University of California
San Francisco

2024 International San Francisco Orthopaedic Trauma Course

Fractures involving the Distal Tibial Physis

or

focusing on "Transitional" Ankle Fractures

Donald Kephart, MD

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UCSF Benioff Children's Hospitals

Disclosure

I have no relevant financial relationships with any companies related to the content of this course.

Overview

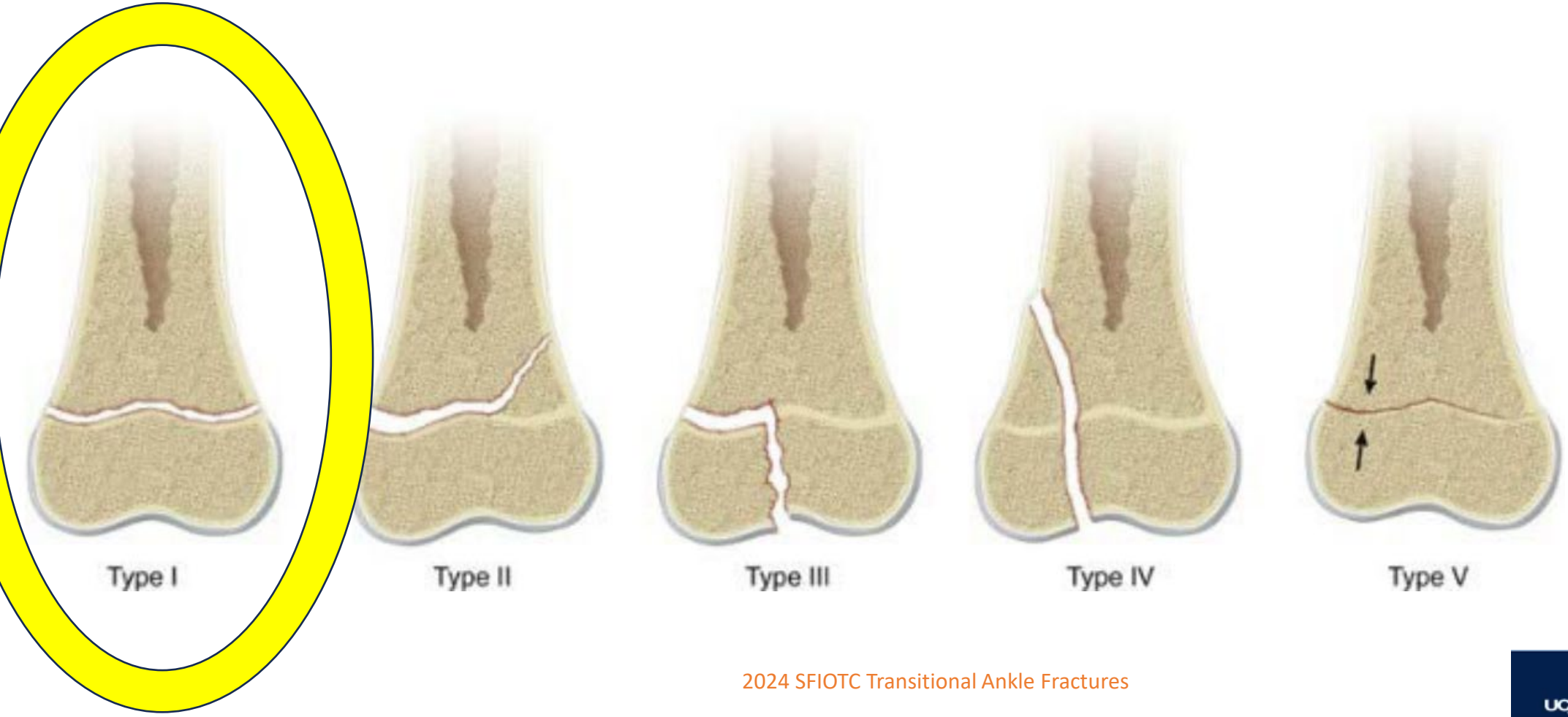
- What is a transitional fracture
- Working it up
- Managing it

Injuries Involving the Epiphyseal Plate

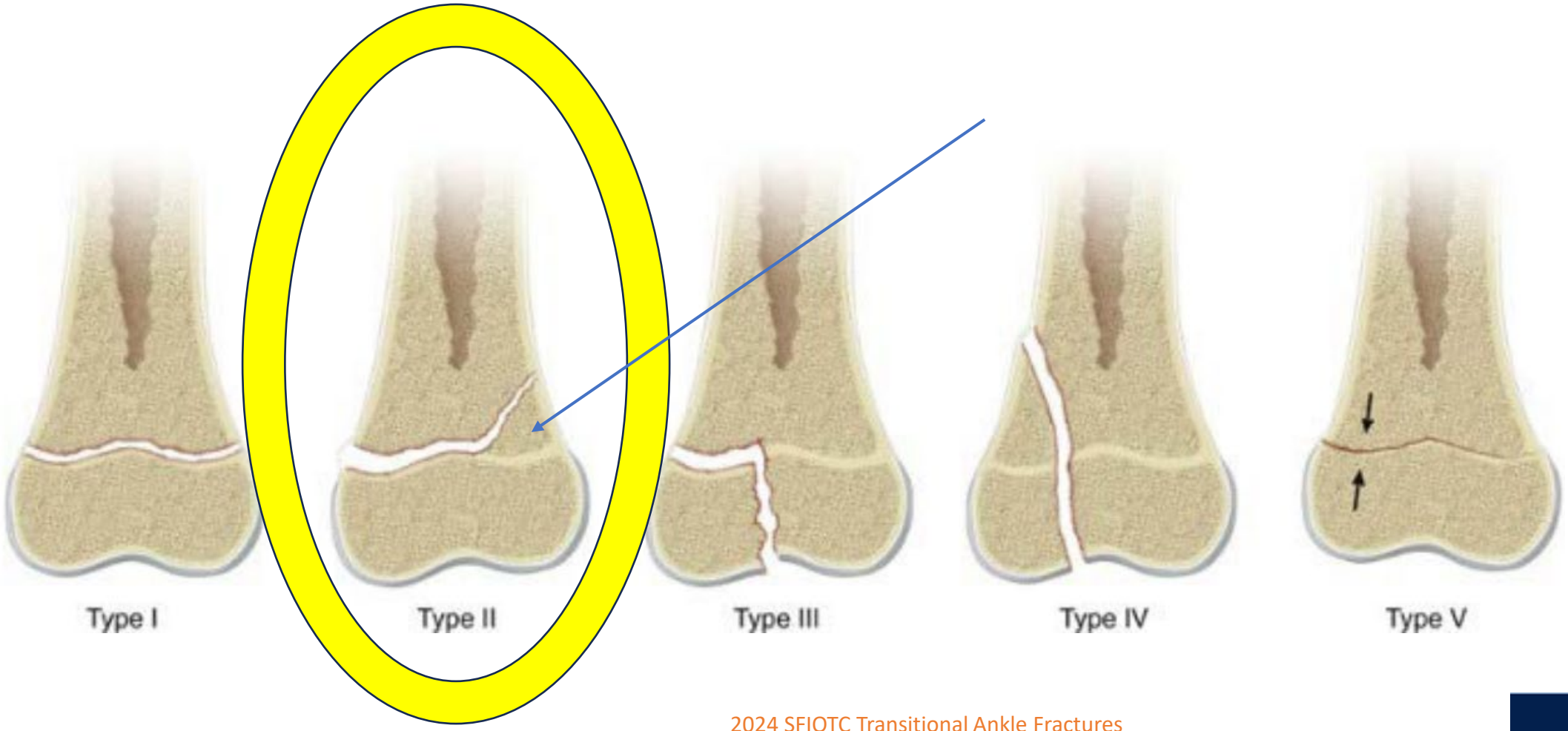
BY ROBERT B. SALTER, M.D., F.R.C.S.(C)*, AND W. ROBERT HARRIS, M.D., F.R.C.S.(C)†,
TORONTO, ONTARIO, CANADA

An Instructional Course Lecture, The American Academy of Orthopaedic Surgeons

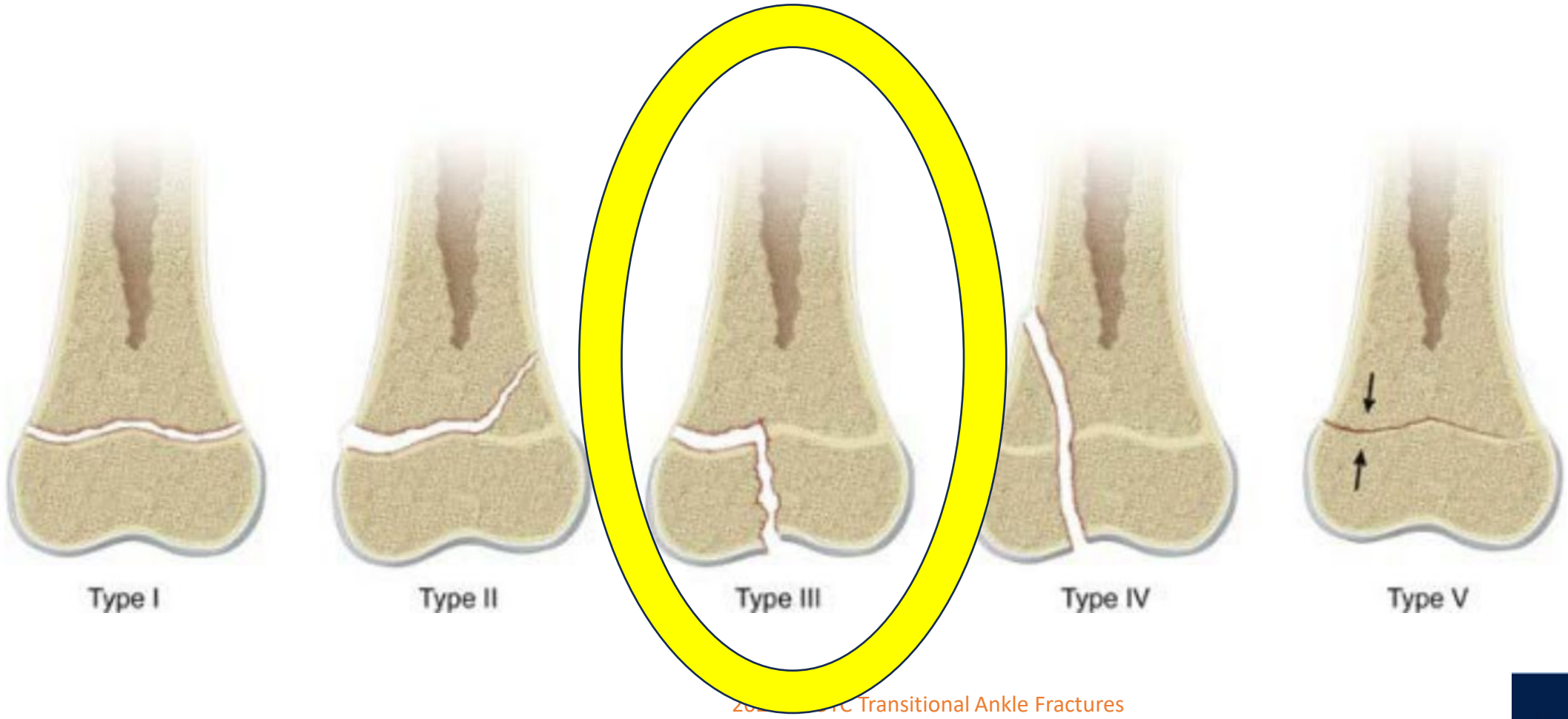
Type I: separation through physis



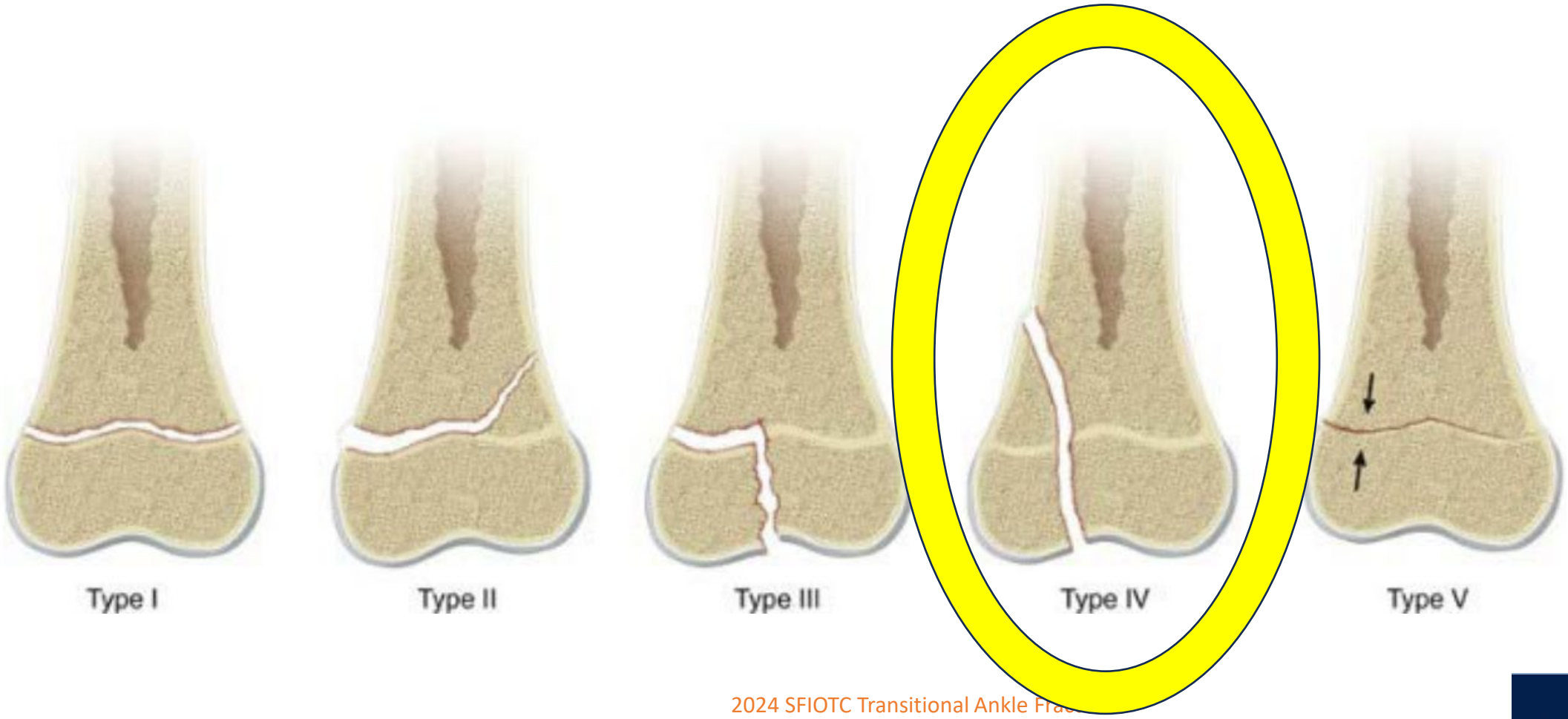
Type II: metaphyseal



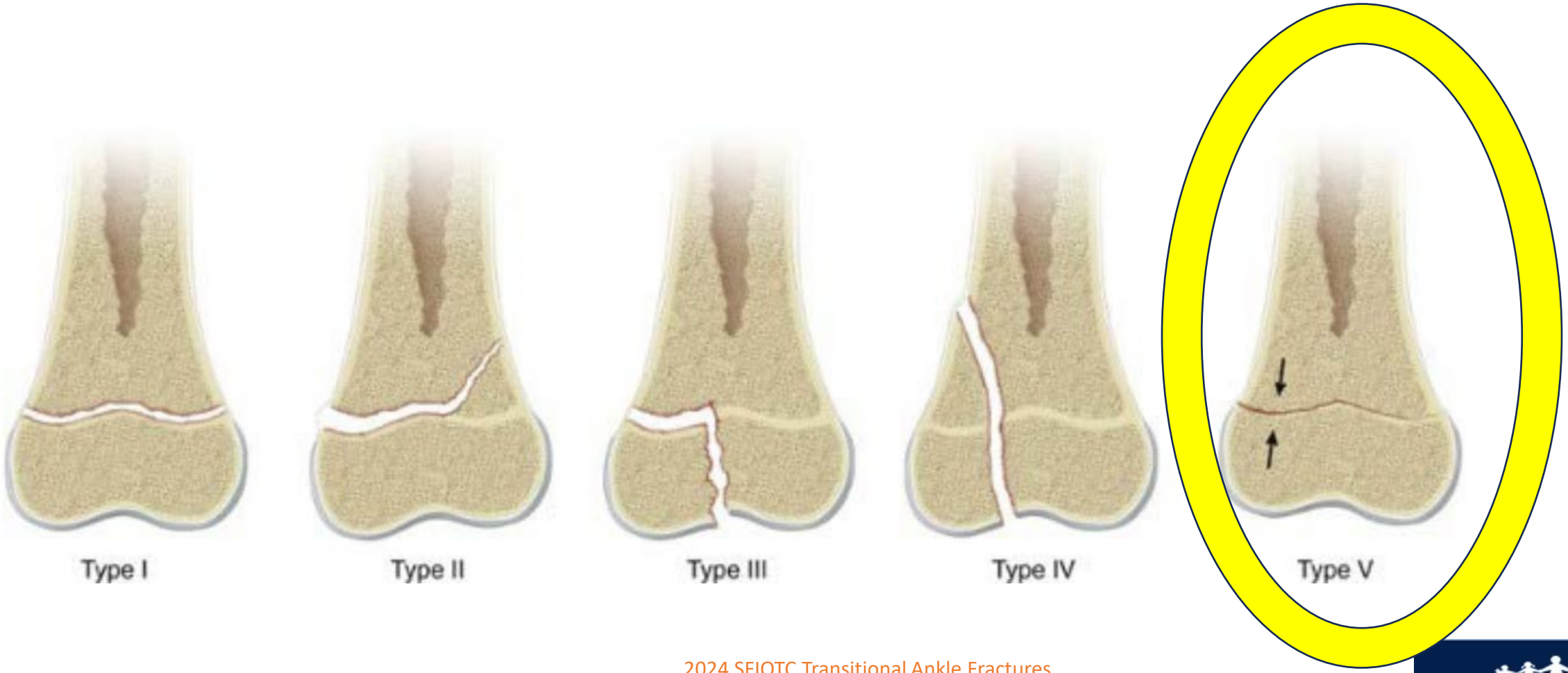
Type III: epiphyseal



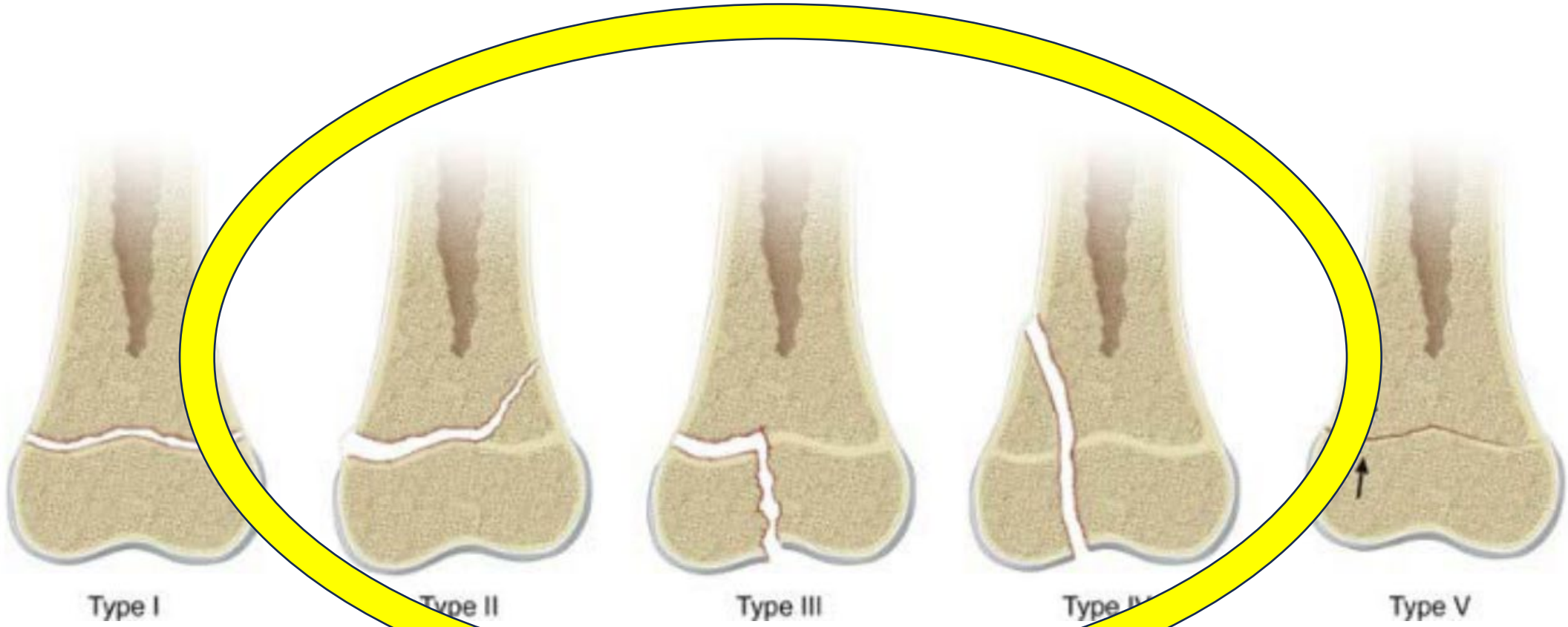
Type IV: crosses physis

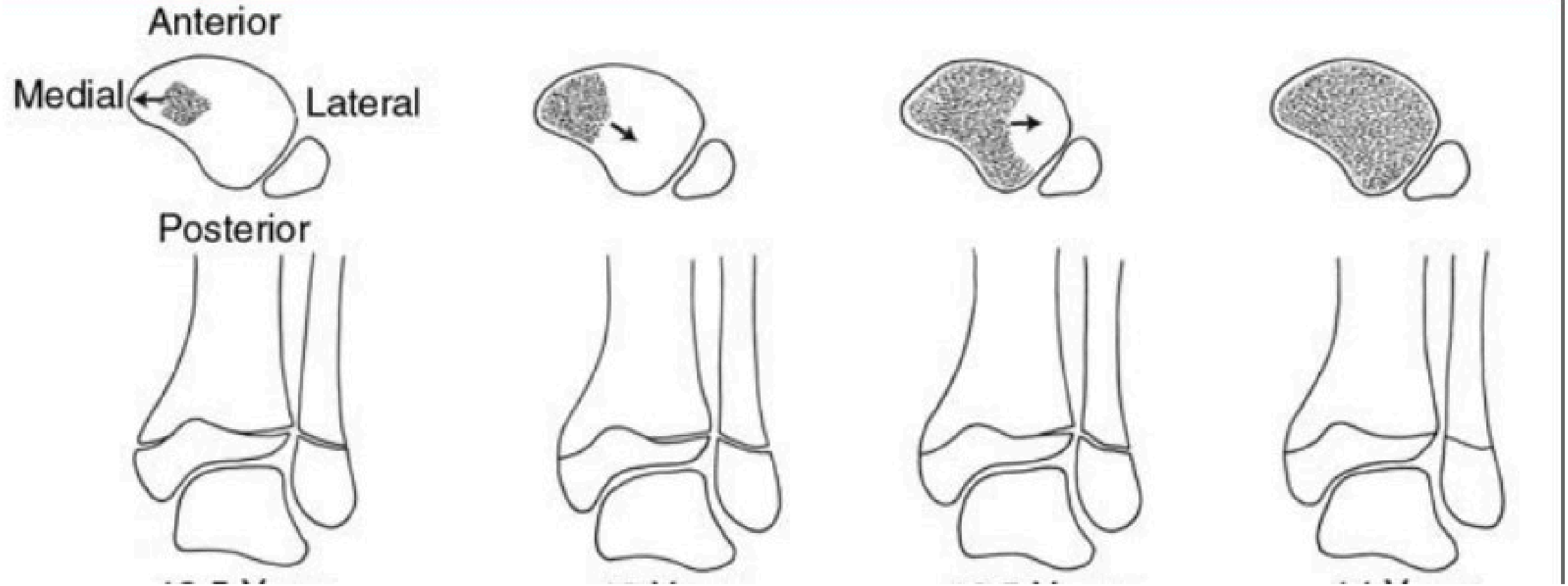


Type V: crush injury to physis



Transitional Ankle Fractures occur in children who area in the process of physiologic epiphysiodesis.



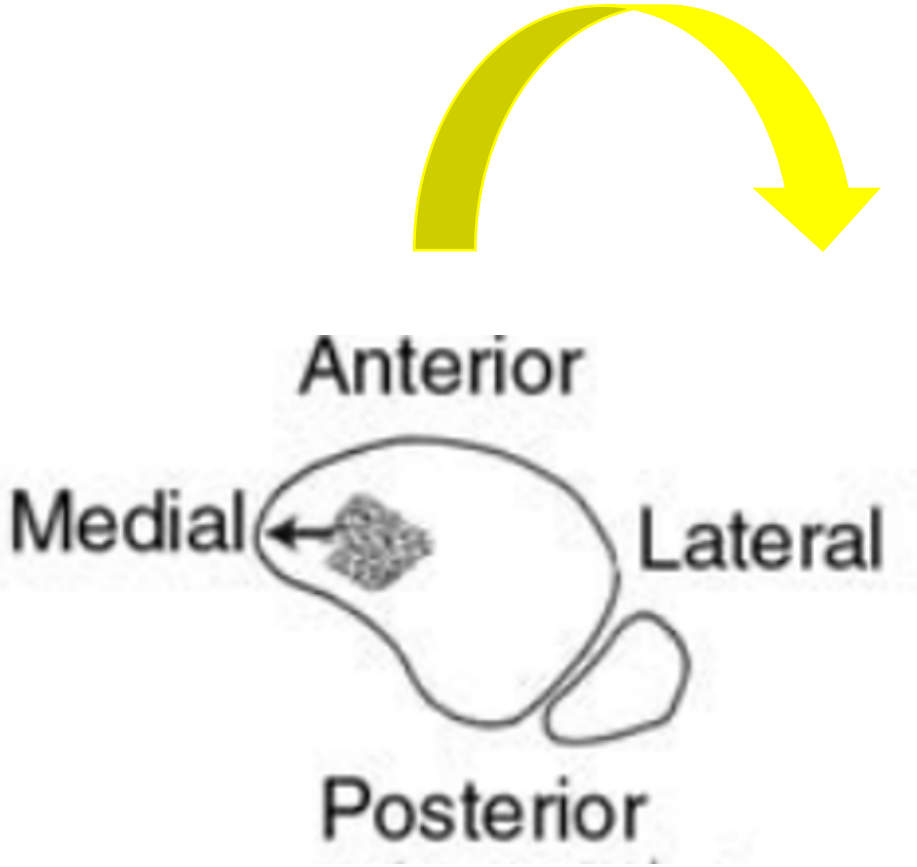


Triplane Fracture

External Rotation w/ Supinated Foot

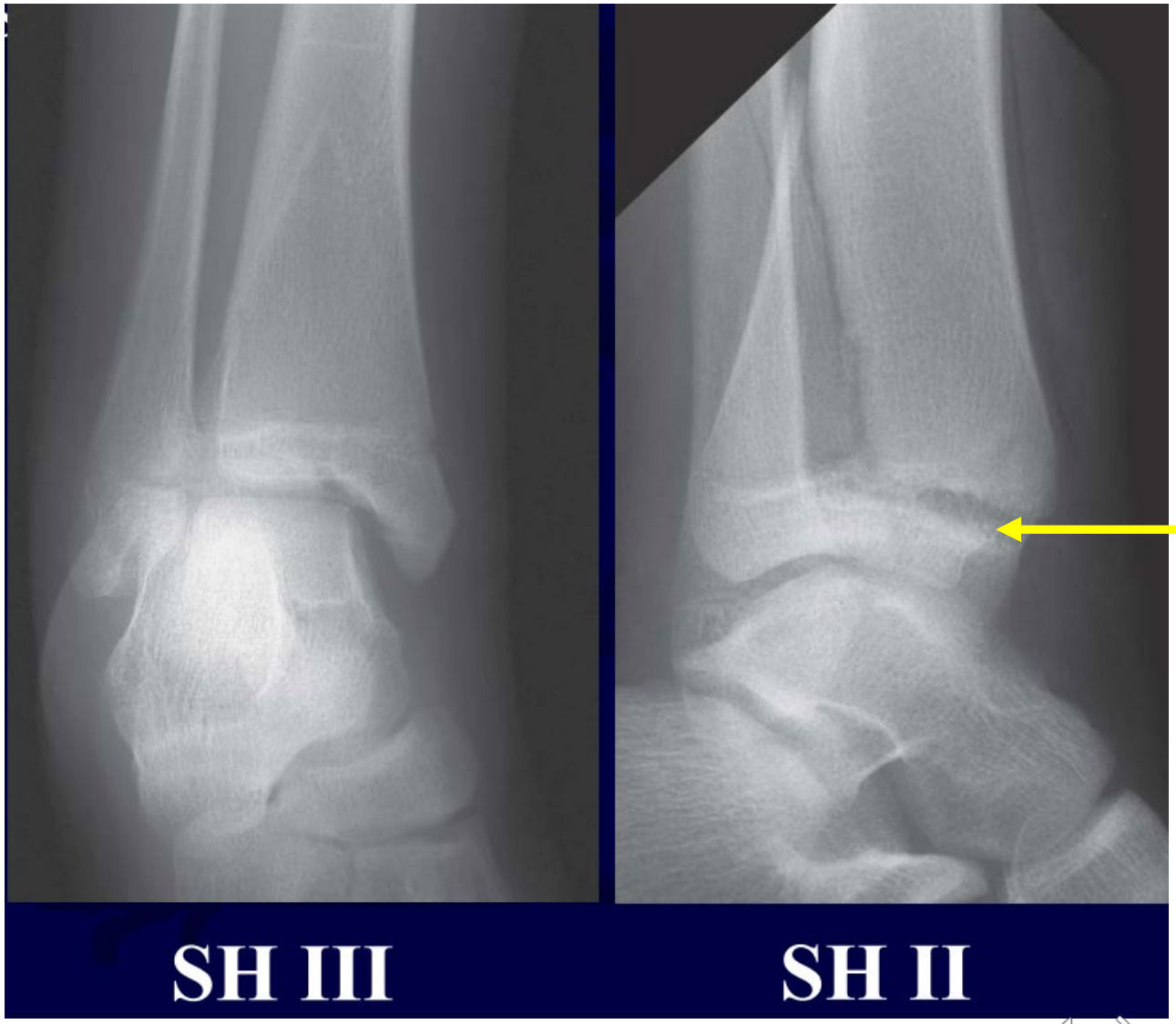
In children who have begun the process of physeal closure

- Girls: 12-14 yrs
- Boys: 13-15 yrs



Triplane Fracture

Fracture Lines Occur in the Transverse, Coronal and Sagittal Plane



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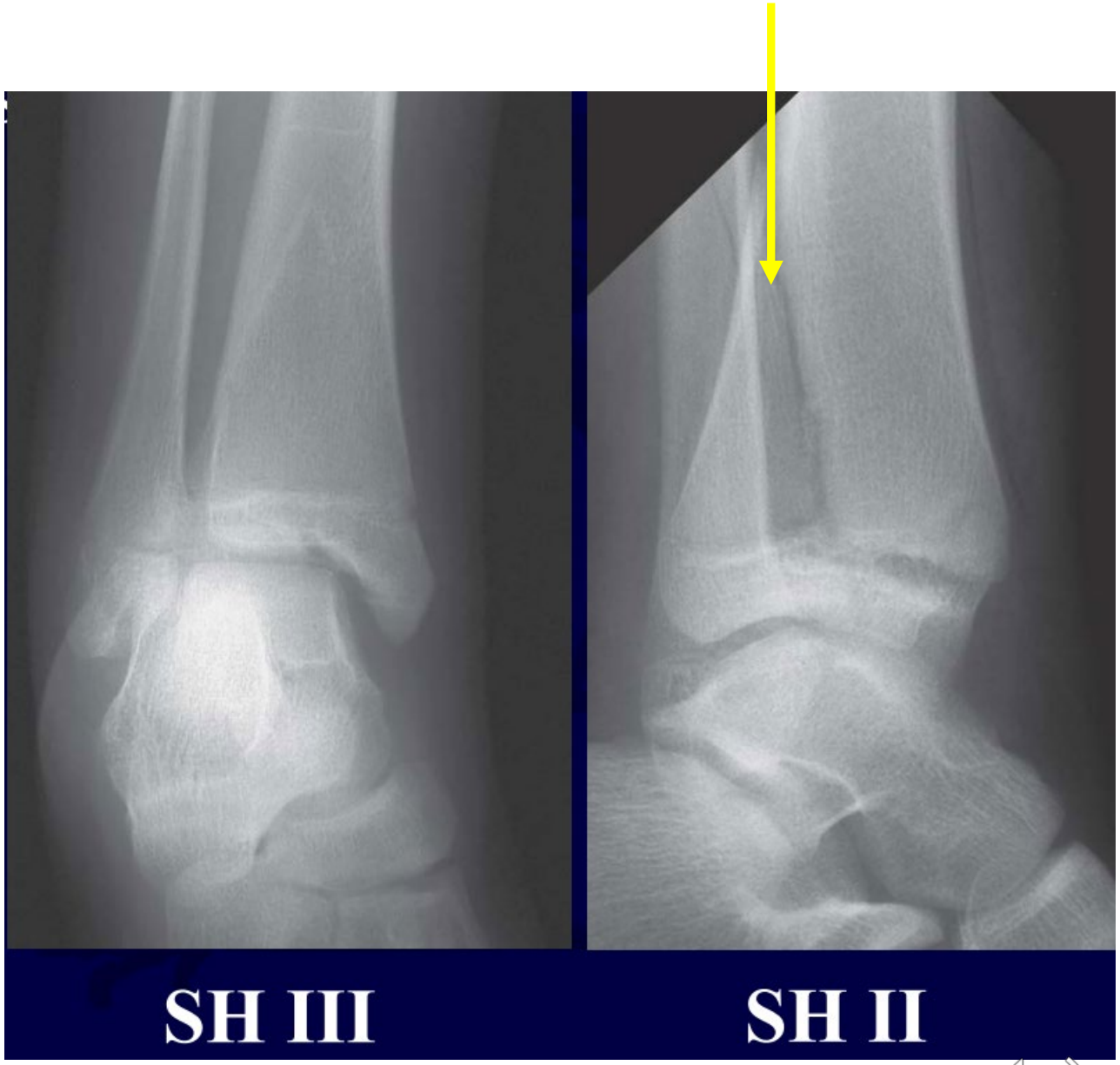

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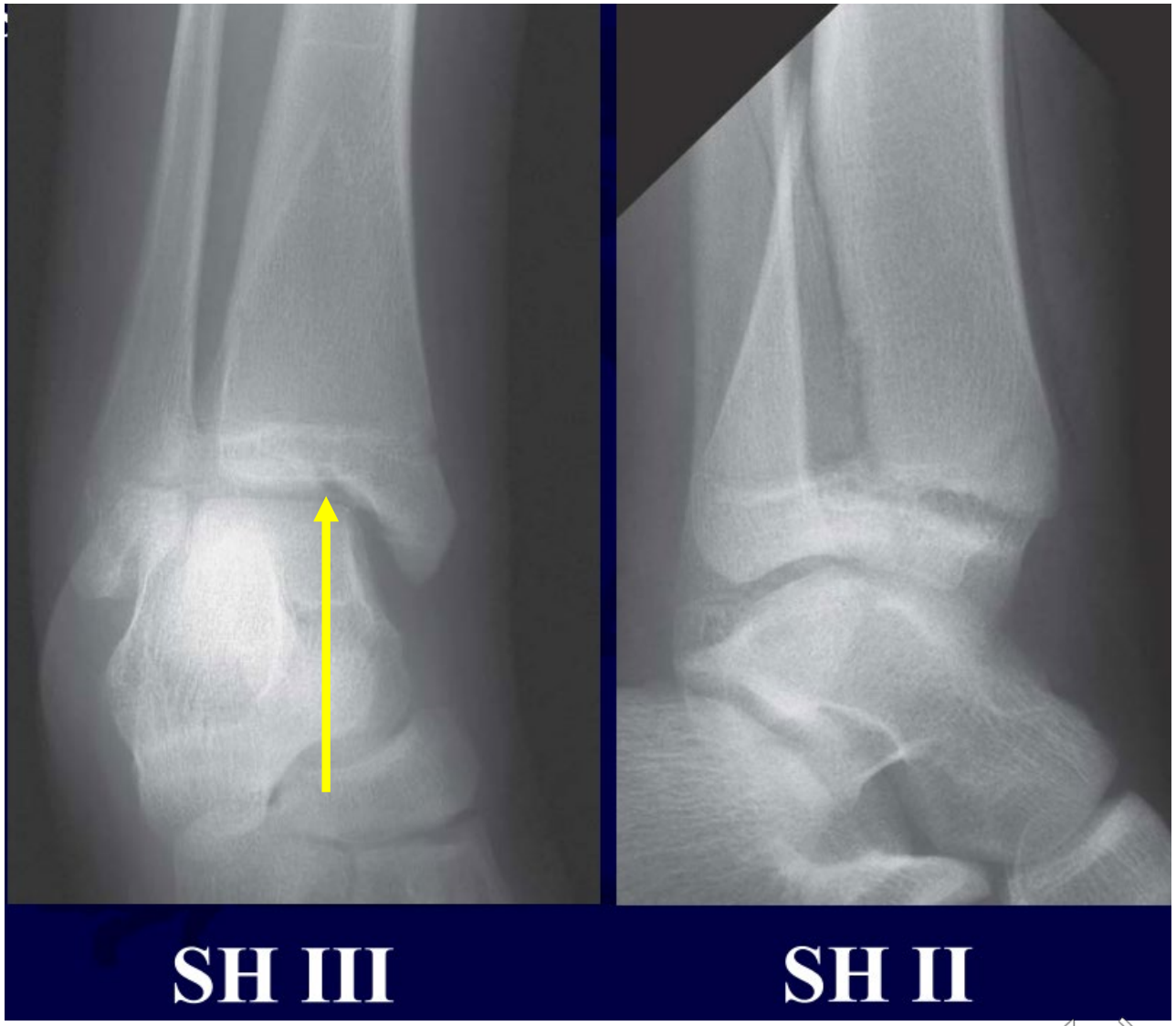
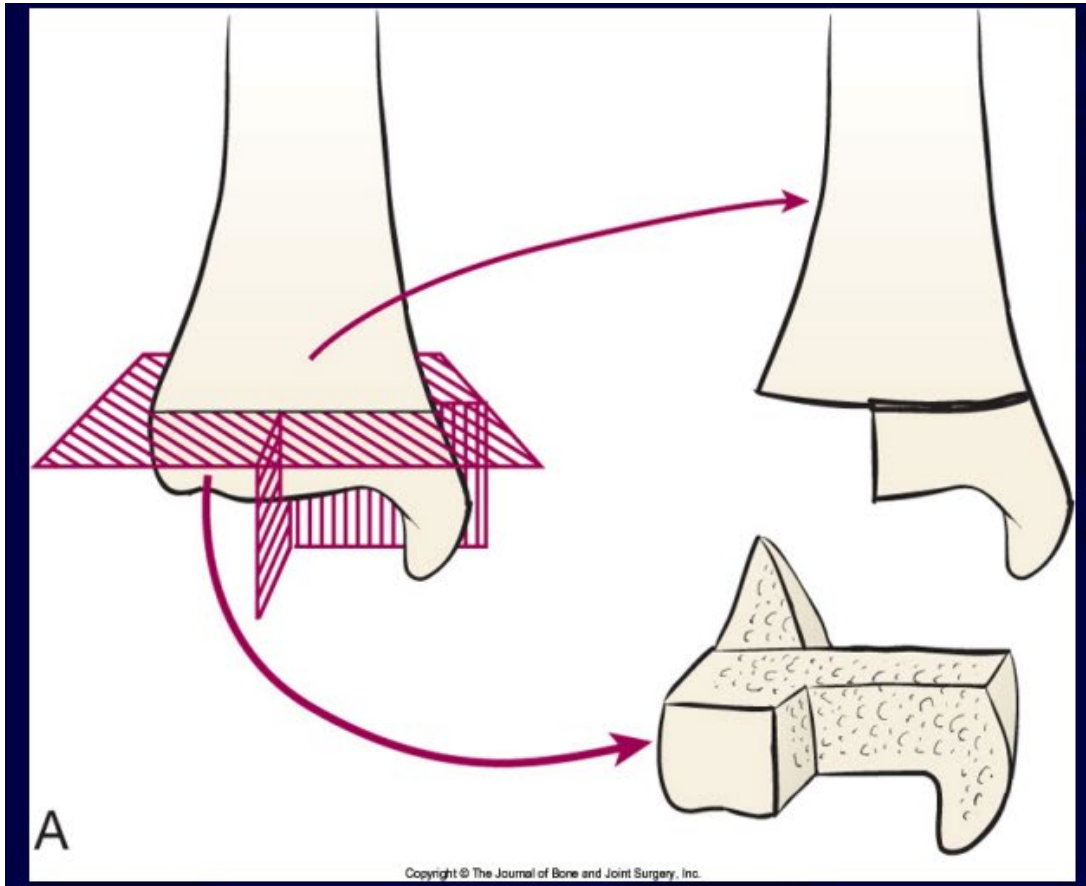
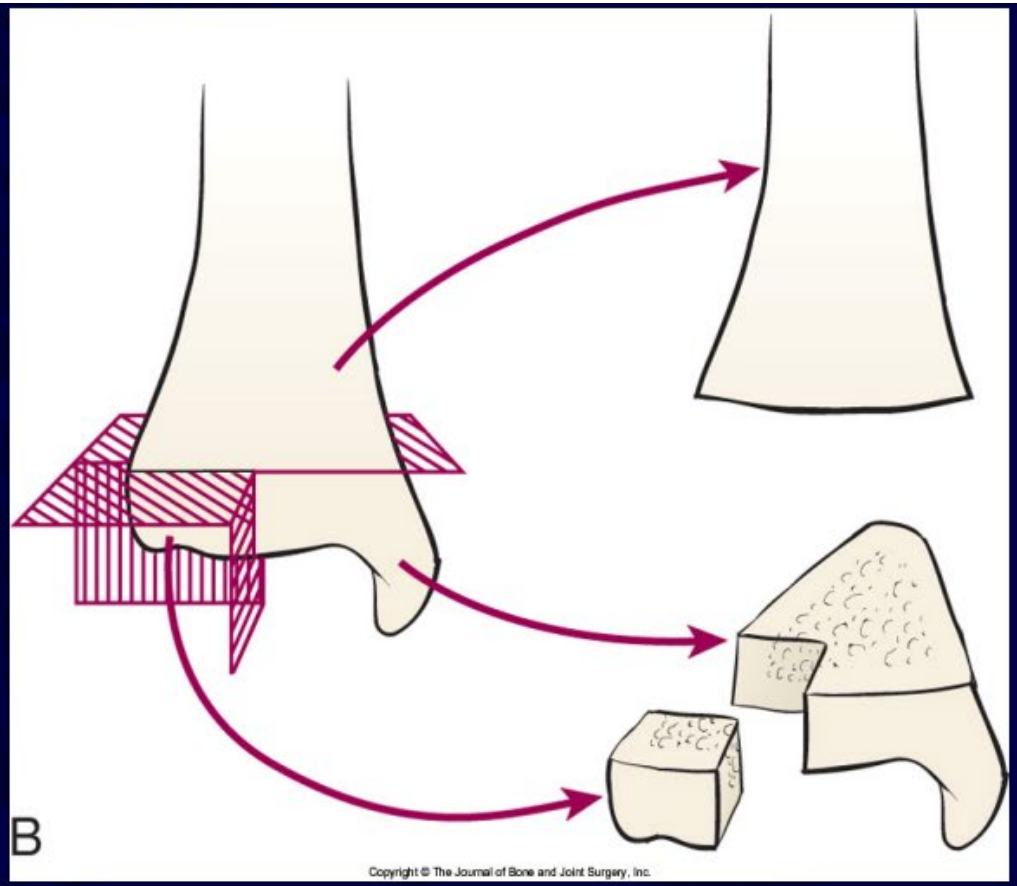






Two Part

Three Part

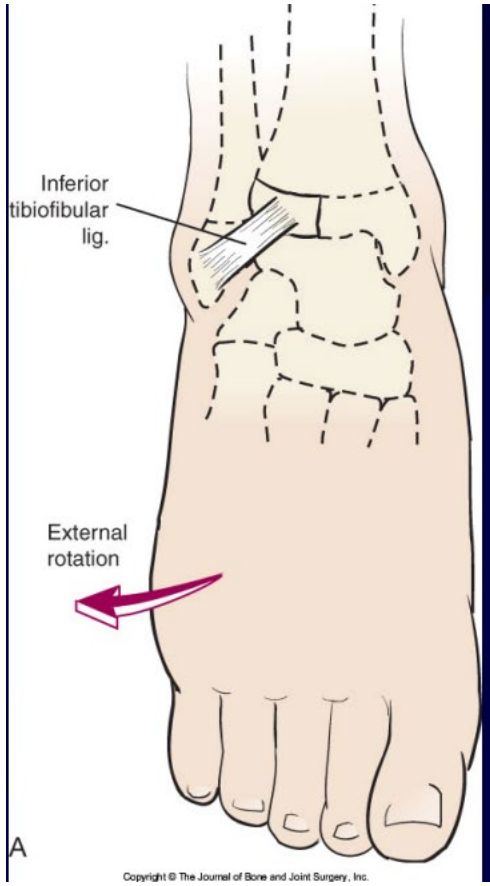
Two Part, Three Part (Separate Tillaux Fragment) and Four Part (Separate Medial Malleolus and Tillaux Fragments) Can Occur

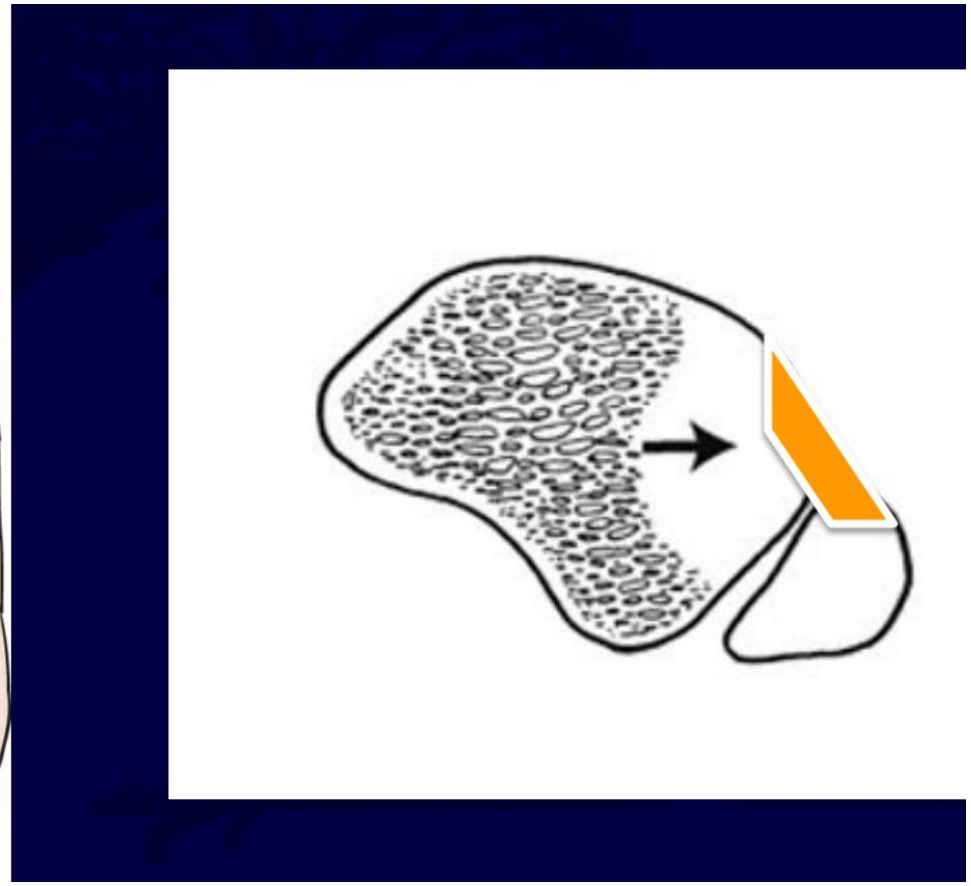
Tillaux fractures

- Avulsion Injury of:

  Anterolateral Epiphysis

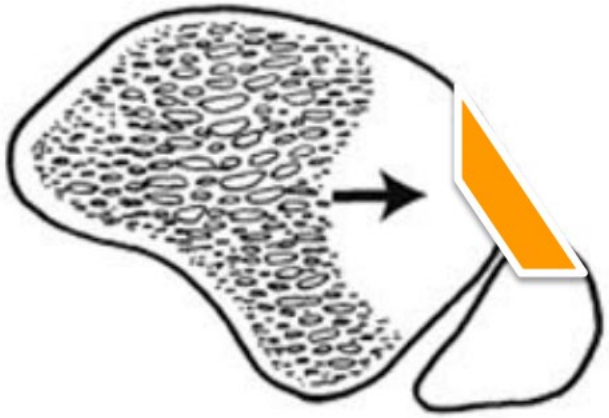
- Mechanism of Injury = External Rotation
- The Anterior-Inferior Tibiofibular Ligament is Stronger than the Lateral Physis and avulses the **Anterolateral Epiphysis** Creating a Salter Harris III Fracture

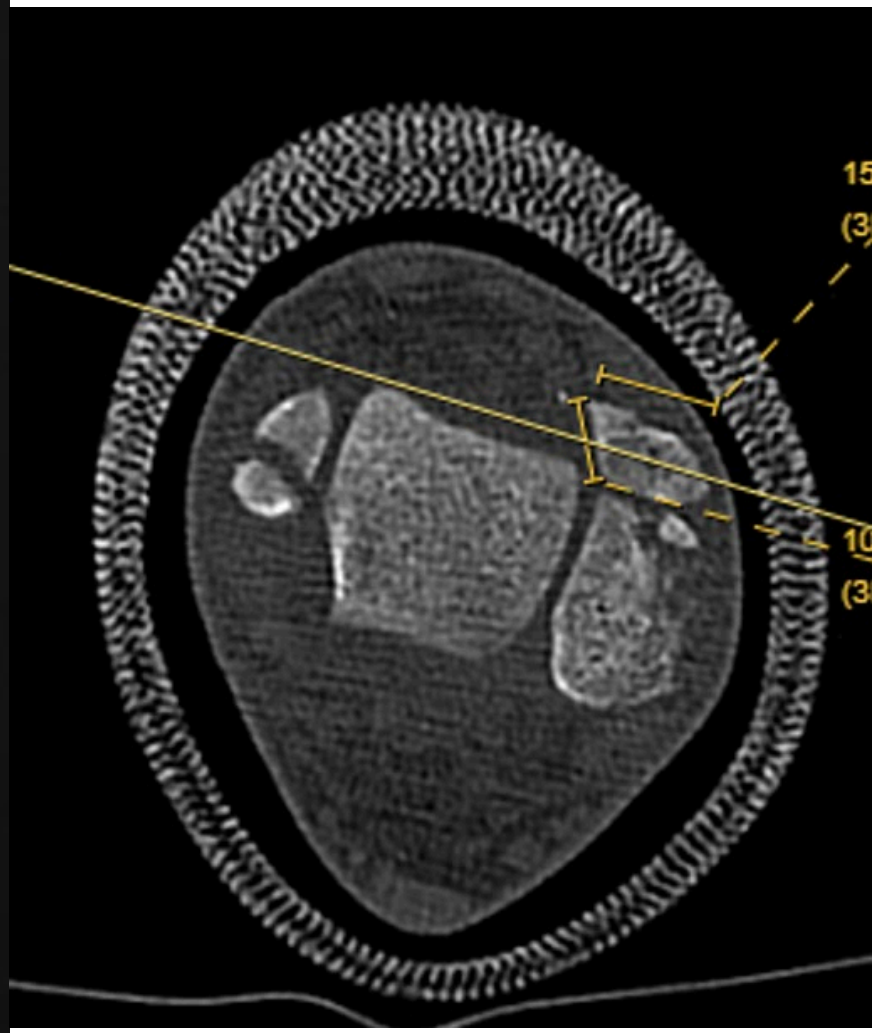




Tillaux fractures

Occur in children generally 18mo to 2yrs older than triplane fractures due to further progression of physeal closure





What are we worried about?

- Intra-articular step-off: All except SH1, 2
- Premature physeal closure: All except Tillaux

What are we worried about?

Step off >2mm in weightbearing area predisposed to decreased function at 36mo post-op

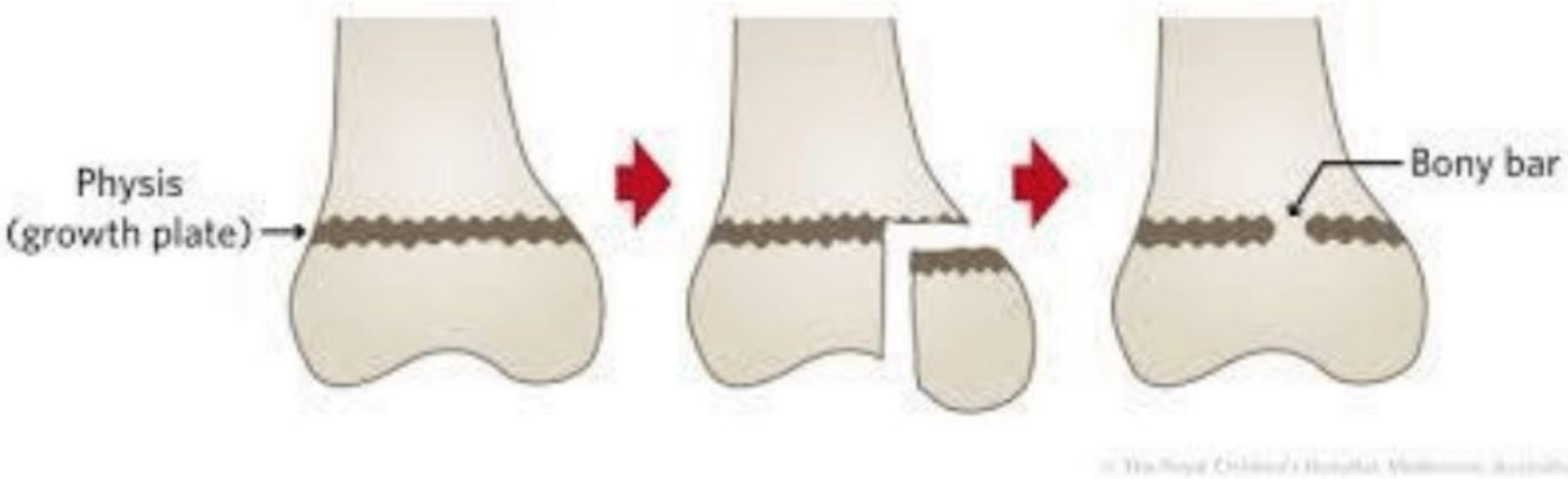
Triplane Fracture of the Distal Tibial Epiphysis

Long-Term Follow-up*†

BY LIEUTENANT COMMANDER JANIKA P. ERTL‡, LIEUTENANT COMMANDER ROBERT L. BARRACK‡, MEDICAL CORPS, UNITED STATES NAVAL RESERVE, CAPTAIN A. HERBERT ALEXANDER‡, AND LIEUTENANT COMMANDER KENT VANBUECKEN‡, MEDICAL CORPS, UNITED STATES NAVY

From the Department of Orthopaedic Surgery, Naval Hospital, Oakland

What are we worried about?



Central/large → Shortening

Peripheral/small → Angulation

Or both

What are we worried about?

TABLE 3. Distribution of Fractures According to Salter-Harris Classification (SH)

References	SH I	SH II	SH III	SH IV	SH V	Tillaux	Triplane	PPC
Spiegel et al[29]	36 (3%)	91 (7%)	49 (6%)	3 (33%)	2 (100%)	6	15	13 (7%)
Barmada et al[18]	6 (67%)	45 (31%)	4 (75%)	4		14	19 (21%)	25 (27%)
Leary et al[17]	4	40 (25%)	20 (10%)	11 (18%)		23	26 (4%)	15 (15%)
Schurz et al[25]	181	113 (1%)	66	16				1 (0.2%)
Seel et al[26]	3	128 (6%)	34 (6%)	17 (6%)		15	28 (4%)	12 (5%)
Russo et al[28]		96 (42%)						40 (42%)
Cai et al[13]	4	191 (17%)	53	38 (26%)				42 (15%)
Özkul et al[24]		44 (27%)	37 (41%)	23 (43%)				37 (36%)
D'Angelo et al[27]	3 (33%)	30	7	6				1 (2%)
Karlikowski and Sułko[11]	9	35 (3%)	7	6		2	8	1 (1%)
Park et al[23]		95 (39%)						37 (39%)
Stenroos et al[22]	15 (7%)	138 (12%)	19	15 (27%)		17	29	21 (9%)
Total	261	1046	296	139	2	77	125	245
Total PPC rate	3%	17%	8%	20%	100%	0%	5%	13%

Physeal Fractures of Distal Tibia: A Systematic Review and Meta-analysis

Jenni Jalkanen, MD, PhD, Juha-Jaakko Sinikumpu, MD, PhD,† Jani Puhakka, MD,‡ Topi Laaksonen, MD,‡ Yrjänä Nietosvaara, MD, PhD,*‡ Jussi Kosola, MD, PhD,‡ and Antti Stenroos, MD, PhD‡*

How do we know if growth disturbance has occurred?

- Is it there?
- Is it far enough from the physis
  (using rule of thumb)
- Is it parallel?

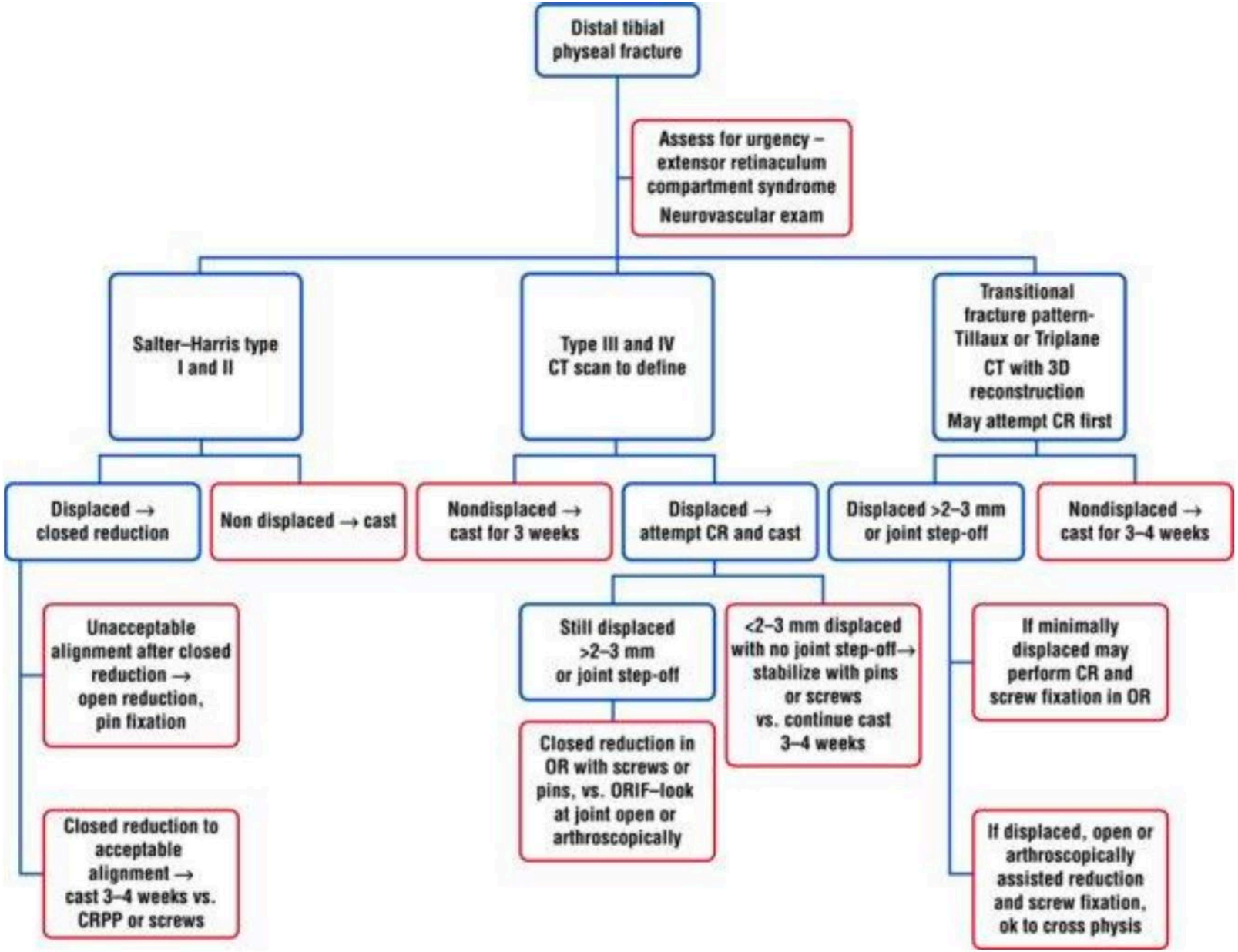
Harris Park Line

What are we NOT worried about?

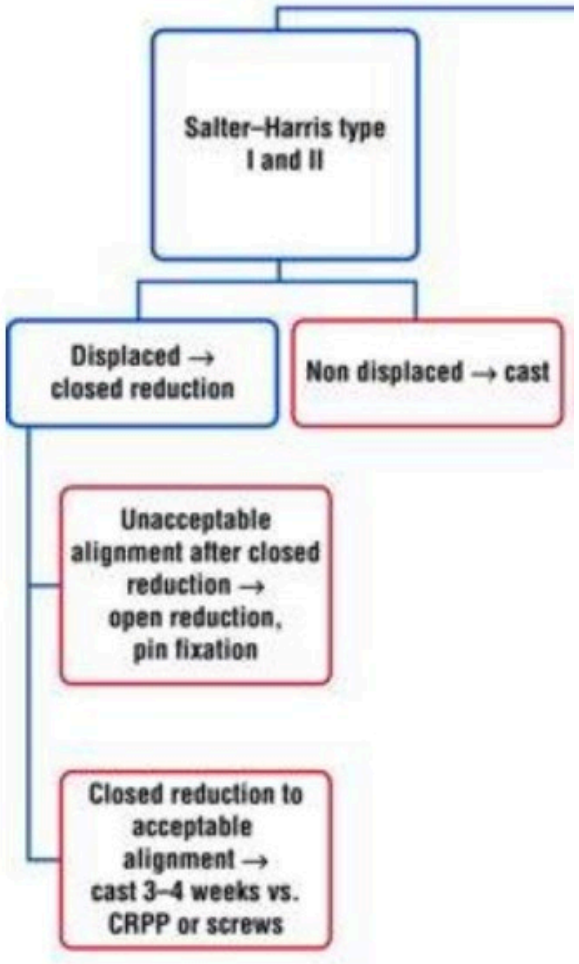
- Kump's Hump

What are we Not worried about?

- Os subfibulare
- Accessory ossification center

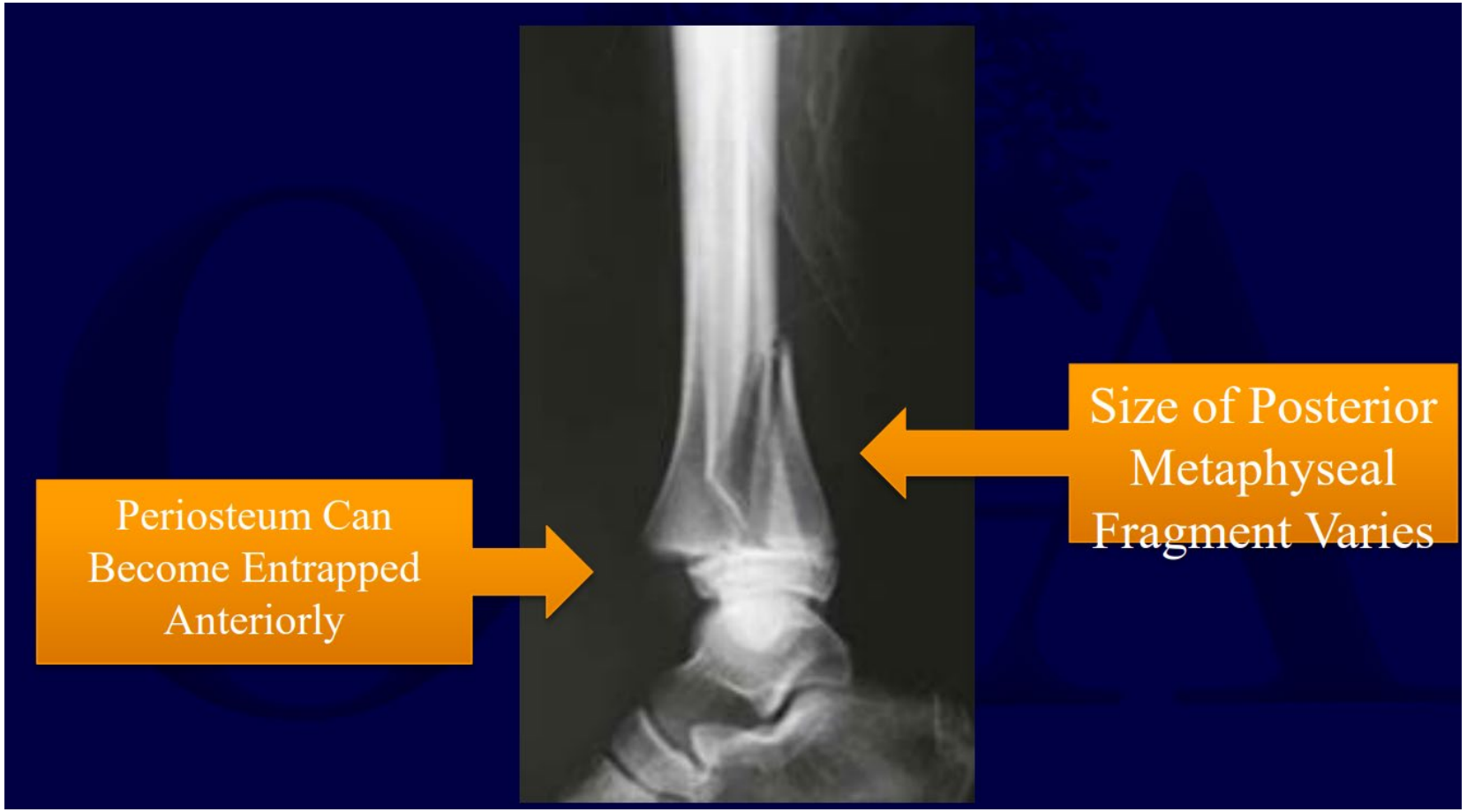


SH I distal tibia fracture

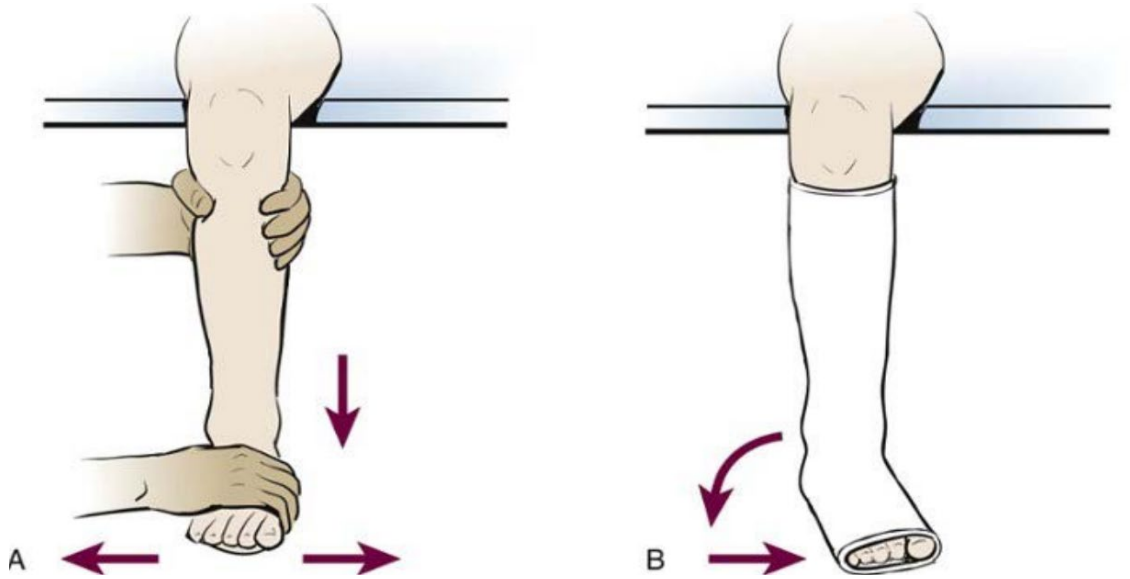


SH II Distal tibia fractures

- Most common
- 40% of all paeds ankle fractures
- Associated fibula fracture in 20% cases
- Average age at injury 12.5 years



Treatment of SH II distal tibia fractures



- Can be managed with reduction and casting
- Reduction:
  - Sedation
  - Flex knee and plantar-flex ankle to relax gastro-soleus
  - Apply axial traction and manipulation to oppose deformity force
- Casting
  - Long leg cast
  - Knee flexed 30-90 degrees
  - Inversion/eversion of foot directed by initial direction of displacement

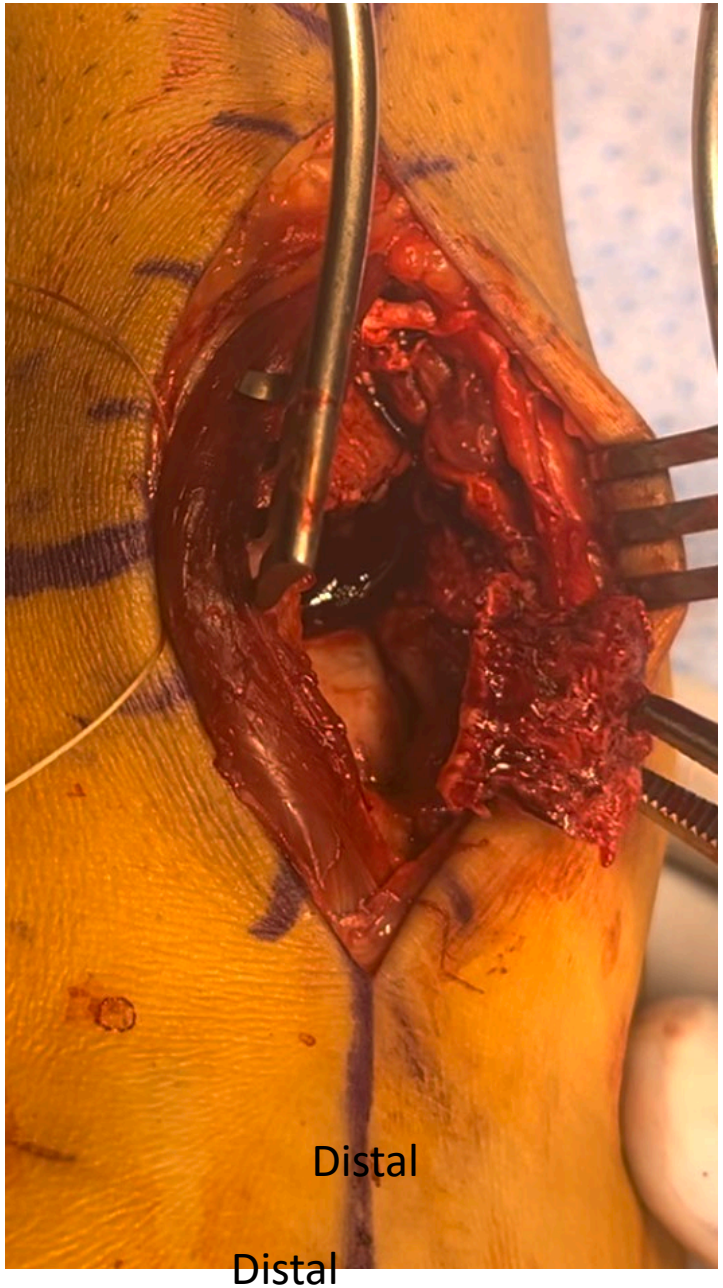

Closed
Reduction

Anterior Physeal Gapping > 3 mm s/p Reduction May Indicate Entrapped Periostium and be Predictive of Early Physeal Arrest

SHIII Medial malleolus fractures

SH III “Tillaux” fractures

Medial

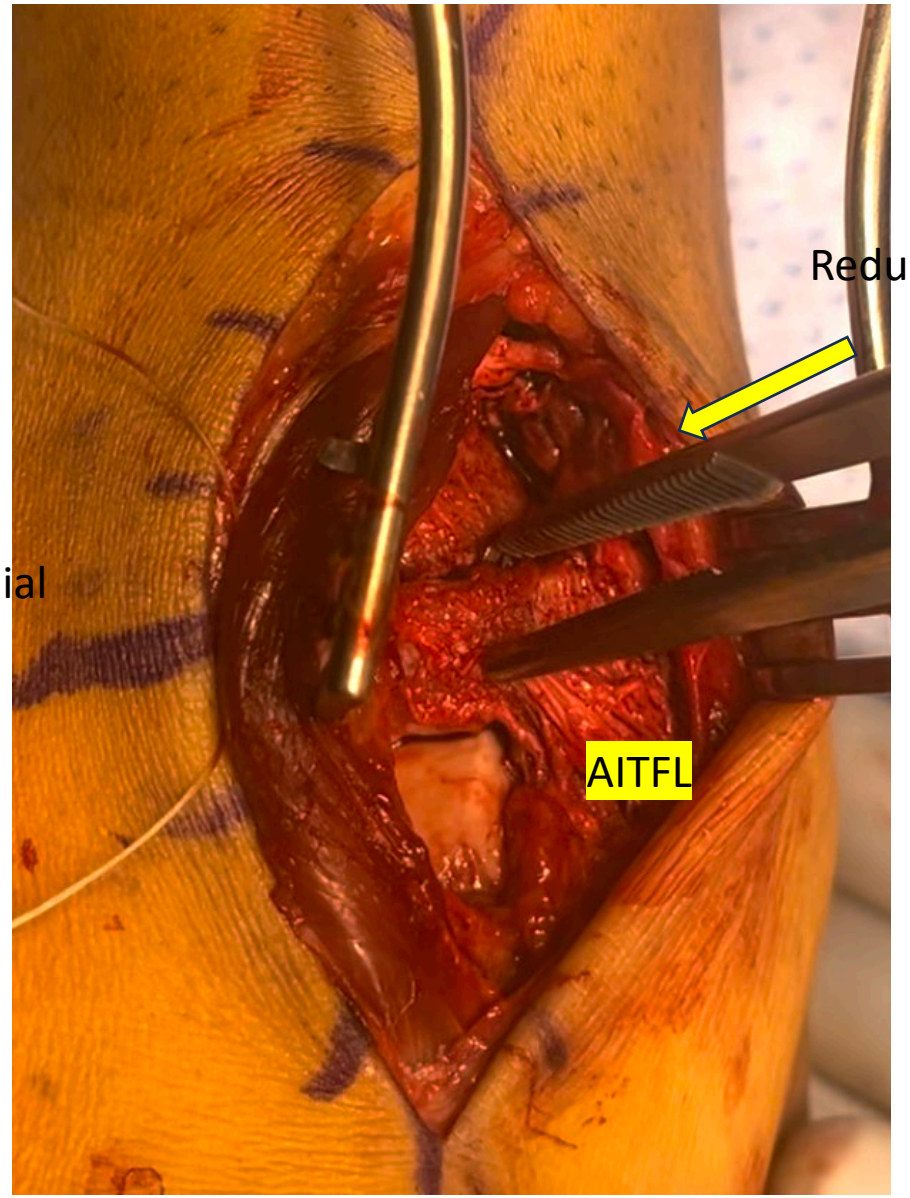


Distal

Distal

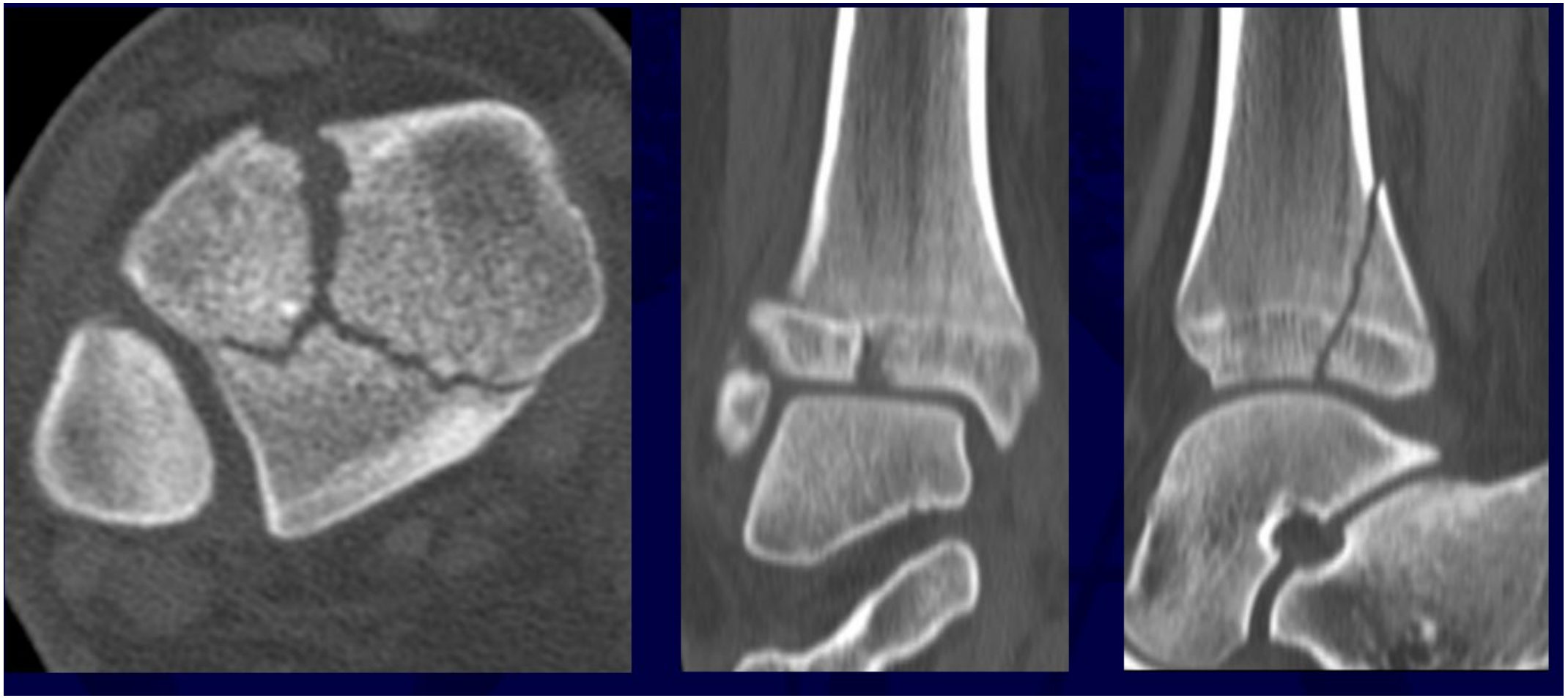
Widely displaced Tillaux fragment

Medial

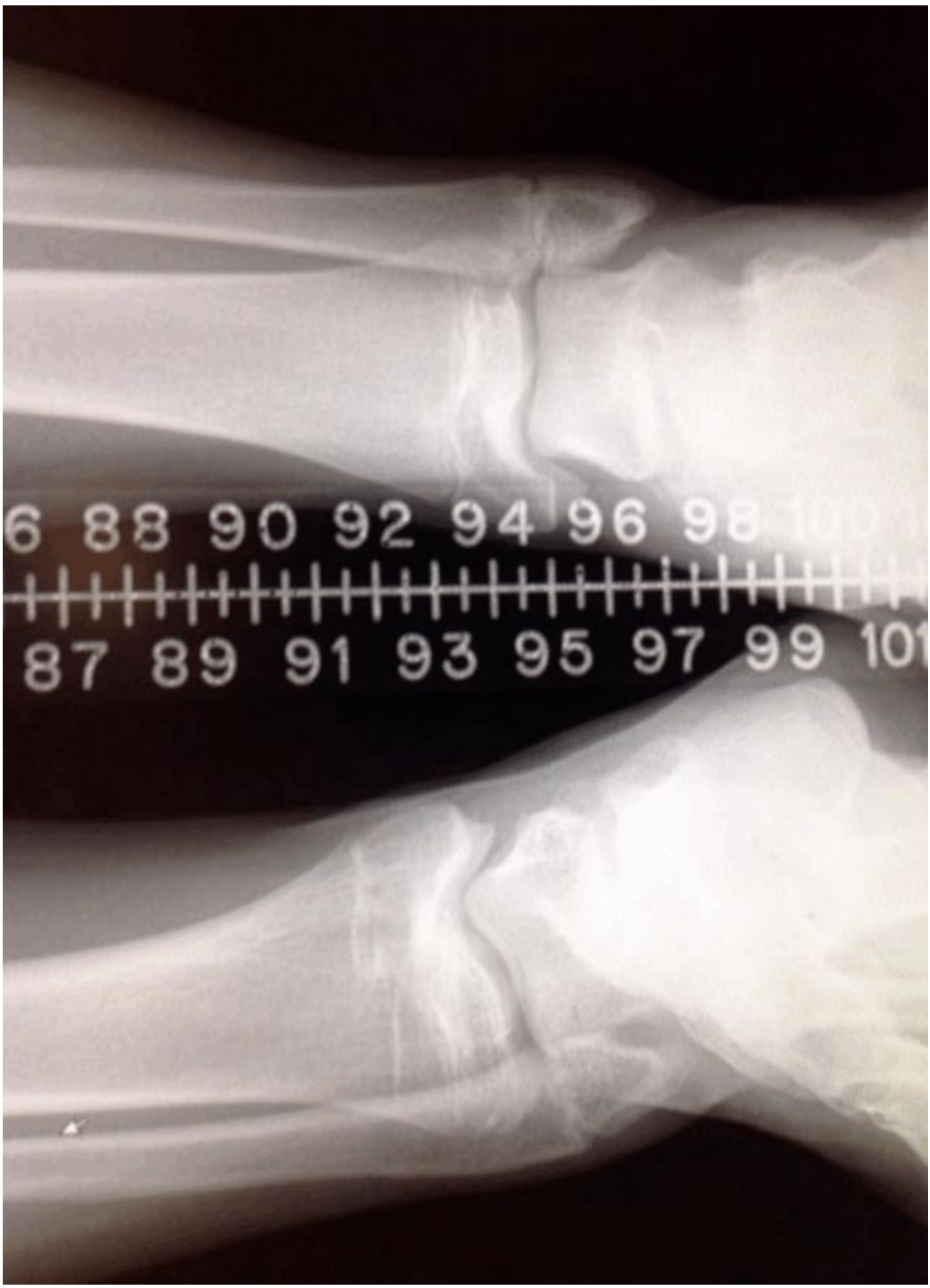


Distal

Triplane fractures with displacement more than 2-3mm or step-off need to go to OR. Nice to attempt CR prior to CT if possible



Have a low threshold to treat operatively and vigilant follow up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87 89 91 93 95 97 99 101


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Attempt closed reduction prior to CT

Assure articular reduction

Monitor growth