

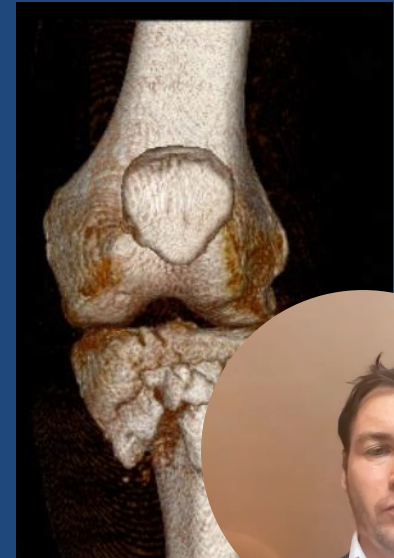
Pr Thomas NERI

MD, PhD



PROXIMAL TIBIAL FRACTURES

SOFT TISSUE ISSUES (MENISCI, SKIN, LIGAMENT, PT)





Outline

- Introduction
- skin
- menisci
- ligaments
- Tendons
- Nerve, vascular





Outline

- **Introduction**
- skin
- menisci
- ligaments
- Tendons
- Nerve, vascular



EPIDEMIOLOGY

> [Arthroscopy](#). 2006 Jun;22(6):669-75. doi: 10.1016/j.arthro.2006.01.018.

Arthroscopic evaluation of soft tissue injuries in tibial plateau fractures: retrospective analysis of 98 cases

Mohamed Zaki Abdel-Hamid ¹, Chung-Hsun Chang, Yi-Sheng Chan, Yang-Pin Lo, Jau-Wen Huang, Kuo-Yao Hsu, Ching-Jen Wang

soft tissue injury = **71%**

- menisci in 57%
- ACL in 25% (bony avulsion)

> [Medicina \(Kaunas\)](#). 2024 Dec 17;60(12):2073. doi: 10.3390/medicina60122073.

Evaluating Meniscus, Ligament and Soft Tissue Injury Using MRI in Tibial Plateau Fractures: A Tscherne Classification Approach

Yong-Bum Joo ¹, Young-Mo Kim ¹, Young-Cheol Park ¹, Soo-Hyeok Chae ¹, Dong-Hwan Kim ¹

derangement of meniscus and ligament around the knee was found in **98.9%** patients.

> [Eur J Trauma Emerg Surg](#). 2022 Oct 28;49(2):661-679. doi: [10.1007/s00068-022-02127-2](#) 

The value of magnetic resonance imaging in the preoperative diagnosis of tibial plateau fractures: a systematic literature review

[Gregoire Thürig](#) ^{1,2}, [Alexander Korthaus](#) ¹, [Karl-Heinz Frosch](#) ^{1,3}, [Matthias Krause](#) ^{1,8}

Recent systematic review including 877 patients

At least one ligament or meniscal lesion is present in

TPF cases

ACL 36.8%, PCL 14.8%, MCL 20.7%, LCL 22.9%

lateral meniscus 48.9%, and medial meniscus



MECHANISM

Direct impact: +++.

- severe soft tissue injury.

Indirect mechanism

- in association with high-energy trauma
- axial compression type fractures
- fall, or violent twisting as a result of high-energy sporting injuries (i.e., skiing, football, rugby, etc.)





Outline

- Introduction
- **skin**
- menisci
- ligaments
- Tendons
- Nerve, vascular



CHALLENGES WITH SKIN INTEGRITY

Edema and Blisters:

- Rapid swelling due to hematoma and inflammation
- Blisters (serous or hemorrhagic)



Necrosis Risks:

- Severe contusions can lead to secondary necrosis, especially in medial injuries.

Open fractures: 10%



CLASSICATION

Oestern and Tscherne :

Oestern and Tscherne classification of soft tissue injury in closed fractures	
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



MANAGEMENT OF COMPROMISED SKIN

No Immediate Need for Surgery

- Wait for swelling to subside and skin condition to improve
- brace > cast (skin care)
- Elevation, ice
- Skin care: 

Blisters:

- Serous: Managed conservatively with dressings.
- Hemorrhagic: Require de-roofing and wound management.

Necrosis: necrosectomy + Negative-pressure wound therapy



TECHNICAL DETAILS

Surgical Approach:

- Use minimally invasive techniques when possible.
- Avoid placing incisions over areas of compromised skin.

Special Techniques

- Negative-pressure wound therapy (NPWT) for compromised skin.
- Temporary external fixation followed by definitive fixation after skin recovery.





Outline

- Introduction
- skin
- **menisci**
- ligaments
- Tendons
- Nerve, vascular



LATERAL MENISCAL TEAR

- more common than medial (LM 49%, MM 24%)
- associated with Schatzker II fracture pattern
- associated with >10mm articular depression
- associated with >6mm condylar widening

MEDIAL MENISCAL TEAR

- most commonly associated with Schatzker IV fractures

> [Orthopedics](#). 2010 Feb;33(2):80-4. doi: 10.3928/01477447-20100104-05.

Lateral tibial plateau fracture depression as a predictor of lateral meniscus pathology

Vytautas M Ringus ¹, Frederick R Lemley, David F Hubbard, Stanley Wearden, Dina L Jones

> [Eur J Trauma Emerg Surg](#). 2022 Oct 28;49(2):661-679. doi: [10.1007/s00068-022-02127-2](#) 

The value of magnetic resonance imaging in the preoperative diagnosis of tibial plateau fractures: a systematic literature review

Gregoire Thürig ^{1,2}, Alexander Korthaus ¹, Karl-Heinz Frosch ^{1,3}, Matthias Krause ^{1,8}

> [J Trauma](#). 2006 Feb;60(2):319-23; discussion 324. doi: 10.1097/01.ta.0000161111.x

Prediction of soft-tissue injuries in Schatzker IV tibial plateau fractures based on measurement of radiographs

Michael J Gardner ¹, Shahan Yacoubian, David Geller, Matthew P. Stein, David L Helfet, Dean G Lorch



COMMON MENISCAL INJURIES TYPE

- **Root avulsions:** Often associated with depression fractures or Schatzker IV-VI patterns.
- **Radial tears:** Disrupt load-sharing function.
- **Longitudinal tears:** Occur near the periphery, often repairable.



DIAGNOSTIC TOOLS

- **MRI:** Gold standard for identifying meniscal injuries.

Look for extrusion or displacement of the meniscus.

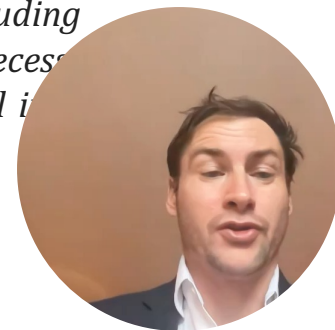
[Home](#) > [Skeletal Radiology](#) > [Article](#)

Comparison of CT and MRI in patients with tibial plateau fracture: can CT findings predict ligament tear or meniscal injury?

Scientific Article | Published: 30 November 2006

Volume 36, pages 145–151, (2007) [Cite this article](#)

In the acute setting, CT offers high sensitivity and specificity for depicting osseous avulsions, as well as high negative predictive value for excluding ligament injury. However, MRI remains necessary for the preoperative detection of meniscal injury.



TREATMENT

Like any others meniscus tears

- Meniscal repair when possible to restore function.
- Partial meniscectomy if repair is unfeasible, but balance the risk of degenerative changes.

In my practice

- 1-Start by arthroscopy (exploration and wash the joint)
- 2- Bone first (use arthroscopy to control intra-articular reduction)
- 3- Then meniscus repair





Outline

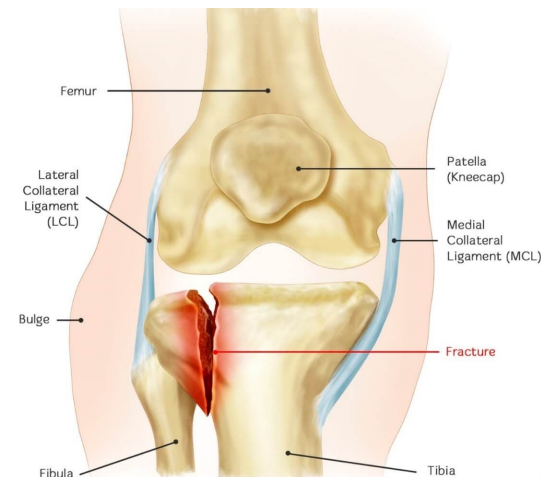
- Introduction
- skin
- menisci
- **ligaments**
- Tendons
- Nerve, vascular



LIGAMENT INJURIES IN PROXIMAL TIBIAL FRACTURES

Commonly involved:

- ACL: Avulsion or midsubstance tears.
- PCL: Common in posterior depression fractures.
- MCL/LCL: Collateral ligament tears with complex fracture-dislocations.



► Eur J Trauma Emerg Surg. 2022 Oct 28;49(2):661–679. doi: [10.1007/s00068-022-02127-2](https://doi.org/10.1007/s00068-022-02127-2)

The value of magnetic resonance imaging in the preoperative diagnosis of tibial plateau fractures: a systematic literature review

[Gregoire Thürig](#)^{1,2}, [Alexander Korthaus](#)¹, [Karl-Heinz Frosch](#)^{1,3}, [Matthias Krause](#)^{1,®}

ACL 36.8%, PCL 14.8%
MCL 20.7%, LCL 22.9%



CHALLENGES IN ASSESSMENT

- Preoperative clinical exam limited by pain and swelling.
- Intraoperative assessment:

Perform **post-fixation** to avoid false laxity caused by the fracture.



[Home](#) > [Skeletal Radiology](#) > Article

Comparison of CT and MRI in patients with tibial plateau fracture: can CT findings predict ligament tear or meniscal injury?

Scientific Article | Published: 30 November 2006

Volume 36, pages 145–151, (2007) [Cite this article](#)

[Review](#) > [Eur J Trauma Emerg Surg.](#) 2023 Apr;49(2):661-679.

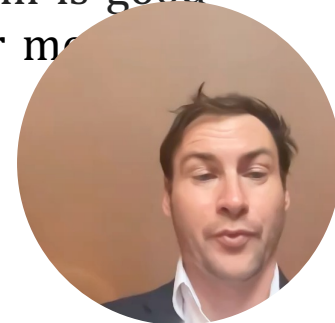
doi: 10.1007/s00068-022-02127-2. Epub 2022 Oct 28.

The value of magnetic resonance imaging in the preoperative diagnosis of tibial plateau fractures: a systematic literature review

Gregoire Thürig ^{1 2}, Alexander Korthaus ¹, Karl-Heinz Frosch ^{1 3}, Matthias Krause ⁴

In the acute setting, CT offers high sensitivity and specificity for depicting osseous avulsions, as well as high negative predictive value for excluding ligament injury.

CT + clinical exam is good
MRI often do for meniscal
injuries



MANAGEMENT OPTIONS

Repair vs. Reconstruction:

- Ligament repair feasible in acute injuries.
- Reconstruction considered in chronic instability.

Timing: Can be staged if soft tissue conditions delay definitive management

ACL and PCL Avulsions: Fix with screws or suture (tape)

Collateral Ligaments:

- MCL: Repair or brace if stable.
- LCL: Often requires reconstruction





Outline

- Introduction
- skin
- menisci
- ligaments
- **Tendons**
- Nerve, vascular



TENDINOUS INJURIES: Extensor mechanism injuries must be investigated.

Mechanism of Injury

- **Patellar Tendon Ruptures:** often associated with high-energy trauma and TT fractures
- **Quadriceps Tendon Tears:** Often underdiagnosed in elderly or low-energy injuries



DIAGNOSIS

Clinical Signs:

- Preoperative: Straight leg raise test, palpable gap, and swelling.
- Intraoperative: Evaluate tendon insertion and quality.

Imaging:

- MRI to confirm diagnosis and rule out partial tears



MANAGEMENT

- Early surgical repair crucial for functional recovery.

IN THE SAME TIME

- **Options:**
 - Suture repair material.
 - Augmentation with grafts if tissue quality is poor.





Outline

- Introduction
- skin
- menisci
- ligaments
- Tendons
- **Nerve, vascular**



NEUROVASCULAR INJURIES – NERVE

Common Nerve Involvement:

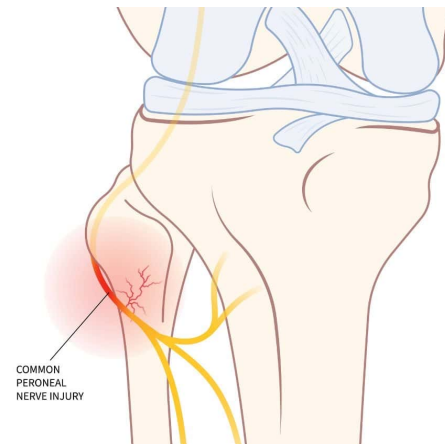
- Common fibular nerve: Most frequently affected (2-3%).
- Mechanism: Stretch or direct injury
- Symptoms: Foot drop, sensory loss (over dorsum of the foot)

Diagnostic Tools:

- Clinical exam: Motor and sensory testing.
- Electromyography (EMG): For persistent deficits

Management:

- Acute: Decompression if entrapment is suspected.
- Chronic: Tendon transfer (e.g., posterior tibialis) for foot drop.



NEUROVASCULAR INJURIES – VASCULAR

Vascular Compromise:

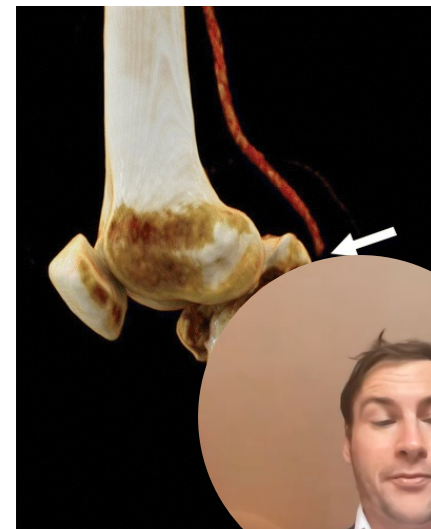
- Mechanism: Popliteal artery or solus arch due to dislocation or high-energy trauma.
- Types: Intimal tear, thrombosis, occlusion.

Diagnostic Tools:

- Clinical: Pulse asymmetry, delayed capillary refill.
- CT Angiography (gold standard).

Management:

- Immediate vascular surgery (need external fixation)
- Monitor for compartment syndrome after revascularization.





Conclusion



- **Soft Tissue Injuries:** Extremely **frequent** (70-90%) in proximal tibial fractures
- **Comprehensive Diagnostic Assessment:**
 - **Clinical Examination:** Essential for **initial** assessment.
 - **CT (2D/3D):** Accurate fracture and **ligament bony avulsion** mapping.
 - **MRI:** Detects **meniscal**, ligamentous, and cartilage injuries.
 - **CT Angiography:** For **vascular** injury .
 - **Arthroscopy and Perioperative Evaluation:** Under anesthesia, enables accurate diagnosis and immediate treatment of associated soft tissue injuries during fixation.



Key Principles of treatment:

- **Skin is Your Friend: No rush**—delay surgery if needed, protect skin integrity
- **Extensor Mechanism:** Diagnose and treat tendons (patellar/quadriceps) **intraoperatively**.
- **Ligament Injuries:**
 - **ACL (Most Common):**
 - Fixation if bony avulsion or repairable (MCL)
 - Consider delayed surgery for midsubstance tears (LCL)

