Physical Medicine and Rehabilitation Residents Lexington, KY
Cardinal Hill Hospital, 7 - 9 a.m.

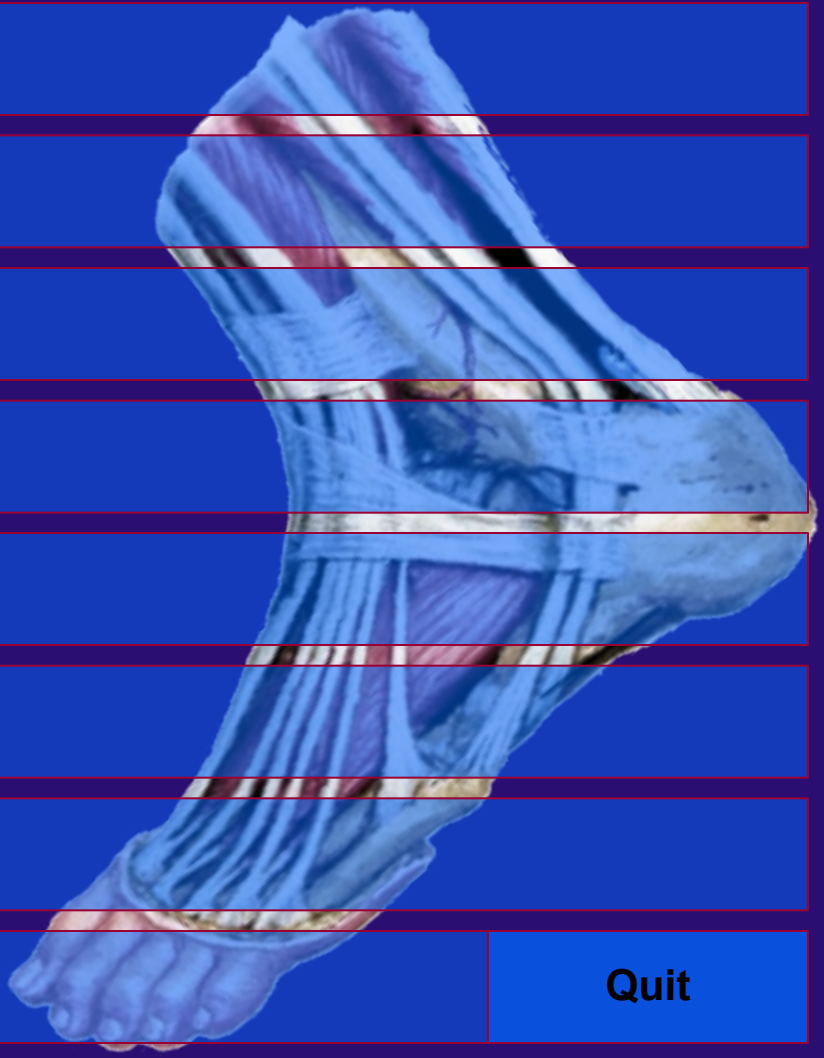
Common Foot and Ankle Diagnoses



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University of Kentucky
Dept. of Orthopaedic Surgery and
Sports Medicine
Lexington, Kentucky

Common Foot and Ankle Pathologies

- Intro
- DDx: Lateral
- DDx: Medial
- DDx: Posterior
- Fracture Dislocation
- Mid-foot Injury
- Conditions
- Conclusions



Quit

A good History and Physical
is Key

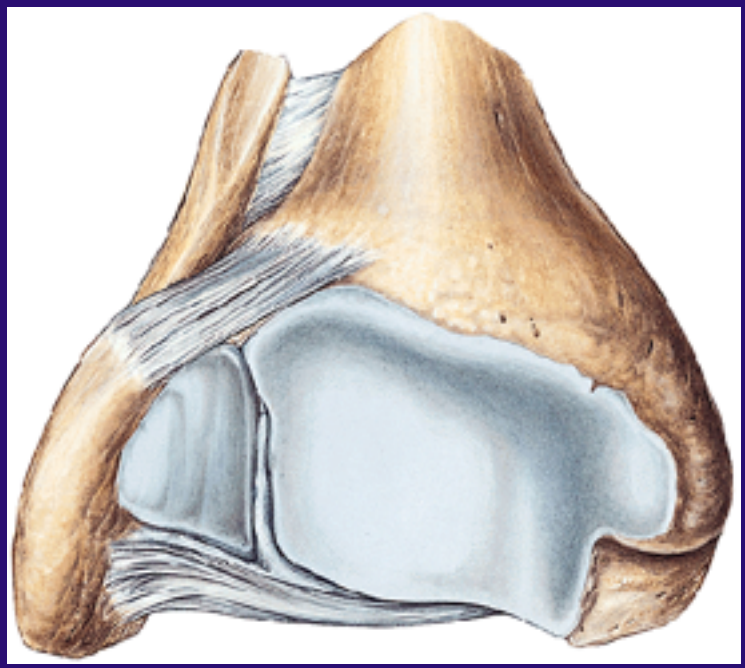


Foot: Pronated Hand
Ankle: Modified Hinge



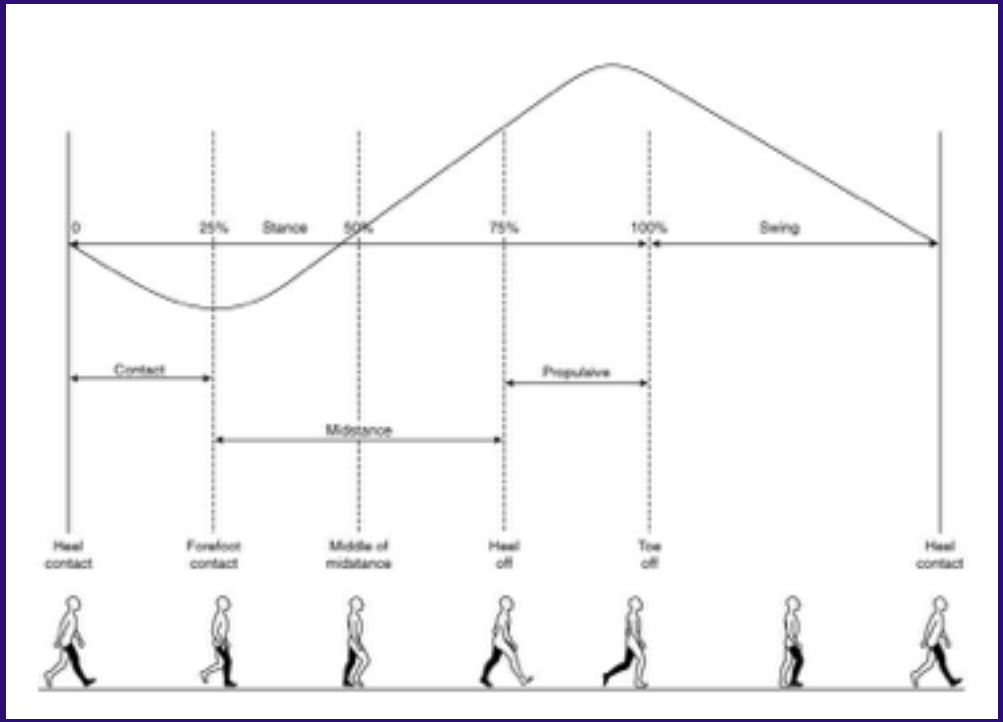






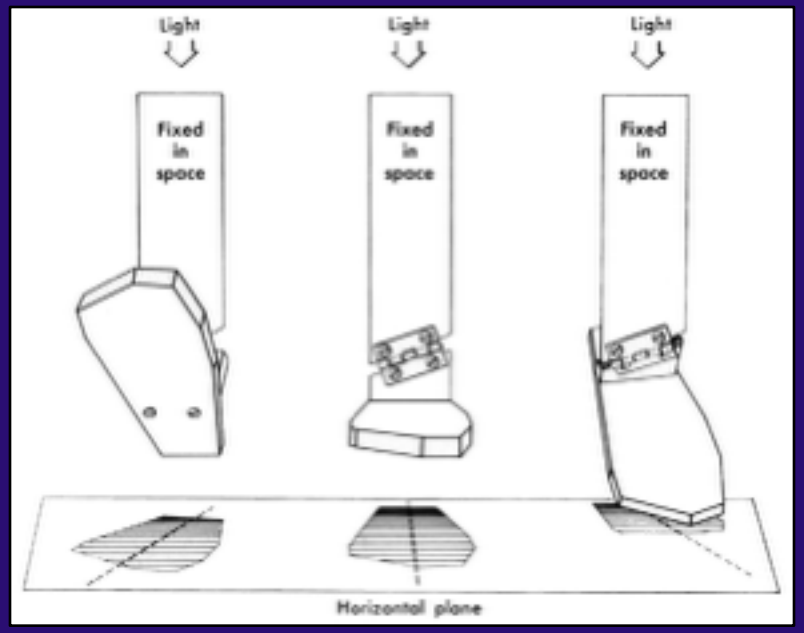
Function

- Propulsion
- Support
- Flexibility
- Rigidity
- Gait mechanics: ankle and foot motions



Ankle Axis

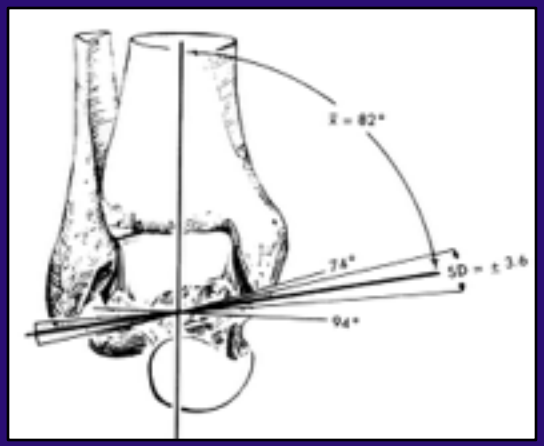
- Thus, with leg fixed and foot free
  - Dorsiflexion results in outward deviation of the foot
  - Plantarflexion results in inward deviation





Ankle Axis: Opposite with foot fixed

- With foot fixed, dorsiflexion / Plantarflexion results in rotation of the leg
  - Dorsiflexion results in internal rotation
  - Plantarflexion results in external rotation





Subtalar Joint

- Eversion and inversion of the subtalar joint are directly tied to internal and external rotation of the tibia



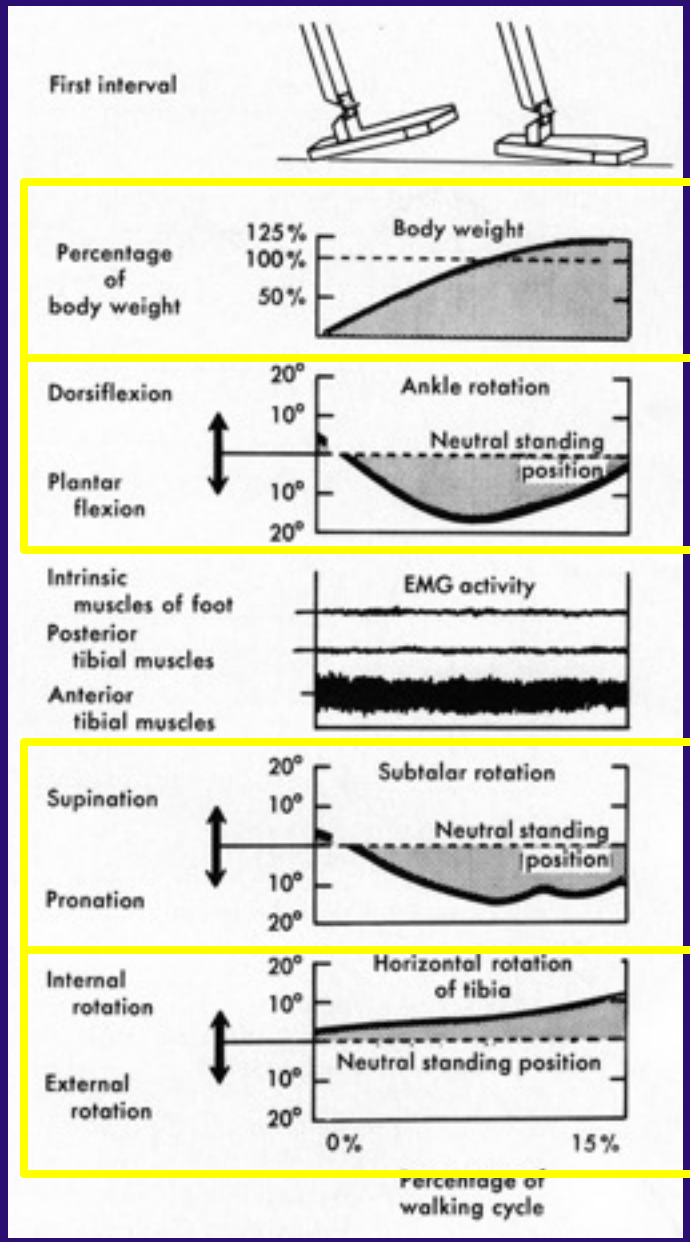
Windlass Mechanism

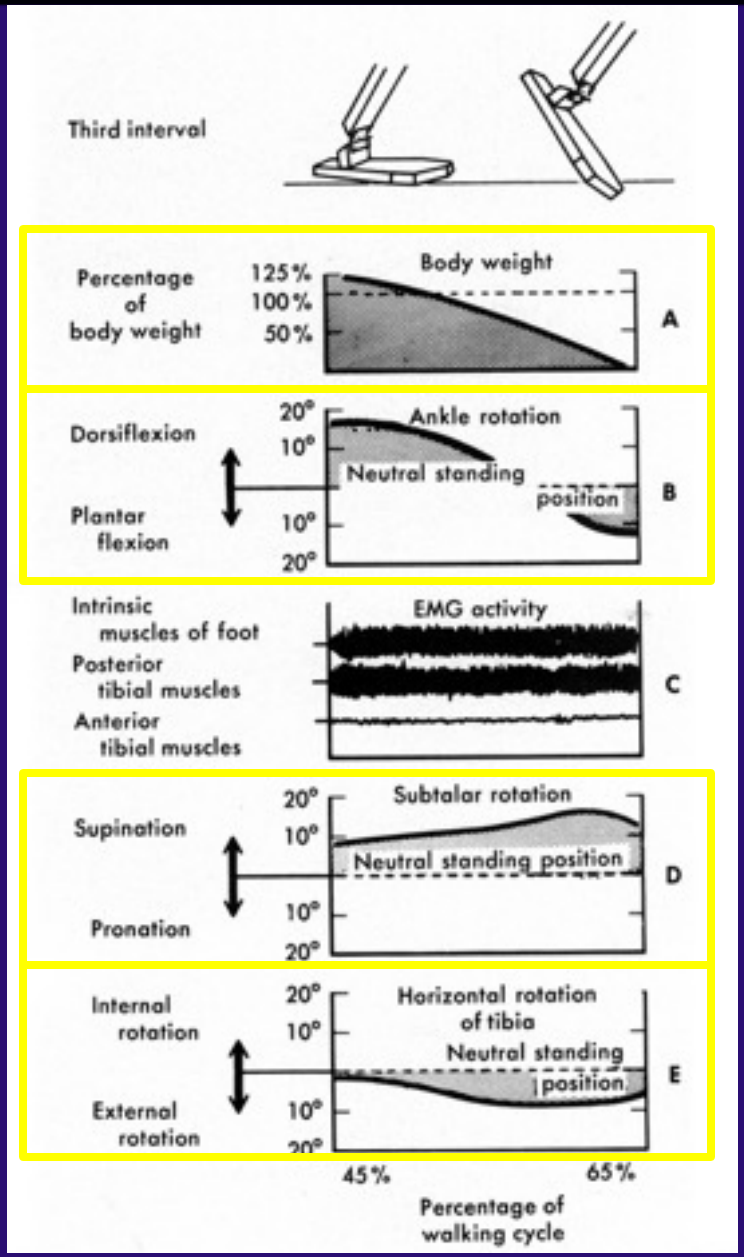


- Dorsiflexion of the proximal phalanges pulls the plantar aponeurosis over the metatarsal heads, resulting in depression of the metatarsal head and elevation of the longitudinal arch

During gait: coupled motion between ankle and subtalar joints

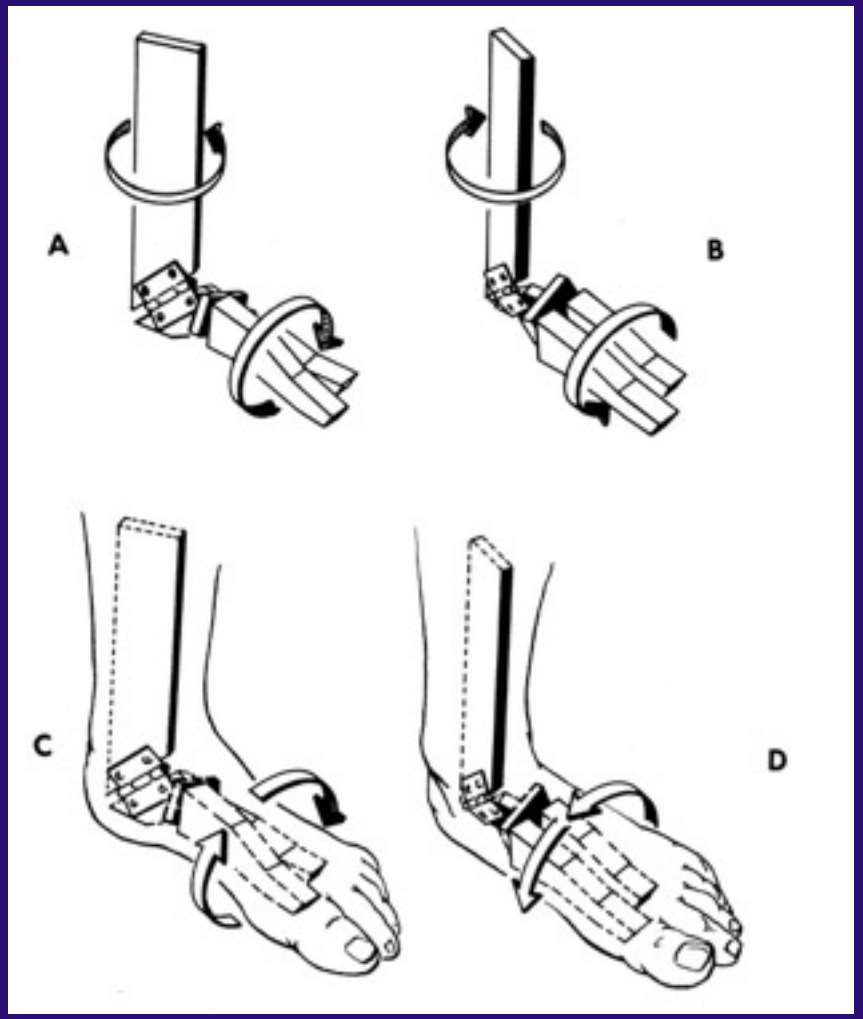
- First
  - Tibial internal rotation
  - Talar eversion
  - Foot pronation
- Third
  - Tibial external rotation
  - Talar inversion
  - Foot supination


First interval
Second interval
Percentage of body weight
125%
100%
50%
Body weight
Dorsiflexion
Plantar flexion
20°
10°
Ankle rotation
Neutral standing position
Intrinsic muscles of foot
Posterior tibial muscles
Anterior tibial muscles
EMG activity
Supination
Pronation
Subtalar rotation
Internal rotation
External rotation
Horizontal rotation of tibia
0%
15%
Percentage of walking cycle


Third interval
Percentage of body weight
125%
100%
50%
Body weight
A
Dorsiflexion
Plantar flexion
20°
10°
10°
20°
Ankle rotation
Neutral standing position
B
Intrinsic muscles of foot
Posterior tibial muscles
Anterior tibial muscles
EMG activity
C
Supination
Pronation
20°
10°
10°
20°
Subtalar rotation
Neutral standing position
D
Internal rotation
External rotation
20°
10°
10°
20°
Horizontal rotation of tibia
Neutral standing position
E
45%
65%
Percentage of walking cycle






A
B
C
D

Ankle: Modified Hinge Joint

- Bony configuration
  - Mortise
  - Circular Pretzel
- Ligamentous stability
  - ATF and CF laterally
  - Deltoid superficial and deep medially
  - Syndesmosis superiorly

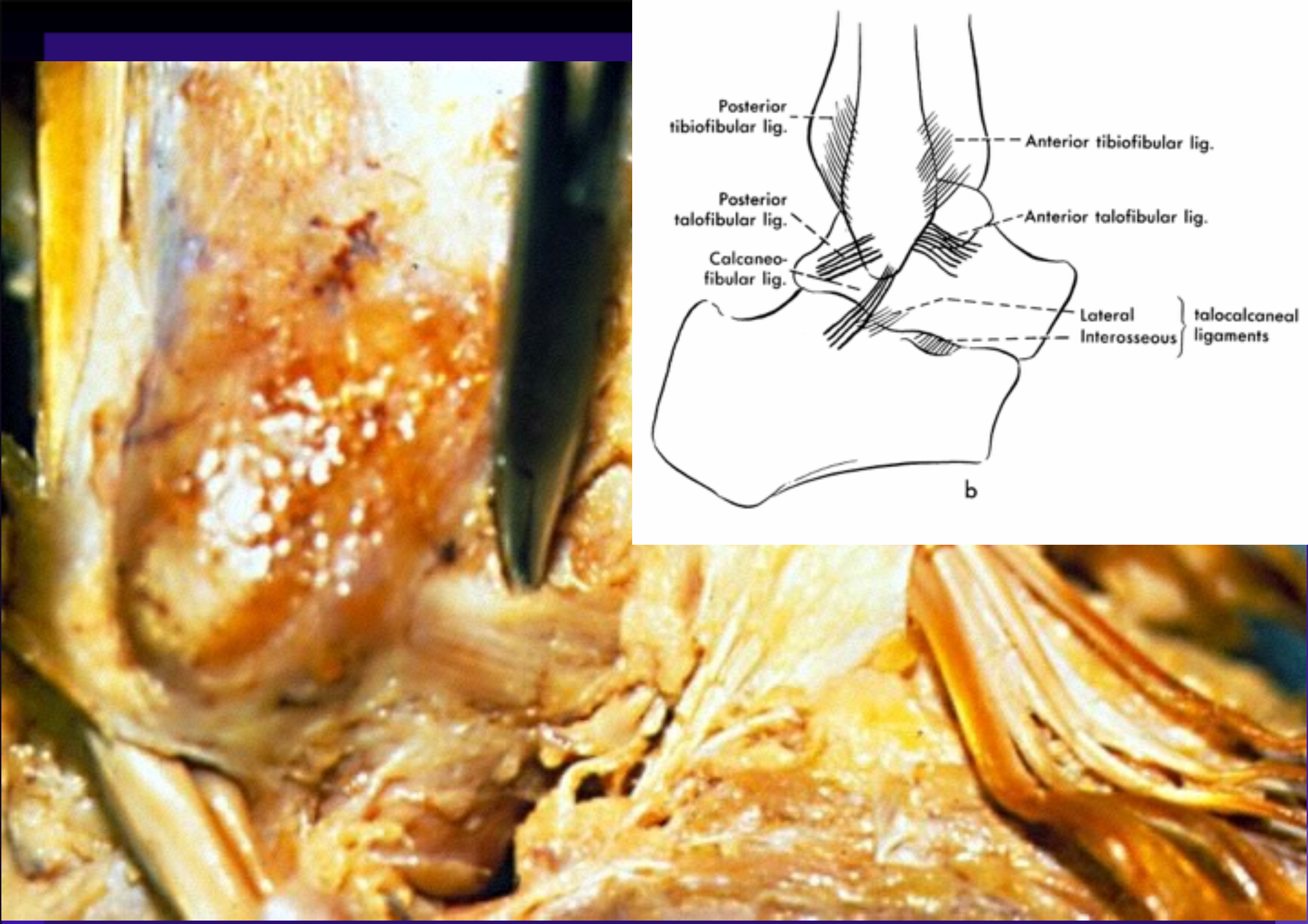
With complete history and physical and appropriate imaging, the diagnosis should be made and be specific.

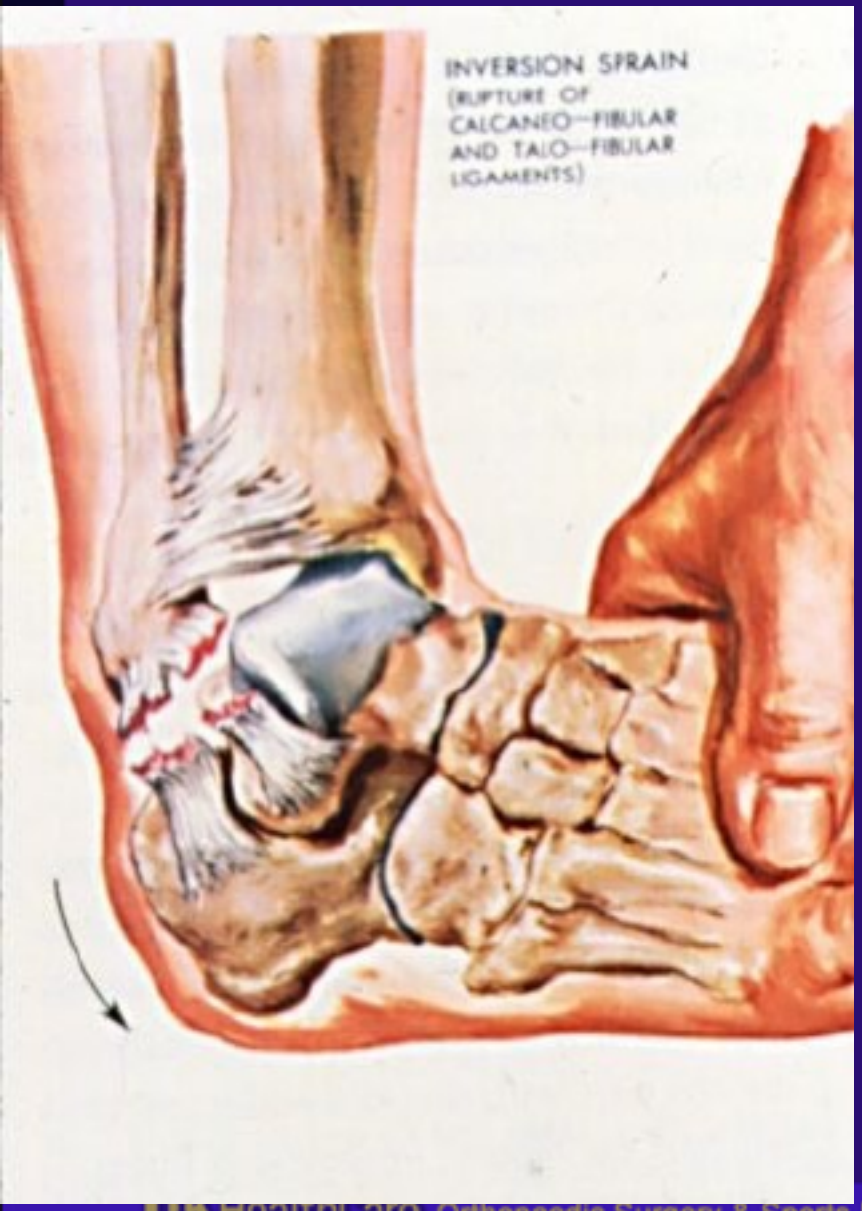
Think of location of pain and anatomic structures in that area.

- Lateral
- Medial
- Posterior
- Anterior

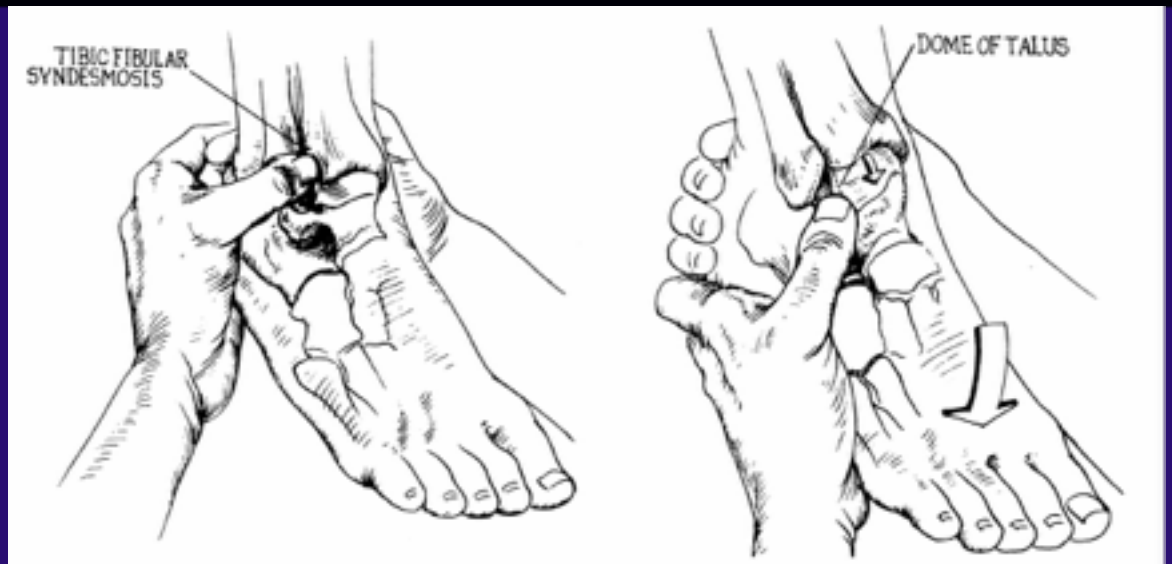
LATERAL ANKLE PAIN

- Sprain ATF and/or CF
- Sinus Tarsi Syndrome
- Subtalar Joint
  - Arthrosis Fracture
- Cuboid Subluxation
- Peroneal Dysfunction


Posterior tibiofibular lig.
Anterior tibiofibular lig.
Posterior talofibular lig.
Anterior talofibular lig.
Calcaneo-fibular lig.
Lateral
Interosseous
talocalcaneal ligaments
b


INVERSION SPRAIN
(RUPTURE OF
CALCANEO—FIBULAR
AND TALO—FIBULAR
LIGAMENTS)





Figs. 20, 21. Palpation of the lateral edge of the dome of the talus (anterolateral portion). Plantar flexion of the foot exposes a larger surface of the talar dome.

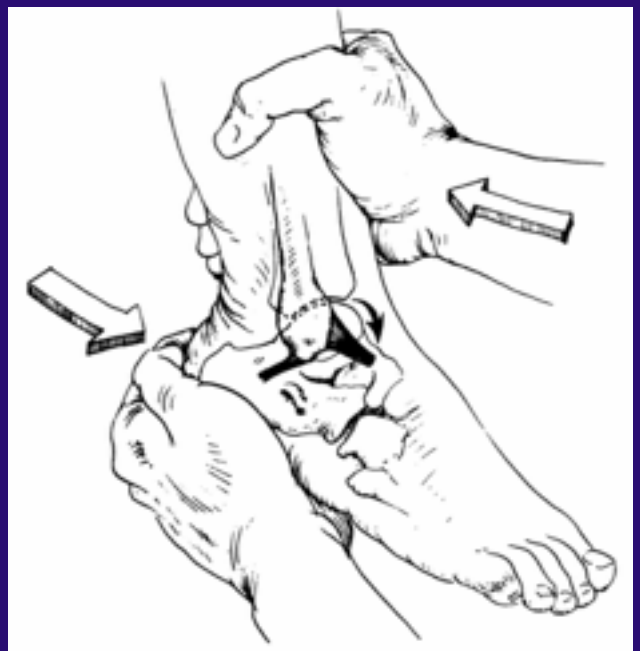


Fig. 61. The anterior draw sign test to evaluate the intactness of the anterior talofibular ligament.

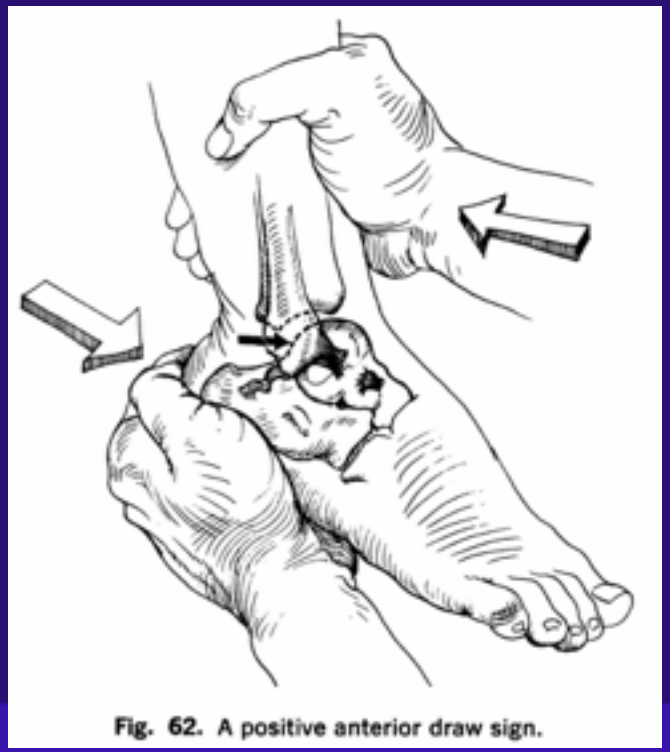


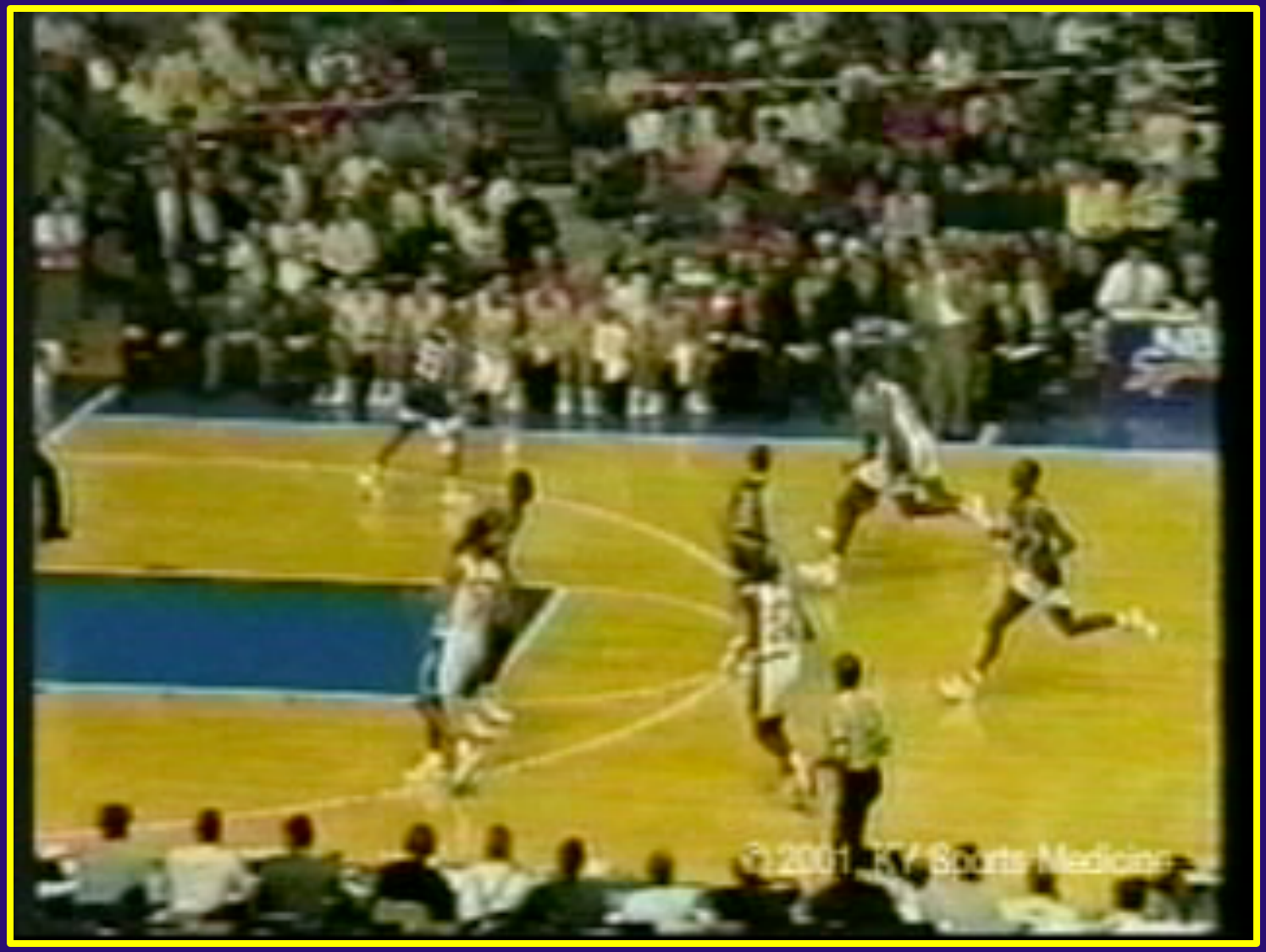
Fig. 62. A positive anterior draw sign.

Summary of Findings From the National Collegiate Athletic Association Injury Surveillance System on Foot and Ankle Injury.*

Sport	Game Injuries Relating to the Ankle (%)	Game Injuries Relating to the Foot (%)
Men's baseball	7.4	0
Women's softball	10.3	0
Men's basketball	26.2	2.6
Women's basketball	24.6	2.4
Men's football	15.6	1.1
Men's lacrosse	11.3	0
Women's lacrosse	22.6	1.3
Men's soccer	18.8	4.2
Women's soccer	19.4	2.7

*in Anderson, RB, Hunt KJ, McCormick JJk, "Management of Common Sports-Related Injuries About the Foot and Ankle," JAAOS Sept. 2010, Vol. 18, No 9, 546-556. Table 1, p. 547.

Basketball Injury Mechanism



EUA Gross instability, right ankle



18 YO Female Gymnast

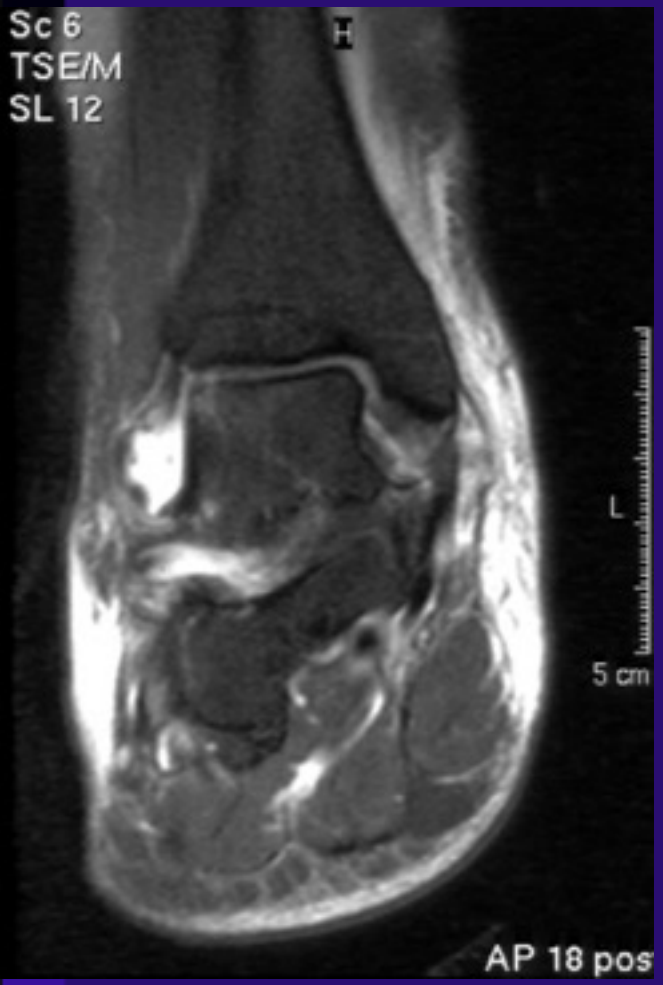
- Right ankle injury
- Landed awkwardly doing a back tuck
- Immediate pain and swelling, right ankle

Initial X-rays



Stress tests, L & R ankles



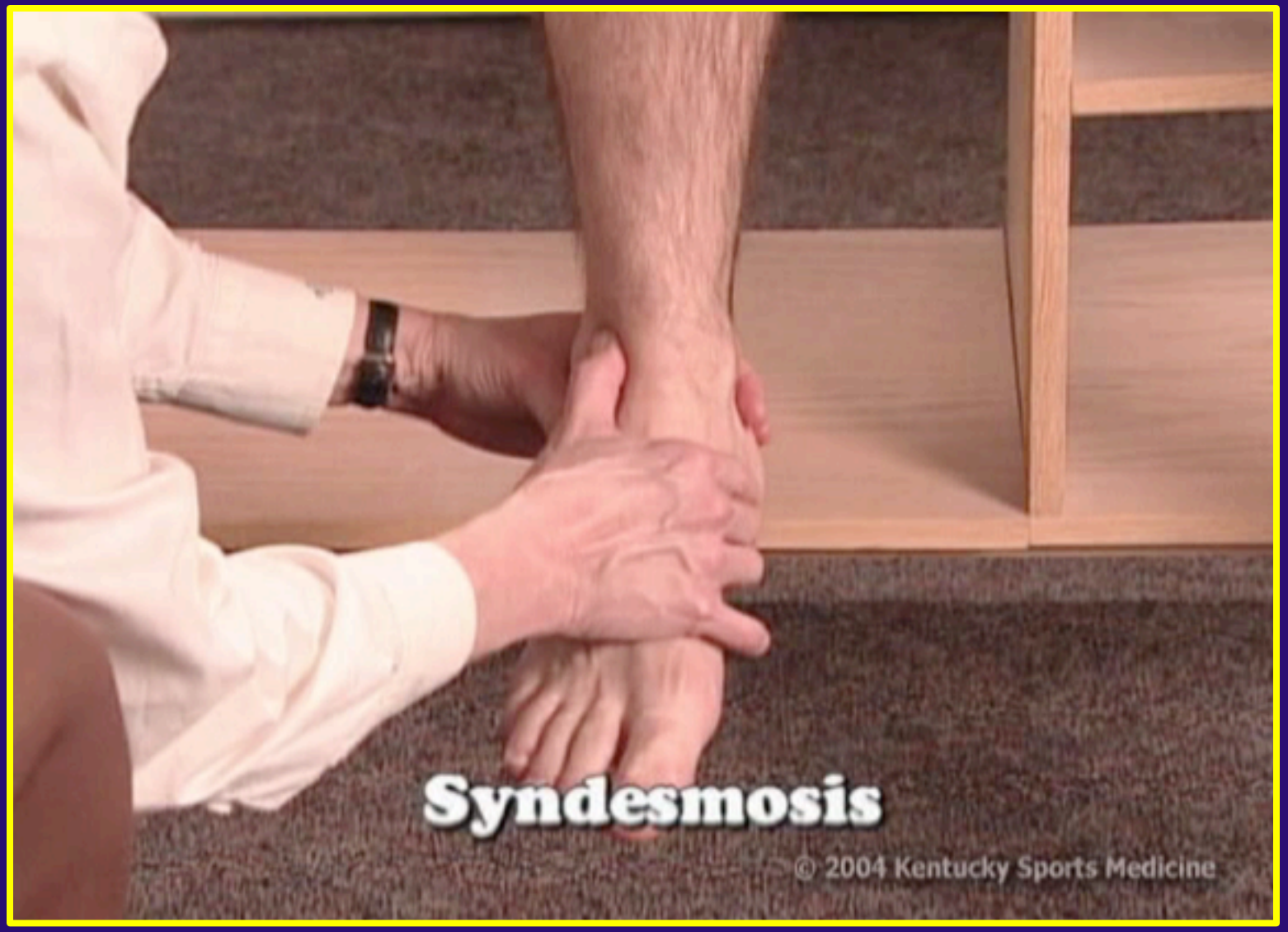






Dx lateral talus fracture displaced
Severe lateral ankle sprain

Physical Exam of the Foot and Ankle



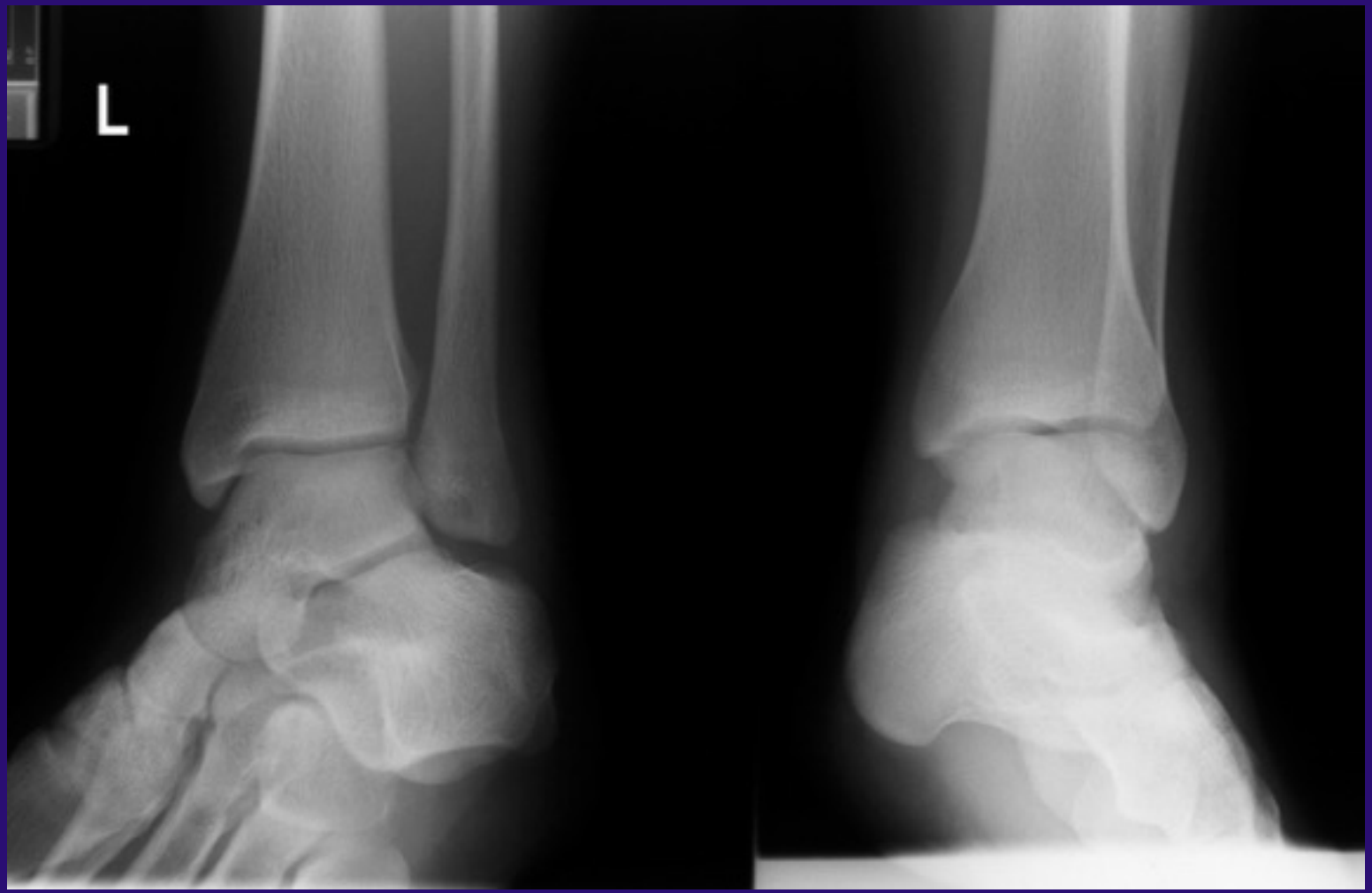
Lateral Ankle Pain
Soft Tissue

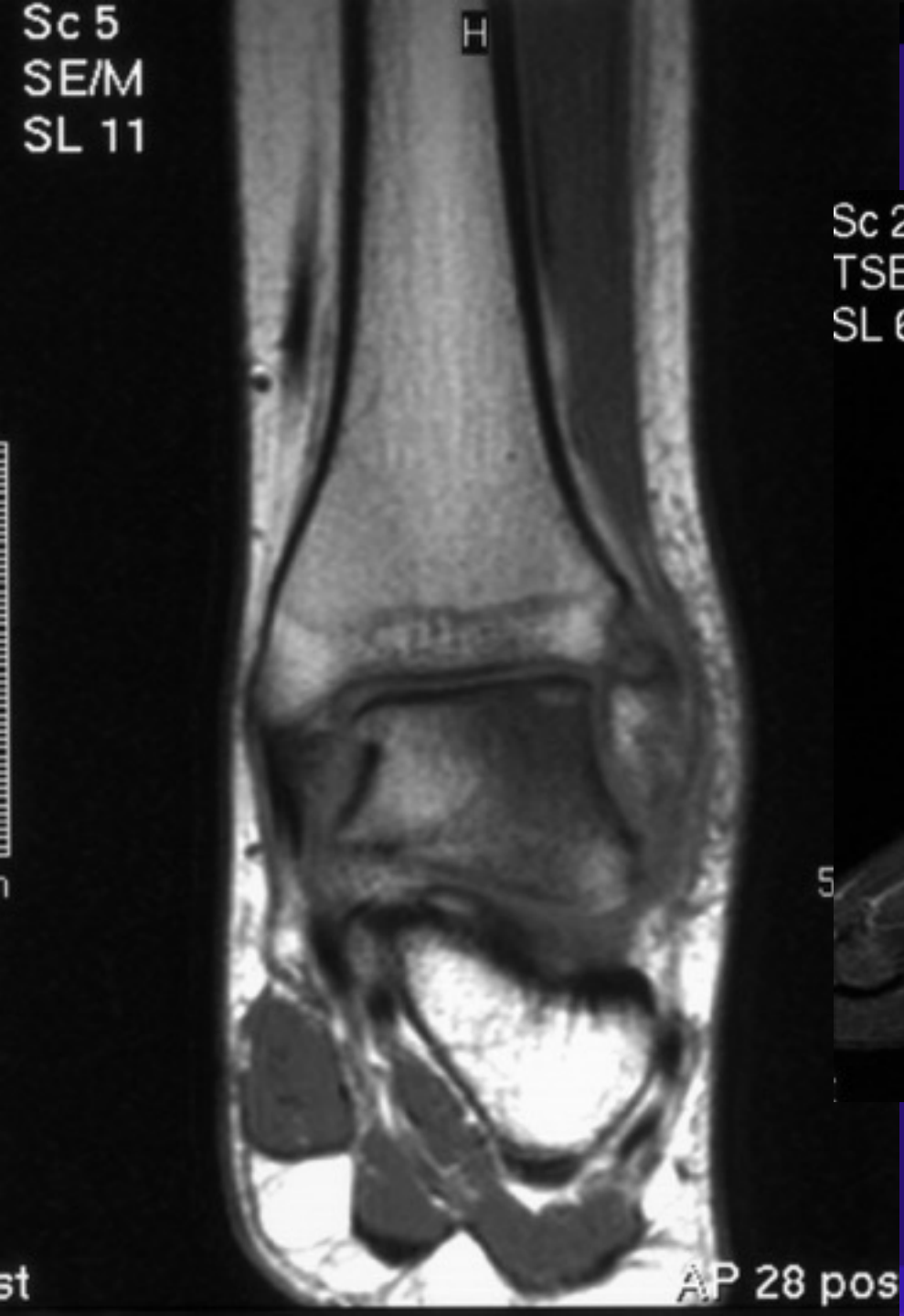
- Soft Tissue Mass
  - Ganglion
- Meniscoid of the Ankle
  - Tomansen, Denmark 1982
- Scar + Synovitis Gutter
  - Ferkel's Phenomenon, AJSM 1991
- Distal Slip Anterior Tibiofibular Ligament
  - Bassett's Ligament, JBJS, 1990

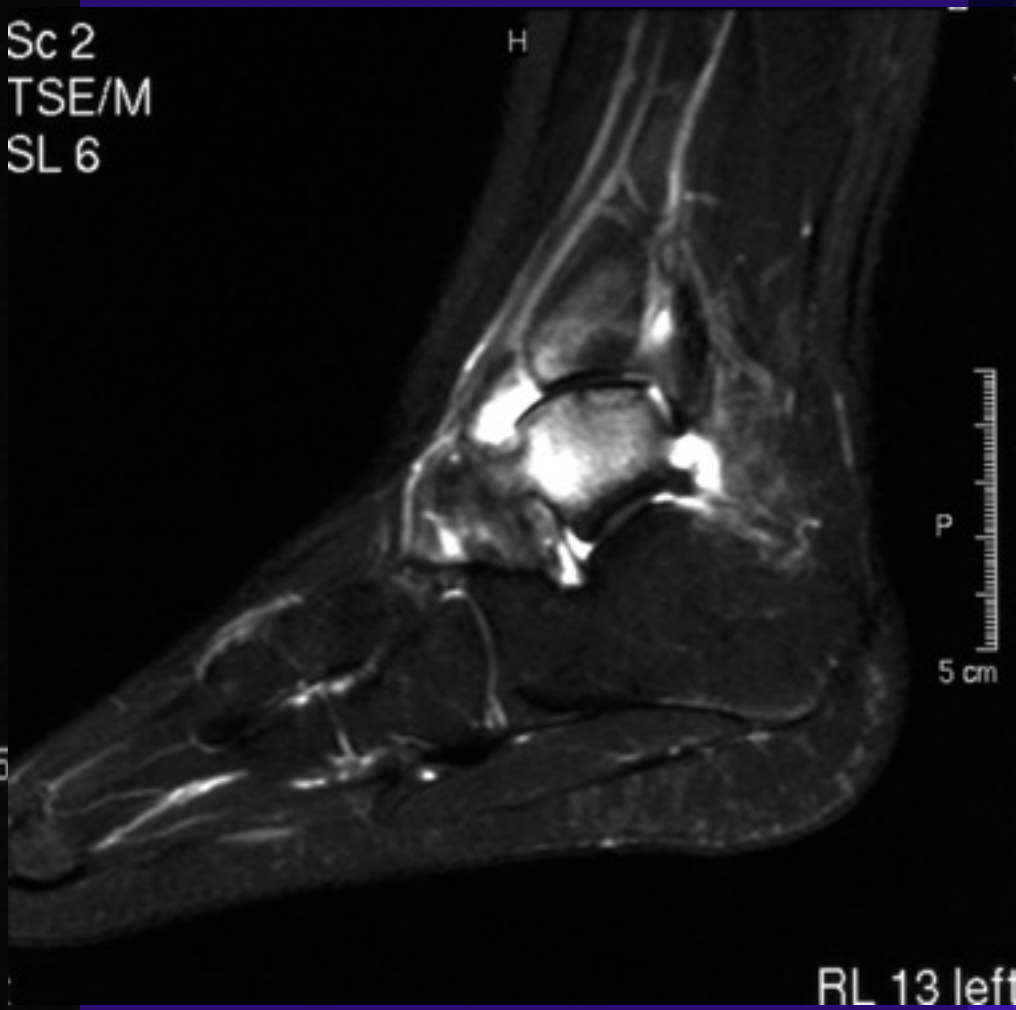
14 YO Female

- Soccer athlete
- Left ankle
- Acute lateral talar dome fracture
- Documented by plain films and bone
- edema on MRI

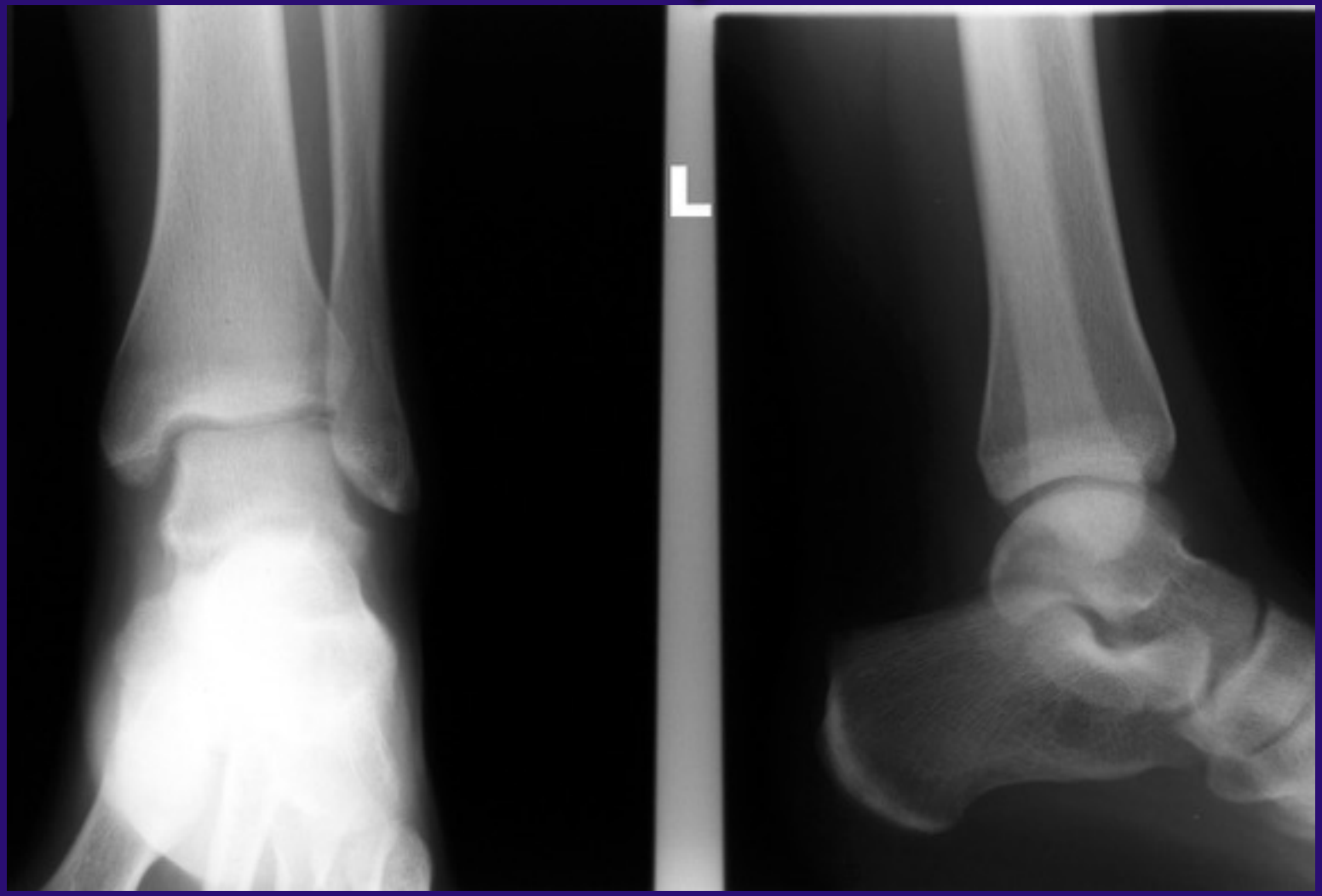
Initial X-Rays




Sc 5
SE/M
SL 11
H
AP 28 pos

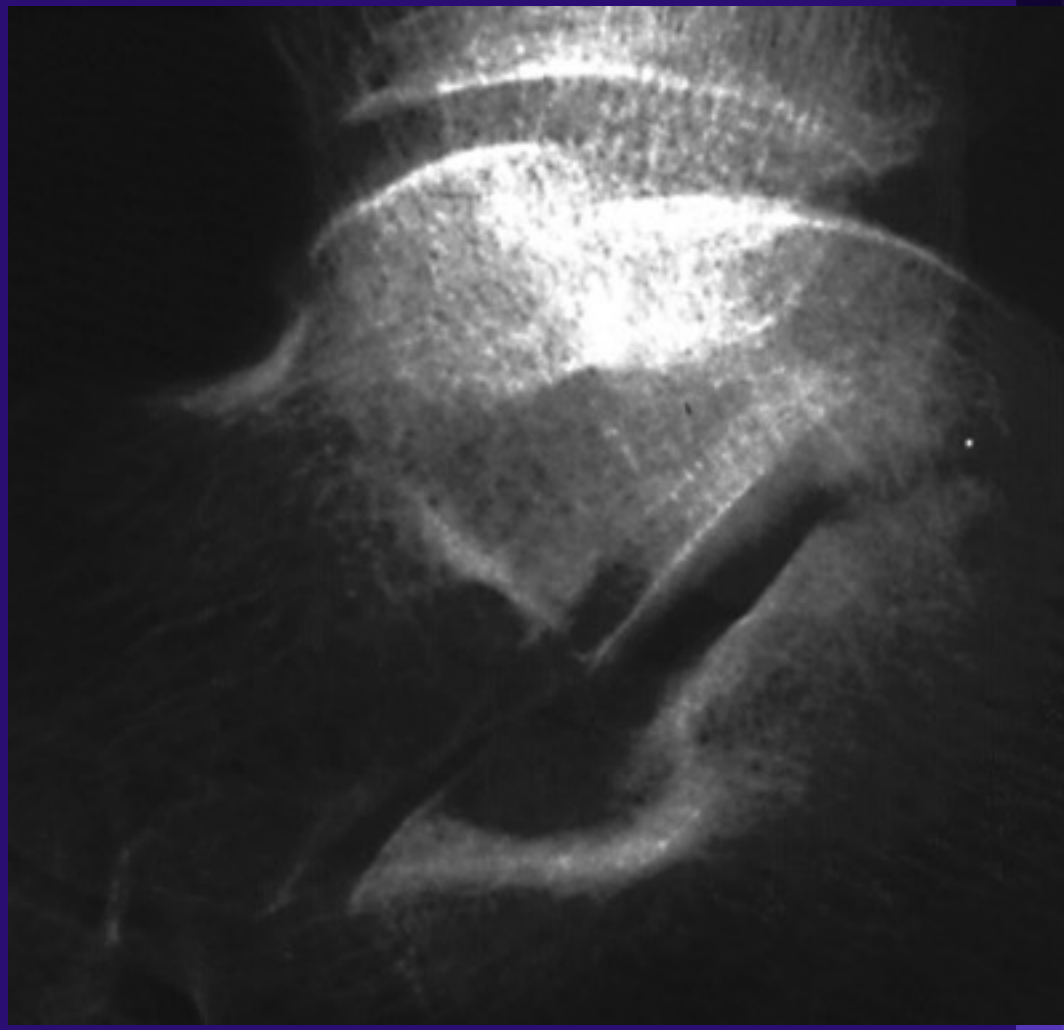

Sc 2
TSE/M
SL 6
H
P
5 cm
RL 13 left

1 Month after Initial presentation



Talar Dome Fracture



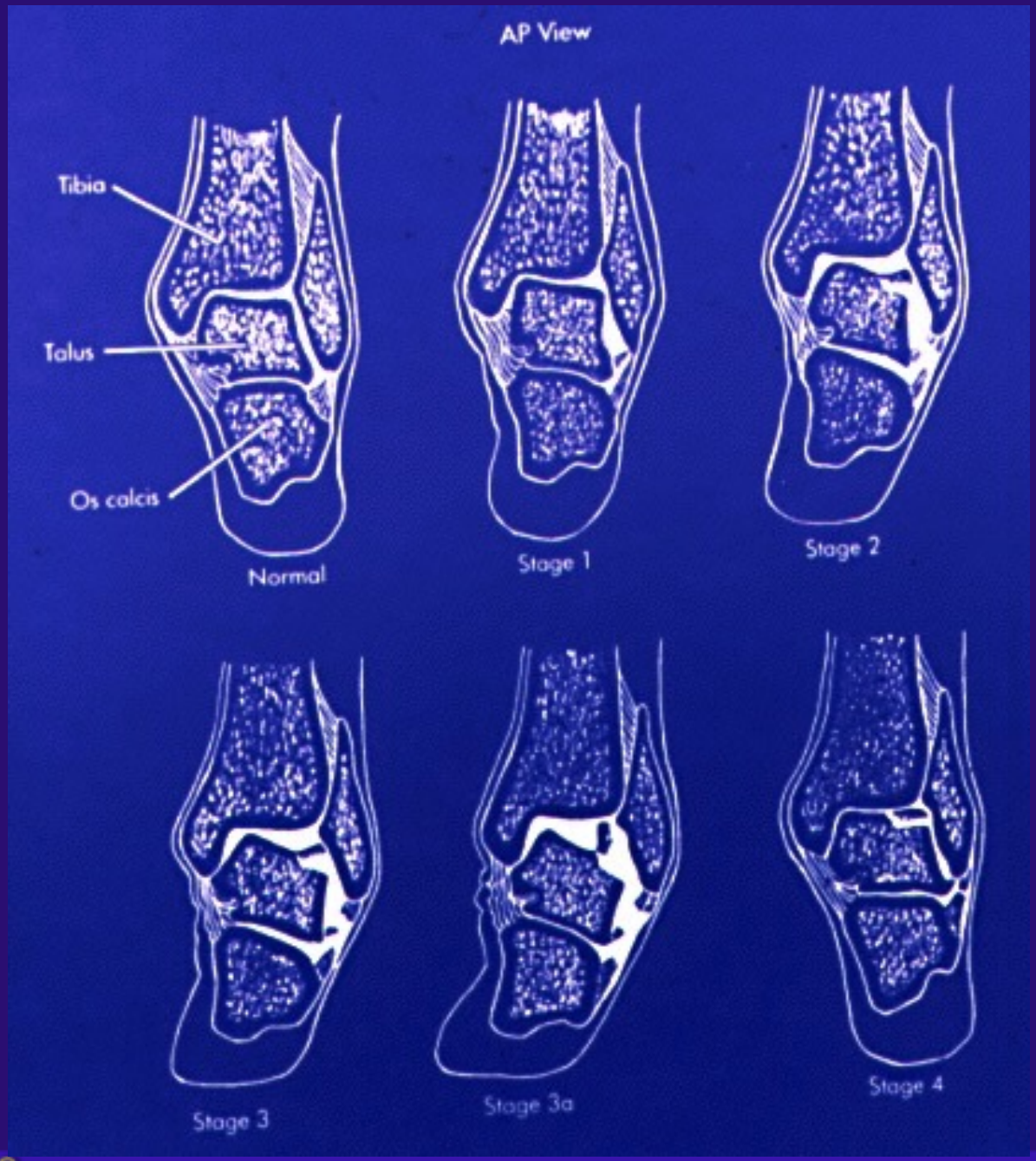


Osteochondral Talar Lesions

- Osteochondritis Dissecans
  - Men 3 : 1 Women
- Medial : Lateral
  - 2 : 1
- Etiologies
  - Trauma
    - Vascular
    - Repetitive Loading

Mechanism of injury of medial border of the dome of the talus.

- Berndt, A.L. and Harty, M.: "Transchondral fractures of the talus" – JBJS 41 –A:988, 1959

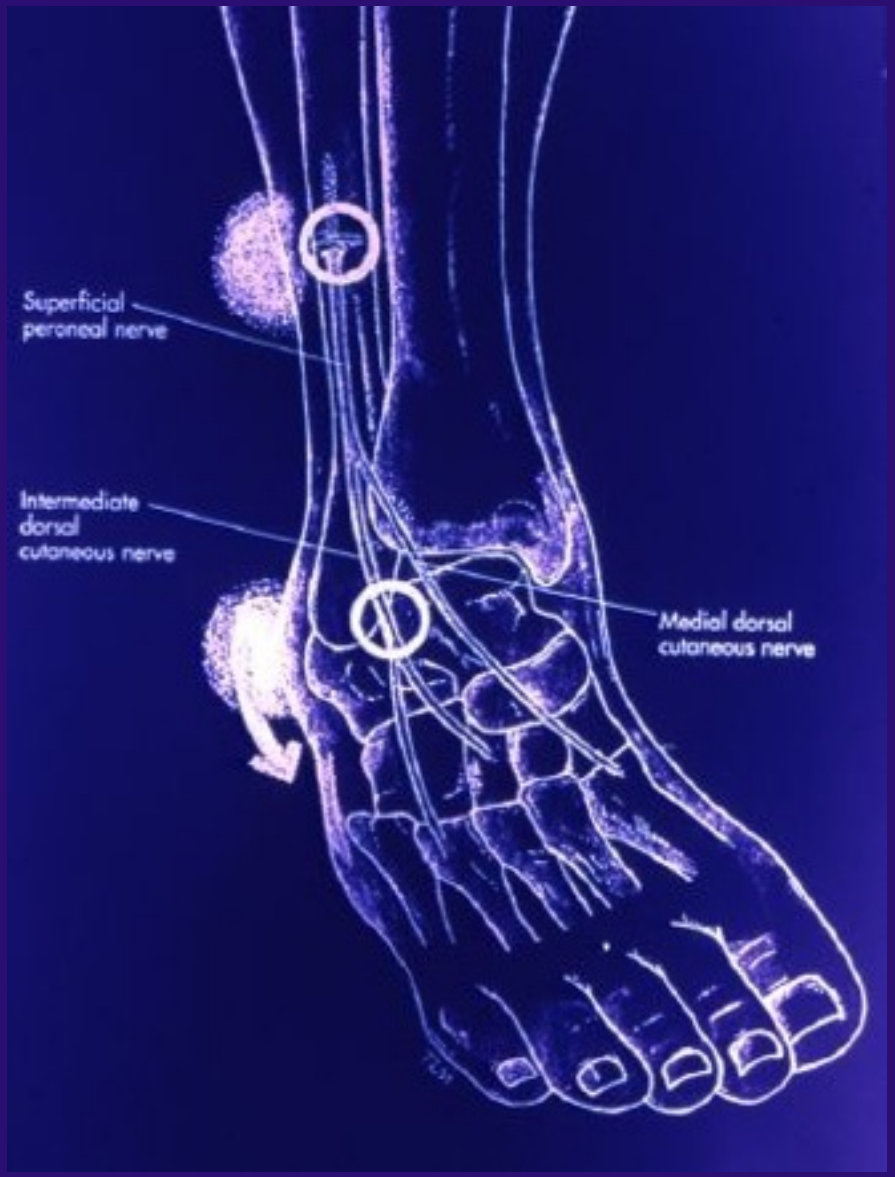

AP View
Tibia
Talus
Os calcis
Normal
Stage 1
Stage 2
Stage 3
Stage 3a
Stage 4

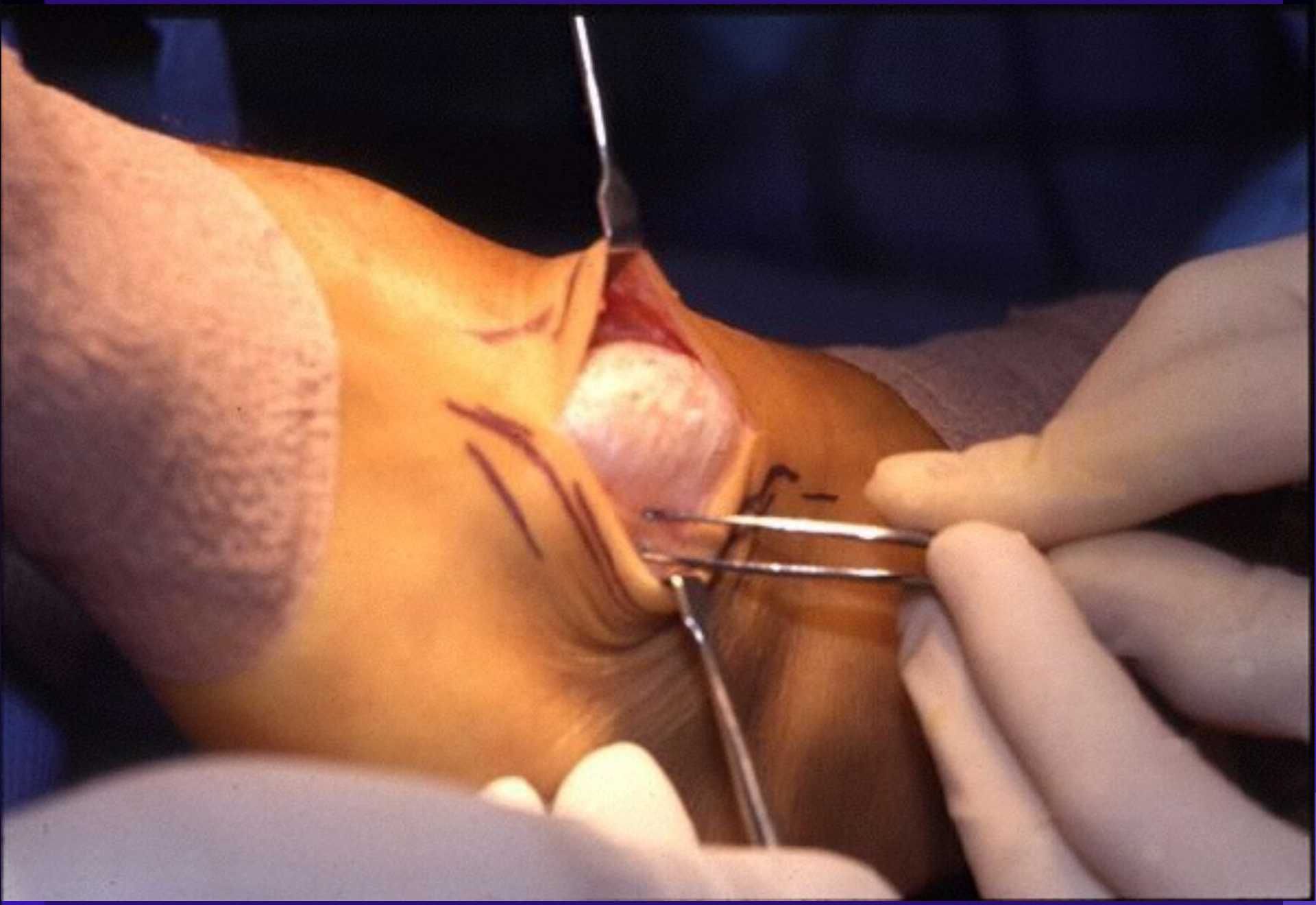


Soft Tissue Lesion Location

- Ankle
  - Anterolateral
    - ATF or CF Sprain
    - Peroneal Tendinitis
  - Posteromedial
    - PT or FHL Tendinitis
    - Deltoid Sprain




Superficial peroneal nerve
Intermediate dorsal cutaneous nerve
Medial dorsal cutaneous nerve





Physical Exam of the Foot and Ankle



Think About Peroneal Tendon Involvement If:

- Recurrent Ankle Complaints
- Sprain Not Getting Better
- Pain, Swelling Higher in Peroneal Tendon Sheath



In Acute Ankle Sprain, Assess Peroneal Function





17 YO WM

High school Baseball/Football Player

C/O Repeated Inversion Ankle Sprains

#13414



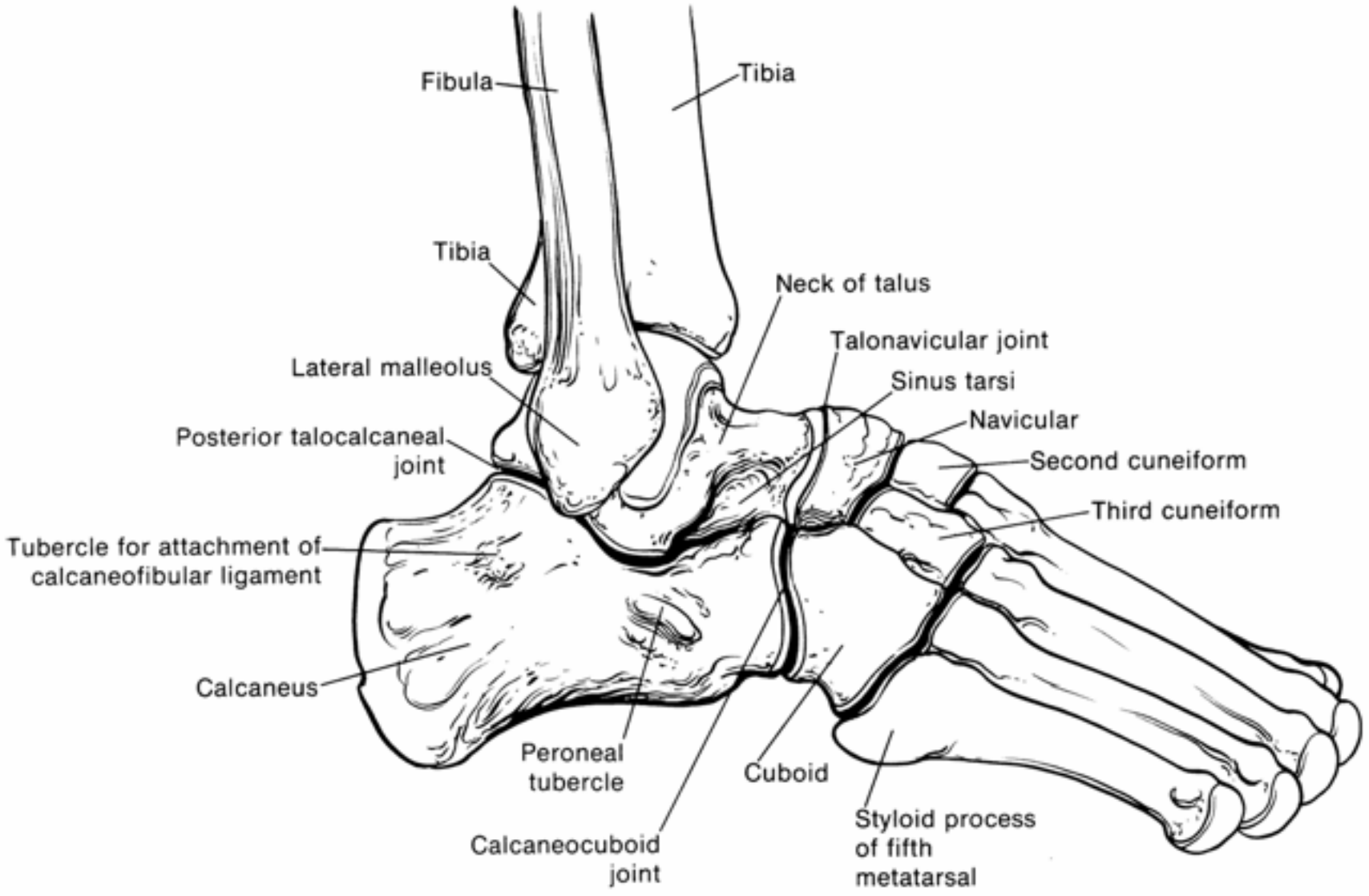


FIG. 11-61. Osteology of the lateral side of the foot and ankle.

Physical Exam of the Foot and Ankle



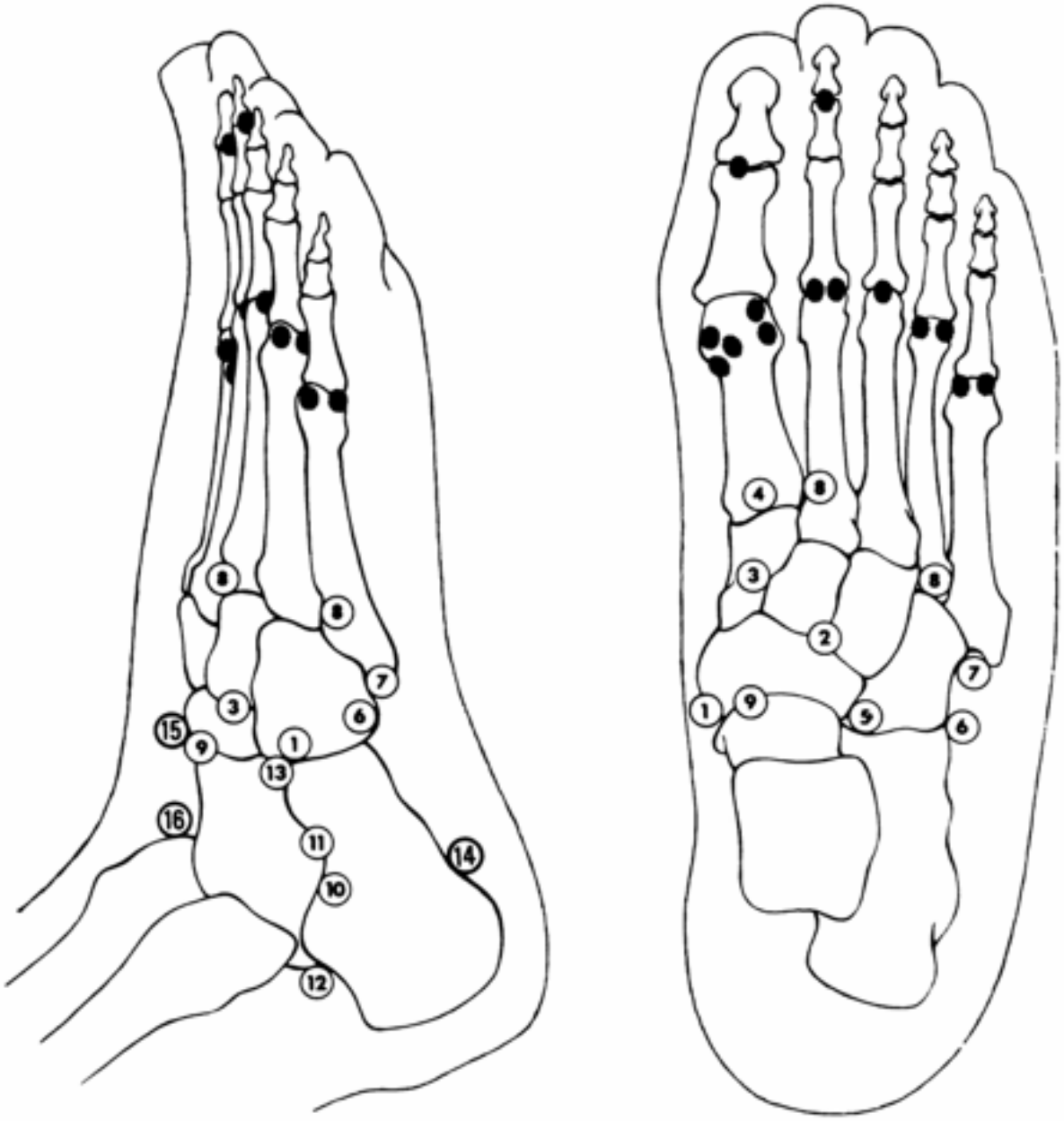


Fig. 19-25. Lateral (*left*) and anteroposterior (*right*) drawings of the foot indicating the location of the commonly found accessory bones (*circles with numbers*) and forefoot sesamoids (*shaded circles*). (1) Os tibiale externum, (2) processus uncinatus, (3) os intercuneiforme, (4) pars peronea metatarsalia 1, (5) cuboides secundarium, (6) os peroneum, (7) os vesalianum, (8) os intermetatarseum, (9) os supratalare, (10) talus accessories, (11) os sustentaculum, (12) os trigonum, (13) calcaneus secundarium, (14) os subcalcis, (15) os supranaviculare, (16) os talotibiale. (Keats, T. E., An Atlas of Normal Roentgen Variants That May Simulate Disease, 2nd ed., p. 371. Chicago, Year Book Medical Publishers, 1979.)





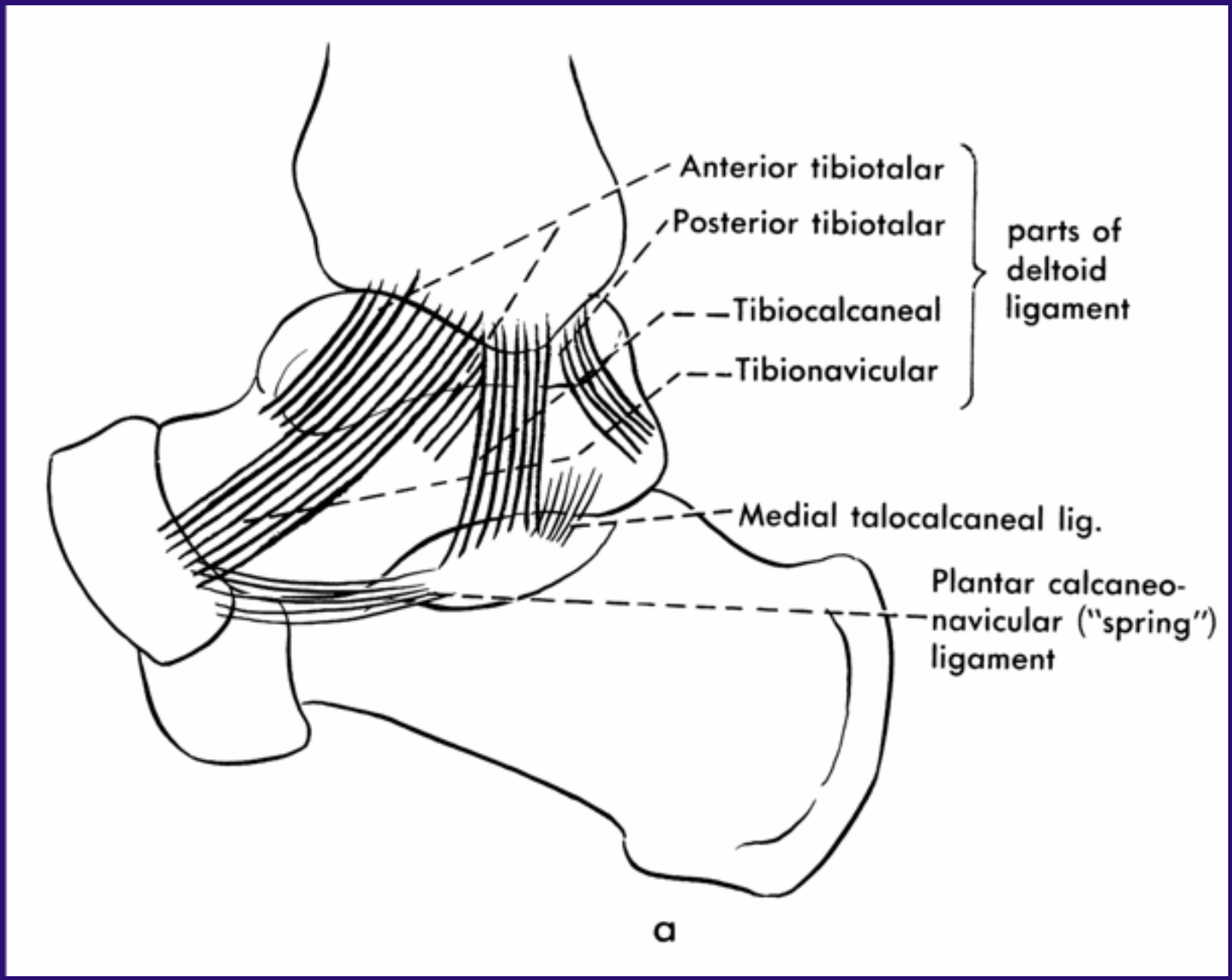
19 YO basketball player Os vesalianum bilateral feet.

Os peroneum



MEDIAL ANKLE PAIN

- Differential Diagnosis
  - Deltoid Sprain
  - Medial Malleolus Fracture
  - Tendinitis
    - Posterior Tibialis
    - Flexor Hallucis Longus
  - Osteochondral
  - Talus Fracture
  - Osteochondritis Dissecans


Anterior tibiotalar
Posterior tibiotalar
Tibiocalcaneal
Tibionavicular
parts of deltoid ligament
Medial talocalcaneal lig.
Plantar calcaneo-navicular ("spring") ligament
a

Posterior Tibial Tendon Dysfunction

Stages	I	II	III
Tendon Length	Normal	Elongated	Elongated
Hindfoot	Normal	Mobile Min. Valgus	Fixed Valgus
Deformity	None	Mild	Mod – Severe
Treatment	Non-Op	Transfer	Subtalar
Op	Synovectomy	FDL	Arthrodesis

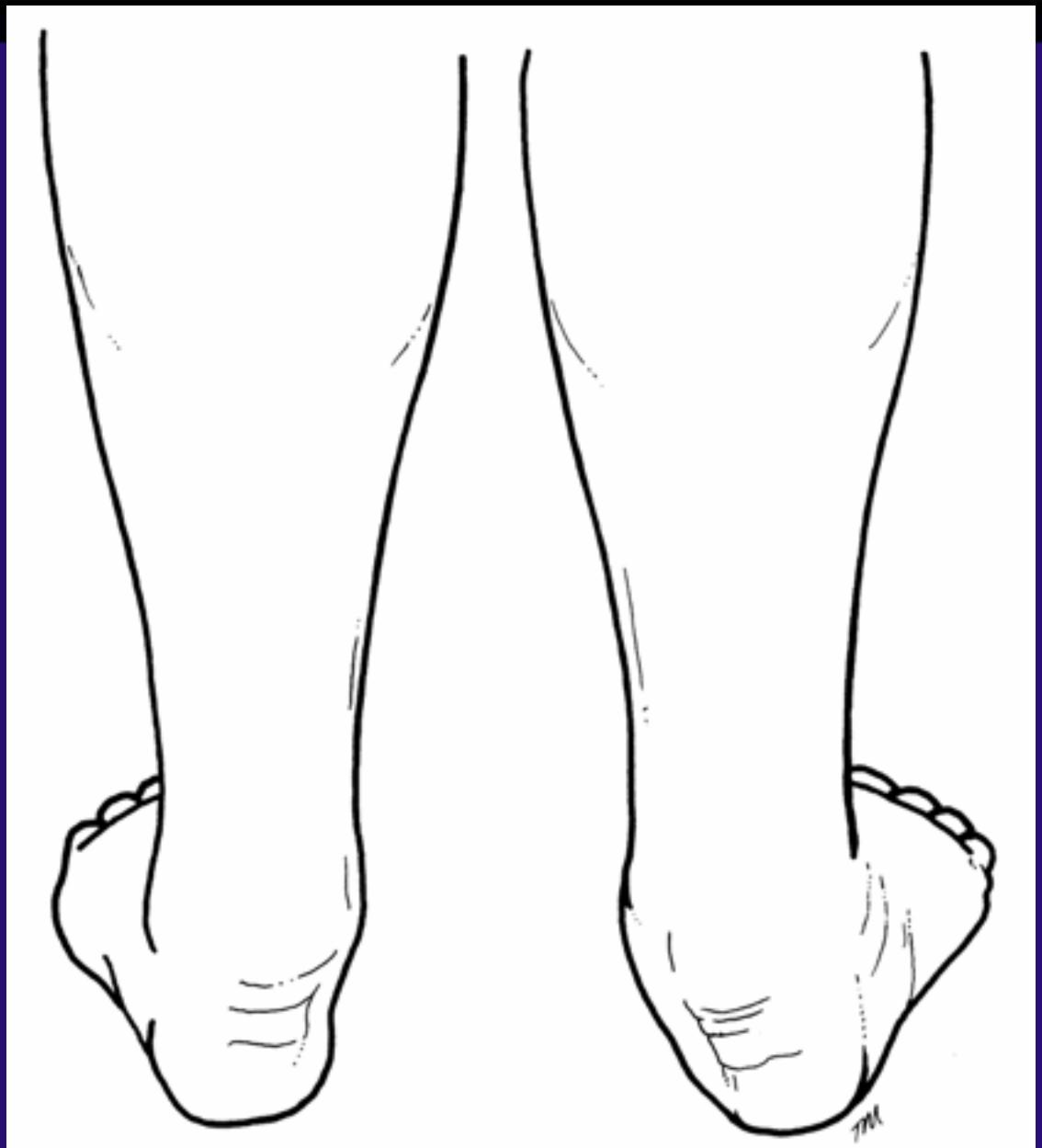
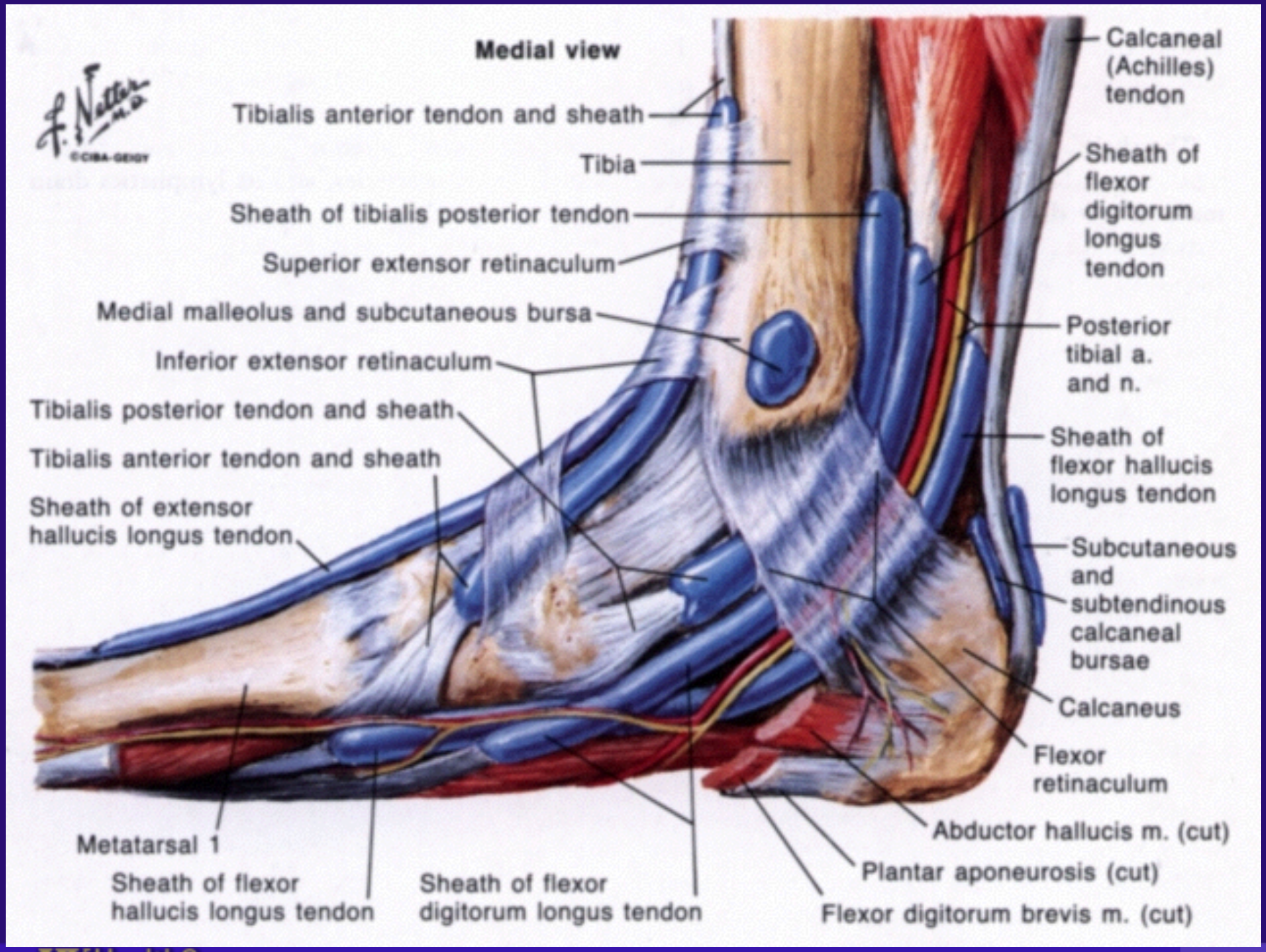


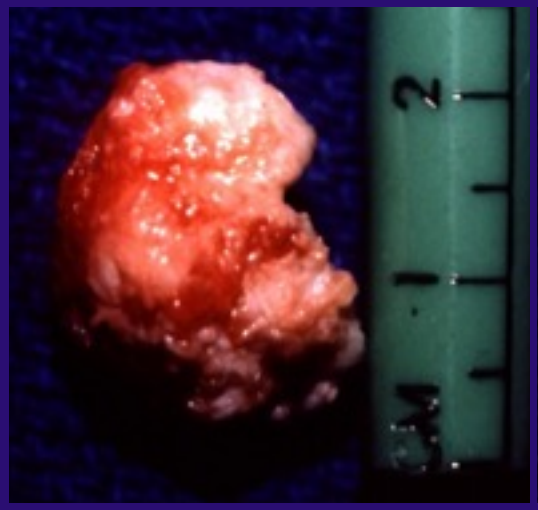
Fig. 4-2. "Too-many-toes" sign signifying lateral forefoot rotation. Two and one-half toes seen on the left foot, four toes on the abnormal right foot.

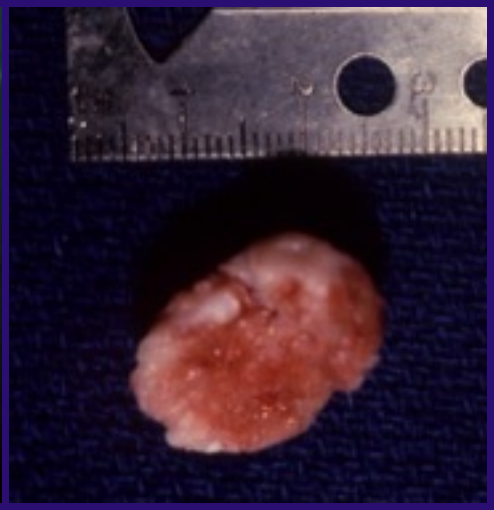
UKHealthCare

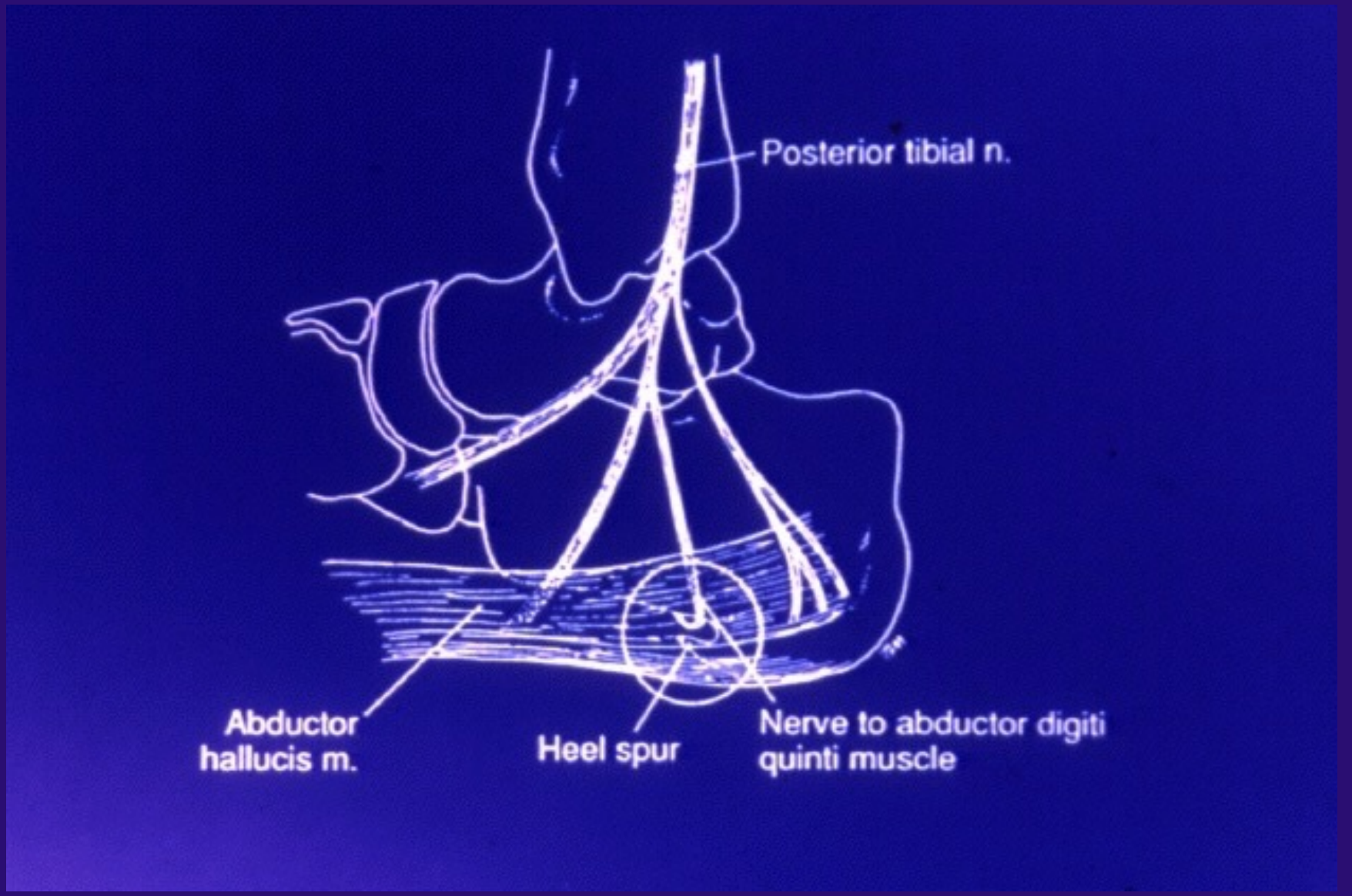

Medial view
F. Netter M.D.
©CIBA-GEIGY
Tibialis anterior tendon and sheath
Tibia
Sheath of tibialis posterior tendon
Superior extensor retinaculum
Medial malleolus and subcutaneous bursa
Inferior extensor retinaculum
Tibialis posterior tendon and sheath
Tibialis anterior tendon and sheath
Sheath of extensor hallucis longus tendon
Calcaneal (Achilles) tendon
Sheath of flexor digitorum longus tendon
Posterior tibial a. and n.
Sheath of flexor hallucis longus tendon
Subcutaneous and subtendinous calcaneal bursae
Calcaneus
Flexor retinaculum
Abductor hallucis m. (cut)
Plantar aponeurosis (cut)
Flexor digitorum brevis m. (cut)
Metatarsal 1
Sheath of flexor hallucis longus tendon
Sheath of flexor digitorum longus tendon










Posterior tibial n.
Abductor hallucis m.
Heel spur
Nerve to abductor digiti quinti muscle

18 YO Freshman
Div. I basketball athlete

- C/O mid-foot pain, L > R
- Started when she was running, playing in shoes mandated by her school
- History of “normal” periods

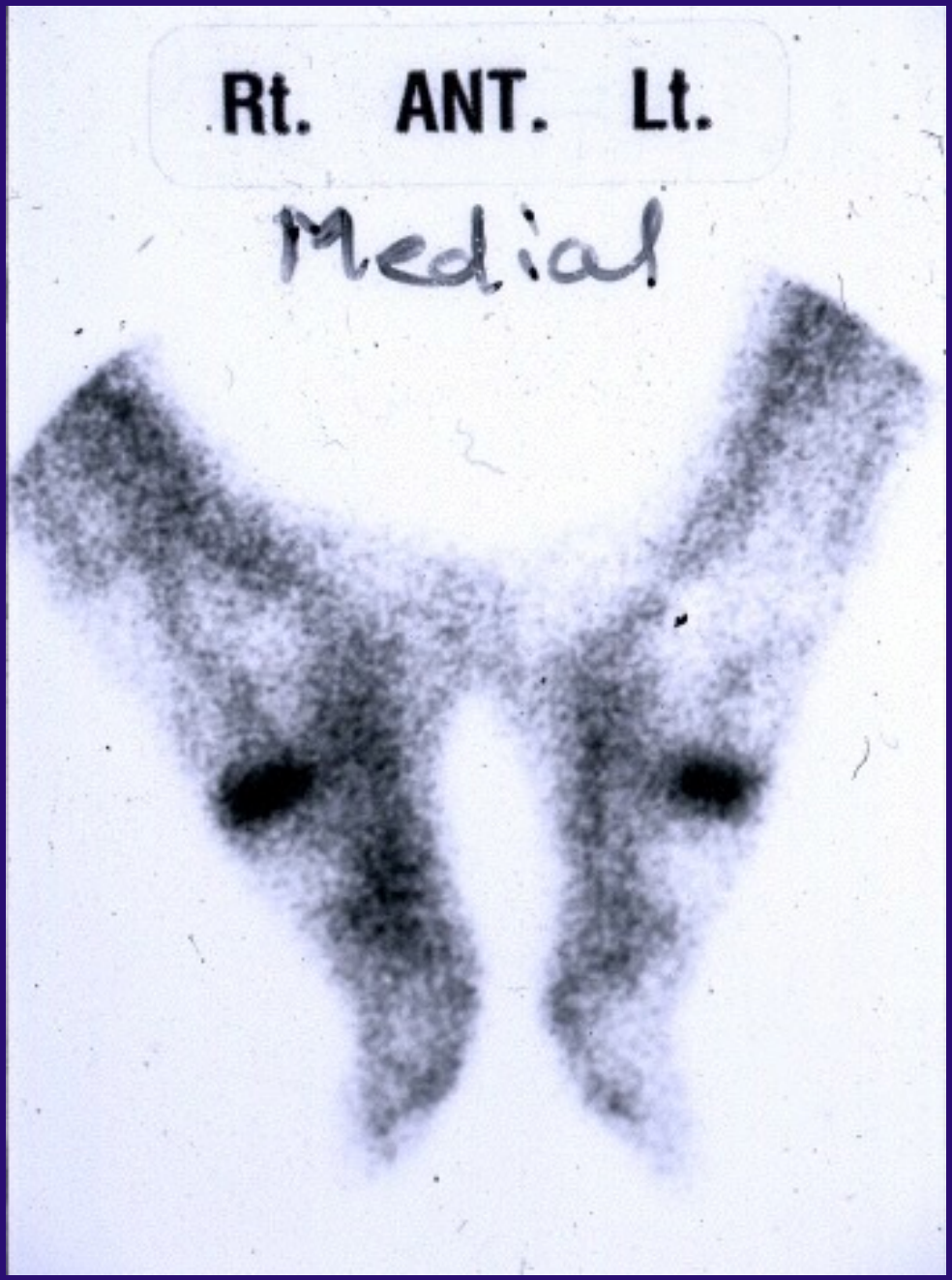
Navicular

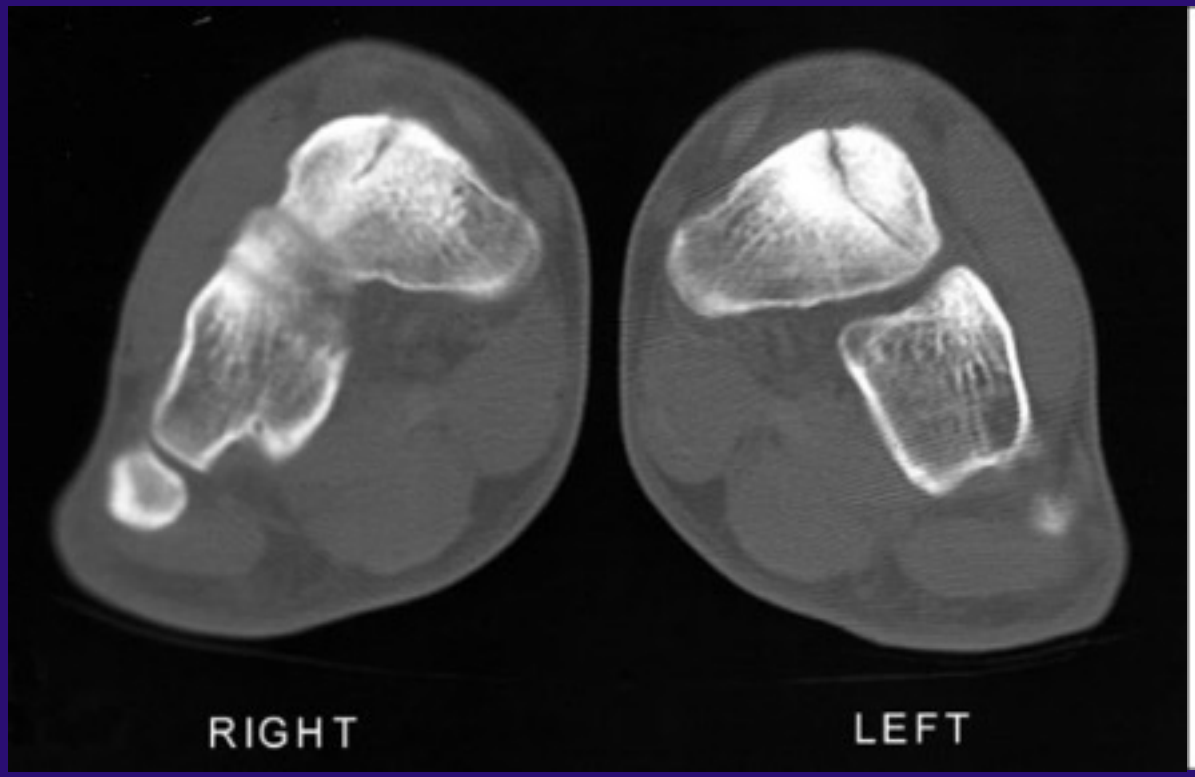
- Initial x-rays

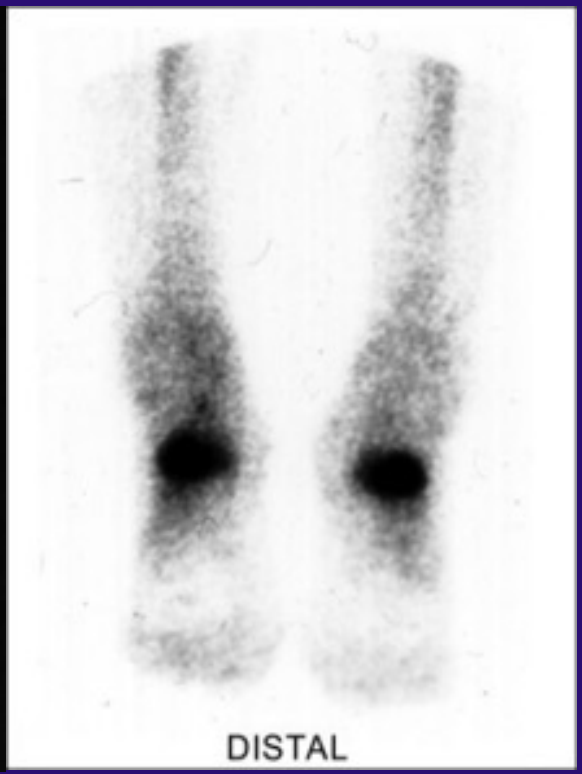


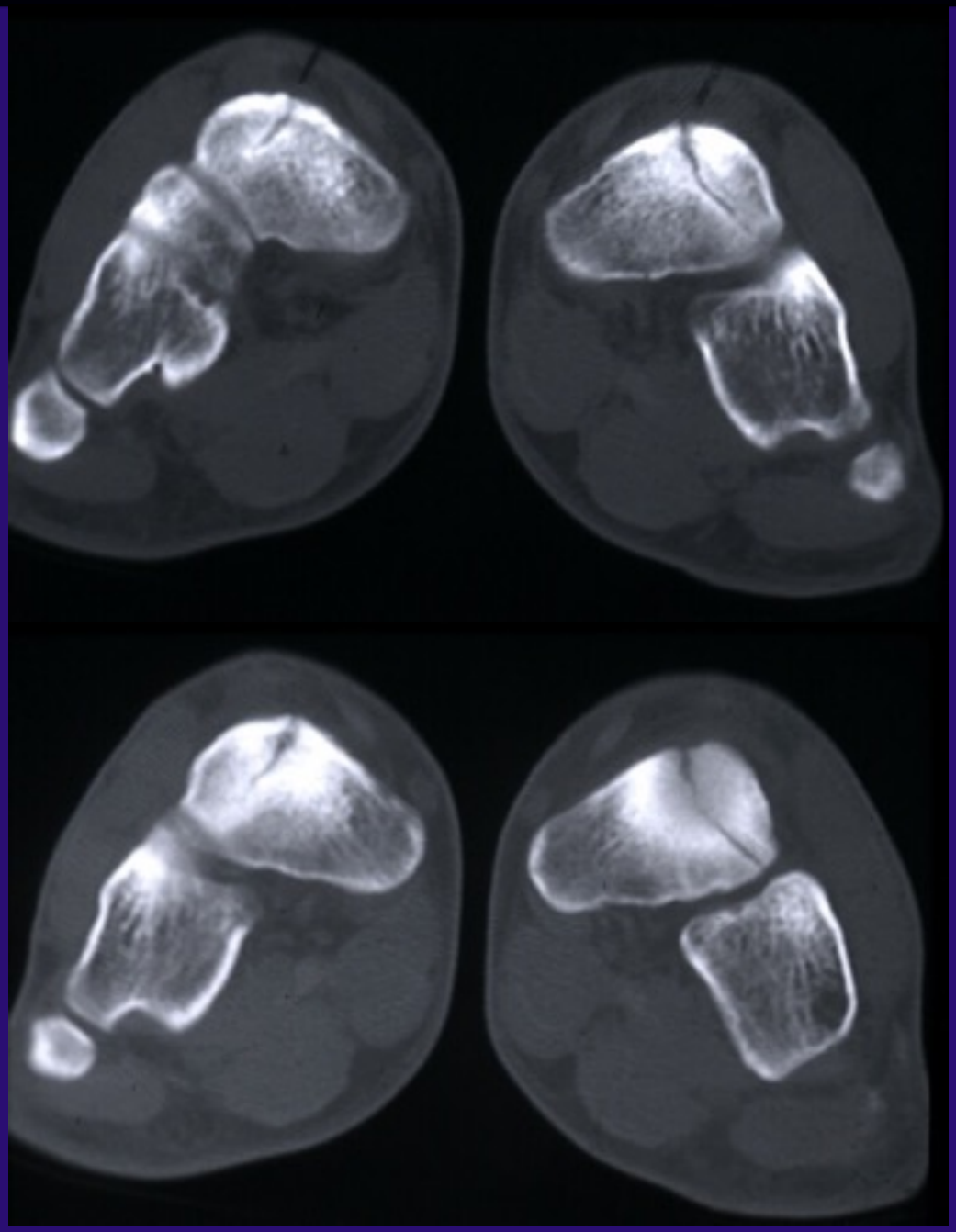





Rt. ANT. Lt.
Medial


RIGHT
LEFT


DISTAL

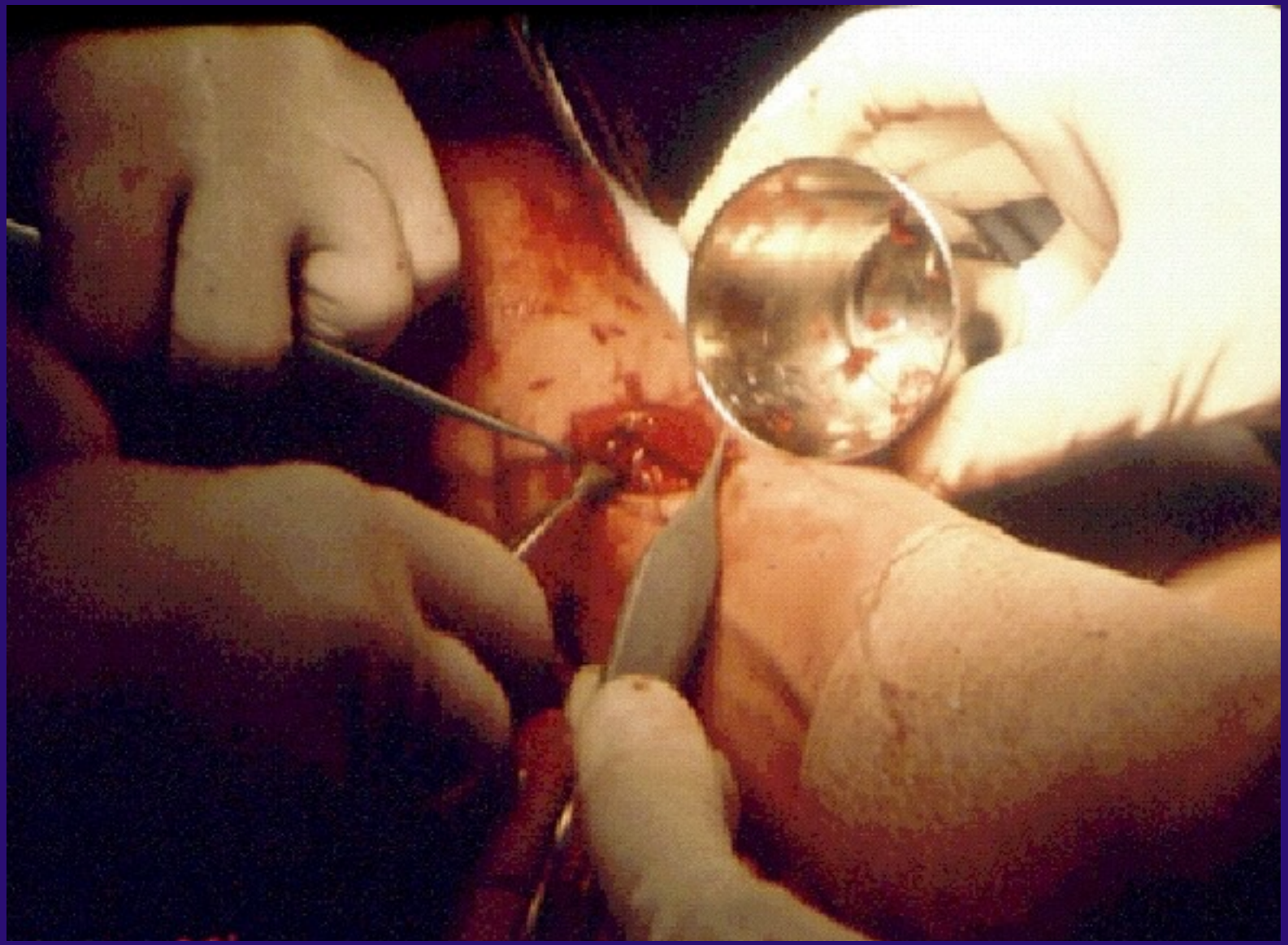


Right

Left

Navicular view
30º ER
Torg described





POSTERIOR ANKLE PAIN

- Differential Diagnosis
  - FHL Tendinitis
    - Posterior Process Talus Fracture (Shepherds 1982)
  - Posterior Impingement
    - Os Trigonum
  - Achilles Tendon
    - Overuse
    - Tear, partial vs. complete

Bony Impingement of the Ankle

MOTION	CONTACT AREAS	
Dorsiflexion	Anteromedial	Talus Tibial
Plantar Flexion	Posterolateral	Tibia Os Calcis

From William G. Hamilton: "Impingement Syndromes" p. 39, *The Foot and Ankle in Sport* 1995, ed. By Donald E. Baxter, M.D.

Anterior Tibiotalar Impingement Syndrome

"Footballers" Ankle

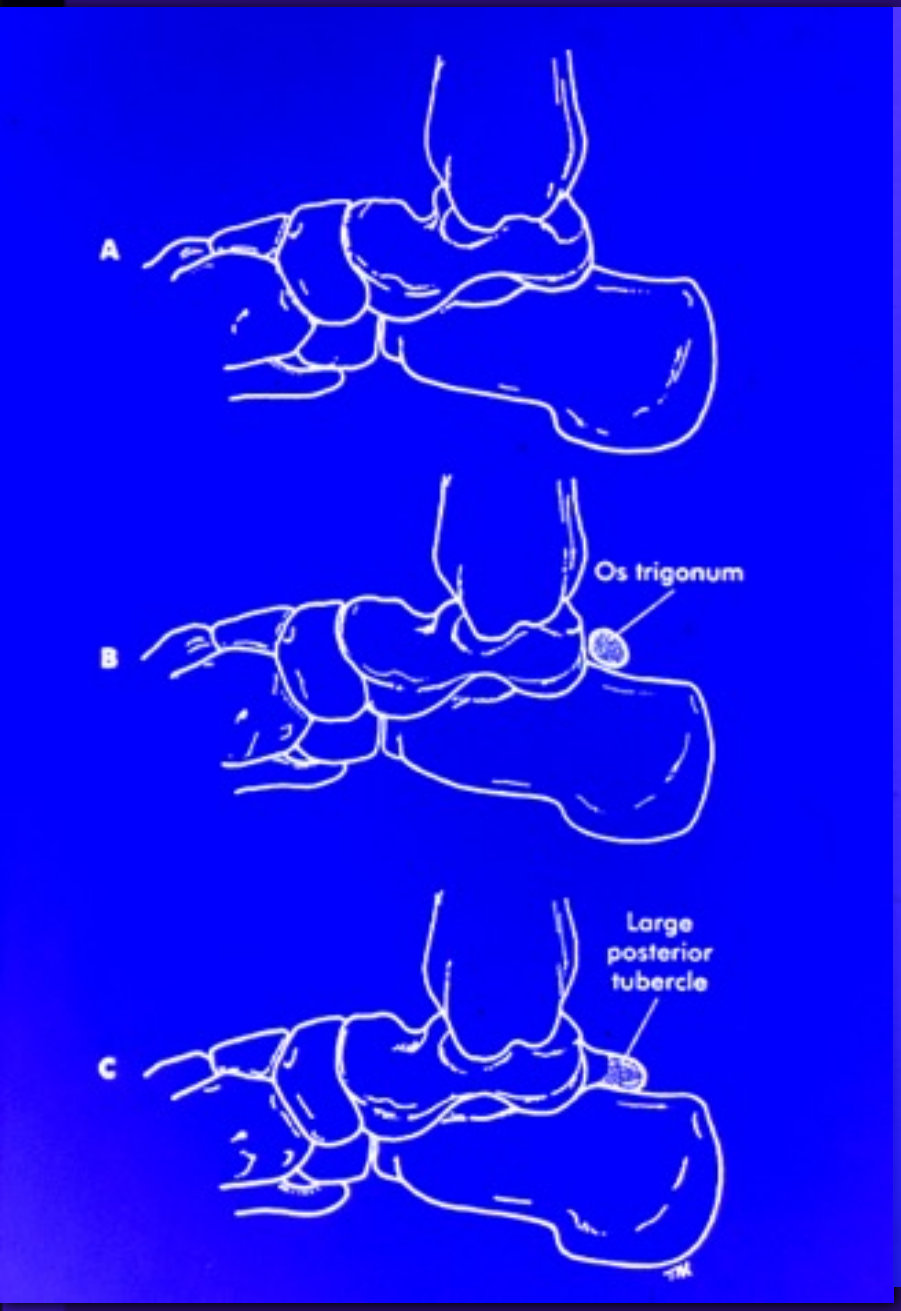


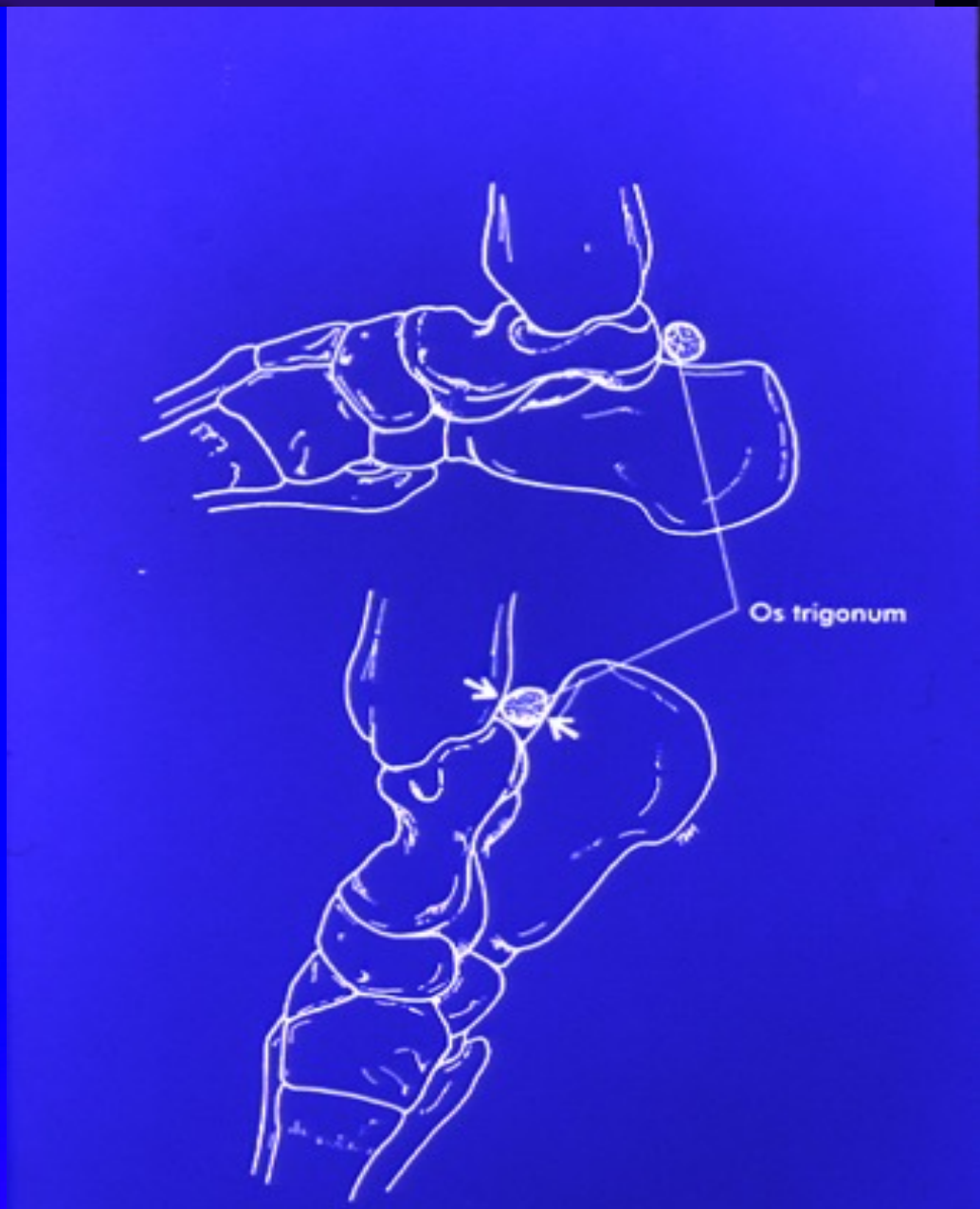
- McMurray, TT: Footballers Ankle, JBJS, 323:68, 1950

FHL Tendinitis

- "Dancers" Tendinitis




A
B
Os trigonum
C
Large posterior tubercle


Os trigonum

Witherspoon MOI



Thompson Test



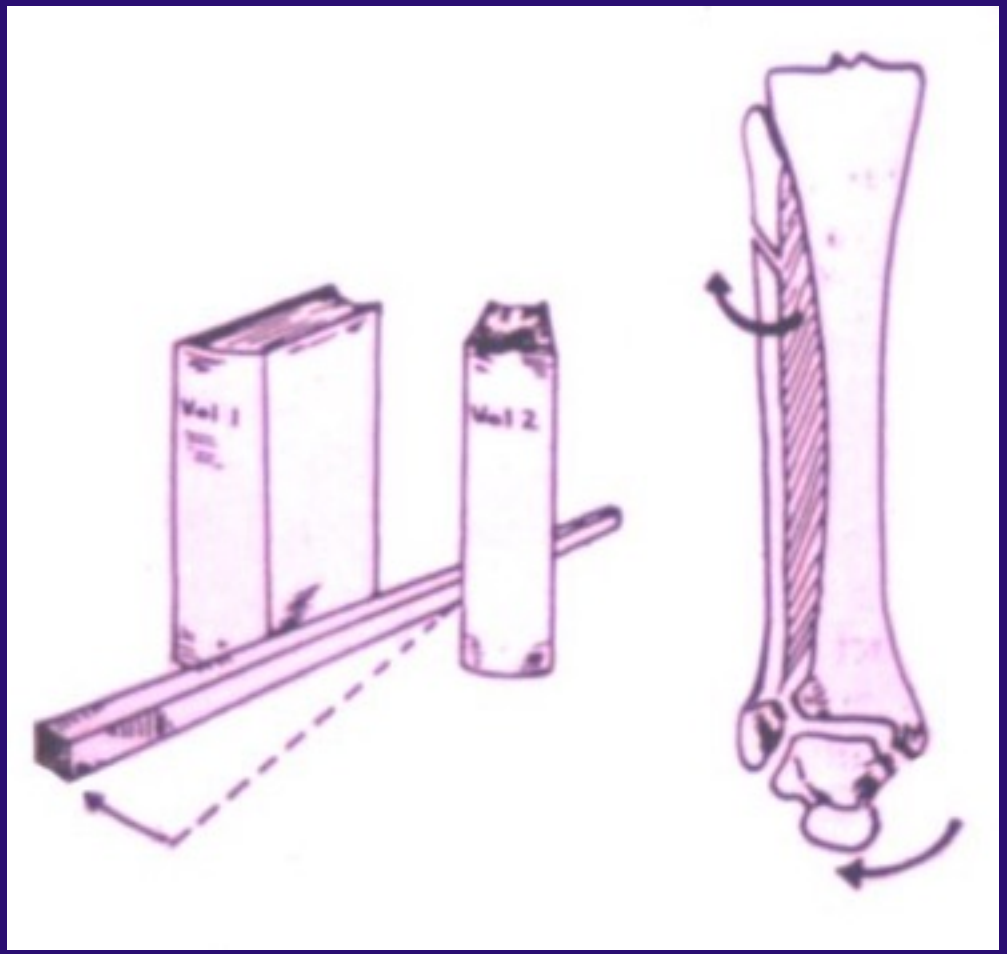
Achilles Tendon



Ankle Fracture Dislocations



Fractures





Maisonneuve Fracture

Figure 4—*The mechanism of the supination-internal rotation injury to the ankle.*

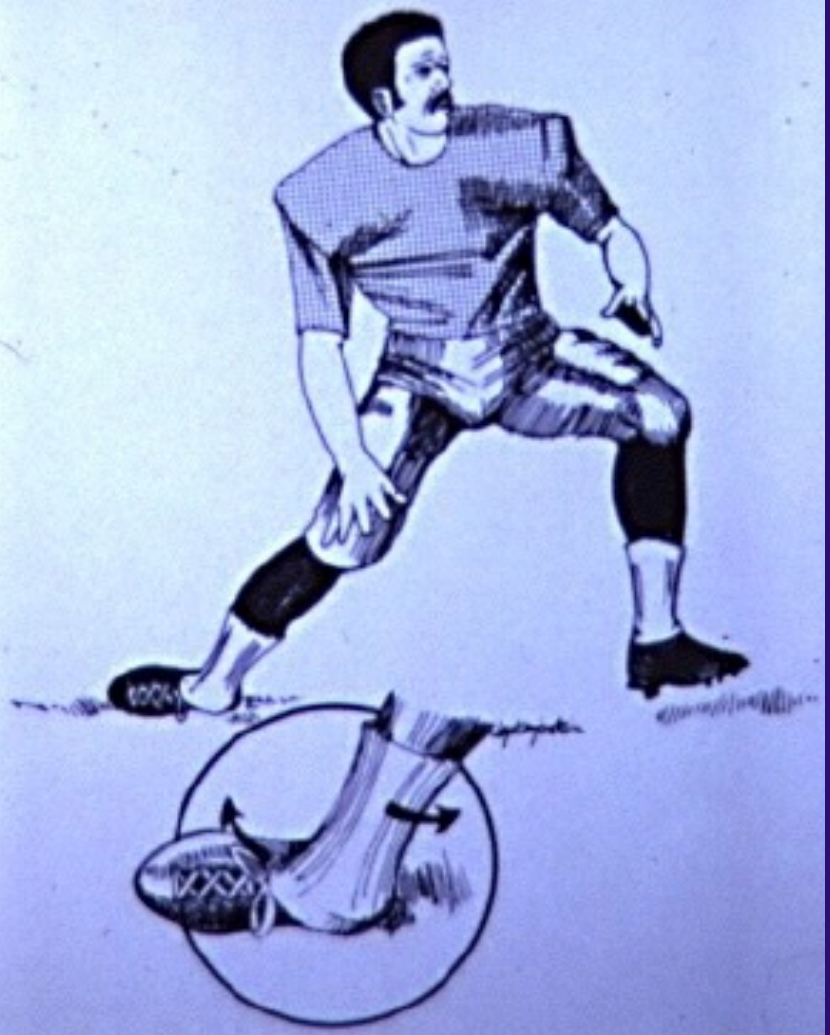
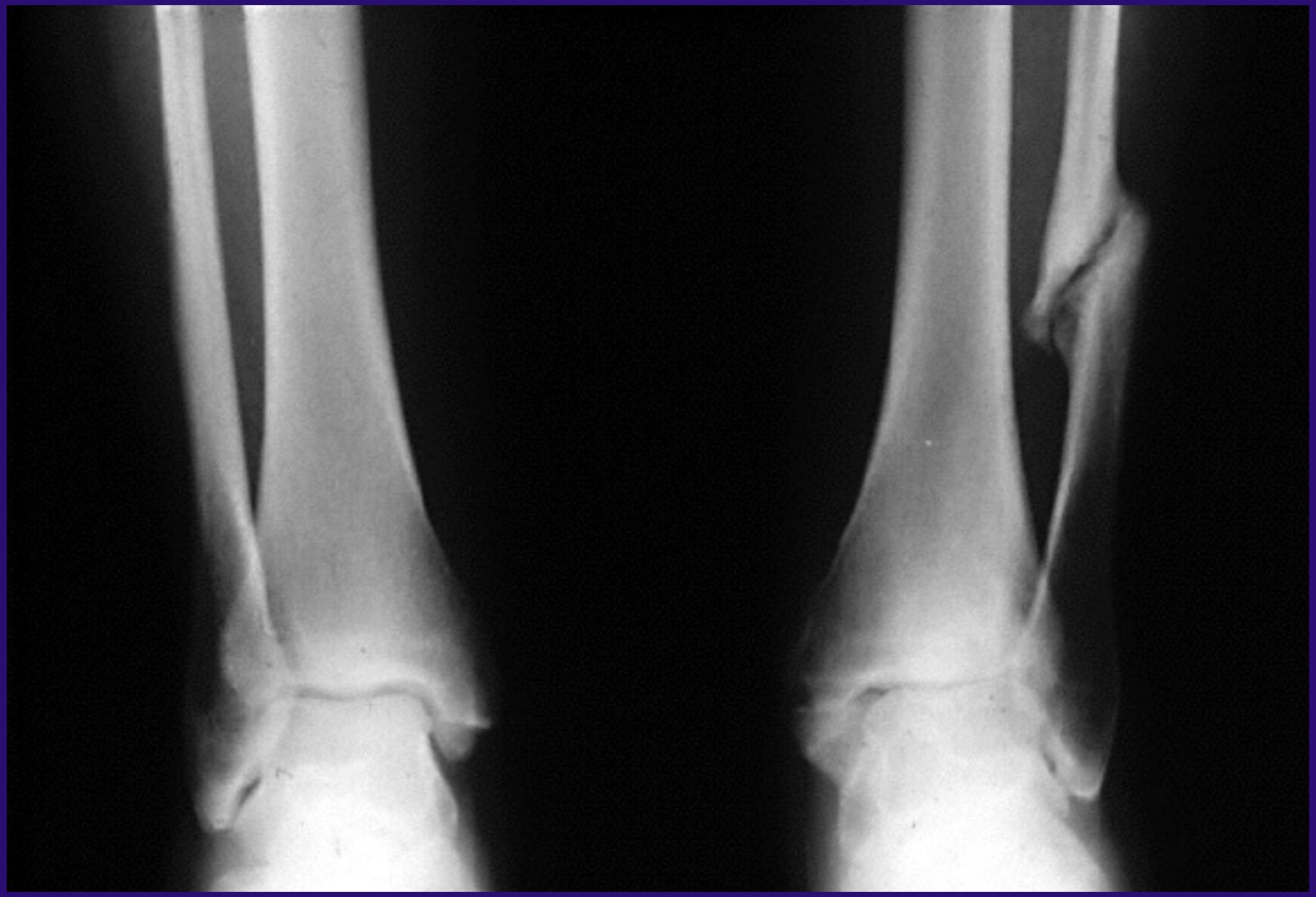


Figure 5—*The mechanism of the pronation exiernal rotation injury to the ankle*







Non-treated Maisonneuve fracture rapid progression DJD non-union fibula





Stress views external rotation and eversion





Fracture blisters
Leave alone. Do not
lance unless they





Football athlete:
Twists ankle on Astroturf




© 1995 Ky Sports Medicine





Fractures Dislocation

- Subtalar Dislocation
- Closed Reduction



Radiographs

- Out of Splint
- Include Obliques
- R/O Small Avulsion Fractures





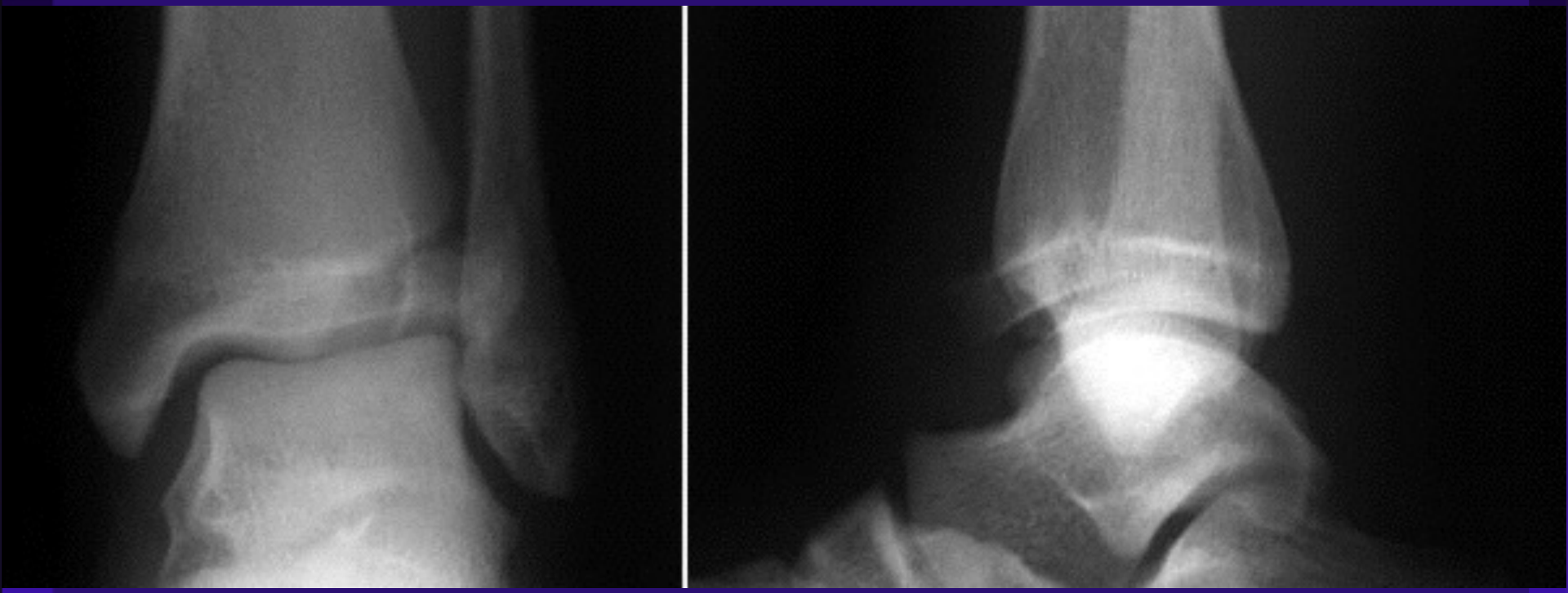


14 YO Male

- Left ankle
- Tillaux fracture with displacement

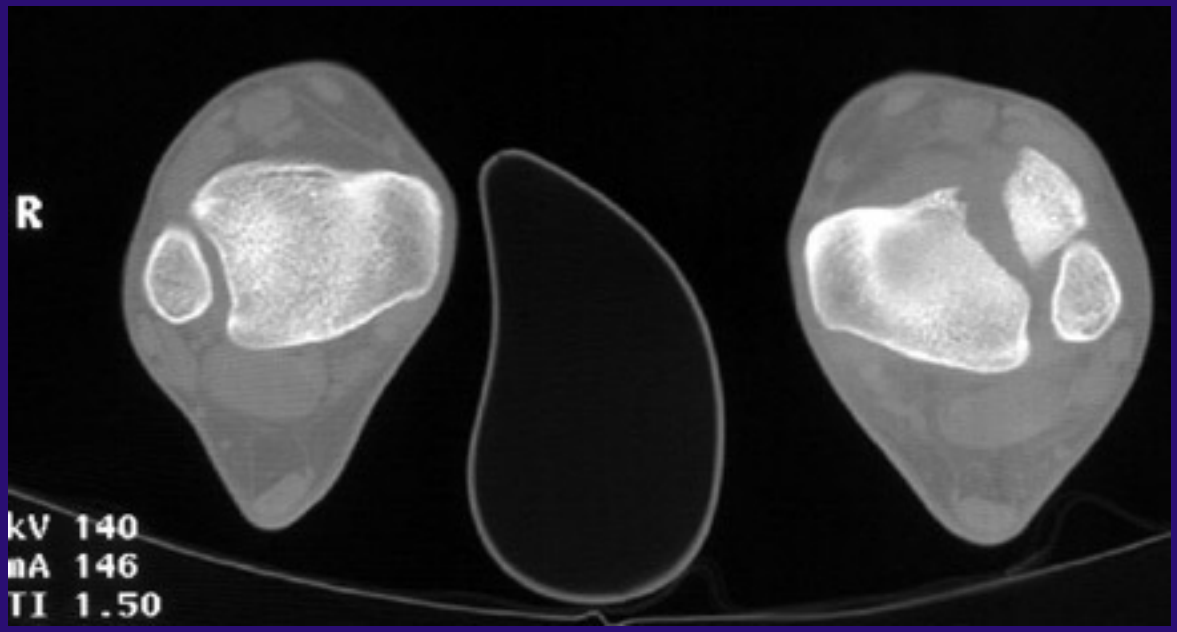






CT Scan



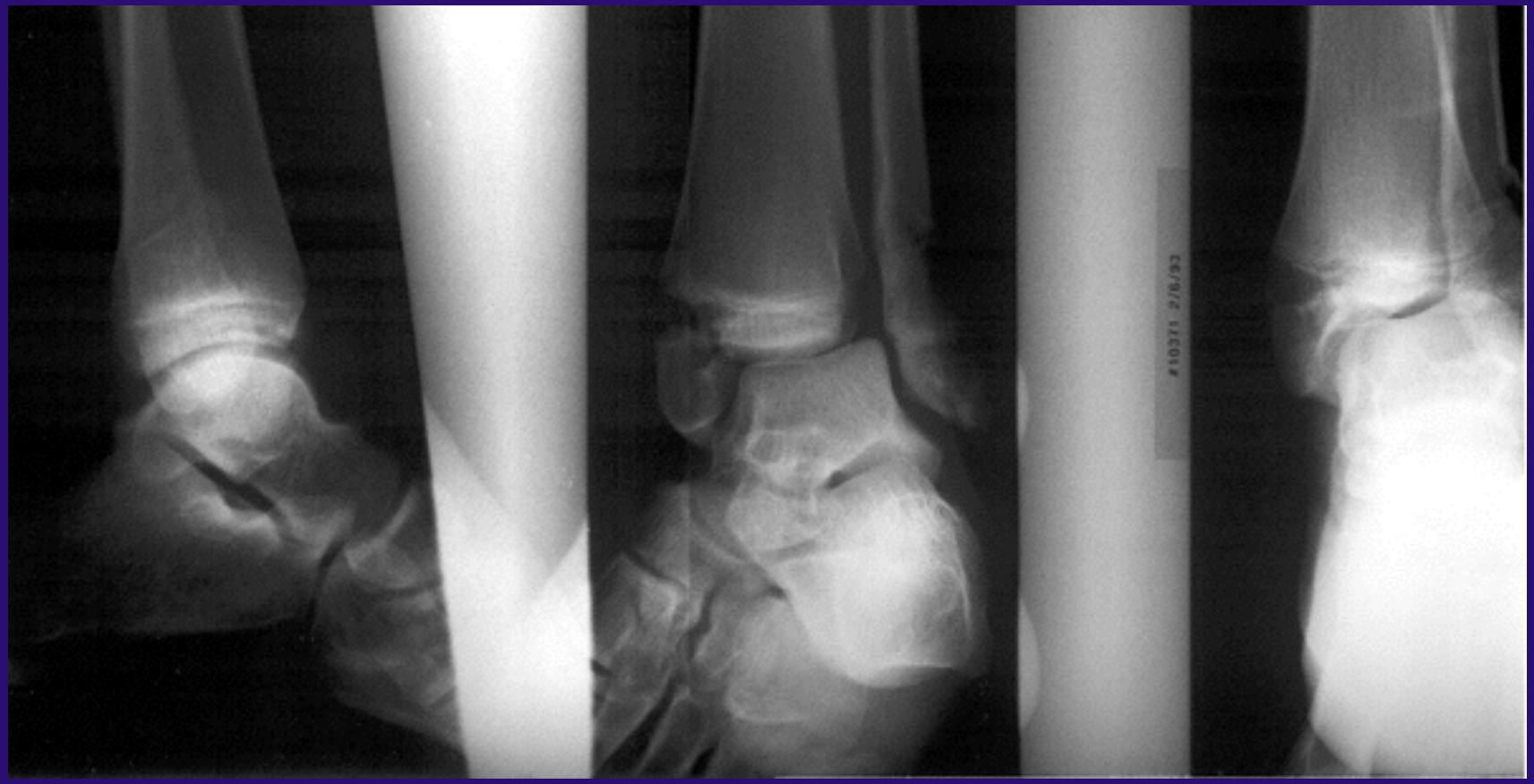


16 YO WM Basketball Athlete

- Injury: Left Ankle
- 8 months prior to KSM visit
- Continued ankle pain and swelling

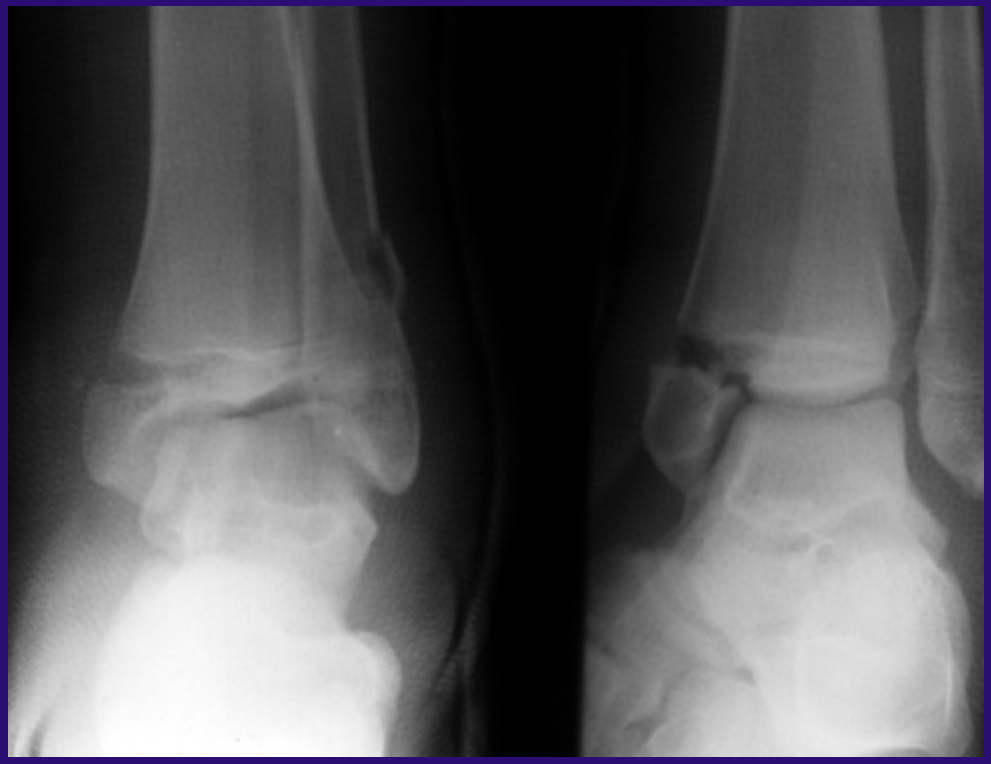


Radiographs in ER post injury



Casted for 3 months

2 weeks post injury





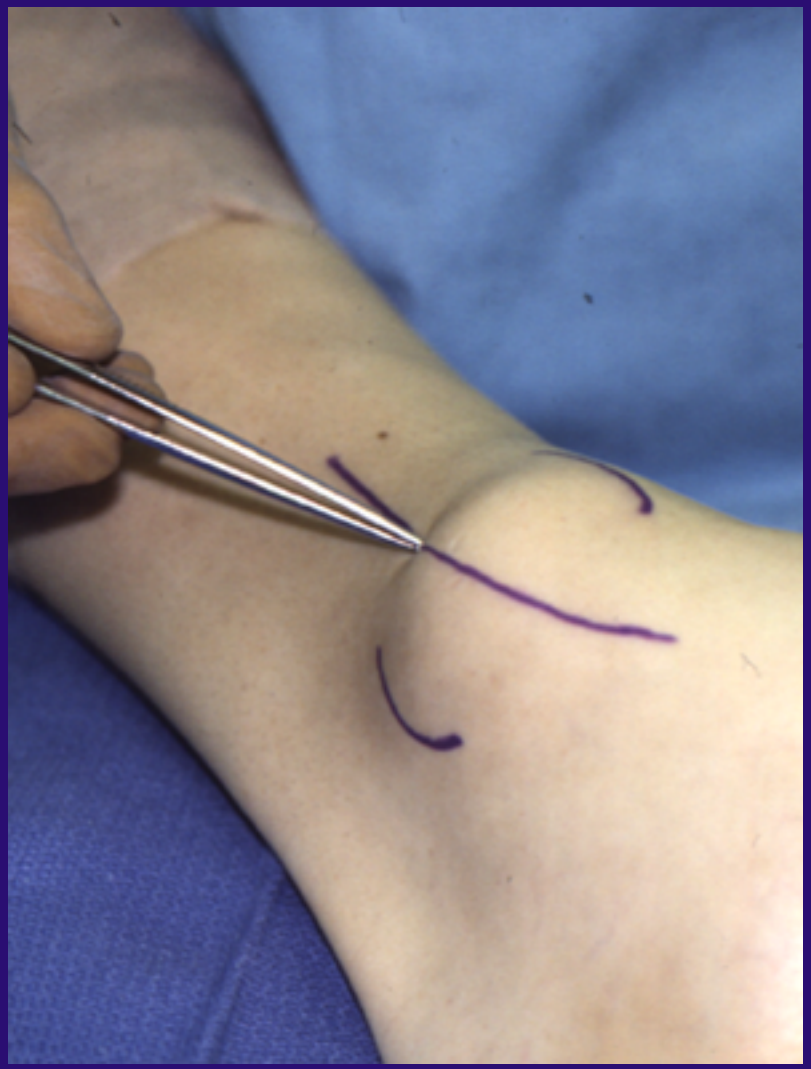
2 months post injury

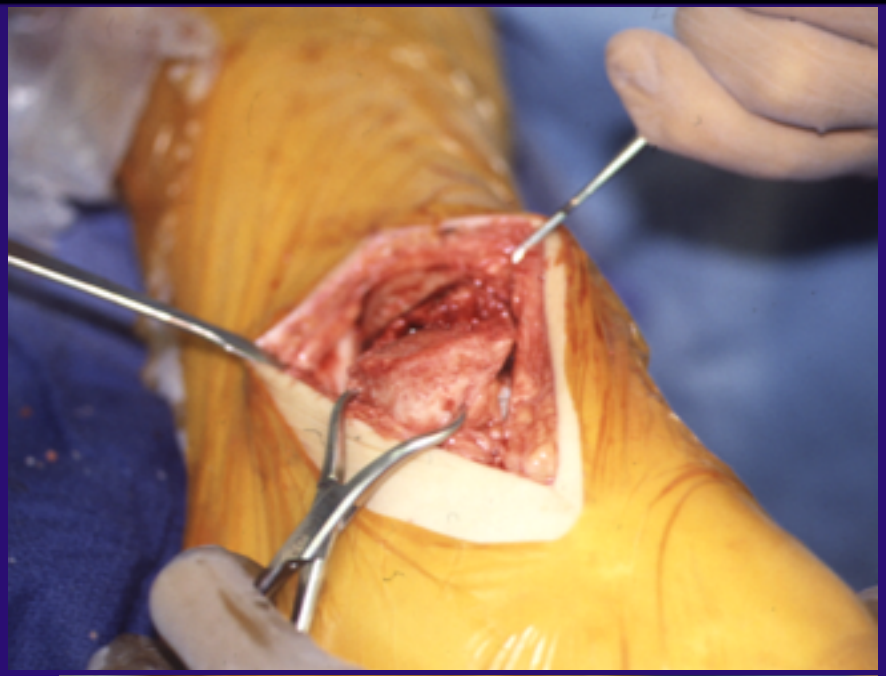
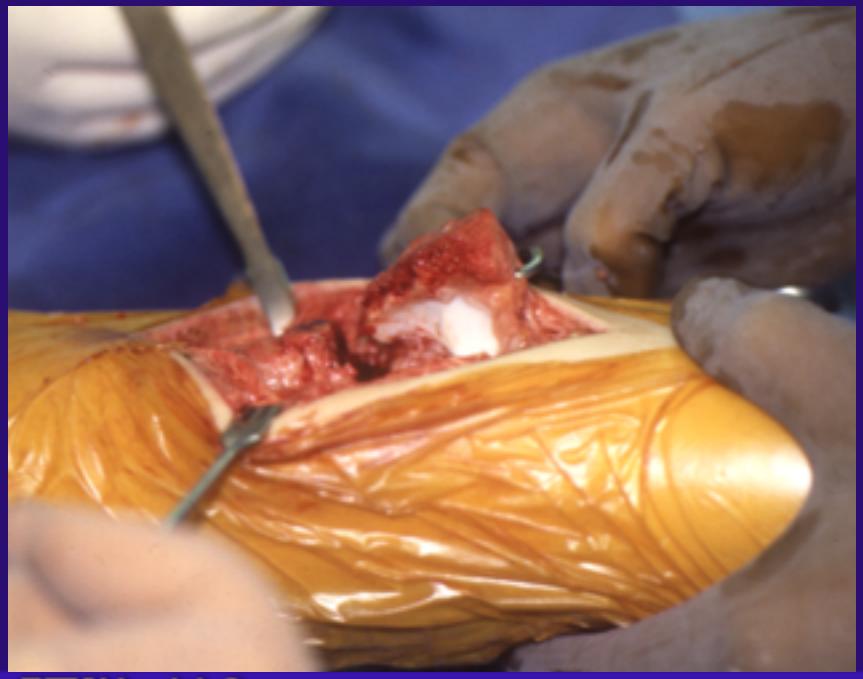
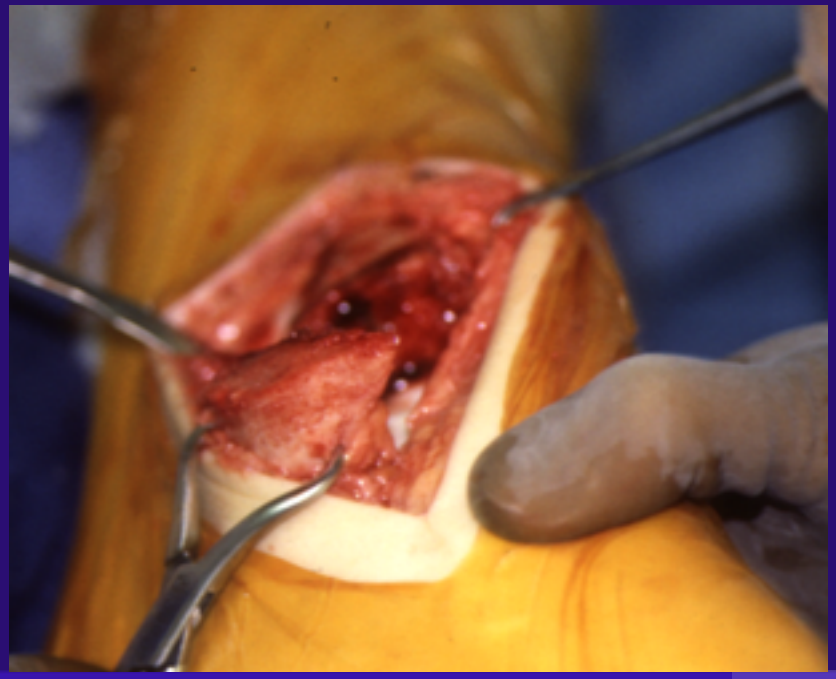


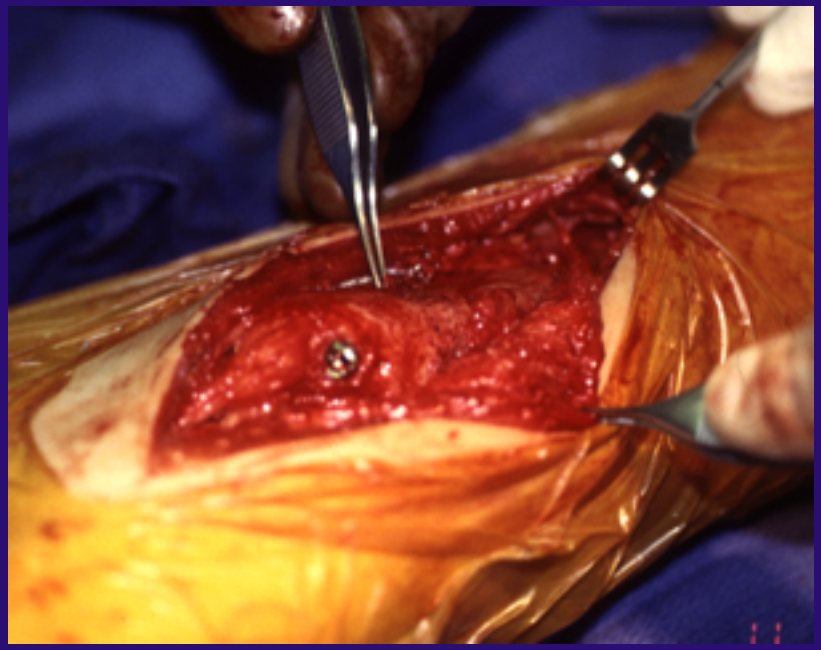


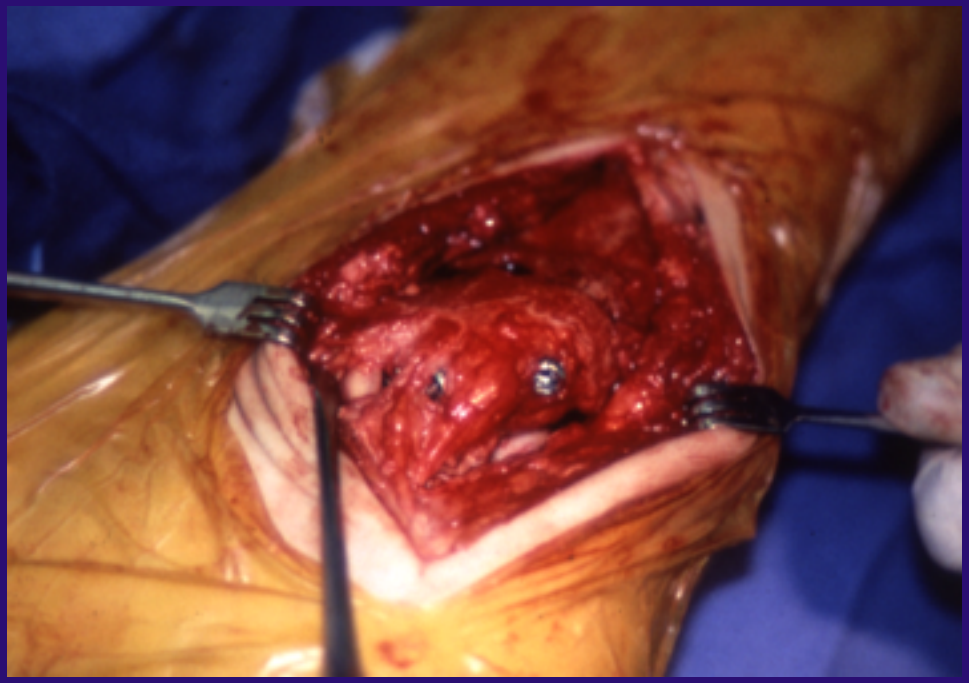
Surgery – 9 months post injury



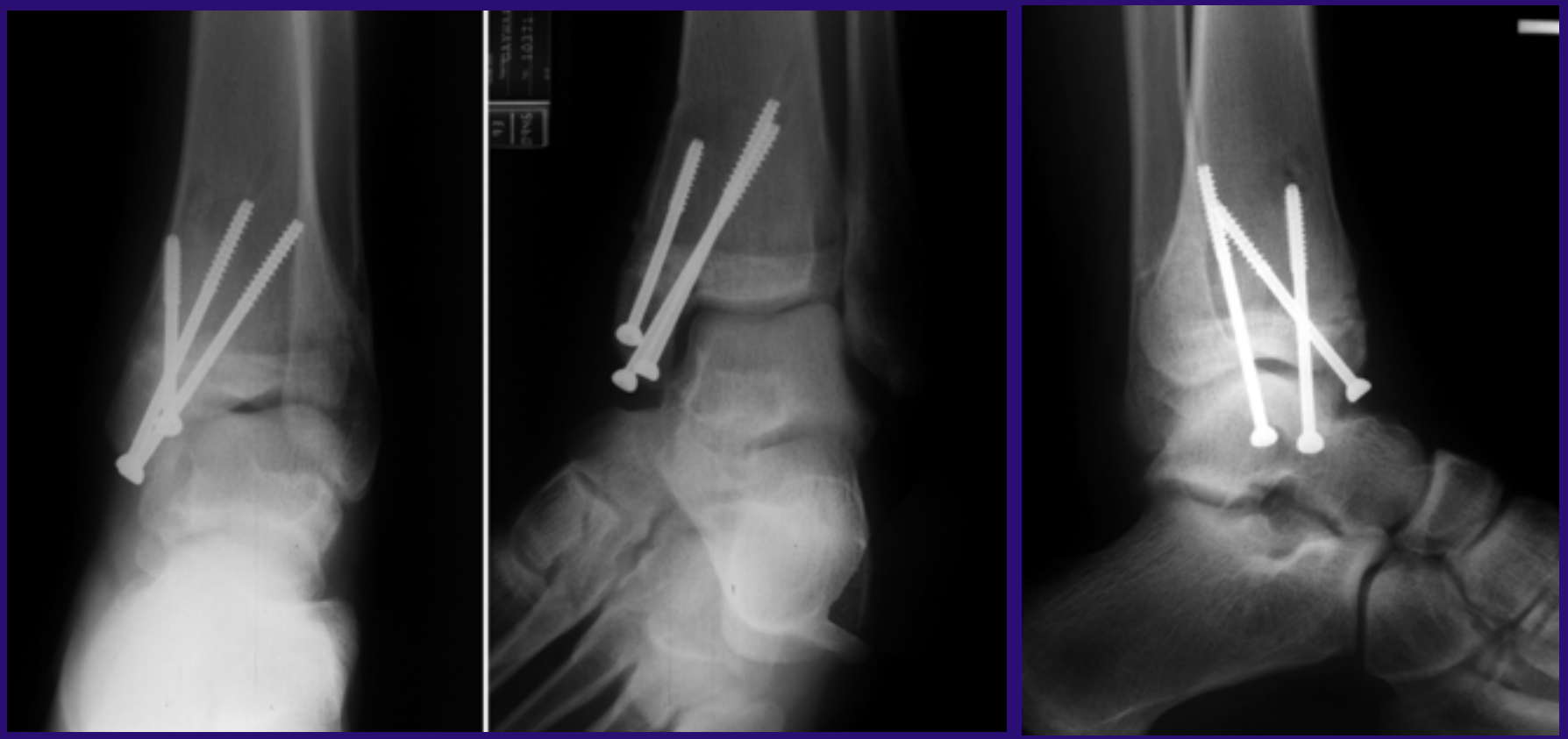


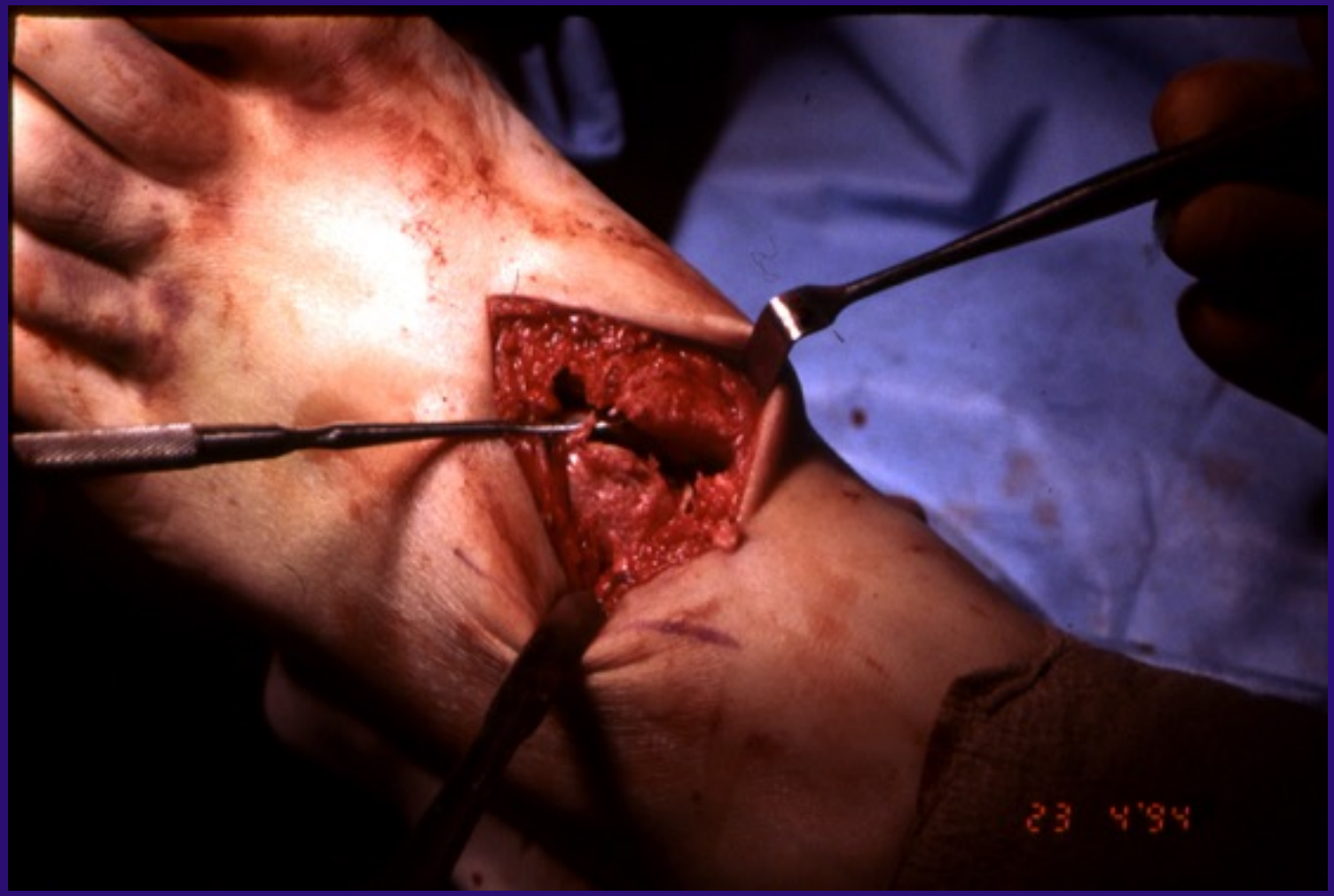




1 month post surgery

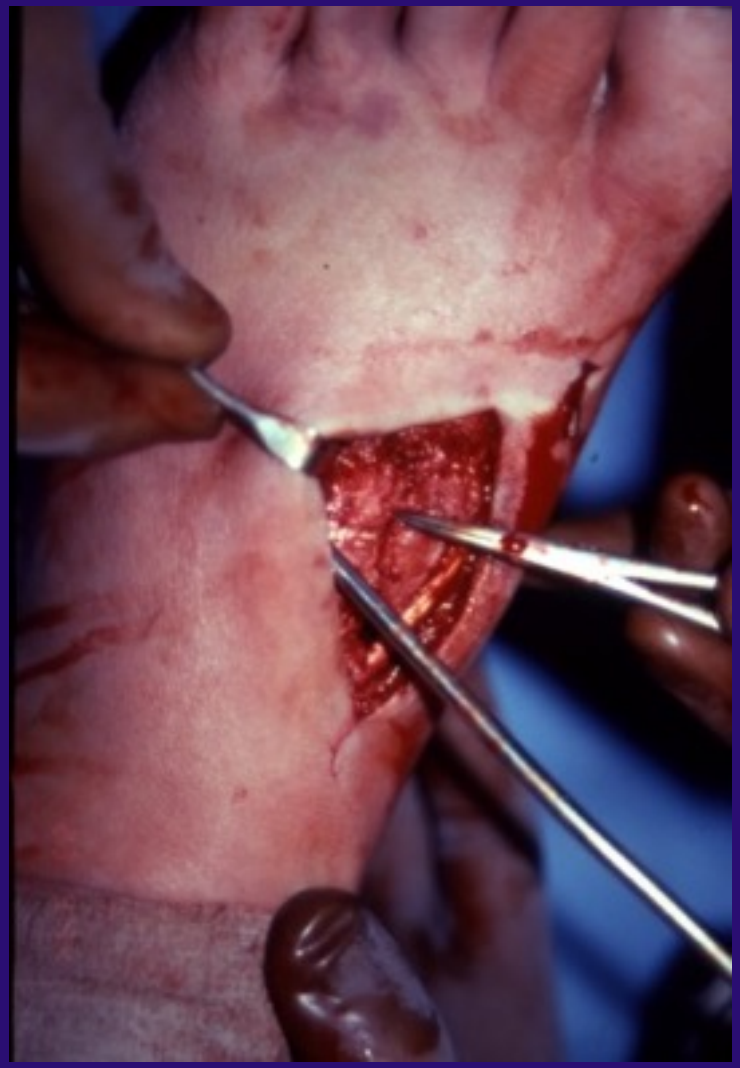


Don’t miss a Lisfranc midfoot fracture dislocation



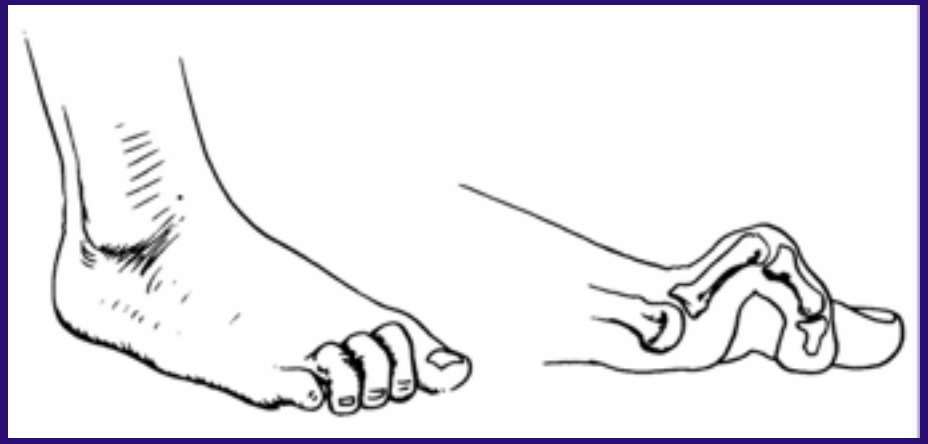


Will require ORIF





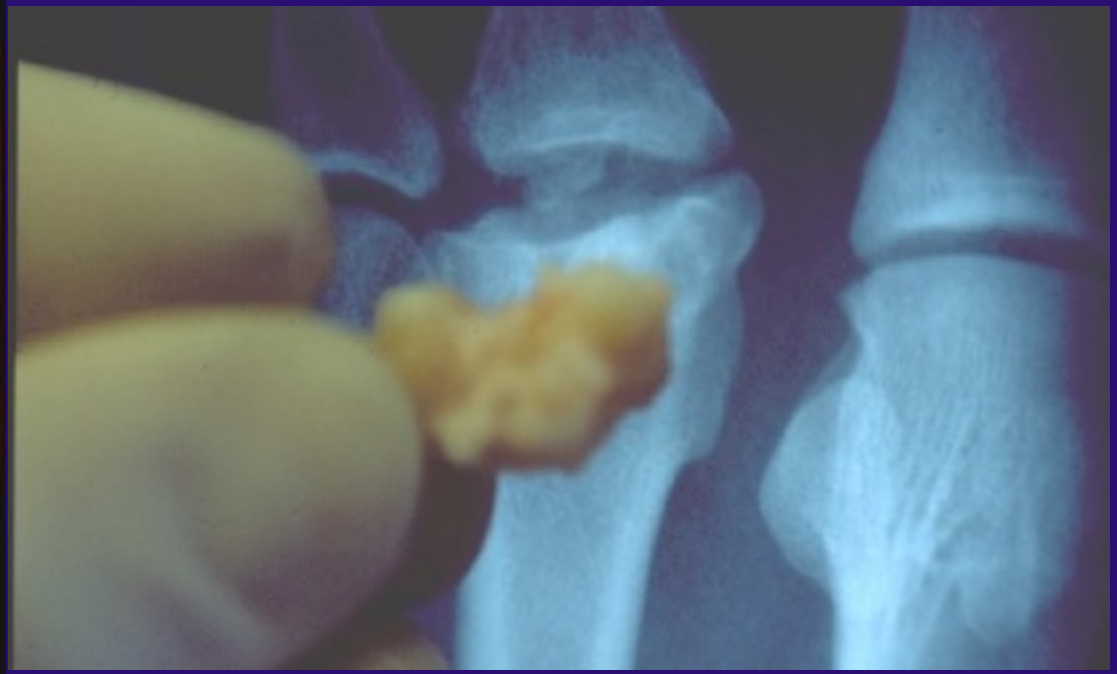
Claw Toes Flex:ed PIPJ/DIPJ: Think Neurologic Involvement





Freiberg's Infraction

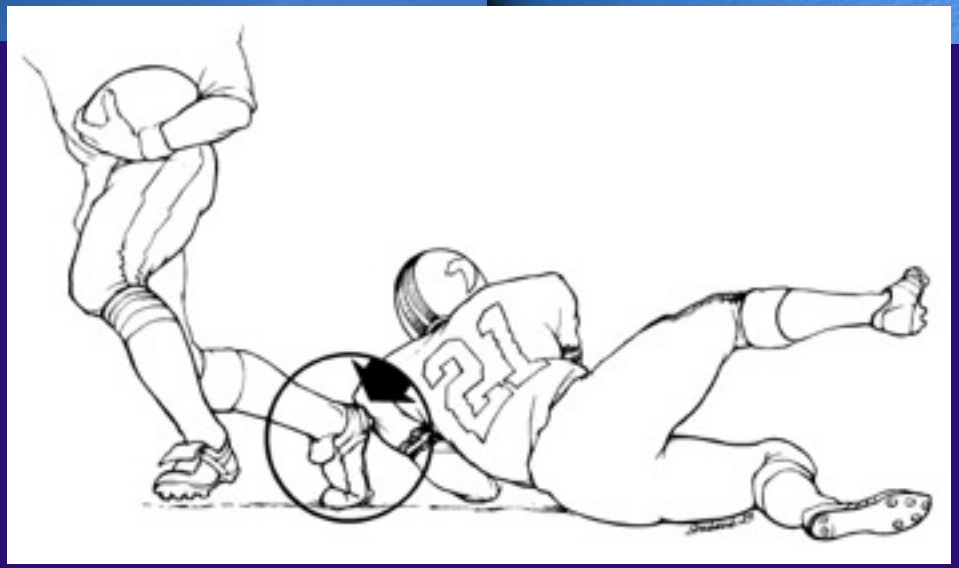




Turf Toe: Football Athlete







Heel Pain

- Adolescent male
  - Rheumatoid condition
    - Ankylosing spondylitis
    - Reiter's syndrome
    - Enthesistis Related Arthritis
  - Infection
    - Sever's disease
      (usually younger males, peaking at age 8)
  - Stress fracture
  - Conditions / tumors
    - Osteoid osteoma

13 YO White Male

- Right midfoot pain for 1 month
- No specific injury
- Baseball athlete
- Rapid growth phase
- PE:
  - Tenderness over medial arch and midfoot
  - Stable normal ankle exam
  - Tenderness over posterior tibialis tendon

13 YO White Male

- Workup:
  - Plain xrays – negative
  - MRI scan – medial cuneiform stress fracture
- Treatment
  - Boot
  - Nonweightbearing 4 weeks
  - Full weightbearing 4 weeks
  - Improved
  - Cleared for return to baseball

Films in early summer 2009





Films in early summer 2009



Films in early summer 2009



Films in late summer 2009







Followup

- 8 months later
  - Developed recurrent medial foot pain and swelling
- PE:
  - Mild ankle effusion, stable
  - Swelling and pain over posterior tibialis tendon
  - Workup:
    - Plain films
    - MRI scan

RIGHT FOOT







RIGHT ANKLE







RIGHT FOOT - MRI

- AX T1 3D
- AX T2 FATSAT
- COR T1 3D
- COR T2
- COR T2 FATSAT
- SAG T1 3D
- SAG T2 FATSAT

MRI Scan

- Bone edema
  - Medial mallelous
  - medial and intermediate cuneiform
- Posterior tibialis tenosynovitis
- Ganglion cyst, talonavicular joint
- Tibiotalar effusion

Consult requested: foot and ankle surgeon

Foot and Ankle Consult Recommended

- Open exploration
- Surgery performed
  - Tenosynovectomy, posterior tibialis tendon
  - Biopsy
- Laboratory work:
  - Rheumatoid profile, rheumatoid factor negative
- Followup
  - Used AFO brace
  - Returned to baseball 6 months later

1 Year Later

- Developed uveitis
- Pediatric ophthalmologist requested consult with pediatric rheumatologist
- Laboratory studies:
  - HLAB 27: positive
  - ANA: negative
  - Rheumatoid factor: negative

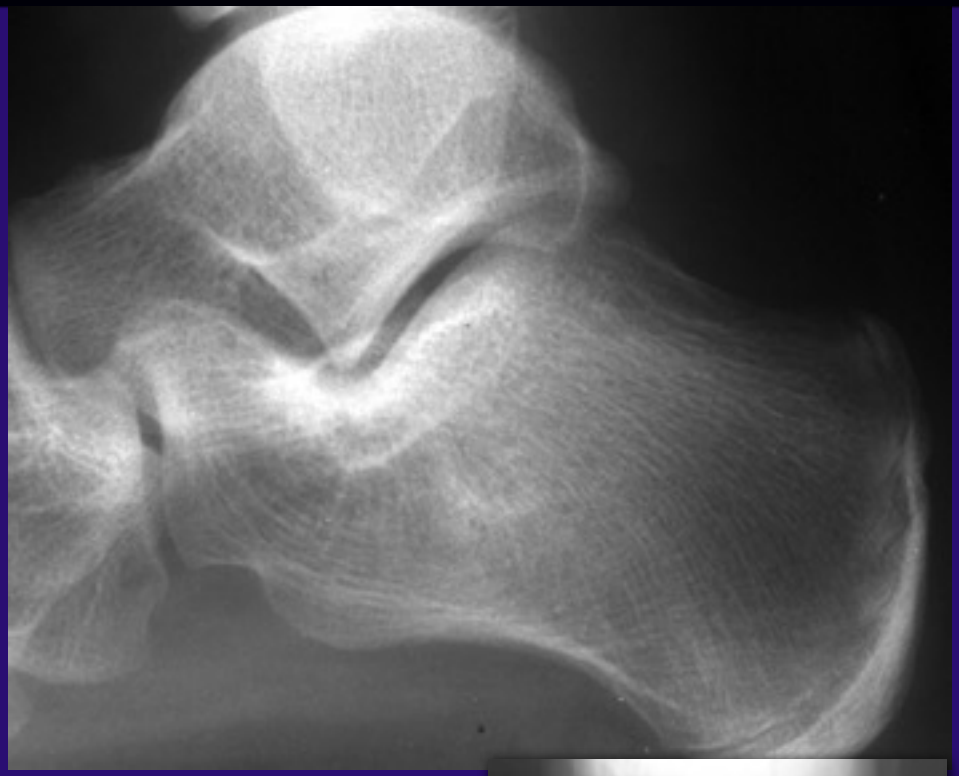
Diagnosis

- Enthesistis Related Arthritis
- HLAB 27 Positive
- No clinical evidence of ankylosing spondylitis

- Treatment:
  - Medications:
    - Methotrexate, Naprosyn
  - Home Rehab program
  - Returned to baseball wearing AFO

15 YO Male

- Right ankle
- 6 Months of Pain
- Initial x-ray:







1 month

1 month followup MRI scan




Rt
Lt Lat

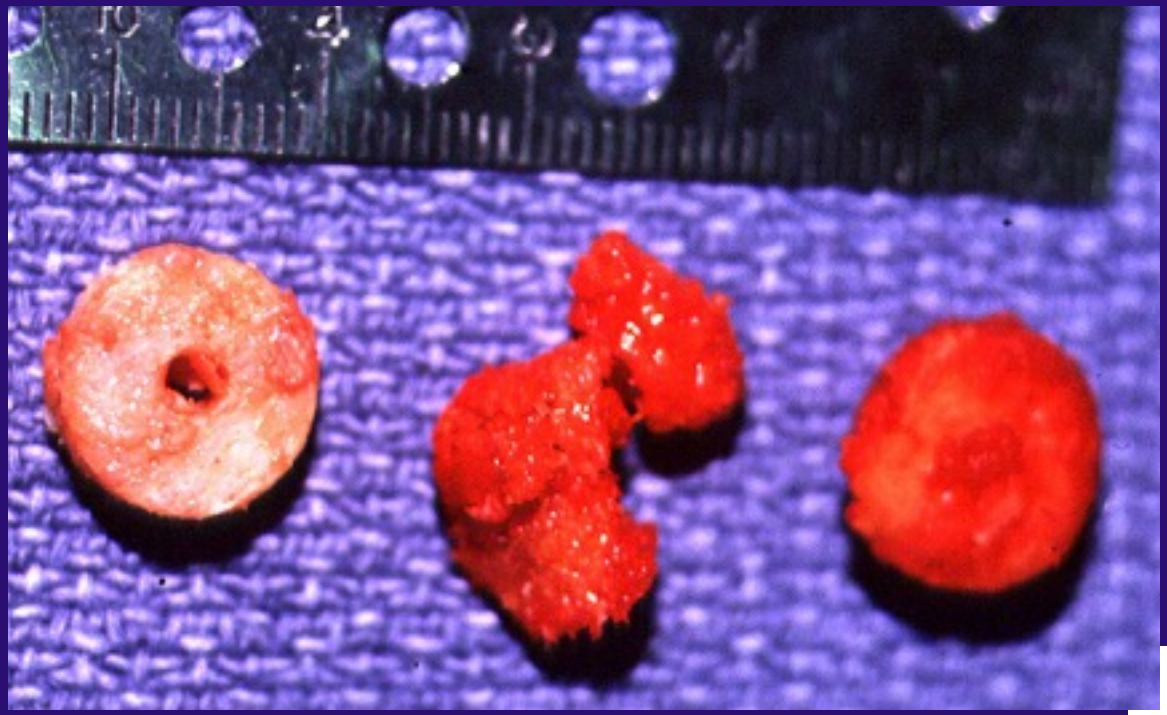




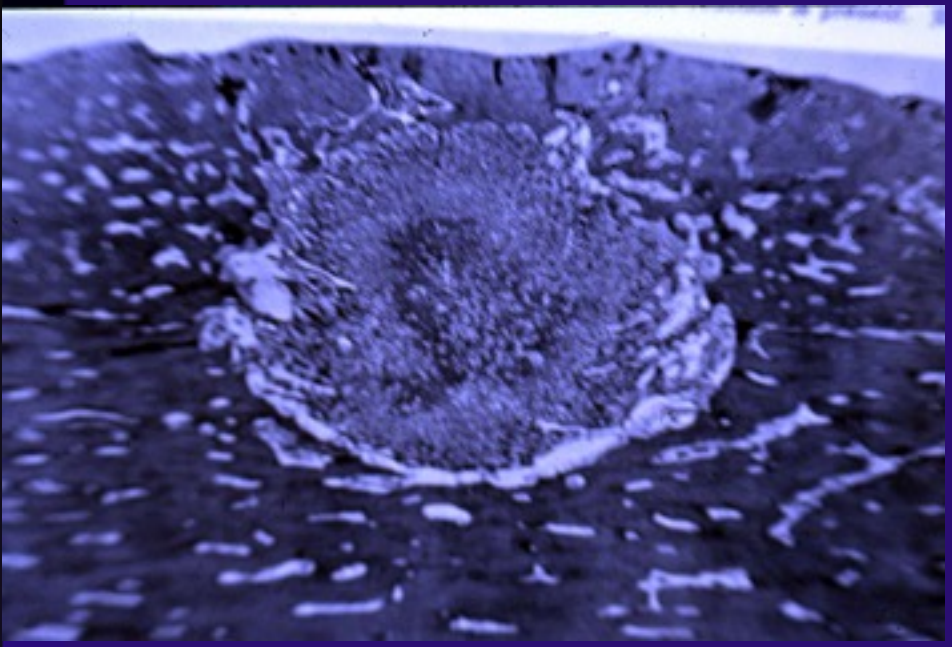


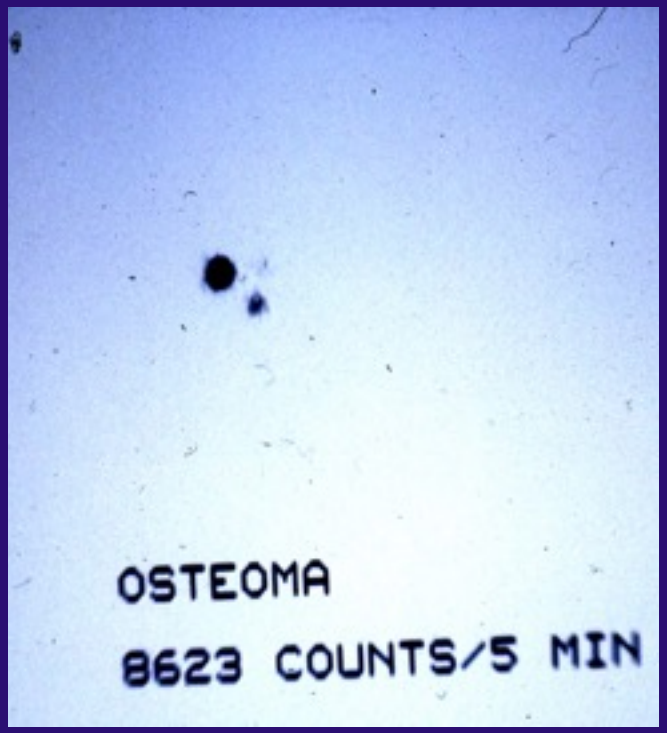


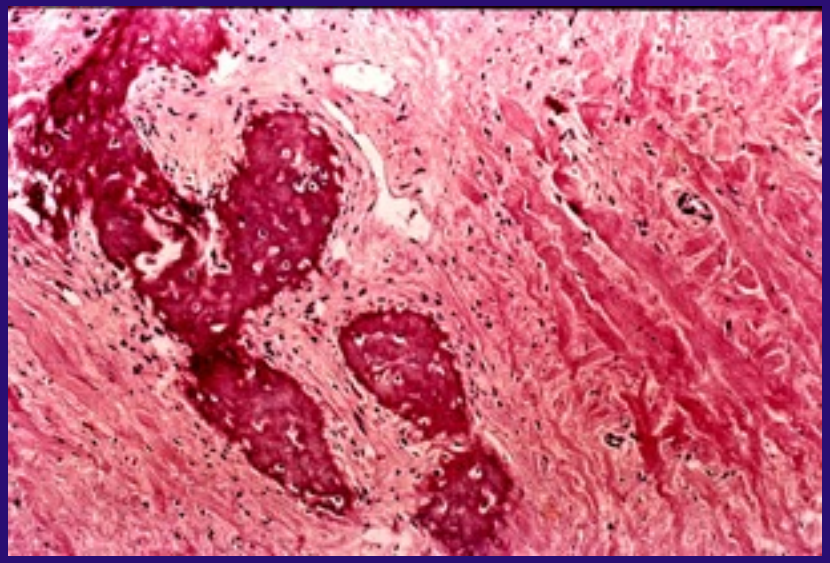









OSTEOMA
8623 COUNTS/5 MIN



14 months post op

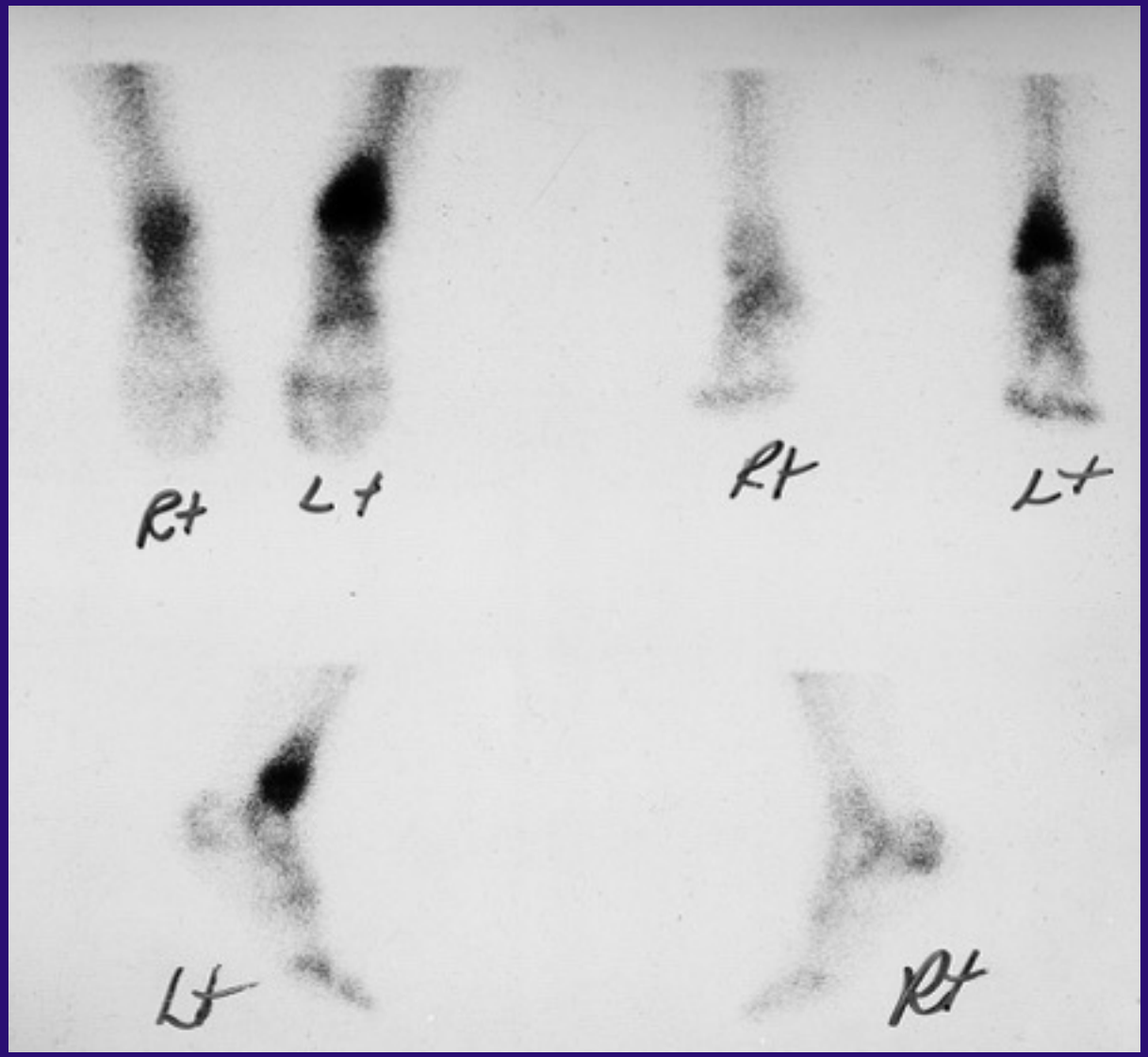


17 YO Male

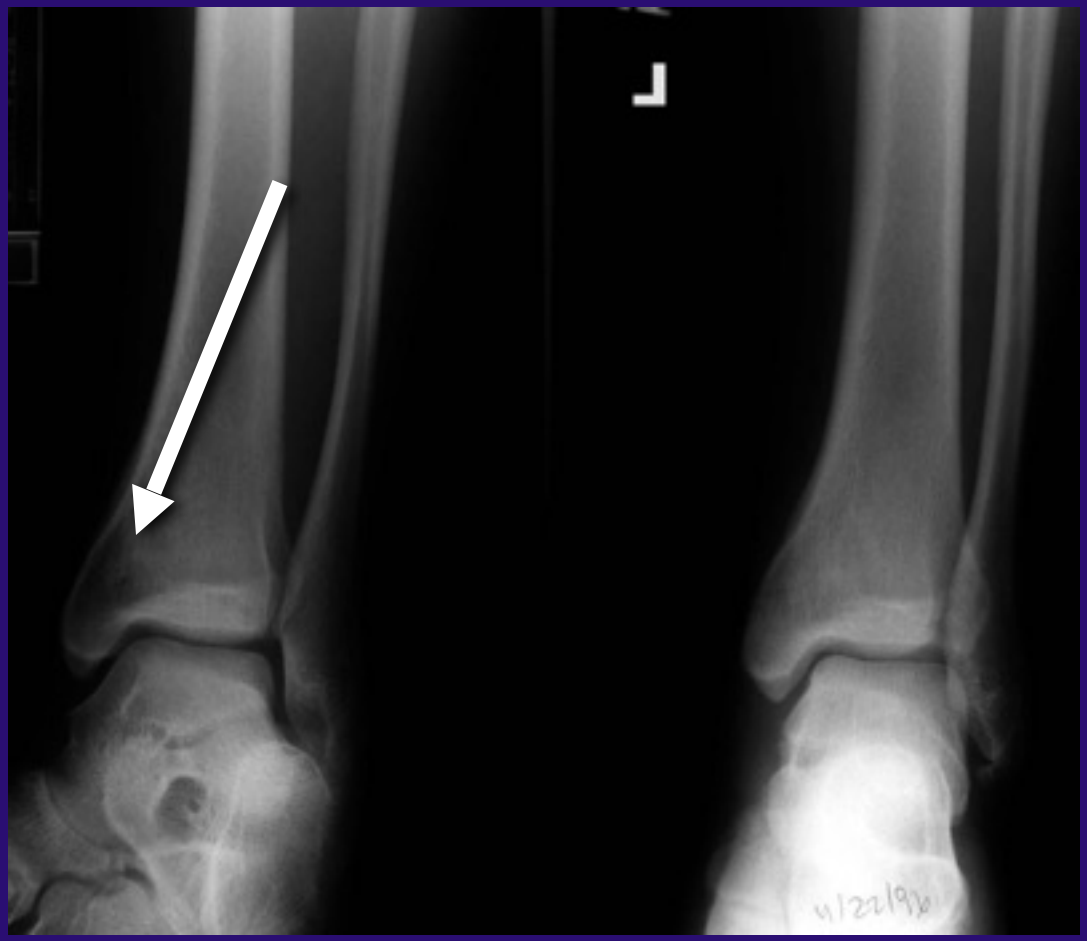
- Left ankle pain x3 weeks
- Trying to get in shape, played more basketball than usual
- Possible stress fracture of the medial malleolus



3 months after initial presentation



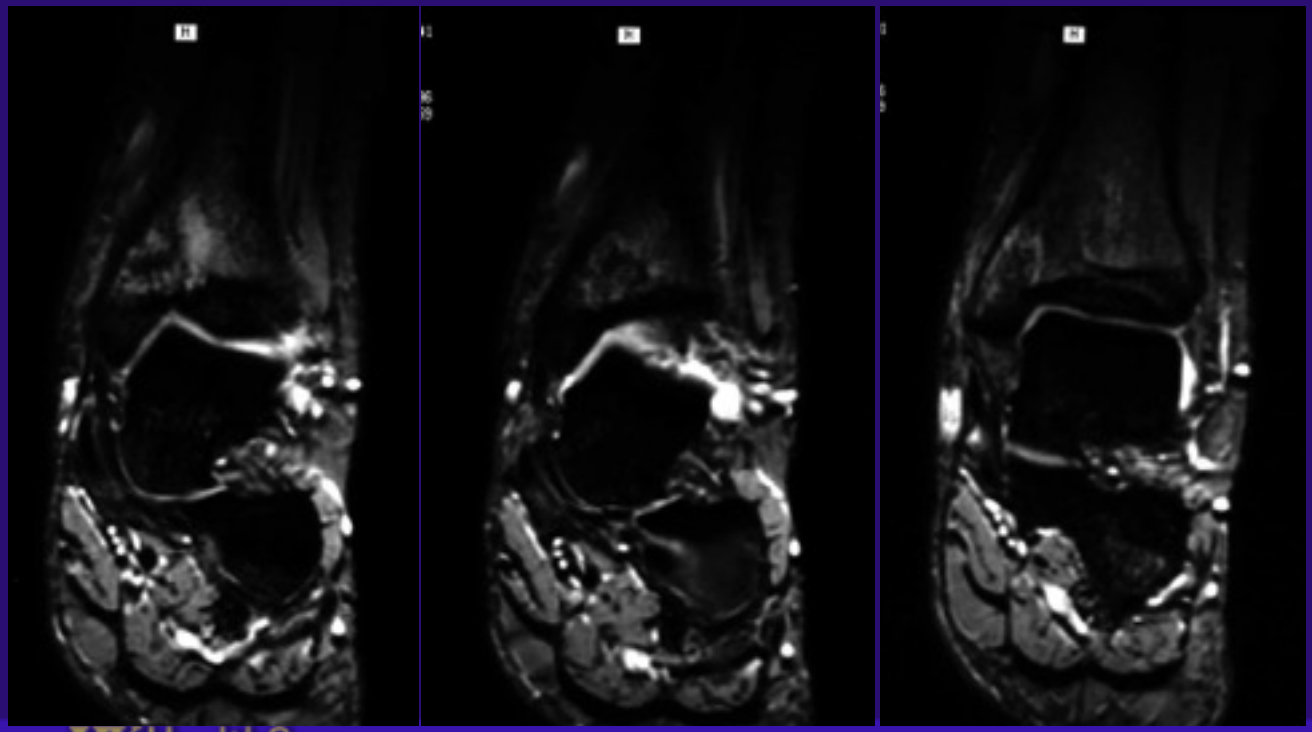
5 Months after initial presentation

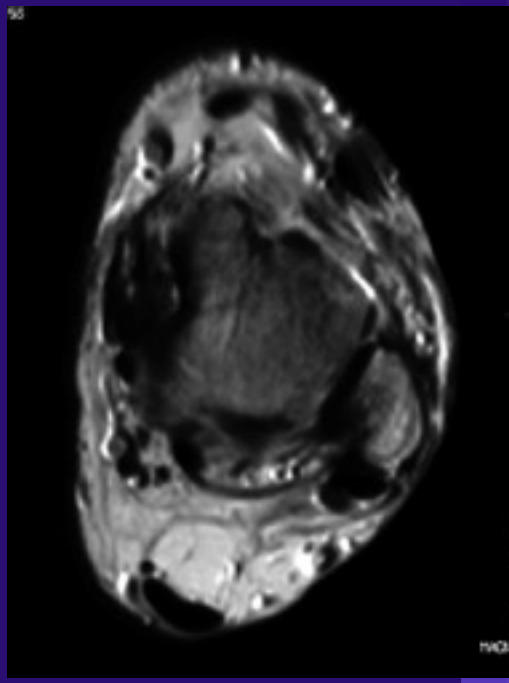




7 months after initial







Small Blue Cell Tumor

- Ewing's sarcoma

  vs.

- Lymphoma

A good History and Physical

is Key



Know the anatomy
Understand the sport

The End — Thank You!



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University of Kentucky
Dept. of Orthopaedic Surgery and
Sports Medicine
Lexington, Kentucky