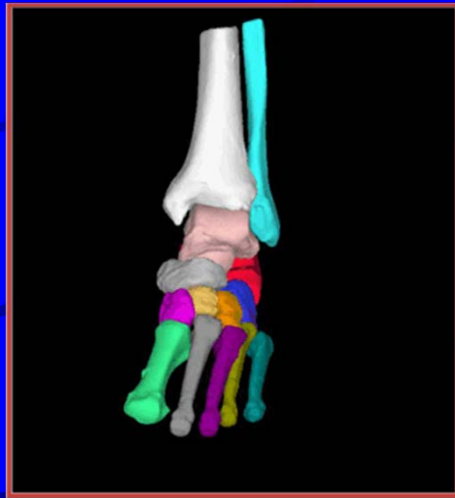


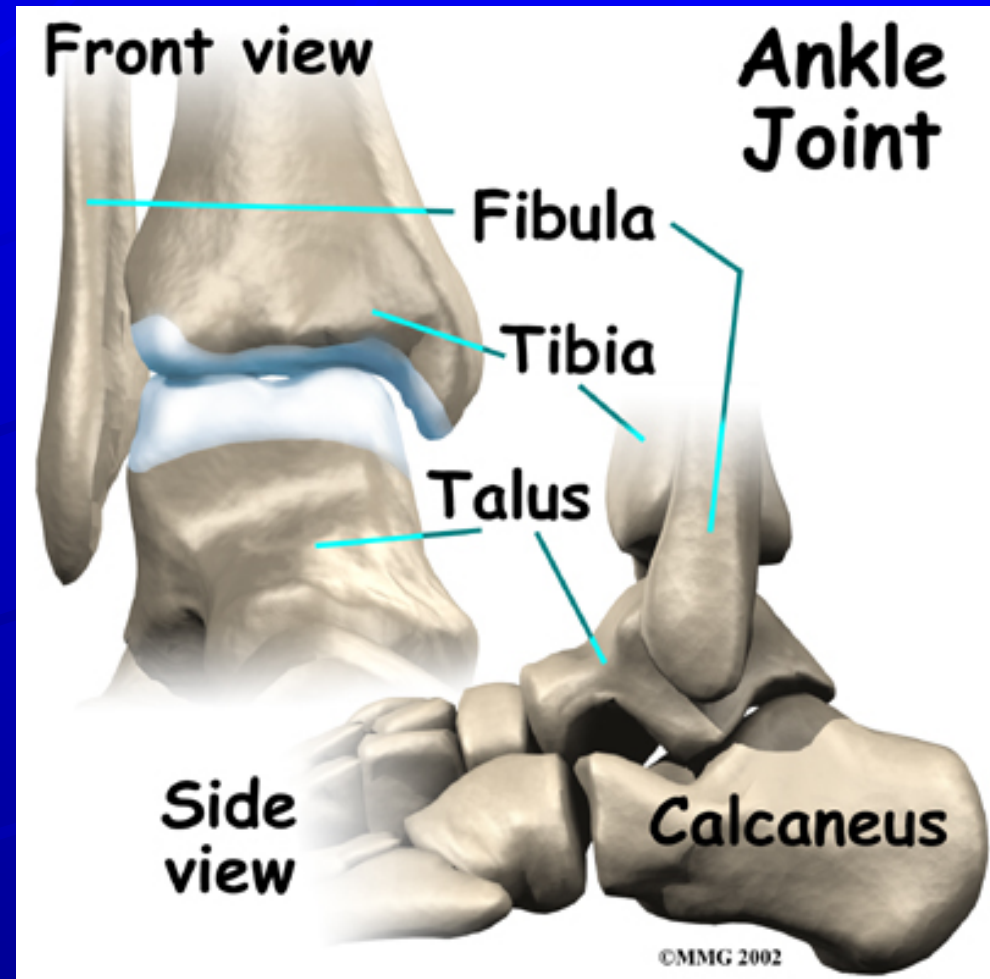
X-Ray Rounds: (Plain) Radiographic Evaluation of the Ankle



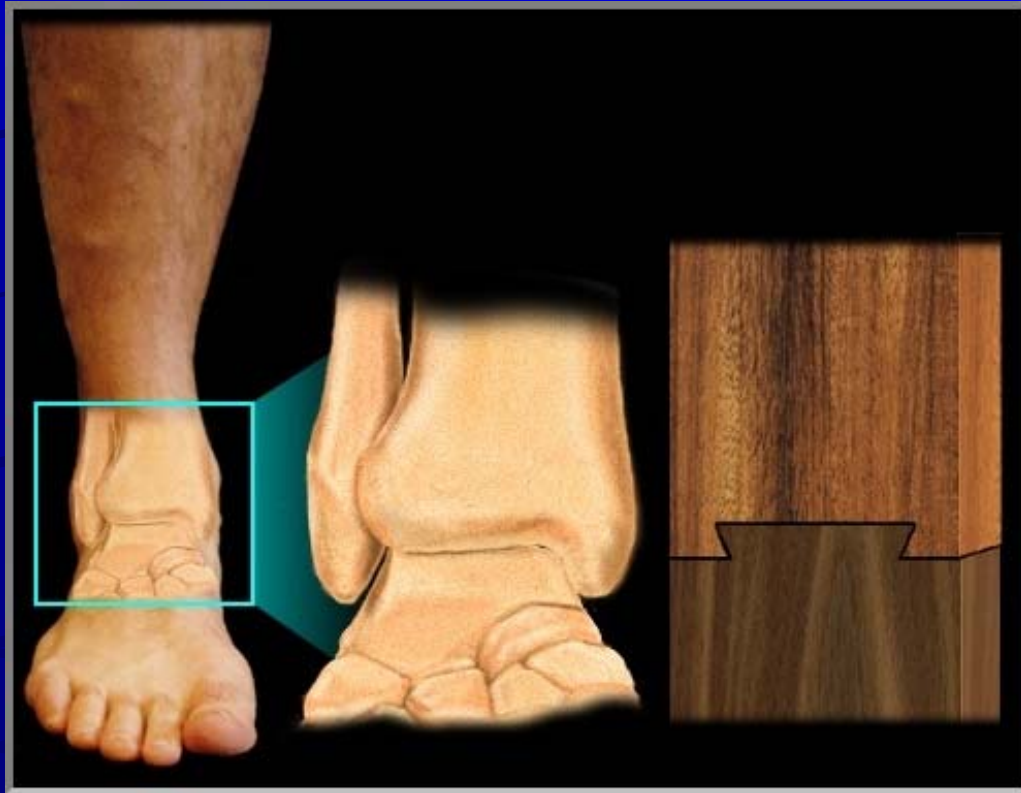
www.fisiokinesiterapia.biz

Anatomy

- ◆ Complex hinge joint
- ◆ Articulations among:
 - Fibula
 - Tibia
 - Talus
- ◆ Tibial “plafond”
 - Distal tibial articular surface
- ◆ Complex ligamentous system



Anatomy



- ◆ Medial malleolus
 - Distal tibia
 - Medial support
- ◆ Lateral malleolus
 - Distal fibula
 - Lateral support
- ◆ Talus
 - Trapezoid-shaped

- ◆ Mortise (tibial plafond, medial & lateral malleoli)
 - Constrained articulation with the talar dome

Anatomy

◆ Syndesmotic ligament complex

- Axial, rotational, & translational stability

- Four ligaments:

- ◆ Anterior tibiofibular ligament
- ◆ Posterior tibiofibular ligament
- ◆ Transverse tibiofibular ligament
- ◆ Interosseous ligament

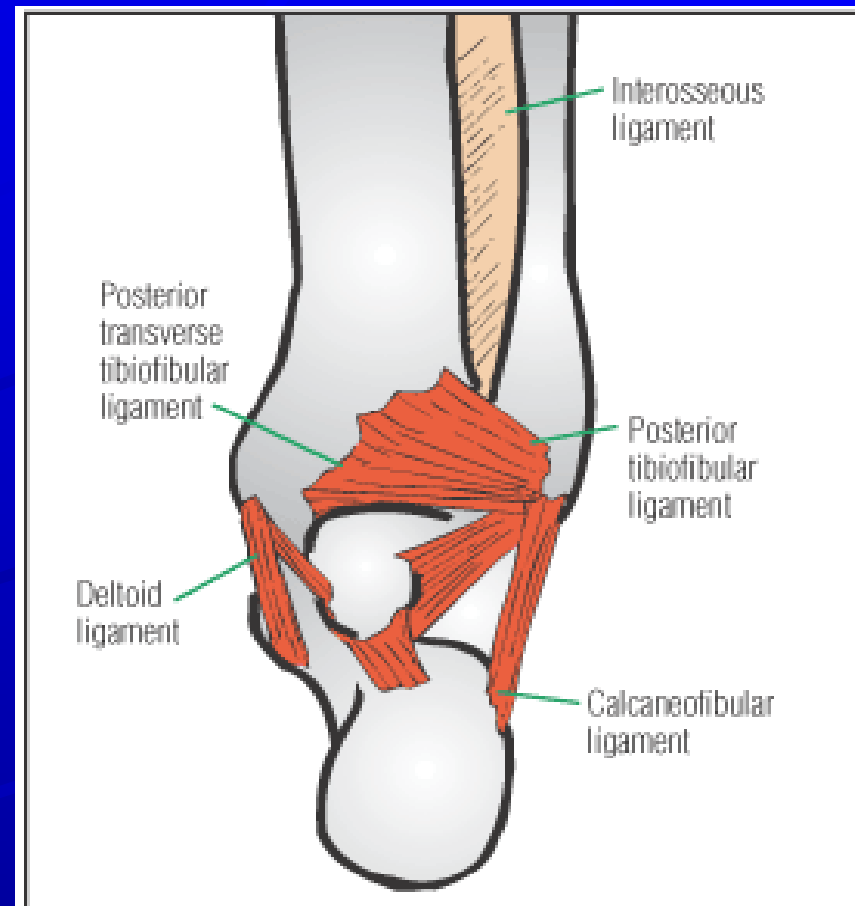
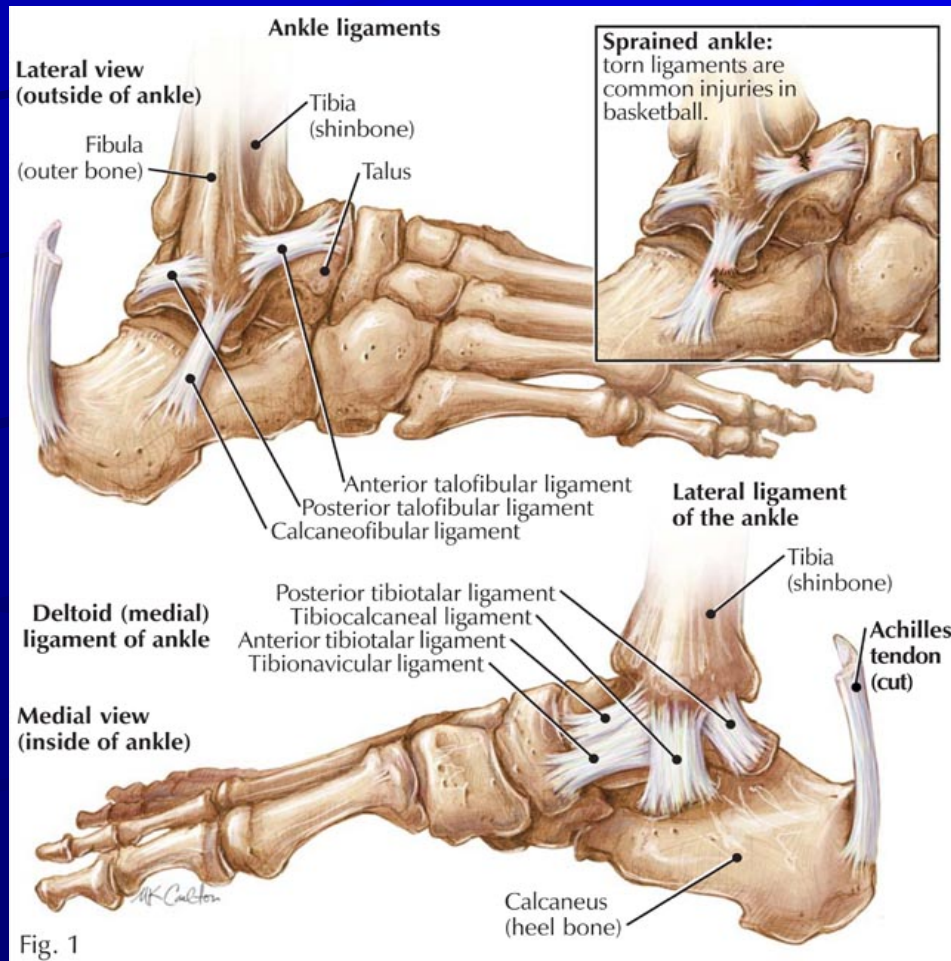


FIGURE 2. Posterior view of the major ligaments of the ankle. Any of these ligaments may be injured in conjunction with a syndesmotic injury.

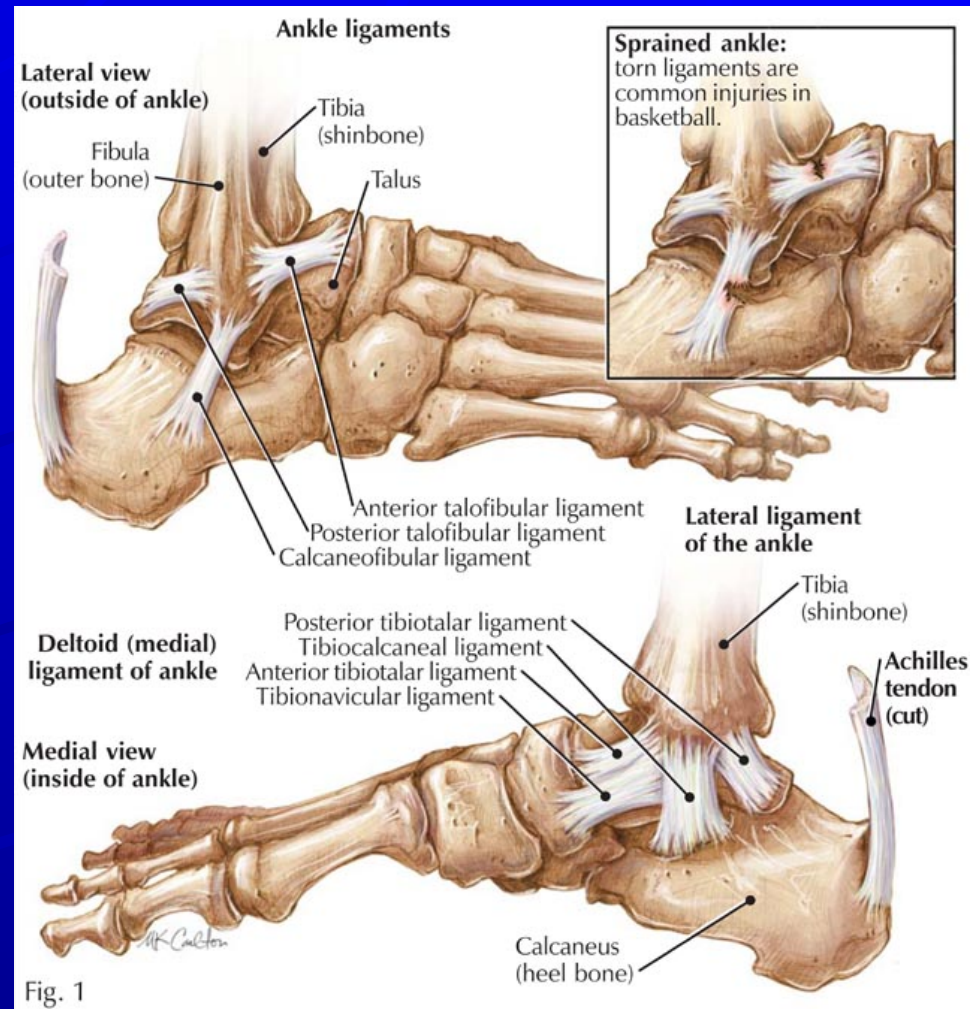
Anatomy



- ◆ Deltoid (medial) ligament complex
 - Superficial (contributes little to stability)
 - ◆ Tibionavicular ligament
 - ◆ Tibiocalcaneal ligament
 - ◆ Superficial Tibiotalar ligament
 - Deep (primary medial stabilizer)
 - ◆ Intraarticular:
 - ◆ Deep tibiotalar ligament

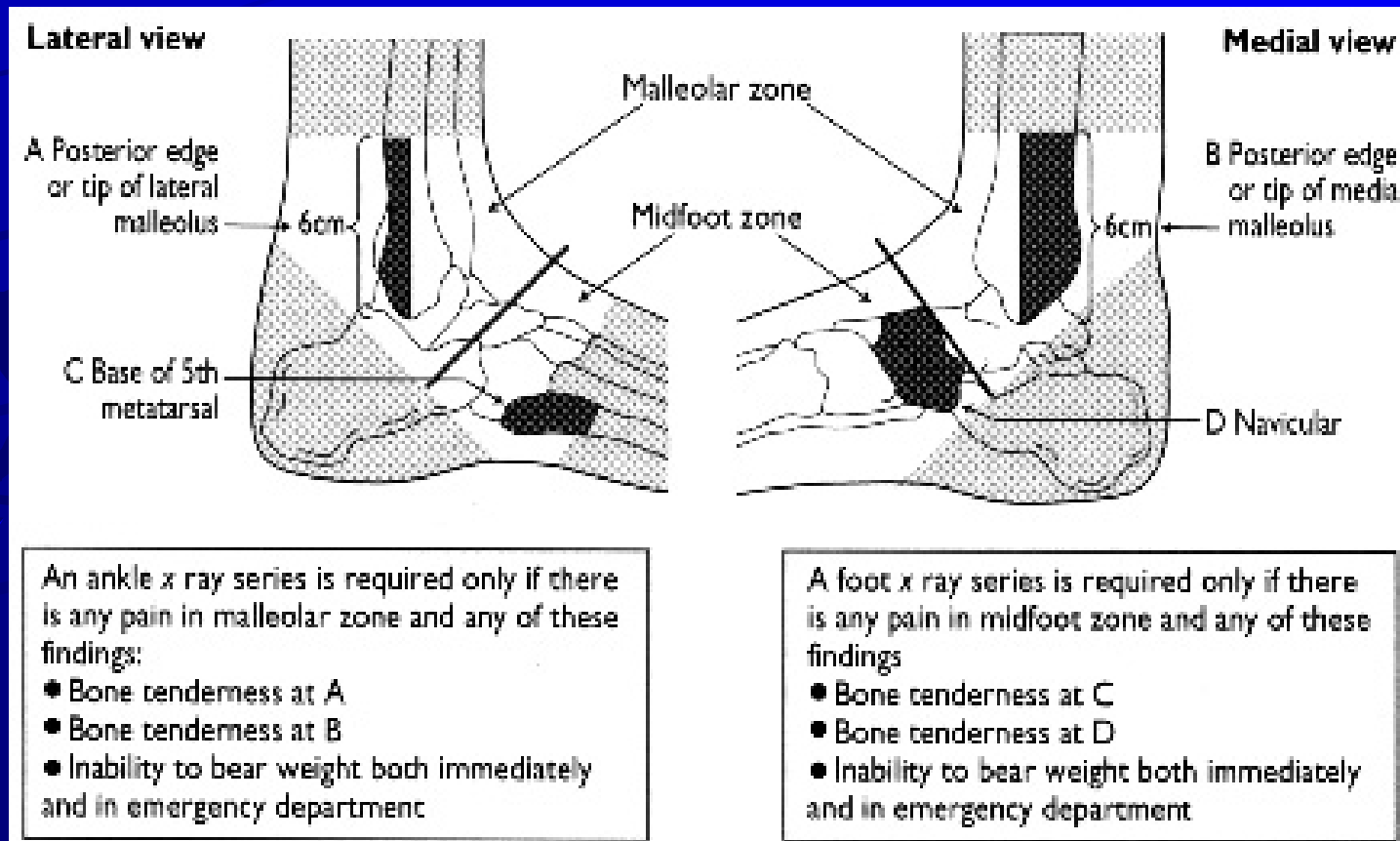
Anatomy

- ◆ Lateral (fibular collateral) ligament complex
 - Anterior talofibular ligament (weakest)
 - Posterior talofibular ligament (strongest)
 - Calcaneofibular ligament
- Deltoid (medial) ligament of ankle



Indications for Ankle Radiographs

- ◆ Ottawa Ankle Rules
 - Age 55 years or older



Indications for Ankle Radiographs

- ◆ How good are the Ottawa Rules?
 - When originally published:
 - ◆ 100% sensitivity & 40% specificity for detecting malleolar fractures
 - Subsequent studies:
 - ◆ Lower sensitivity (93% to 95%) and specificity (6% to 11%) than originally thought
 - ◆ Not perfect, but still a good tool
- ◆ Other indications
 - The patient cannot communicate (altered mental status, alcohol intoxication, or other)
 - Pain and swelling do not resolve within 7-10 days after injury
 - Anytime your history and physical don't give you enough information

Normal ankle
(AP view)

R

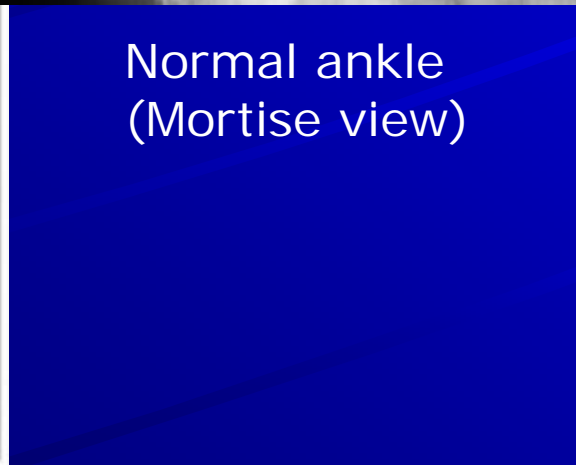


<http://www.xray2000.co.uk>
NICK OLDNALL
01/01/01

[Redacted]



Normal ankle
(Mortise view)



Normal ankle
(Lateral view)



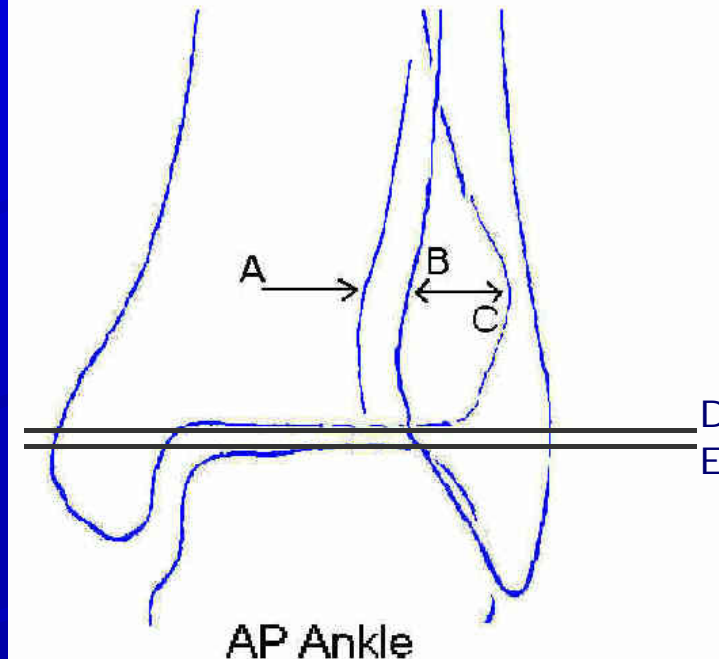
www.xray2000.co.uk

AP View of the Ankle



AB: Tibiofibular Clear Space: NI < 5 mm

BC: Tibio-Fibular Overlap: NI > 10 mm

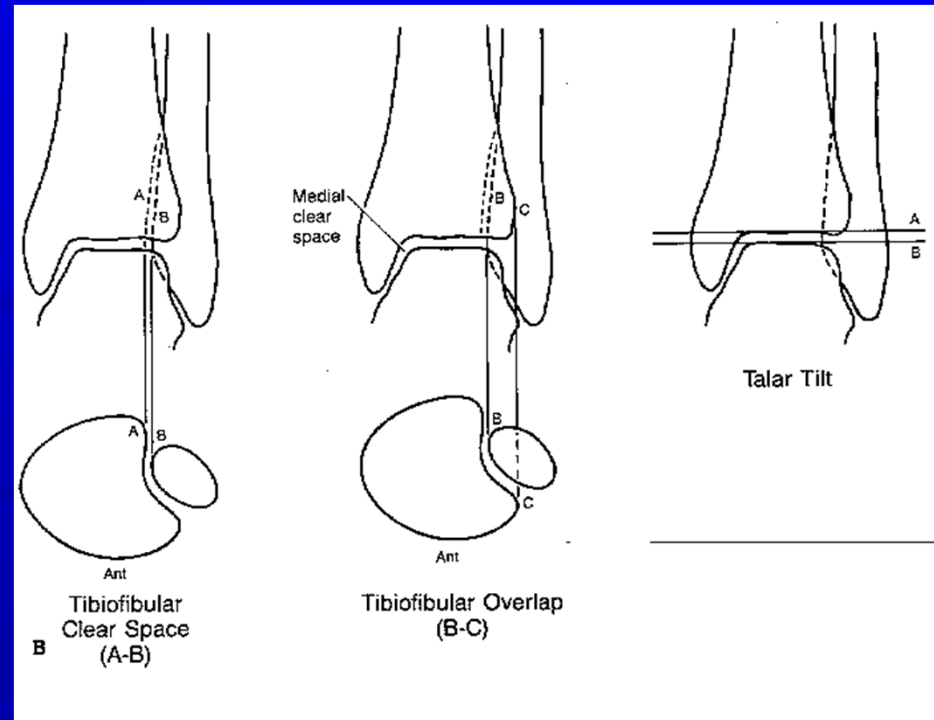


DE: Talar Tilt: < 2 degrees of angulation is NI

AP View of the Ankle



Tib-fib Clear Space $> 5\text{mm}$ or
Tib-fib Overlap $< 10\text{mm}$
may indicate syndesmotomic injury



Talar Tilt: > 2 degrees angulation may
indicate medial or lateral disruption

Lateral View of the Ankle

Posterior tibial tuberosity fractures & direction of fibular injuries can be identified

Dome of the talus: centered under and congruous with tibial plafond

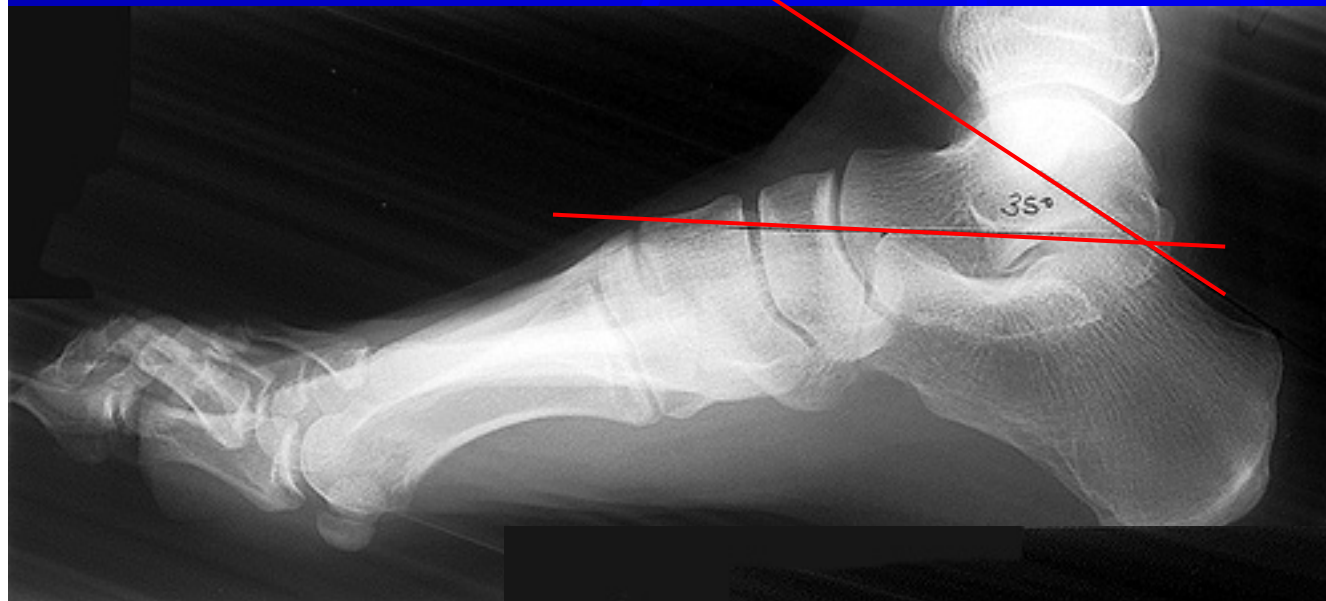
Avulsion fractures of the talus by the anterior capsule can be identified

Any deformity to the talus, calcaneus or subtalar joint



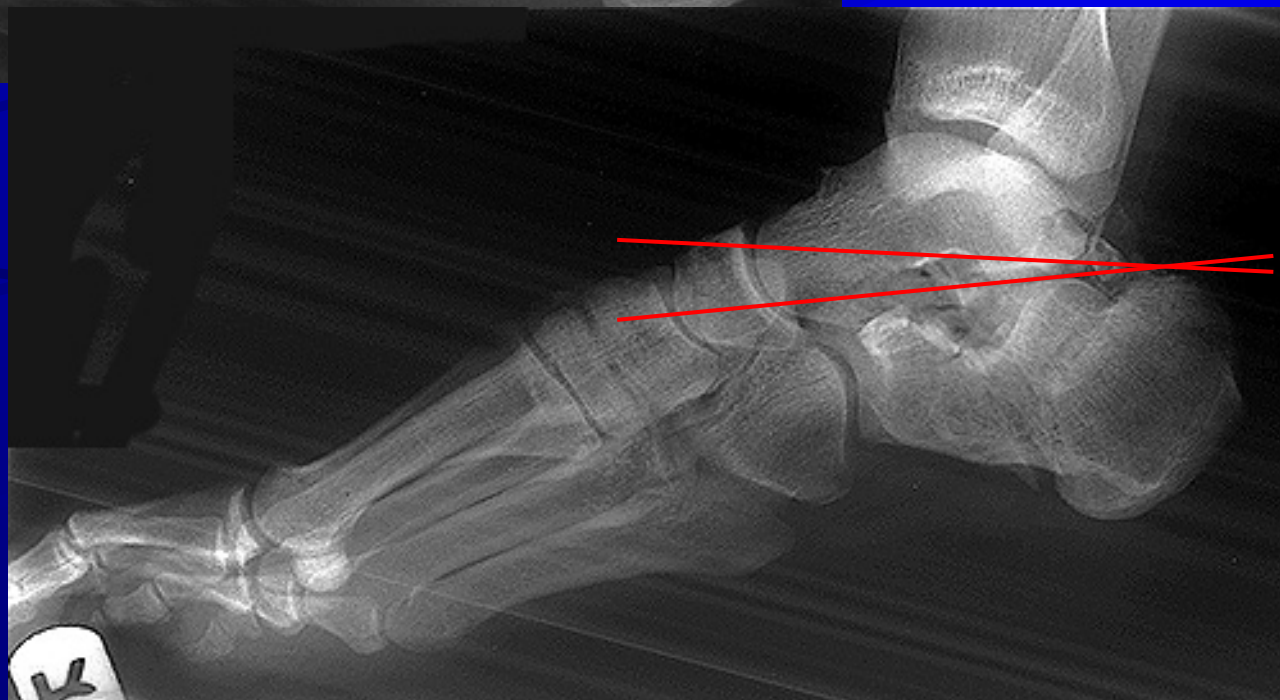
Calcaneal Fractures

Bohler's Angle
30-35 degrees
is normal



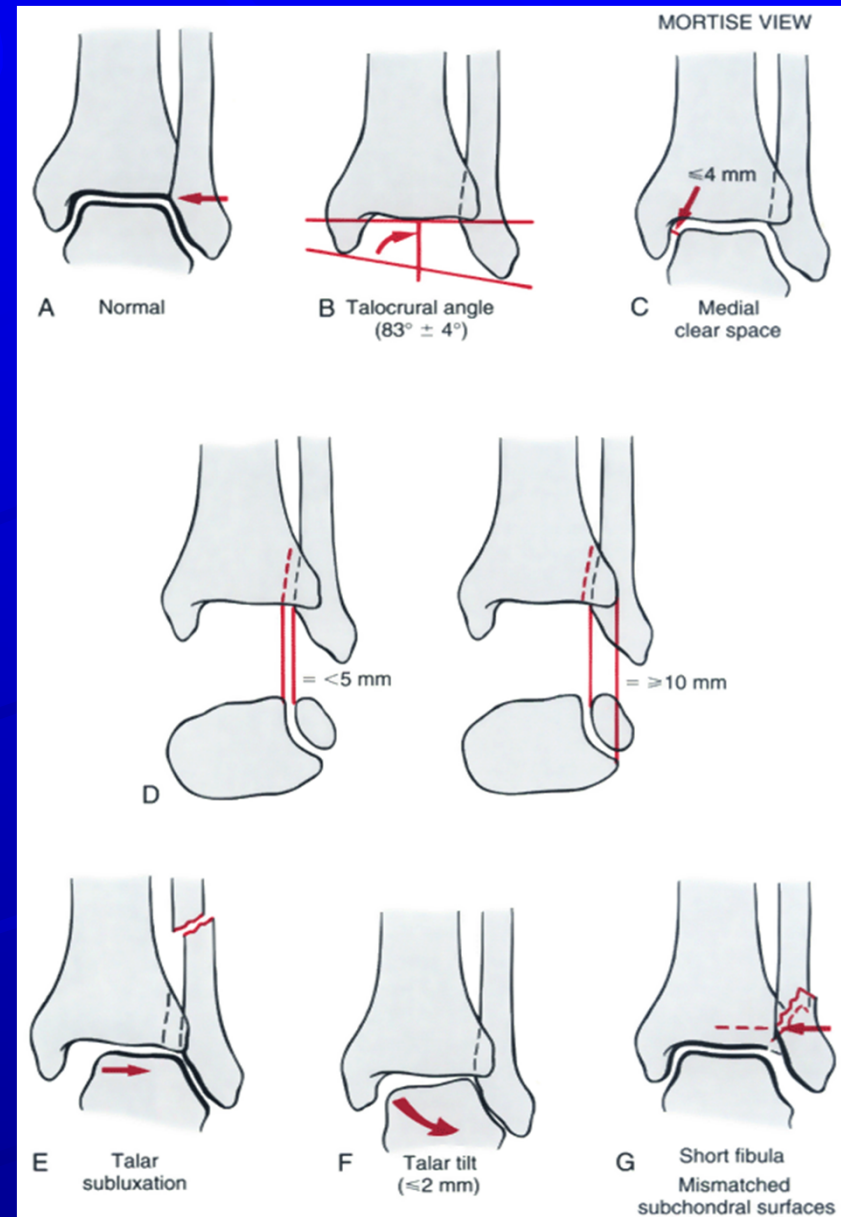
Others:
Critical Angle
of Gissane

Broden's
Views

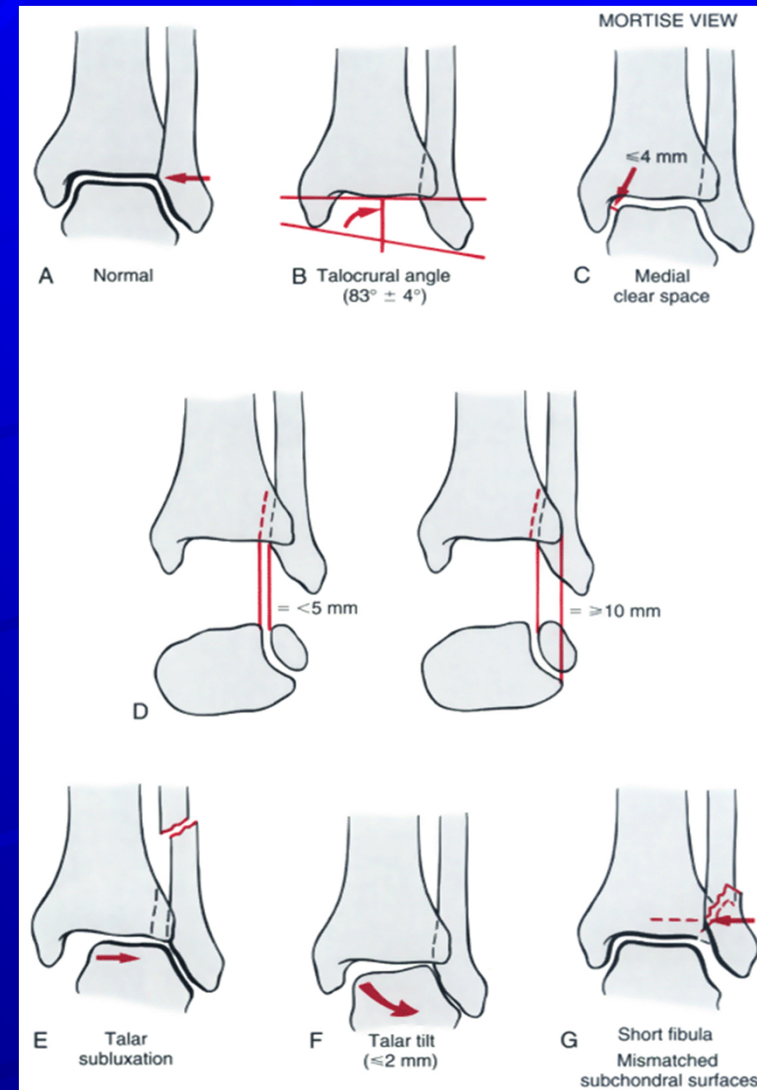


Mortise View of the Ankle

- ◆ AP view taken with the foot in 15-20 degrees of internal rotation to offset the intermalleolar axis
- ◆ Medial clear space
 - > 4mm may indicate lateral talar shift
- ◆ Talar tilt, Tib-fib Overlap, Tib-fib clearspace (see AP view)
- ◆ Talocrural angle (angle b/w plafond parallel and intermalleolar line)
 - Normal is 8-15 degrees (where the lines intersect)
 - Smaller angle may indicate fibular shortening



Mortise View of the Ankle





Normal AP &
lateral right
ankle X Ray





AP View:

Widened medial
clear space

Mortise View:

Open mortise
(decreased tib-fib
overlap)

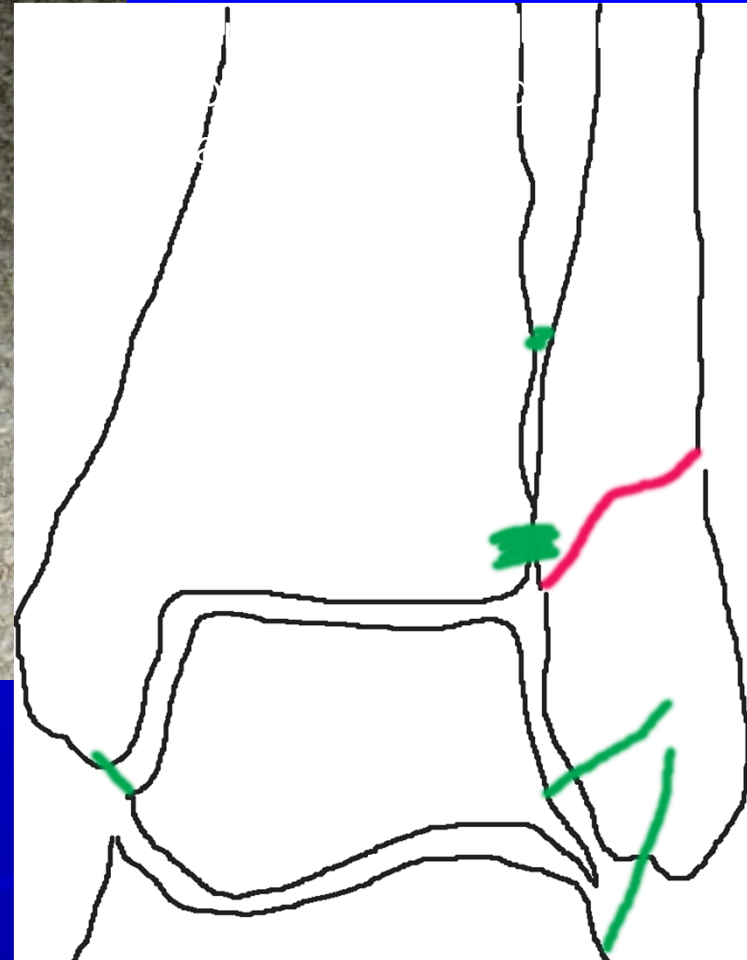
= Syndesmotic
injury

= Surgical referral
("needs a screw")



mm

28 y/o M who
"twisted" his left



Danis-Weber Type B fibular
ankle fracture

Ankle Fracture Classification

- ◆ Danis-Weber Classification

- Defined by location of the fracture line

- ◆ *Type A*: below the tibiotalar joint

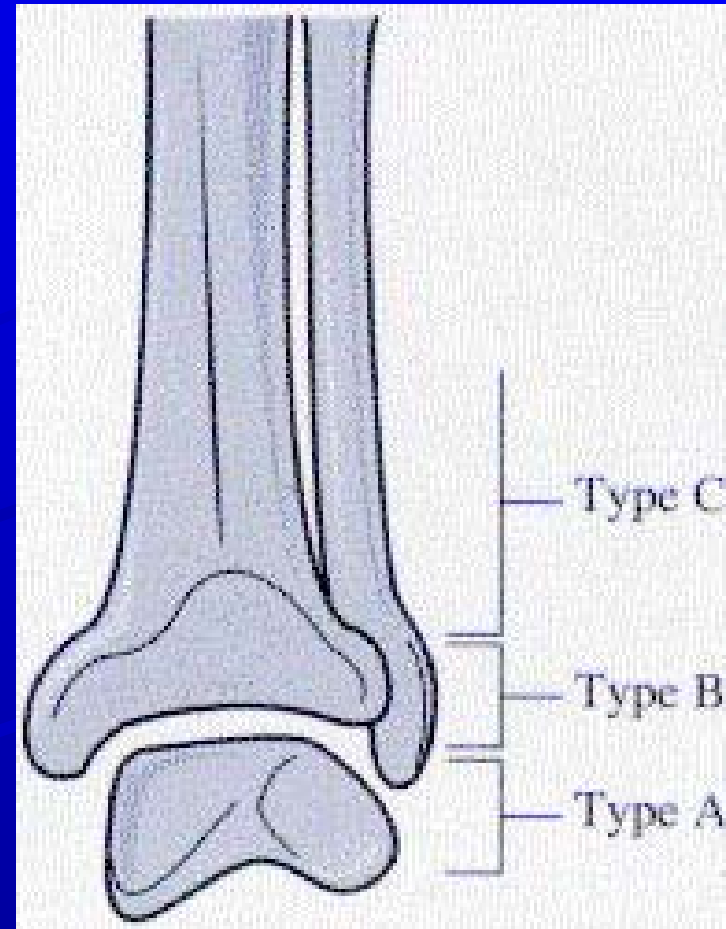
- ◆ *Type B*: at the level of the tibiotalar joint

- ◆ *Type C*: above the tibiotalar joint

- Syndesmotic ligament compromise

- ◆ Lauge-Hansen Classification

- Infrequently used, clinically; mostly academic



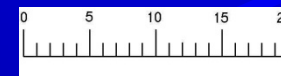


Mortise view:

Weber C fracture
with open mortise
and widened
medial clear space

= deltoid &
syndesmotic
ligament tears,
with fracture

= surgical referral



mm

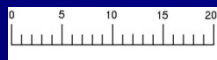
25 y/o volleyball
player "landed
on the right foot
"hurting" the ankle

Exam with pos
talar tilt

Lateral
ligament
tears

-ATFL

-CFL



mm

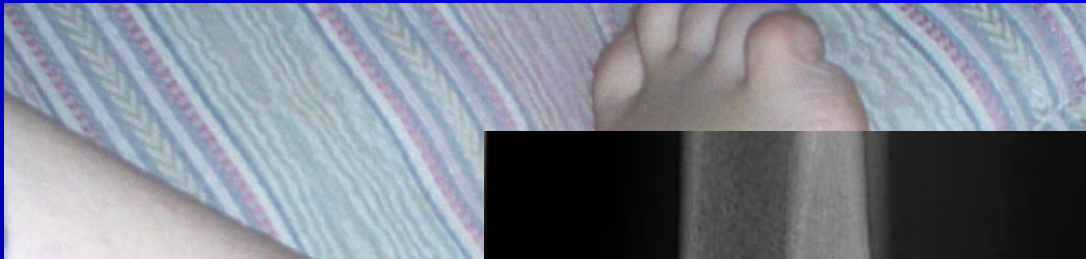


Radiographic Stress Tests of the Ankle

◆ Talar Tilt Stress Test

- Stabilize the leg with one hand while inverting plantar flexed heel with the other
 - ◆ Contralateral ankle used for comparison
 - ◆ Line is drawn across the talar dome and tibial vault
 - Degree of lateral opening angle is measured
 - Normal tilt is less than 5 deg
- Standing Talar Tilt Stress Test:
 - ◆ may be more sensitive
 - ◆ Patient stands on an inversion stress platform with the foot and ankle in 40 deg of plantar flexion and 50 deg of inversion





25 y/o male tennis player "torqued" his right ankle



Exam with positive anterior drawer sign

Grade III
ATFL ankle
sprain

Radiographic Stress Tests of the Ankle

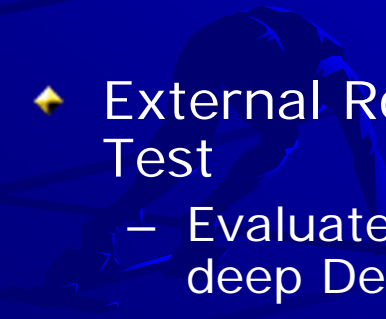
◆ Anterior Drawer Test

- Abnormal anterior translation is between 5 to 10 mm, or 3 mm more than other side



◆ External Rotation Stress Test

- Evaluates syndesmotic & deep Deltoid ligaments
- Difference in width of superior clear space between medial and lateral side of the joint should be < 2 mm





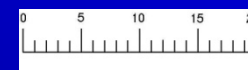
AP View:

Widened
medial clear
space

Decreased tib-
fib overlap

= Medial &
syndesmotic
ligament
compromise

= surgical
referral



mm

Normal AP &
lateral views



mm

Open mortise
= "needs a screw"



R

Weber Type A
lateral malleolar
fracture

Treat conservatively



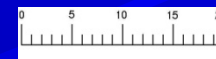
mm

Open mortise
with high fibular
fracture

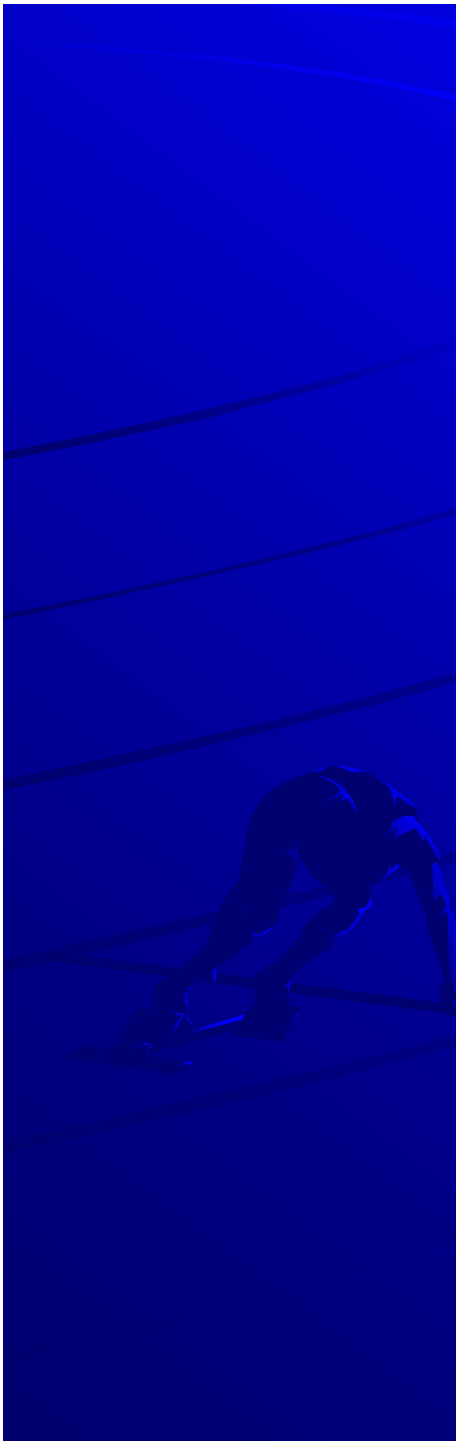
Name?


*Maissonneuve
fracture*

= surgical
referral



mm



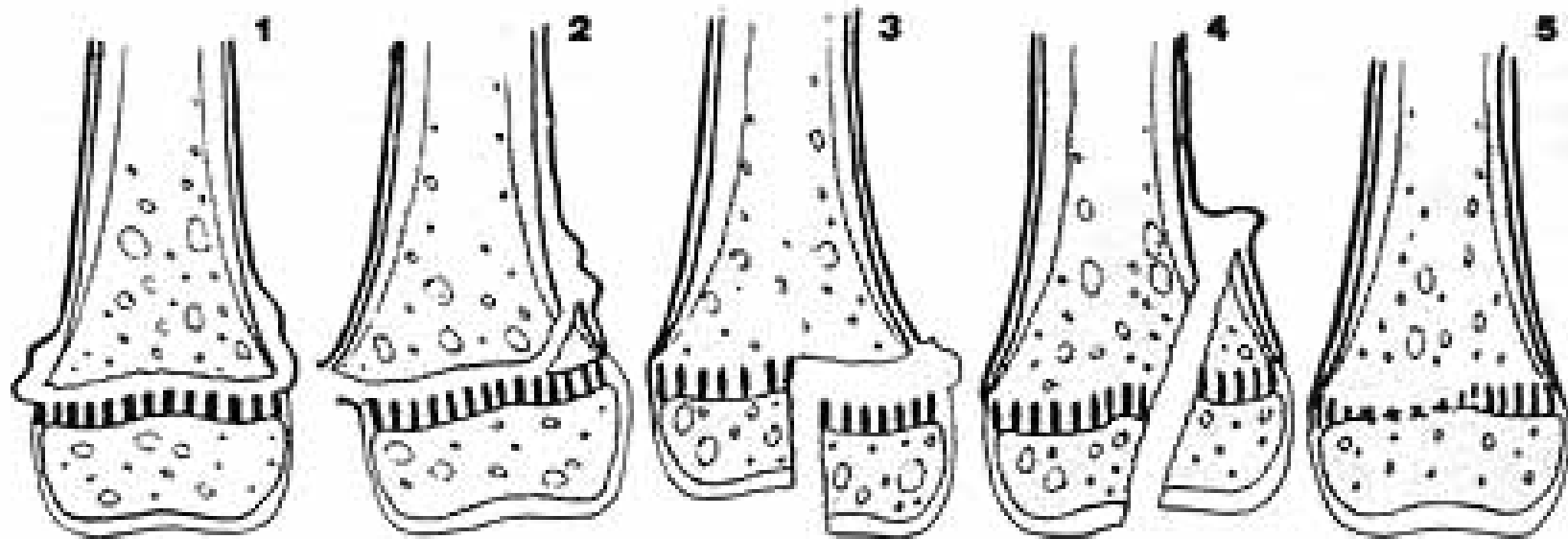


Salter-Harris
fracture, type II

= Refer for ORIF



Figure 8. The Salter-Harris Classification of Growth-Plate Fractures



Adapted with permission: Salter RB, Harris WR. Injuries involving the epiphyseal plate. *J Bone Joint Surg* 1963;45A:587.

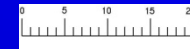
Straight **A**bove **b**e **L**ow **T**hrough **c** **E**R **u**sh
 1 2 3 4 5



Lateral ligamentous injury

Medial malleolar avulsion fracture

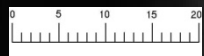
Surgical referral



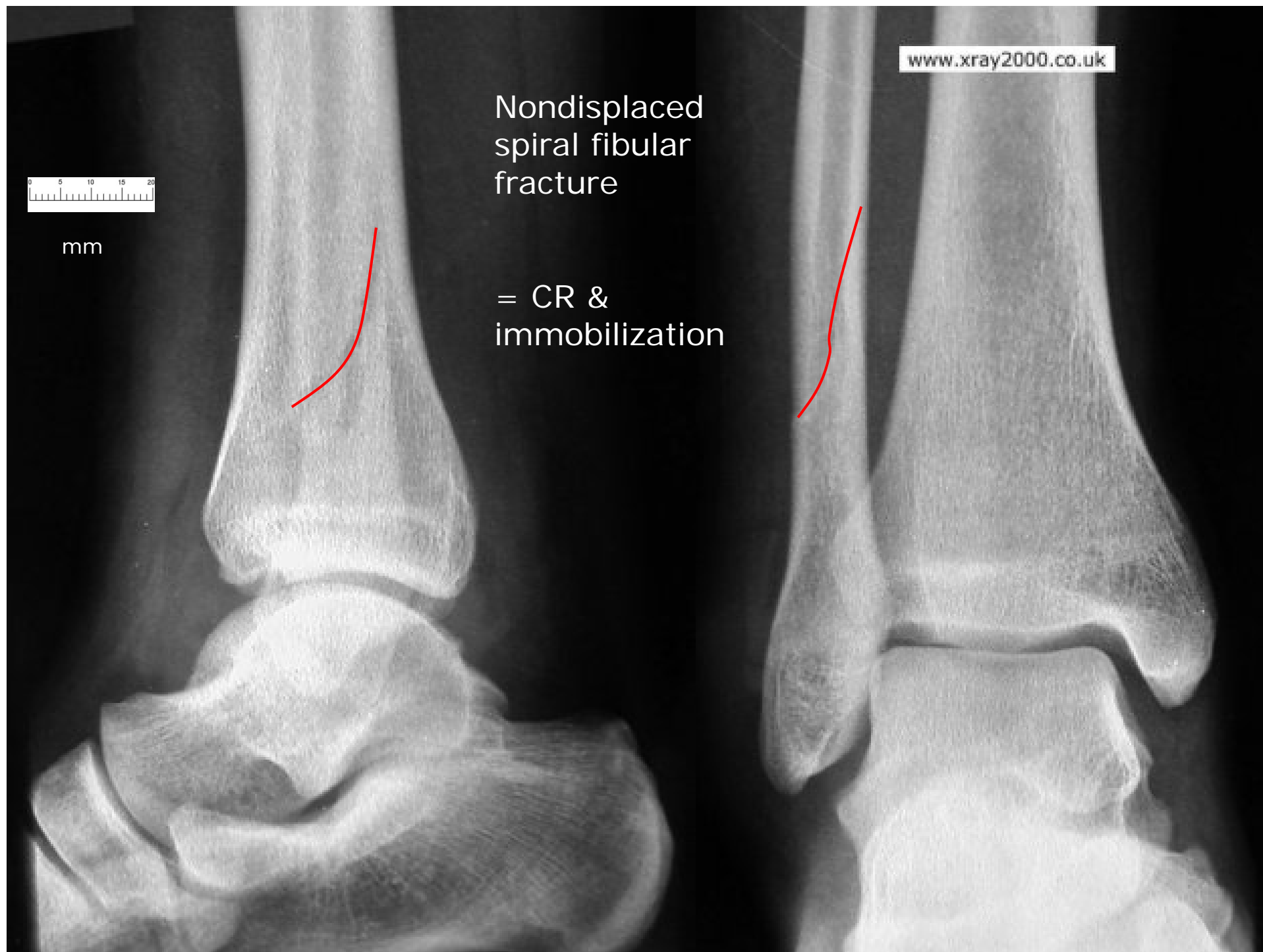
mm

Nondisplaced
spiral fibular
fracture

= CR &
immobilization

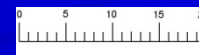


mm





Posterior malleolar
avulsion fracture



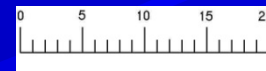
mm



Abnormal
Bohler's angle

= Calcaneal Fx

"Surgerize!"



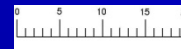
mm

RG

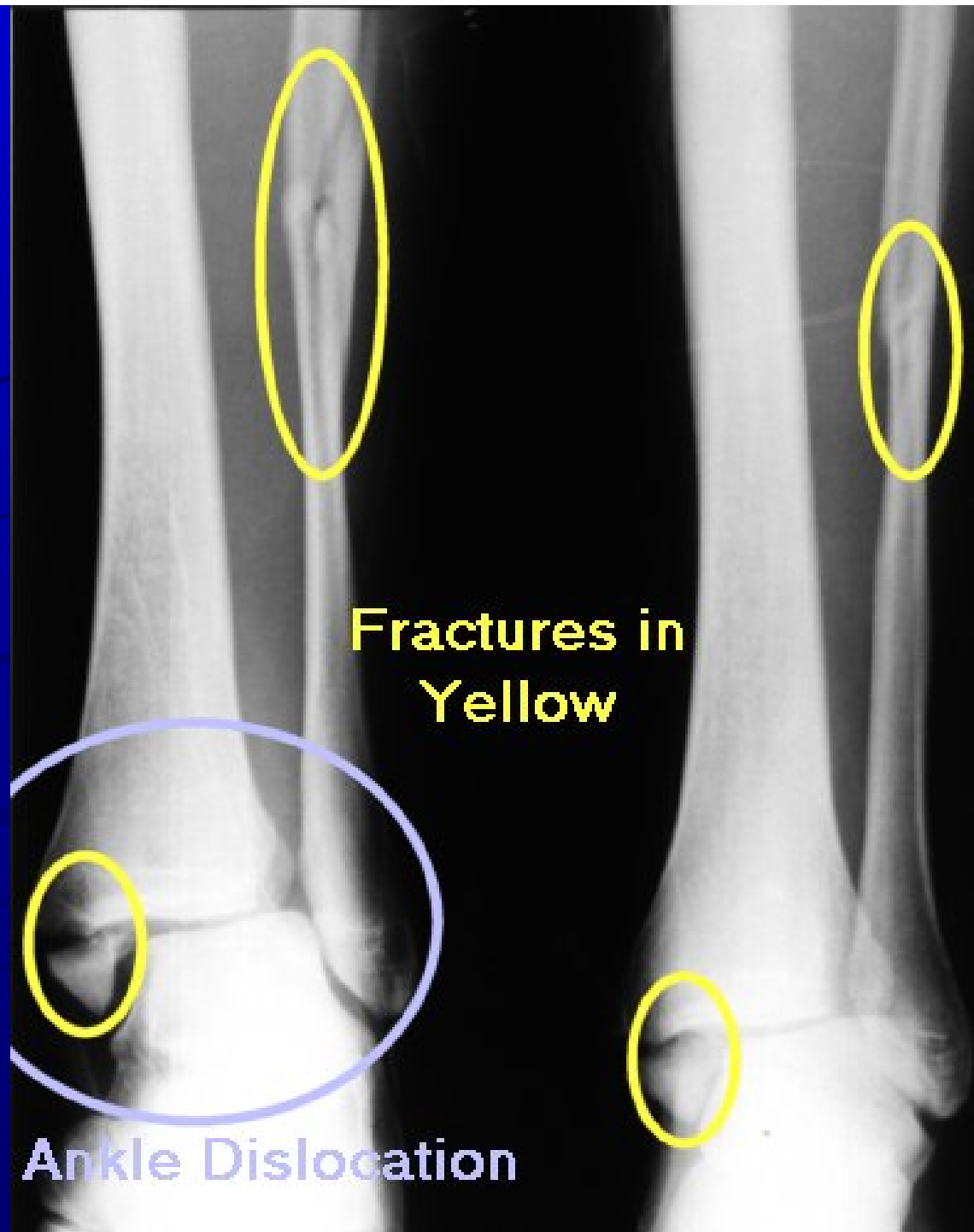


Medial malleolar
fracture

= refer for screw
fixation



mm



**Fractures in
Yellow**

Ankle Dislocation

Medial malleolar Fx

Widened medial
clear space: talar
dislocation

Open mortise:
syndesmotic injury

Maissonneuve Fx

= Surgery



mm

IZ. BEAM



Bimalleolar fractures
Osteopenic appearing
bone

Surgical referral
Tx osteoporosis prn

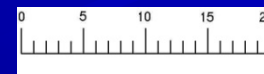


mm



Diagnosis?

Charcot's foot

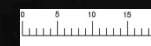


mm



Anterolateral
tibial epiphyseal
fracture

aka: *Tillaux*
fracture



mm

Tillaux Fracture

- ❖ Fracture of the anterolateral tibial epiphysis
- ❖ Mechanism
 - ❖ Avulsion of epiphyseal fragment due to the strong anterior tibiofibular ligament
 - ❖ External rotational force across the ankle
- ❖ Commonly seen in adolescents
- ❖ Treatment: ORIF



FIGURE 4. Juvenile Tillaux fracture of the tibia. A lateral fragment is avulsed from the tibia. The fragment is displaced more than 2 mm.



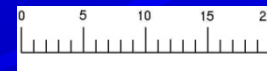
FIGURE 3. Postoperative AP (A) and lateral (B) films of the same patient reveal excellent alignment of the Tillaux fragment.



Calcaneal
osteomyelitis

= IV Abx

= Surgical I & D
if chronic



mm



embbs

Calcaneal
fracture

= ORIF



mm

Mortise view



mm



L
RG

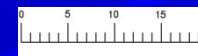
Lateral view





Positive talar tilt
stress test

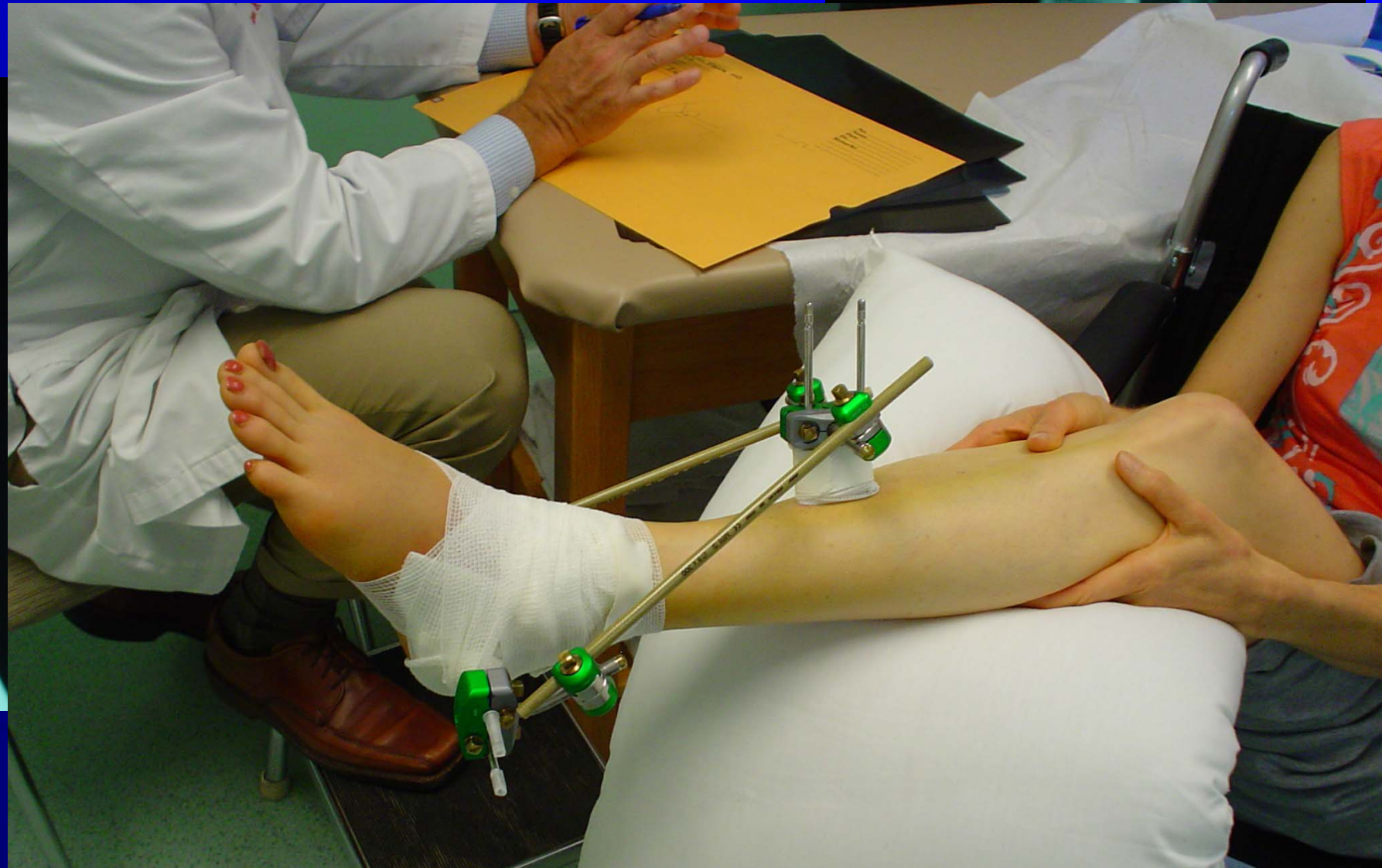
Surgery



mm

s/p Fall while rockclimbing

Treatment ?



Conclusion

- ◆ Plain radiographic anatomy of the ankle
- ◆ Indications for plain radiographs of the ankle
- ◆ Direct and indirect signs of injury on plain radiographs

