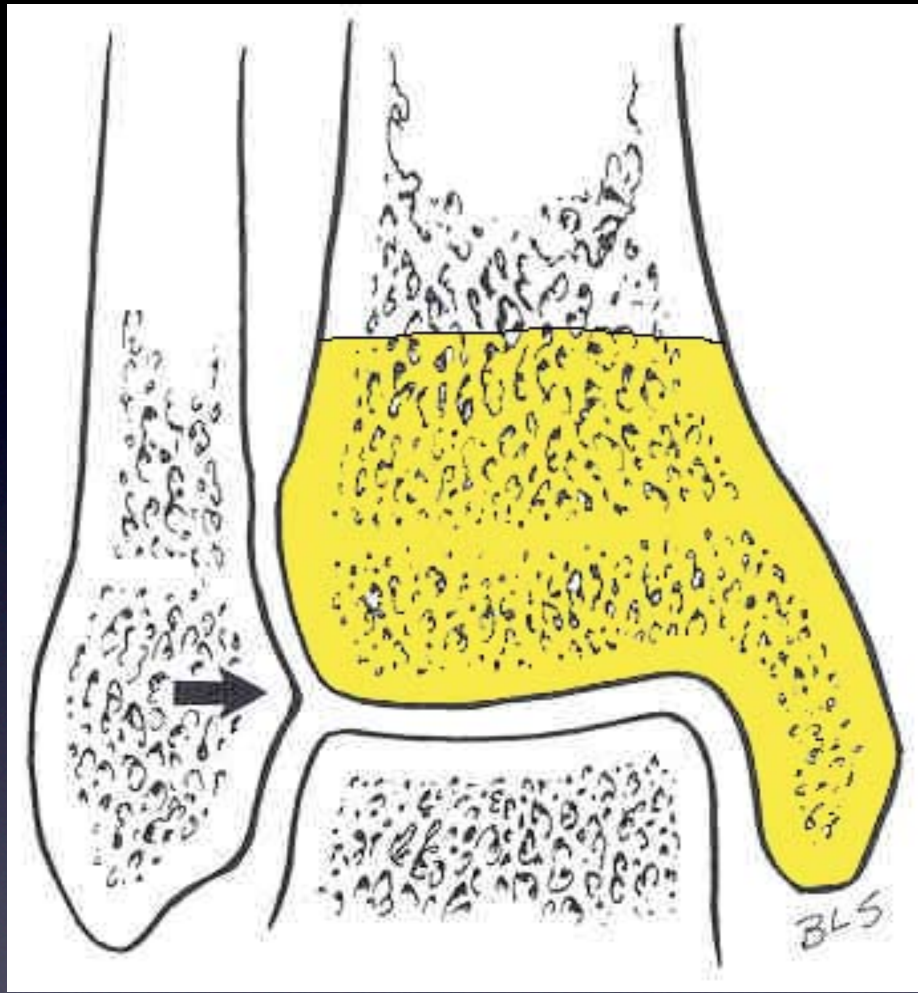
Classification of Pilon Tibial Fractures

J de Halleux, MD

Geneva, June 2th 2016

Fracture of the distal tibial metaphysis

(intra or extra articular)



- *Destot 1911 : "Pilon fracture"*
- *Bonin 1950 : "Plafond fracture"*

PILON FRACTURE

Talus acts as a hammer that impacts and injures the tibialplafond

- There is virtually no resistance to a compressive force more than 3cm proximal to the subchondral bone plate *(Atiken et al.)*
- High-energy which is axially loaded => pilon fracture


Mechanisme of injury

High (ski-road accident)
Low (osteoporosis)

ENERGY ↔ **FORCES**

Axial loaded compr F
Torsional component

POSITION OF THE FOOT

Varus-valgus
Plantar-dorsiflexion

Pilon Fractures : Mechanisme of injury

Rotation Force

- Slow rate of load application
- Little energy released at failure (yield point)
- Little comminution
- Predominant translation displacement of the talus
- Minimal soft tissue injury

Axial load Force

- Rapid rate of load apllication
- Large amount of energy released
- Comminuted articular surface and metaphysis
- Proximal displacement of the talus
- Severe soft tissue injury

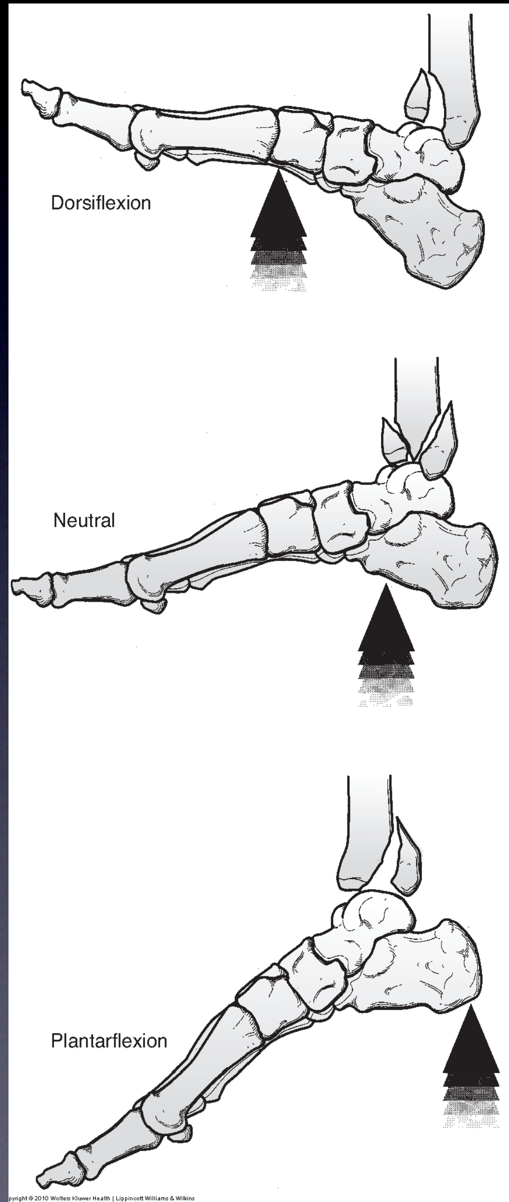
Courtesy of Marsh JL, Saltzman CL

Mechanisme of injury

Böhler

1951

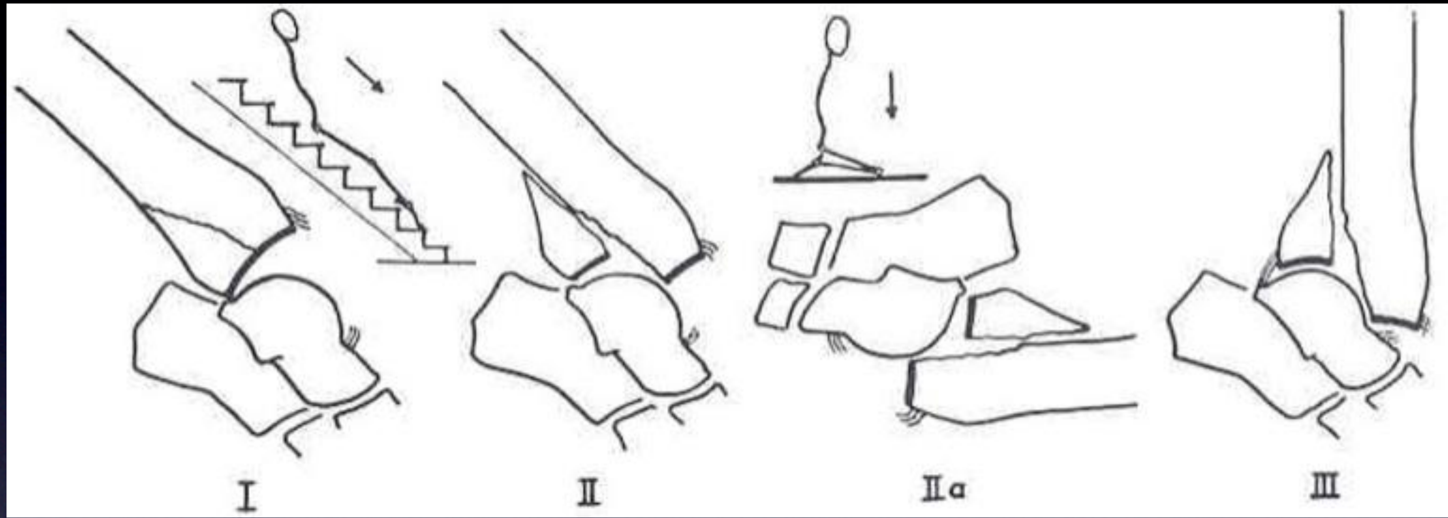
Position of the foot at the time of injury



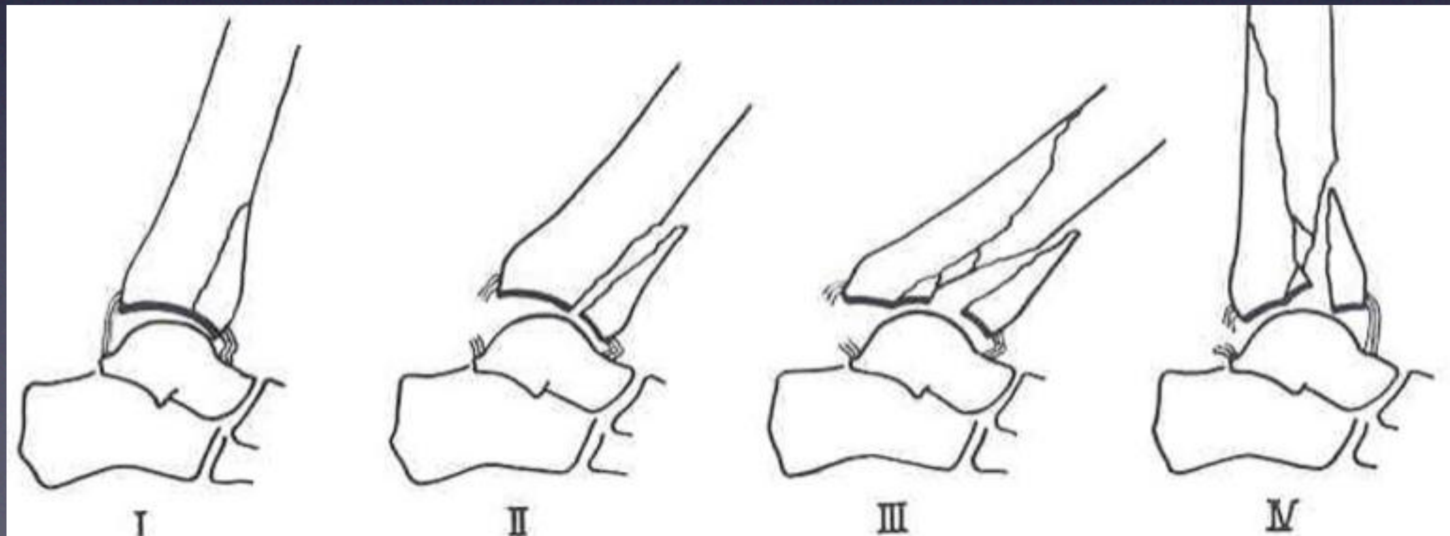
Böhler and all, in Technik der knochenbruchbehandelung. Vienna:Aufi Maudrich;1951;p12-3

Böhler

PLANTAR FLEXION



DORSAL FLEXION



Classification

RÜEDI AND ALLGÖWER

1968
Most commonly used

- **Severity of the injury**
- **Outcome**
- **Planning the surgical approach**

Rüedi, Allgöwer, Injury, 1973; 5:130—4
Rüedi, Matter, Allgöwer, Helv Chir acta, 1968; 35:556-82

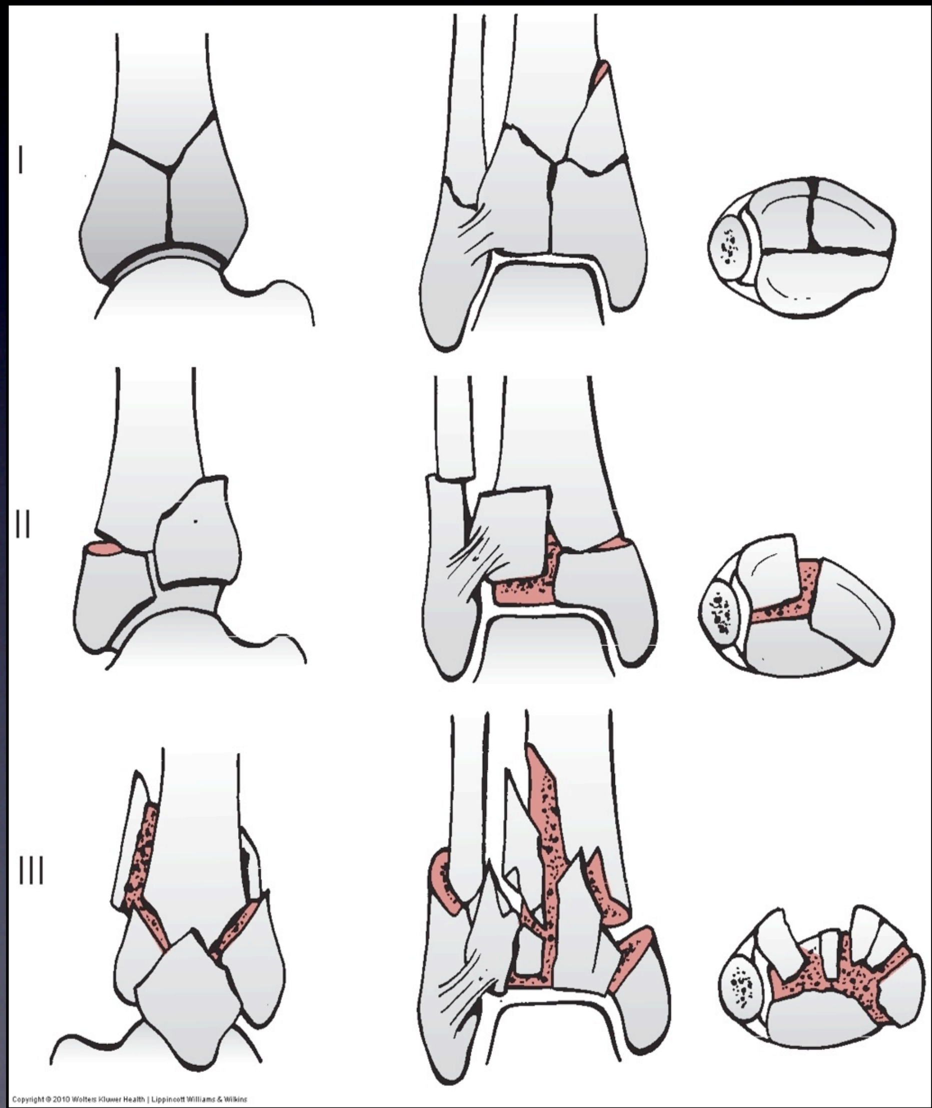
Rüedi and Allgöwer CLASSIFICATION

only intrarticular fracture !

TYPE 1 *Non displaced*

TYPE 2 *Large articular fragments*

TYPE 3 *Communition + impaction*

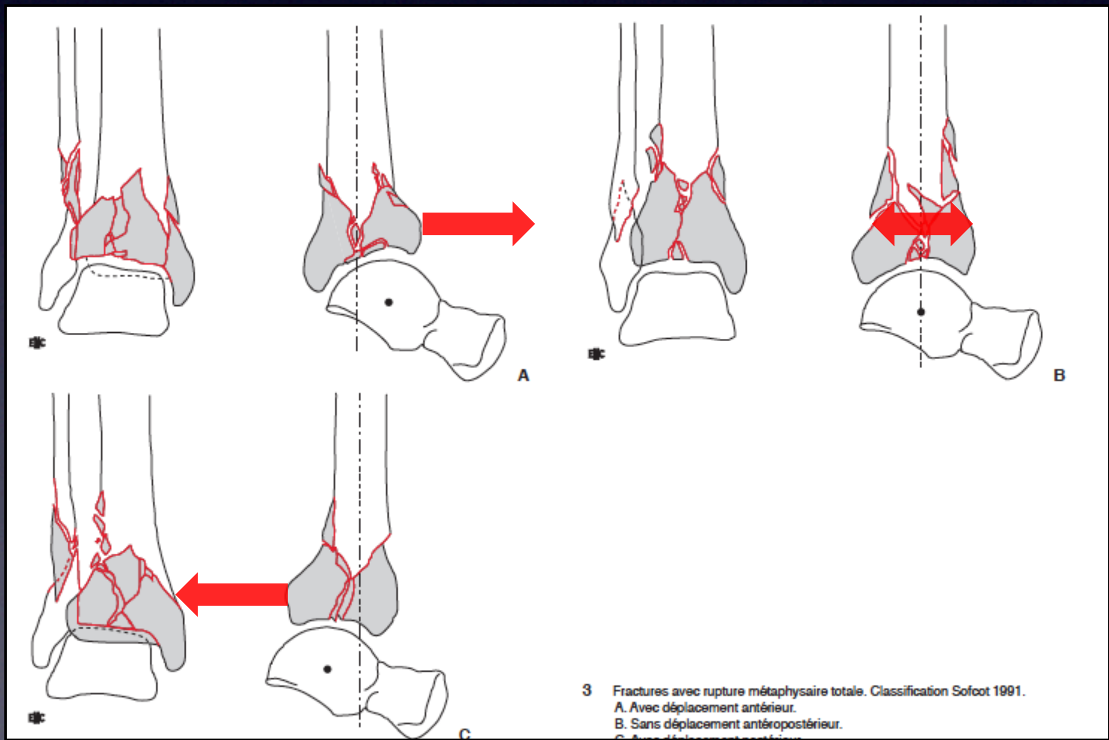


Rüedi, Allgöwer, Injury, 1973; 5:130—4
Rüedi, Matter, Allgöwer, Helv Chir acta, 1968; 35:556-82

Classification SOFCOT, 1991

(706 patients)

- PARTIAL 43% *(continuity tibial diaphysis/epiphysis)*
- COMPLETE 57% *(NO continuity tibial diaphysis/epiphysis)*



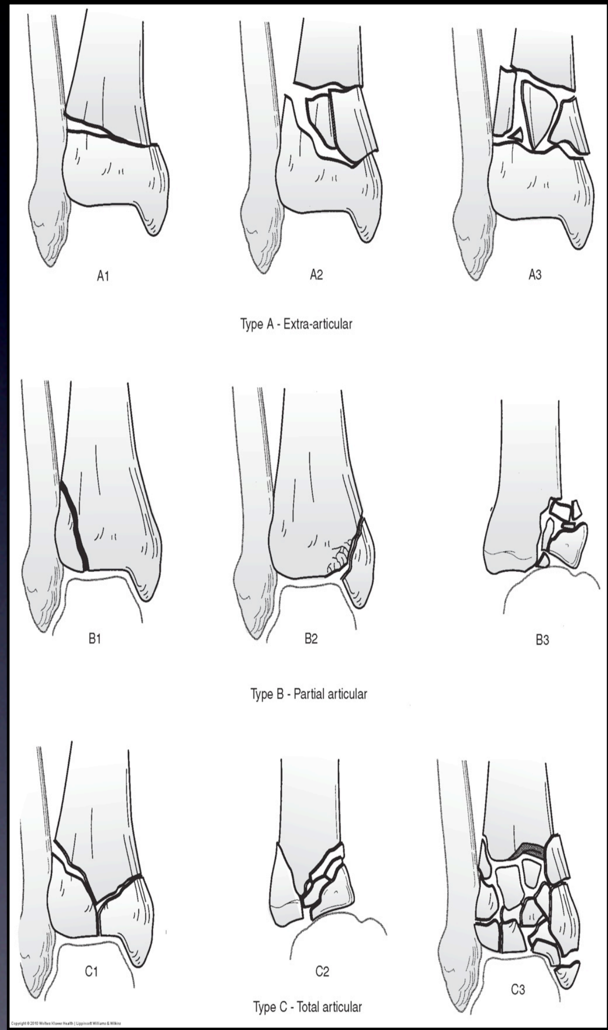
Copin G and all. Les fractures du pilon tibial de l'adulte
(Symposium SOFCOT. Paris, nov1991). Rev Chir orthop 1992;78 (supplI):54-56

AO/OTA CLASSIFICATION

Intra + extrarticular

More details

Extra-articular	43A	1 2 3
Partial intra-articular	43B	1 2 3
Completely intra-articular	43C	1 2 3



1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3

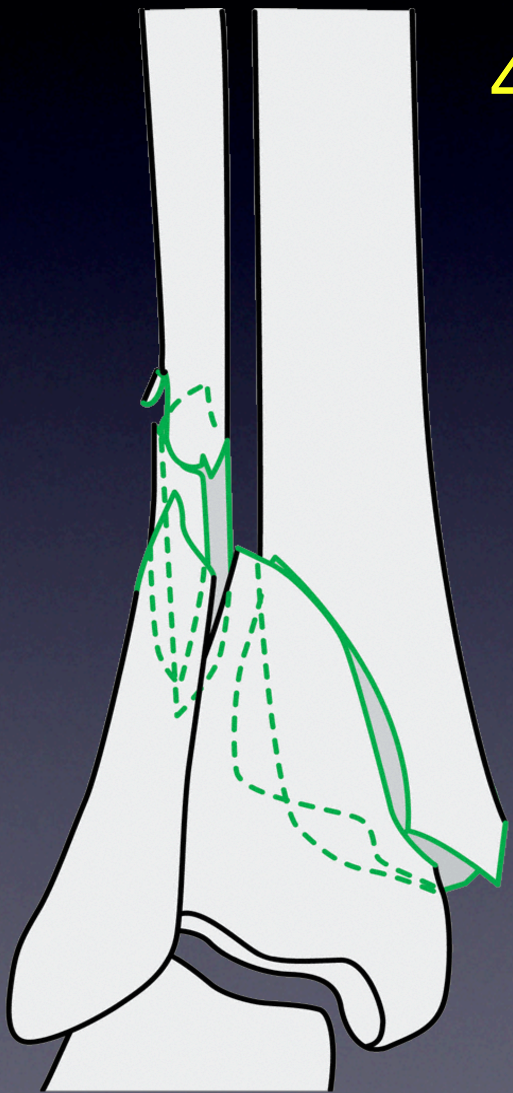
Degree of Fracture
Comminution

Others : fracture direction+description + localisation
impaction
degree of comminution

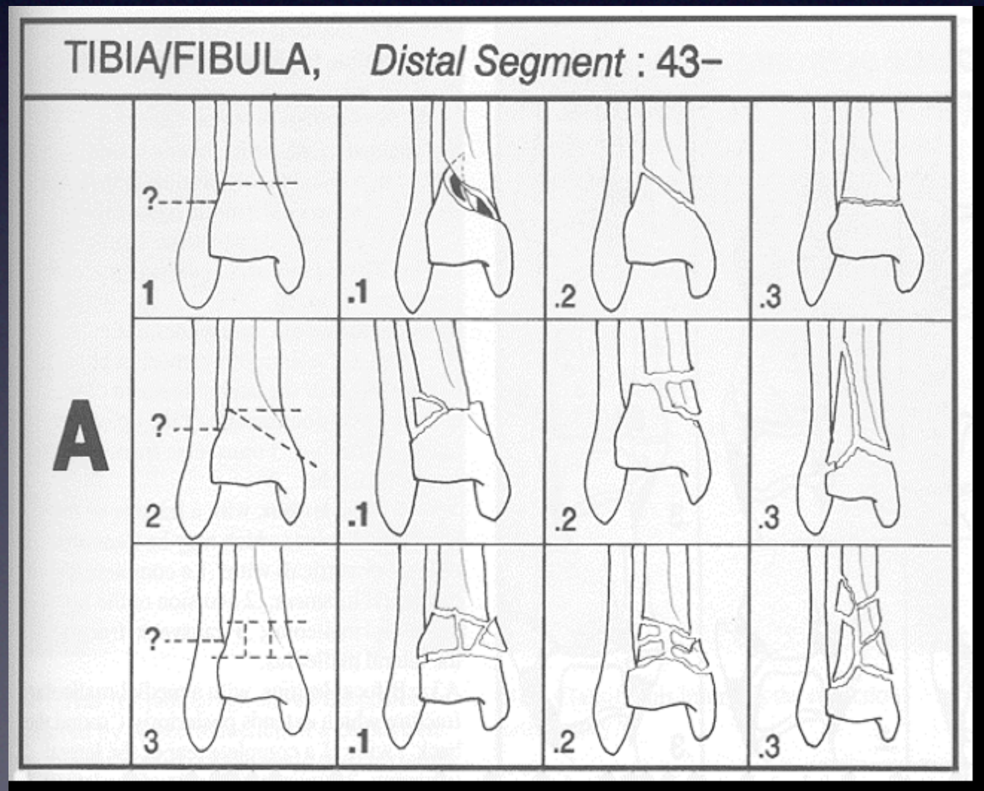
MüllerM and all, The comprehensive classification of fractures of long bones. Berlin: Springer verslag; 1990

Classification AO distal Tibia: 43

43-A: extraarticular



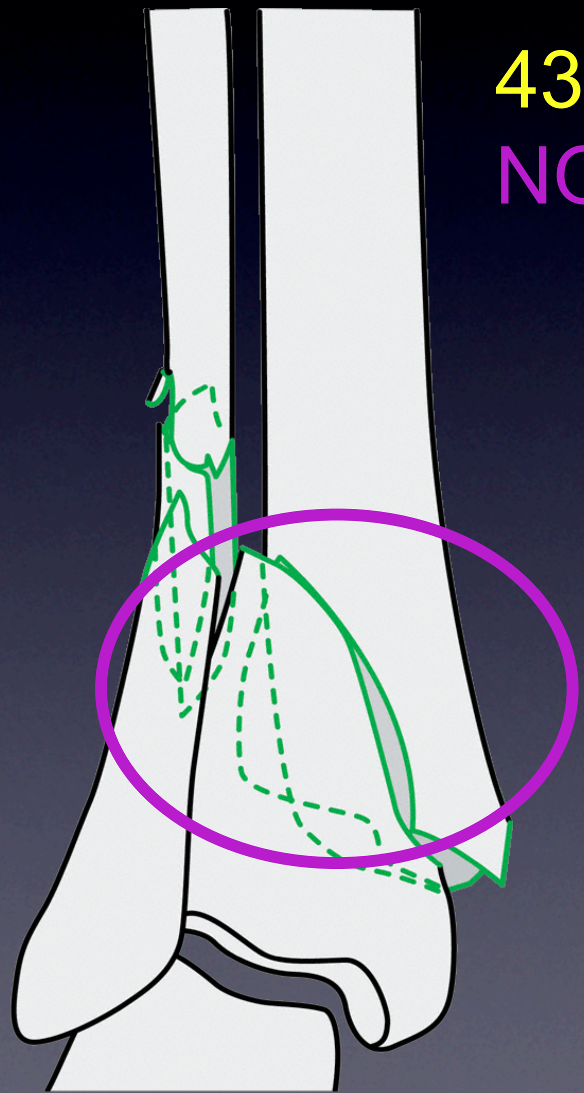
Picture from M Assal



Classification AO distal Tibia: 43

43-A: extraarticular

NO continuity diaphysis/articular surface



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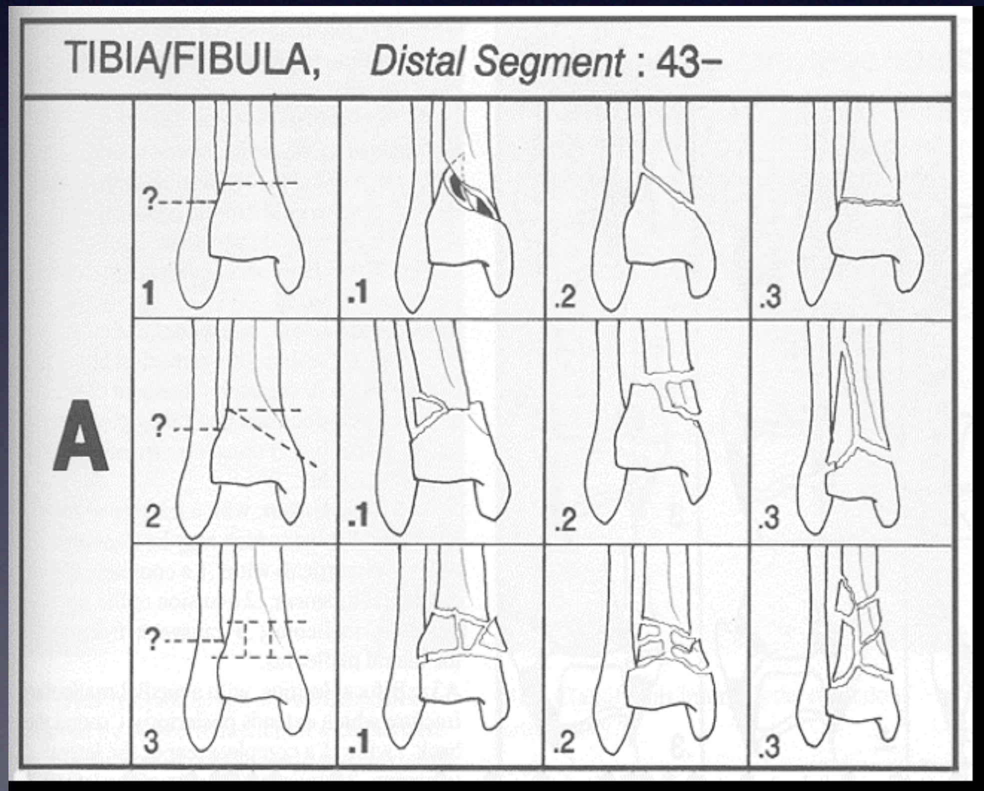
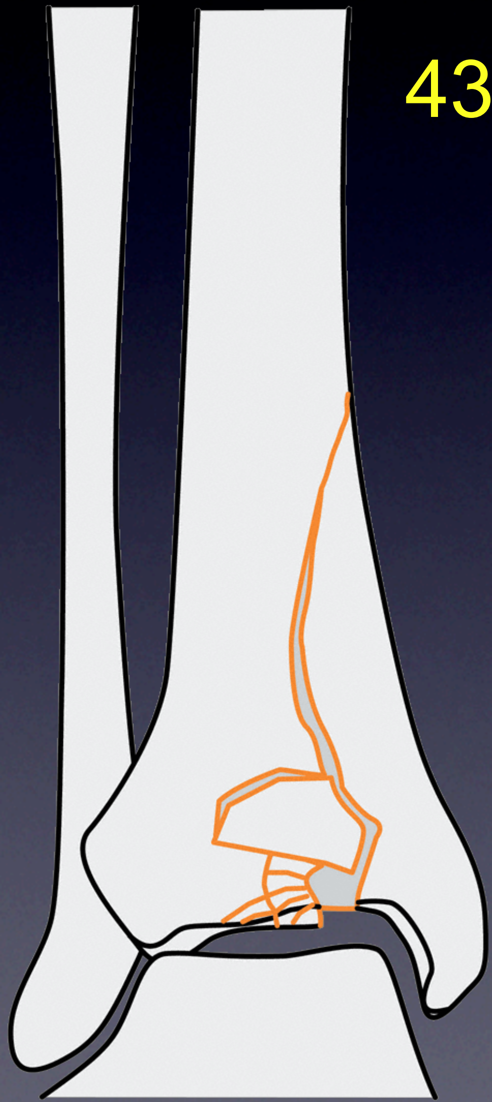


Classification AO distal Tibia: 43

43-B: partial intraarticular (torsion mechanism)



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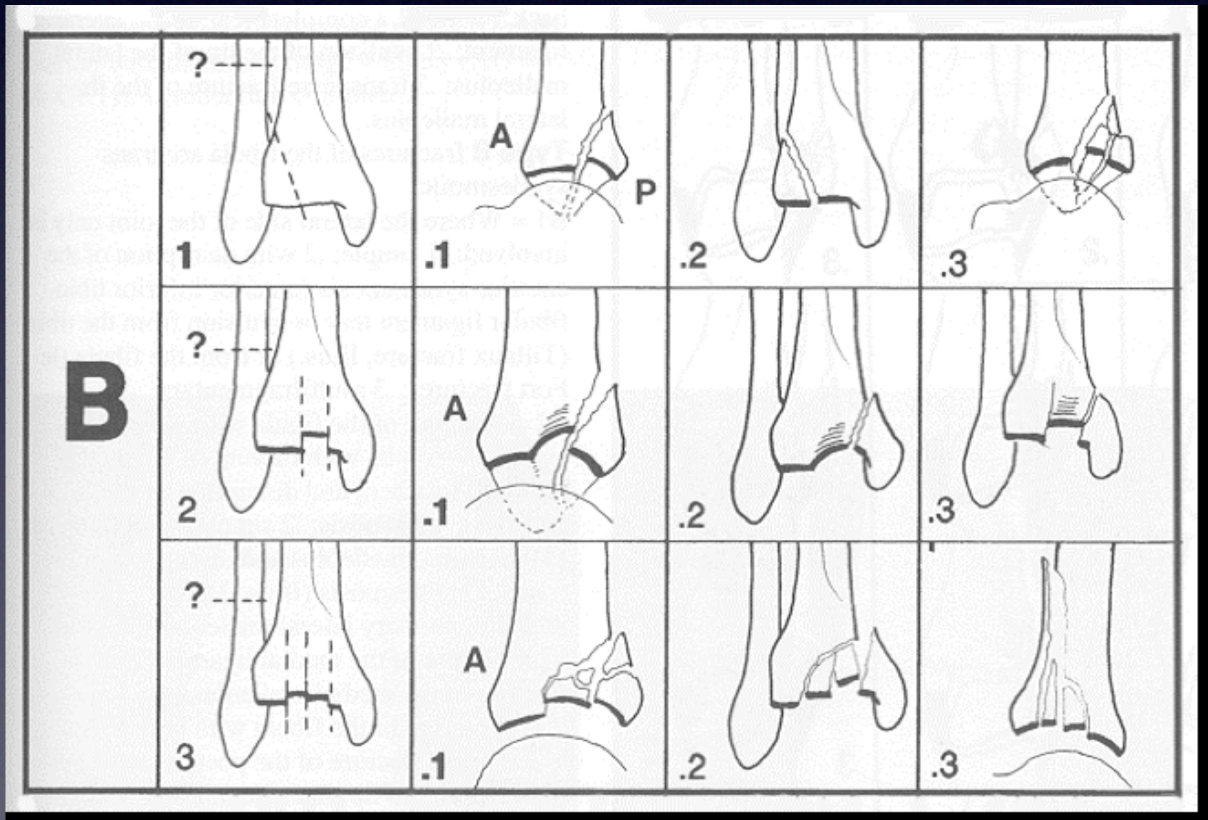
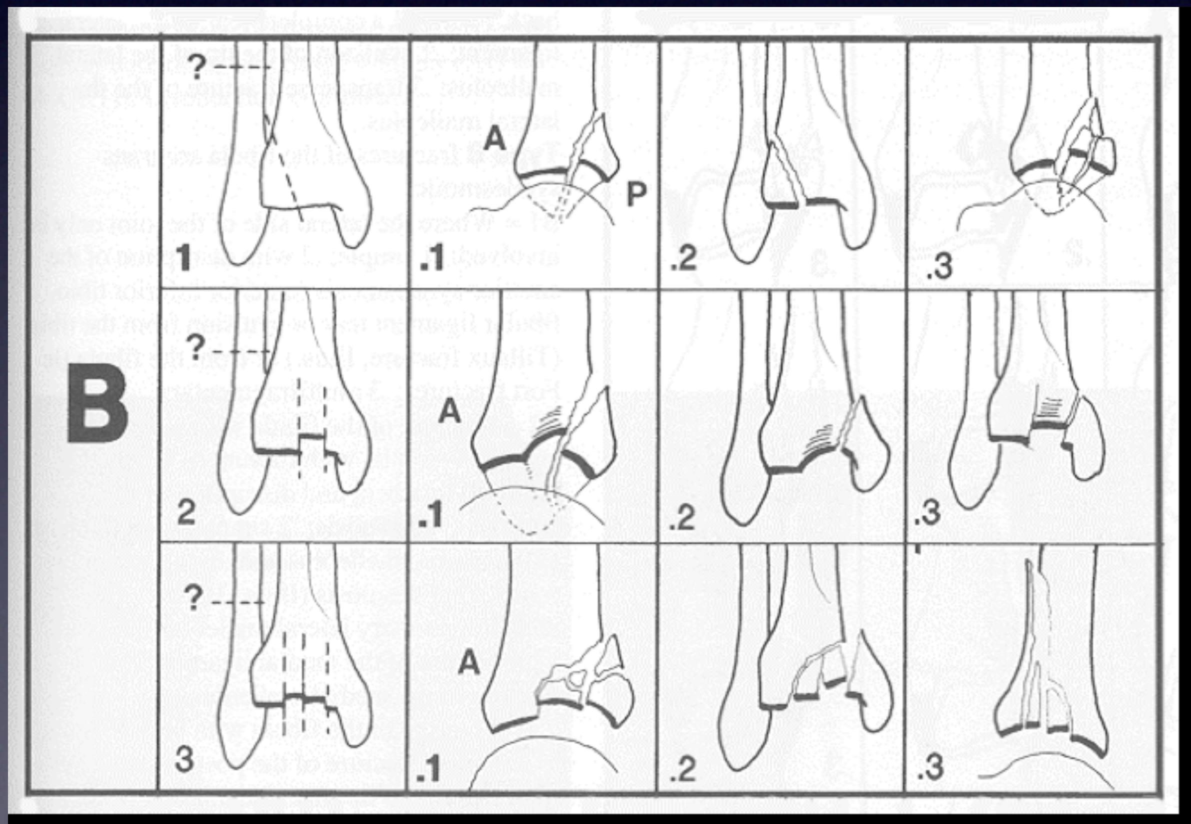


Classification AO
distal Tibia: 43

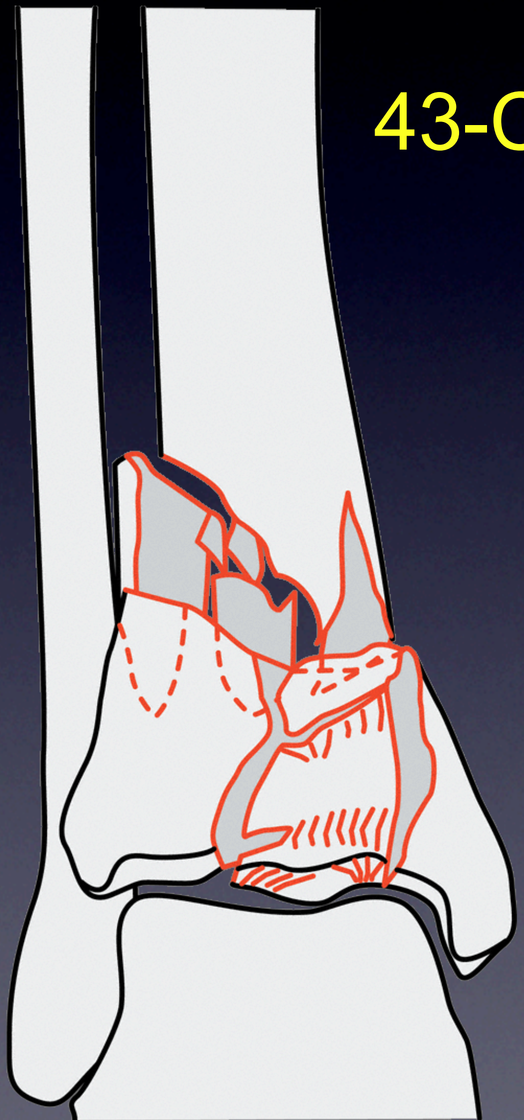
43-B: partial intraarticular (torsion mechanism)
with continuity diaphysis/articular surface

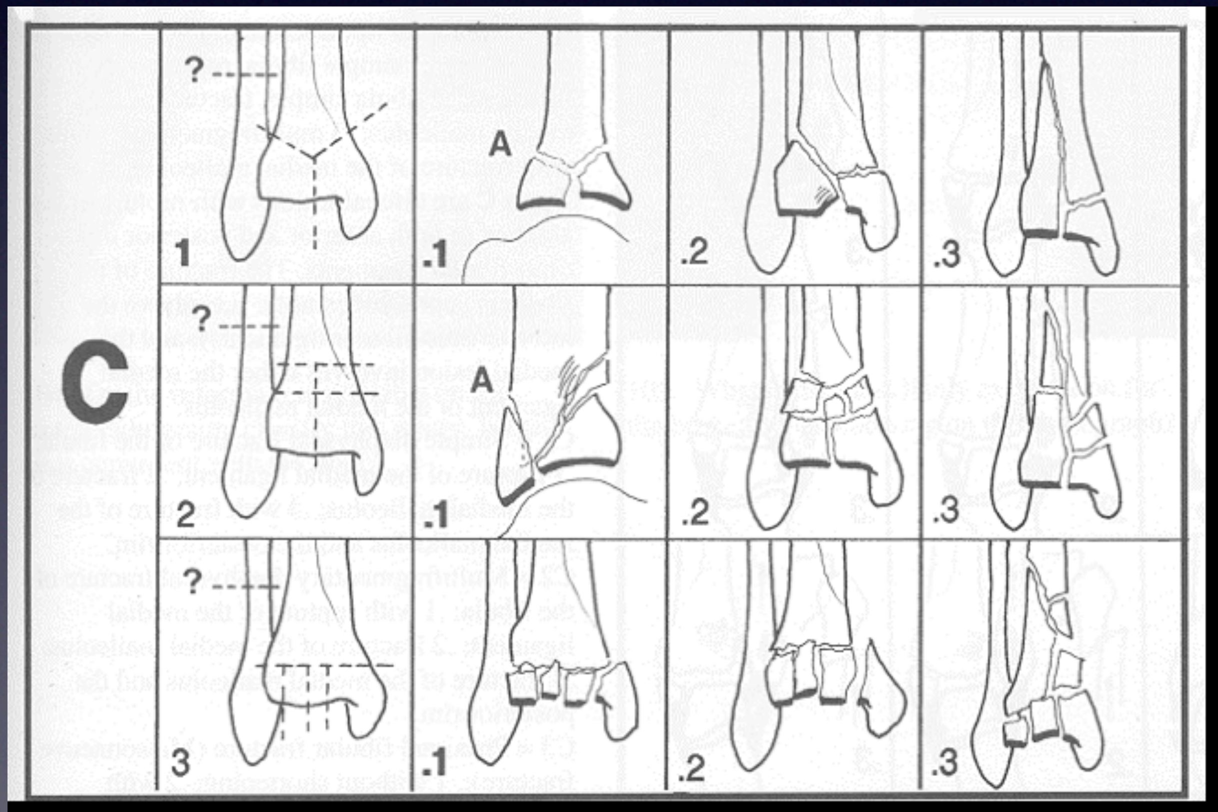
Picture from M Assal



Classification AO distal Tibia : 43

43-C: completely intra articular (high energy compr F)



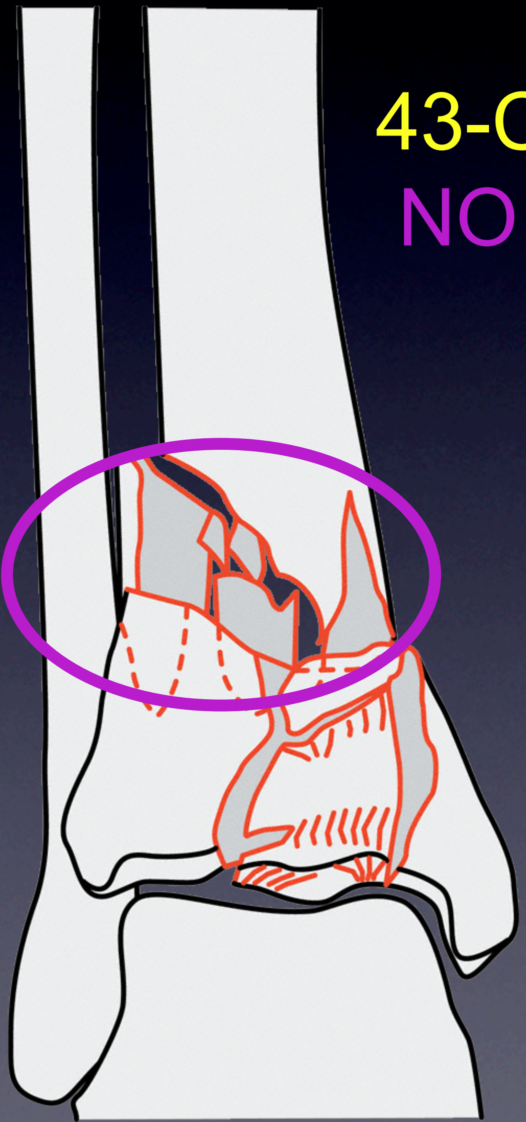


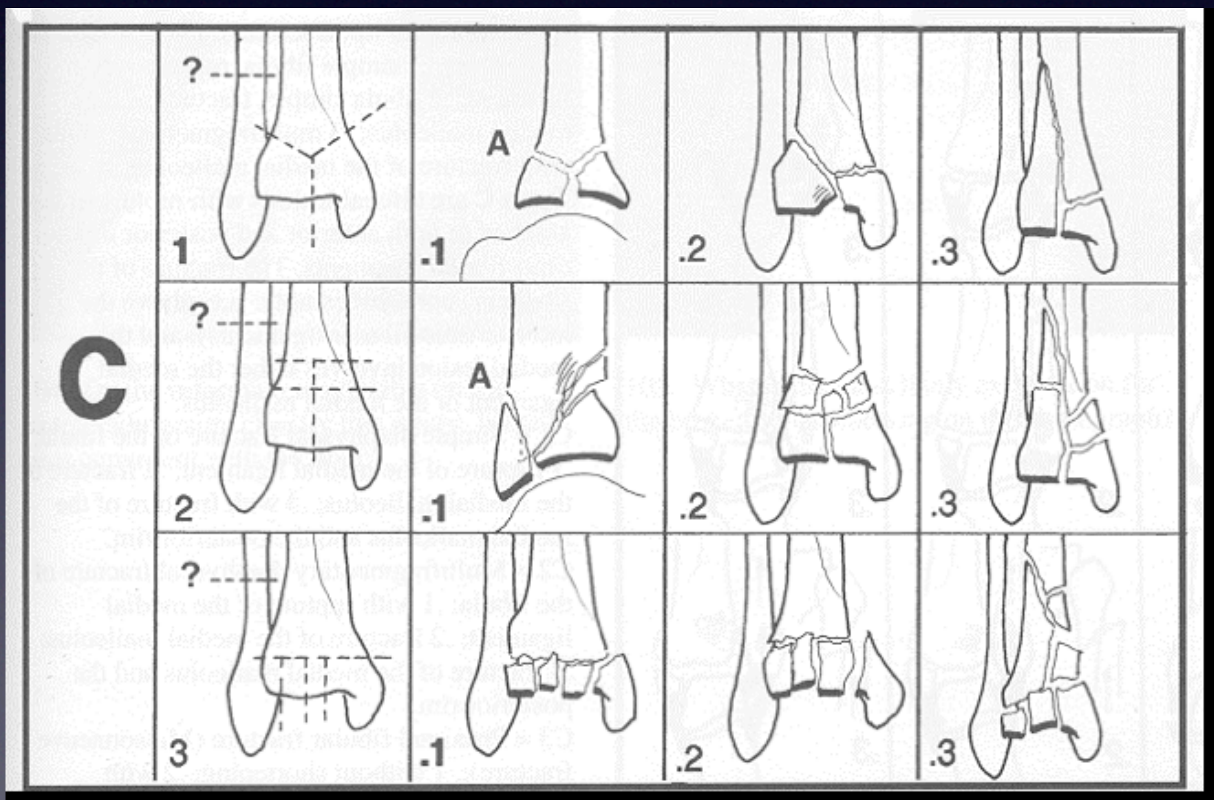
Picture from M Assal

Classification AO distal Tibia : 43

43-C: completely intra articular (high energy compr F)

NO continuity diaphysis/articular surface





Picture from M Assal

CLASSIFICATIONS

No informations of fibula fracture (75-85% *)!

*Rüedi & Allgöwer 1969, Mast & Spiegel 1988)

CLASSIFICATIONS

No informations about medial ,Lateral or Axial deviation

Medial compression

Lateral compression

Axial compression

Barei et al.J Orthop Trauma,Volume 20, Number 1, January 2006

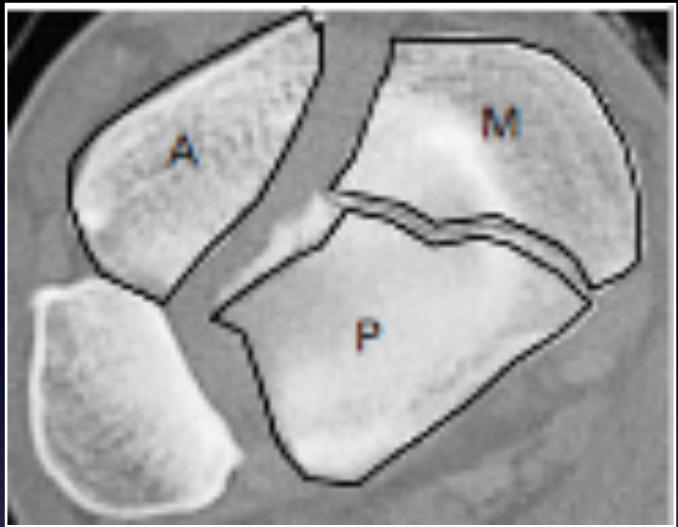
CLASSIFICATIONS

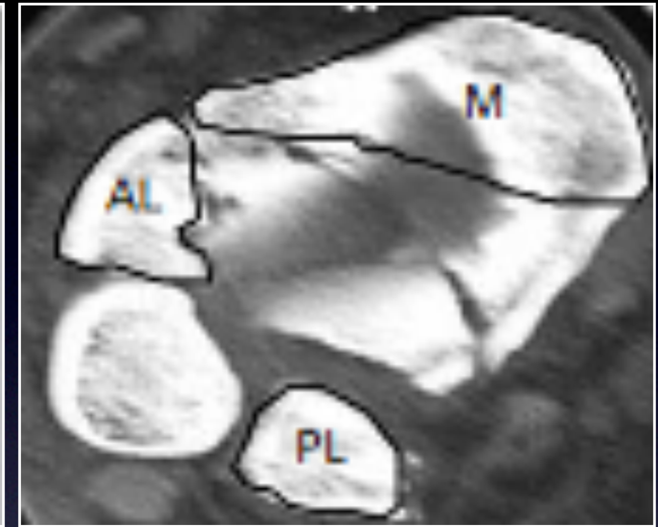
- <u>In Theory</u> :   Helpfull for scientific interest
  (studies, publications)

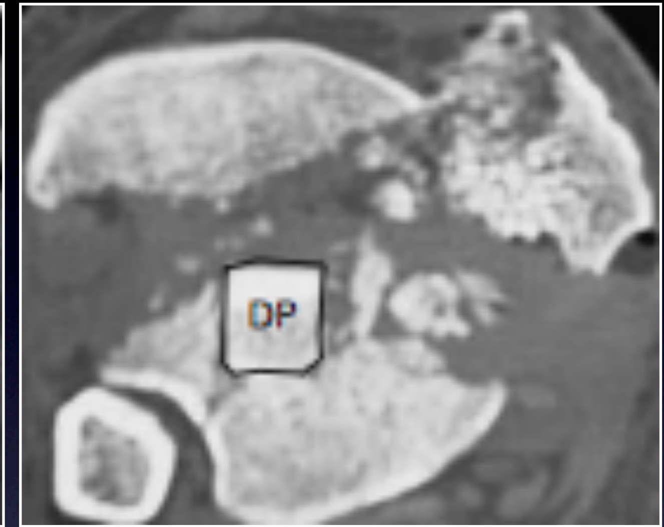
- <u>In Practice</u> :   Doesn't give us really all the necessary needed informations

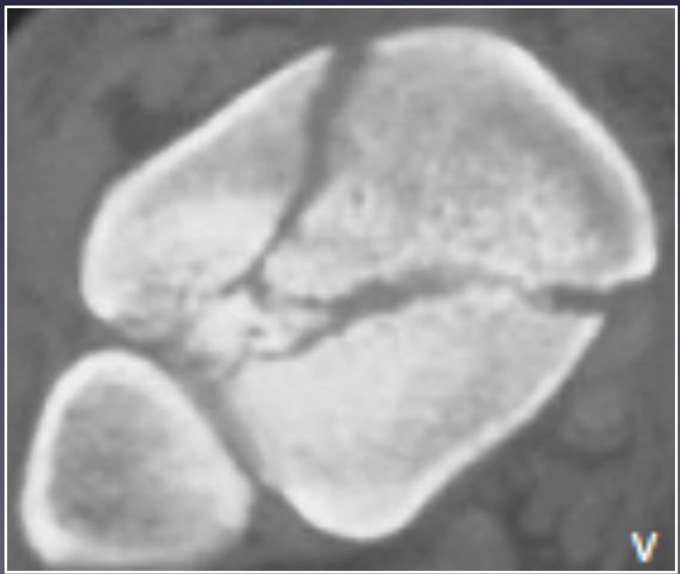
➡ **Ct-scan!!!**

Ct Scan and the pilon map









- Understanding the anatomy of the fracture
- Primary and secondary fracture lines
- Improve operative techniques

Ct scan 3D

POSTERIOR PILON TIBIAL FRACTURE

AMERICAN ORTHOPAEDIC FOOT & ANKLE SOCIETY.

Foot & Ankle International
34(2) 189–199

DOI: 10.1177/1071100712469334
http://fai.sagepub.com

Posterior Pilon Fractures: A Retrospective Case Series and Proposed Classification System

Georg Klammer, MD[1], Anish R. Kadakia, MD[2], David A. Joos, MD[3], Jeffrey D. Seybold, MD[3], and Norman Espinosa, MD[1]

Article

AMERICAN ORTHOPAEDIC FOOT & ANKLE SOCIETY.

Foot & Ankle International
2014, Vol. 35(9) 886–895

DOI: 10.1177/1071100714537630
fai.sagepub.com

Evaluation of Posterior Malleolar Fractures and the Posterior Pilon Variant in Operatively Treated Ankle Fractures

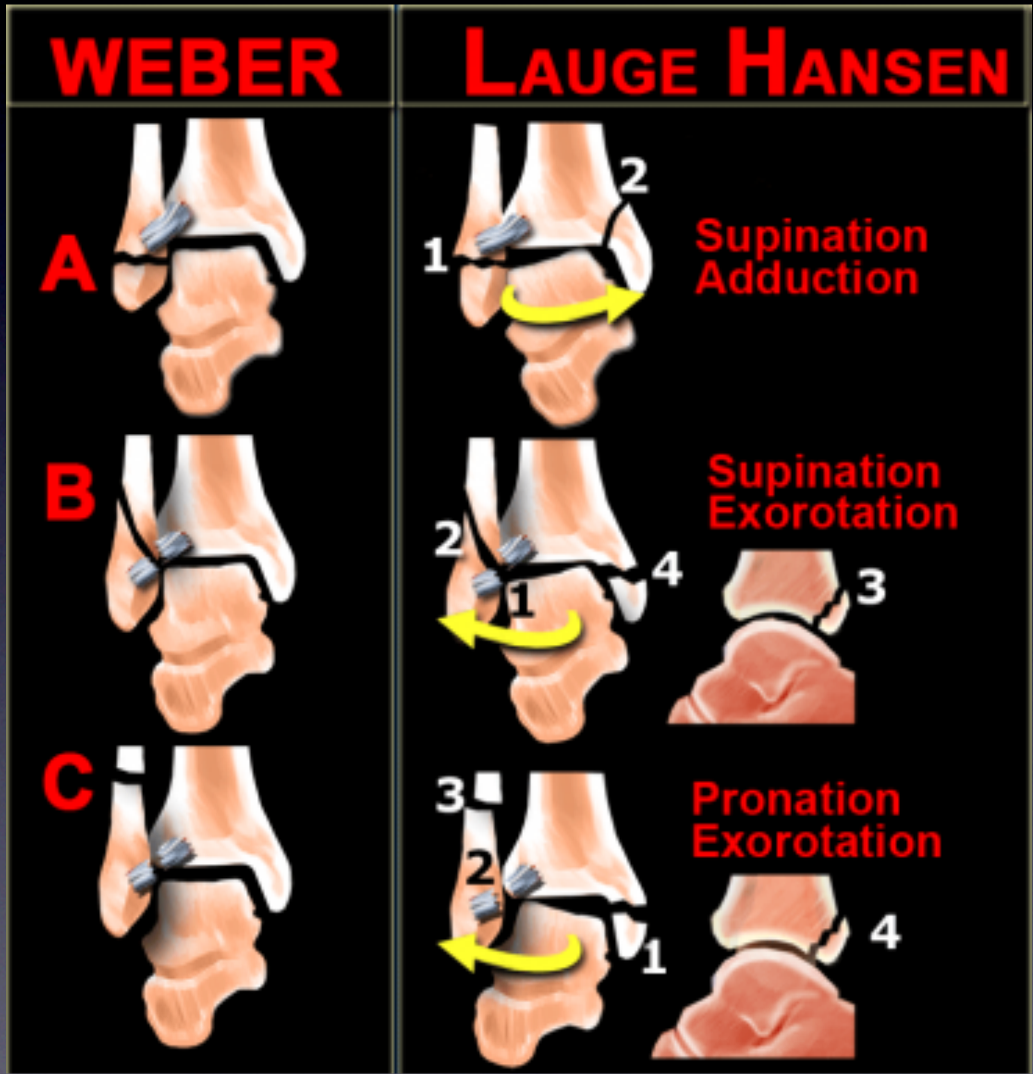
Paul J. Switaj, MD[1], Brian Weatherford, MD[2], Daniel Fuchs, MD[1], Brett Rosenthal, MD[1], Eric Pang, MD[1], and Anish R. Kadakia, MD[1]

Malleolar fracture ?
Tibial Pilon fracture?

DIFFERENCES

Mechanism of injury / Classification / Surgical treatment

Classification of malleolar fracture



POSTERIOR PILON TIBIAL FRACTURE

AP view : Medial malleolar double contour sign

Lateral view: Posterior articular impaction

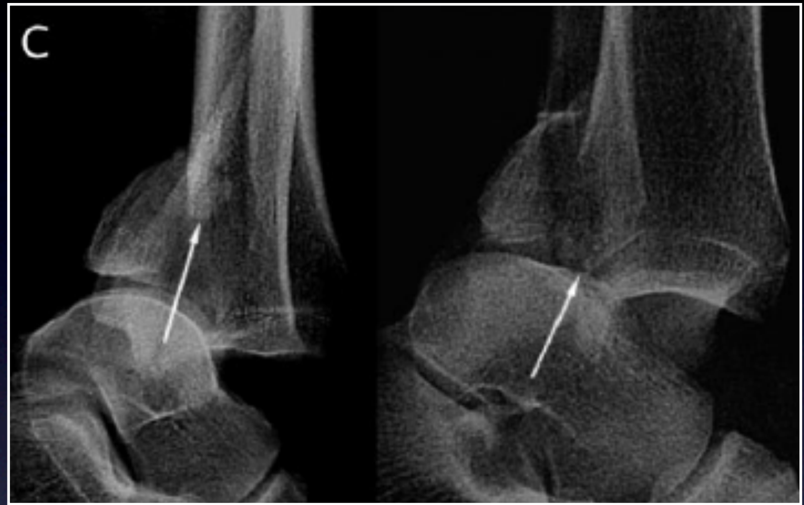
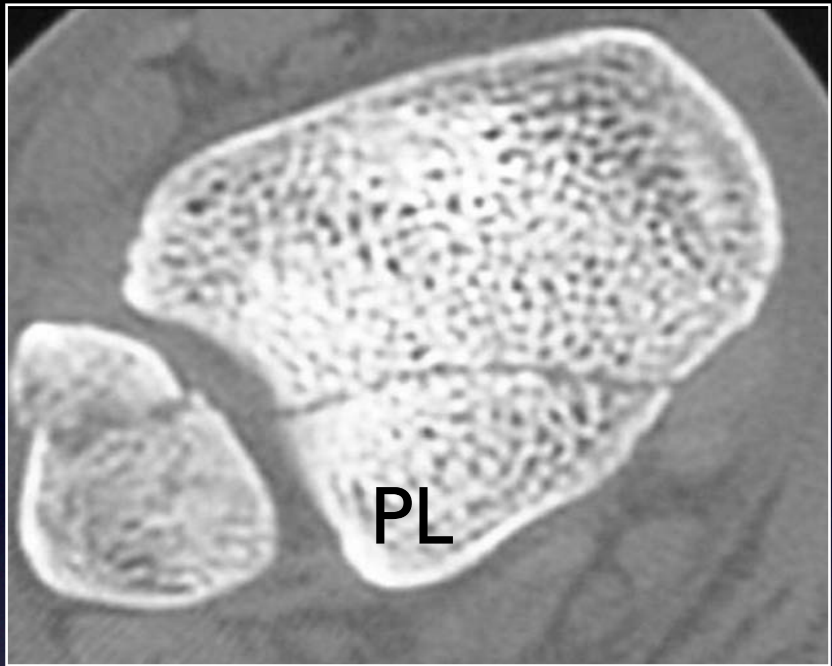


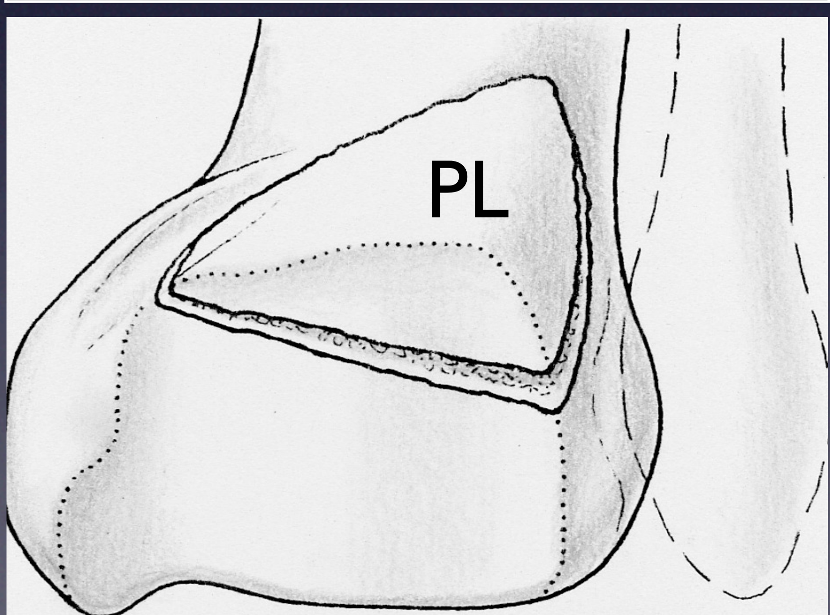
Figure 1. These radiographs represent the characteristics of the posterior pilon variant fracture pattern (A) Anterior-posterior radiographs with arrows demonstrating the medial malleolar double contour sign. (B) Mortise radiographs with arrows demonstrating the sagittal split of posterior malleolus. (C) Lateral radiographs with arrows demonstrating posterior articular impaction.

Paul J. Switaj et al. Foot and ankle international 2014

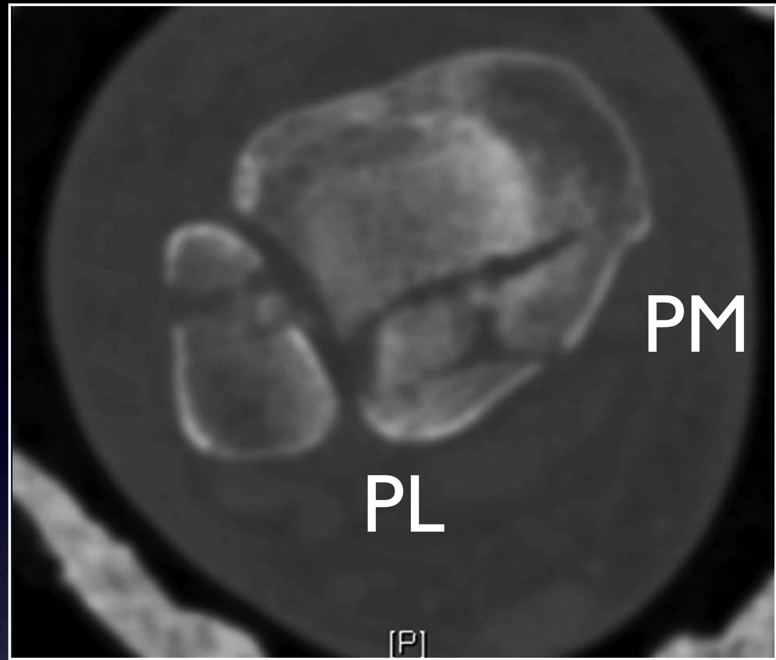
Mortise view : sagital split of the posterior malleolus

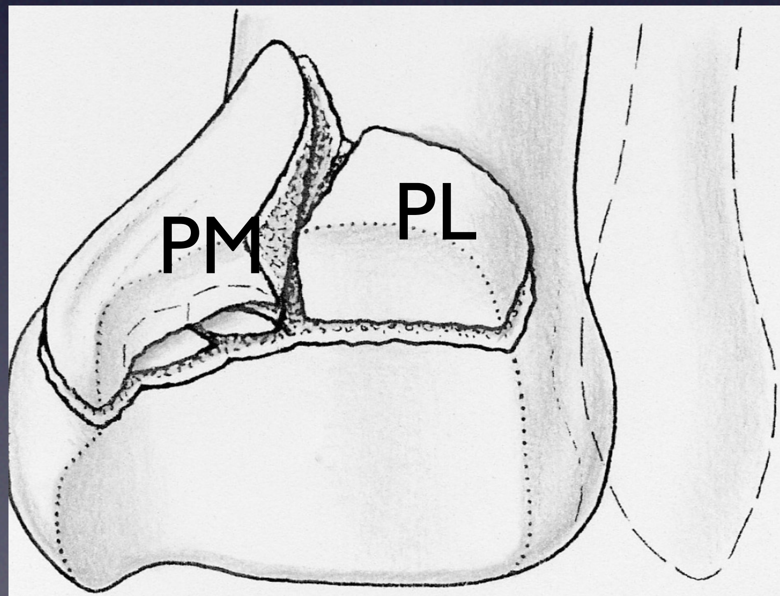
Malleolar fracture



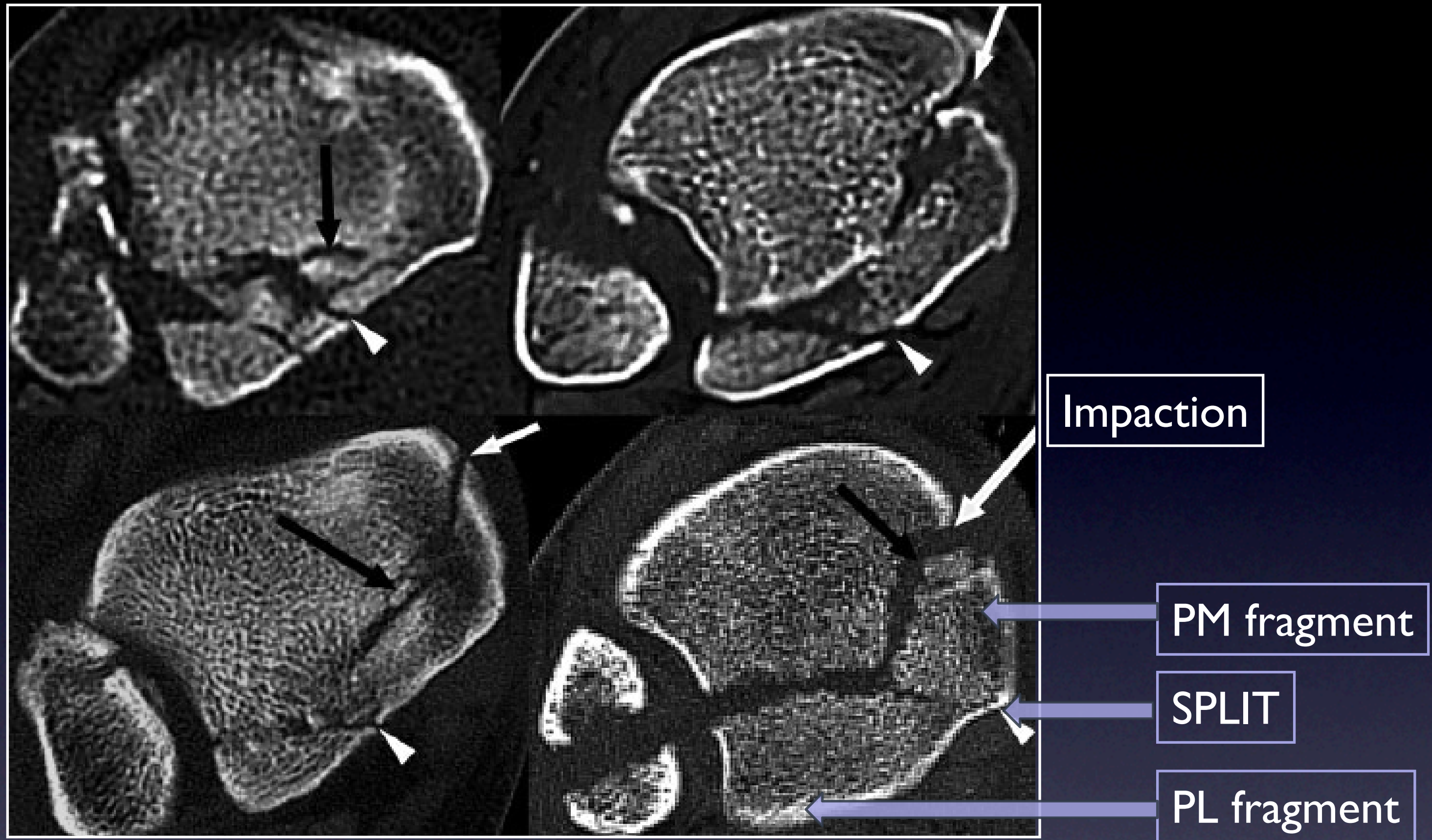


Posterior pilon fracture





Klammer G. Posterior Pilon Fractures: a Retrospective Case Series and Proposed Classification System. Foot and Ankle Int. 2013;34(2):189-199



Paul J. Switaj et al. Foot and ankle international 2014

PM fragment non reduced ?

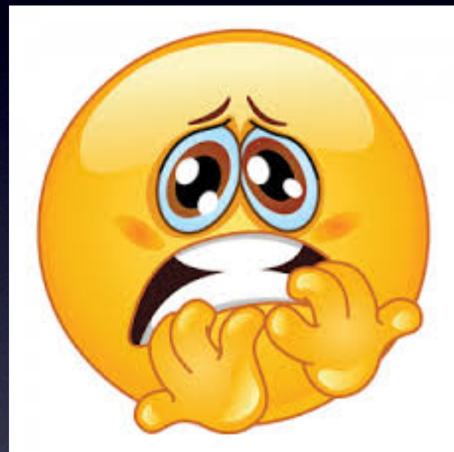
➡ Risk for talar postéromédial subluxation

SOFT TISSUE

- The soft tissue envelope around the tibia is thin and constrained
- Majority of the blood supply is supported by an anastamotic network of extraosseous vessels from the PTA and ATA (Sommer et al.)

“A bone is like a plant with its roots deep in the soft tissues. Orthopaedics requires more the skills of the gardener than those of the cabinet maker”

Gathorne Robert Girdlestone (1881-1950)



Soft Tissue in closed fractures?

Tscherne Classification

(help for decision making : delayed or early surgery?)

Grade 0
- Minimal soft tissue damage
- indirect injury to limb (torsion)
- simple fracture pattern

Grade 1
- Superficial abrasion or contusion
- mild fracture pattern

Grade 2
- Deep abrasion
- skin or muscle contusion
- severe fracture pattern
- direct trauma to limb

Grade 3
- Extensive skin contusion or crush injury
- severe damage to underlying muscle
- compartment syndrome
- subcutaneous avulsion

Tscherne and all. Berlin: Springer-Verslag: 1984, 1-9

Closed Tibial Pilon Fracture?

- Degree of swelling
- Severity of contusion
- Presence of blisters
- Compartment syndrome

Soft tissue in open fracture?

Gustillo-Anderson classification

Type	Description
I	Skin wound less than 1 cm
	Clean
	Simple fracture pattern
II	Skin wound more than 1 cm
	Soft-tissue damage not extensive
	No flaps or avulsions
	Simple fracture pattern
III	High-energy injury involving extensive soft-tissue damage
	Or multifragmentary fracture, segmental fractures, or bone loss irrespective of the size of skin wound
	Or severe crush injuries
	Or vascular injury requiring repair
	Or severe contamination including farmyard injuries

Gustilo and Anderson classification of open fractures

Gustillo and all, J Bone joint Am, 1976;58:453-8

CONCLUSIONS

~~Consensus~~
for pilon Tibial Fracture **classification**

Aim of classification : scientific interest + « make it easier »

- Good # description in the classification

- No one : all the needed information

➡ **Ct scanner !**

CONCLUSIONS

Consensus
For Pilon Tibial Fracture **severity**

- *Fracture Energy*
- *Fragment displacement (CT)*
- *Soft tissue swelling*

Donald D. Anderson,1,2 Teresa Mosqueda,1 Thaddeus Thomas,2 Evan L. Hermanson,1 Thomas D. Brown,1,2 J. Lawrence Marsh1: Quantifying Tibial Plafond Fracture Severity: Absorbed Energy and Fragment Displacement Agree with Clinical Rank Ordering JOURNAL OF ORTHOPAEDIC RESEARCH AUGUST 2008

Thank You