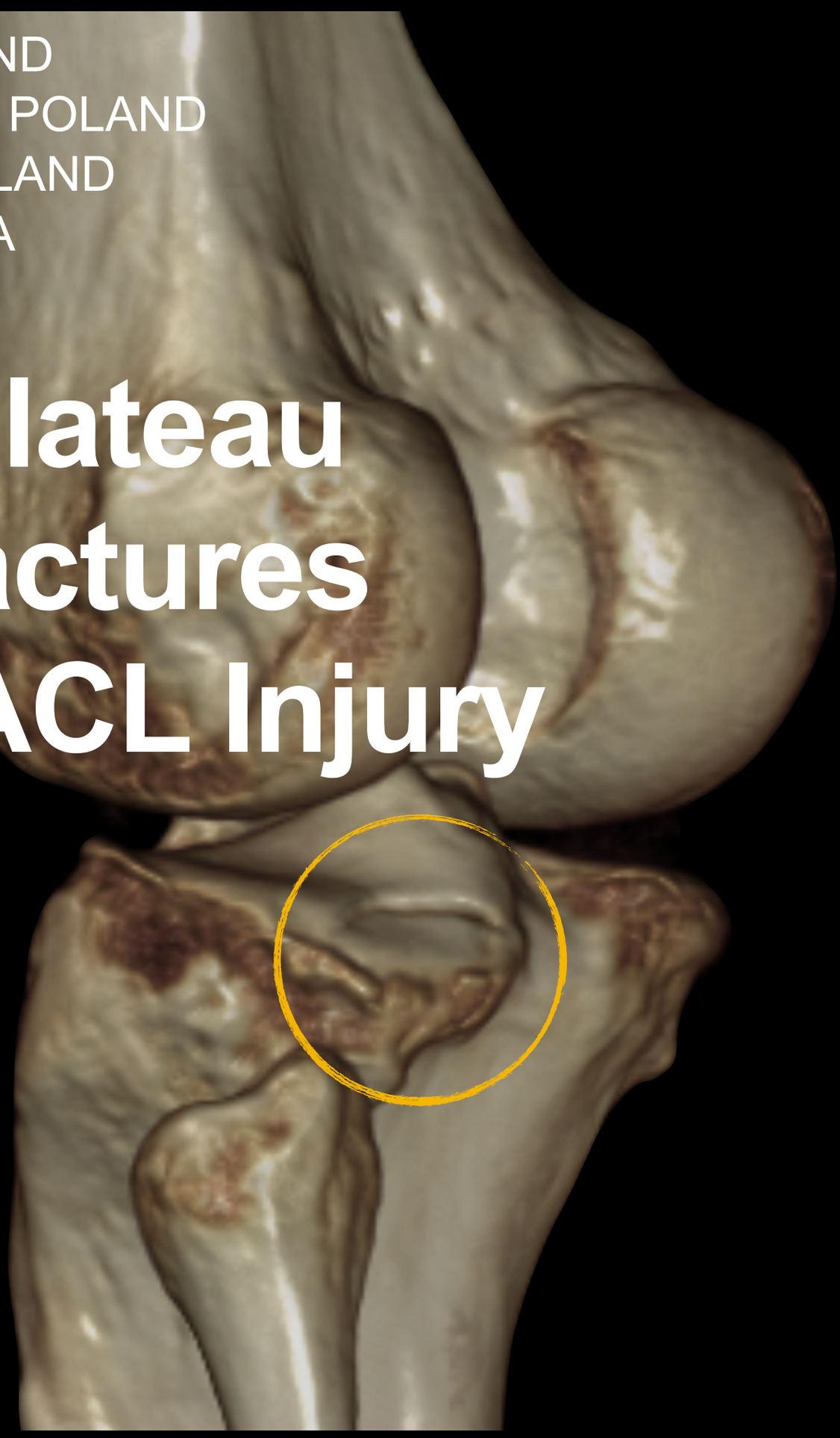
Robert Śmigielski, MD, PhD, Warsaw, POLAND
Beata Ciszkowska-Łysoń, MD, PhD, Warsaw POLAND
Aleksandra Zielińska, MA, BSc, Warsaw, POLAND
Christian Fink, MD, Prof., Innsbruck AUSTRIA
Mirco Herbort, MD, Prof., Munich GERMANY

Posterior Tibial Plateau Compression Fractures Coinciding with ACL Injury

Identification, Treatment Decision-Making Process & Clinical Relevance of Proposed MRI-Based Classification System



ISAKOS CONGRESS 2023
Boston Massachusetts June 18–June 21

I HAVE
NO FINANCIAL CONFLICTS
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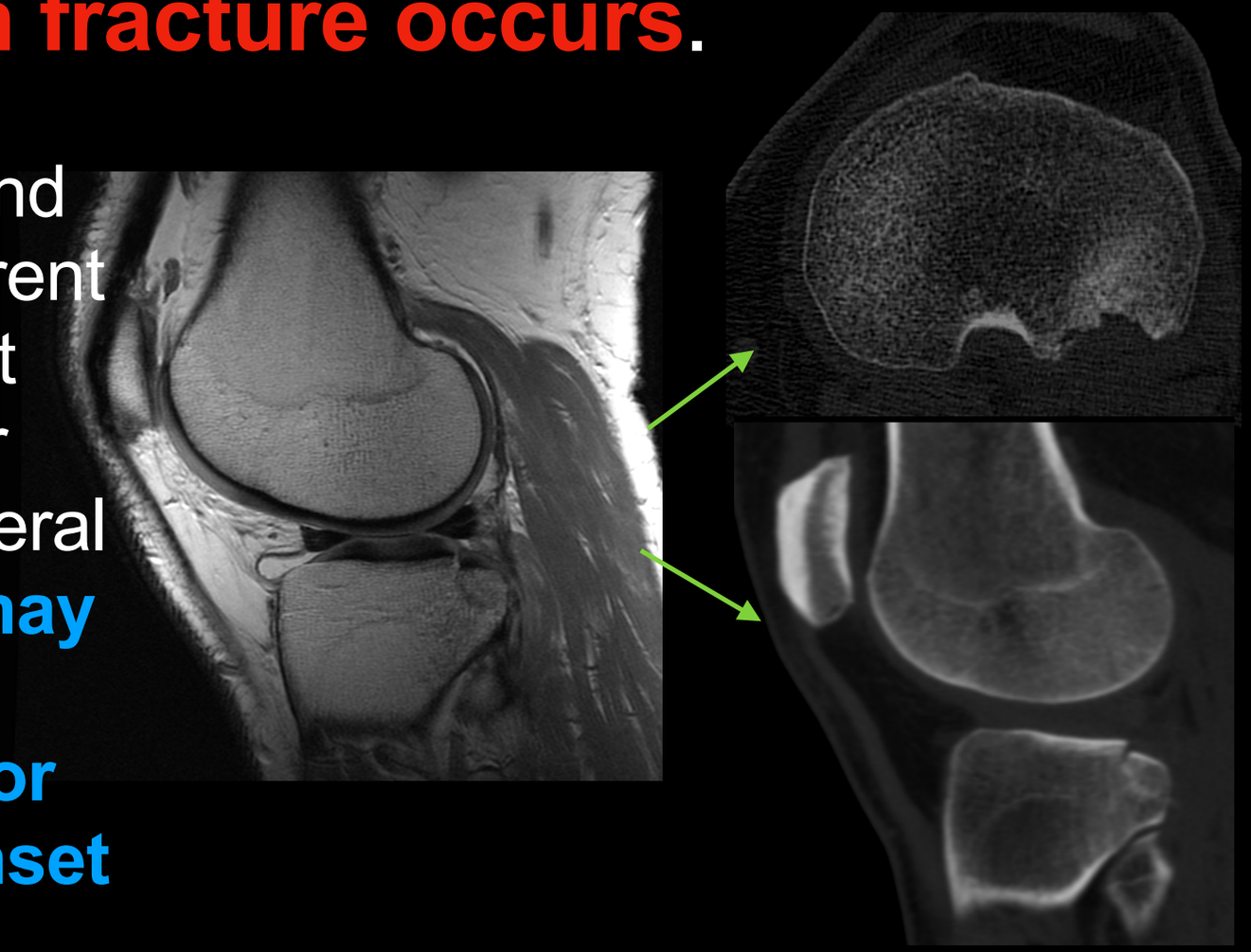
INTRODUCTION

Bone bruises (BB) of the posterior margin of the tibia are commonly observed in patients with anterior cruciate ligament (ACL) injuries (**64-94%**). Depending on the amount of force and mechanism of injury the extent of the damage may vary from light to moderate bruising, however **in more severe cases a compression fracture occurs**.

The authors' observations and research combined with current literature review indicate that the disruption of the articular surface dedicated for the lateral meniscus (LM) movement **may affect knee biomechanics, creating an environment for the occurrence of early-onset osteoarthritis**.

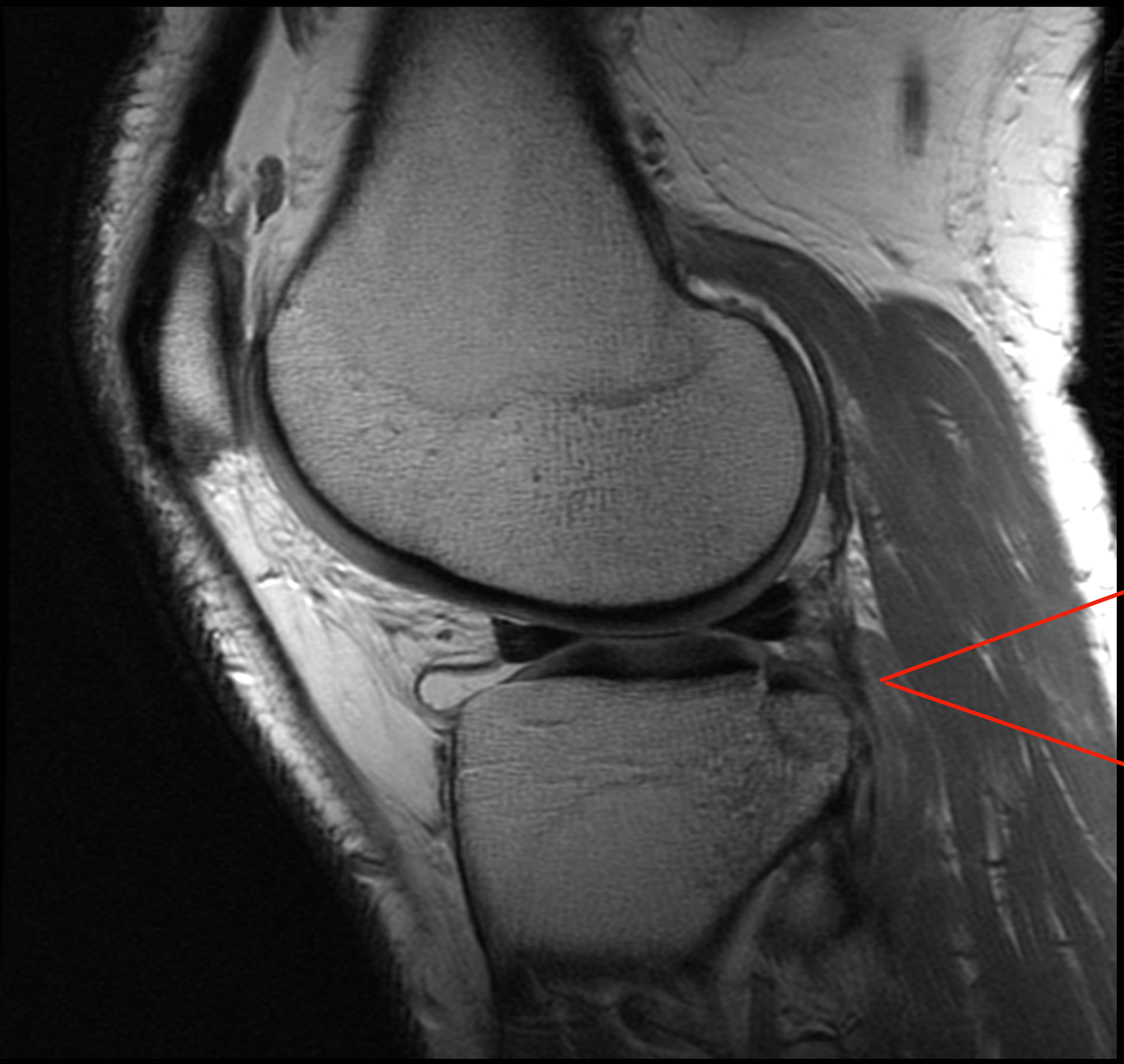


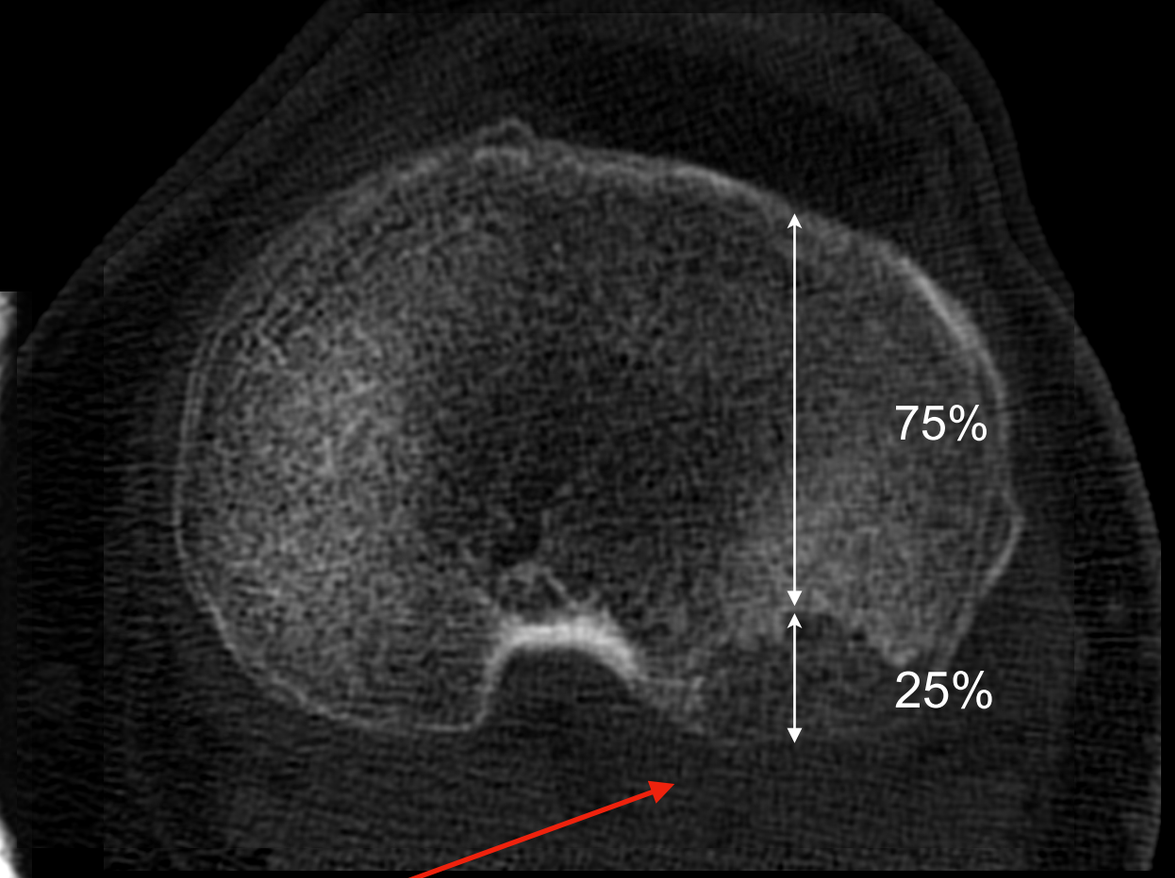
MATERIAL & METHODS

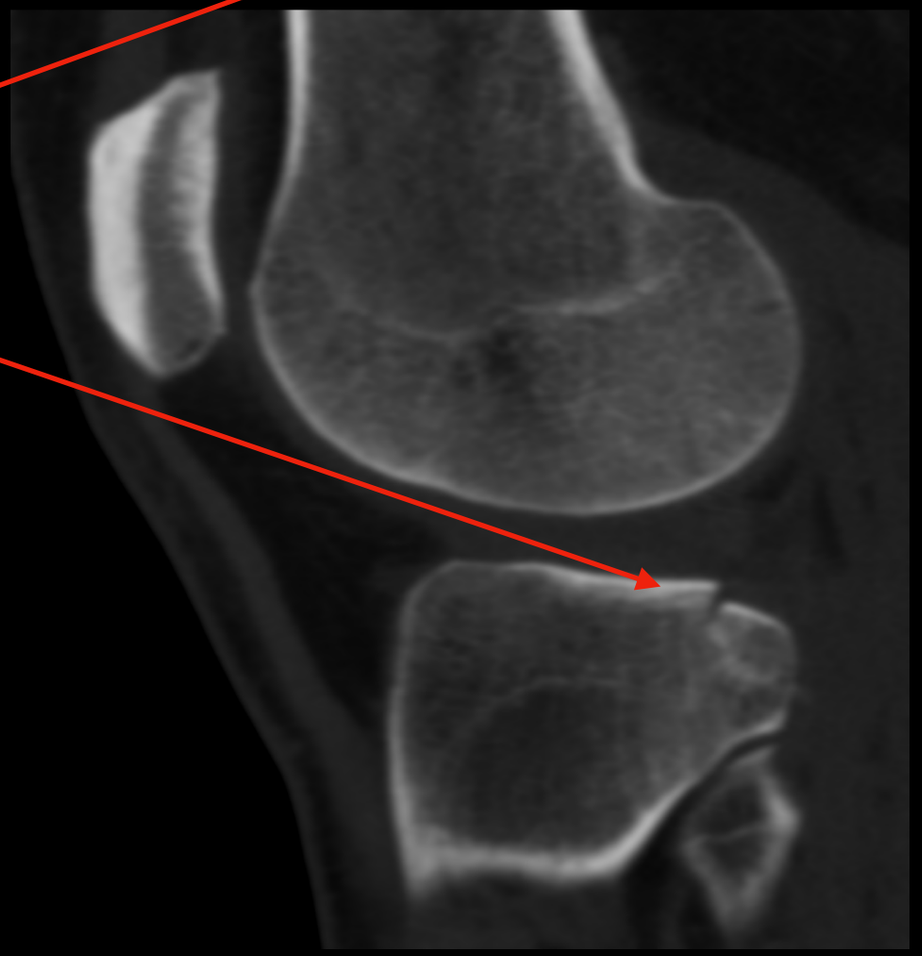
- ✓ a retrospective study
- ✓ cases from 2 European orthopaedic centres
  - ✓ **589 cases** (209 female and 254 male patients) with acute complete ACL rupture assigned to the study group
  - ✓ cases selection followed by the retrieval of relevant MRI scans
  - ✓ MRIs done in all available planes
    - ✓ only axial and coronal STIRs along with sagittal PD images (allowing to visually analyse the position of lateral meniscus on the plateau as a reference point for the observer) were taken into consideration

★ **Further prospective observation** of cases in which posterolateral tibia fracture (PTF) grade III/IV were found is **ongoing**.

Patients report for physical examination and are monitored in CT (3 months post-op) and regular follow-up MRIs to determine the ACL-R outcome, healing progress and overall stability and function of the operated joint.




75%
25%



GRADE I

oedema resulting from the contusion of the bone, **no changes** in the shape of the plateau

RESULTS

Posterior Tibia Fractures “WARSAW” Classification System with Guidelines

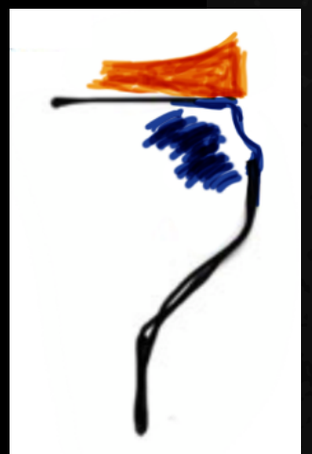
✓ high incidence of posterior tibial fractures coinciding with ACL rupture but also as a separate injury

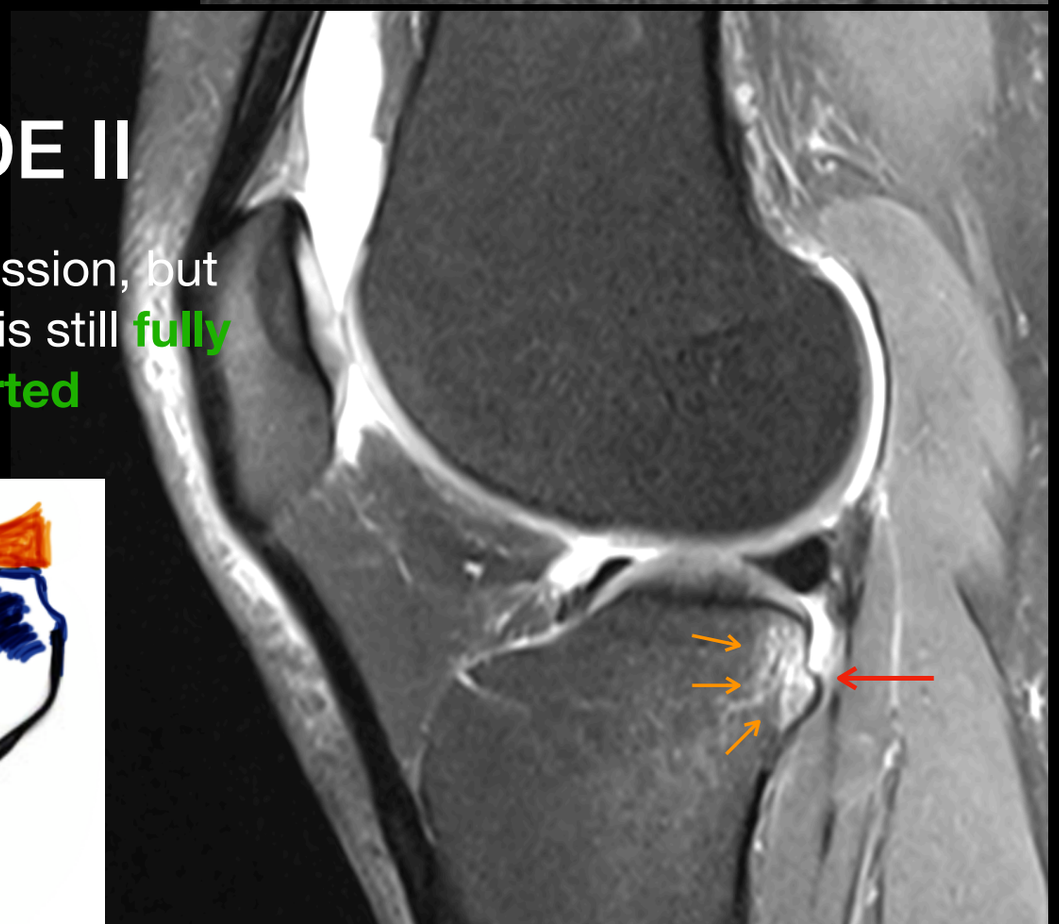
★ **GRADES I & II** do not require surgical intervention

> **FAT SAT & STIR** projections are a golden standard for bone bruising detection; literature analysis combines with the study and researchers’ own clinical experience concludes that FAT SAT best visualises both the oedema and the fracture (**grades I through IV**)

GRADE II

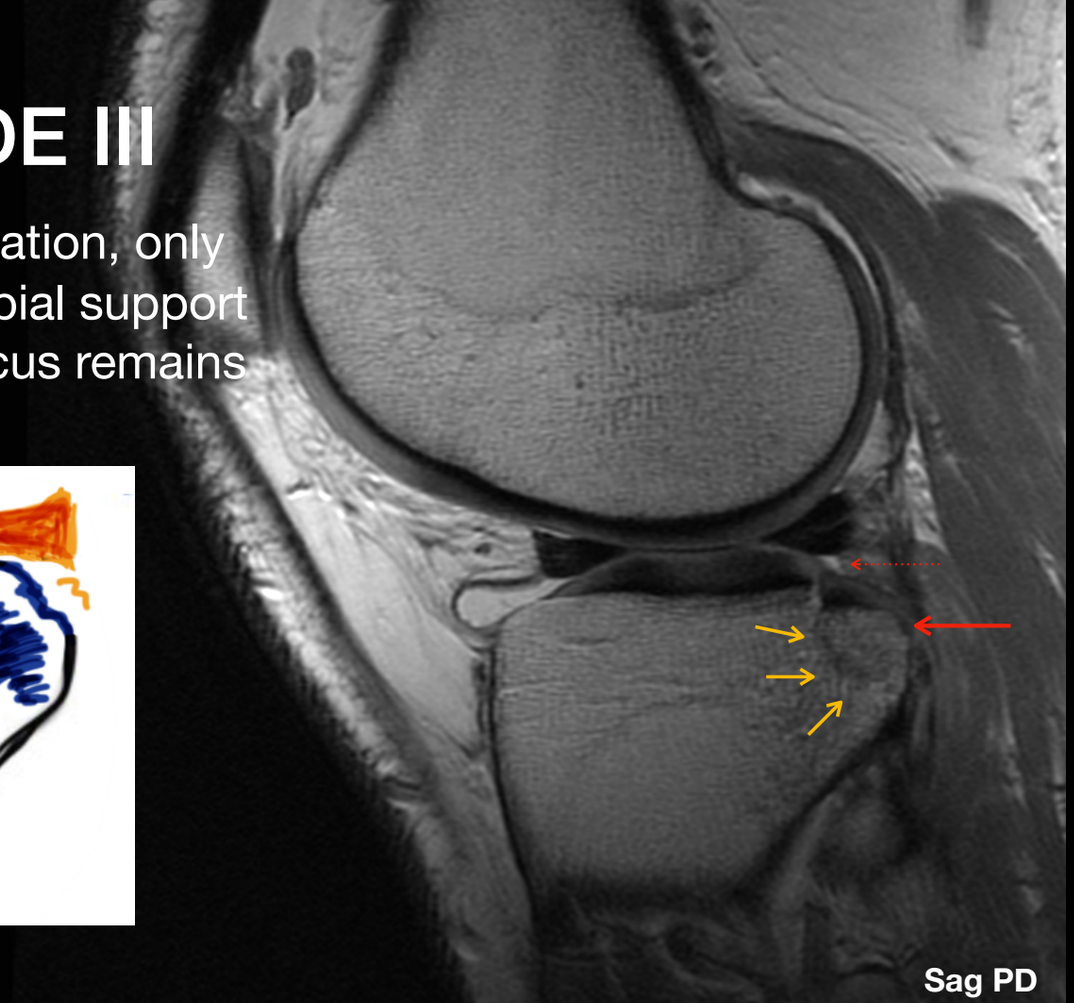
slight compression, but the meniscus is still **fully supported**





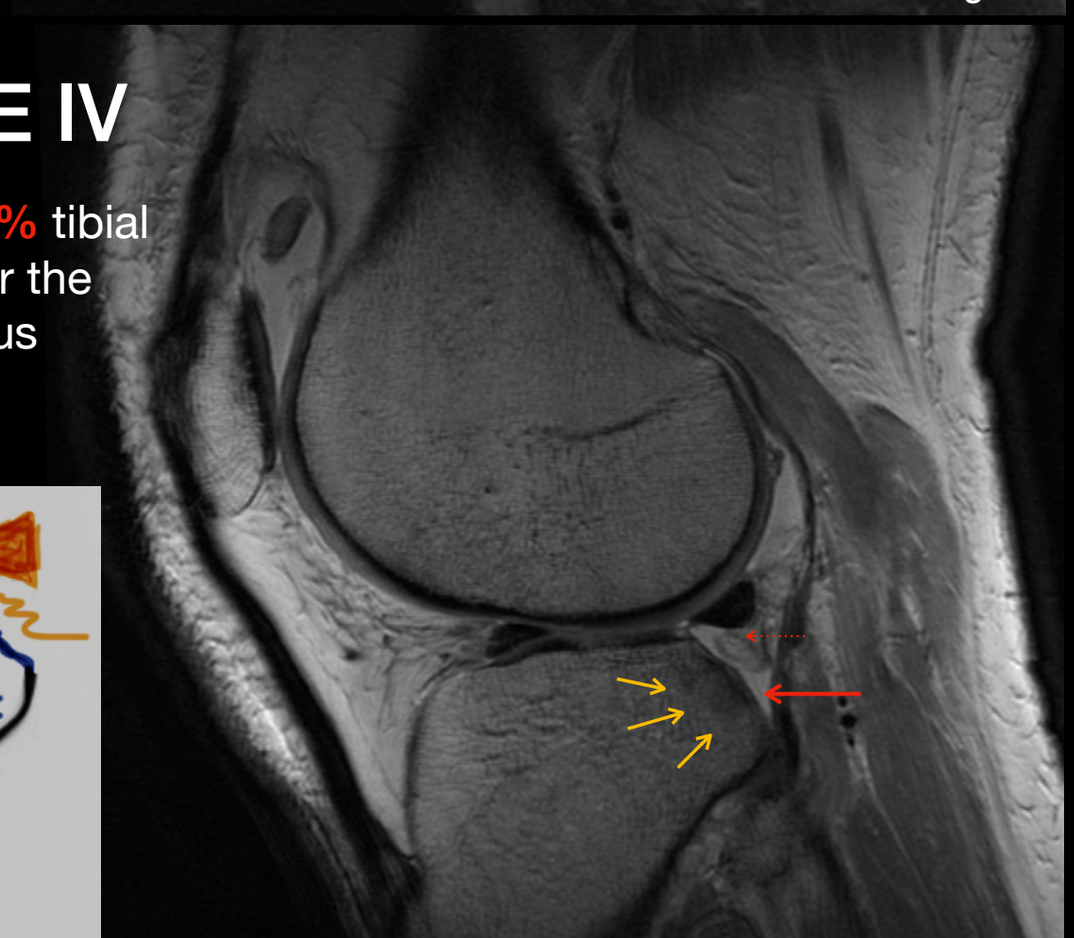
GRADE III

bone degradation, only **about 50%** tibial support for the meniscus remains



GRADE IV

less than 50% tibial support for the meniscus

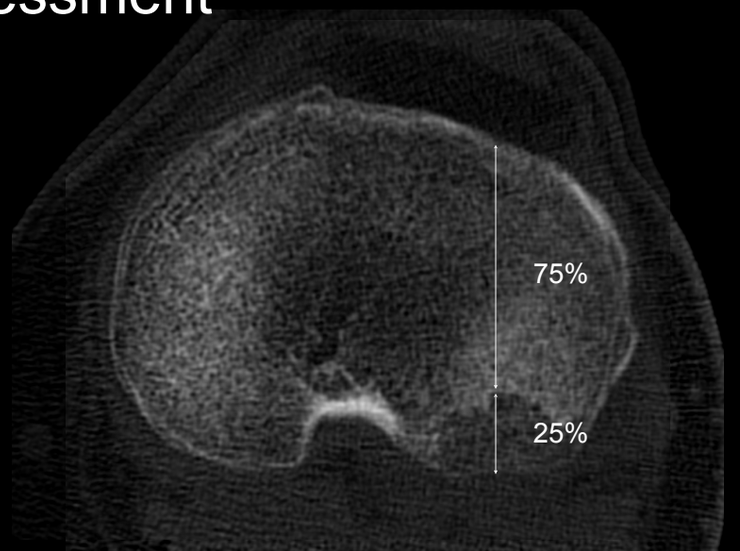


RESULTS

"WARSAW" CLASSIFICATION

★ **GRADES III & IV** require surgical intervention (if diagnosed as concurrence with ACL rupture recommended at the time of the primary ACL-R

> to verify the extent of depression of the bone axial plane scans provide the best assessment



RESULTS

Posterior Tibia Fractures “WARSAW” Classification System with Guidelines

The following guidelines include the Imaging Diagnostics presets. **The crucial step is to evaluate the extent of the tibial support for the lateral meniscus**. If only **50% or less** of LM remains supported, then an additional CT scan is recommended.

MRI RECCOMMENDED PRESETS: SAGITTAL PLANE

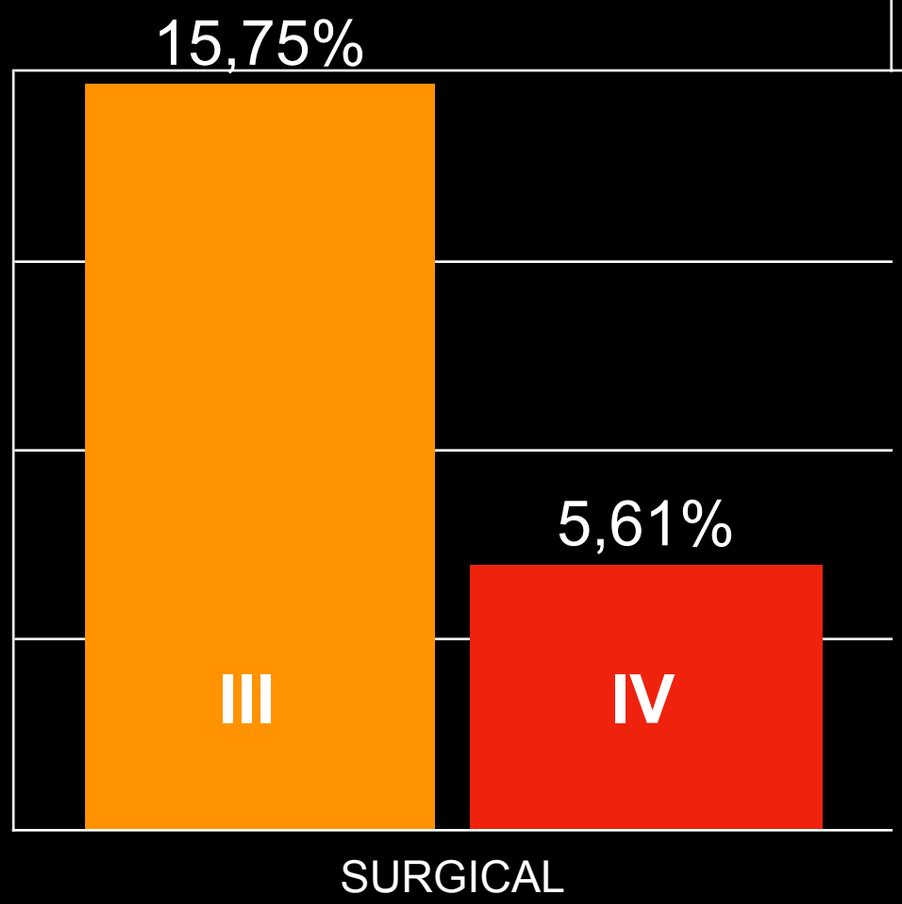
- **Sequence:** PD; PD FAT SAT is recommended
- to visualise PD FAT SAT to visualise the oedema
- S**lice thickness:** 3/0mm or 3/03mm or less
- **Establish lateral meniscus’ placement on its dedicated surface on the plateau**

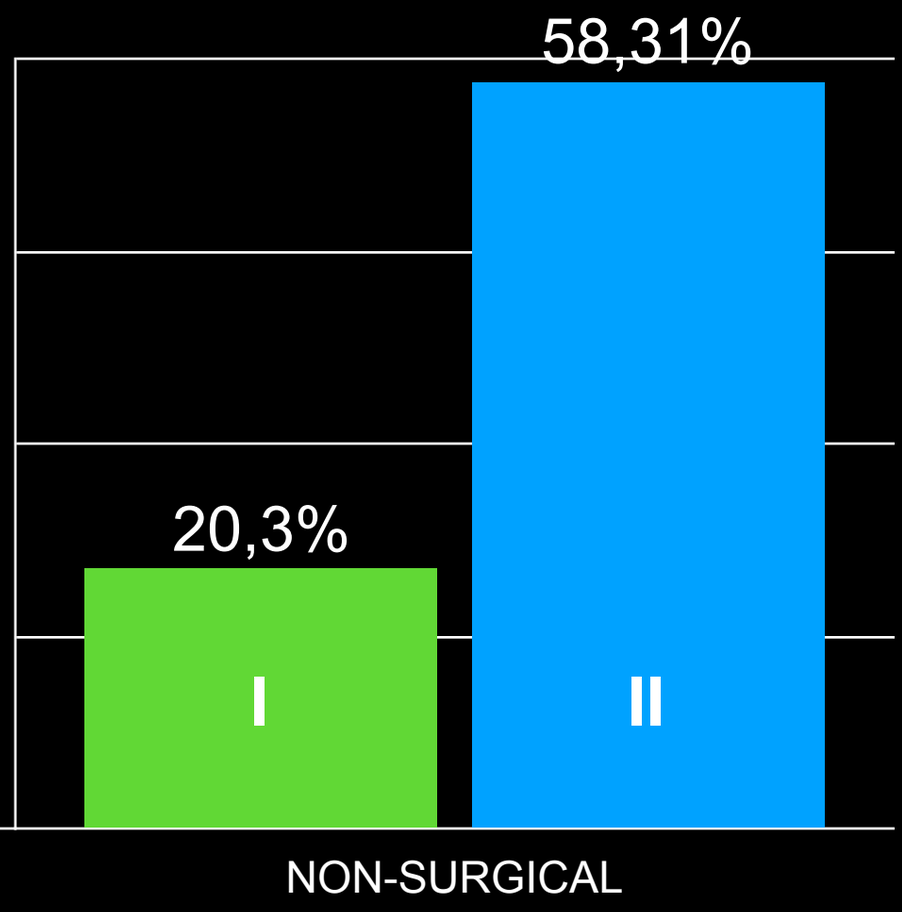
- **Setting/placement**
  - set a line joining posterior margins of the femoral condyles
  - set the next one at the site of the lowest point of the depressed lateral condyle area (tibia)
  - measure the lowering
  - **Note:** Choose the plane that best reveals/shows the fracture **-** sometimes you will need 2 slices

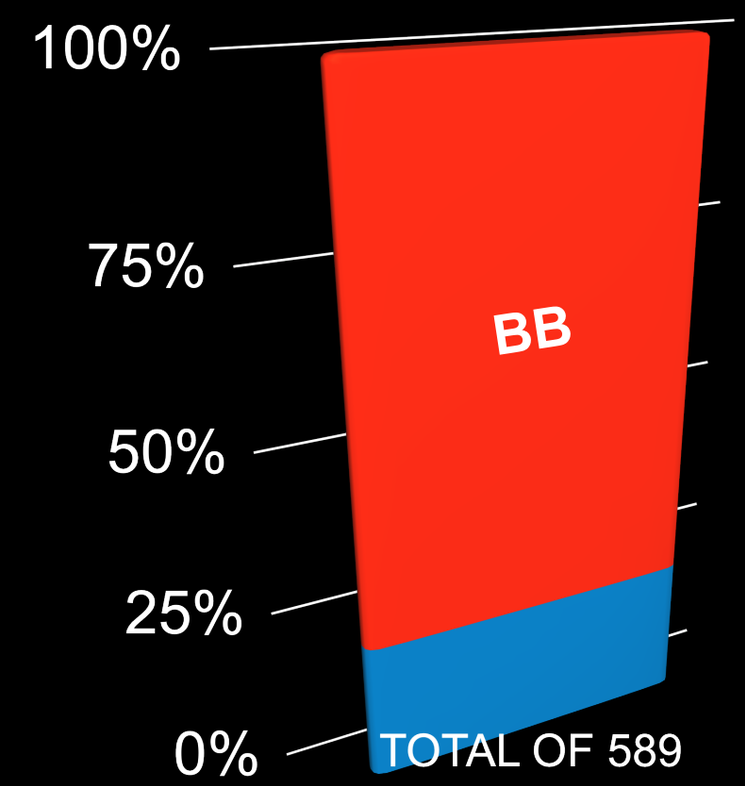
CLINICAL RESULTS

Based on the visual assessment of 589 patients

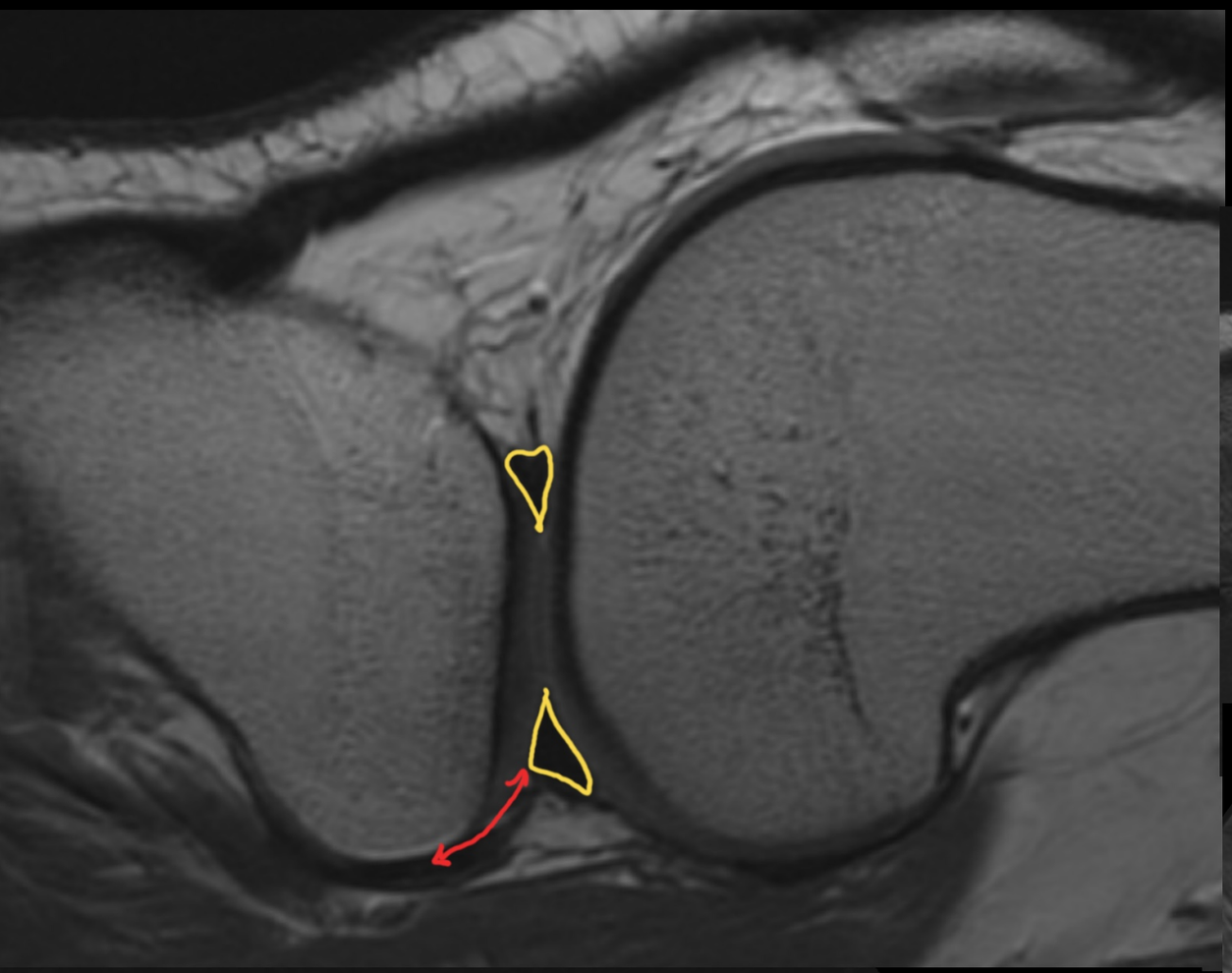
- ➡ BB found in **463 cases** (78,60%)
  - ➡ classified as grade I - 94 (20,30%)
  - ➡ classified as grade II - 270 (58,31%)
  - ➡ classified as grade III - 73 (15,75%)
  - ➡ classified as grade IV - 26 (5,61%)

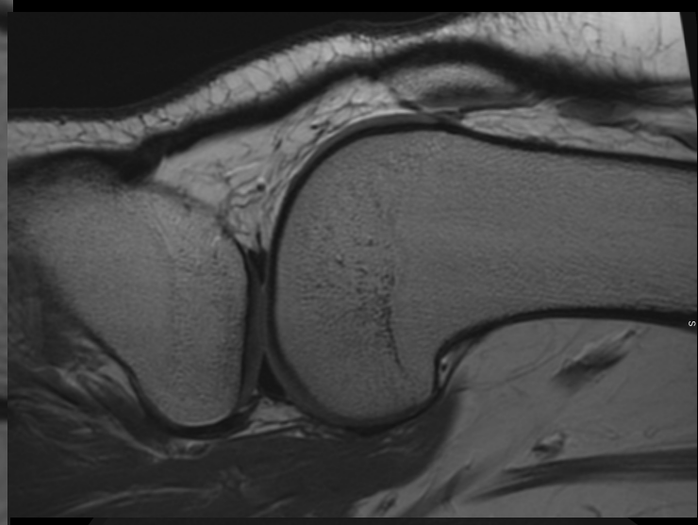


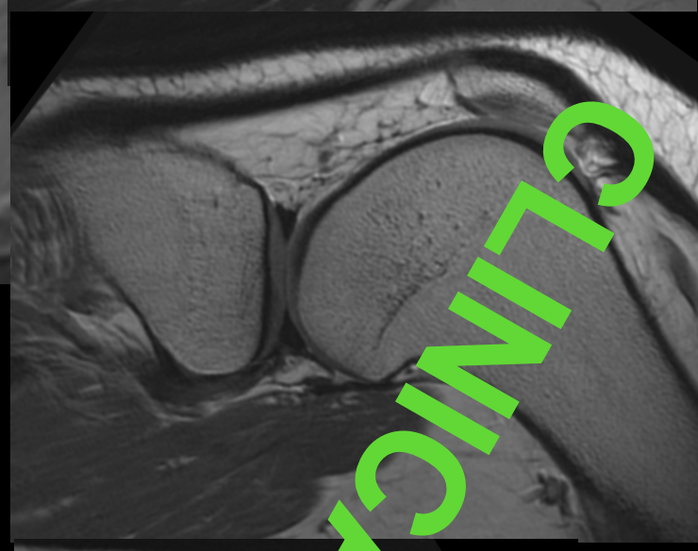


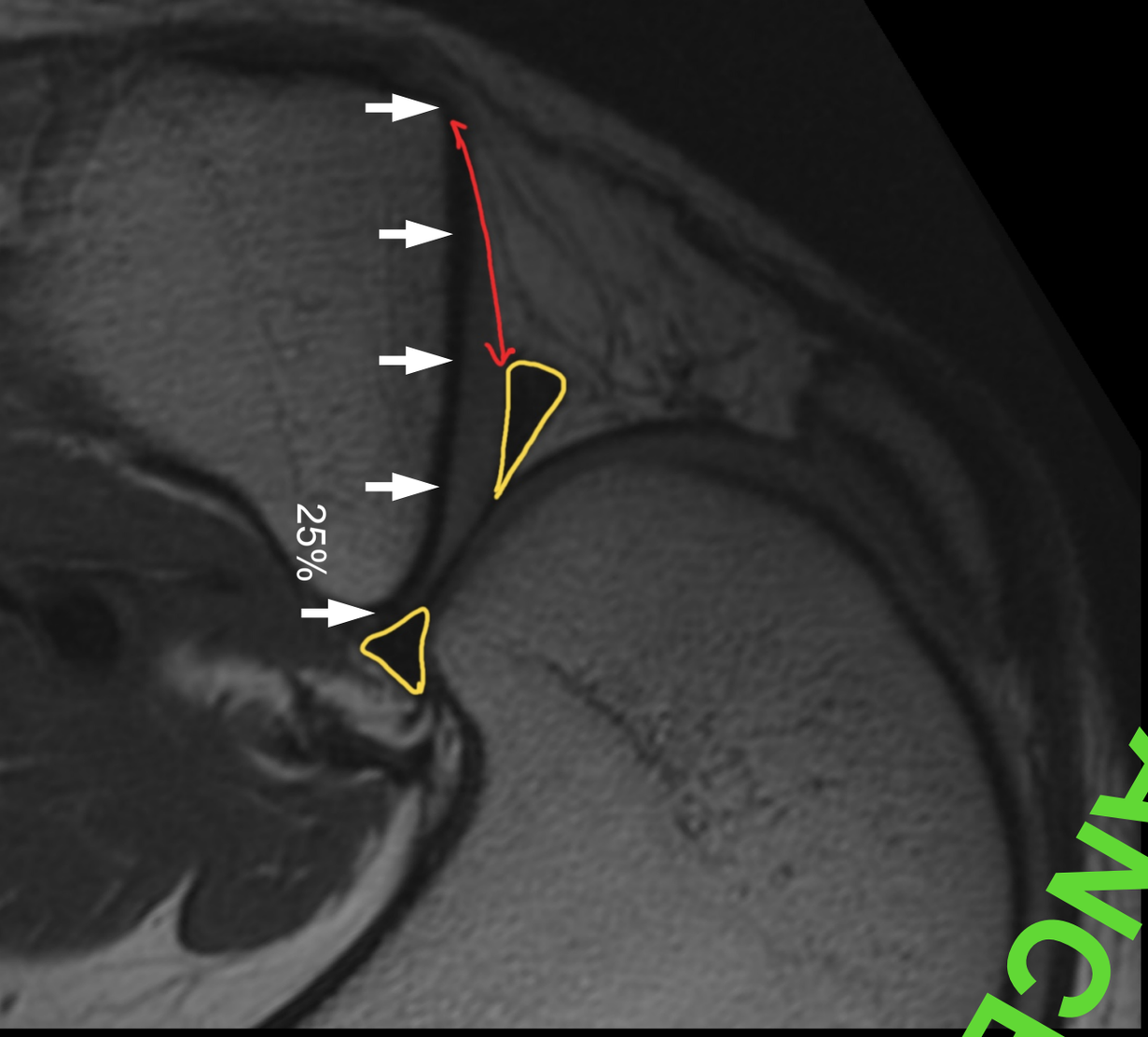


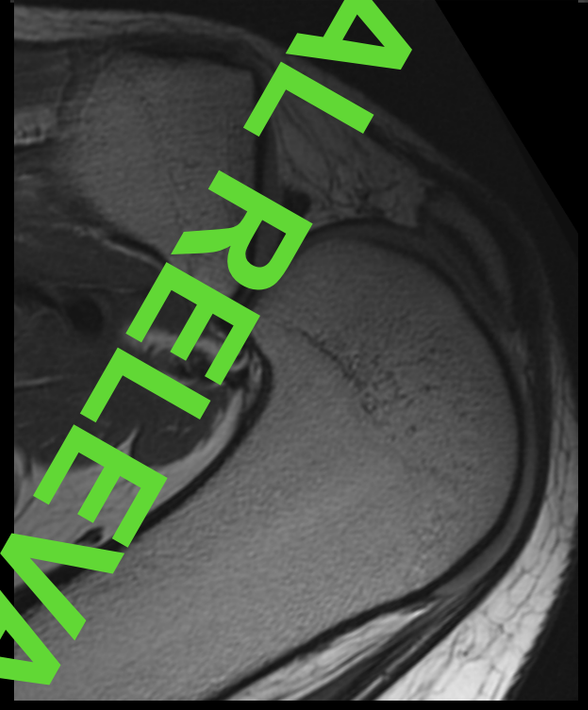
LATERAL MENISCUS MOVEMENT











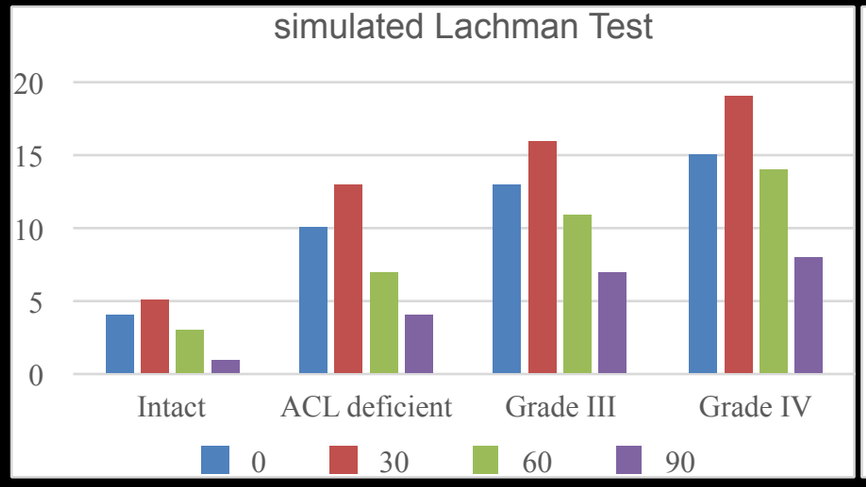
CLINICAL RELEVANCE?

THE „BANKART KNEE“: BIOMECHANICAL CONSEQUENCES OF A POSTEROLATERAL TIBIAL PLATEAU COMPRESSION FRACTURE AS AN INJURY CONCOMITANT WITH ACL RUPTURE

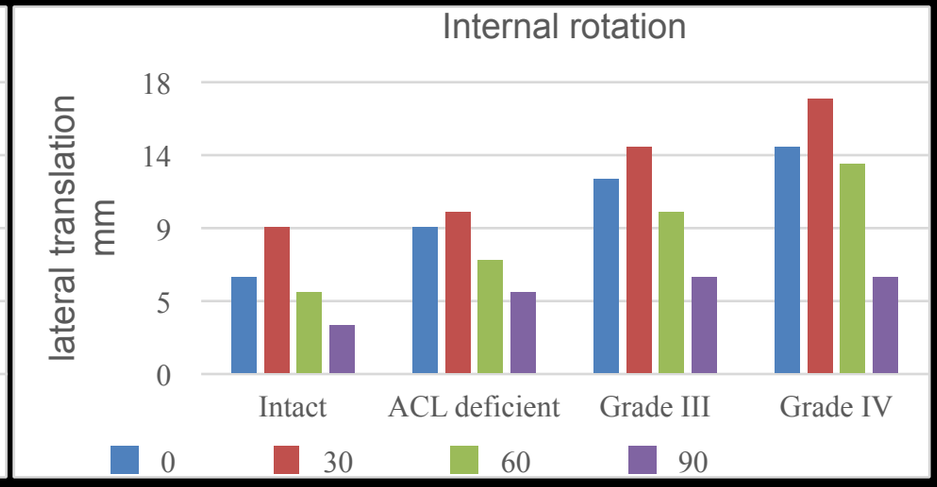
Mirco Herbort, Danko Dan Milinkovic, Christian Fink, Christoph Kittl, Elmar Herbst, Robert Smigielski

In this study 8 human cadaver knees have been tested in a six-degree of freedom robotic setup (KUKA robot) with an attached optical tracking system. After the passive path from 0-90° was established, simulated Lachman test and Pivot Shift test as well external rotation (ER, 4Nm), and internal rotation (IR, 4Nm) were applied at 0°, 30°, 60°, and 90° under constant 200N axial loading.

All these parameters have been tested in the intact knee and the ACL-deficient knee. Next, in the ACL-deficient knees, **the posterolateral tibia has been reduced to imitate 2 different kinds of posterolateral compression fracture**. **The depression height was 10 mm with the width of 15 mm in both groups**. The **depth of the fracture was adapted to cover the half and the entire width of the lateral meniscus imitating grade III and IV fractures respectively** (Smigielski et al.).

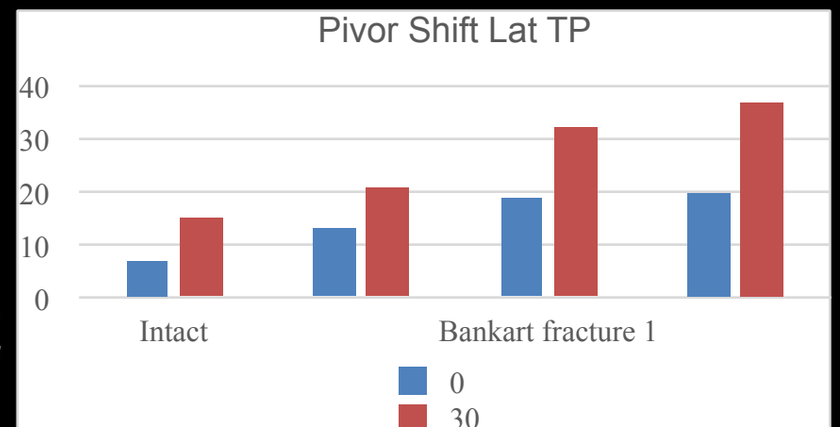


Anterior tibial translation in mm following simulated Lachman test



Anterior translation of the lateral tibia plateau following 4Nm internal rotation test;

Anterior tibial translation following simulated Pivot Shift test.



CONCLUSIONS & CLINICAL RELEVANCE

Conclusion

The proposed classification - if accepted by the orthopaedic community, could significantly aid surgeons while deciding surgical treatment at the time of ACL injury.

Clinical Relevance

#1 Timely identification of the need for comprehensive surgical treatment could minimise the risk of maintaining knee instability or early-onset osteoarthritis.

#2 In the authors' opinion, **grades III and IV** (amounting to 21,37% of cases covered by this study) require the reduction of the compressed bone at the time of ACL reconstruction.

The surgeries done to date show excellent results in terms of patient's stability and recovery rate.

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