

Balaji Purushothaman

Distal Tibia Fractures

- Anatomy
- Introduction
- Classification
- Diagnosis
- Management

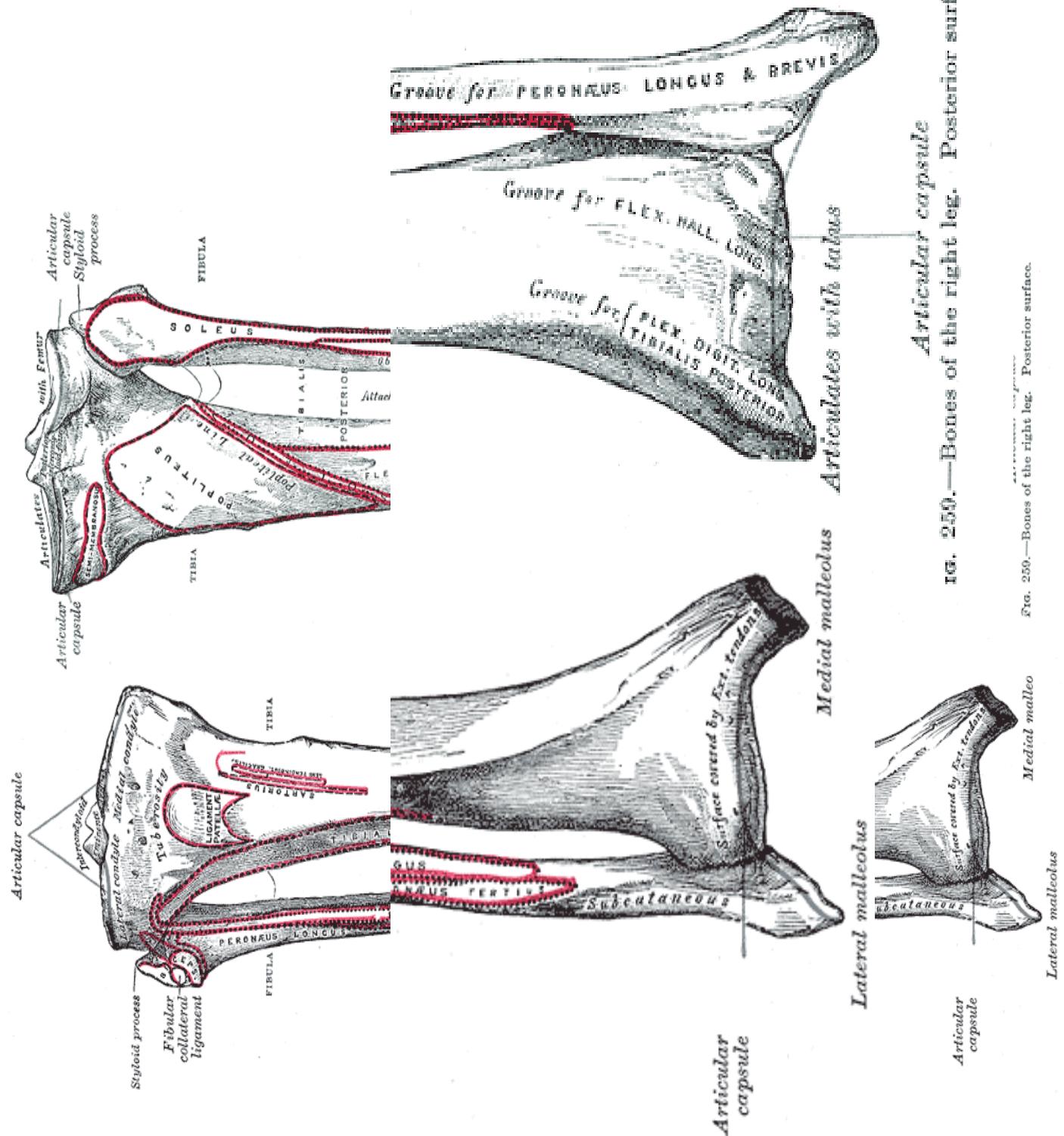
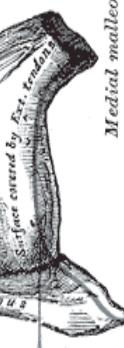


FIG. 259.—Bones of the right leg. Posterior surface.

Fig. 259.—Bones of the right leg. Posterior surface.

Lateral malleolus

Articular capsule

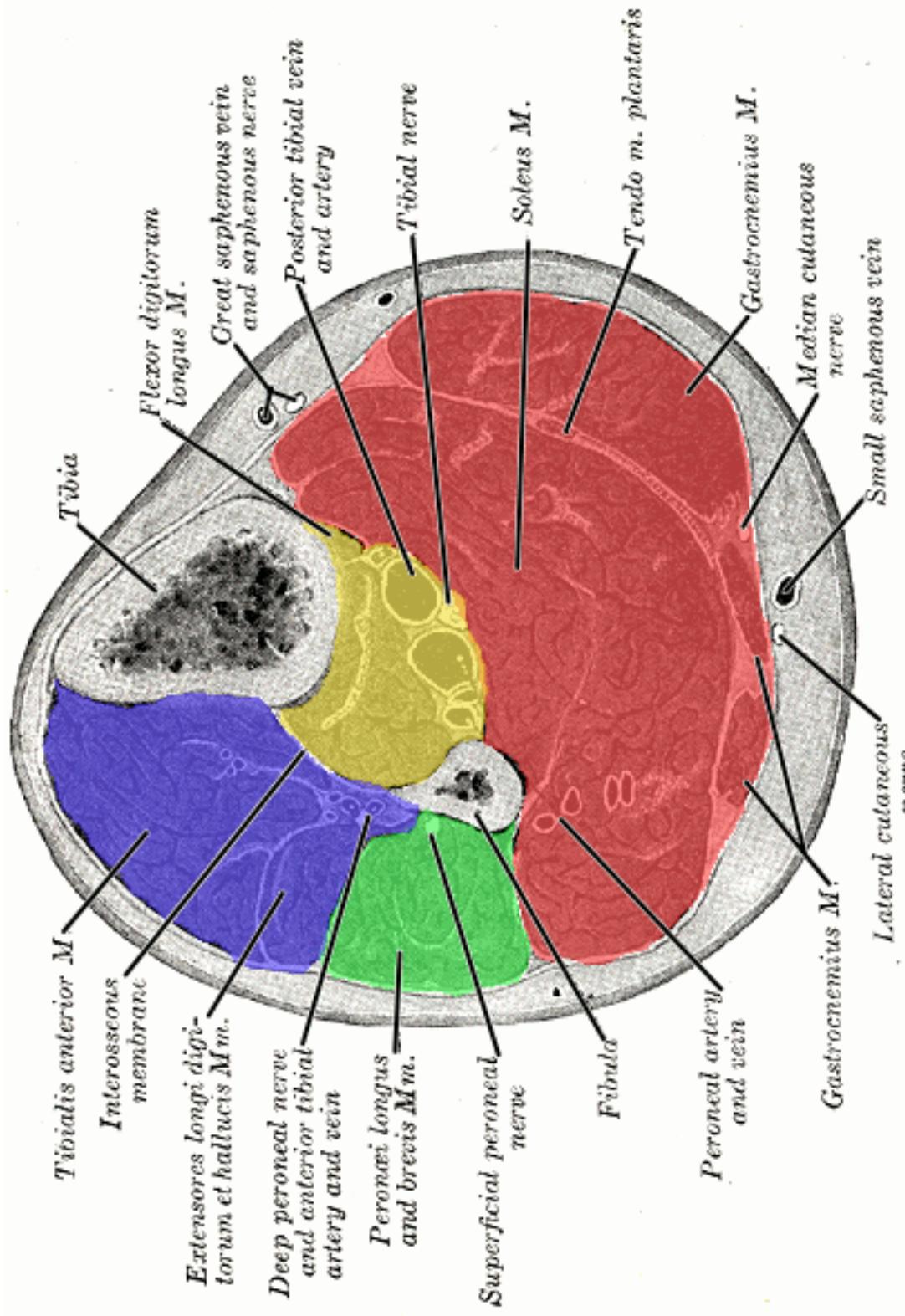


Lateral malleolus

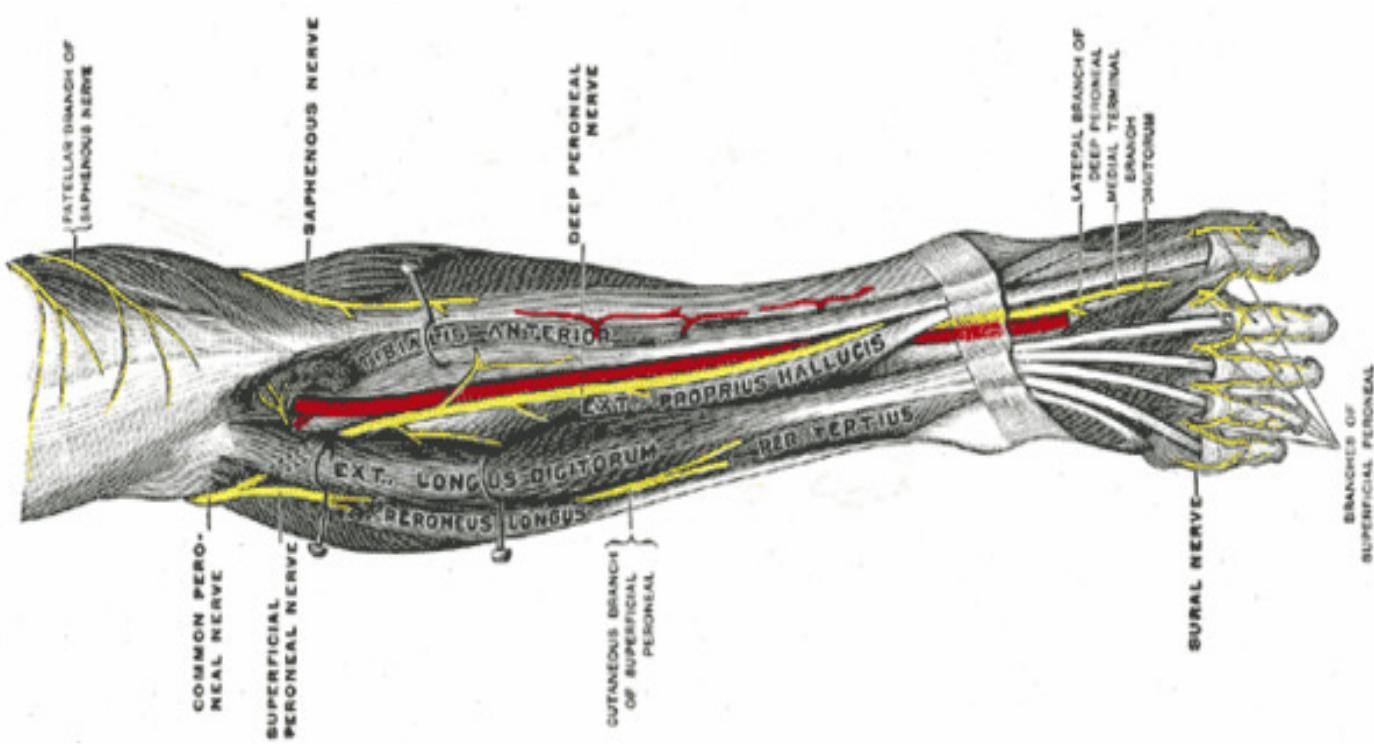
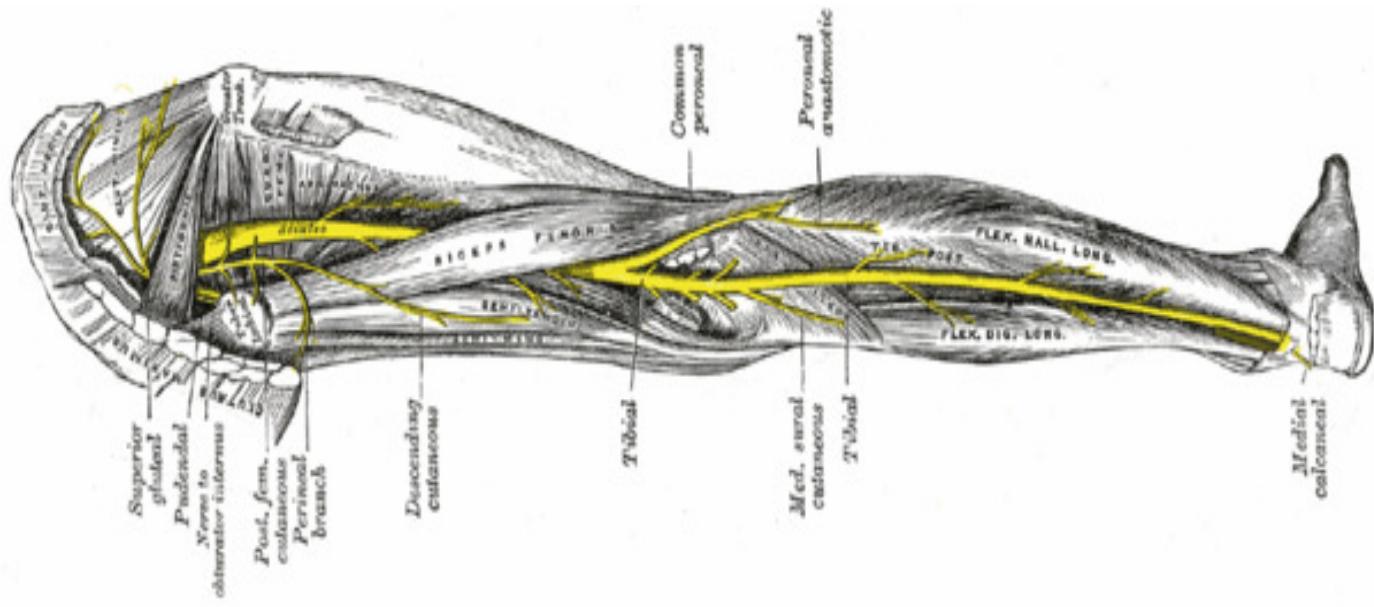
Articular capsule

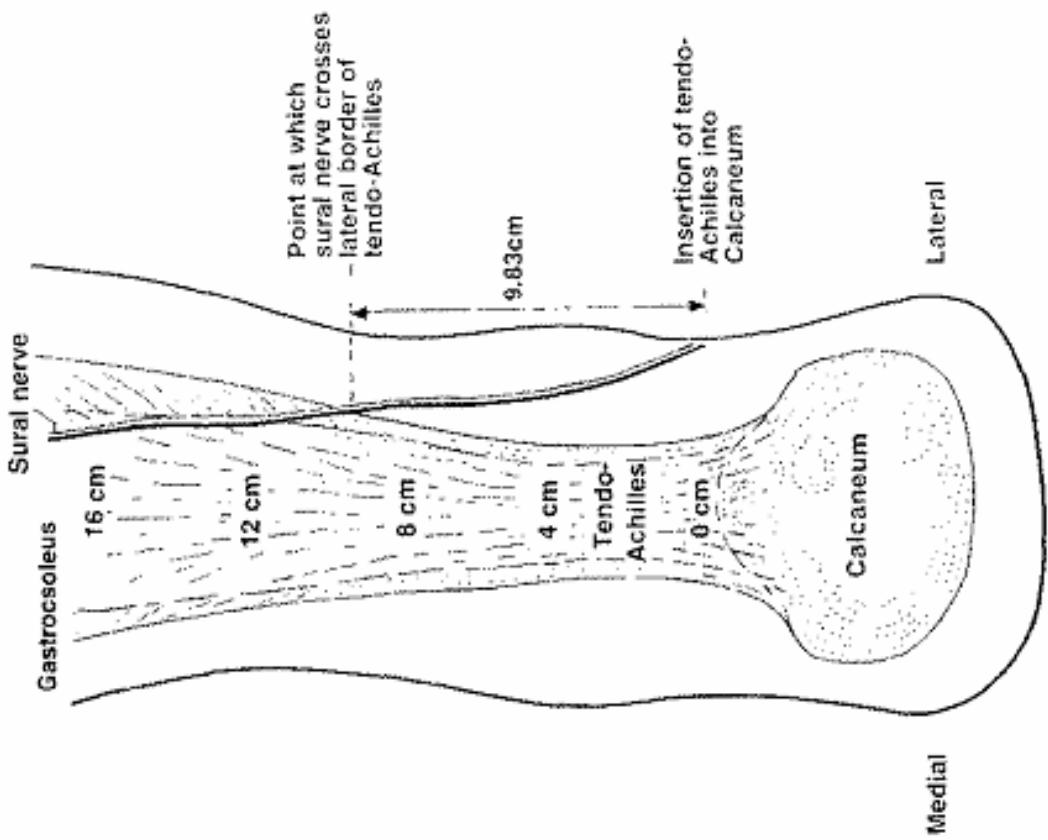
Medial malleolus

Articulates with talus



- | | | |
|-------------------|---------------------------------|--|
| Anterior | Tib. ant., EHL, EDL, PT | Deep peroneal nerve; anterior tibial vessels |
| Lateral | Peroneus longus & brevis | Superficial peroneal nerve |
| Deep posterior | Popliteus, FHL, FDL, Tib. post. | Tibial nerve; posterior tibial vessels |
| Superficial post. | Gastroc., soleus, plantaris | Medial sural cutaneous nerve |





Posterior view of Tendo-Achilles and sural nerve

Ankle Soft Tissues

Particularly
vulnerable!

- ❖ Thin skin
- ❖ Absent muscle and adipose tissue
- ❖ Lack of deep veins

Introduction

- Distal Tibia #
 - Extra-articular metaphyseal
 - Intra –articular (Plafond)

Epidemiology

3-10% of all tibial #
<1% of lower extremity #

Bone LB (1987) Fractures of the tibial plafond. The pilon fracture. *Orthop Clin North Am*; 18:95-104.
Mandracchia VJ, Evans RD, Nelson SC, et al (1999) Pilon fractures of the distal tibia. *Clin Podiatr Med Surg*; 16:743-67.
Mast JW, Spiegel PG, Pappas JN (1988) Fractures of the tibial pilon. *Clin Orthop Relat Res*;68-82.

Causes

- Fall from height
- MVA
- Poly trauma (10-20%)

Open # (10-30%) or severe soft tissue disruption

The Soft Tissue Injury!!

Red Blisters

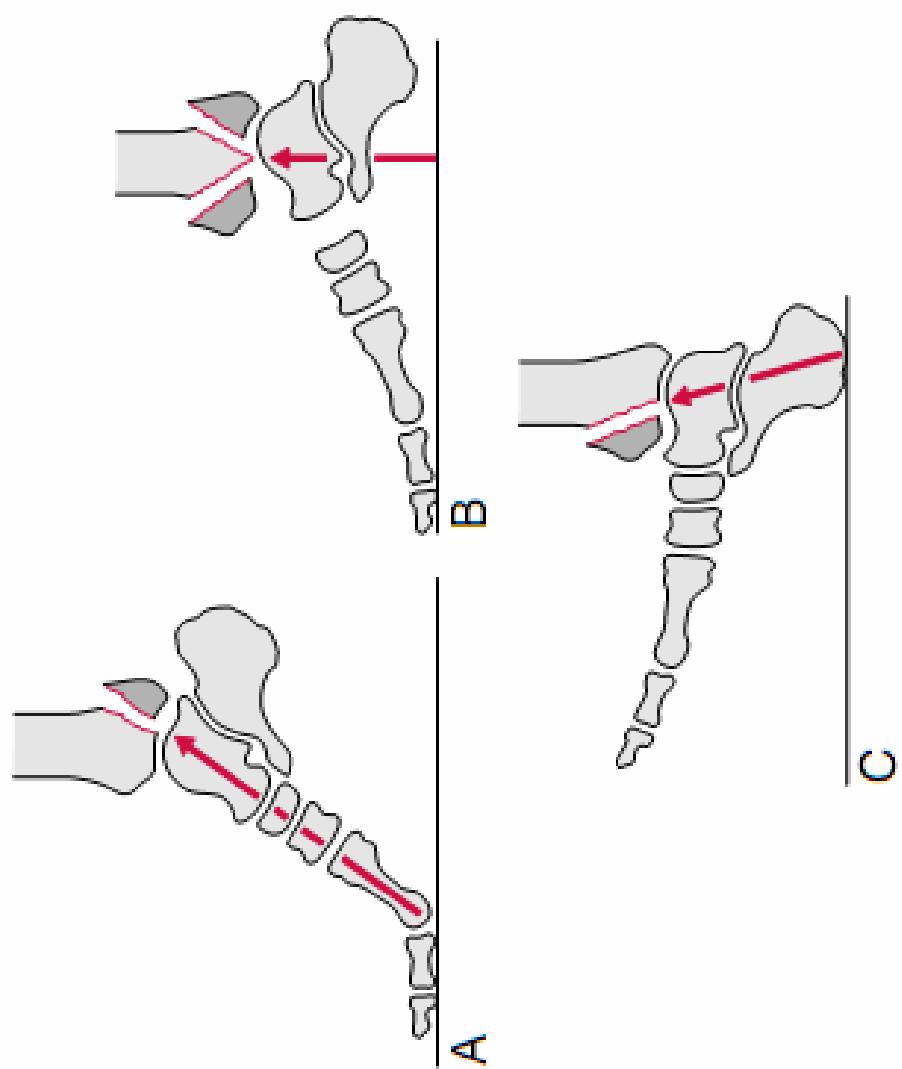


Clear Blisters



Open
Fracture





- Associated fibular fracture 70-85%
 - Valgus shear forces
 - Greater likelihood of axial malalignment and open fractures

Classification

Gustilo Anderson

Type I: clean wound of <1 cm inside-out perforation

Type II: Skin laceration > 1 cm

Type III: extensive soft-tissue damage

III A: adequate soft-tissue coverage

III B: Extensive soft-tissue loss with
periosteal stripping and bone exposure

III C: arterial injury requiring repair. independent of the fracture type

Tscherne classification

Grade 0 (Fr. C 0): *no or minor soft-tissue injury*
simple fracture from indirect trauma.

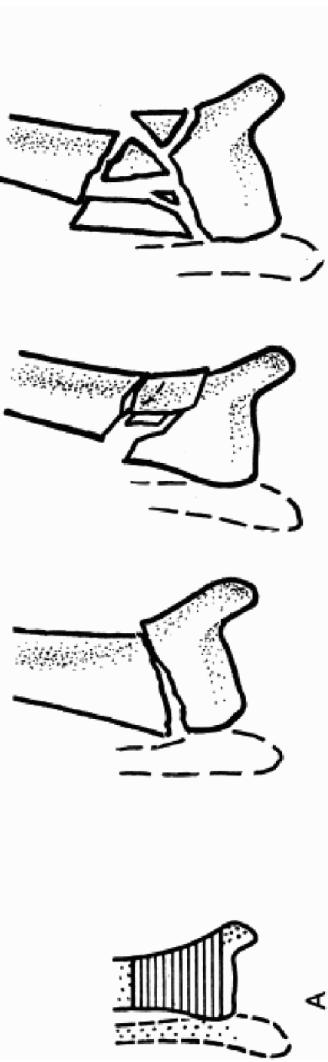
Grade I (Fr. C 1): *superficial abrasion or skin contusion*,
simple or medium severe fracture types.

Grade II (Fr. C 2): *Deep contaminated abrasions and / localized skin or muscle contusions*
direct trauma
Imminent compartment syndrome

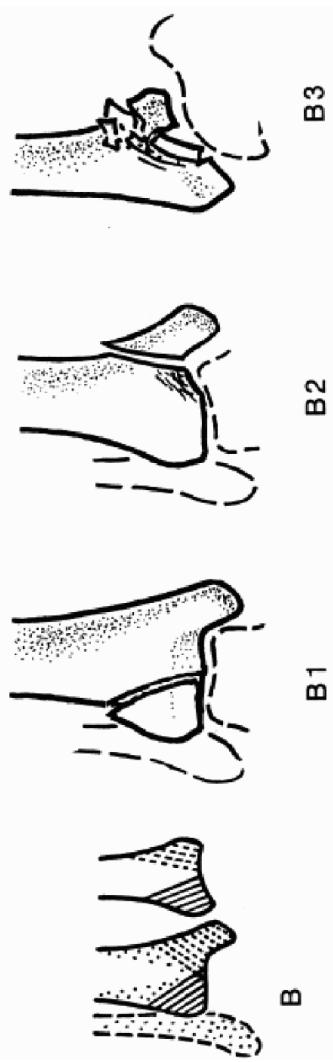
Grade III (Fr. C 3): extensive skin contusion,
(closed degloving)
Manifest compartment syndrome and vascular injuries

Type A: extra-articular

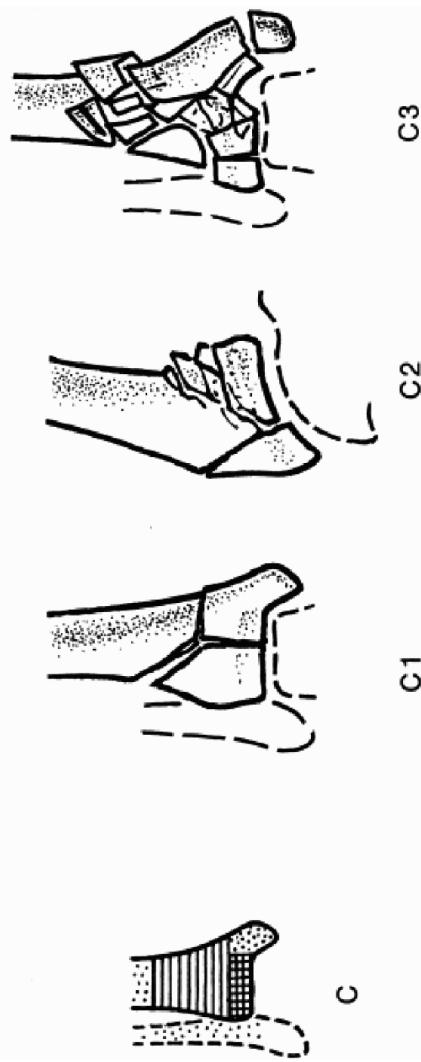
- A1** (simple)
- A2** (wedge)
- A3** (complex)

**Type B: partial articular**

- B1** (pure split)
- B2** (split-depression)
- B3** (multifrag depression)

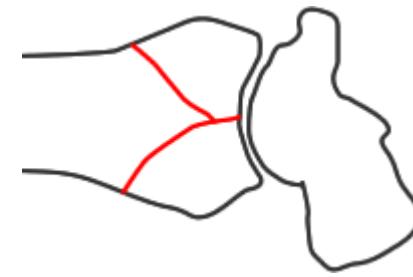
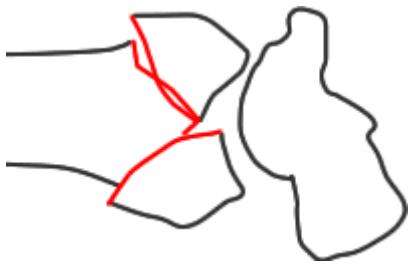
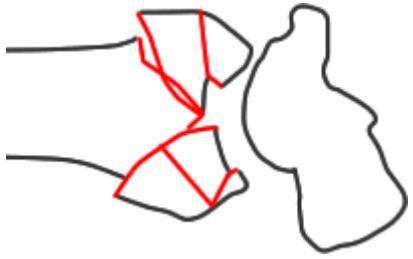
**Type C : complete articular**

- C1** (articular simple, metaphyseal simple),
- C2** (articular simple, metaphyseal multifrag),
- C3** (articular multifrag)



Ruedi Allgower classification

- I - no comminution or displacement of joint fragments
- II - some displacement but no comminution or impaction
- III - comminution and/or impaction of the joint surface



Diagnosis

- ATLS
- 2 survey
- 1/3 injury to contralateral leg and foot
- 6% peroneal nerve injury
- Compartment syndrome (deep posterior)

- Plain films (AP, Lateral, mortise)
 - 45 deg ext rotation view

CT

Extra articular # - 43% has articular involvement
93% associated with spiral #

Pilon # (post ex fix)

Additional info in 82% and change of surgical plan 64%

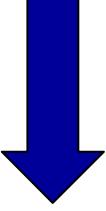
Altman D, et al **Results of a CT Protocol Evaluating Distal Third Tibia Fractures to Detect Occult Ankle Fractures**
poster presentation AAOS 2009
Tornetta, P., 3rd; Gorup, J. Axial computed tomography of pilon fractures. Clin Orthop 323:273–276, 1996.

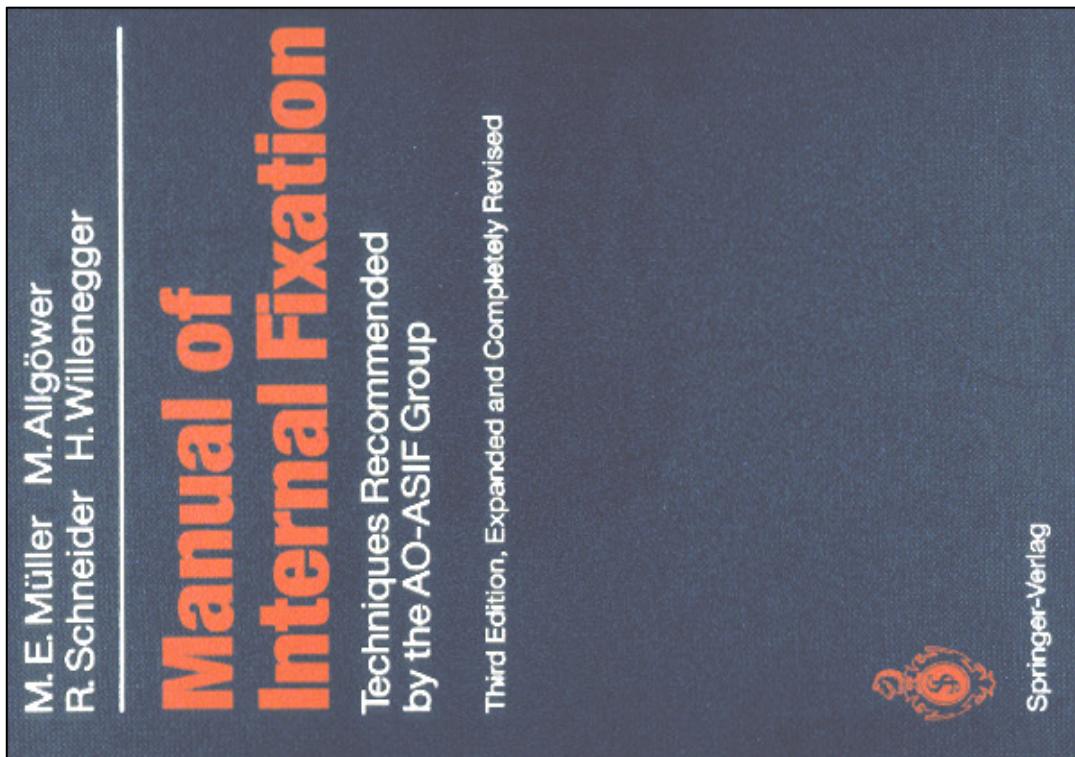
RX

- Extra articular
 - Plating Vs Nail Vs Frames
 - Is Fibular plating needed?

Authors	Details of the study	Implants studied	Results
Strauss et al JOT 2007	Cadaveric study Extra articular #	IMN vs LP (S&N)	Intact fibula LP = IMN Fibular osteotomy LP > IMN
Hoening et al JOT 2010	Cadaveric study Extra articular # Intact fibula (4.3 A3)	SP LP IMN ASN	IMN > LP > SP (stiffness and load to failure) IMN = ASN
Guo et al JBJS 2010	Prosp R trial 85 pts (43 A1-3)	IMN vs MIPO	No diff in union, more pain but better function and AOOFAS in IMN. Shorter op & radiation time and easier removal of implant

Four principles “stood the test
of time”

- Anatomical reduction** 
- Stable internal fixation
- Atraumatic technique
- Early pain-free mobilization



Cases
Treated

1980's
Early
1990's

McFerran et al JOT 1992

21 pts (40%) with major complications
require 77 additional operations

Wyrsch et al JBJS 1996

3/18 amputations in closed fractures

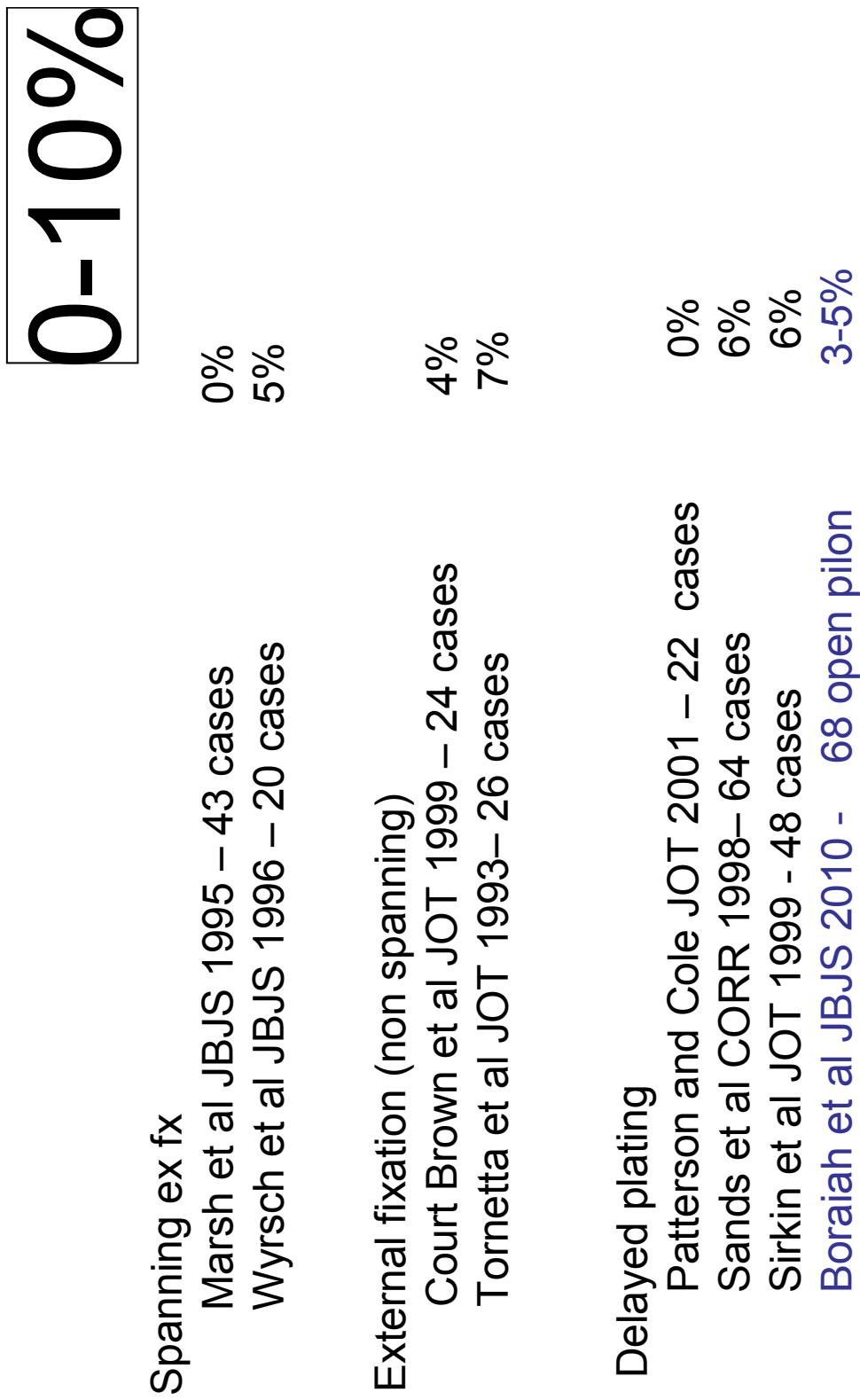
Teeney and Wiss CORR 1993

37% infection and 26% fusion in Type 3's

Current techniques emphasize the soft tissue injury

- Delays to surgery
- Spanning ex fix
- Percutaneous and limited approaches

Complications – current techniques



Pilon

- Temporary stabilisation



- Joint reconstruction

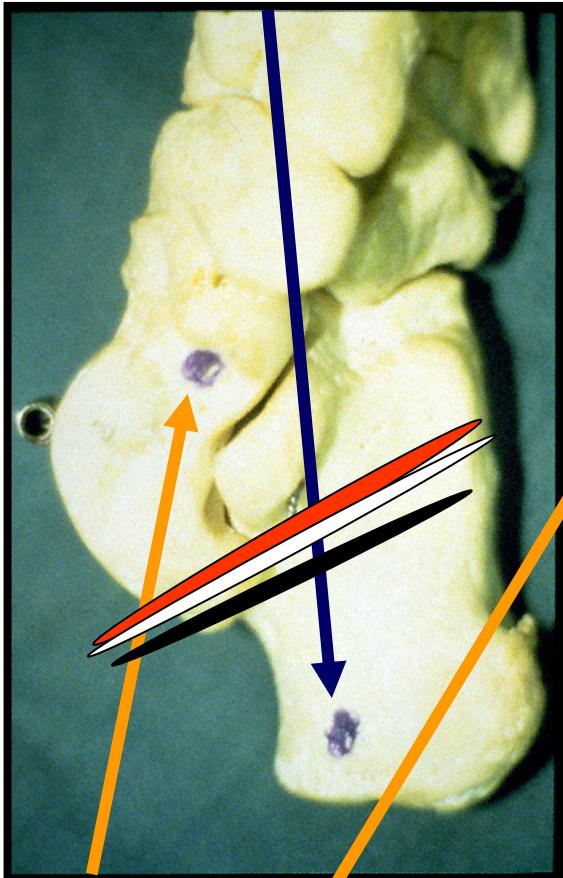
ORIF
Ex fix
Limited ORIF + Ex Fix
MIPO

Ex Fix

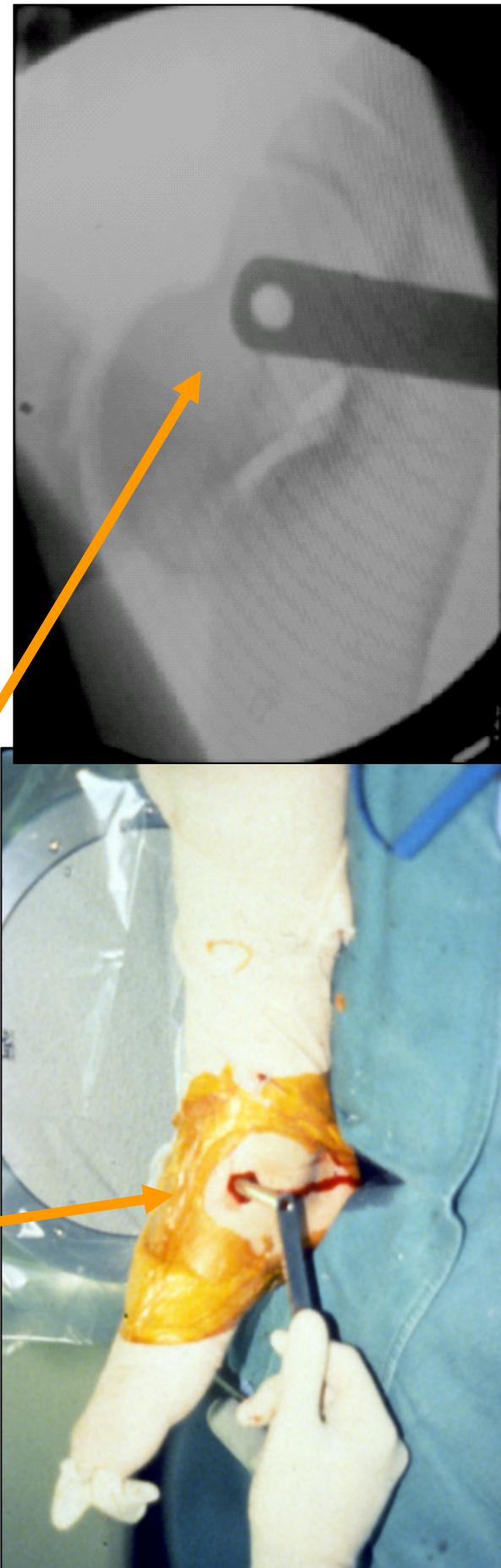
- Plan incision and keep pins away
- Clamps and bars away from the #



posterior
os calcis



Target the neck
of the talus



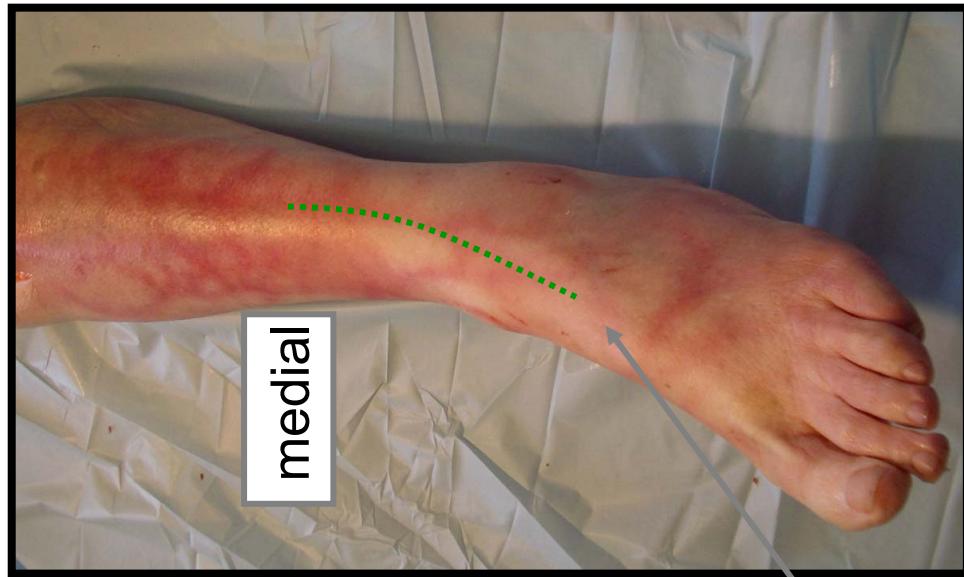
Potential Approaches to the Tibia:

- Extensile Anteromedial Approach
- Anterolateral Approach
- Posterolateral Approach

Anteromedial Approach

— Superficially:

- begin $\frac{1}{2}$ finger breadth lateral to crest over the anterior compartment
- continue parallel to Tib Ant towards the talonavicular joint
- maintaining a 7 cm skin bridge



talonavicular joint

Anteromedial Approach

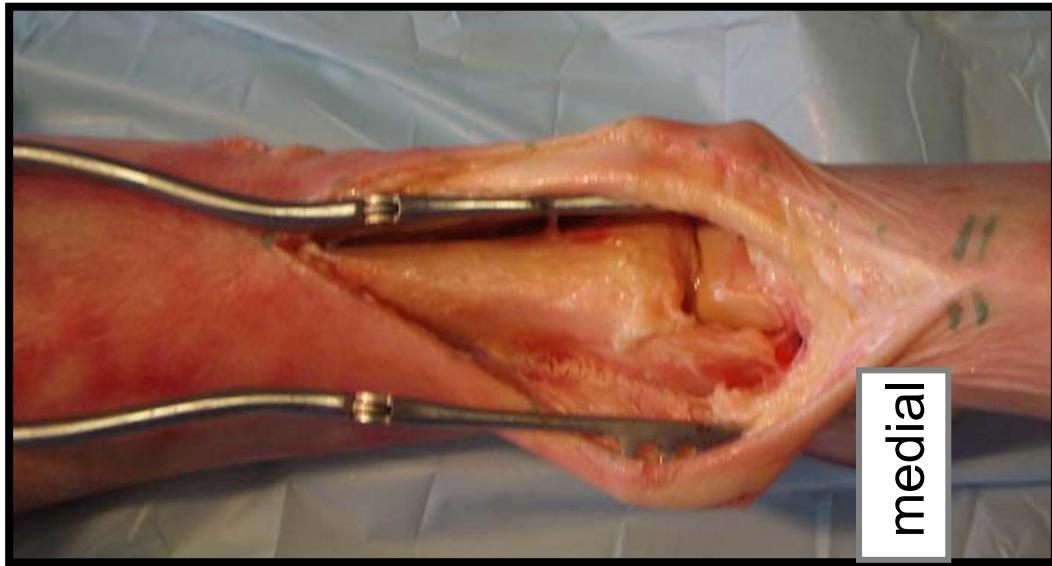


- Deep dissection:
 - carried out medial to Anterior Tibialis tendon

Anteromedial Approach

Anteromedial Approach

- Deep dissection:
 - longitudinal arthrotomy,
 - gentle elevation of tendons and neurovascular bundle



DON'T make medial a incision !!



Anterolateral Approach



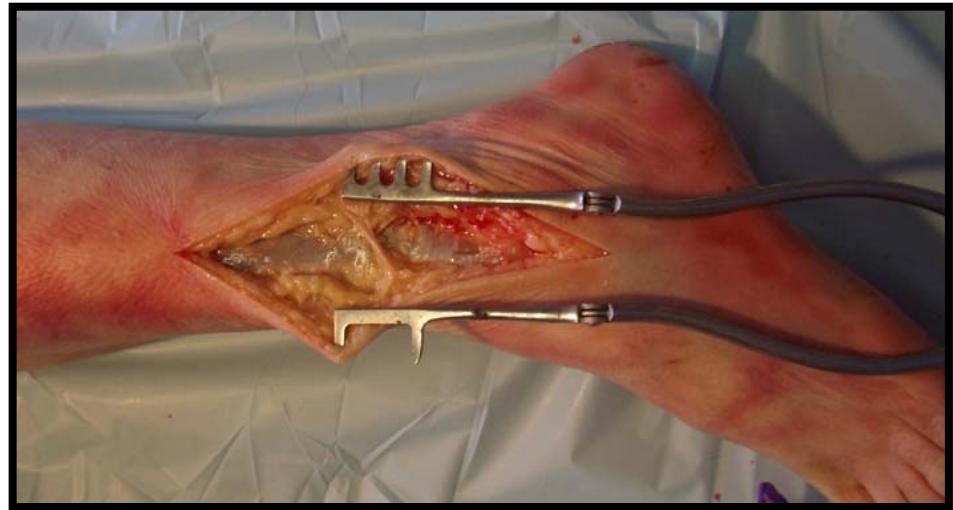
- Indications:
 - open medial wound,
 - displaced Chaput fragment,
 - lateral articular comminution

Advantage:

- plate coverage
- uninjured skin
- Both tibia and fibula often through same incision

- Caution
 - Superficial peroneal nerve

Anterolateral Approach



- Incision in line with 4th MT
- Deep Dissection:
 - through superior and inferior retinaculae,
 - interval between toe extensors and fibula,
 - elevate muscles off interosseous membrane,
- Caution
 - Superficial peroneal nerve

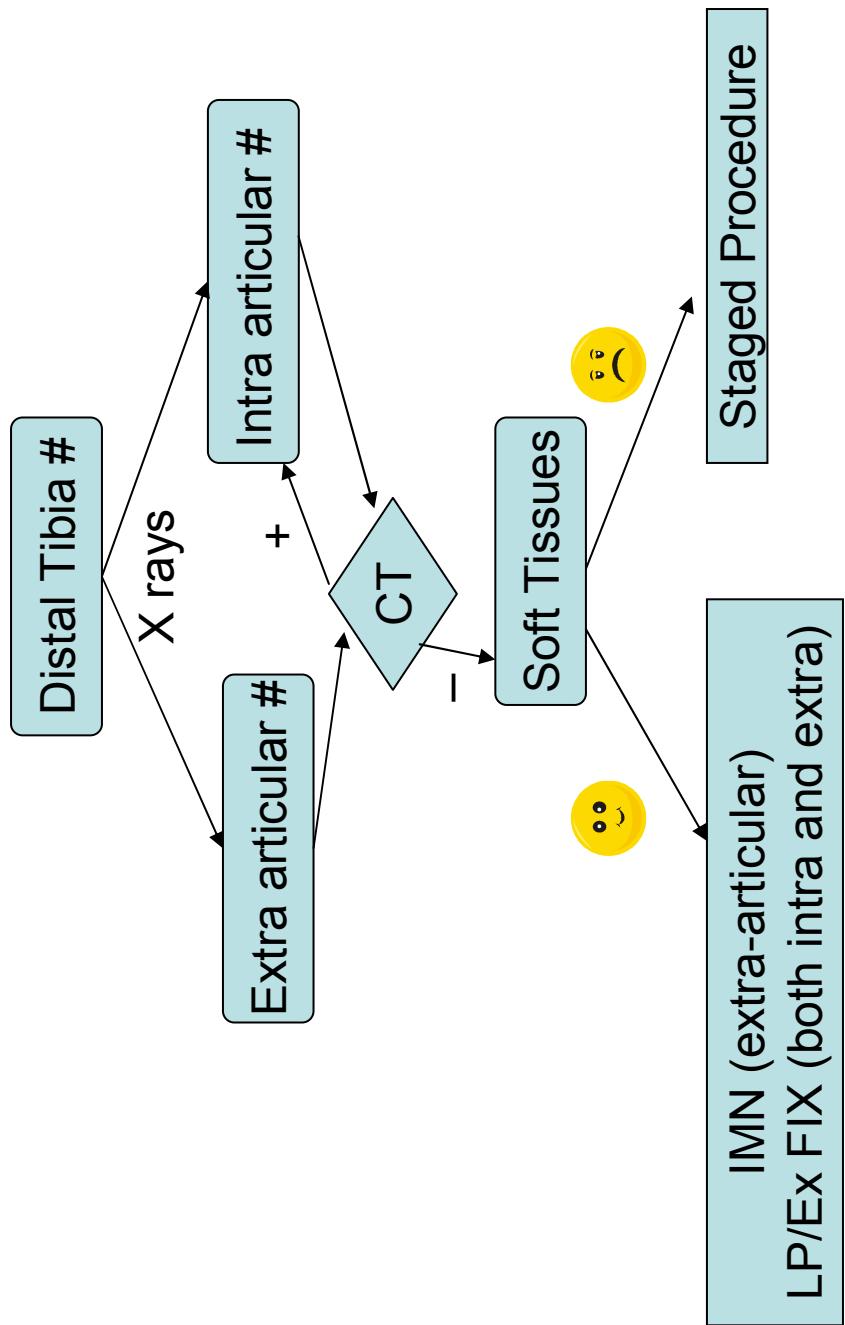
Posterolateral Approach

Between the peroneal tendons and FHL

- Advantages
 - a single incision for ORIF of the tibia and fibula
- Disadvantages
 - limited access to anterior articular fracture fragments
 - prone position
 - sural nerve at risk

Complications

- Early
 - Soft tissue problems
 - Infection
 - Superficial
 - Deep
 - Septic arthritis
- Late
 - Malunion
 - Non union
 - Traumatic arthrosis
 - Chronic osteomyelitis



Summary

- High energy fractures with severe associated soft tissue injury
- Unpredictable outcomes
- Keep complications – 10% or less