Fractures of the proximal tibia : Classification

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Epidemiology

- **Fractures of tibial plateau = 1 % of overall fractures**
- **25% of overall tibia**
- **Previous fracture of tibial plateau: X 5 risk of TKA compared to same matched cohort**

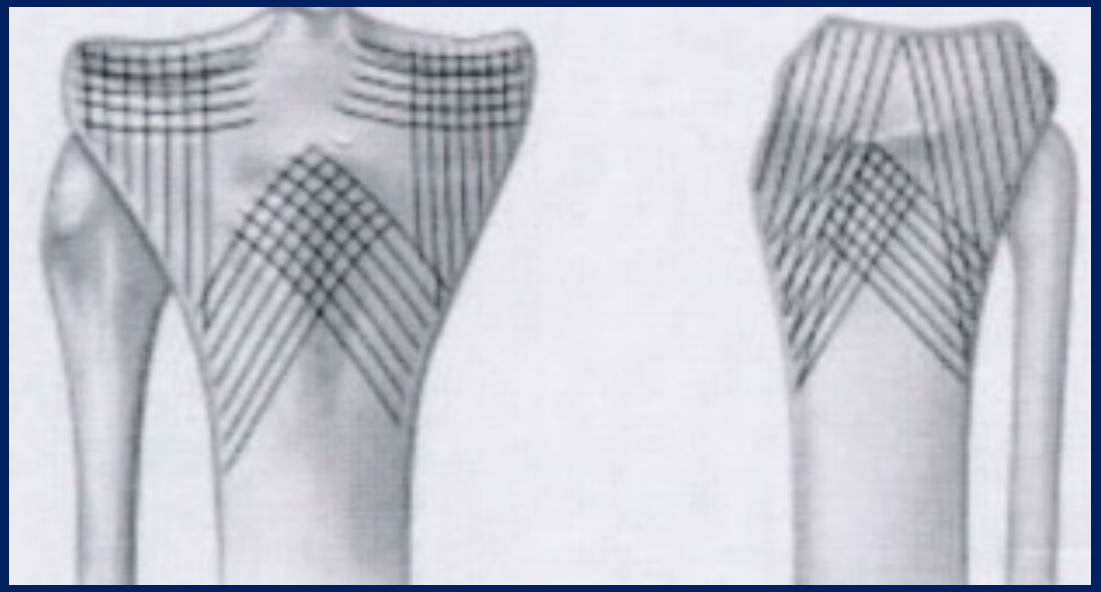
Wasserstein D, Henry P, Paterson JM, Kreder HJ, Jen- kinson R. Risk of total knee arthroplasty after operativelytreated tibial plateau fracture : a matched-population-based cohort study. J Bone Joint Surg Am 2014;96(2):144-150

Epidemiology

- **Before 30 years old, complex fractures during road accident or sport, in male patients**

- **After 65 years old, ofter simple fracture, in a female osteoporotic patient, during a fall at home**

Physiopathology



Trabecular system proximal tibia

Weakness zones proximal tibia

Horizontal spans lie on a system of vertical and ogival pillars

DUPARC J, FICAT P. [Articular fractures of the upper end of the tibia]. Rev Chir Orthop Reparatrice Appar Mot. 1960 Sep;46:399-486. French. PMID: 13725085.

Physiopathology

- **Trois types of basic mechanisms :**
  - **axial compression 11.6 %**
  - **compression in valgus 55 % (or varus)**
  - **sagittal trauma**

Classifications based on X-Rays

Fractures of proximal tibia first time described by Sir Astley Cooper en 1825

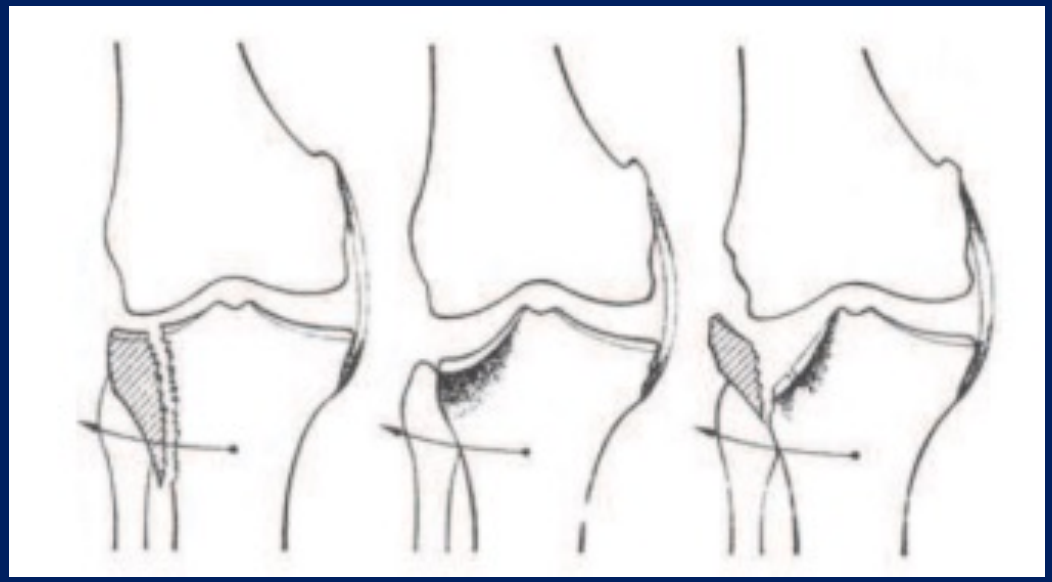
Cooper A. A treatise on dislocations, and on fractures of the joints. Boston: Wells & Lilly; 1825

Classifications

First radiographic descriptive classification by Gerard Marchand in 1939

Elementary Lesions:

1. Split Fracture
2. Depression Fracture
3. Combined Fracture



Gerard-Marchant P. Fractures des plateaux tiabiaux. Rev Chir Orthop1939; 26:499-546

Classifications

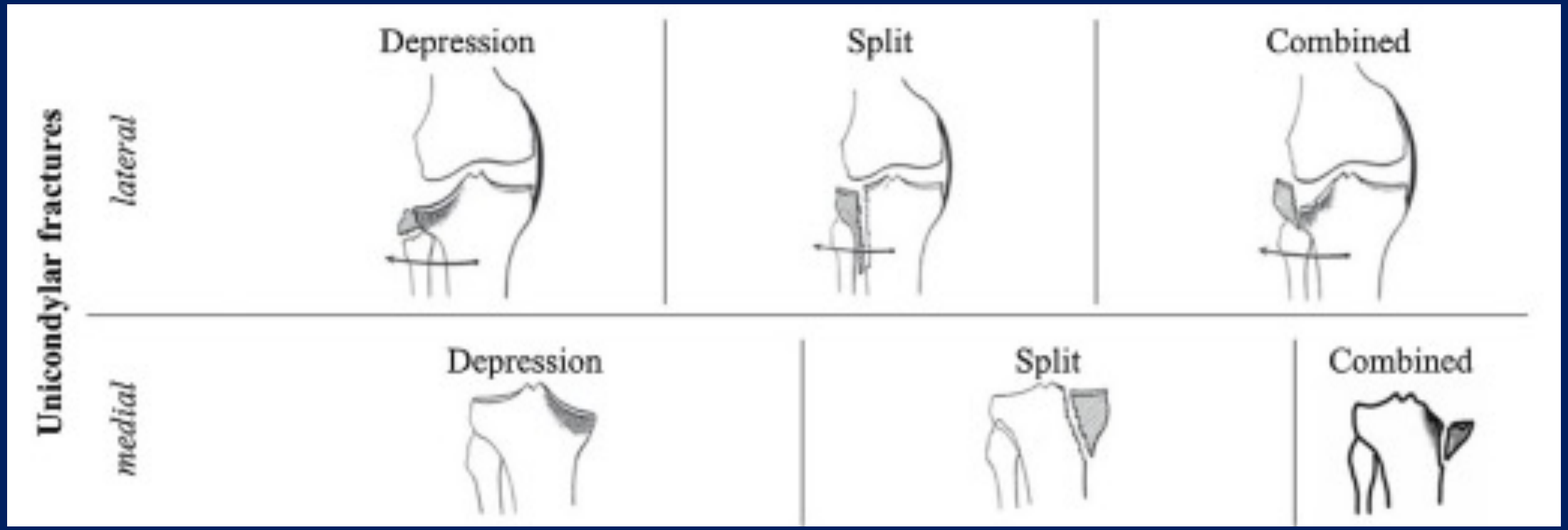
Second radiographic classification : Duparc & Ficat 1960

1) Unicondylar Fractures (60%)
2) Bicondylar Fractures (30 to 35%)
3) Spinocondylar Fractures (less than 10%)
4) Postero-medial Split Fracture

DUPARC J, FICAT P. [Articular fractures of the upper end of the tibia]. Rev Chir Orthop Reparatrice Appar Mot. 1960 Sep;46:399-486. French. PMID: 13725085.

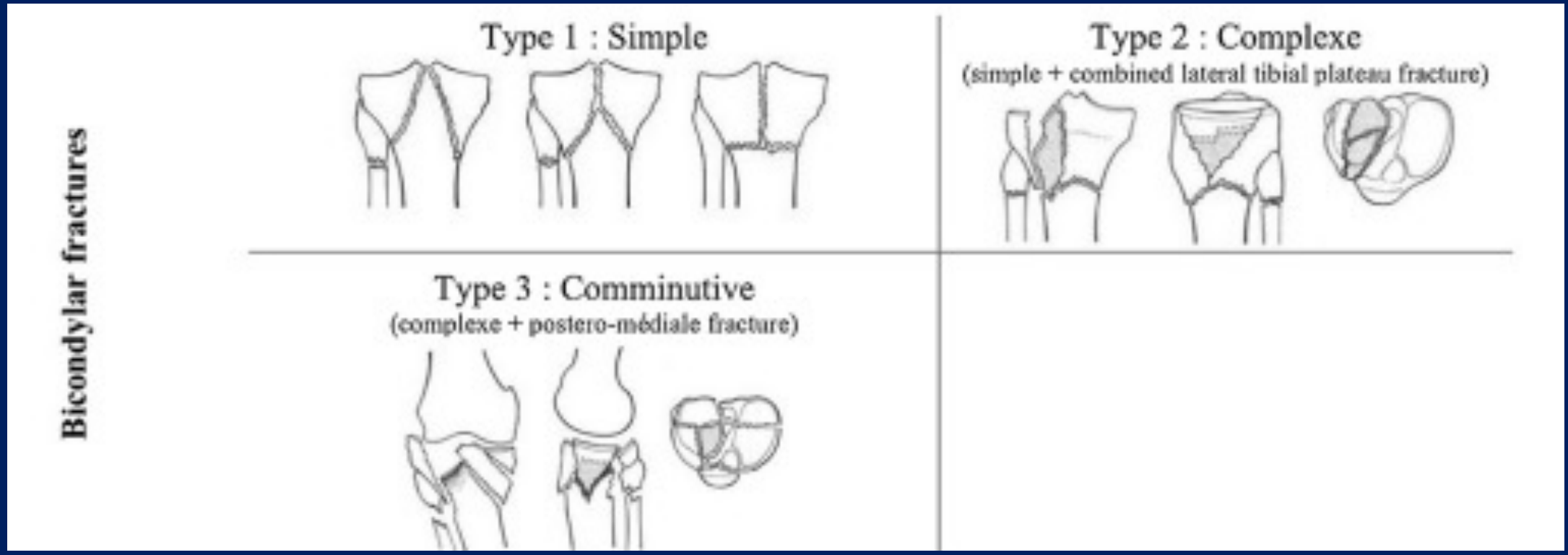
Duparc & Ficat 1960

1) Unicondylar Fractures (60%)



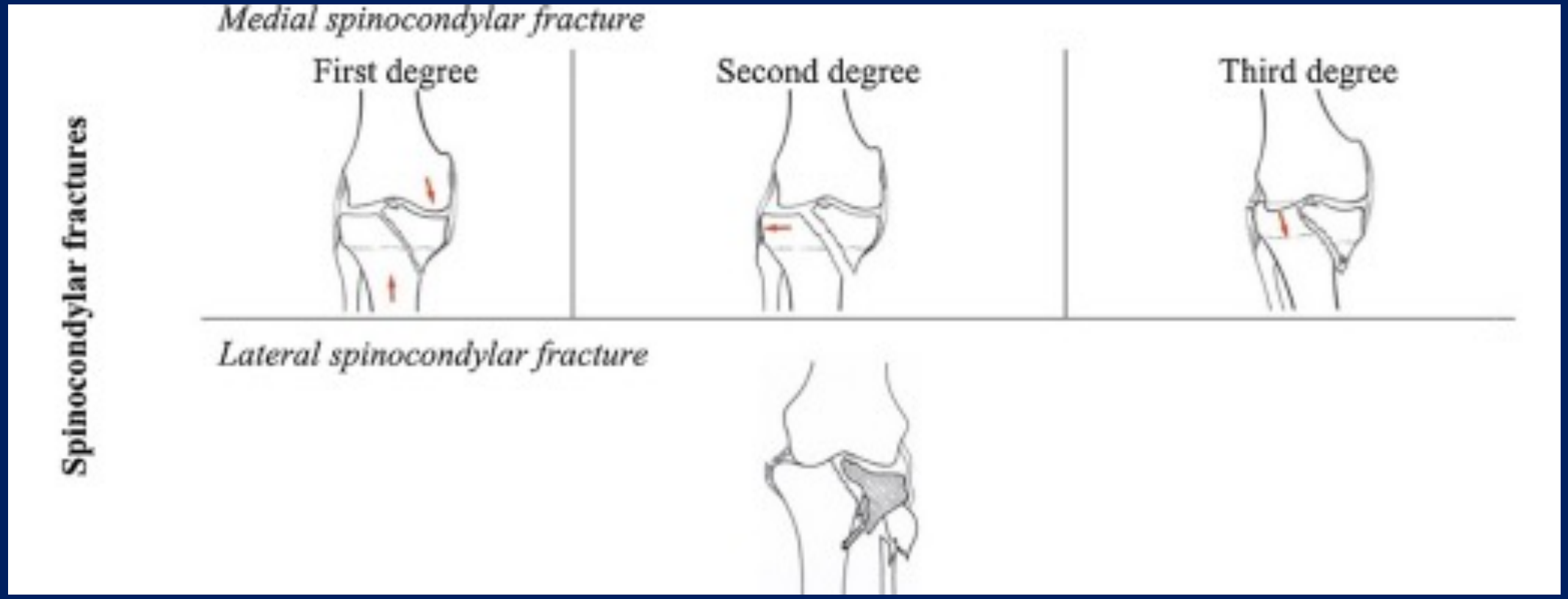
Duparc & Ficat 1960

2) Bicondylar Fractures (30 to 35%)



Duparc & Ficat 1960

3) Spinocondylar Fractures (less than 10%)



Duparc & Ficat 1960

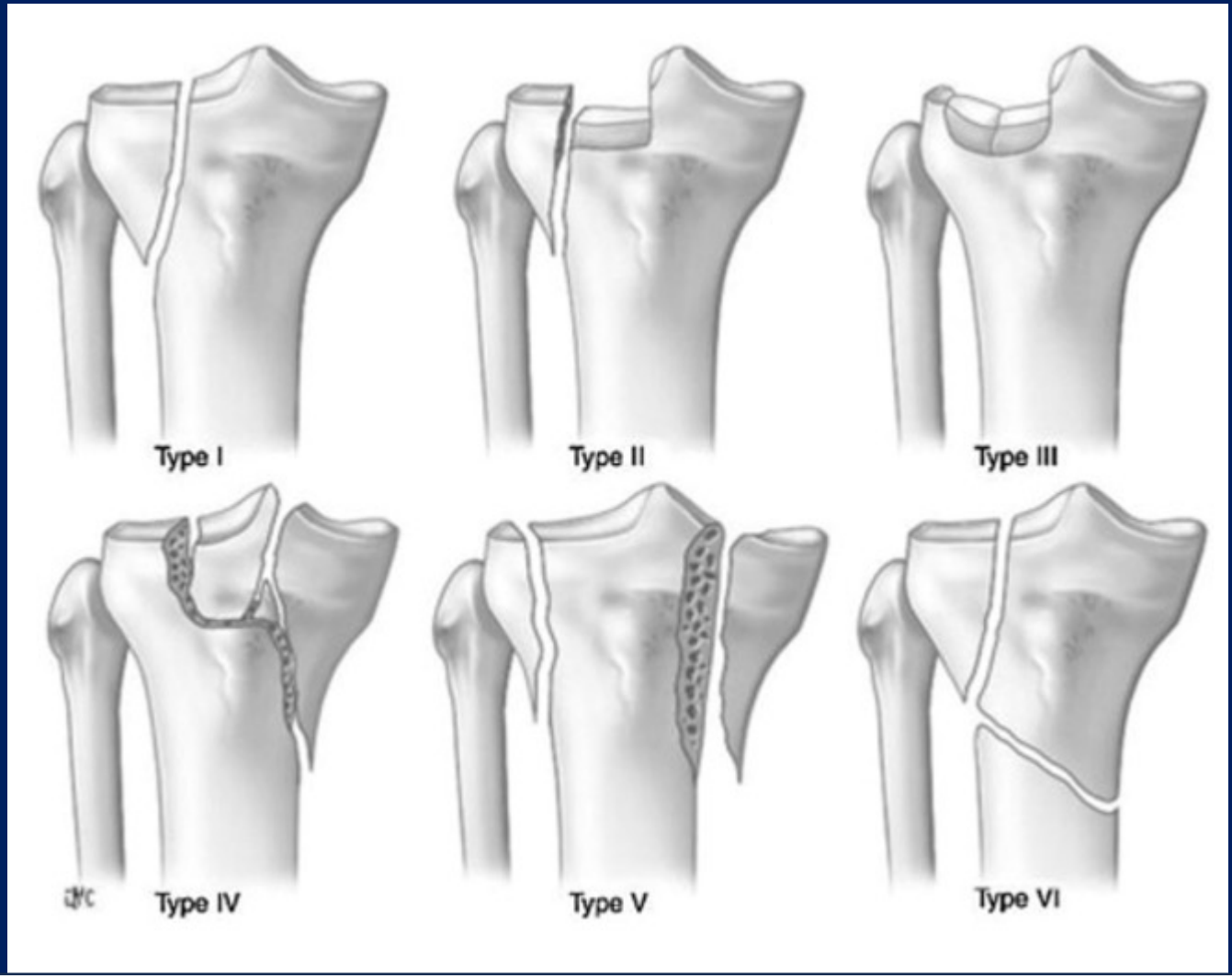
4) Posteromedial Split Fracture

Postéro-mediale fracture

Clinical appearance :
- isolated
- associated to :
  - a combined lateral tibial plateau fracture
  - a complex bicondylar fracture
  - a spinocondylar fracture

Classifications

Schatzker Classification (1968)

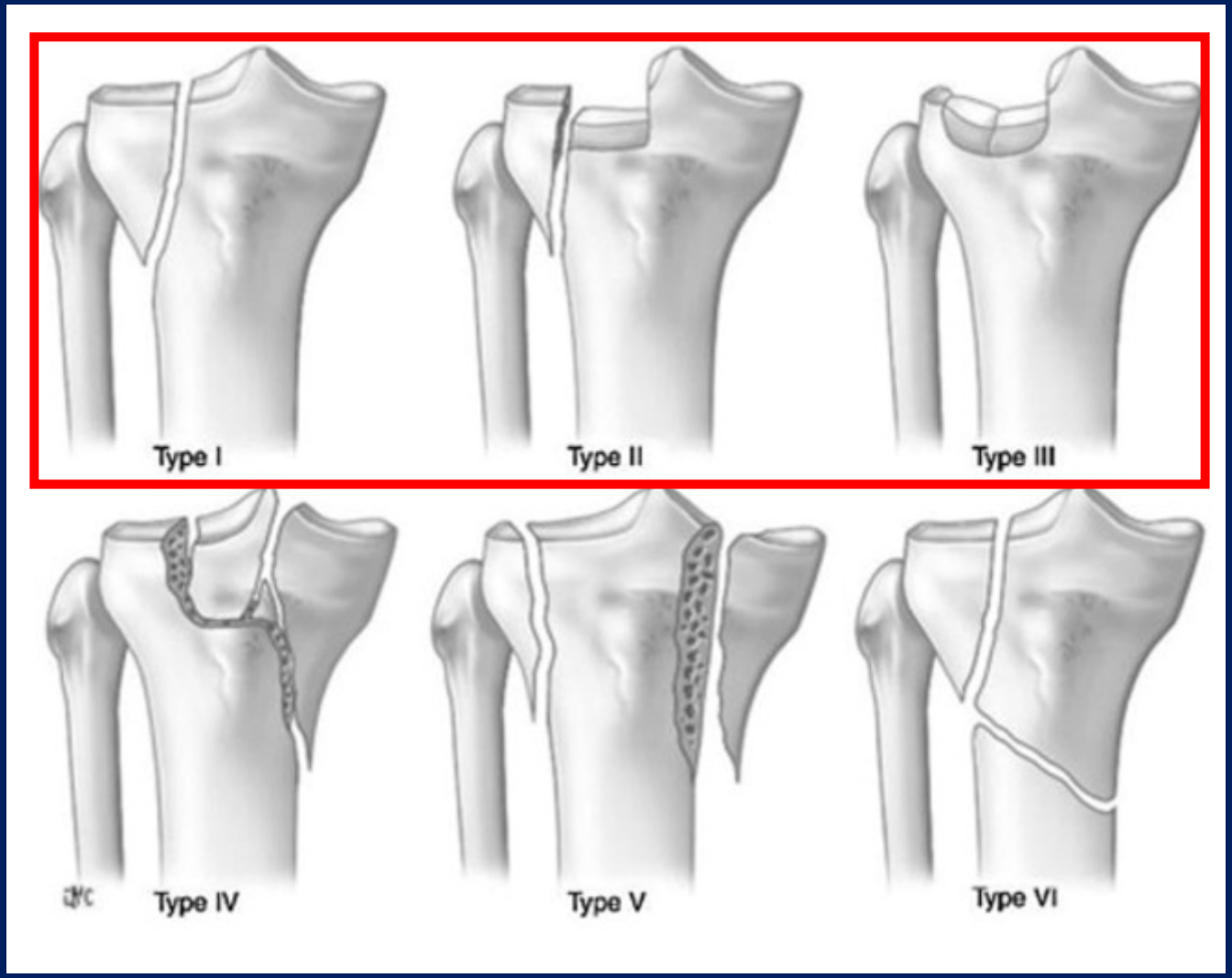


Schatzker J, McBroom R, Bruce D. The tibial plateau fracture. The Toronto experience 1968--1975. Clin Orthop Relat Res. 1979 Jan-Feb;(138):94-104. PMID: 445923.

Schatzker Classification (1968)

Lateral tibial plateau

- Type I : split
- Type II : split + depression
- Type III : depression



Schatzker Classification (1968)

Type I

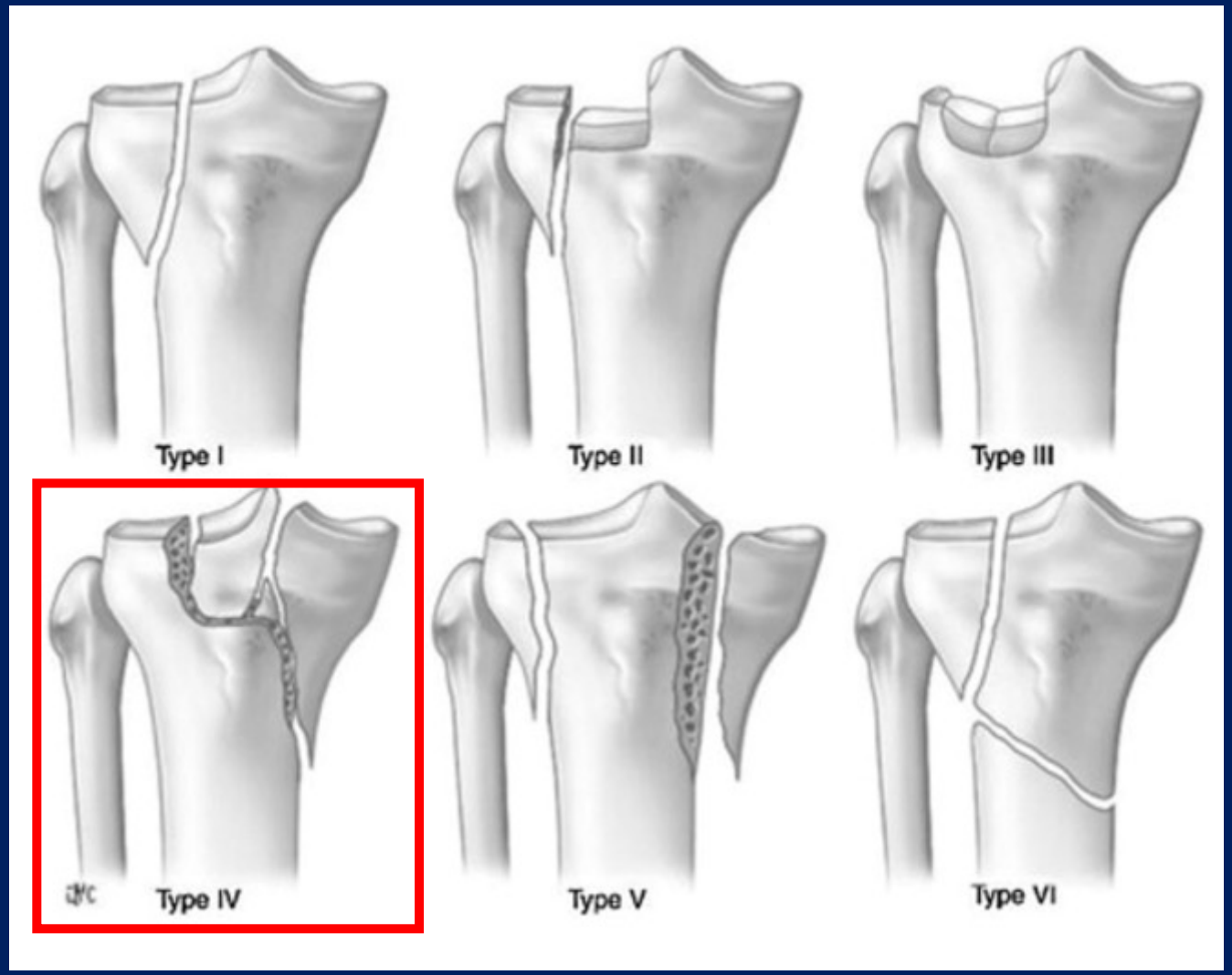
Type II

Type III

Schatzker Classification (1968)

Medial tibial plateau

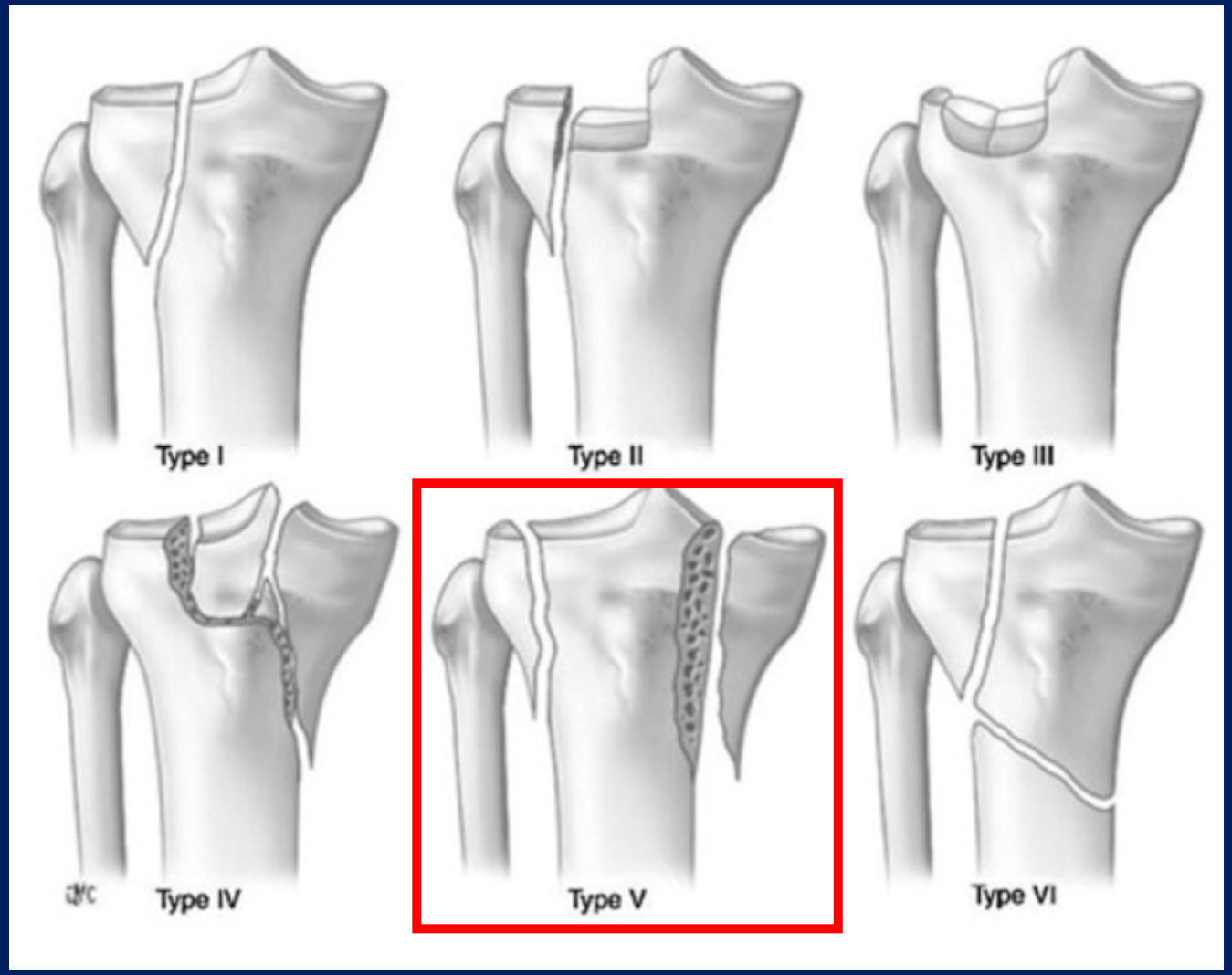
- Type IV : medial plateau fracture



Schatzker Classification (1968)

Medial + lateral tibial plateau

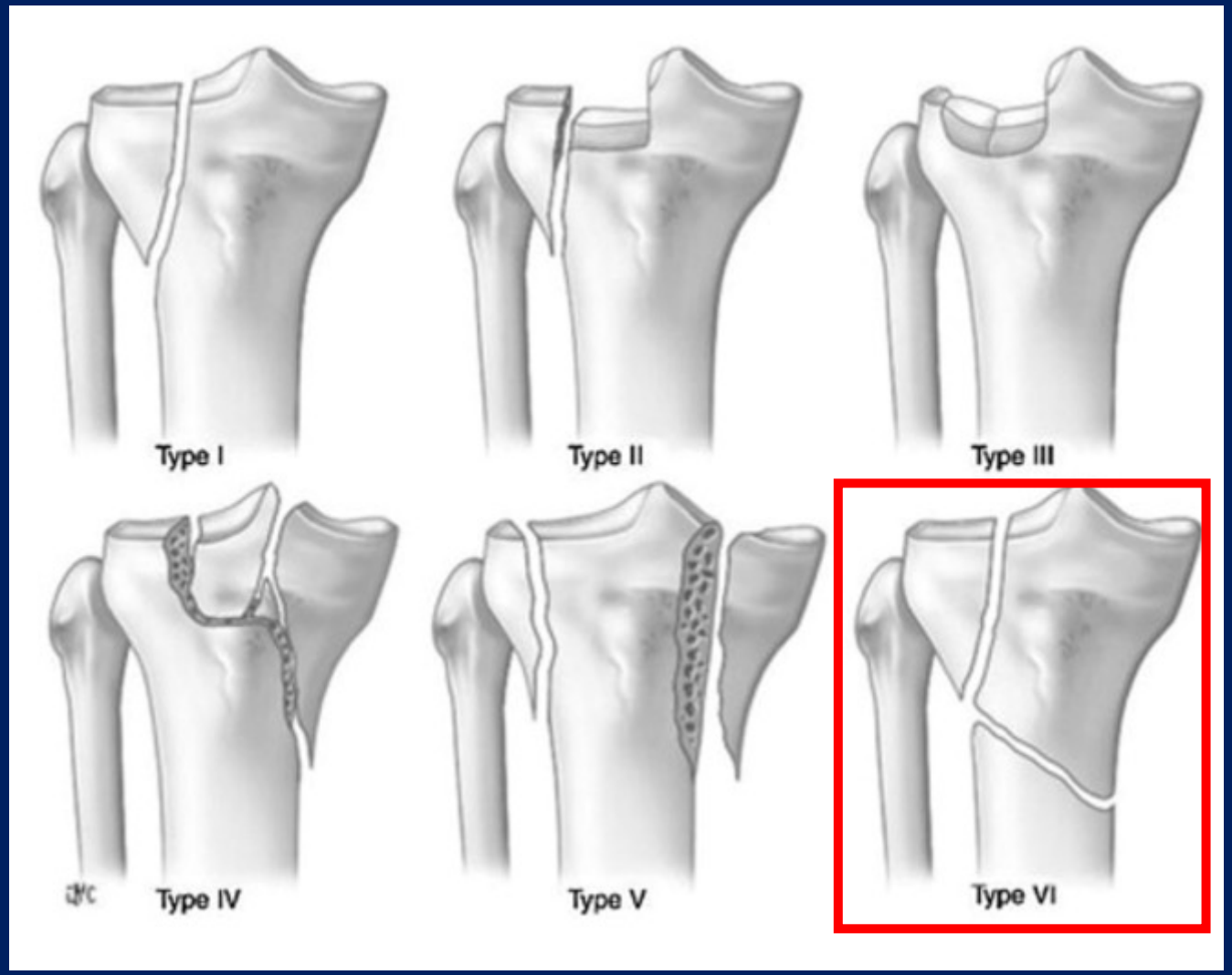
- **Type V : Bicondylar fracture**



Schatzker Classification (1968)

Medial + lateral tibial plateau

- **Type VI : bicondylar fracture + diaphysal fracture**



Schatzker Classification (1968)

Type IV

Type V

Type VI

Classifications

Müller 1989 : AO/OTA

- **3 groups :**

A : Extra-articular fractures

B : Partial articular fractures

C : Complete articular fractures

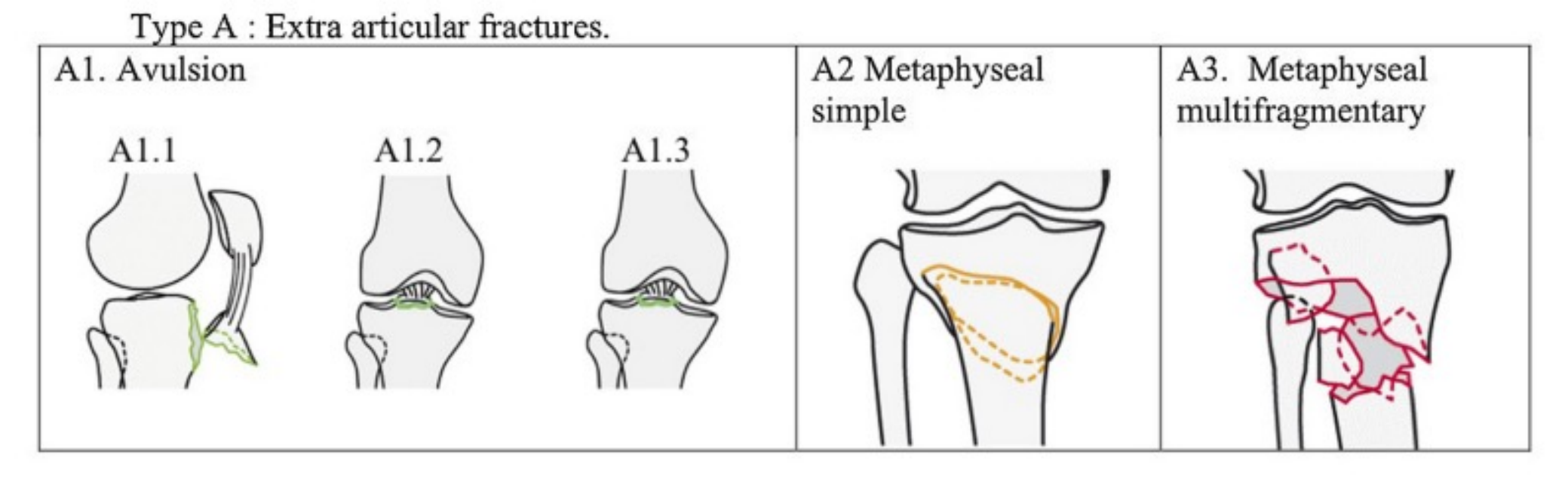
➢ **3 groups :**

A : Extra-articular fractures

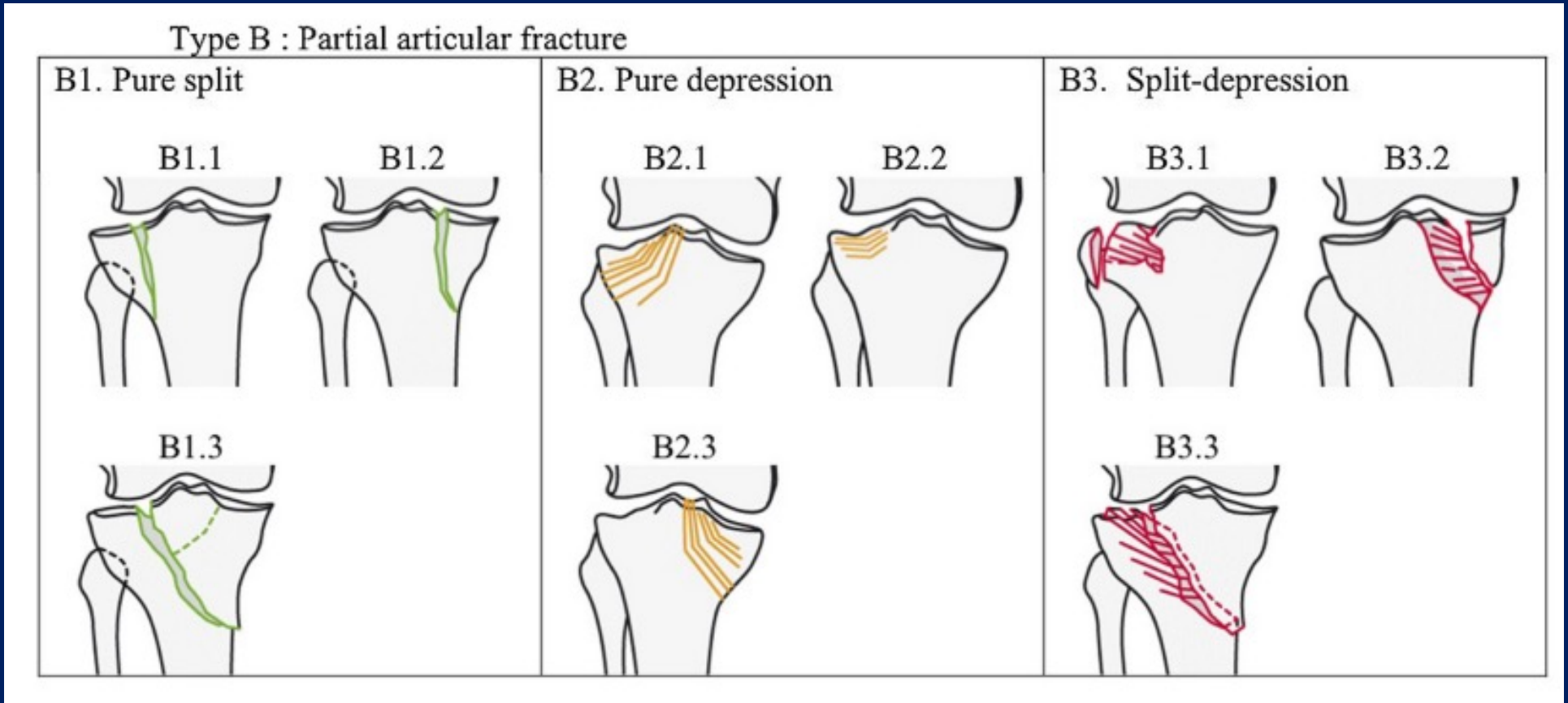
B : Partial articular fractures

C : Complete articular fractures

Müller 1989 : AO/OTA

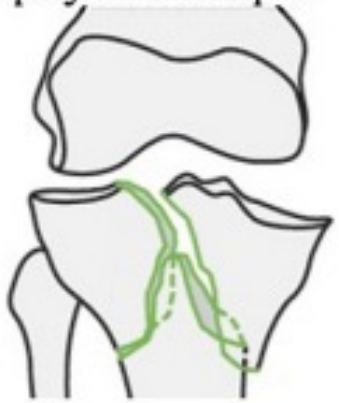
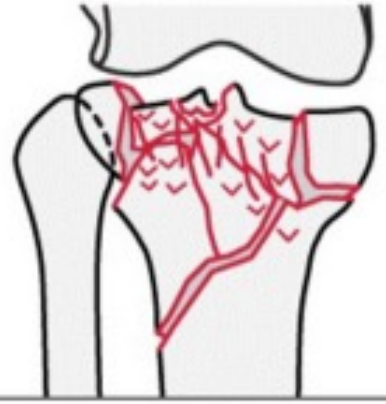


Müller 1989 : AO/OTA



Müller 1989 : AO/OTA

Type C : Complete articular fracture

C1. Articular simple, metaphyseal simple	C2. Articular simple, metaphyseal multifragmentary	C3. Articular multifragmentary
		

➢Comparaison of the 3 classifications :

6 observators, 50 fractures at J0 then J30 with CT

Results :

- inter-observator reproductibility: weak with X-rays, kappa (Duparc = 0.365 ; AO = 0.357 ; Schatzker = 0.404)

- better with CT (Duparc = 0.474 ; AO = 0.479 ; Schatzker = 0.476)

- non classified fractures : Schatzker 14.3 % vs 2 % for Duparc and 7.33 % for AO

- 71% of lateral plateau were in fact bicondylar fractures at CT-scan

Gicquel T, Najihi N, Vendeuvre T, Teyssedou S, Gayet LE, Huten D. Tibial plateau fractures: reproducibility of three classifications (Schatzker, AO, Duparc) and a revised Duparc classification. Orthop Traumatol Surg Res. 2013 Nov;99(7):805-16.

Classifications based on CT-scan

Classifications

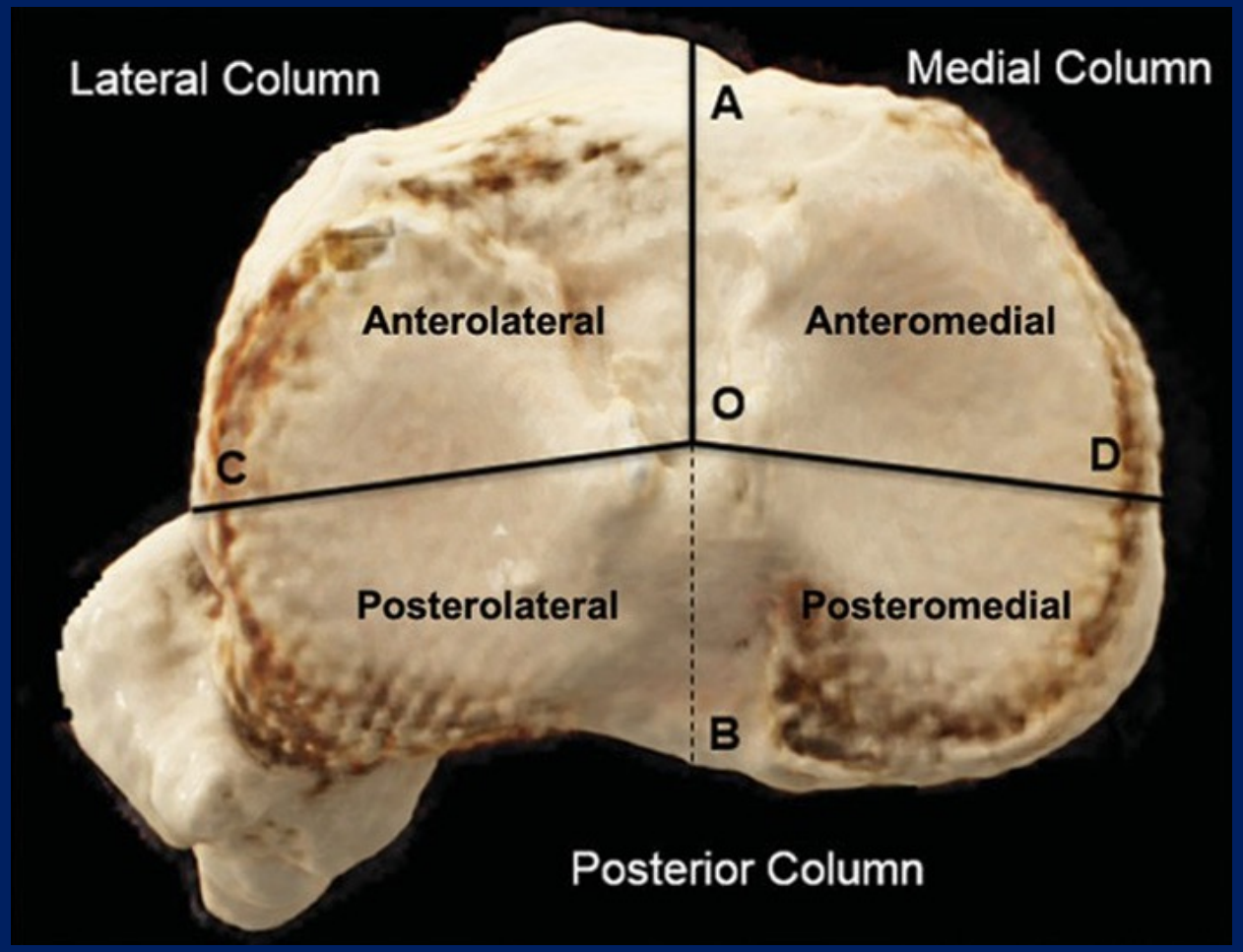
Classification in three columns

- Lack of precision for radiographic classifications regarding posterior part of proximal tibia
- Superior Inter-observator reliability compared to Schatzker and AO classification
- Allows a more complete understanding of the lesions, optimize therapeutic approach

Luo CF, Sun H, Zhang B, Zeng BF. Three-column fixation for complex tibial plateau fractures. J Orthop Trauma. 2010 Nov;24(11)

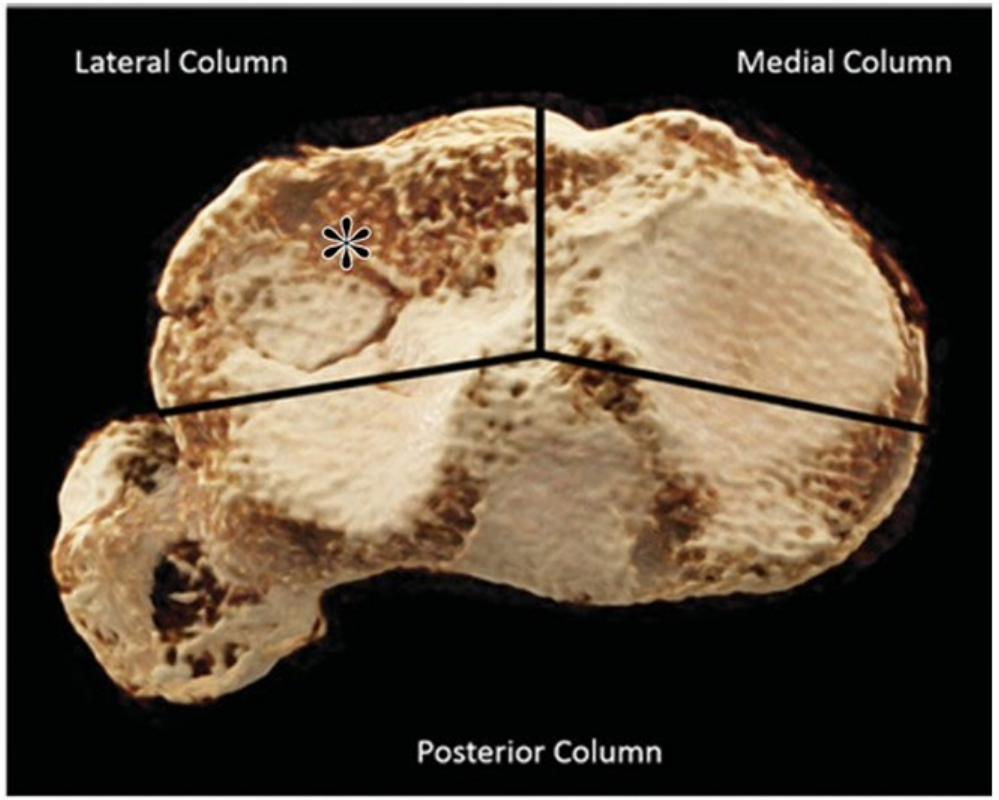
Classification in three columns

A : Anterior tibial tuberosity
C : Anterior part of fibular head
D : Postero-medial crest of proximal tibia



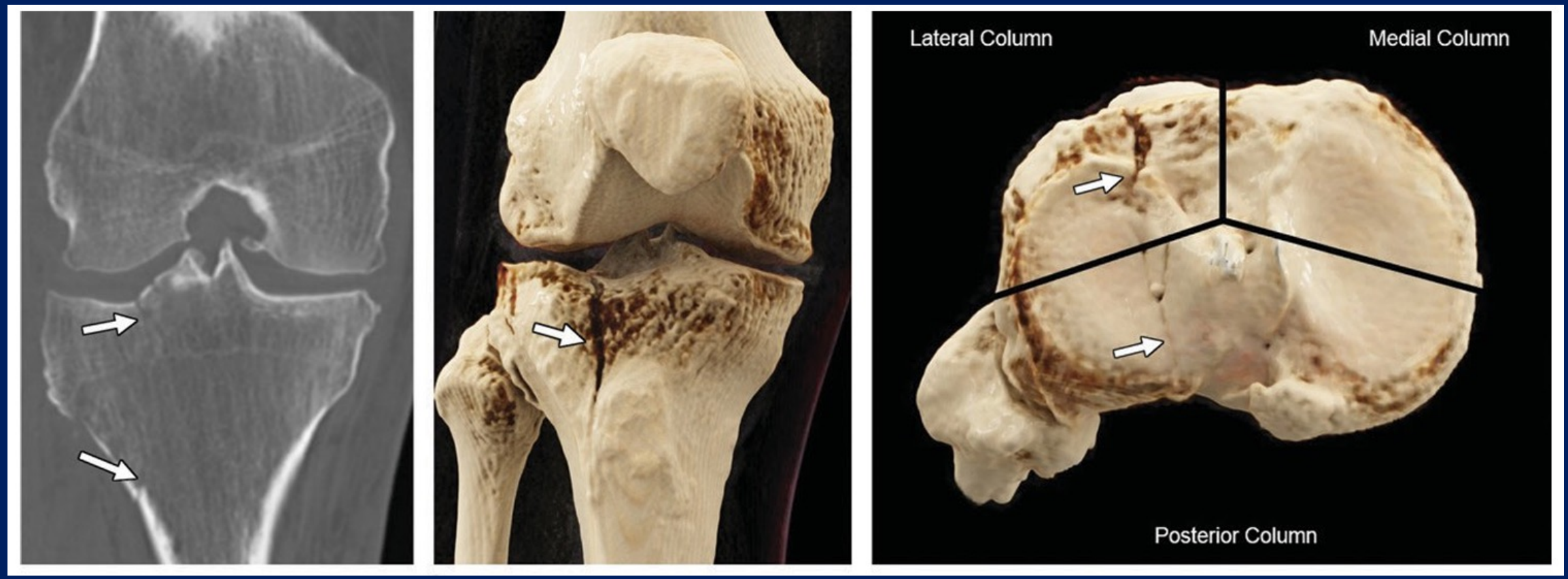
Classification in three columns

Fracture with 0 column : Pure depression fracture



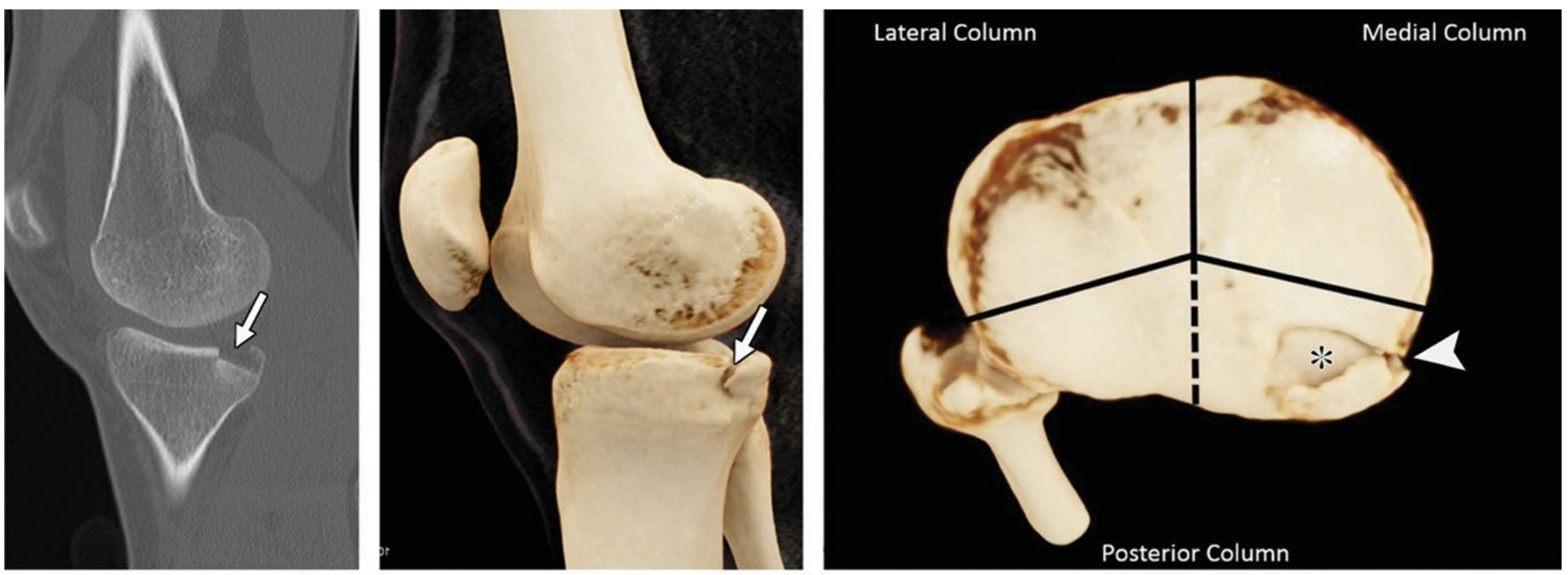
Classification in three columns

<u>Fracture with 1 column</u> : split fracture with one fragment



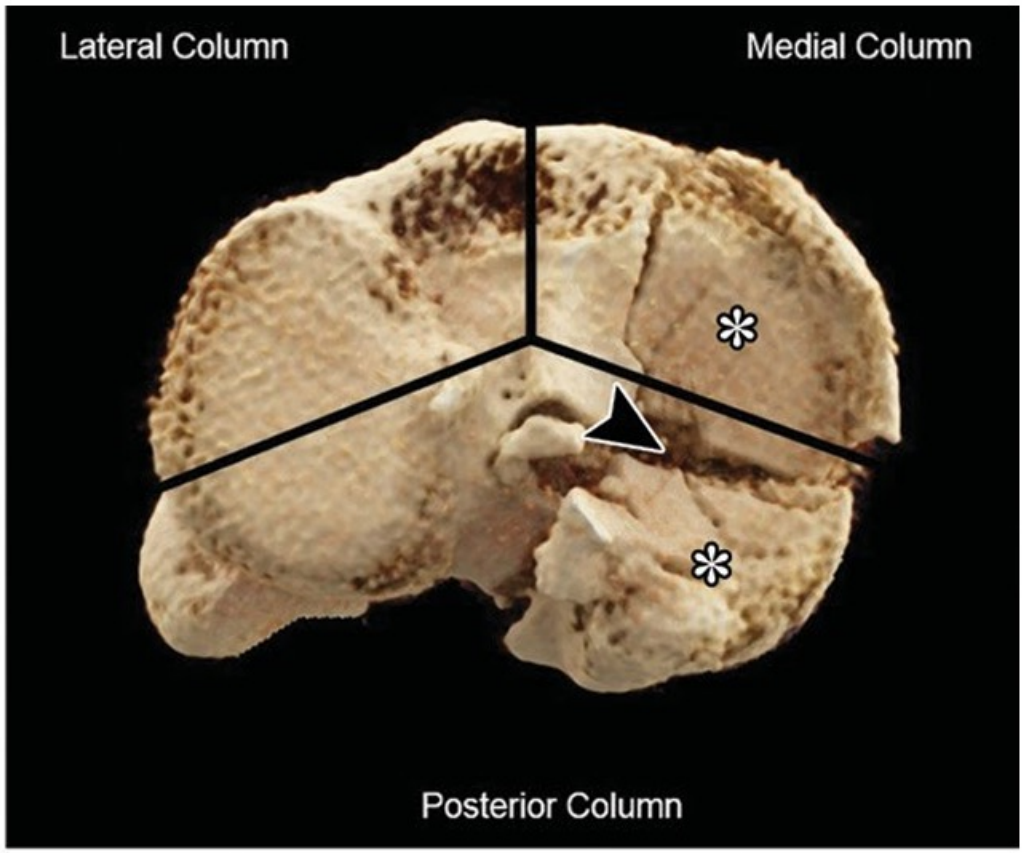
Classification in three columns

Fracture with 1 column : Example of a posterior column fracture



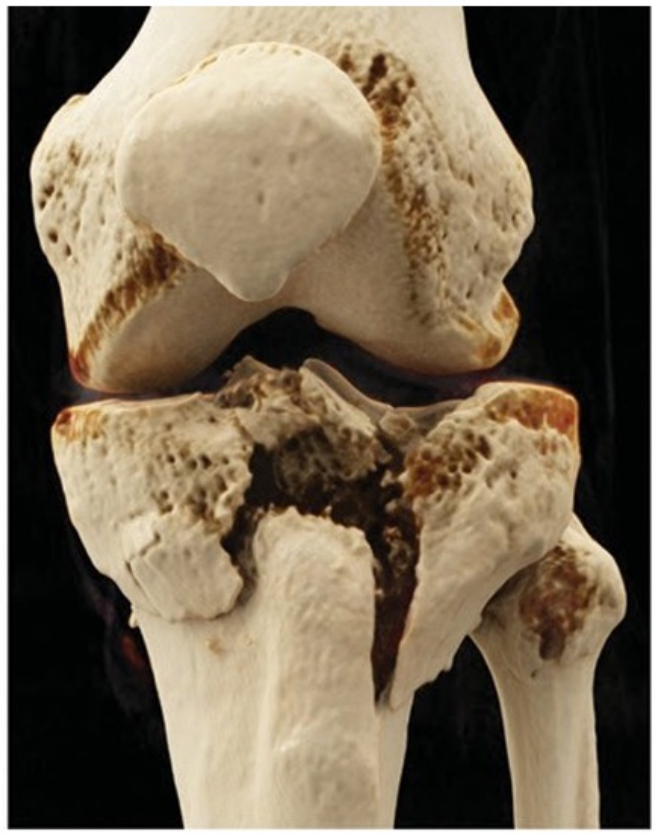
Classification in three columns

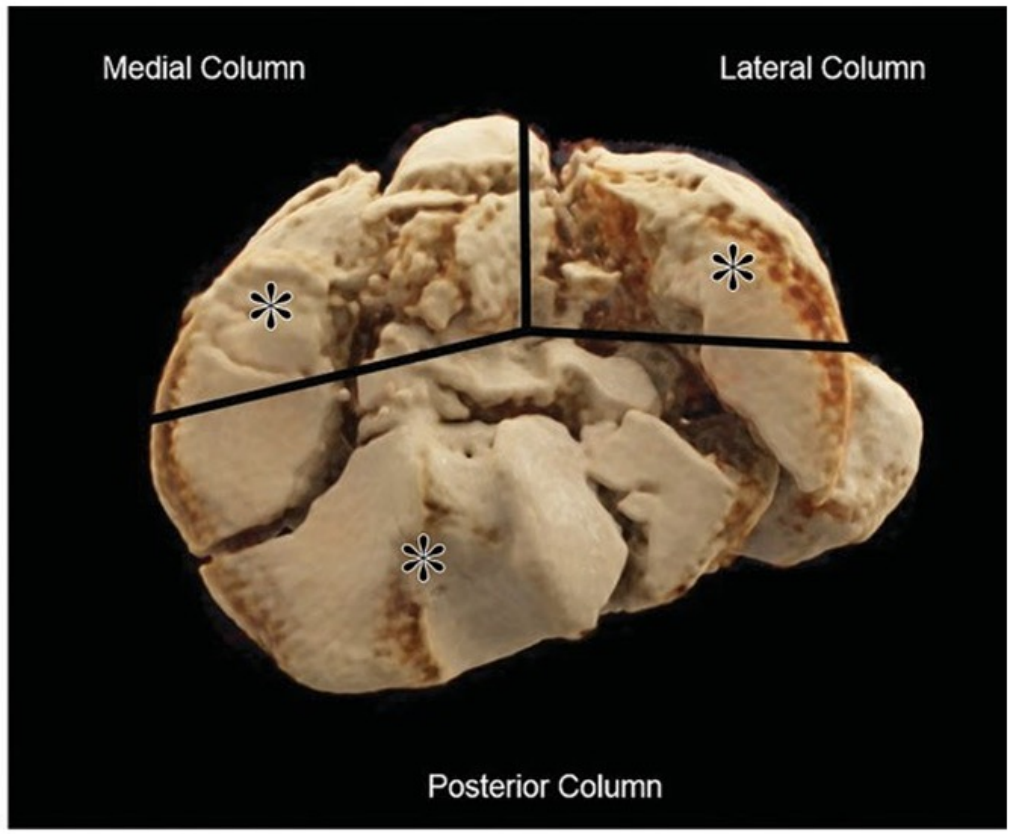
<u>Fracture with 2 columns</u> : two separate fragments in two separate columns



Classification in three columns

<u>Fracture with 3 columns</u> : three separate fragments in the 3 columns





Classification in three columns

- Evolution of Schatzker classification
- Better description of fractures involving the posterior plateau
- Help for choosing the appropriate strategy

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Original article

Bicondylar tibial plateau fracture osteosynthesis with double-plate fixation: Similar complication rates and clinical results but improved radiographic outcomes with dual compared to single approach☆

Emile Dobelle[a,*], Maxime Fabre-Aubrespy[a], Bastien Mandon[a], Xavier Flecher[a,b], Matthieu Ollivier[a], Jean-Noël Argenson[a], Christophe Jacquet[a]

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[b] *Institut du Mouvement et de l'Appareil Locomoteur, CHU Marseille Nord, chemin des Bourrely, 13015 Marseille, France*

Classification in three columns

Clinical Implications :

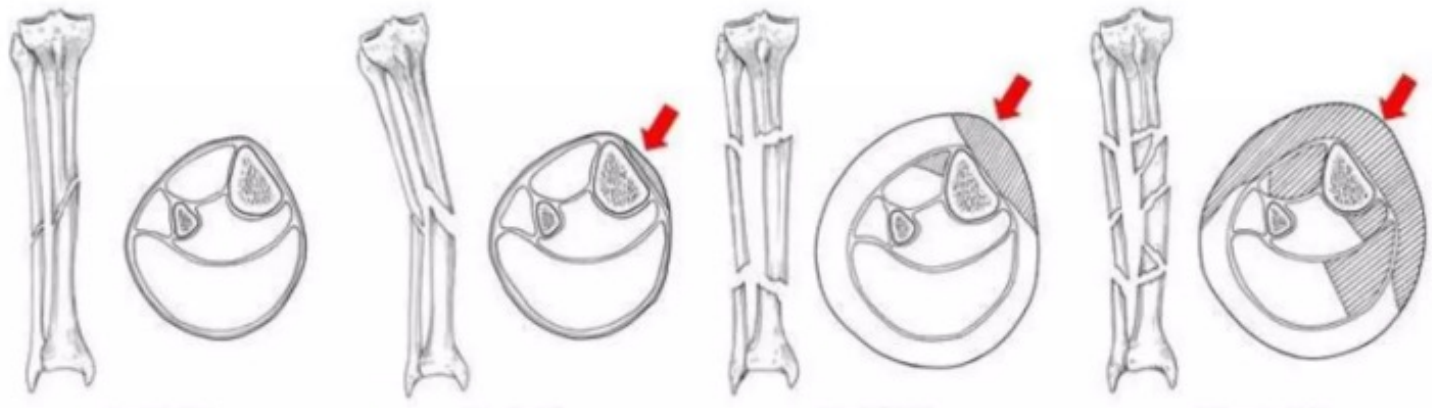
- **Not stabilizing the posterior column increase the risks :**
  - of wrong alignment
  - of bad functional result
  - of secondary osteoarthritis
  - of fixation failure

Liu CD, Hu SJ, Chang SM, Du SC, Xiong WF, Chu YQ. Importance of the Posterior Plate in Three-Column Tibial Plateau Fractures: A Finite Element Analysis and Clinical Validation. Orthop Surg. 2024

Classifications

Do not forget soft tissues !

Tscherne 1984



- Grade C0 : Little or no soft-tissue injury
- Grade CI : Superficial abrasion
- Grade CII : Deep, contaminated abrasion with local contusional damage to skin or muscle
- Grade CIII: Extensive skin contusion or crushing or muscle destruction **(compartment syndrome)**

Tscherne HG : Fractures Associated with Soft Tissue In-juries. 1984 JAAOS, 2003, vol. 11 no. 6 431-438

Conclusion : Planning of tibial plateau fracture surgery

- **Prefer CT classification with 3 columns**
  - More precise and reproducible
  - Taking into account the posterior part of the tibia
- **Look for a skin damage**
  - Tscherne Classification
- **Routinely fix posterior column fractures**