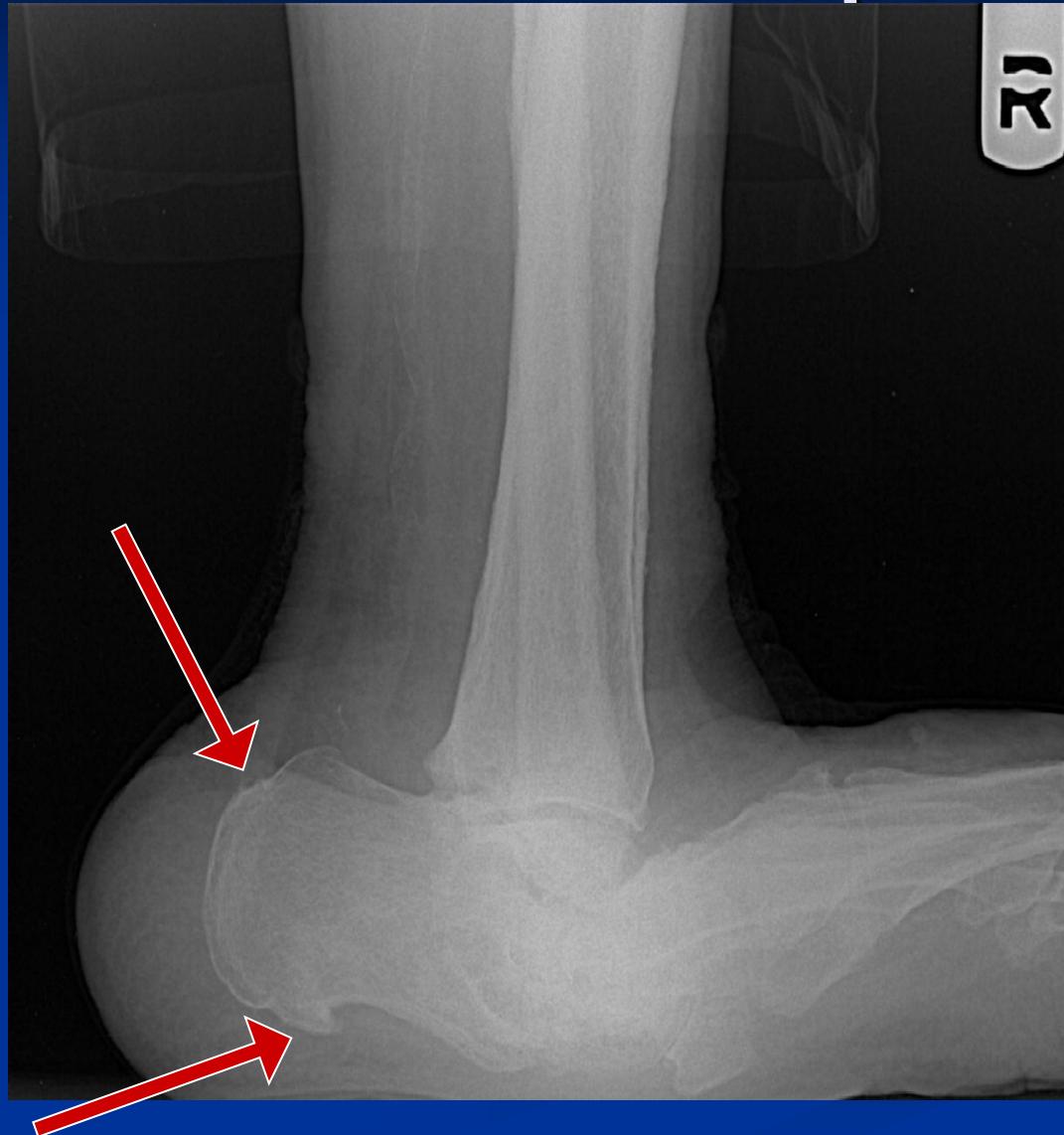
# Increase Tensile Trabeculation



# Multiple Effects of Equinus



# Charcot Collapse

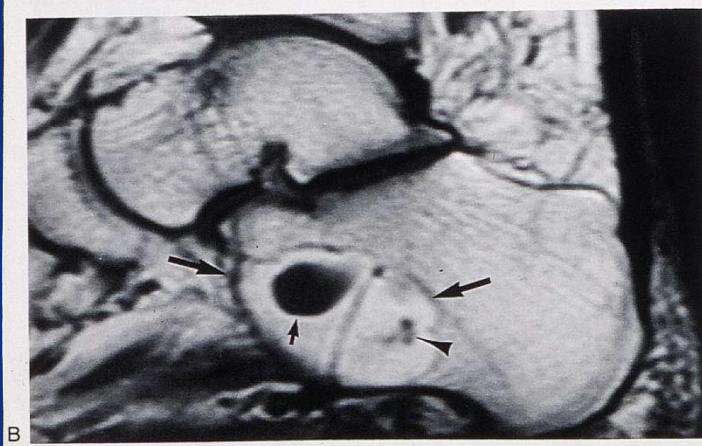
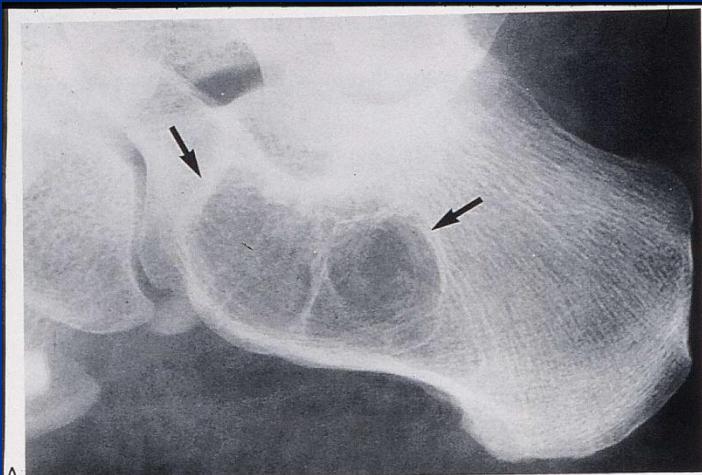


# TUMORS

# UBC with “Fallen Fragment Sign”



# Aneurysmal Bone Cyst



# Chondrosarcoma



# ARTHRITIS

# Rheumatoid Arthritis



# Psoriatic Arthritis



# Reactive Arthritis (Reiter's)



# DISH



# Charcot



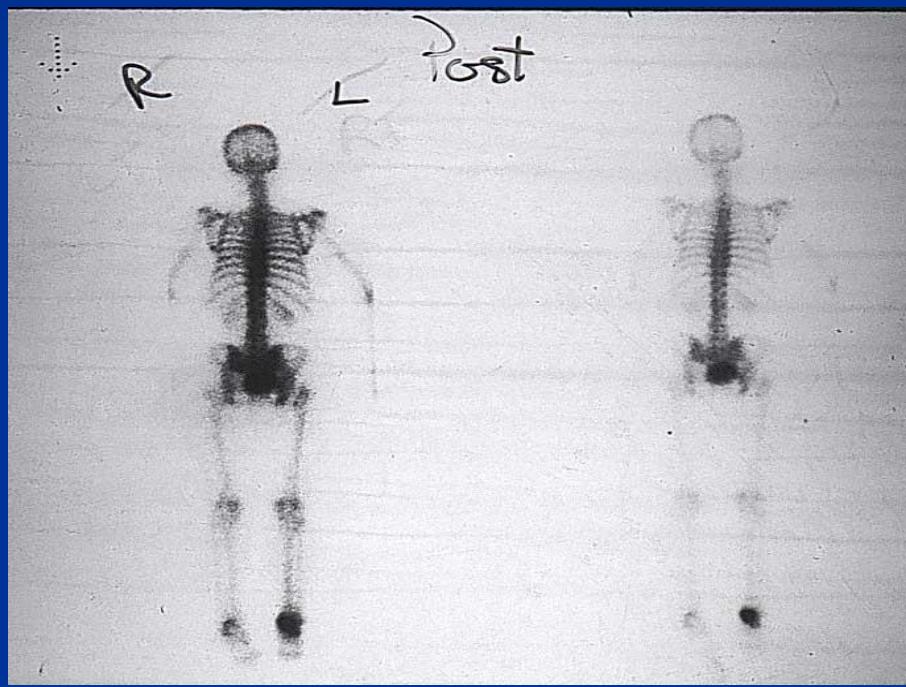
# Paget's Disease



# NUCLEAR IMAGING

# NUCLEAR IMAGING

- Limited utilization in the evaluation of heel pain.
- Plantar Fascitis/ Stress Fractures/ Arthridities/ Osseous neoplasms will all show + uptake of isotope.
- Nerve entrapment alone will have normal scan.
- **May be assistive in identifying occult pathology.**
  - Early Fx, infection or neoplasm. Talar Dome Lesion.



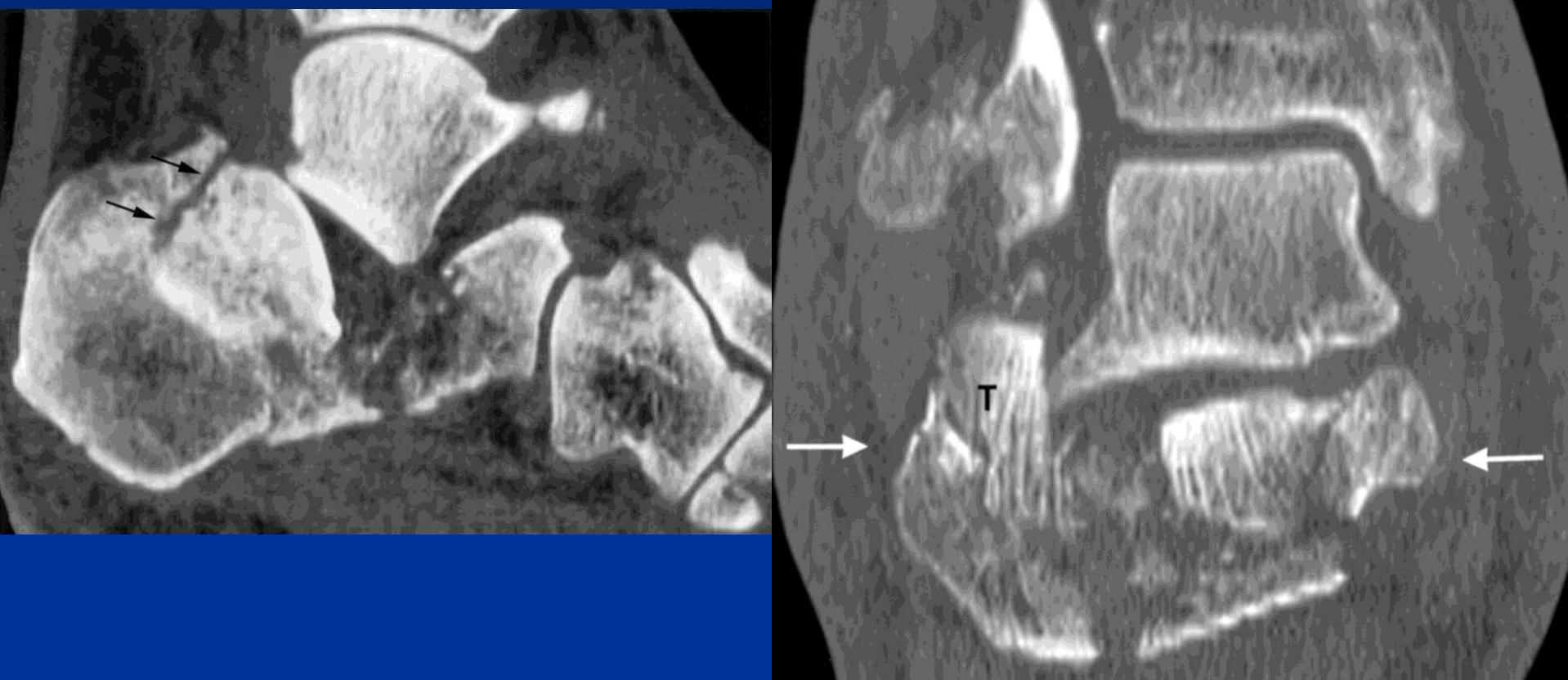
# **COMPUTED TOMOGRAPHY**

**(C.T.)**

# Computed Tomography

- Allows for planar analysis (limited).
- Excellent cortical presentation
  - Calcaneal Fractures
  - Talar Dome Lesions
  - Rearfoot Coalitions

# Computed Tomography

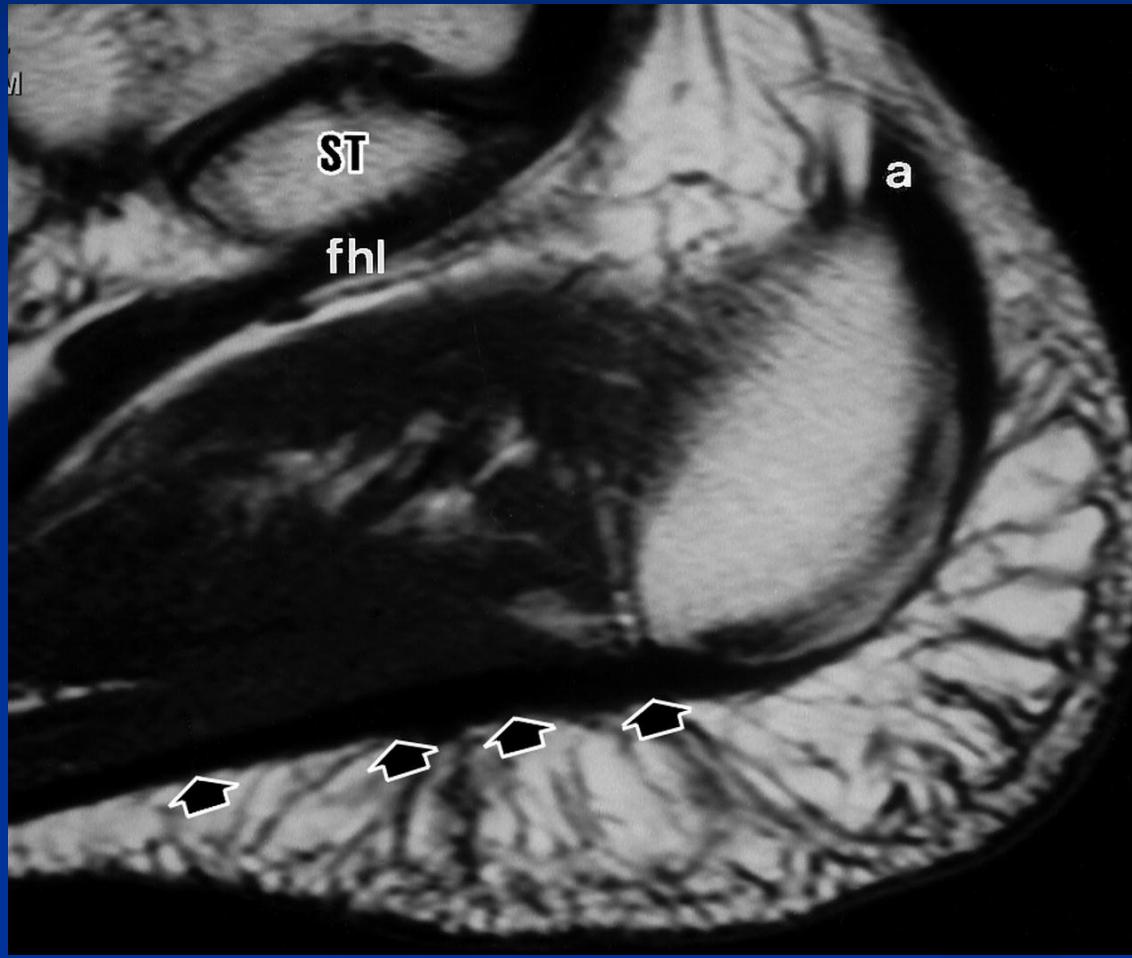


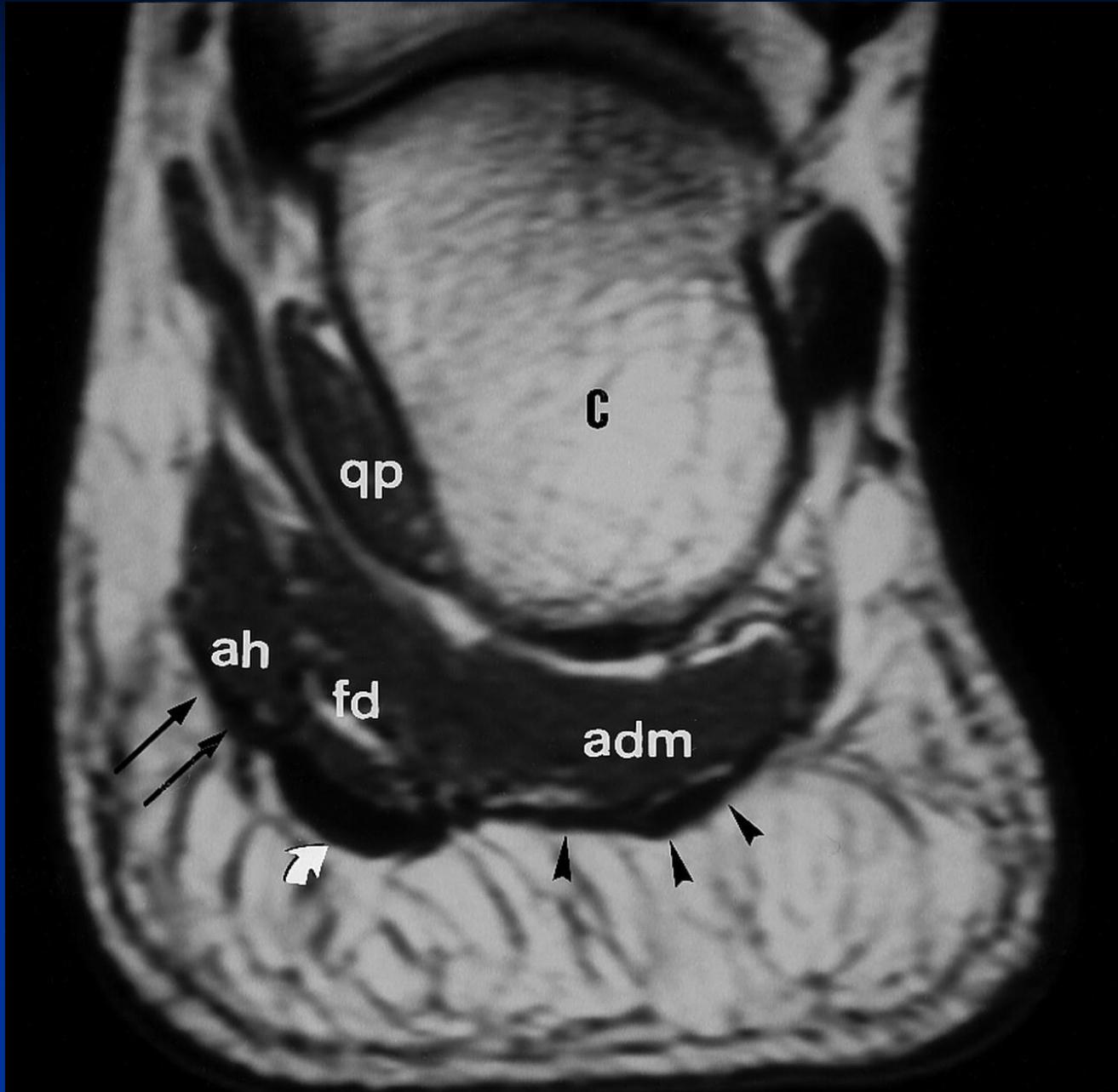
Fractures of the Calcaneus: A Review with Emphasis on CT. A. Daftary, A. Haims, M. Baumgaertner.  
Radiographics, Vol.25, Issue 5. 2005

# MAGNETIC RESONANCE IMAGING (MRI)

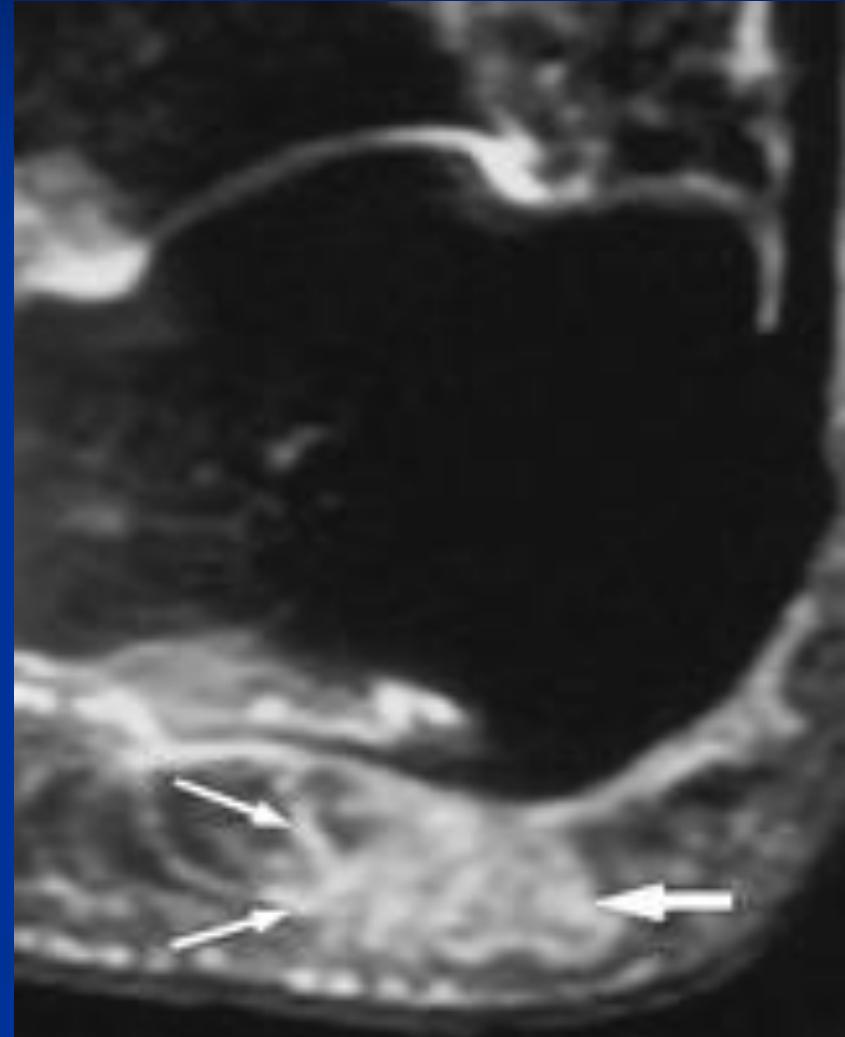
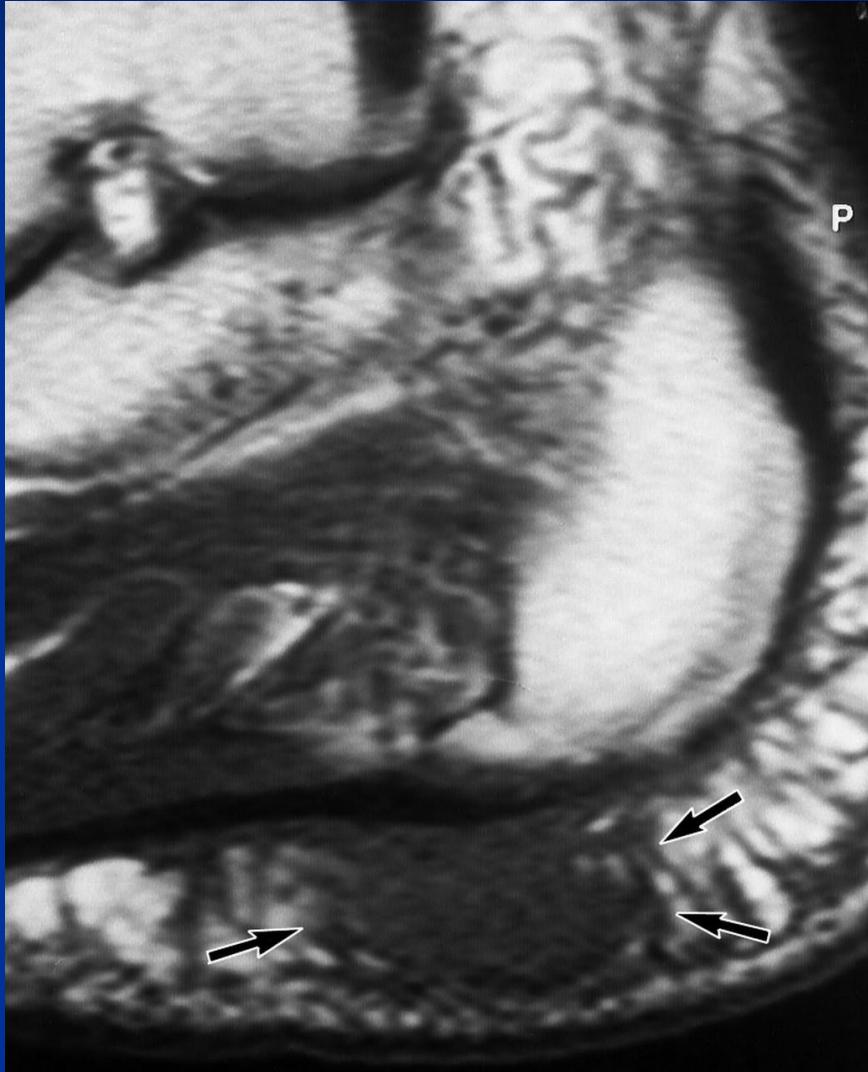
# Magnetic Resonance Imaging

- Multi-planar analysis.
- Demonstration of Anatomical Structures.
- Marrow Analysis.
- Periosteal Response.
- Inflammatory Response.
  
- Limited evaluation of cortical bone.

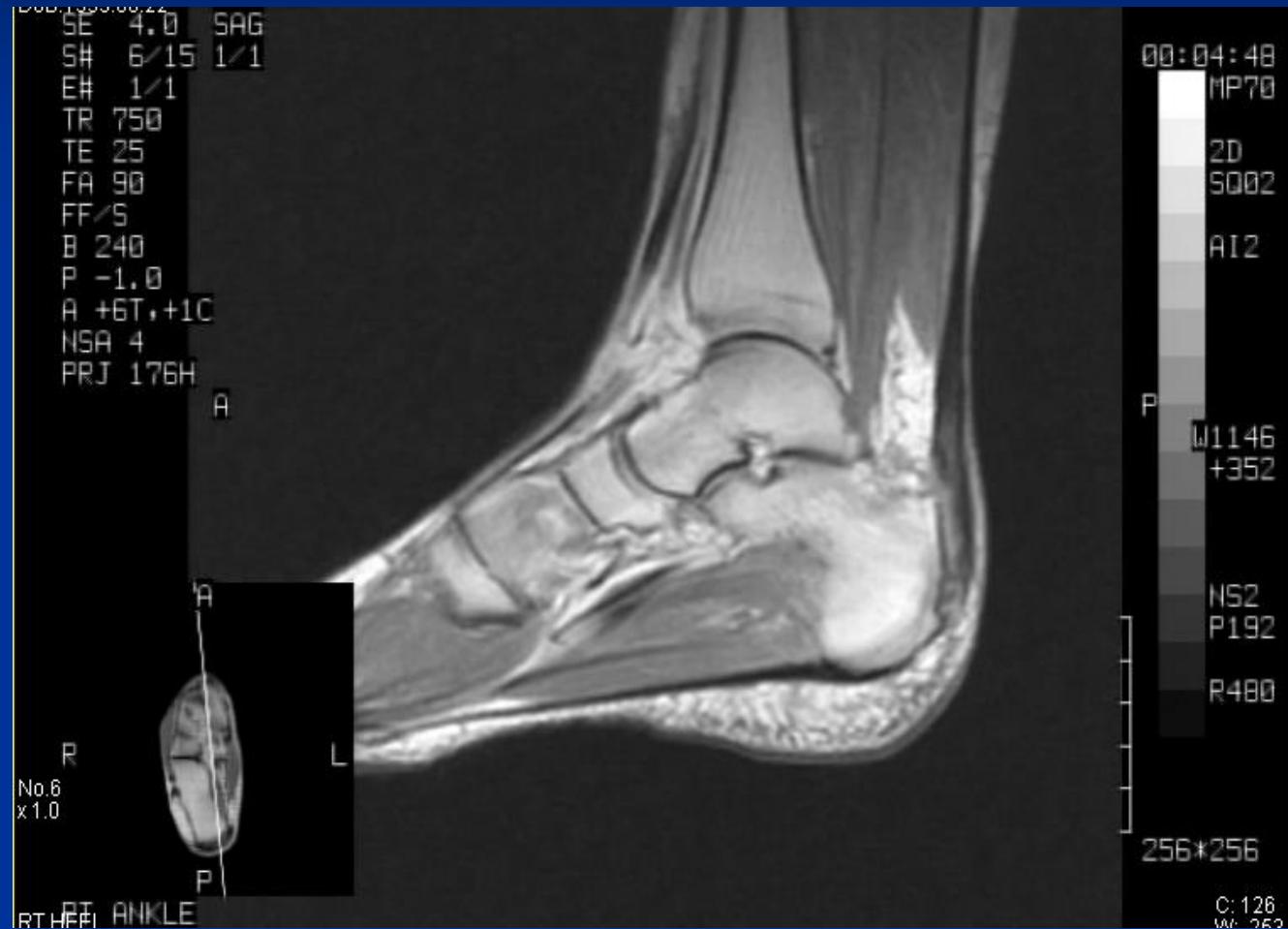




# Rheumatoid Nodule



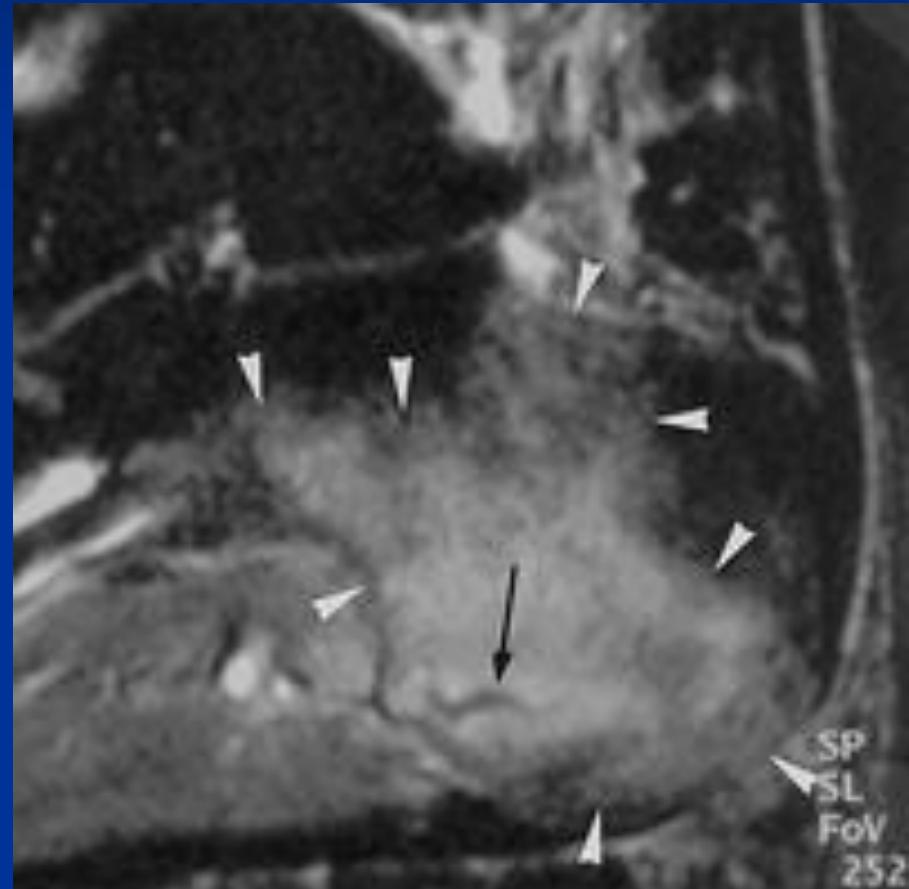
# Retrocalcaneal bursitis



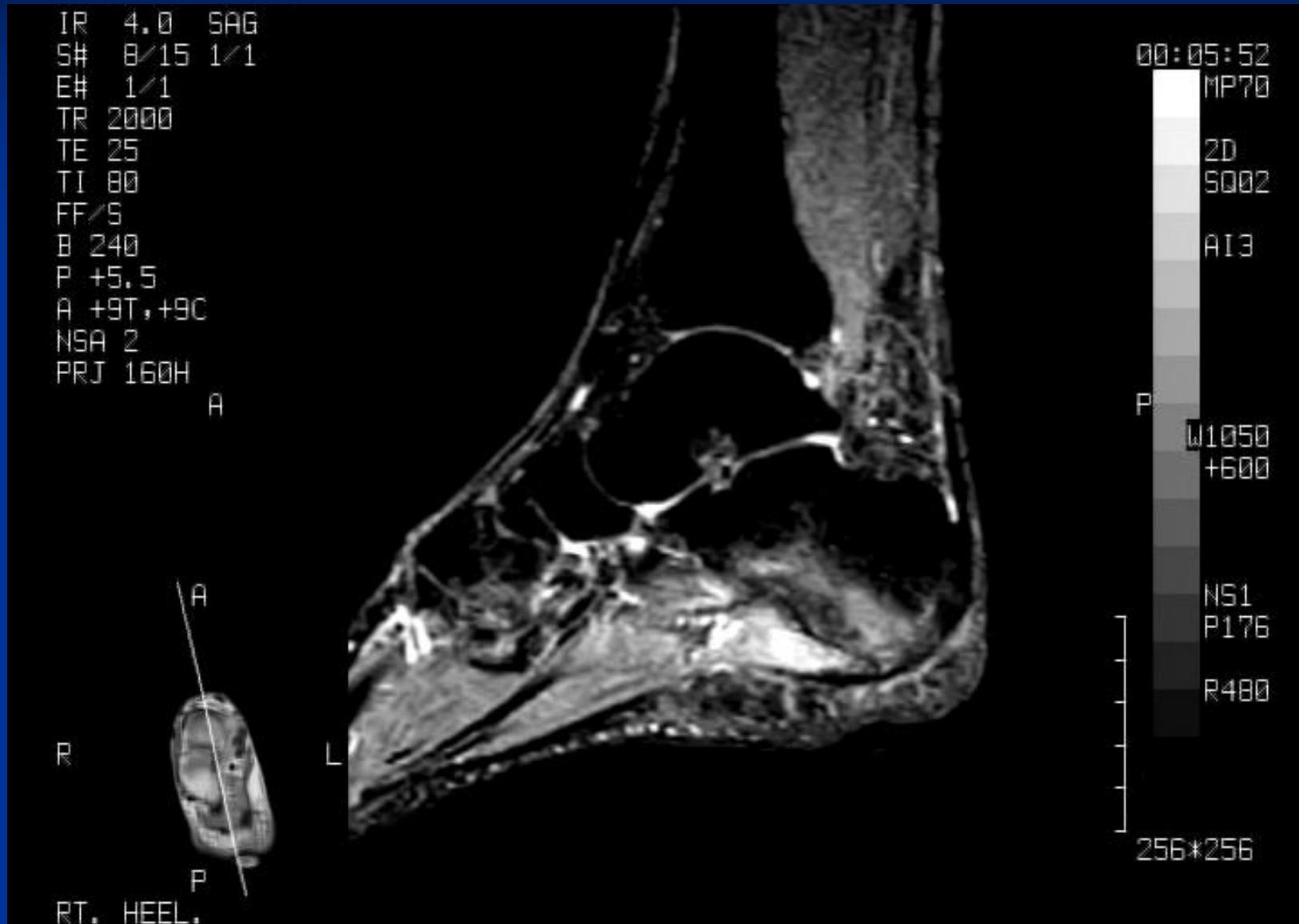
# Stress Fracture Calcaneus

## ■ STIR – Image

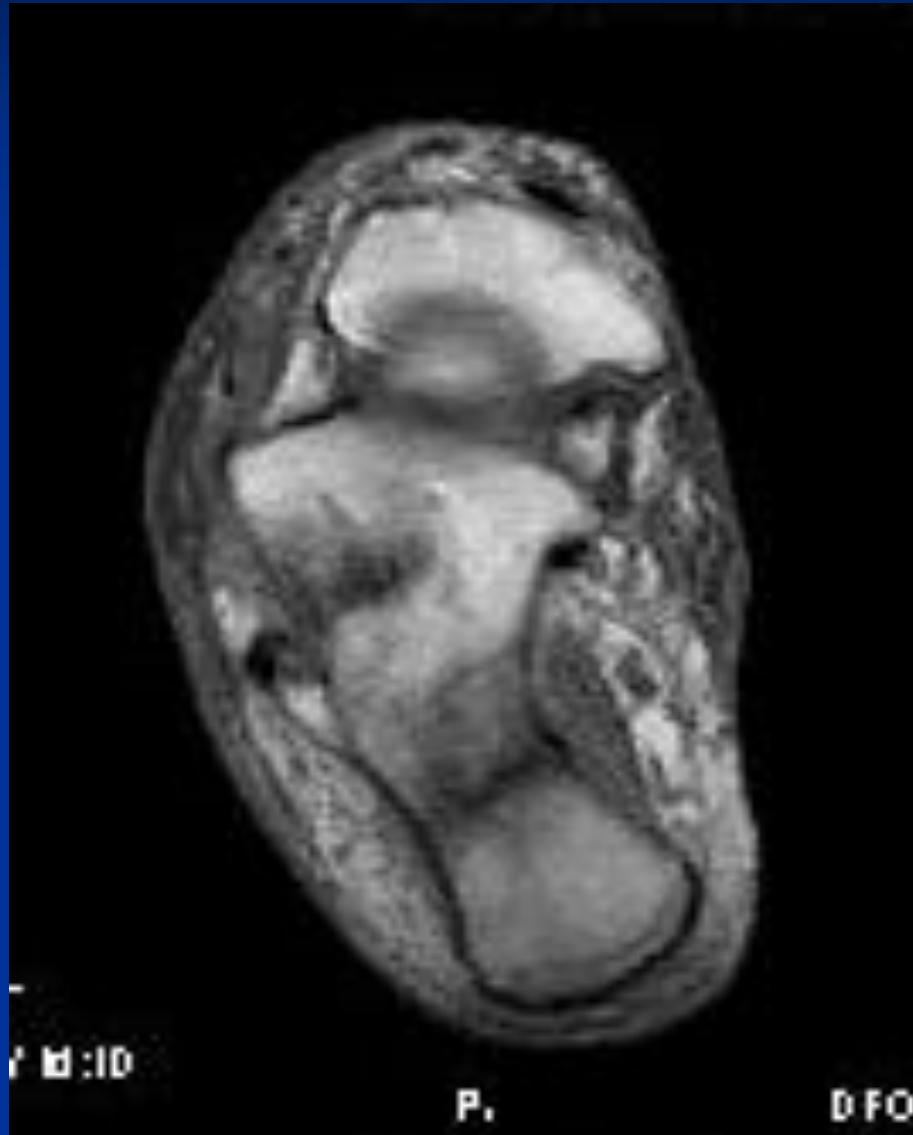
- Note evidence of marrow edema
- Linear stress risers from anterior aspect of medial tuberosity angling posterior-superiorly.



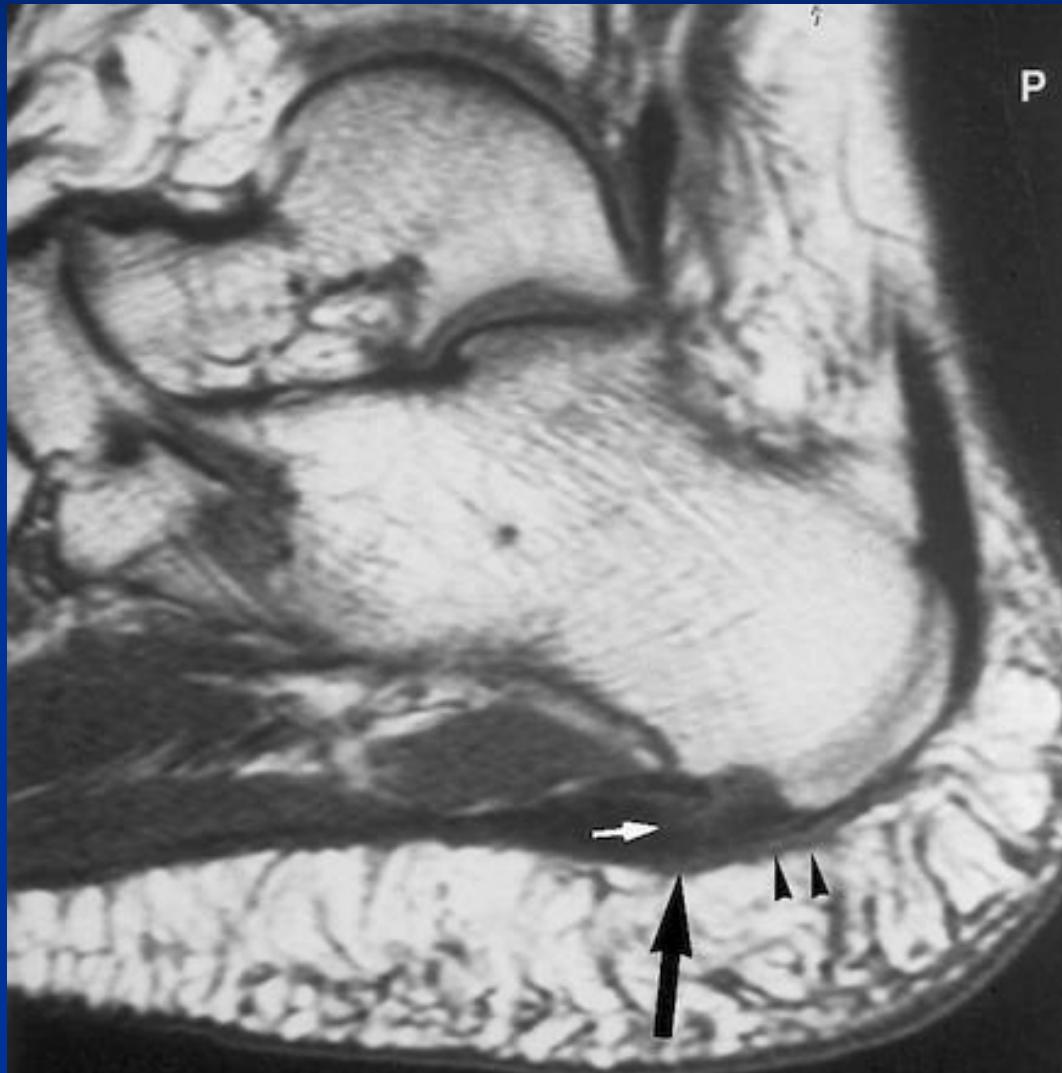
# Calcaneal Stress fracture



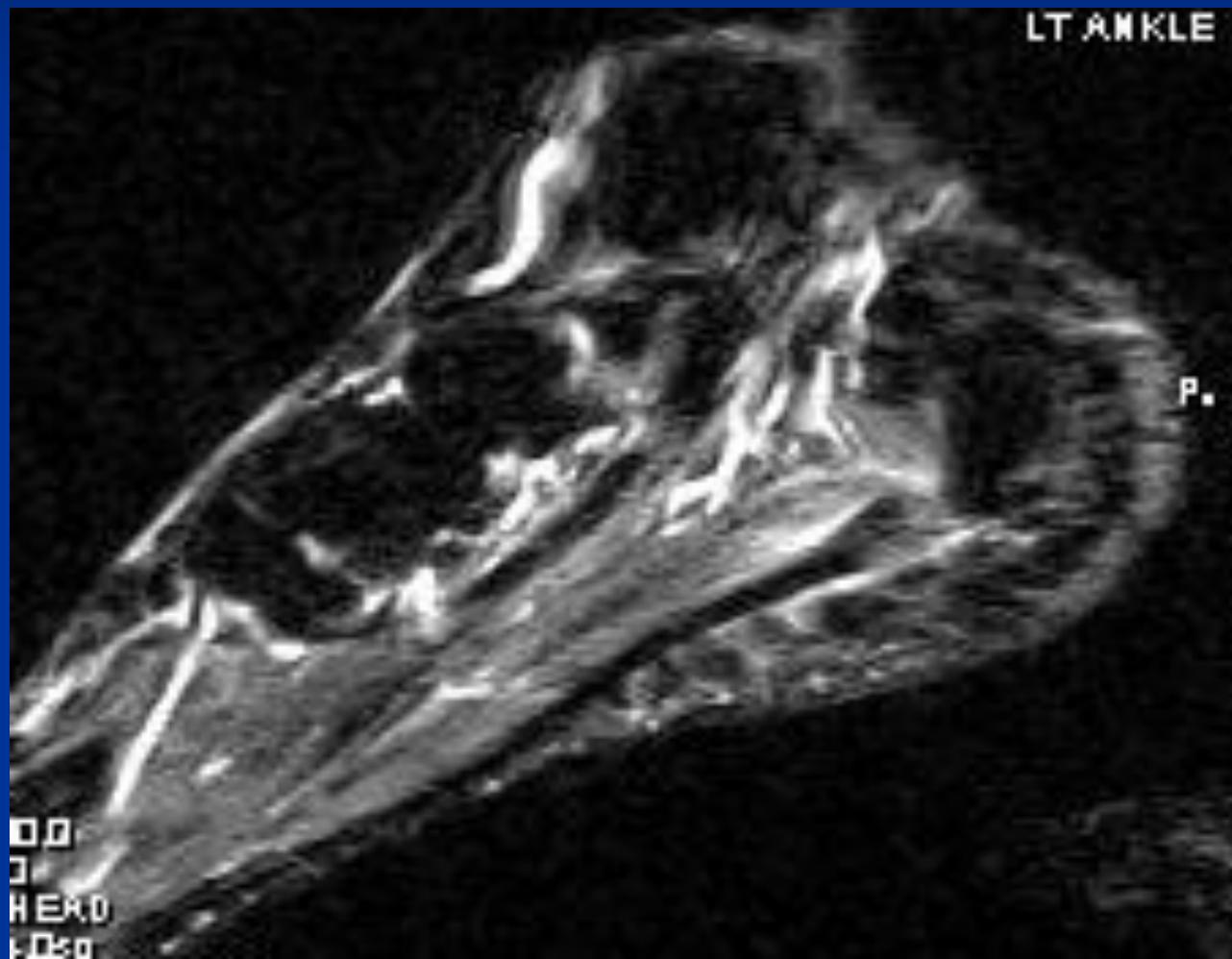
# Calcaneal Stress Fracture



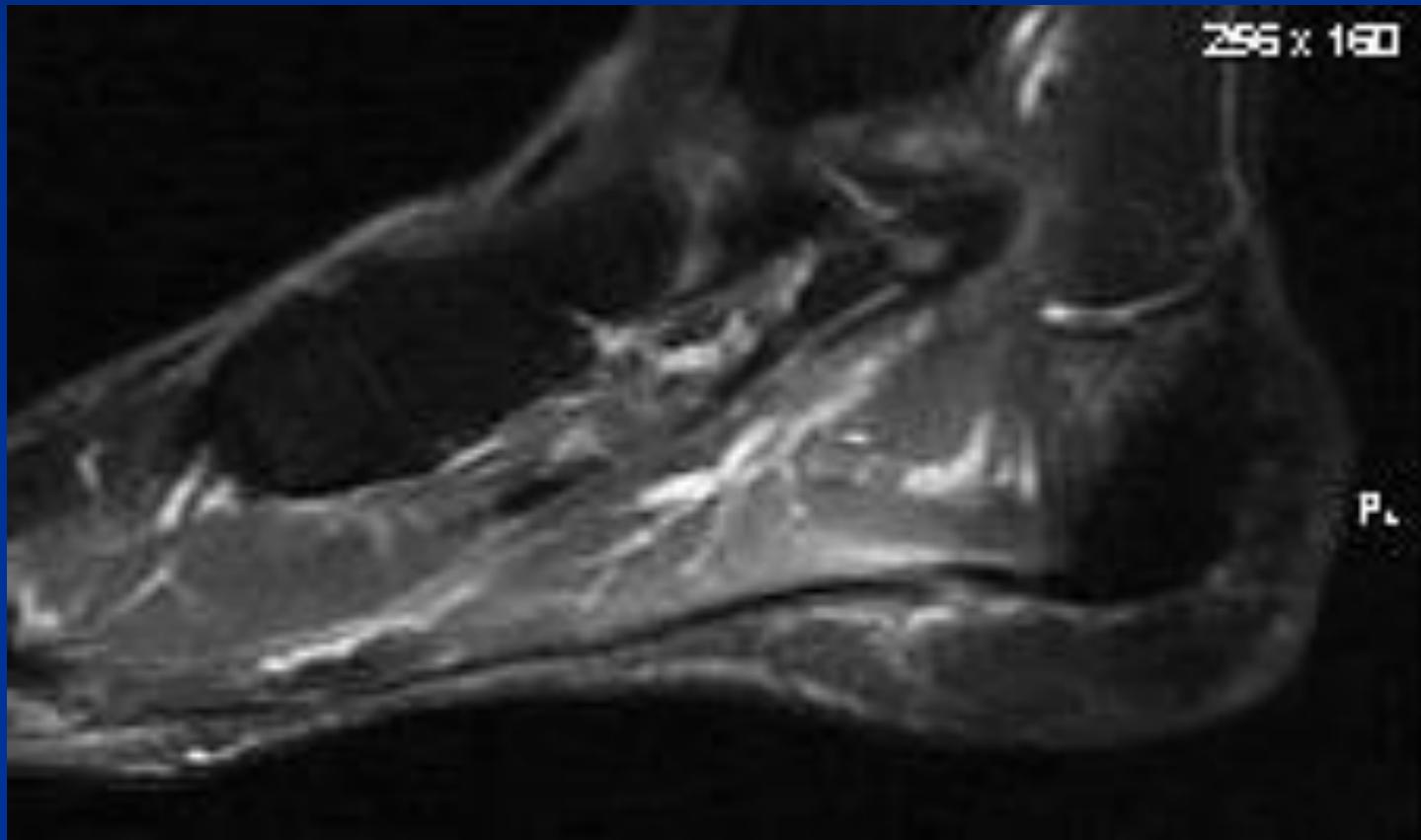
# Plantar Fascitis Thickening of PF



## Partial Tear Plantar Fascia STIR



## Partial Tear Plantar Fascia STIR



## Hypertrophied Plantar Fascia with Partial Tear T1WI



## Hypertrophied Plantar Fascia with Partial Tear STIR



## Insertional Tendinopathy of the Achilles Tendon



## S/P EPF Right Heel 1/4



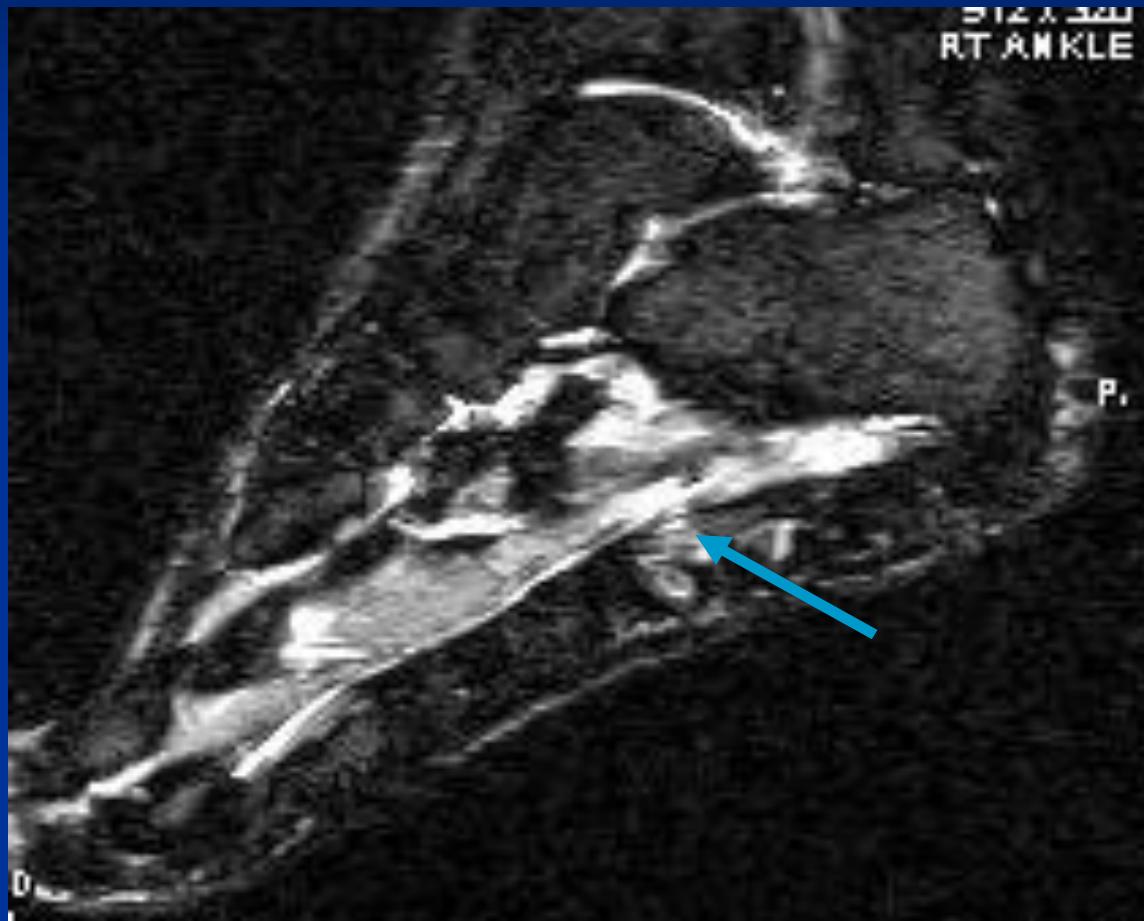
**S/P EPF Right Heel Abductor Digiti Minimi Inflammation 2/4**



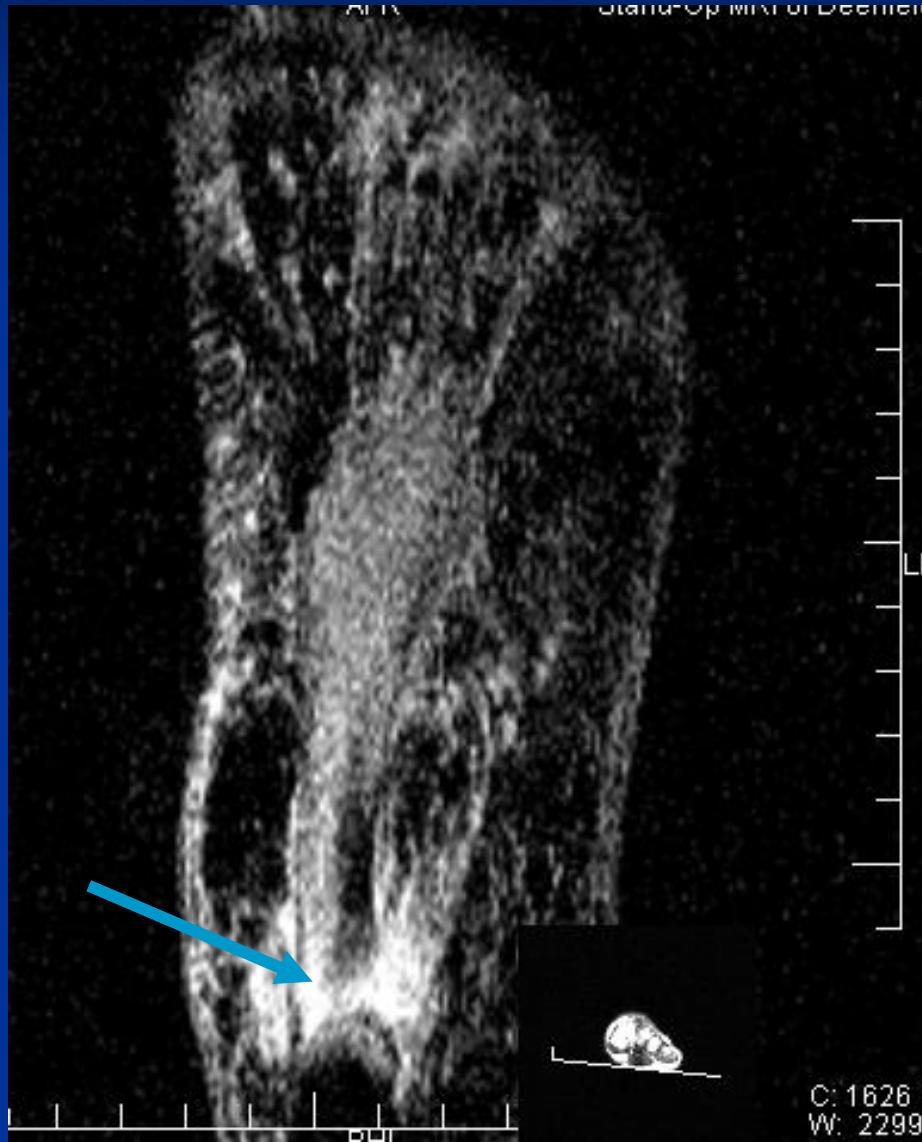
**S/P EPF Right Heel with Inflammation of Long Plantar Ligament 3/4**



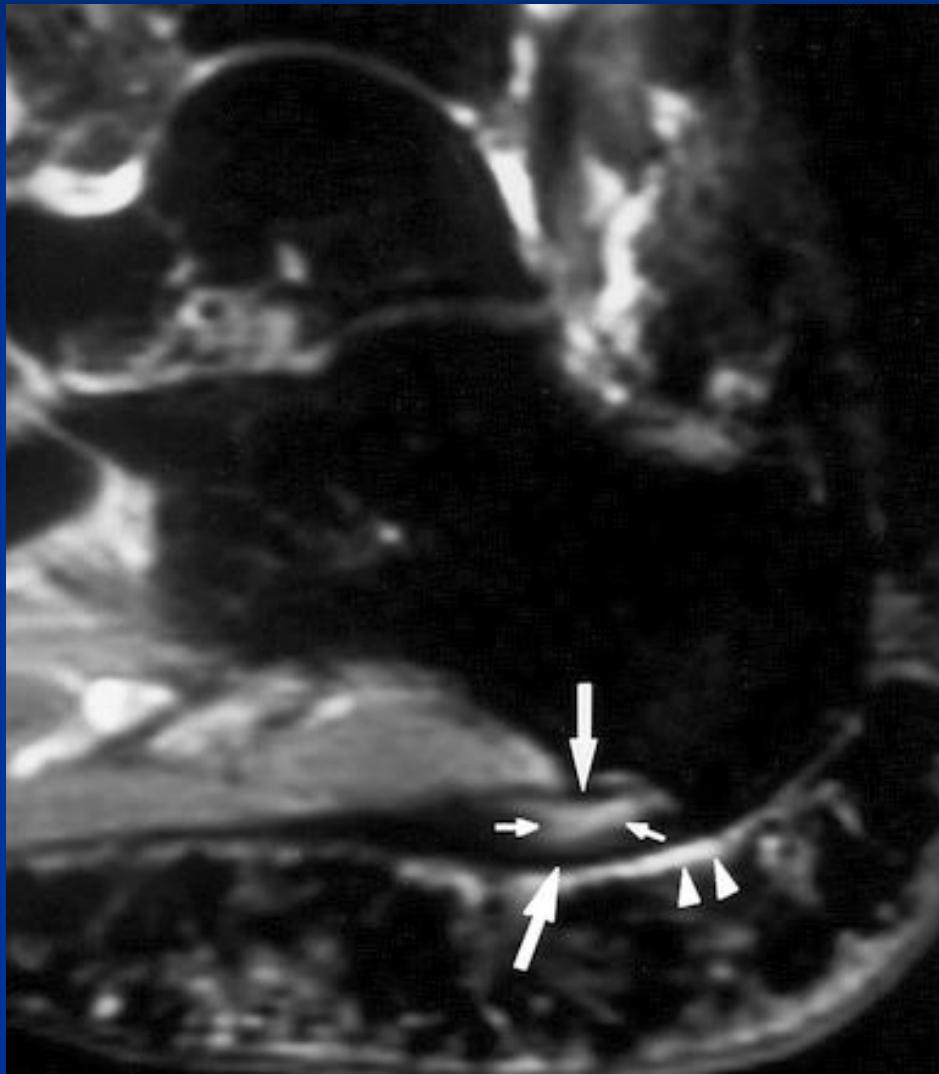
**S/P EPF Right Heel with Rupture of Lateral Band of PF 4/4**



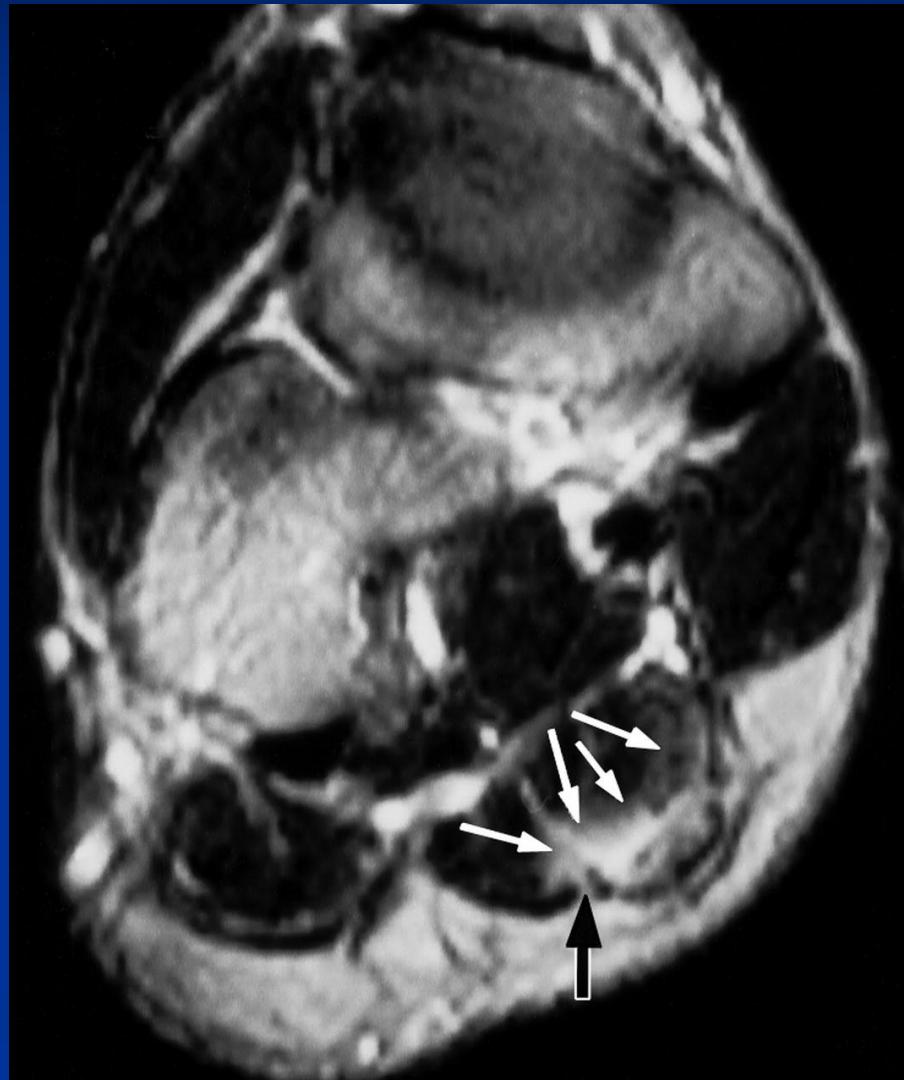
# Plantar Fascia Rupture



# MRI Stir Intrasubstance tear



- T-2 MRI
- Aponeurotic Defect  
(Black Arrow)
- FDB Muscle edema  
(White Arrows)



# ULTRASOUND

# **ULTRASOUND**

- Static as well as Dynamic evaluation of anatomical structures.
- Non-invasive.
- Ultrasound guided injections.
  
- Operator Dependent.
- Images inverted.

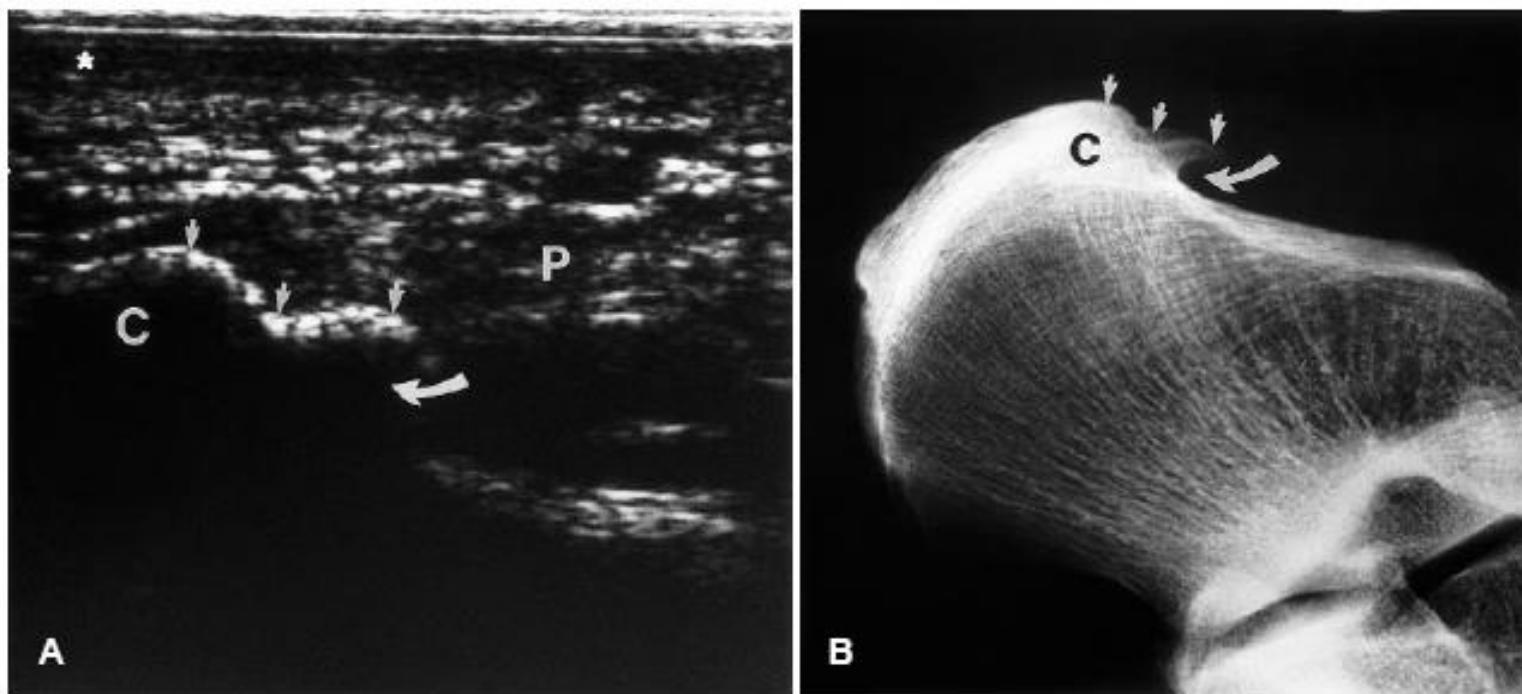
# ULTRASOUND





W.W. Gibbon  
G. Long

## Ultrasound of the plantar aponeurosis (fascia)

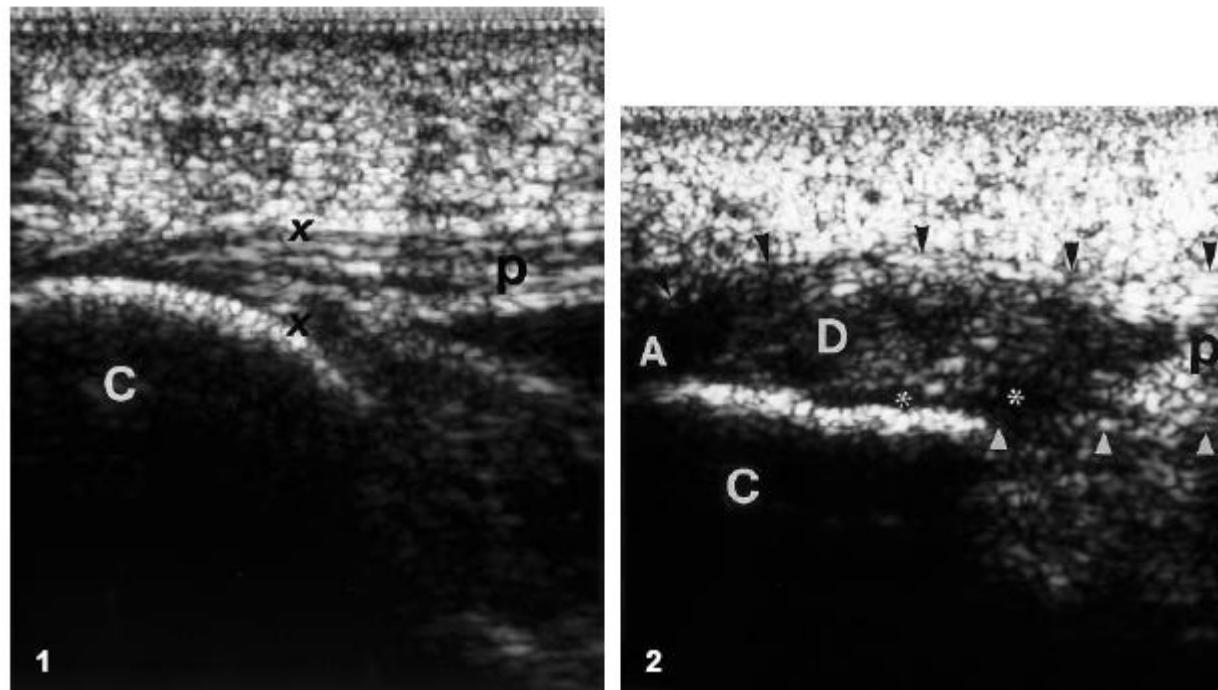


**Fig. 3A, B** Inferior calcaneal spur formation. **A** LS sagittal ultrasound image of the inferior heel. The plantar aponeurosis (*P*) demonstrates a heterogeneous hypoechoic echogenicity due to chronic tendinitis. There is a bony prominence (*arrowheads*) anterior to the medial calcaneal tuberosity (*C*) with a sharp anterior “cut-off”

to the calcaneal surface and apparent “overhang” (*curved arrow*) consistent with an anterior-inferior (buttressing) calcaneal spur. **B** Inverted lateral calcaneal radiograph of the same heel demonstrates identical bony features

W.W. Gibbon  
G. Long

## Ultrasound of the plantar aponeurosis (fascia)



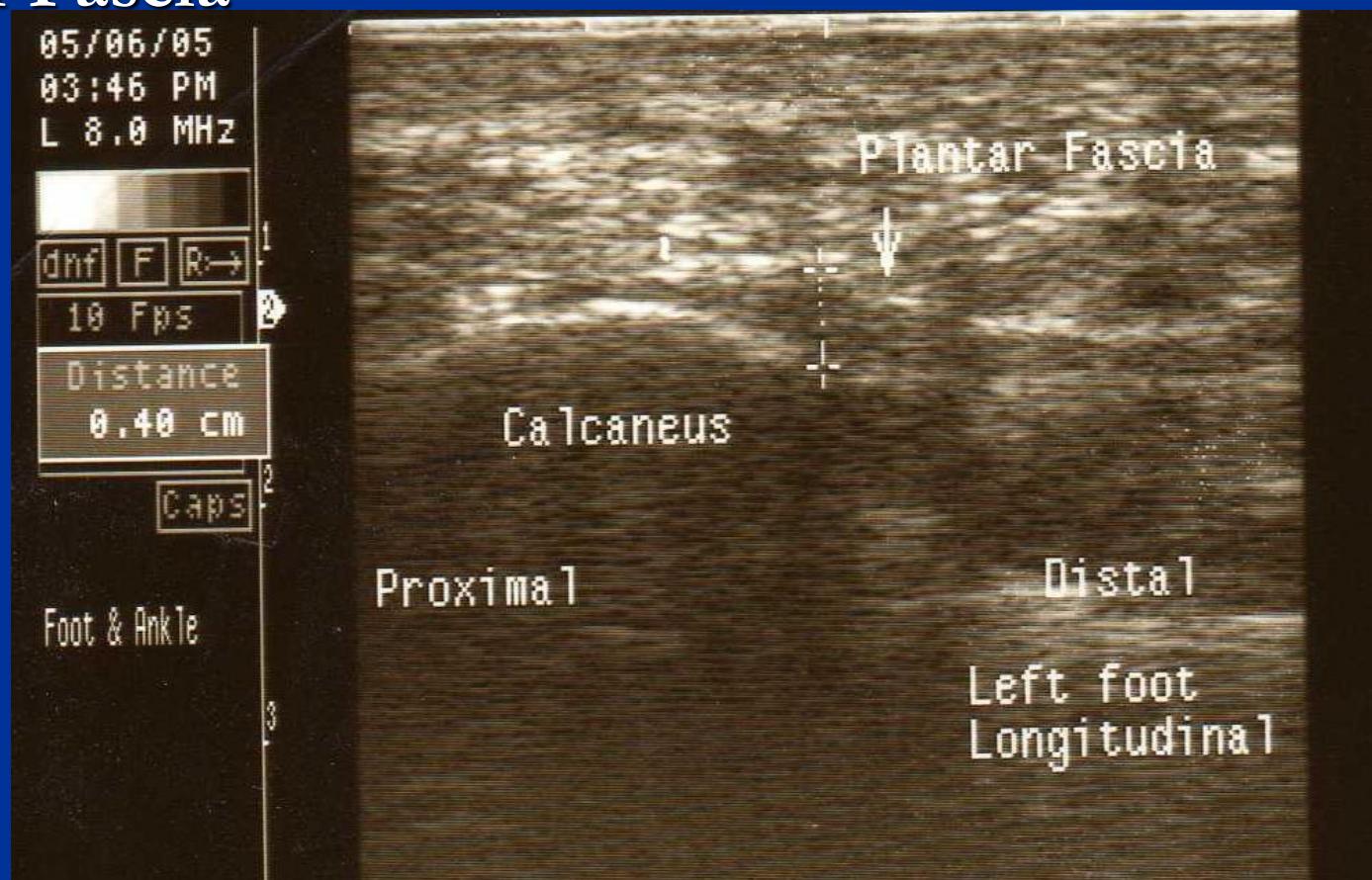
**Fig. 1** Site of measurement for quantitative analysis of changes at the plantar aponeurosis origin. LS sagittal ultrasound image, inferior calcaneal region, plantar aspect of foot. The normal internal longitudinal fibrillar pattern is clearly demonstrated within the plantar aponeurosis (fascia) origin (*P*). The plantar aponeurosis thickness (x-x) is measured at a point where it crosses the anterior-inferior border of the calcaneus (*C*)

**Fig. 2** Chronic plantar aponeurosis tendinitis with mucoid degeneration and possible intrasubstance tear of the left plantar aponeurosis origin. LS sagittal ultrasound image, plantar aspect of calcaneus. The left plantar aponeurosis origin (arrowheads), lying superficial to the calcaneus (*C*), is thickened and heterogeneous in echogenicity proximally (*D*) when compared with the normally echogenic plantar aponeurosis slightly more distally (*P*). The appearances are typical of a chronic tendinitis. In addition there is a frankly anechoic area anterior/deep to the surface of the plantar aponeurosis osseotendinous junction (\*) consistent with mucoid degeneration/intrasubstance tear. This latter area may reflect an impingement process due to levering of the aponeurosis over the anterior-inferior calcaneal border similar to the Haglund phenomenon seen at the posterior-superior calcaneal border. An apparently hypoechoic area at the posterior border of the plantar aponeurosis origin (*A*) is not, however, due to mucoid degeneration but is artifactual due to beam obliquity, i.e. anisotropy

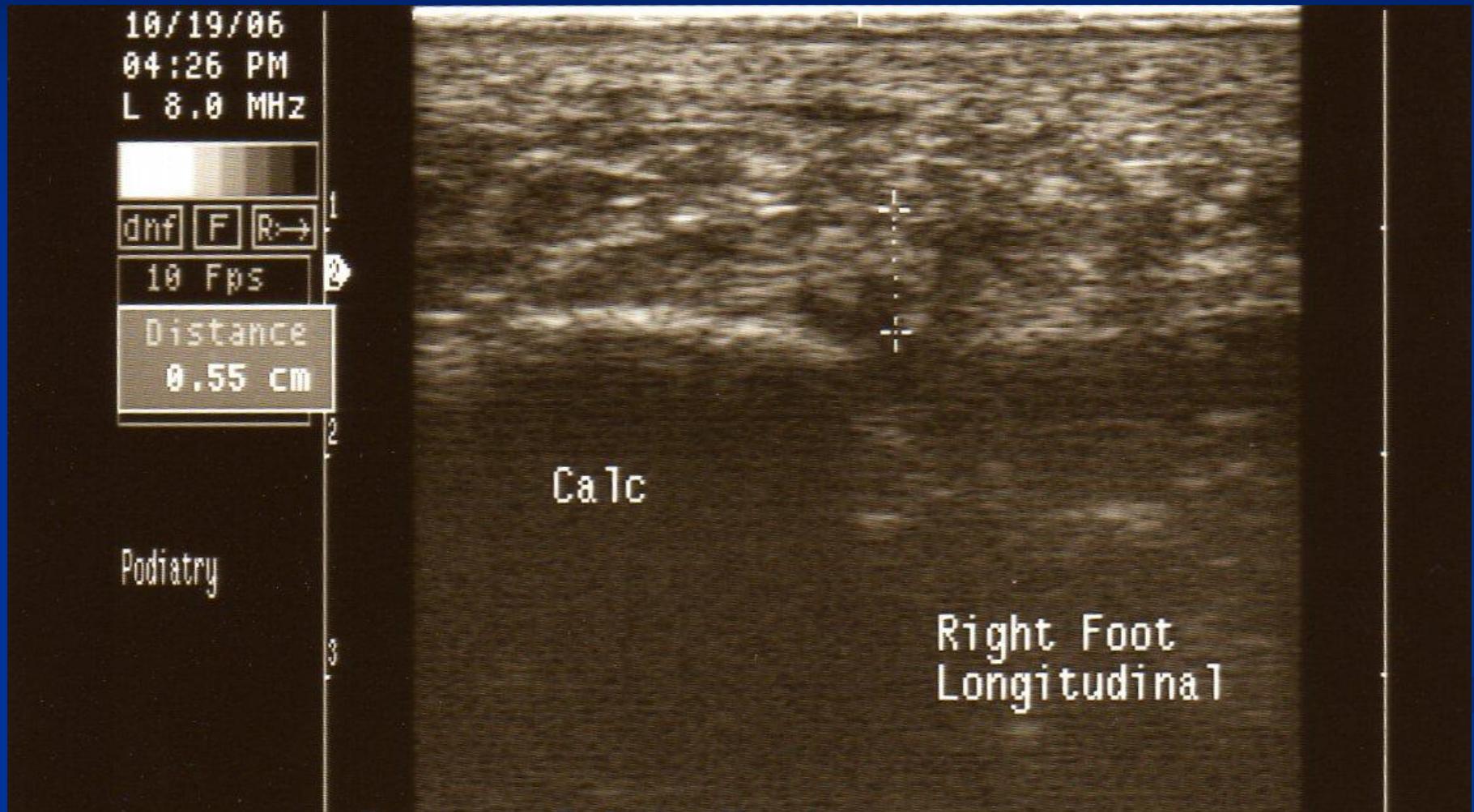
# Normal #1

- Normal Thickness  
of Plantar Fascia

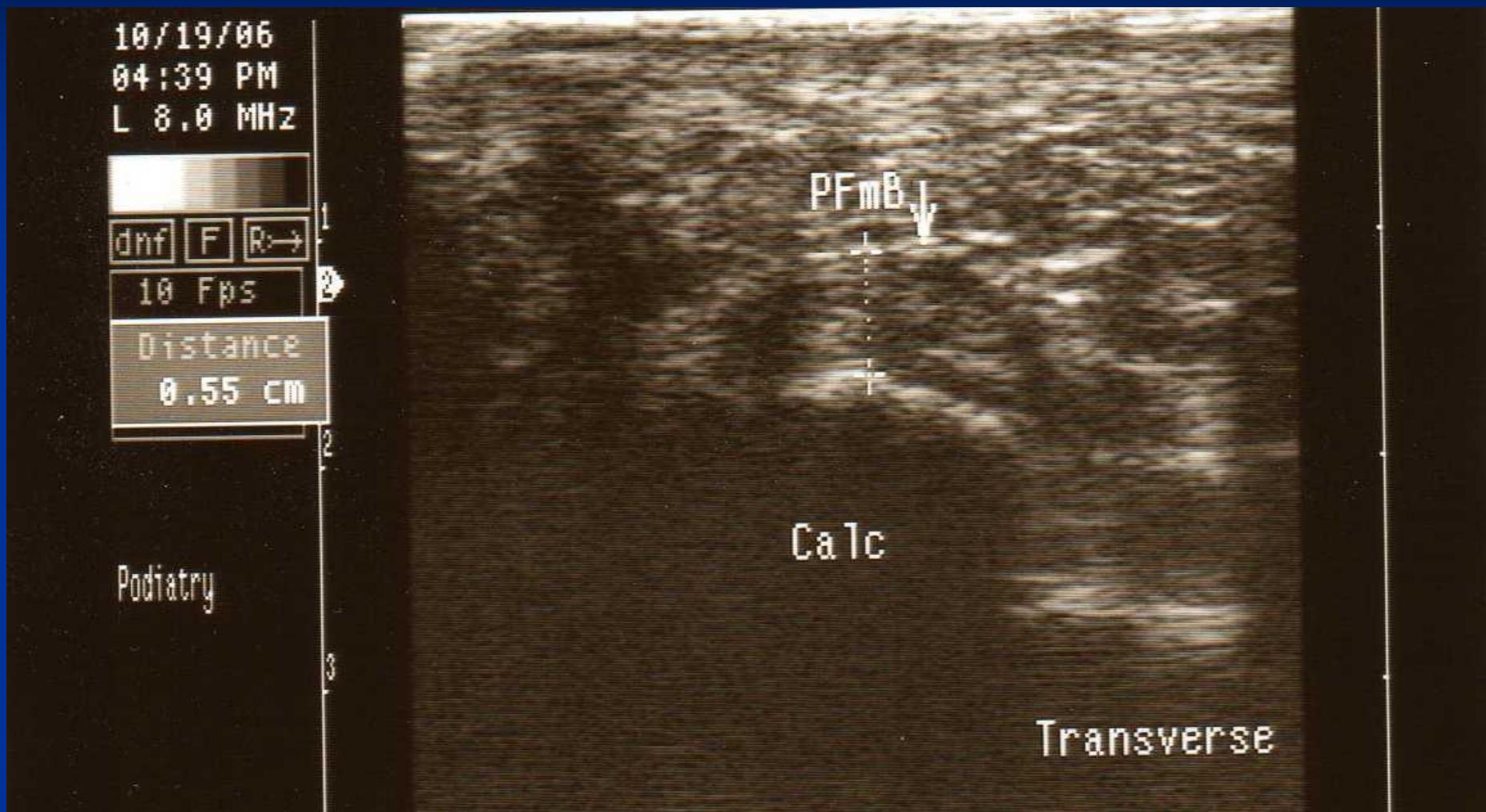
<.40 cm.



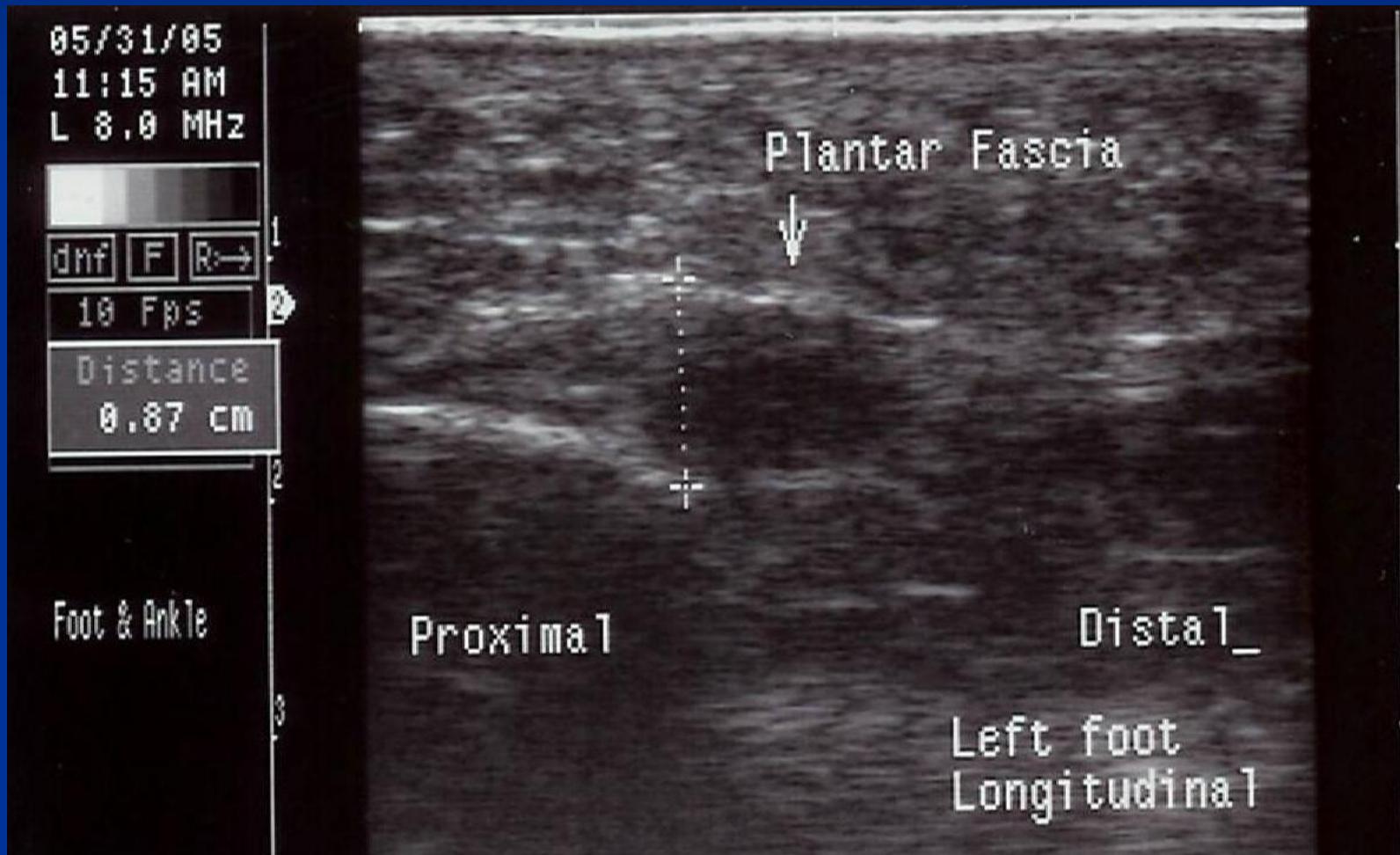
# Plantar Fascitis 2



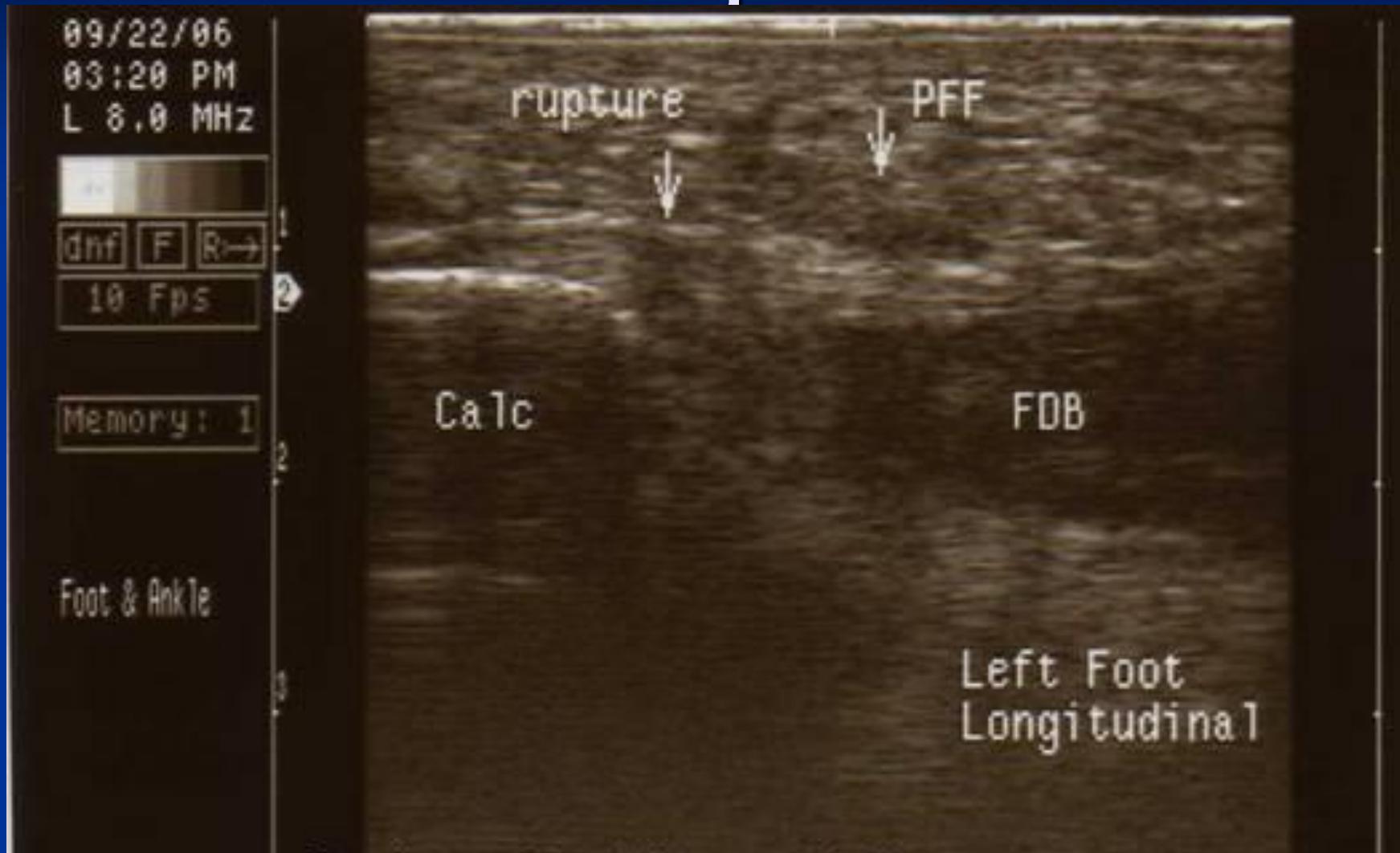
# PF Transverse 3



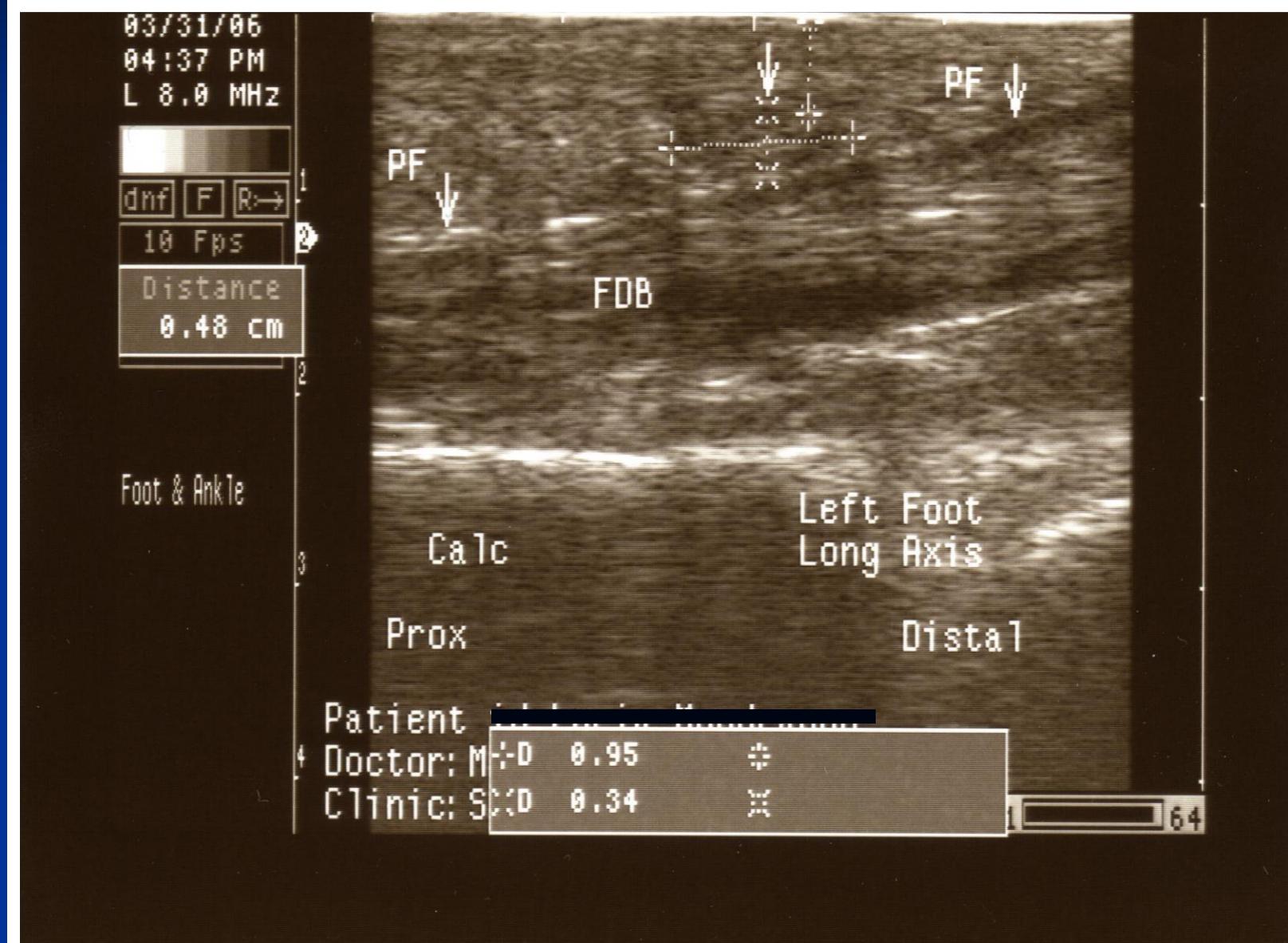
# PF with Partial tear



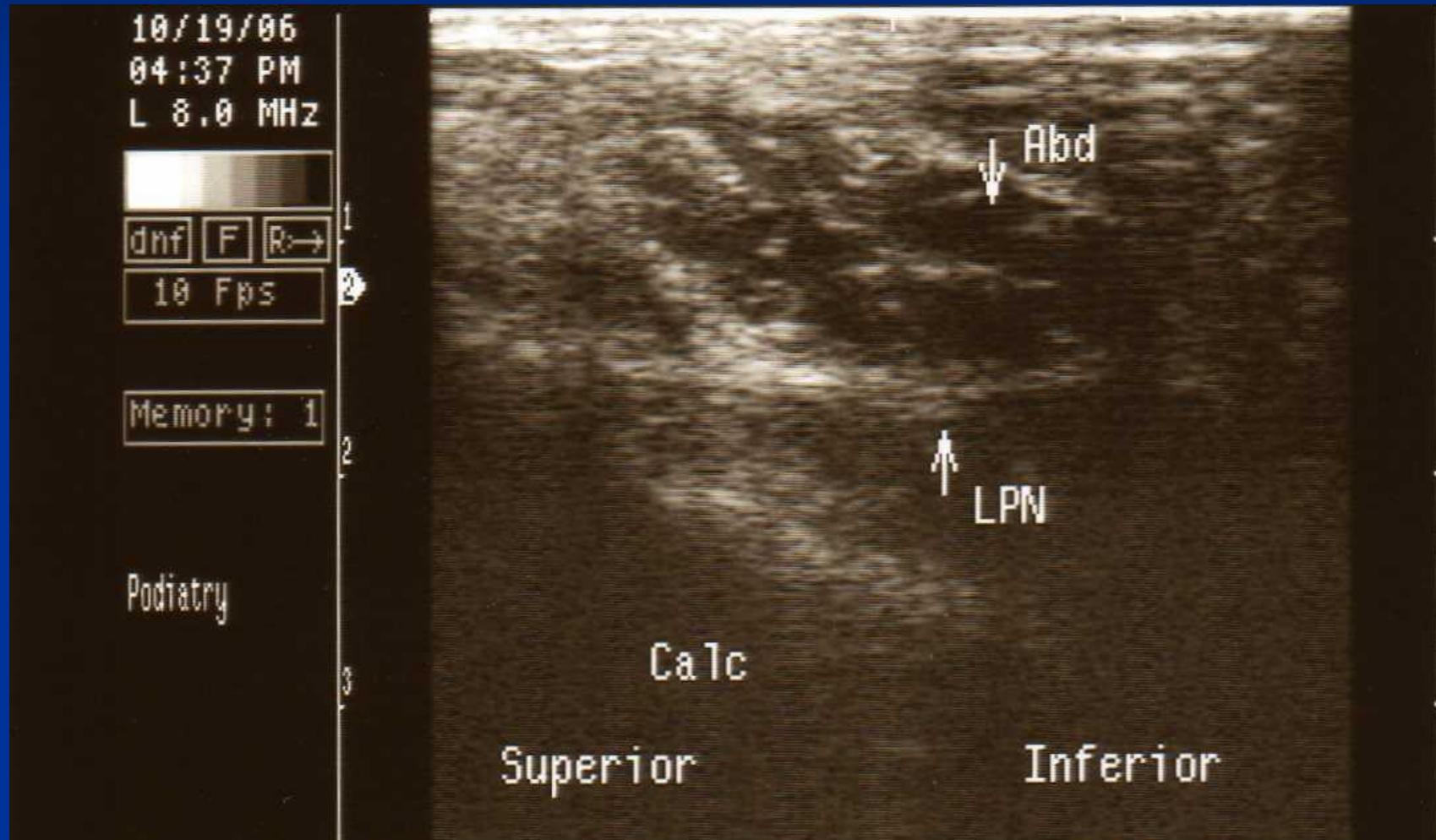
# Partial tear with perifascial fluid



# Plantar Fibroma



# Lateral Plantar nerve 1<sup>st</sup> branch (Baxter's neuritis) entrapment



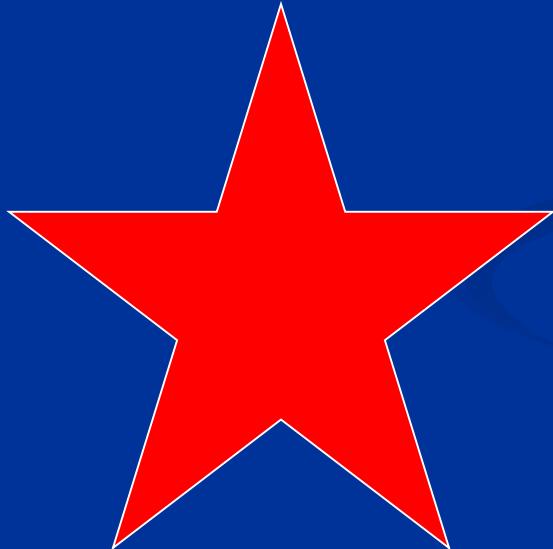
# CONCLUSION

- Plain Film Analysis Proceeds Advanced Modalities.
- C.T. - Cortical involvement, calcaneal fx.
- MRI – Multiplanar anatomical analysis.  
Excellent in evaluation of edema and marrow involvement.
- Ultrasound: Gives both static and dynamic images. Assistive in injection placement.

# Dr. Jason Harrill

# Staged Treatment for Plantar

# Fasciosis / Heel Spur Syndrome



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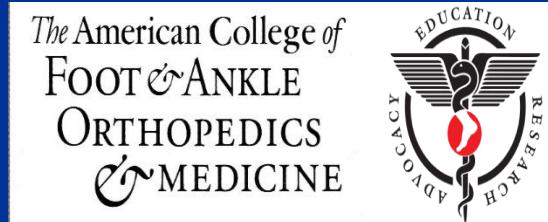
QUBWHYJK # 11-13

# HEEL PAIN: Diagnosis & Conservative Treatment

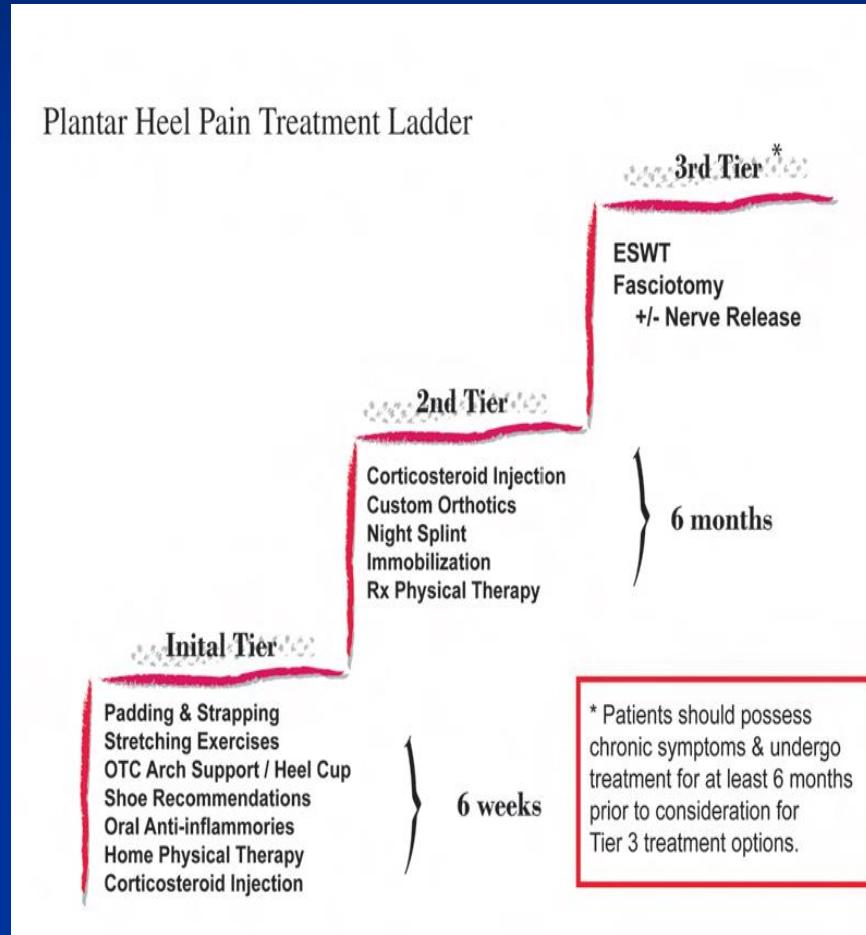


Jason Harrill, DPM, FACFAOM,  
FACFAS

Desertfootandankle.com Mesa, AZ



# Staged treatment for Plantar Fasciosis or Heel Spur Syndrome.



The Diagnosis And Treatment of Heel Pain A CLINICAL PRACTICE GUIDELINE REVISION  
2010 The Journal of Foot & Ankle Surgery 49 (2010) S1–S19.

# Dry Needling <sup>1</sup>

An alternative treatment for plantar heel pain is trigger point dry needling, which involves stimulation of myofascial trigger points (MTrPs) using a fine filament needle. Dry needling is increasingly used by physical therapists for the treatment of neck pain, shoulder pain, knee pain, posterior thigh pain and low back pain

Although MTrP dry needling is becoming increasingly used for the treatment of plantar heel pain, only two studies have been published that have investigated the effectiveness of this intervention for this disorder <sup>1,2</sup>

1. Cotchett MP, Munteanu SE, Landorf KB. Effectiveness of trigger point dry needling for plantar heel pain: a randomized controlled trial. *Phys Ther.* 2014;94(8):1083–94.
2. Eftekharsadat, B., Babaei-Ghazani, A., & Zeinolabedinzadeh, V. (2016). Dry needling in patients with chronic heel pain due to plantar fasciitis: A single-blinded randomized clinical trial. *Medical Journal of the Islamic Republic of Iran*, 30, 401.



Physiologically, it has a much greater physiological and neurological effect than IASTM. This is due to the increased stimulation that occurs when a needle penetrates the skin. Even more stimulation occurs when therapeutic electrical stimulation is then hooked up.

Dry needling in conjunction with electrical stimulation has been shown to have an inhibitory effect on pain through opioid release.

# ASTYM / Graston



# ASTYM / Graston

10 therapy visits **91.8%** improved or much improved.

	Total cases	Avg # ASTYM tx	Improved	Same	Worse
Achilles tendonopathy	476	9	95.4%	4.4%	0.2%
Ankle/ foot pain	184	9	94%	5.4%	0.5%
Calf strain	103	7	95.1%	4.9%	0
Plantar fasciopathy	1243	10	91.9%	7.7%	0.4%

Holtz BJ, Davey K, Bayliss AJ, Loghmani MT (2012). A conservative manual therapy approach using instrument-assisted soft tissue mobilization for the treatment of bilateral plantar-fasciitis: a case series Journal of orthopaedic & sports physical therapy, 42(1),

Looney B, Srokose T, Fernández-de-las-Peñas C, Cleland JA (2011). Graston instrument soft tissue mobilization and home stretching for the management of plantar heel pain: a case series Journal of manipulative and physiological therapeutics, 34(2), 138-142.

Phipps RL, Carney SL, Loghmani MT, Bayliss AJ (2011). An innovative manual therapy approach for the treatment of patients with Achilles tendinopathy: a case series Journal of orthopaedic & sports physical therapy, 41(1),

White KE (2011) High hamstring tendinopathy in 3 female long distance runners. Journal of Chiropractic Medicine. 10:93-99.

Perle S, Perry D, Carey-Loghmani M (2003). Effects of Graston Technique on soft tissue conditions: a prospective case series (.pdf). Poster presentation, WFC exposition.

# Platelet Rich Plasma (PRP) Injections<sup>1-4</sup>

A newer treatment regimen that stimulates a healing response instead of suppressing the inflammatory process. It should be regarded as a more effective treatment option as platelet-rich plasma (PRP) is well-known to induce cell growth and subsequently tissue healing.

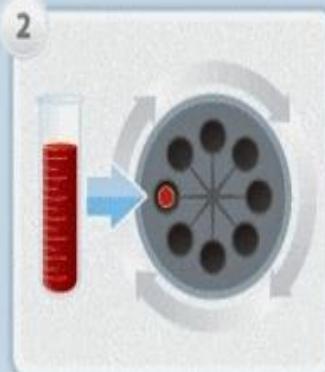
1. Lee TG, Ahmad TS. Intralesional autologous blood injection compared to corticosteroid injection for treatment of chronic plantar fasciitis. A prospective, randomized, controlled trial. *Foot Ankle Int* 2007; 28(9):984–990.
2. Martinelli, N et al. “Platelet-Rich Plasma Injections for Chronic Plantar Fasciitis.” *International Orthopaedics* 37.5 (2013): 839–842.
3. Akşahin E. et al. The comparison of the effect of corticosteroids and platelet-rich plasma (PRP) for the treatment of plantar fasciitis Arch. Orthop. Trauma Surg., 132 (6) (2012), pp. 781–785
4. Acosta-Olivo C. et. al. Plantar fasciitis. A comparison of treatment with intralesional steroids versus platelet-rich plasma (PRP). A randomized, blinded study.. Journal of the American Podiatric Medical Association 2016 In-Press.

## PROCESS OF PRP THERAPY



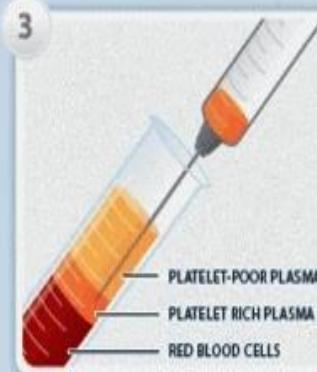
Collect blood

0-60ml of blood is drawn from the patient's arm.



Separate the platelets

The blood is then placed in a centrifuge. The centrifuge spins and separates the platelets from the rest of the blood components.



Extract platelet-rich plasma

Extract 3-6ml of platelet-rich plasma.

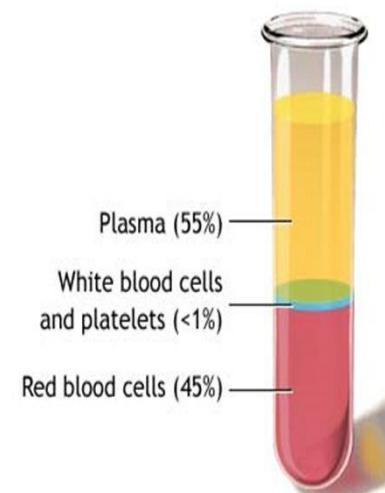


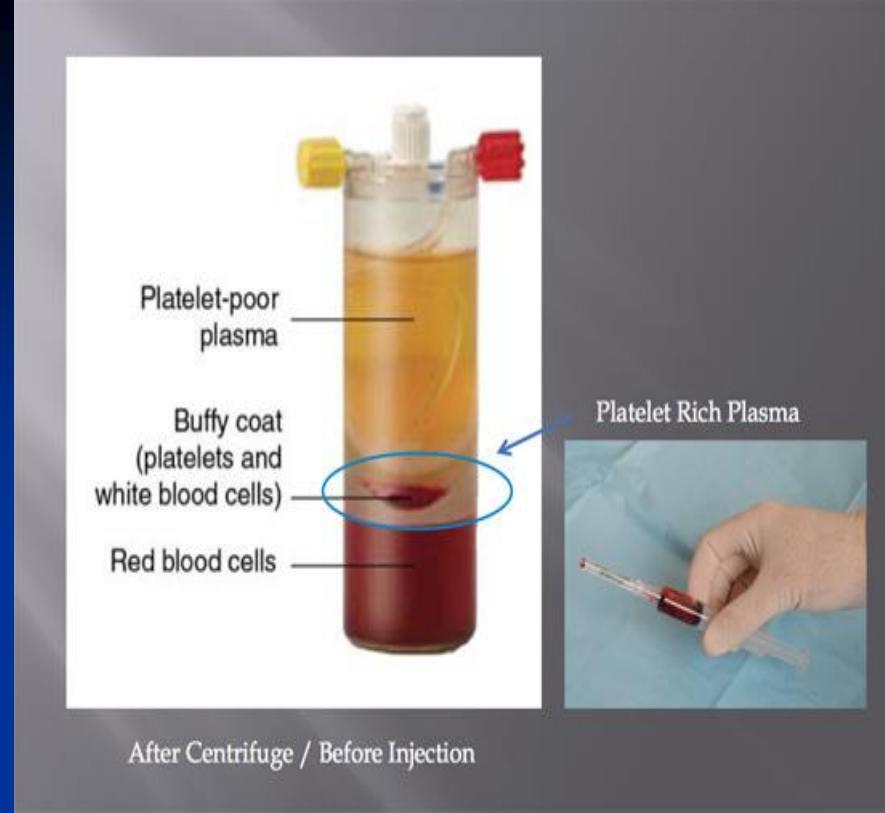
Blood is a mixture of cells and plasma



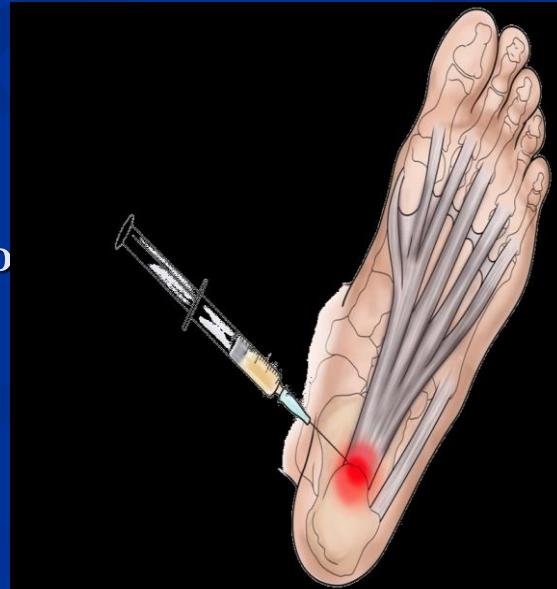
Human Blood after centrifugation

- ~55% Plasma
- ~45% Red blood cells
- <1% White blood cells and platelets ("buffy coat")





ctio



AAOS 2012 Annual Meeting . SAN FRANCISCO . FEB. 7-11

## Study: PRP more effective than cortisone for severe chronic plantar fasciitis

Patients with severe chronic plantar fasciitis who received a platelet-rich plasma injection had a more durable response than patients who received a cortisone injection, according to a presenter here.

"Platelet-rich plasma is significantly more effective than cortisone both in the short-term and the long-term treatment of these difficult patients. I think to speculate, this is probably the result of modulation of the local angiogenesis collagen turnover," Raymond R. Monto MD said.

In the prospective, block-randomized study, 36 patients with several chronic plantar fasciitis who failed traditional nonoperative treatments underwent pretreatment MRIs and ultra-sounds consistent with plantar fasciitis. Patients in the first group were treated with a single ultrasound-guided injection of 40 mg of methylprednisolone

at the injury site. The second group received a single ultrasound-guided injection of 3 mL of unbuffered autologous platelet-rich plasma (PRP) at the injury site. All patients were immobilized fully weight bearing in a cam walker for 2 weeks and started on home exercises before returning to normal activities.

The methylprednisolone group, with an average of 59 years, failed 5.4 months of standard nonoperative management and had an average pretreatment AOFAS score of 52. The patients who received PRP injections, with an average of 51 years, failed 5.7 months of standard nonoperative management and had an average pretreatment AOFAS of 37.

Three months following treatment, the methylprednisolone group had a post-treatment average AOFAS score of 81, which decreased to 74 and 58 at 6 months and 12 months, respectively. Patients with PRO had a

post-treatment average AOFAS score of 95 at 3 months, which stayed at 94 points for the 6-month and 12 month follow-up.

"It raises the question of whether or not that this may be an assistive device when traditional treatment fails," Monto said.

**Disclosure:** Monto is on the speakers' bureau and is paid consultant for Exactech Inc. This was an unfunded study.

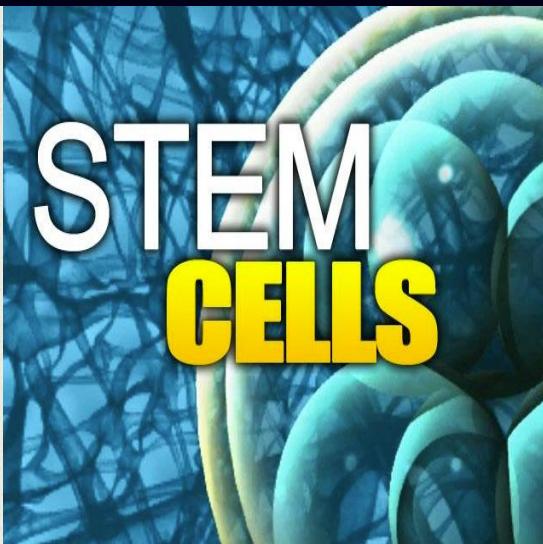
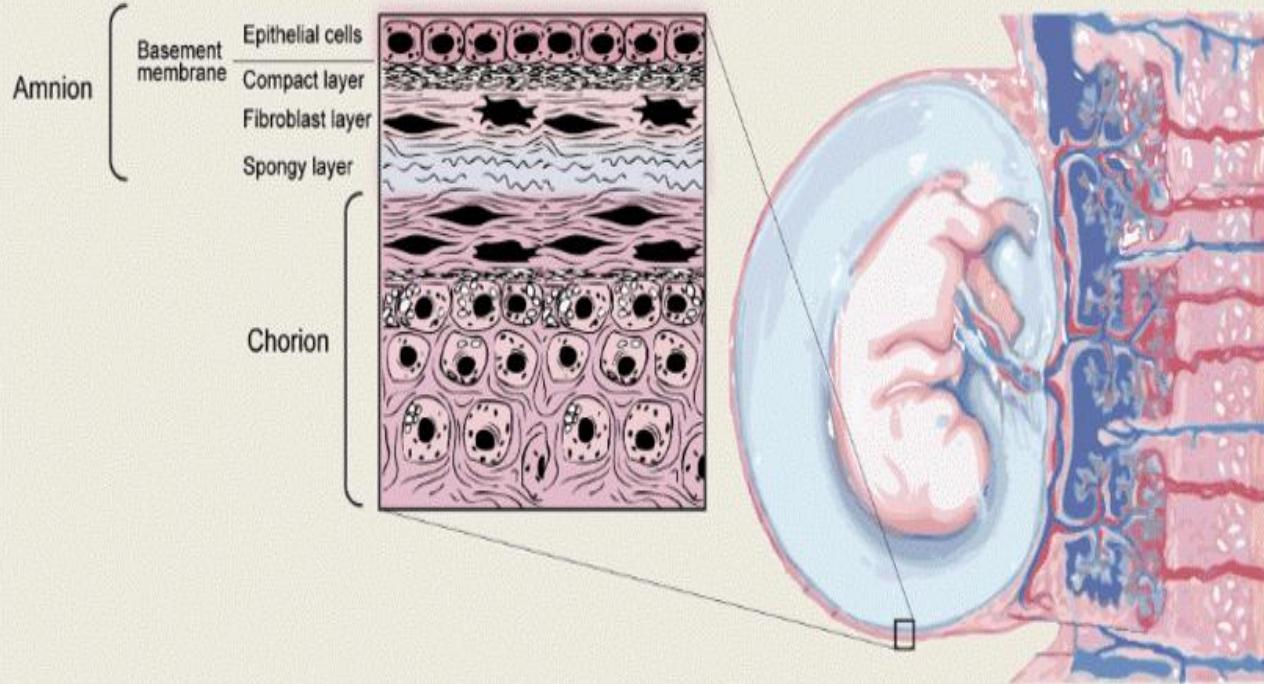


Yukihide Iwamoto, MD, president of the Japanese Orthopaedic Society and speaker for the AAPS Guest Nation of Japan, addresses the audience at the opening ceremony.

# Human Amniotic Membrane <sup>1,2</sup>

This reconstituted injectable is rich in mesenchymal cells, growth factors and anti-inflammatory proteins that support the body's native tissue-regeneration potential.

1. Hanselman AE, Tidwell JE, Santrock RD. Cryopreserved human amniotic membrane injection for plantar fasciitis: a randomized, controlled, double-blind pilot study. *Foot Ankle Int.* 2015;36(2):151-158.
2. Werber B "Amniotic Tissues for the Treatment of Chronic Plantar Fasciosis and Achilles Tendinosis," *Journal of Sports Medicine*, vol. 2015, Article ID 219896, 2015

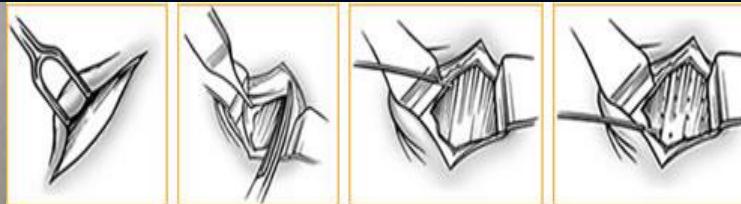
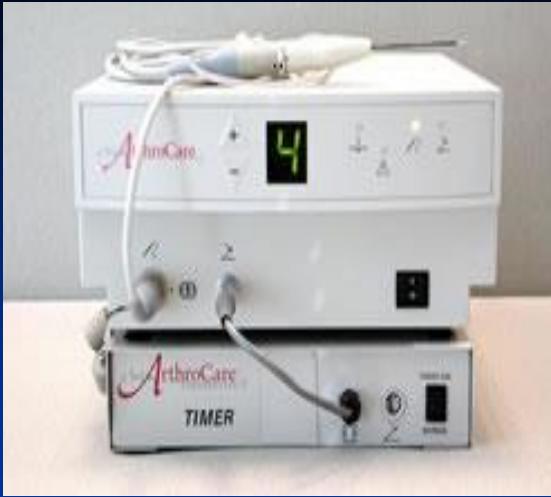


	% Improvement (1 Injection)	% Improvement (2 Injections)
6 weeks (c-hAM)	65.0	8.33
6 weeks (steroid)	81.8	68.3
12 weeks (c-hAM)	60.8	90.0
12 weeks (steroid)	87.7	89.7
18 weeks (c-hAM)	n/a	98.3
18 weeks (steroid)	n/a	75.0

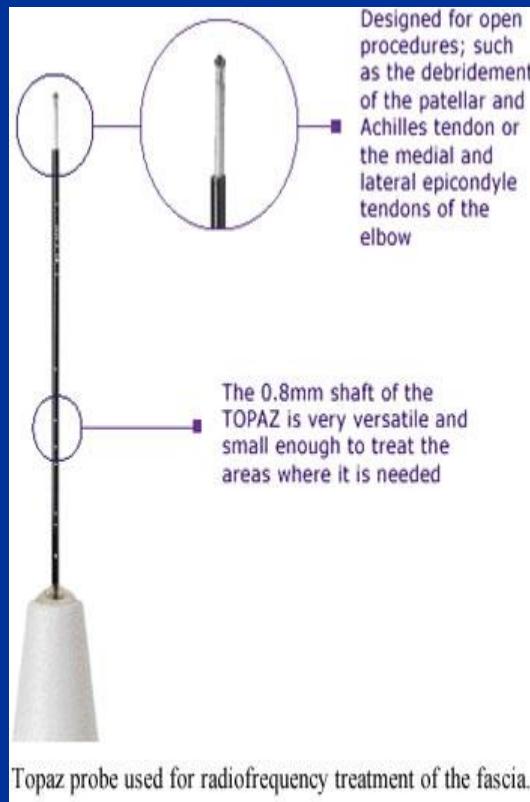
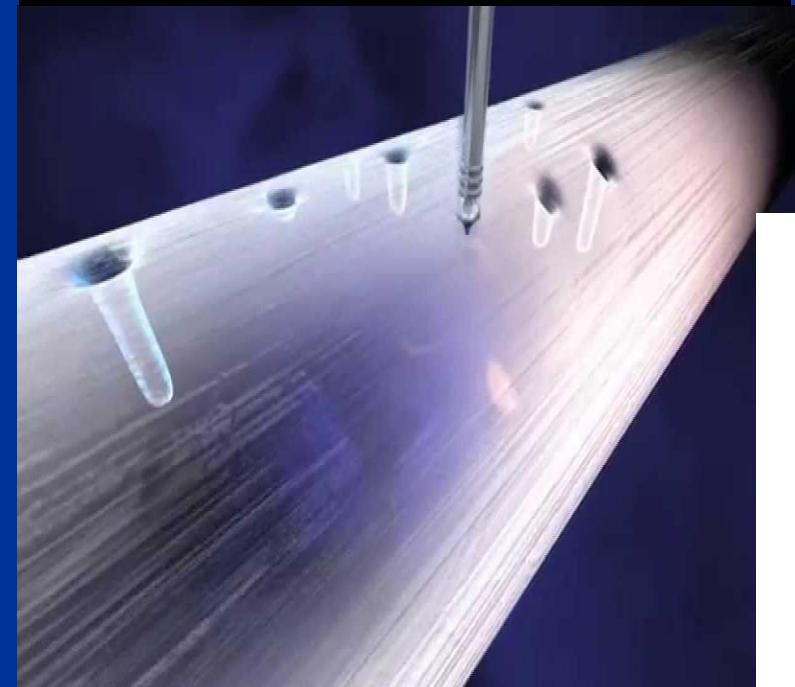
# Topaz (Cobalation) Procedure <sup>1</sup>

Strategically placed radio frequency waves create microtrauma in area of fasciosis. Revascularization ensues with an increase in growth factors to the site. <sup>1</sup>

1. Wei M. et. al. Comparison of Clinical Efficacy Among Endoscopy-Assisted Radio-Frequency Ablation, Extracorporeal Shockwaves, and Eccentric Exercises in Treatment of Insertional Achilles Tendinosis. Journal of the American Podiatric Medical Association: January 2017, Vol. 107, No. 1, pp. 11-16.



# TOPAZ COBLATION



# Pulsed Radiofrequency Electromagnetic Field (PRFE) Therapy

- PRFE for the treatment of plantar fasciitis, A short study with a small, wearable PRFE device used at night as a home-based therapy delivered nightly during sleep. Resulted in a 40% reduction in symptoms after 7 days.
- 70 subjects- 40% reduction active PRFE vs. 7% placebo



# Botulinum Toxin Injection



Placzek <sup>1 2</sup> investigated the effects of a single injection of botulinum toxin A in an open case series of 9 patients. **Two weeks after injection the pain of the study subjects had been significantly reduced.**

Babcock <sup>3</sup> performed a randomized, double-blind, placebo-controlled study of 27 patients (a total of 43 feet) with plantar fasciitis. Patients were assessed before injection and 3 and 8 weeks after injection. Compared with the group that received placebo injections, **the group treated with botulinum toxin A exhibited improved pain according to all measures used: the results of the pain VAS ( P< .005),**

1. Placzek R, Deuretzbacher G, Buttgereit F, Meiss AL. Treatment of chronic plantar fasciitis with botulinum toxin A: an open case series with a 1 year follow up. *Ann Rheum Dis* 2005; 64:1659-61.
2. Placzek R, Deuretzbacher G, Nat R, Meiss AL. Treatment of chronic plantar fasciitis with botulinum toxin A. Preliminary clinical results. *Clin J Pain*. 2006;22:190–192
3. Babcock MS, Foster L, Pasquina P, Jabbari B: Treatment of pain attributed to plantar fasciitis with botulinum toxin A: A short-term, randomized, placebo-controlled, double-blind study. *Am J Phys Med Rehabil* 2005;84:649–654.

A recent study from Foot and Ankle International compared steroid injections with Botox injections to treat plantar fasciitis.<sup>1</sup> Researchers randomly divided and treated 36 patients with either Botox injections to the gastroc-soleus muscle complex or traditional steroid injections to the painful insertion area of the plantar fascia. Both treatment groups supplemented their therapy with plantar fascia stretching exercises.

The results of the study show that, "**When compared to patients who received steroids, the patients who received BTX-A exhibited more rapid and sustained improvement over the duration of the study.**"<sup>1</sup>

1. Elizondo-Rodriguez J. A comparison of botulinum toxin A and intralesional steroids for the treatment of plantar fasciitis: a randomized, double-blinded study. *Foot Ankle Int.* 2013; 34(1):8-14.

# Low Level Laser Therapy (LLLT)<sup>1,2</sup>



LLLT at low doses has been shown to enhance cell proliferation of fibroblasts, keratinocytes, endothelial cells and lymphocytes. The mechanism of proliferation is thought to result from photo-stimulation of the mitochondria leading to activation of signaling pathways and up regulation of transcription factors eventually giving rise to increases in growth factors.

LLLT can enhance neovascularization, promote angiogenesis and increase collagen synthesis to aid in the healing of acute and chronic wounds.

**These low doses of light have demonstrated the ability to heal skin, nerves, tendons, cartilage and bones.**

1. Macias D M. et al. Low-Level Laser Therapy at 635 nm for Treatment of Chronic Plantar Fasciitis: A Placebo-Controlled, Randomized Study The Journal of Foot and Ankle Surgery, 2014 Volume 54 , Issue 5 , 768 - 772
2. Jastifer JR et. al. Low-level laser therapy for the treatment of chronic plantar fasciitis: a prospective study. Foot & Ankle International (2010) Vol 35, Issue 6, pp. 566 - 571







# Case Study 1

- 38 year female complains of recent onset of right heel pain.
- Pt. is moderately obese.
- Denies specific trauma.
- Biomechanical exam reveals a forefoot. valgus deformity.
- STJ motion is normal.

# CS 1 -Plain Film Radiographs

- Initial Films demonstrate no evidence of pathology.

# Biomechanical finding of a Plantarflexed first ray



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- Which of the following orthotic adjustments would best assist you in the management of this patient?
  - Deep Heel Seat
  - Heel Spur Cut-out
  - Extrinsic Shock absorbing rearfoot post
  - First Ray cut-out with forefoot EVA topcover with sulcus length extension and valgus wedge.



# Case Study 2

- 27 y/o female c/o painful left heel.  
Insidious onset 4 weeks ago. Gradual increase in pain the past several days.
- PMH and ROS unremarkable.
- PE: Normal with the exception of:
  - Localized edema over medial aspect of heel and along course of P.F.
  - Pronated pedal architecture.
  - Parasthesias extending to the distal aspect of the hallux.
  - Pain upon palpation of flexor retinaculum, both Tinnel's sign and Valleix's sign are positive.

# What do you think is the etiology?

- Neuritic etiology for heel pain ranks as the number one leading cause for misdiagnosis of the etiology of heel pain.
- How would you further work this patient up?

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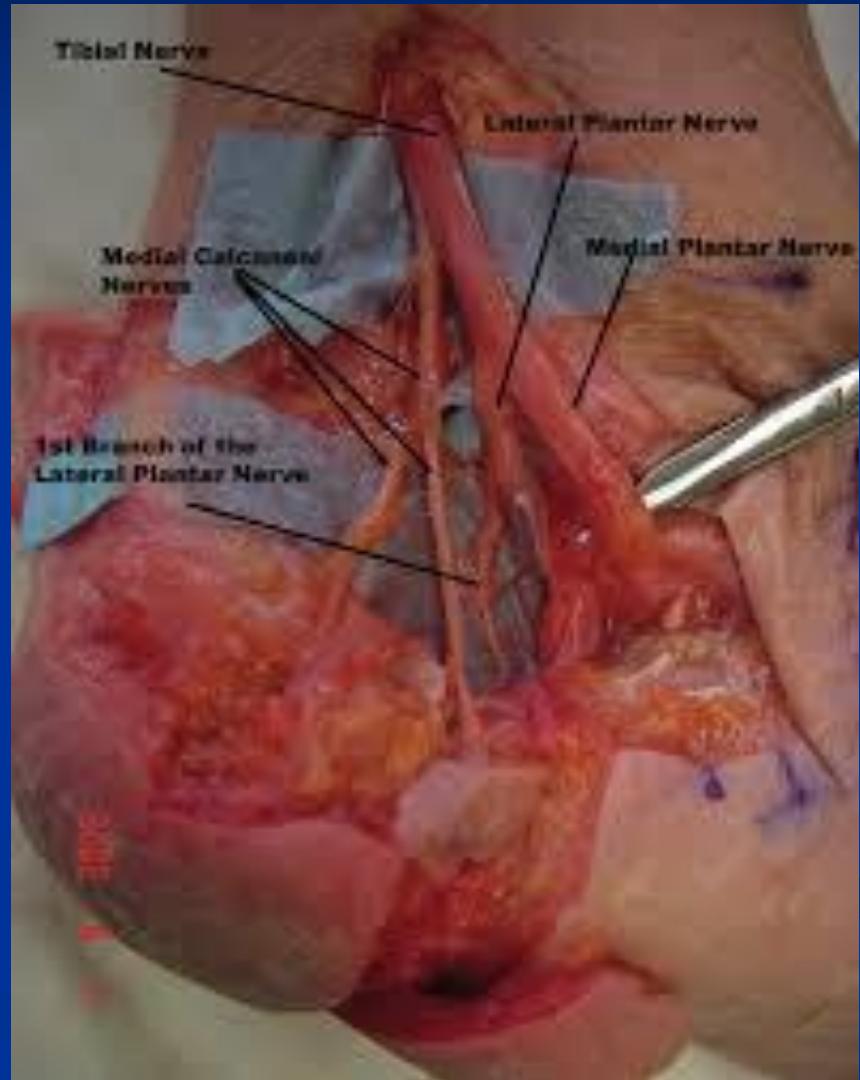
- Nerve Block
- Nerve Conduction Studies/ EMG
- Nerve Biopsy
- MRI

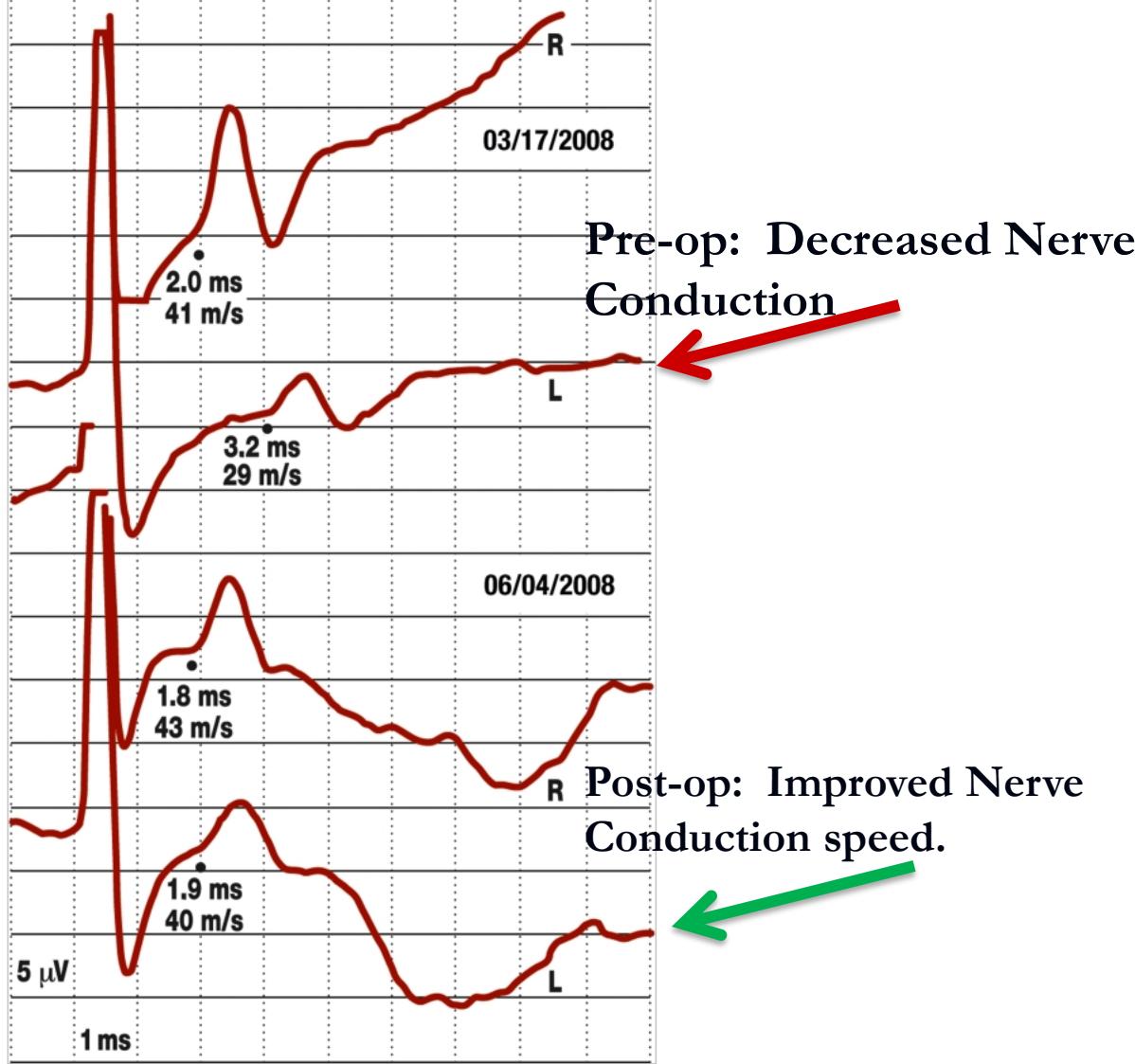
[www.Beta.socrative.com](http://www.Beta.socrative.com)

QUBWHYJK      # 15

# CS 2 Differential Diagnosis

- Tarsal Tunnel Syndrome
- “Heel Neuroma”
- Sciatica
- Entrapment of Medial Plantar Nerve
- Entrapment of Lateral Plantar Nerve
- Peripheral Neuropathy





A 42-year-old woman with an electrographically confirmed diagnosis of left tarsal tunnel syndrome. Sensory neurography of the medial plantar nerve bilaterally reveals a decreased nerve conduction velocity on the left that renormalized after surgical treatment in parallel with clinical improvement.

Posterior Tarsal Tunnel Syndrome: G .Andoniadis. Deutsches Arzteblatt International Nov. 2008.

# A word on EMG and NCV

- Less predictive than upper extremity exams.
- High rate of false negatives.
- If positive, “the nerve may be too far gone for an adequate outcome”.
- Intra-operative nerve testing may have better benefits.

Has Intraoperative Nerve Testing Reinvented Our Approach To Tarsal Tunnel and Nerve Surgery? B. Bavarian. Podiatry Today Vol. 22 March 2009

# How do you treat Neuritic Pain?

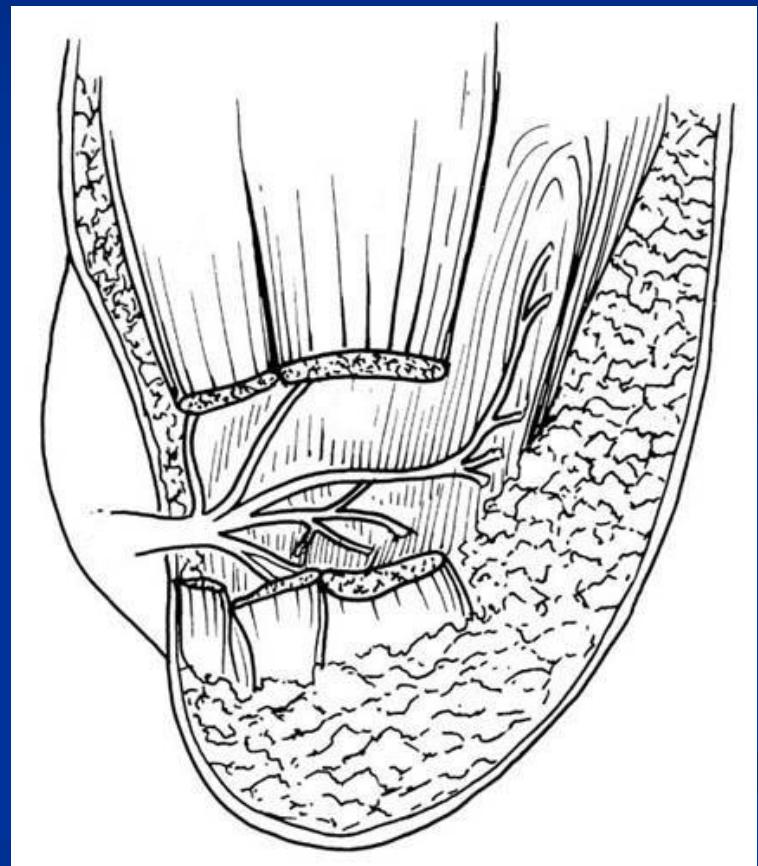


# CS 2 Treatment

- Steroid Injection
- Peripheral Nerve Blocks
- Orthotics
- Vitamin therapy – B6 for ETOH
- Sclerosing agents
- Surgery

# Nerve Entrapment

- Entrapment of the first branch of the lateral plantar nerve (Baxter's nerve)
- Thought to account for the cause of heel pain in 20% of patients



# CS 2 Nerve Entrapment

**20% of all chronic heel pain is due to entrapment of the first branch of the lateral plantar nerve.**

Baxter DE, Thigpen CM. Heel pain-operative results. *Foot and Ankle*. 5: 16-25, 1984.



# Baxter's nerve entrapment

Arslan et al. “Treatment of chronic plantar heel pain with radiofrequency neural ablation of the first branch of the lateral plantar nerve and medial calcaneal nerve branches” JFAS 2016

- 37 patients/41 feet recruited, had all failed therapy with ECSWT/Steroid injections
- 88% rated treatment as successful or better after 12 months

# Arslan

**Diagnostic nerve block  
administered to confirm  
diagnosis before ablation  
Nerves were identified  
with low energy impulses,  
tingling felt in the case of  
a sensory nerve, toe  
movement when near a  
motor nerve**



# Baxter's

Fatty atrophy of ADM  
muscle after  
denervation



# Tarsal tunnel syndrome

Kinoshita et al. “The dorsiflexion-inversion test for diagnosis of tarsal tunnel syndrome” Journal of Bone and Joint Surgery 12/2001

- With proposed technique patients (82%) noticed symptoms of numbness within 10 seconds as opposed to 60 seconds for the linscheid test
- No controls tested positive

# Kinoshita

Ankle max eversion  
MPJs to max dorsiflexion



# Case Study 3

- 57 y/o male presents for evaluation following a fall off of a six foot ladder, injuring his right heel.
- What are other anatomical areas that may have been injured?

# Initial Films

- How many of you would elect for this to be treated conservatively?
- How many of you would elect for this to be treated via ORIF?





**Three weeks Post Operative:**  
The patient was found passed out  
and inebriated with a wet and  
soiled cast.

Upon removal the incision was  
dehisced and capsule and  
hardware was exposed.

# What NOW!!!

- Surgical hardware removed, culture and sensitivity. Necrotic and devitalized bone removed. Bone cultures confirm osteomyelitis.



FOOT 3 O



FOOT 3 O



- How long should patient be on antibiotics?
- The patient refuses further surgery.
- He agrees to having a port placed and completes a six weeks of IV antibiotics.

**He is then lost to follow-up!!!!**



# The patient returns 12 years later!!!

- States that he has been working and has had a couple of episodes of infection which he states was treated with “a couple of weeks of antibiotic pills”.
- Physical exam demonstrates a superficial 12mm ulceration plantar heel region. No drainage, no surrounding erythema.



# Osteomyelitis??

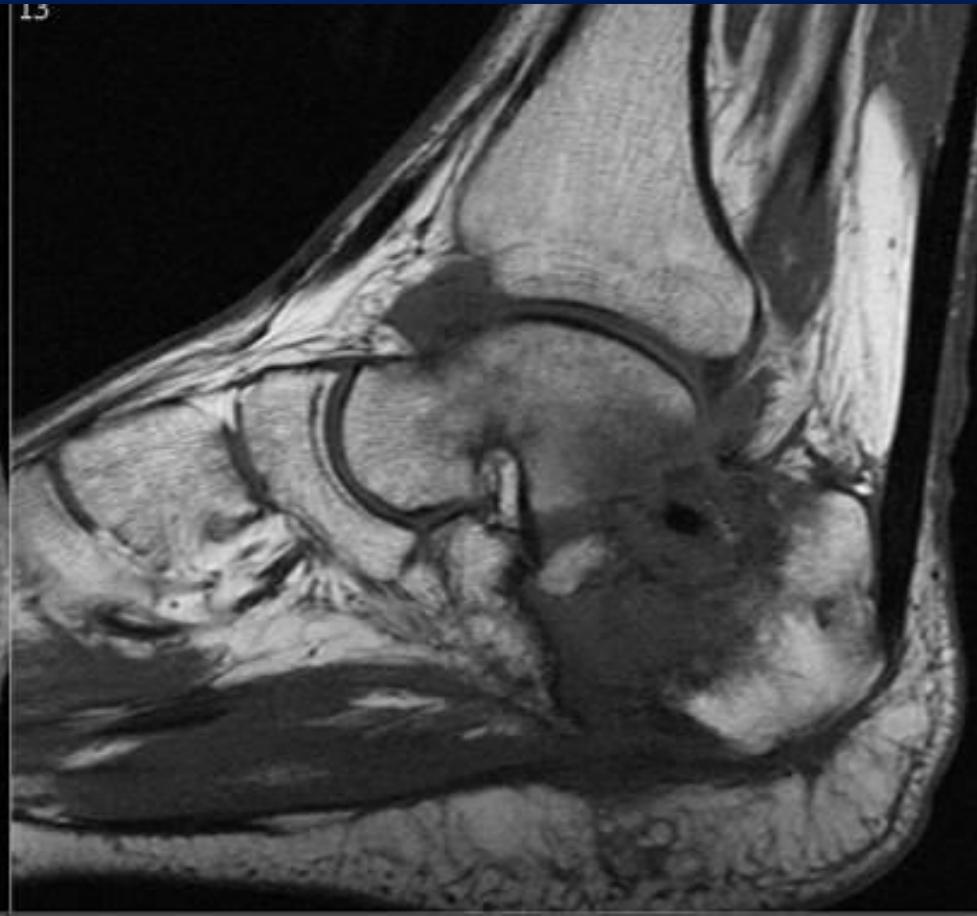
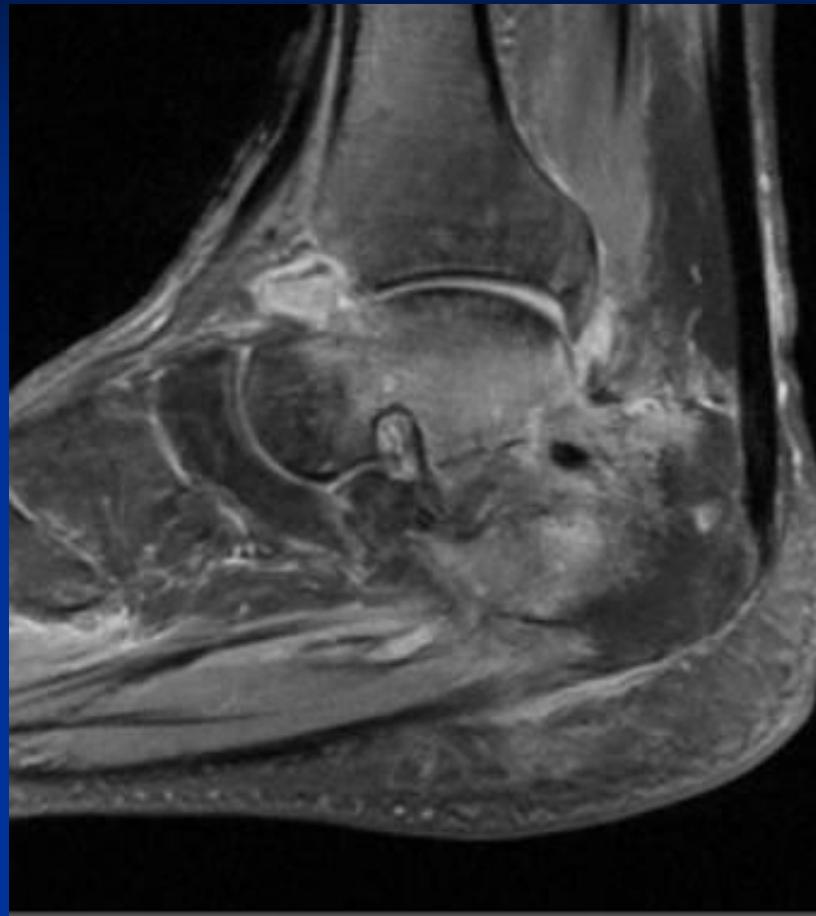
- Does the patient have chronic osteomyelitis, or are these degenerative changes associated with the previous trauma and infection?
- What would you like to order to further assess this patient?

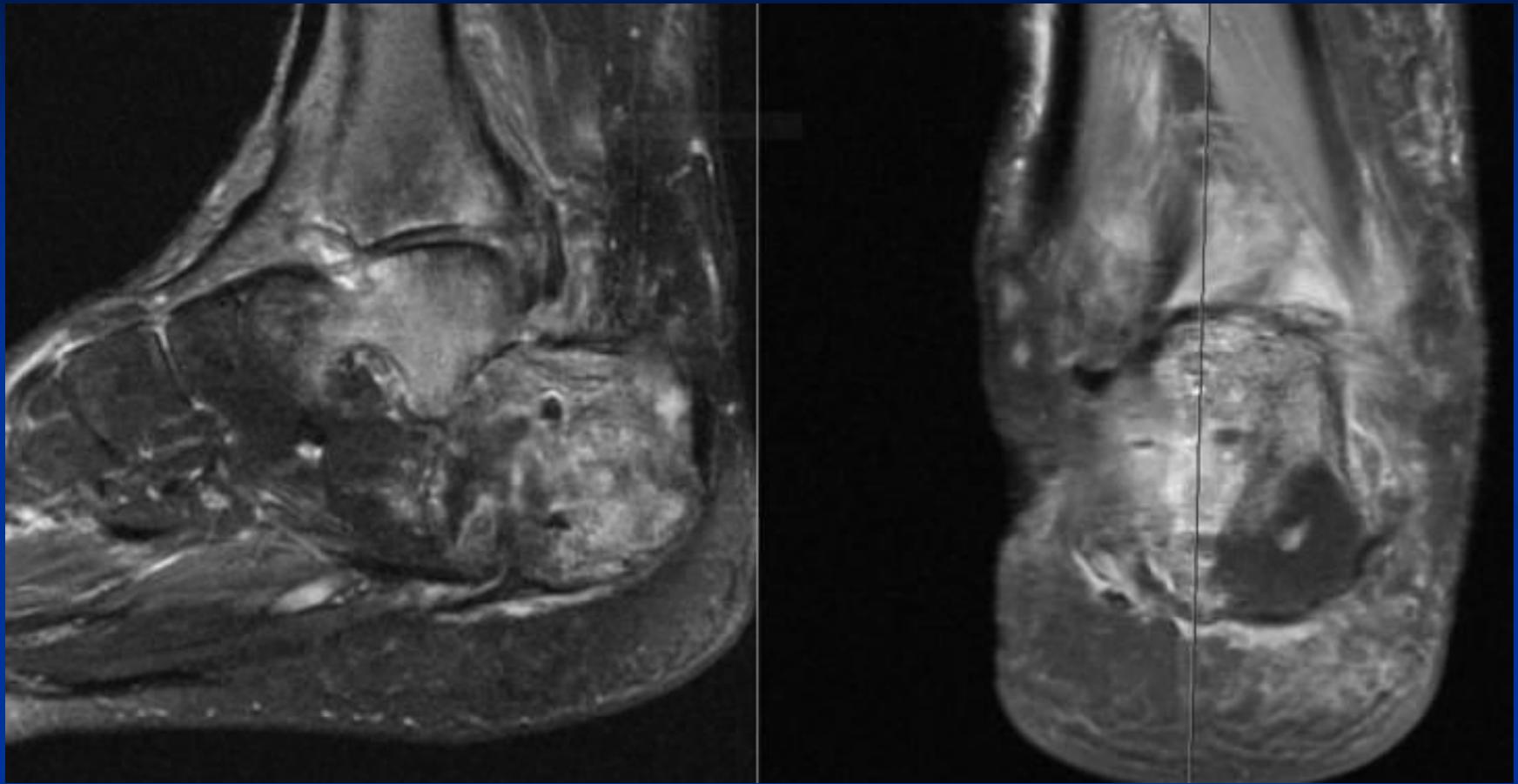
# [www.Beta.socrative.com](http://www.Beta.socrative.com)

- MRI
- Computed Tomography
- Bone Scan
- Ultrasound

[www.Beta.socrative.com](http://www.Beta.socrative.com)

QUBWHYJK      # 16





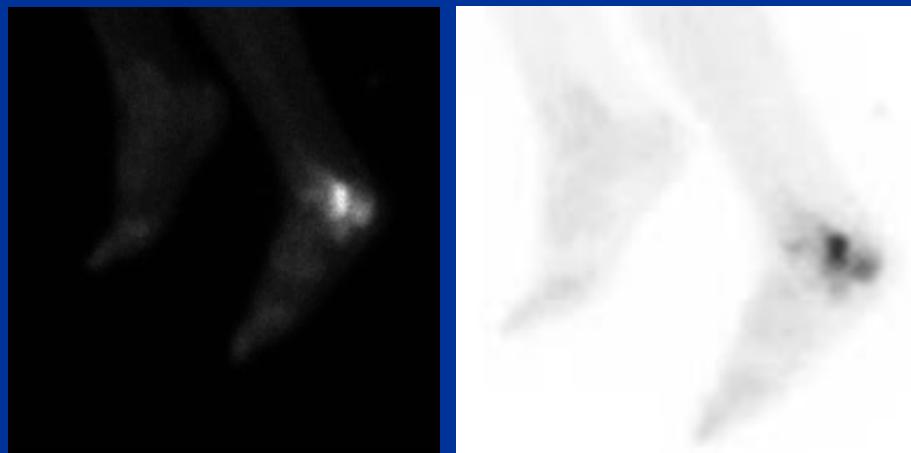
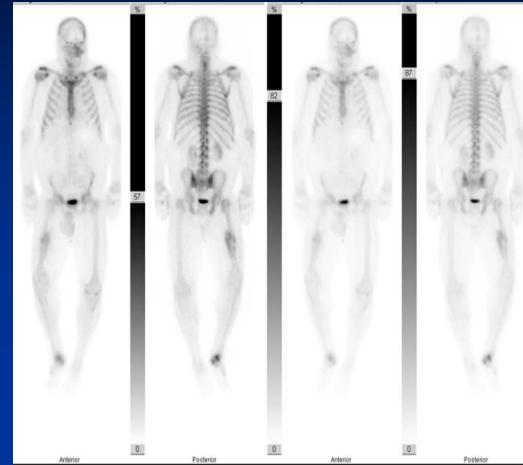
# CT SCAN



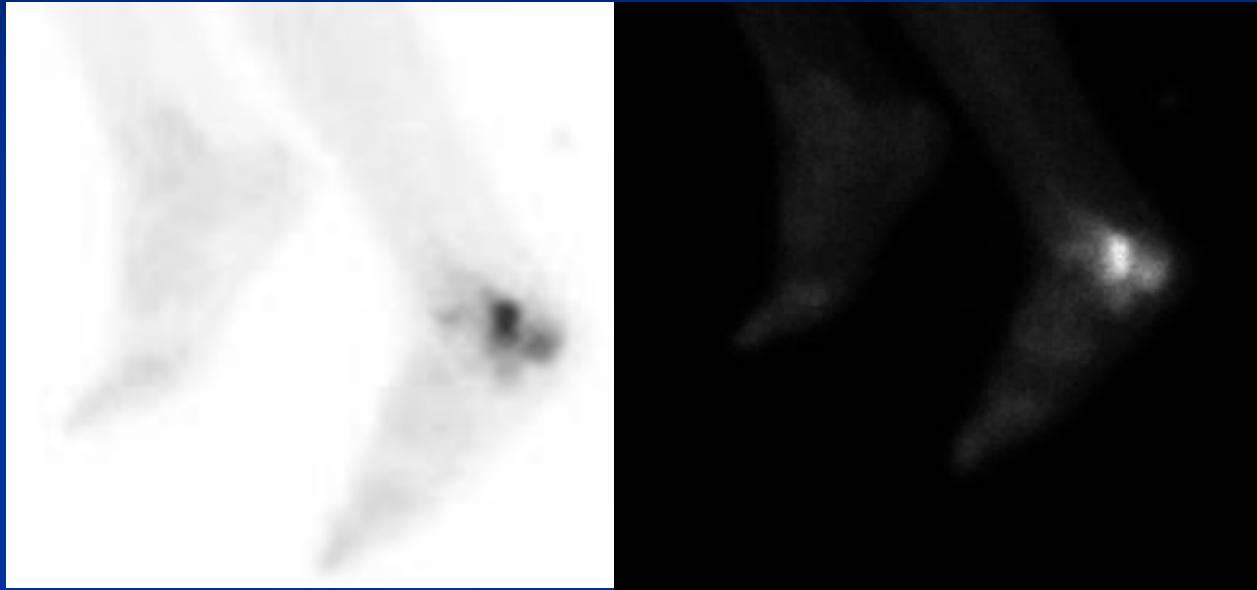
# Would a Bone Scan Help?



# Ceretec Tc<sup>99</sup> Labeled WBC's



# How would you Interpret the Scans?



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# What is your Diagnosis?

- Osteomyelitis
- Osteoarthritis
- Osteomyelitis and Osteoarthritis
- Non-union of a calcaneal fracture

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QUBWHYJK      # 17

- Patient refuses any further surgery.
- How would you treat him conservatively?

- Patient was treated with NWB, local wound care with Iodosorb and healed the ulcer without incident.
- He was then casted for a UCBL with a plastazote liner, Chukka boots with rocker sole.
- **He has remained ulcer free for the past two years!!!**



# Case Study 4

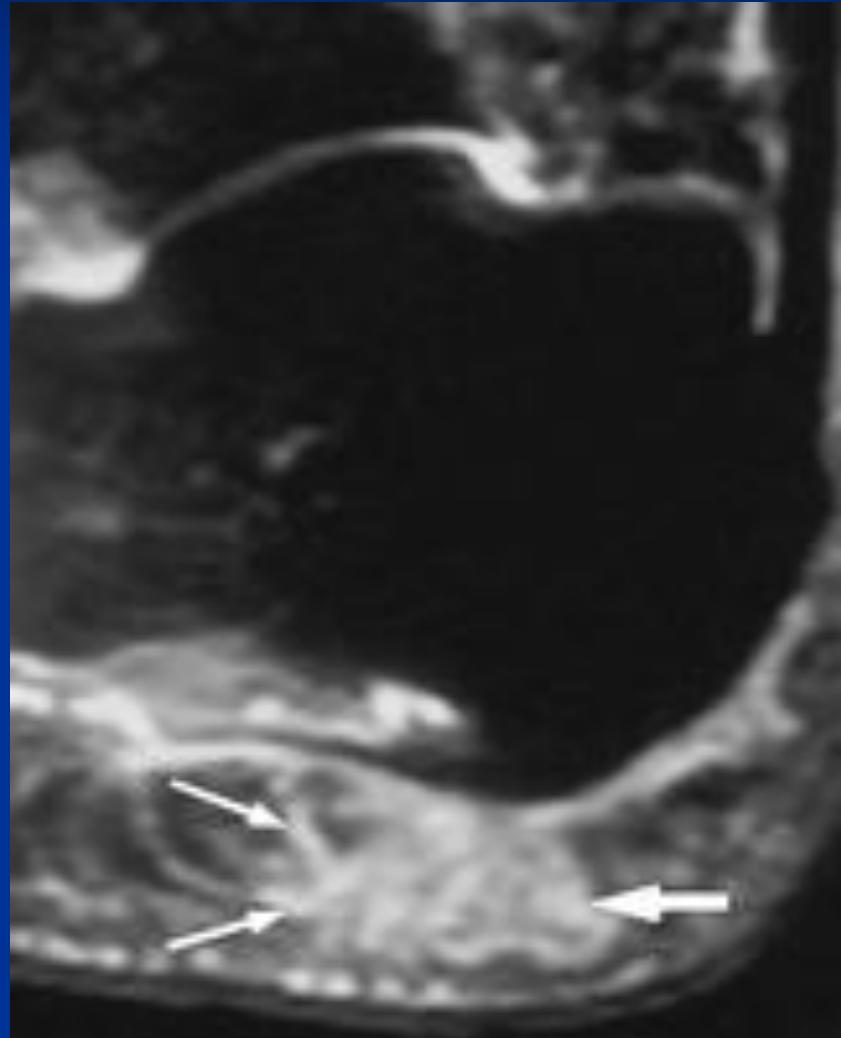
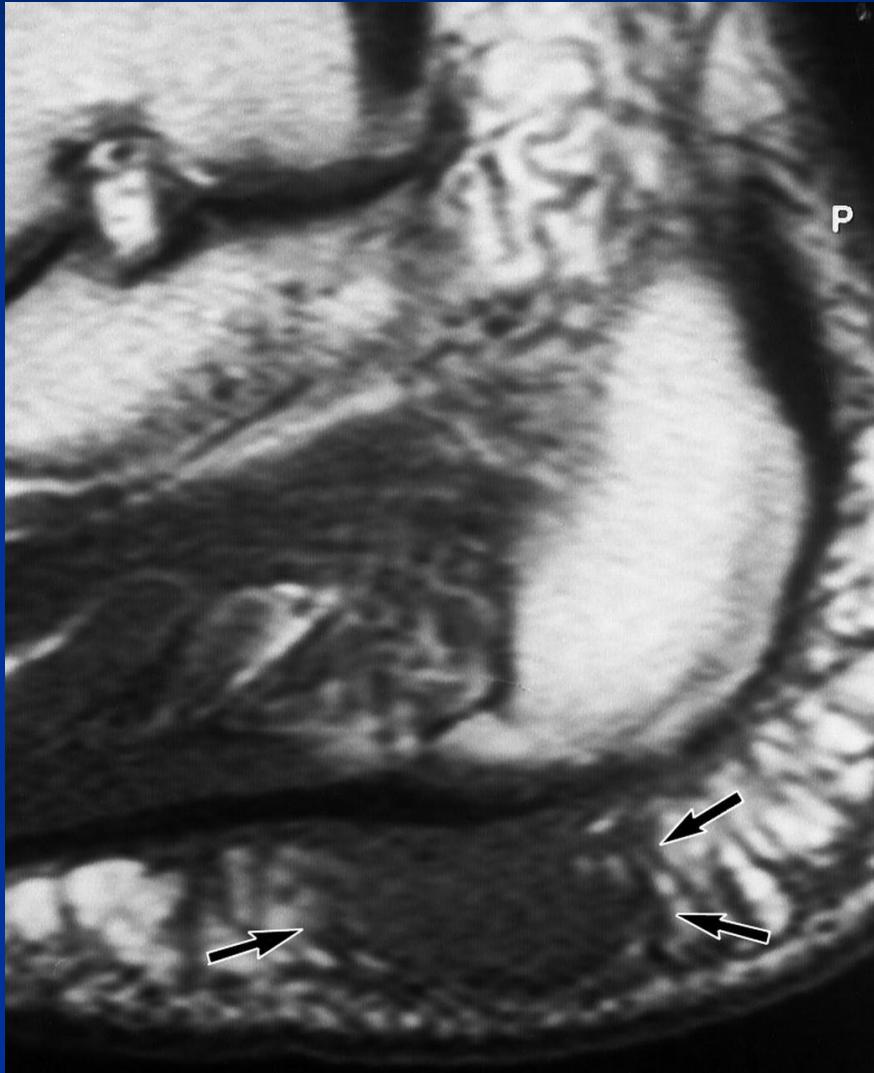
- A 54 year old female presents c/o heel pain. Pain present predominantly when bearing weight.
- PE: Pain upon palpation to inferior aspect of left heel. No edema, erythema or pain upon compression of calcaneus.

# Lateral Projection –Case Study 4

- What radiographic findings do you note?
- With what systemic condition might these findings be associated?
- How would you further assess the plantar heel soft tissue mass?



# MRI Case Study 4



# CS 4 Diagnosis

- Rheumatoid Arthritis with rheumatoid nodule formation.

# CS 4 Rheumatoid Nodule

- Treatment Options:
  - Steroid Injection
  - Orthotic Management
  - Surgery

# Differential Diagnosis of Arthritis

## ■ Inflammatory

- Rheumatoid Arthritis
- Erosive Arthritis
- Seronegative Arthritis
  - Psoriatic Arthritis
  - Reiter's Disease
  - Ankylosing Spondylitis
  - Enteropathic

## ■ Non-Inflammatory

- Degenerative Joint Disease

## ■ Metabolic

- Gout
- CPPD Disease

## ■ Neuropathic

- Neuropathic Joint Disease

## ■ Miscellaneous

- DISH
- PHO
- Pigmented Villonodular Synovitis

## ■ Collagen Vascular Disorders

- SLE
- Scleroderma

# Presence of Heel Spur Formation

- Reiter's Syndrome - 59% heel changes
- Ankylosing Spondylitis – 44%
- Psoriatic Arthritis - 41%
- Rheumatoid Arthritis – 36%
- *Asymptomatic Patients – 22%*

- From Resnick

# Rheumatoid Arthritis

- **Age of onset:** 40 – 60 yoa
  - Peak: 40 – 50 yoa, males = females
  - Between 20 – 40 yoa females 3:1 males
- Seropositive for rheumatoid factor 70%
- **Distribution:**
  - Small joint f hands and feet
  - C-spine
  - Bilateral and symmetrical

# Pathological/Radiographic Correlation of RA

## ■ Pathological

- Edema & effusion
- Rheumatoid nodule
- Pannus-cartilage
- Pannus- synovial reflection
- Intra-osseous pannus and synovial fluid intrusion
- Inflammatory hyperemia
- Periostitis
- Fibrous tissue metaplasia
- Capsule and ligament laxity, tendon rupture

## ■ Radiological

- Peri-articular edema
- SubQ soft tissue mass
- Symmetrical jt. space loss
- Marginal erosion
- Subchondral bone cysts
- Juxta-articular osteopenia
- Linear periosteal new bone
- Ankylosis
- Deformity



# Case Study 5

- 48 y/o male presents c/o classic plantar fascial pain.
- Initial radiographs demonstrate the following:



# CS 5 DIAGNOSIS

- Unicameral Bone Cyst
  - Generally asymptomatic, incidental finding.
- Calcaneal cysts at risk to fracture when they reach a critical size, defined as 100% intracalcaneal cross section in the coronal plane and at least 30% in the sagittal plane.

Pogoda P, Priemel M, et. al. Clinical relevance of calcaneal bone cyst: a study of 50 cysts in 47 patients: Clin Orthop Relat Res.2004 Jul;(424):202-210.

# CS 5 Treatment

- Supportive if asymptomatic.
- Orthotic Therapy
- Steroid Injection
- Excision –Curettage and packing.

# Tumor Differential

- Unicameral Bone Cyst
- Intraosseous Lipoma
- Aneurysmal Bone Cyst
- Giant Cell Tumor
- Chondromyxoid Fibroma
- Osteoblastoma
- Osteoid Osteoma
- Ewing's Sarcoma
- Osteosarcoma
- Metastatic Lesion



# CONCLUSION

- Heel pain patient's can be both the most rewarding as well as the most frustrating patients that we treat.
- Keep multiple other differentials on your radar.
- MRI may be of best assistance imaging modality.
- Multiple alternative treatment options are available.



But, Don't forget the  
Podiatric Corollary!



TIME  
WOUNDS  
ALL  
HEELS



**THE NATIONAL**  
NASHVILLE  
JULY 27-30, 2017

# Questions?

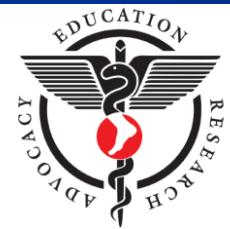
*Thank You for your  
participation!*

Daniel P. Evans, DPM, FACFAOM

Stephen Albert, DPM, FACFAOM

Jason Harrill, DPM, FACFAOM, FACFAS

The American College of  
FOOT & ANKLE  
ORTHOPEDICS  
& MEDICINE







# Case Study 5

- 13 year old male
- Gradual onset of pain over last 3 months
- Playing soccer
- “My son can’t run and compete at the level that I want him to.”

# CS 5 Physical Examination

- Pes Planus.
- Taught peroneal tendons.
- Pain upon inversion/eversion of foot.
  
- What films do you want to order to further assess the patient?

# Harris & Beath Projections



# DIFFERENTIAL DIAGNOSIS

- RHEUMATOID ARTHRITIS
- TRAUMA
- ACROMEGALLY
- EXTRA-ARTICULAR ARTHRODESIS
- OVERCORRECTED CLUBFOOT
- OSTEOCHONDRAL DYSTROPHY
- INFECTION
- NEOPLASM
- JUVENILE R.A.
- CONGENITAL CONVEX PES CALGUS
- PERONEAL MUSCLE CONTRACTURE 2 TO ISCHEMIA
- NEUROMUSCULAR DISEASE

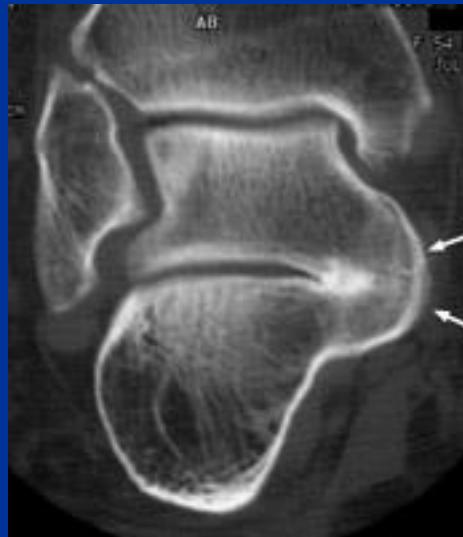
# Ossification of Coalition

- Talonavicular Coalition: 3-5 years old.
- Calcaneal Navicular Coalition: 8-12 years old.
- Talocalcaneal Coalition: 12 – 16 years old.

\*Age of ossification of coalition corresponds to the onset of symptoms.

# CS 5 Coalition

- Subtalar joint coalition most common.
- Calcaneal Navicular coalition second most common.



# CS 5 Treatment

- Supportive
- Orthotic Therapy
- Surgical Intervention
  - Resection
  - Fusion

# Calcanal Apophysitis





# HEEL PAIN

1. ★ Annual Number of Patient's treated for Plantar Fasciitis.
  - 2 Million
2. ★ Medicare Annual Cost: \$376 million\*

Tong KB, Furia J. Economic burden of plantar fasciitis treatment in the United States. *Am J Orthop.* 2010; 39(5):227-31.

Chimutengwende-Gordon M, O'Donnell P, Singh D. Magnetic resonance imaging in plantar heel pain. *Foot Ankle Int.* 2010; 31(10):865-70

Grasel RP, Schweitzer ME, Kovalovich AM, et al. MR imaging of plantar fasciitis: edema, tears and occult marrow abnormalities associated with outcome. *AJR Am J Roentgenol.* 1999; 173(3):699-701.

\*\* Jacobs A. An Evidence-Based Medicine Approach to Plantar Fasciitis. *Podiatry Today.* Vol. 26-Issue 11-Nov. 2013.

# In the United States what number of patients will receive treatment for plantar fascitis each year?

- 50,000
  - 150,000
  - 1 Million
  - 2 Million
- 
- Answer: Approximately 2 Million patients every year!

3. ★ What percentage of adult patients visiting a podiatric physician will have the chief complaint of heel pain?

**Answer: 15%**

4. ★ Which of the following patients would most likely present with the symptoms of heel pain?

17 year old male

45 year old female

**Answer: 45 Year old Female**

55 year old male

65 year old male

The person sitting to your left.

**5. Most Common location for the development of an infracalcaneal spur?**

**6. What percentage of patients with radiographic evidence of heel spur will have a spur on the contralateral asymptomatic side?**

**Answer: 63%**

**Beta – 5-6**

# 7. What is the likelihood for patient's presenting with heel pain to be overweight?

Answer: 27 X as likely!!!

Beta 7

# Beta.socrative.com

8. In your practice, What percentage of patient's with heel spur pain respond to initial conservative treatments?
  
9. On a scale of 1-10, with 1 being the **LEAST** frustrating, and 10 being the **MOST** frustrating, How would you rank your level of frustration when dealing with patients who do NOT respond to appropriate conservative care for heel pain?

- Patient's with Plantar Fasciitis Exhibit Inflammation of the Plantar Fascia

TRUE

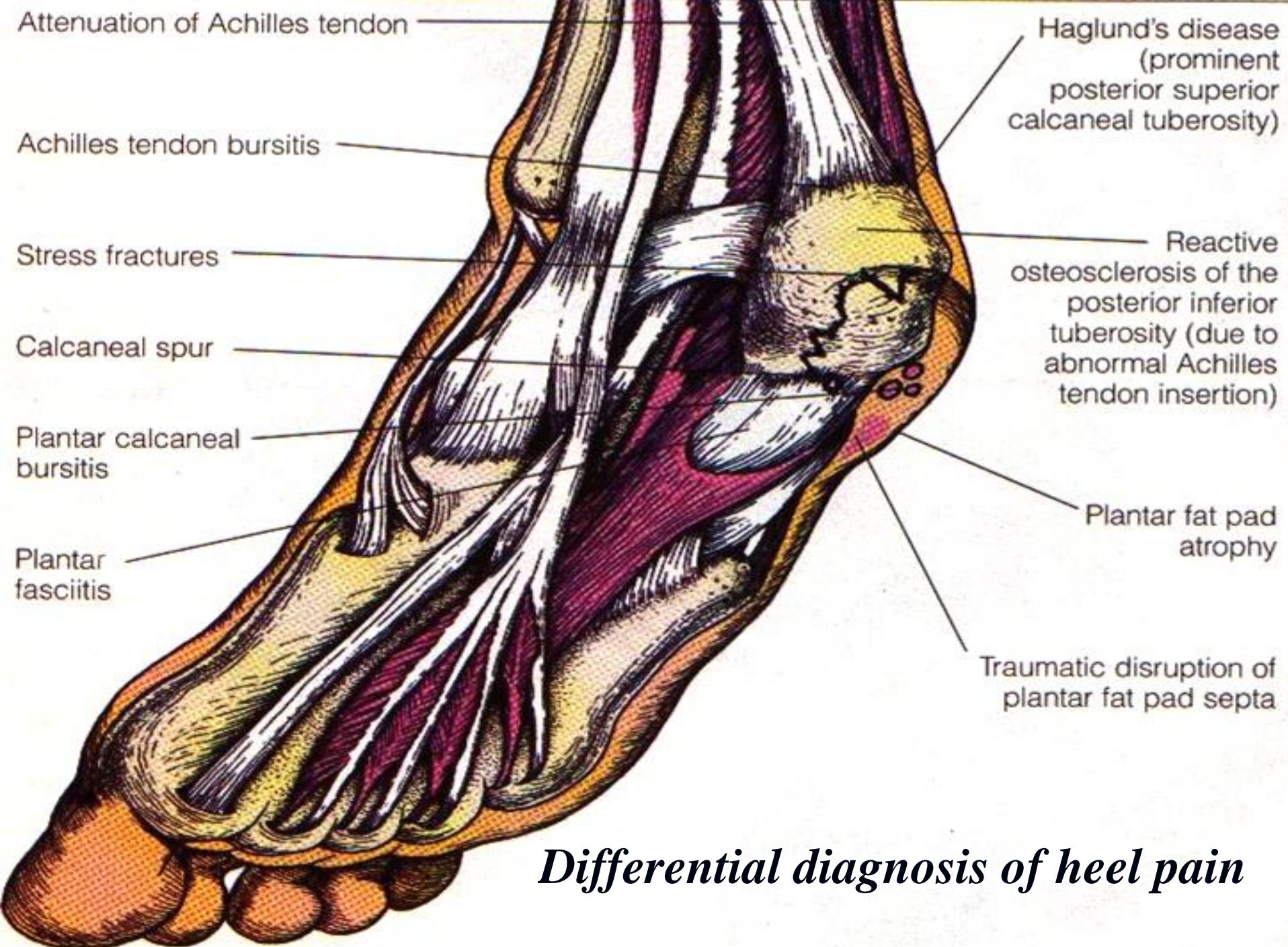
FALSE

- What Biomechanical findings are frequently encountered in Patients with Plantar Fasciitis/Heel Spur Syndrome?
  - Pes Planus
  - Pes Cavus
  - Limb-Length Innequality
  - Hallux Limitus
  - All of the above
  - None of the above

# ETIOLOGIES FOR HEEL PAIN



Beta – 12



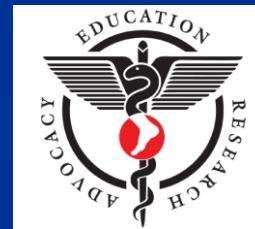
*Differential diagnosis of heel pain*



# Questions?

## Thank You!

Daniel P. Evans, DPM, FACFAOM

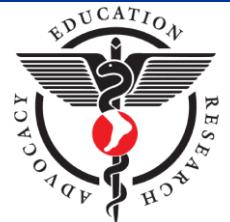


# Imaging Options for the Assessment of the Complicated Heel



Daniel P. Evans, DPM, FACFAOM

The American College of  
FOOT & ANKLE  
ORTHOPEDICS  
& MEDICINE



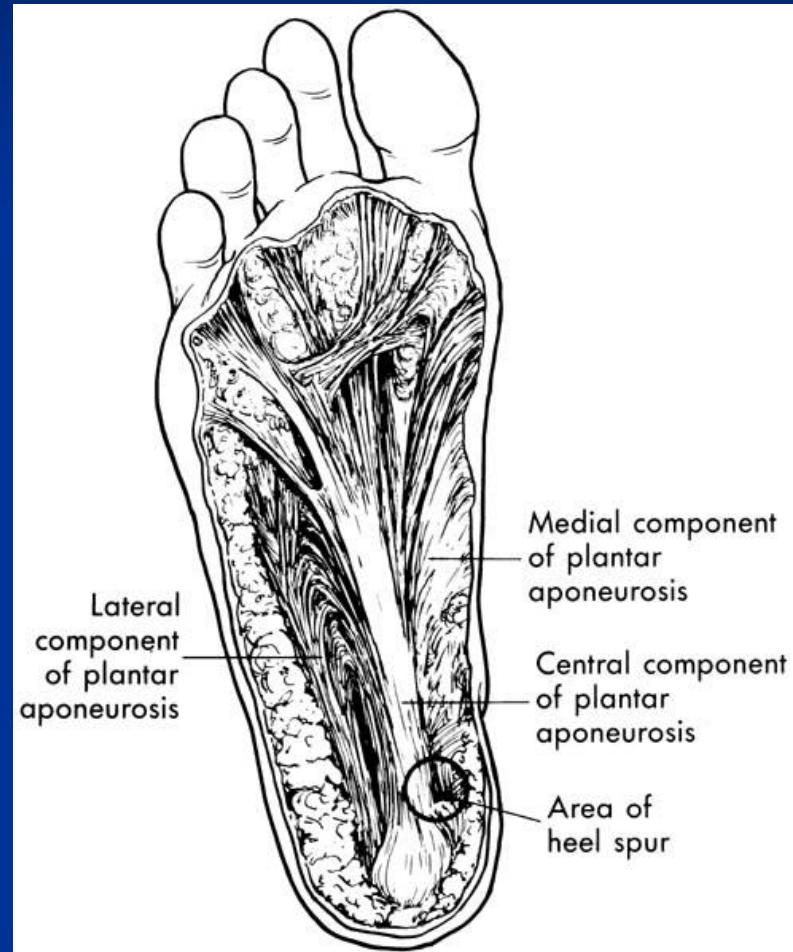


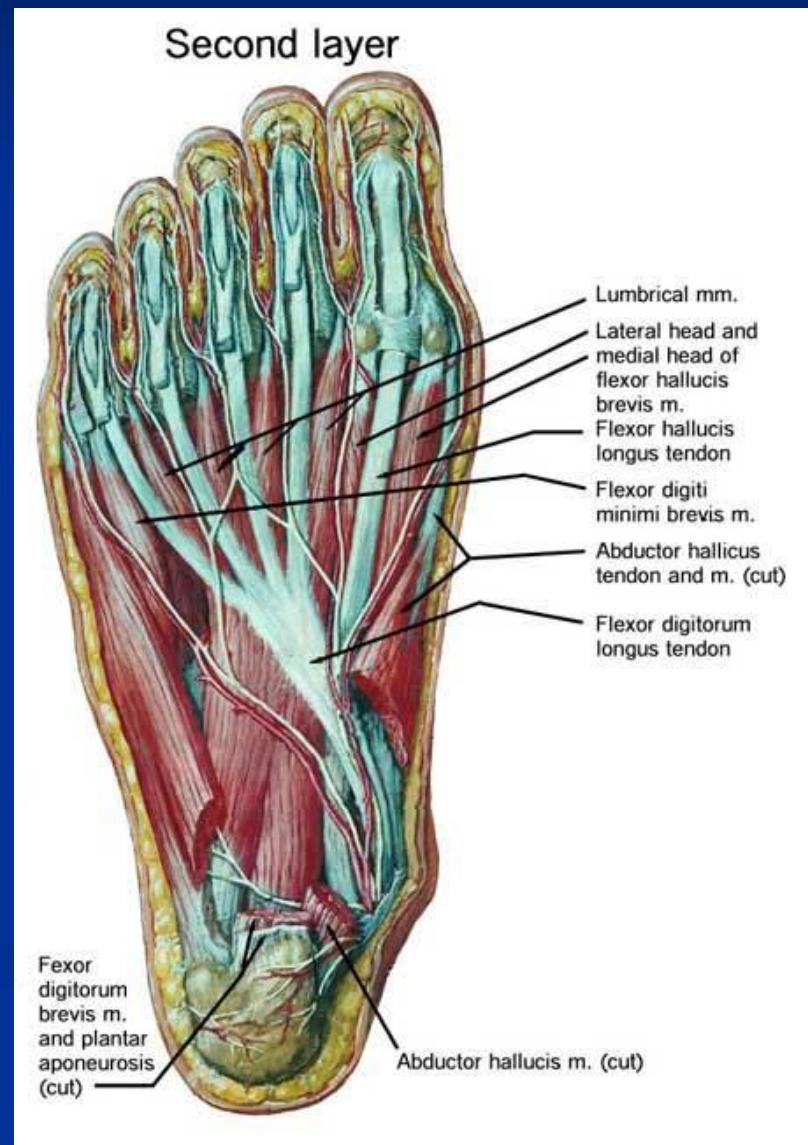
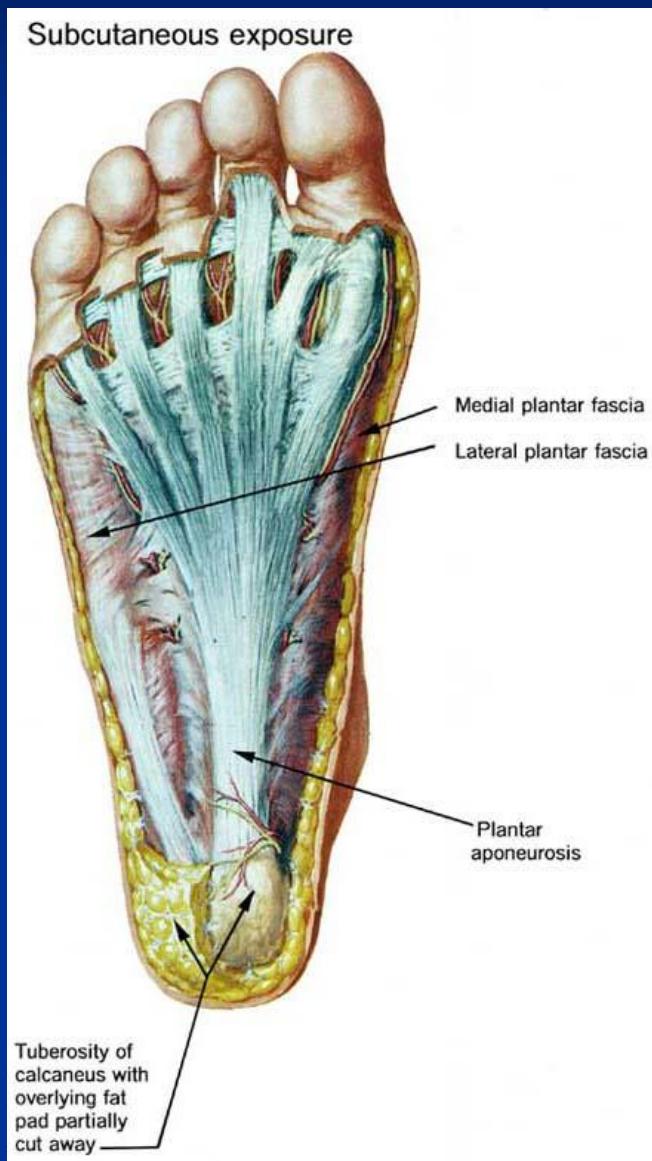
# Anatomy Of Heel Pain



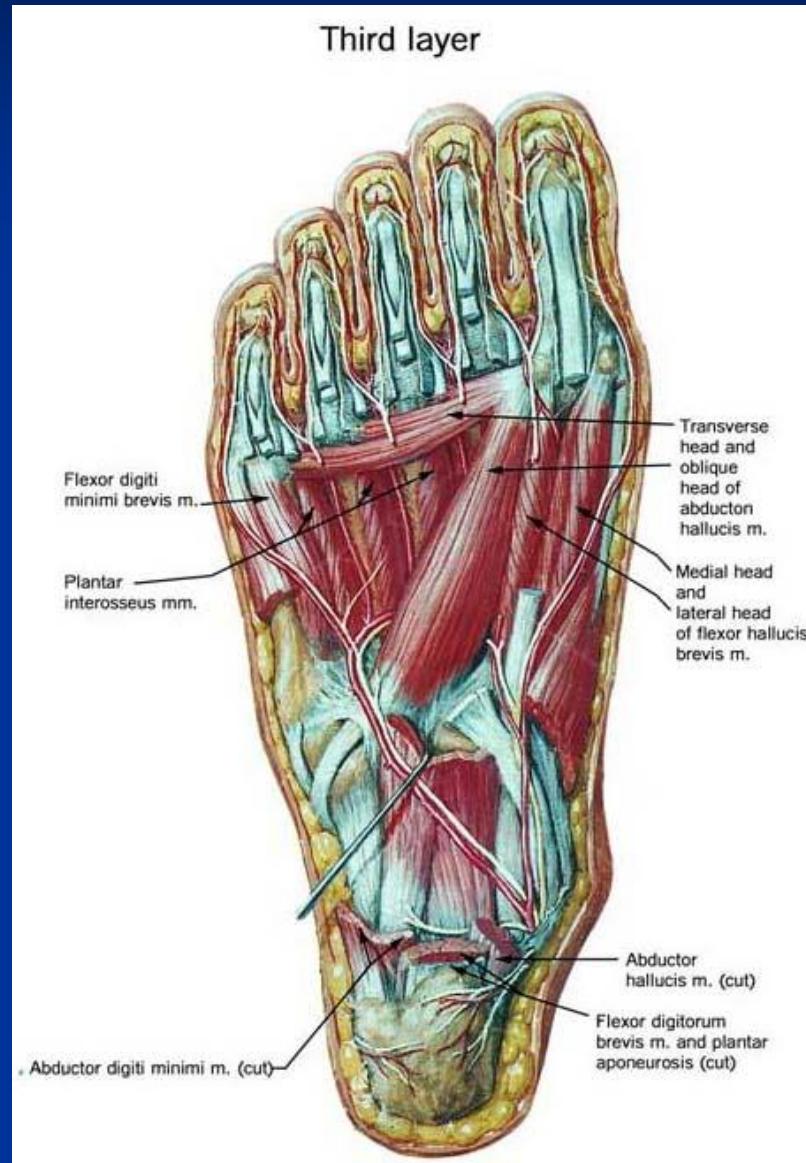
# Anatomy

- The plantar fascia is a tough, fibrous band superficial to the muscle layers of the foot
- Extends from the medial and lateral tubercle of the calcaneus
- Distally divides into five bands to the level of the MTPJ



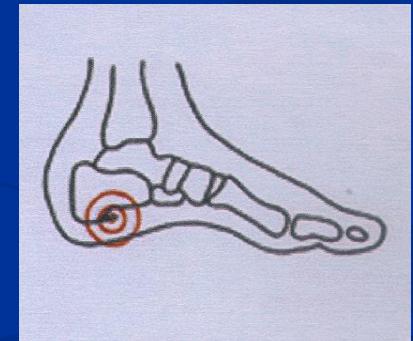


[www.foottrainer.com](http://www.foottrainer.com)



# Etiology of plantar Fasciitis

- Repetitive micro trauma to the plantar fascia tends to result in micro tears at its origin
- The chronic micro tearing and reparative process may result in thickening of the plantar fascia when left untreated



# Heel fat pad atrophy

- The heel pad cushion is composed of globules of fat encapsulated in a fibroelastic reticulated structure, which effectively absorbs 20-25% of the contact force at heel strike
- After the age of forty there is a loss of collagen, elastic tissue, water, and the overall thickness of the heel pad diminishes.

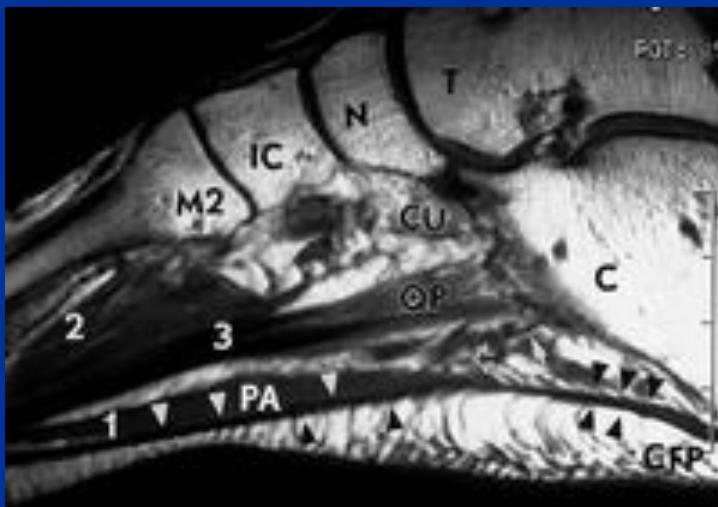
# Plantar Fasciitis and Fascial Rupture: MR Imaging Findings in 26 Patients Supplemented with Anatomic Data in Cadavers 1:

Radiographics, 2000;20:S181-197

Theodorou, DJ; Theodorou, SJ, Kakitsubata, Y, Lektrakul, N, Gold, GE, Roger, B and Resnick, D



- Note vertical orientation of fat lobules separated and maintained by fibrous septa.



# Body Weight

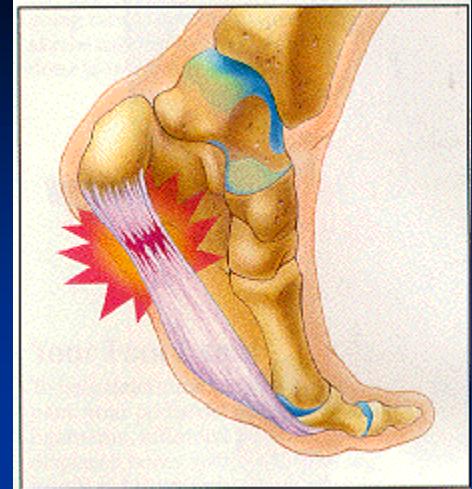
Excess body weight is a major cause of heel pain. Our visitors are 27 times more likely to be overweight ( $BMI > 25$ ) than underweight ( $BMI < 20$ ). Our visitors are twice as likely to be obese ( $BMI > 30$ ) as the average American. But our visitors often do not know they are overweight because they are comparing themselves to other Americans who are the heaviest people in the world. Caloric restriction experiments since the 1930's in many species have shown that for every excess dry ounce of food (28 grams, 120 calories) you eat, you lose one hour of your life and health.

**BMI (Body Mass Index) Between 20-25**

[Heelspur.com](http://Heelspur.com)

# Plantar Fasciitis

- The most common cause of heel pain
- Typically unilateral, although bilateral up to 10% of the cases
- Associated with cavus and planus foot types



# HEEL SPUR FORMATION

- Generally believed to occur at the insertion of plantar fascia.
- Spur often found slightly deeper, within the fibers of the Flexor Digitorum Brevis.

Karr SD. Subcalcaneal heel pain.

Ortop. Clin North America 25:161-175, 1994

# PLANTAR FASCITIS

- “FASCITIS” – May be a misnomer.  
Pathologic study of 50 patients who underwent fascial surgery release.
  - Findings did not show any evidence of inflammatory cells within the fascia.
  - Common finding was degeneration of the tissue.
  - Inflammation appears to be in the underlying intrinsic musculature.

**Lemont H, Ammirati KM, Usen N.** Plantar Fascitis: a degenerative process (fasciosis) without inflammation. J Am Podiatr Med Assoc 2003;93:234-7. j Foot Ankle Surg. 2005 Mar-Apr; 44(2):137-43

# PLANTAR FASCITIS

- Histologic studies confirm evidence of tractional strain with findings of fascia microtears, collagen necrosis, chondroid metaplasia, and angiofibroblastic hyperplasia -findings similar to those in other repetitive stress disorders (ie, tennis elbow.

Schon LC: Plantar fasciitis/heel pain, in: Pfeffer GB, Frey CC(eds): Current Practice in Foot and Ankle Surgery. New York, McGraw-Hill, 1993 pp 243-261.

# Case Study 1

- 38 year female training for first marathon.
- Onset 3 weeks ago.
- Denies specific trauma.
- Mileage now 25 miles per week.

# CS 1 -Plain Film Radiographs

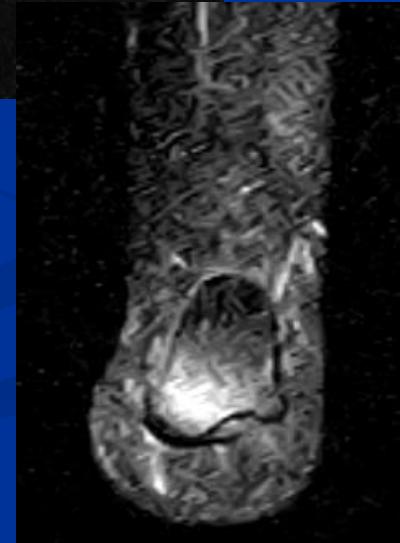
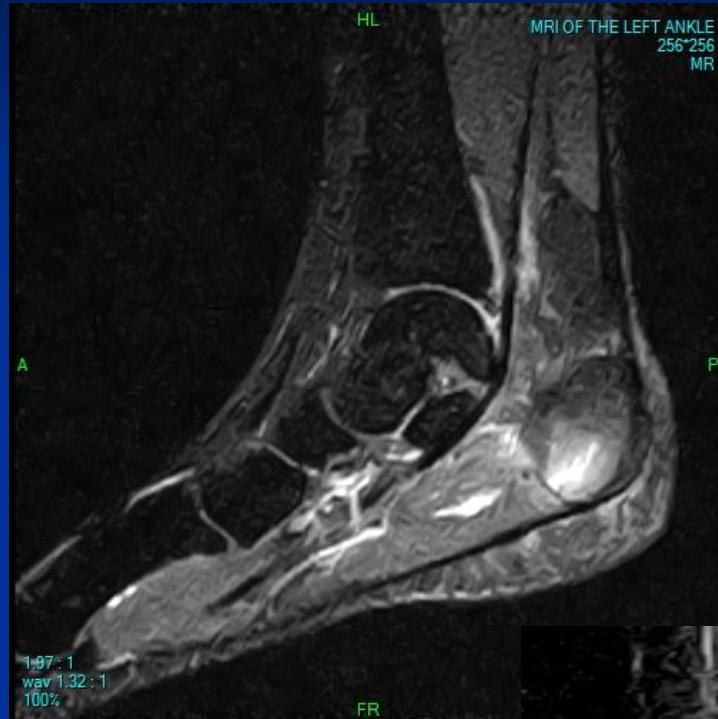
- Initial Films demonstrate no evidence of pathology.
- How would you further work up the patient, what are your differential diagnosis, and what would be your specific treatment plan?



DIGITAL CRONEX® QUANTUM DETAIL DR

# Stress Fracture Calcaneus

- STIR – Image
- Note evidence of marrow edema
- Linear stress risers from anterior aspect of medial tuberosity angling posterior-superiorly.



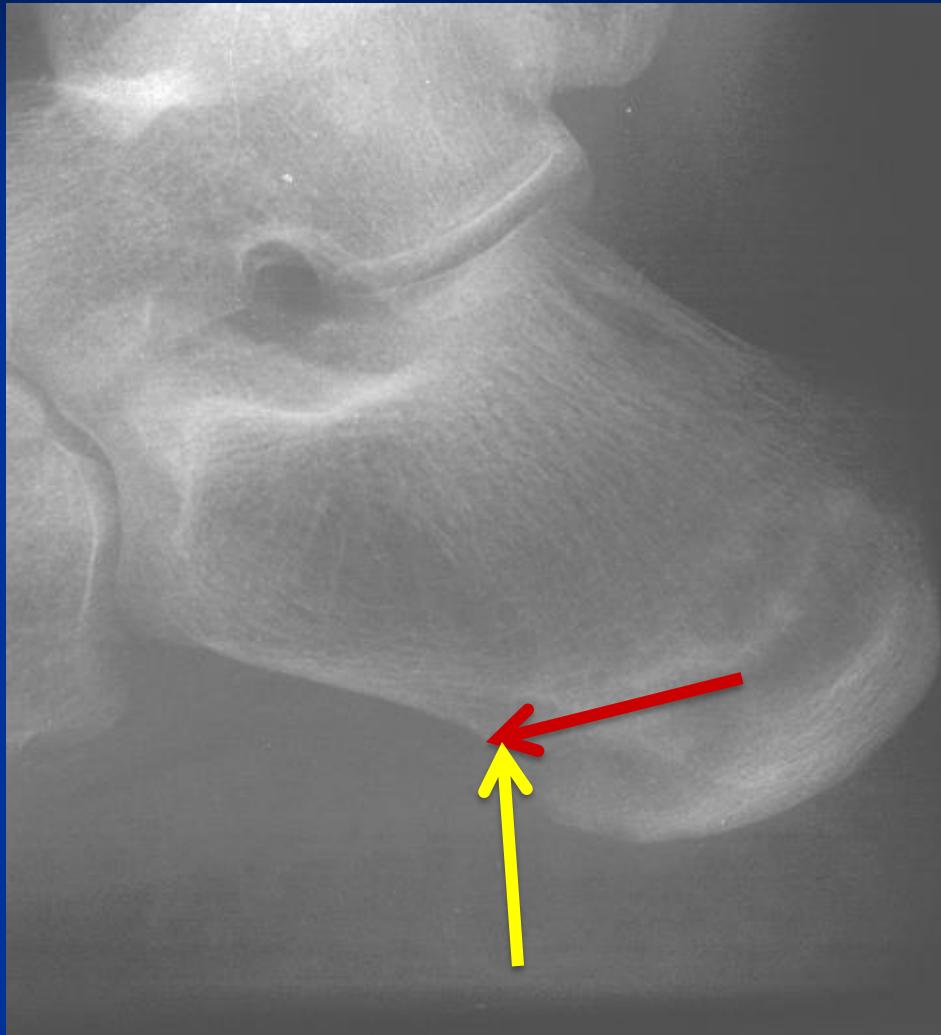
- T1 Images most likely to demonstrate linear fracture.
- T2 will demonstrate medullary edema



Images courtesy Dr. Robert L. Baron

# Patterns of Stress Fx. of Calcaneus

- Running obliquely from plantar distal to proximal superior starting at anterior aspect of medial tuberosity
- Transversely running from anterior to posterior from anterior aspect of medial tuberosity.



# CS 1

- How would you treat this patient?

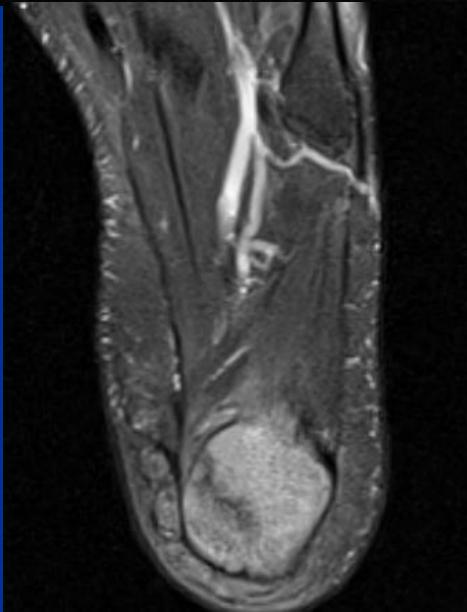
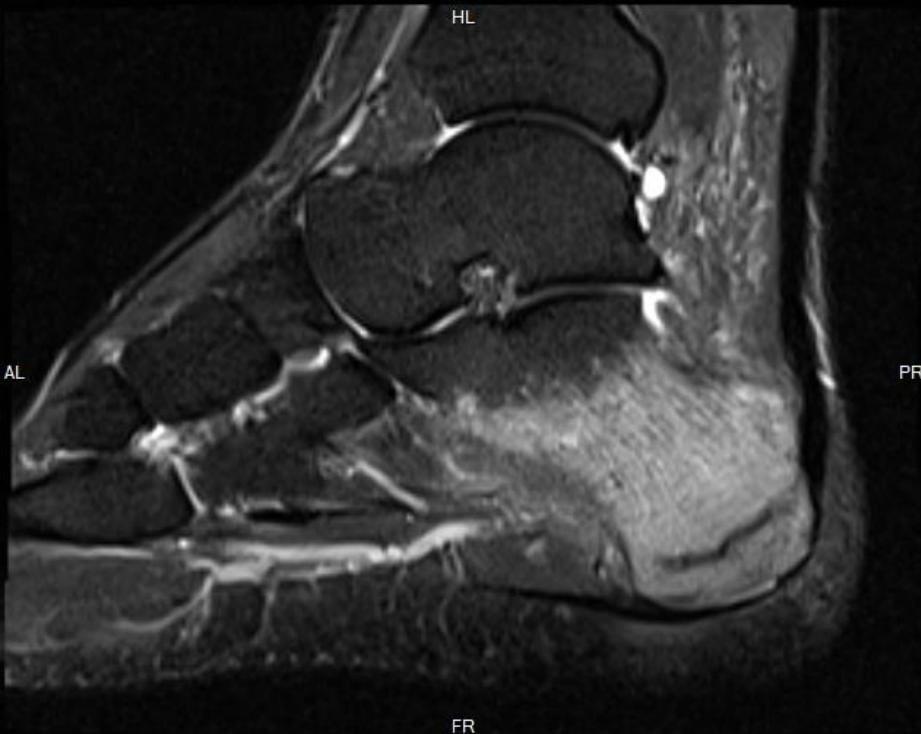
# Trauma – Differential Diagnosis

- Stress fracture
- Calcaneal fracture
- Tendonosis
- Stone Bruise



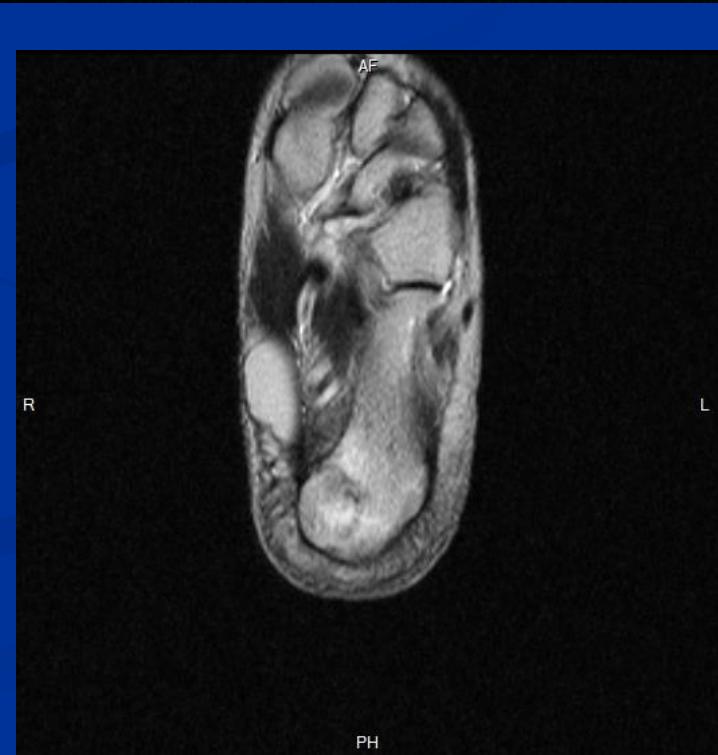
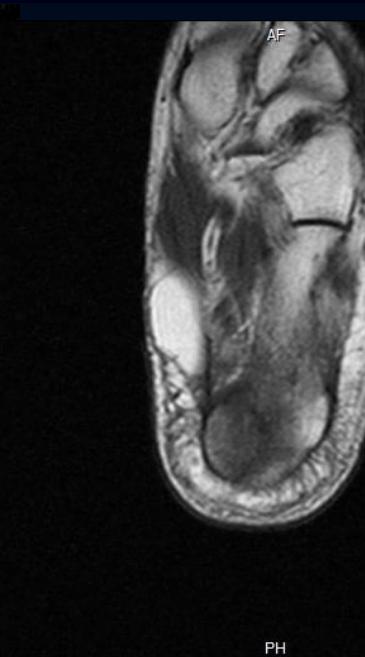
# Beta.socrative.com

- Which of the following advanced imaging modalities would you next order to further assess this patient?
  - Computed Tomography
  - Bone Scan
  - MRI
  - Ultrasound



Start your analysis with the STIR or T2WI to identify marrow edema. Next assess T1WI to search for linear signal changes.





# New Internal Fixation Device





# TREATMENT OPTIONS???

- [Beta.socrative.com](http://Beta.socrative.com)
- What other treatment options or “pearls” can you share with us that have been successful in your hands in treating the difficult heel pain patient?

Beta – 1-4