



Treatment of PCL and combined ligamentous injuries

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Combined PCL injuries

- Isolated PCL injuries are rare
- Most are a part of multi-ligament injuries



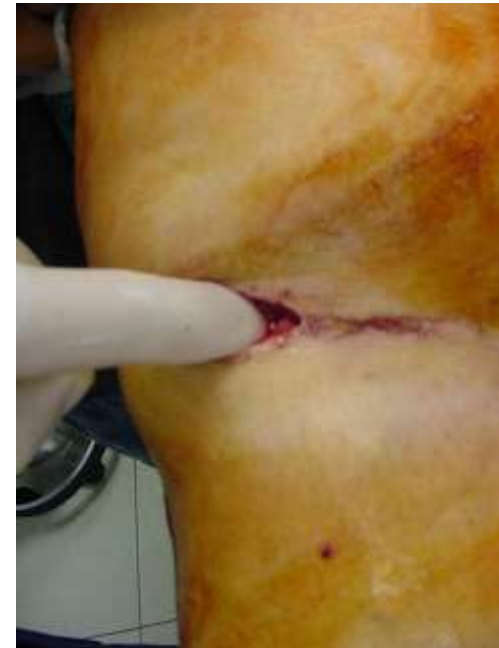
Epidemiology

- High energy injuries with significant soft tissue trauma
- Associated injuries
 - Peroneal nerve 16-50%
 - Popliteal artery 4-35%
 - Tibial rim fractures
 - Patellar tendon avulsion
- Surgery indicated for almost all patients



Emergency management

- Monitor vascular integrity
- Maintain reduction
 - Anterior external fixation if unstable in an immobilizer
- Manage open wounds
- Observe for compartment syndrome



Plain X-rays





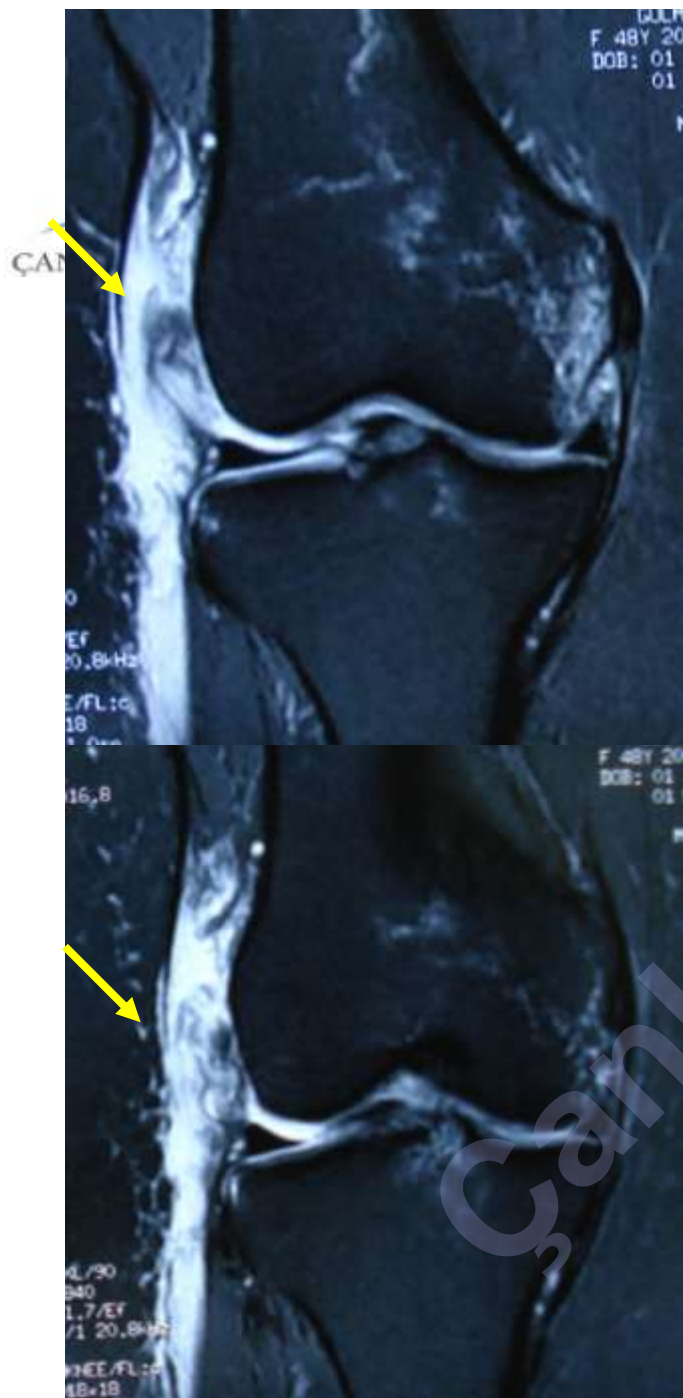
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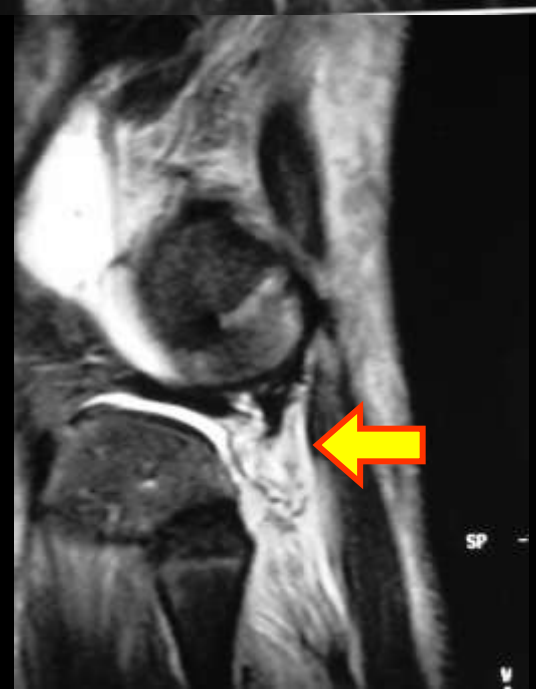
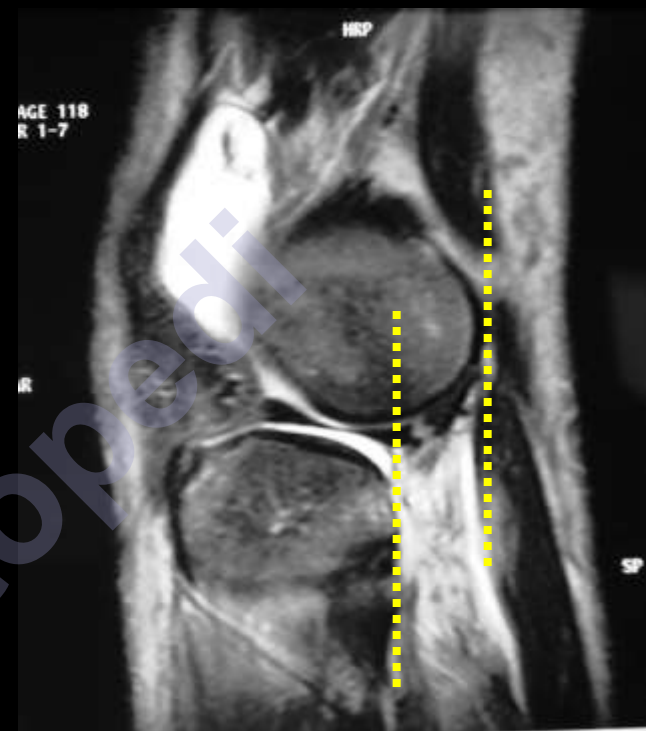


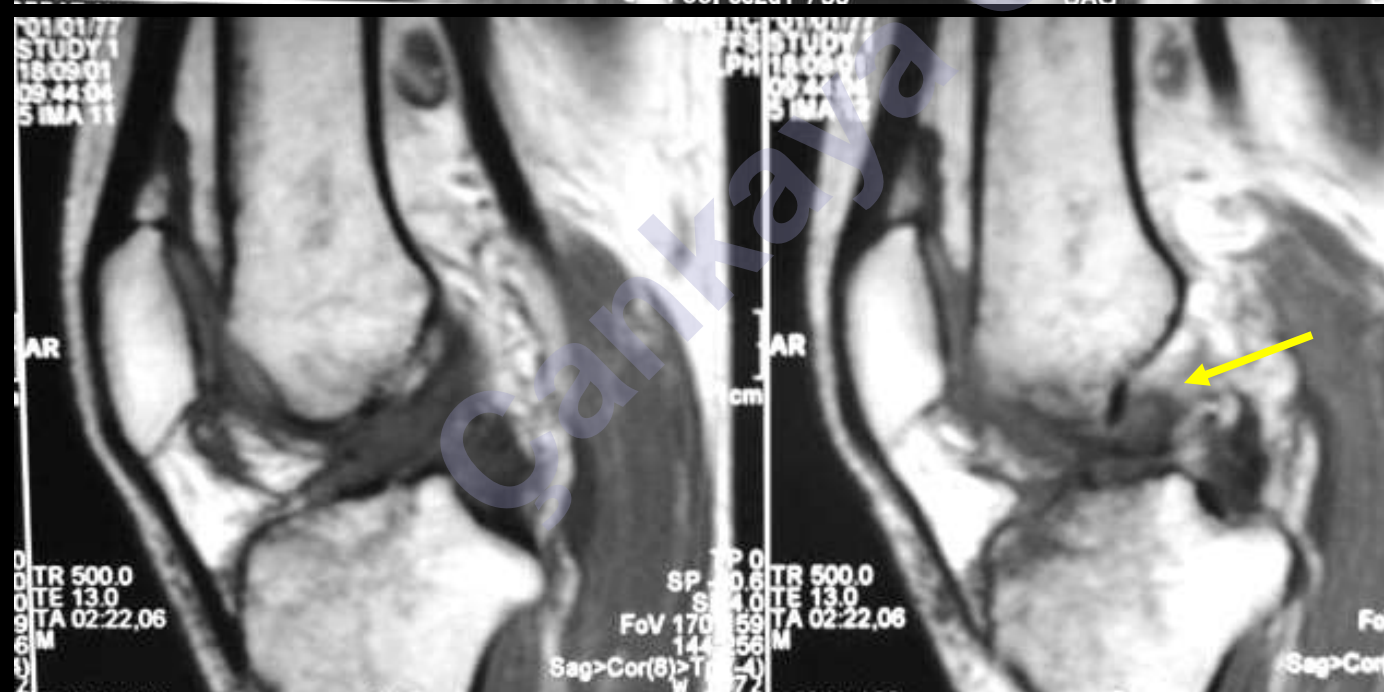
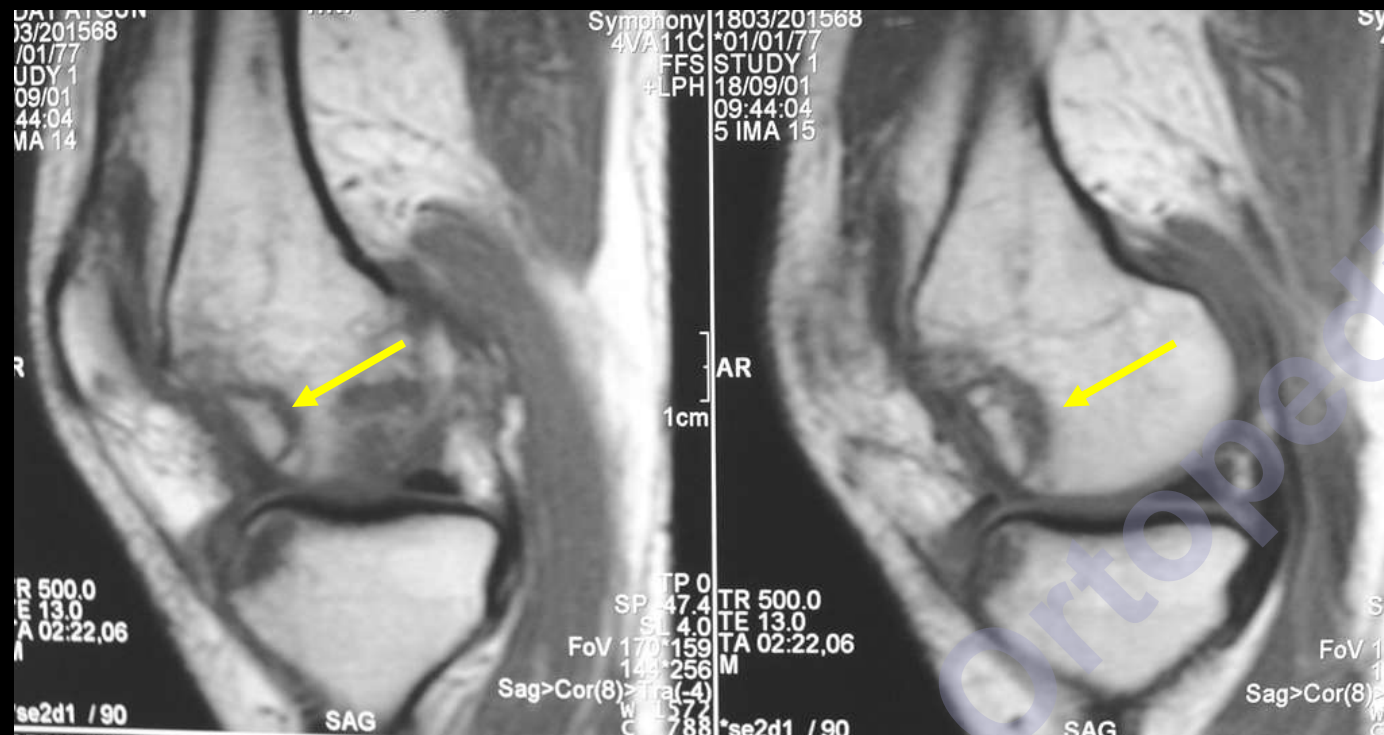
Tibio-fibular separation



Femoral peel-off







**Occult
fractures
of the
contra-
lateral
compart-
ment**

Pre-op plan

- Incisions
- Graft selection
 - Allograft
 - Contra-lateral knee
- Implants
- Timing : 2-3 weeks to allow for a synovial seal and soft tissue healing



Surgical strategy

- Repair all injured structures in the same setting
 - Higher risk of arthrofibrosis
- Reconstruct PCL and repair PL and PM side in the first surgery
- Reconstruct ACL at 6 weeks before WB
 - *Stannard JP. J Knee Surg. 2012; 25(4):287-94.*
 - *Stannard JP: Am J Sports Med. 2005; 33(6):881-8.*
- All reconstructions must be complete before full weight-bearing

Exam under anesthesia

- Pain, effusion and muscle spasm preclude a complete ligament exam in the awake patient
- EUA useful in final decision making



Valgus stress test



Varus stress test

- Increase of lateral opening at 90 degrees is indicative of associated PCL injury



Postero-lateral drawer test



External rotation recurvatum test

Postero-lateral
subluxation of the tibia
results in
hyperextension and
varus



Dial test

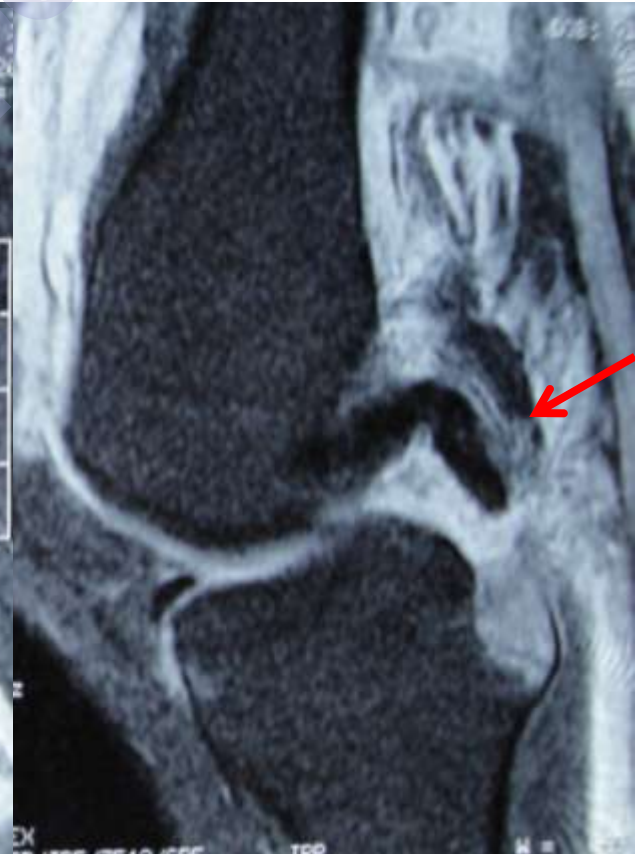
- ER more than 15 degrees compared to the healthy knee is positive
- 30 degrees PLC
- 90 degrees PLC + PCL

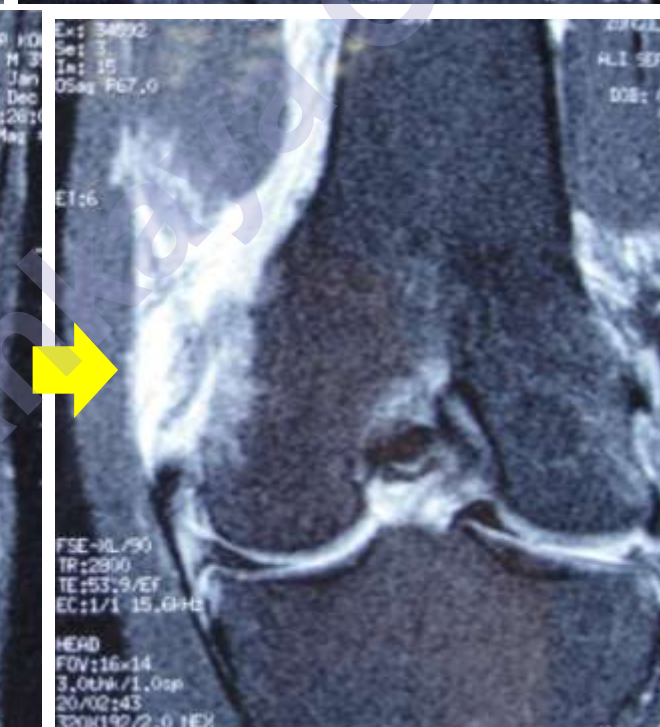
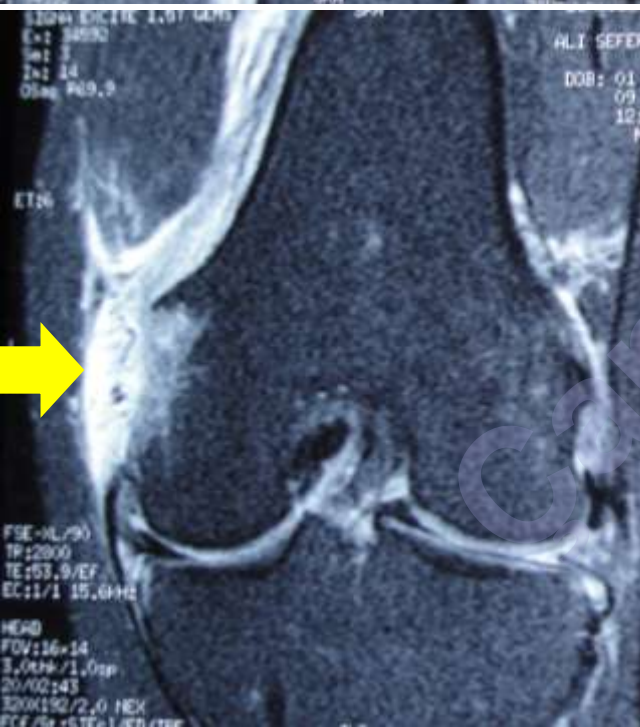


Surgical principles

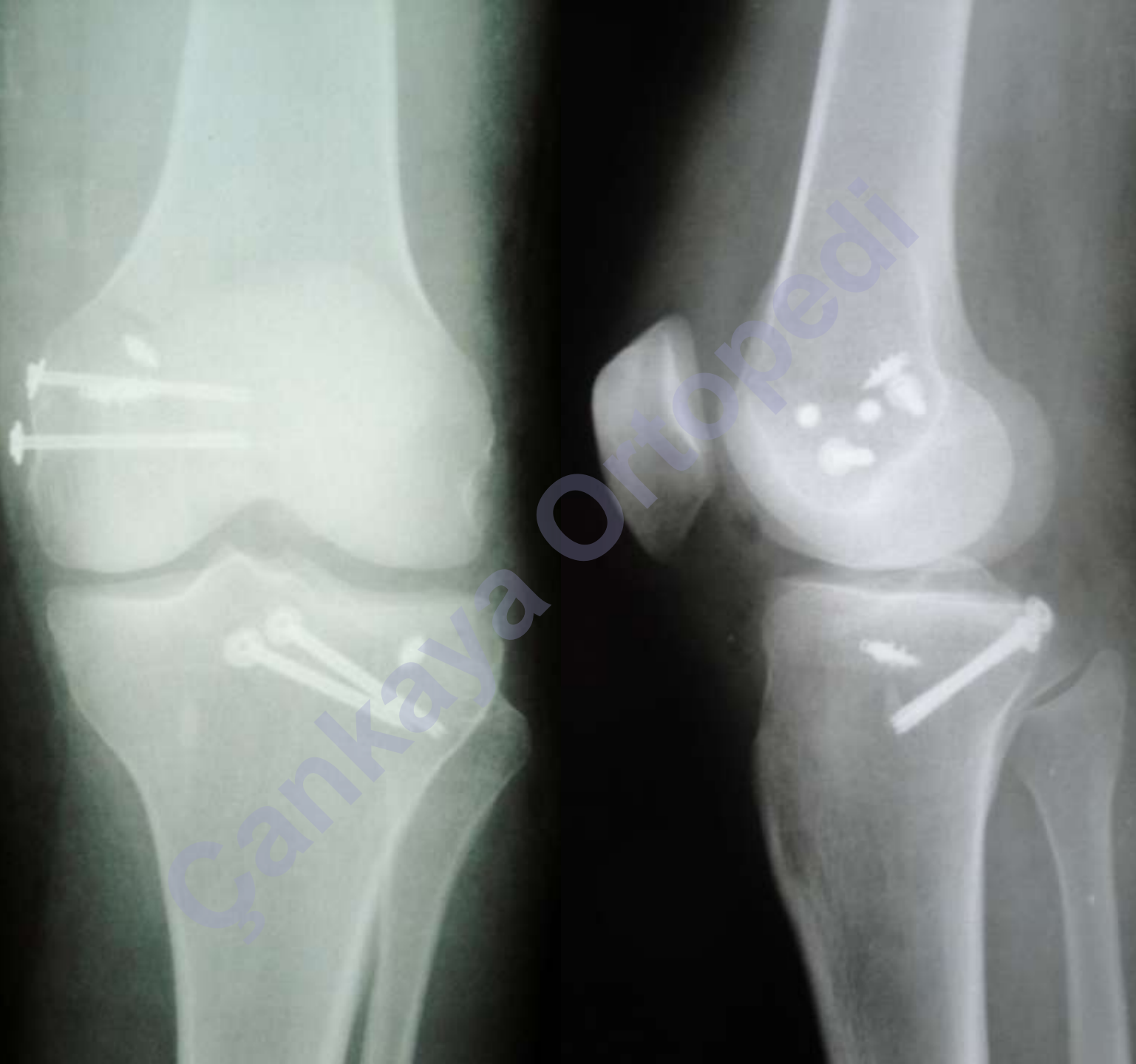
- Address PCL / ACL
 - Internal fixation for bone avulsions
 - Allograft reconstruction for mid-substance injuries
- Primary repair of capsule and menisci
- Collaterals & popliteus
 - Internal fixation for bone avulsions
 - Primary repair: good tissue quality
 - Primary reconstruction : questionable tissue quality

PCL tibial avulsion





**MCL
femoral
avulsion**





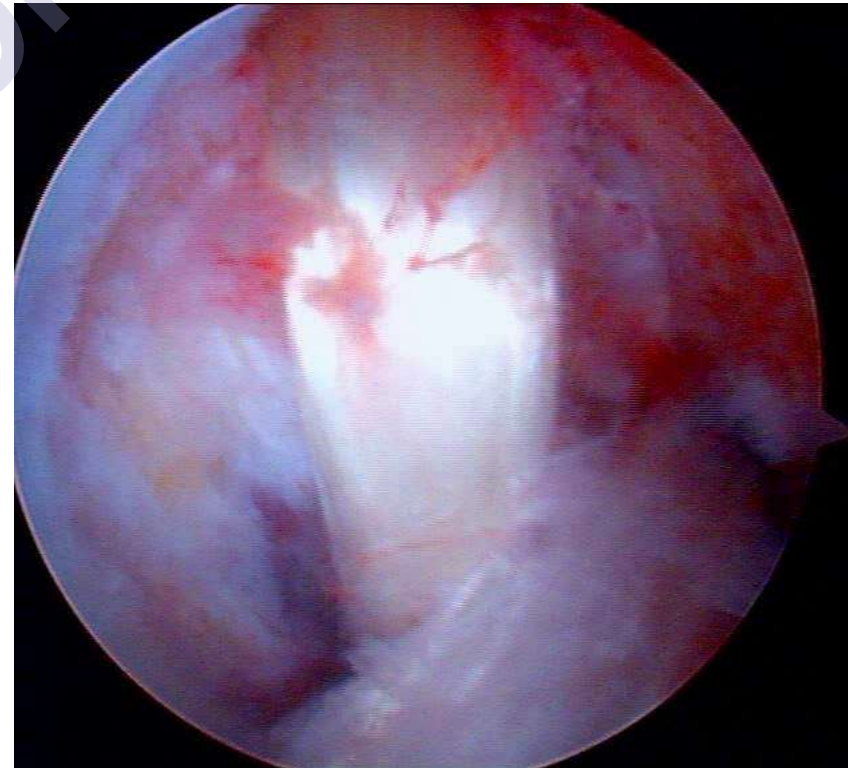
Arthroscopy

- Injury pattern of the cruciates
- Opening of the involved compartment
- Peripheral tears of the meniscus
- Fractures and chondral injuries in the contralateral compartment



Reconstruct cruciates

- Allografts to minimize morbidity
- Single bundle, trans-tibial PCL
- Anatomical, single bundle AM portal ACL



Lateral side

- Peroneal nerve
- ITB
- LCL
- Popliteus
- Menisci & Coronary ligaments
- Posterolateral capsule
- Lateral gastroc
- Biceps insertion



Peripheral repair

- Suture anchors
- Avoid large screw-washer combinations
- Non- absorbable no:2 sutures
- Anatomical repair of capsule, menisci, collateral ligaments and popliteus



LCL + popliteus femoral insertion repair

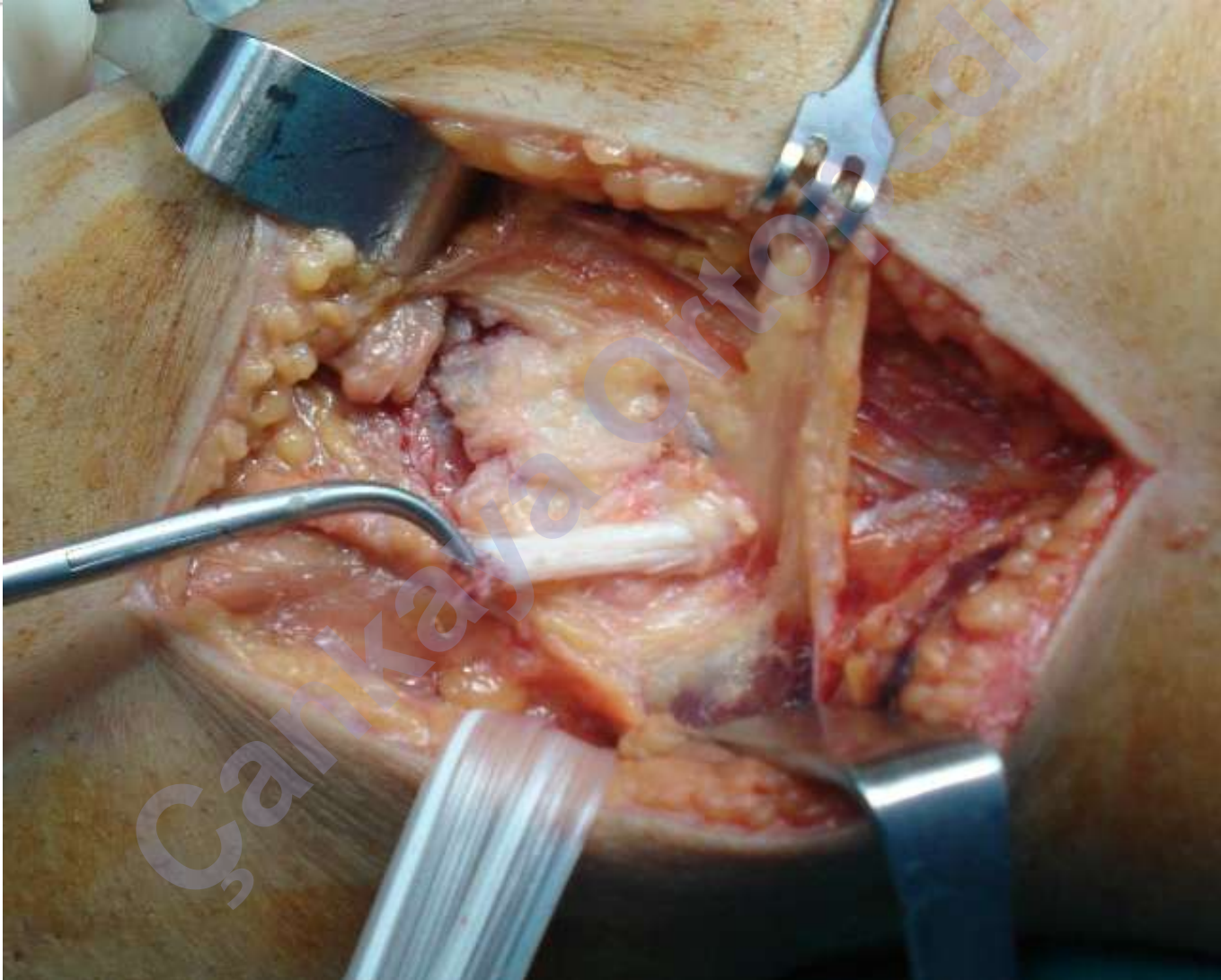




**LCL + popliteus
femoral insertion
repair**



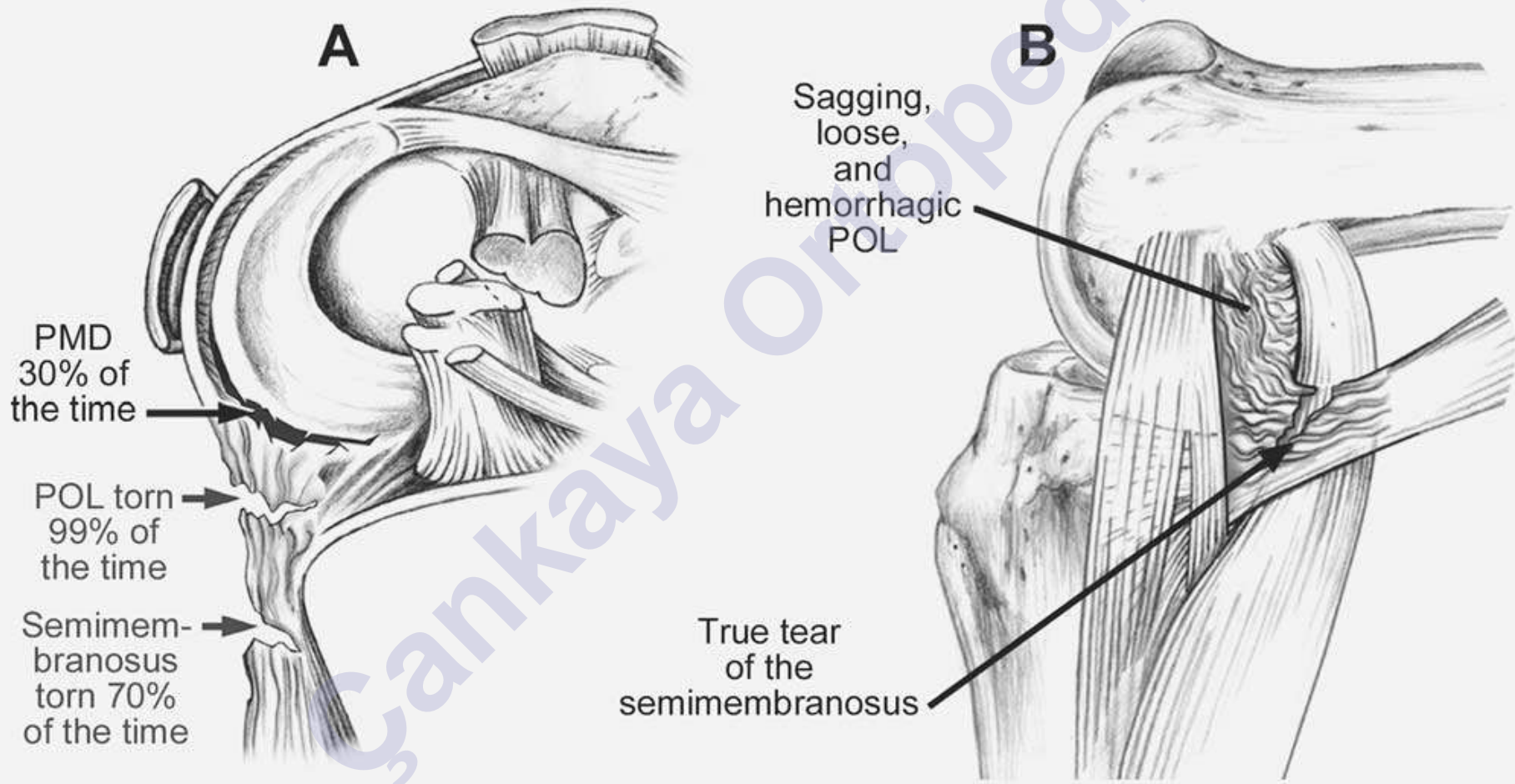
Augmentation of LCL



Augmentation of LCL

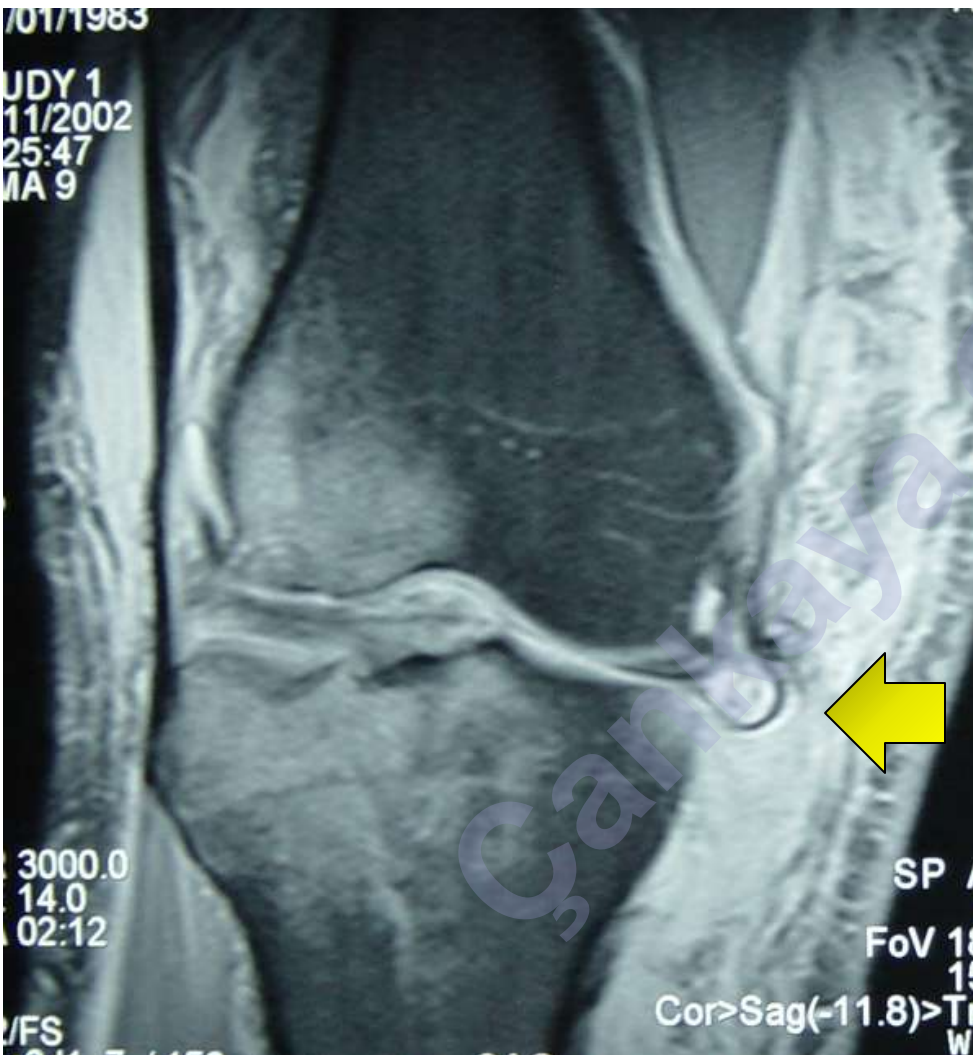


Medial side



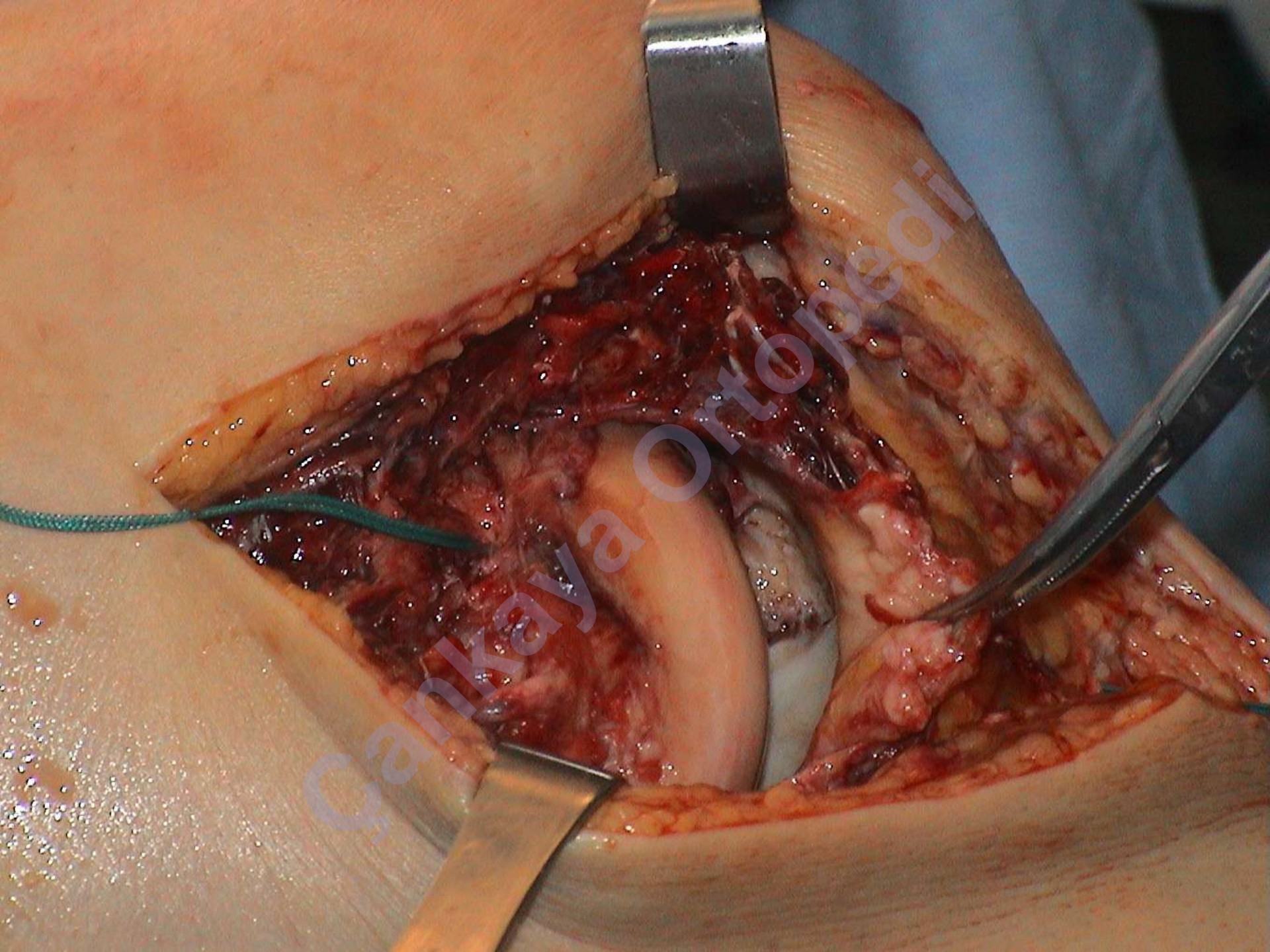
- *Sims WF: Am J Sports Med 2004,32:337*

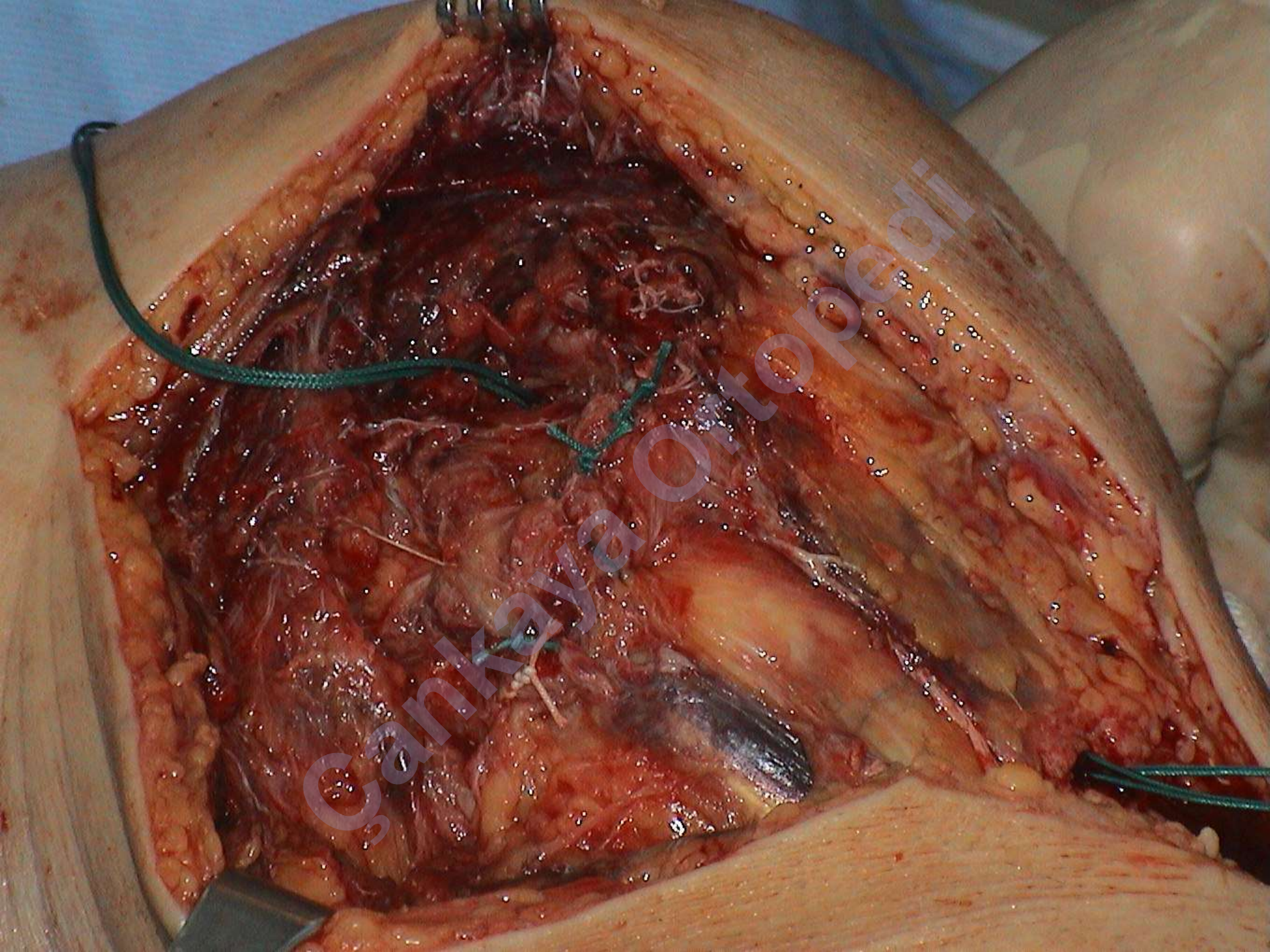
Intra-articular entrapment of MCL



Bi-cruciate injury + MCL









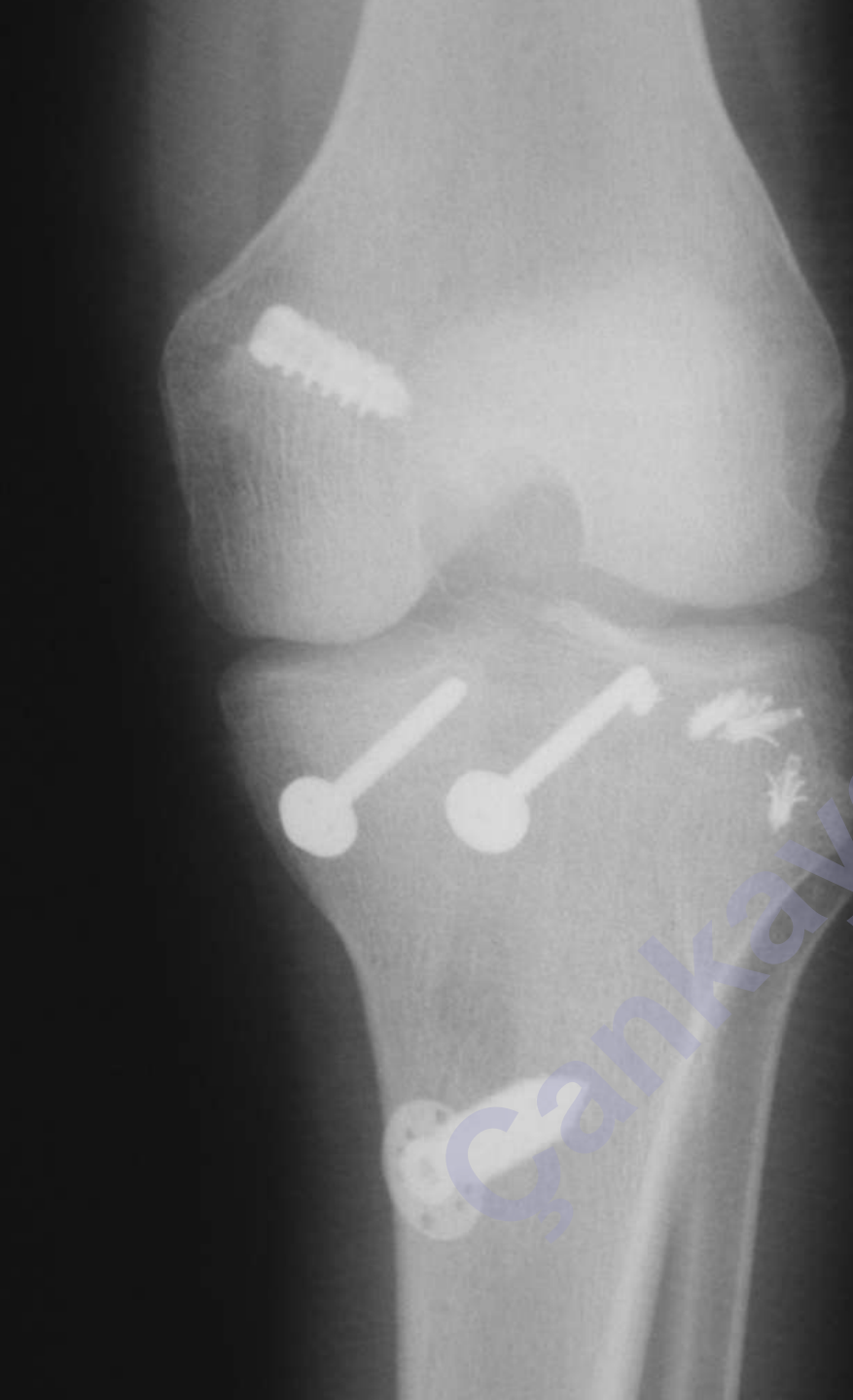






Fix tibial rim fractures





D. Lee Bennett: Anterior rim tibial plateau fractures and posterolateral corner knee injury
Emergency Radiology (2003) 10: 76–83

- 16 PLC injuries
- 1/3 have anterior tibial rim fractures
- Suggestive of PLC injury if seen on X-rays
- Very important in knee stability

- **PRIMARY RECONSTRUCTION** if extensive damage to tissues present, precluding primary repair



Reconstruction superior to primary repair in both lateral & medial injuries

- 64 knees postero-lateral injury
 - Primary repair : 37% failure
 - Primary reconstruction: 9% failure
 - Stannard JP. *Am J Sports Med.* 2005;33(6):881-8.
- 71 knees, postero-medial injury
 - Primary repair : 20% failure
 - Primary reconstruction: 4% failure
 - Stannard JP. *J Knee Surg.* 2012; 25(5):429-34.
- 28 knees, postero-lateral injury
 - Primary repair : 40% failure
 - Primary reconstruction: 6% failure
 - Levy BA. *Am J Sports Med.* 2010; 38(4):804-9.

**x3 to x6
Failure**

Rehabilitation

- Tailored to injury pattern and stability at the end of surgery
- 1-2 weeks immobilization for soft tissue healing
- Prone flexion started in 3 weeks
- Partial WB for 6 weeks
- Minimum 2 months brace
- High impact sports not before 8 months.

What not to do in combined PCL injuries

- Partial repair/ reconstruction
 - Abnormal loads on the reconstructed ligaments lead to failure
- Conservative treatment followed by reconstruction
 - Impossible to identify and repair anatomical structures in chronic cases
 - Results of acute surgery better than late reconstruction

Failure to correct all components of instability



Beware of fixed posterior dislocations

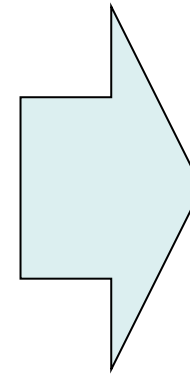


After extensive release 2nd revision



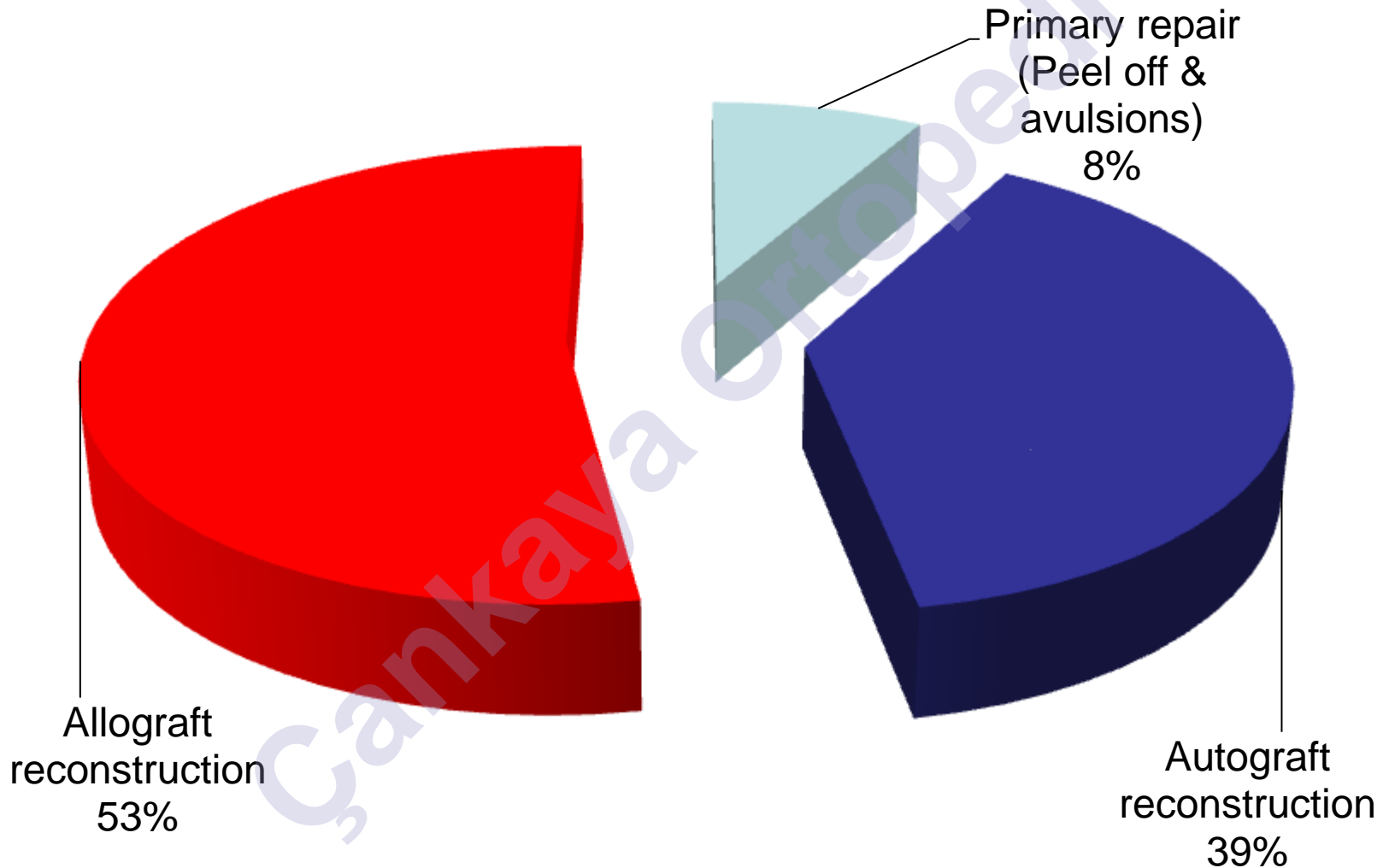
1997-2014 : 167 PCL repairs

- Isolated PCL : 70
- PCL + ACL : 31
- PCL+ MCL : 10
- PCL + PLC : 11
- PCL +ACL + MCL : 21
- PCL + ACL +PLC : 18
- PCL+ ACL+PCL+MCL : 6

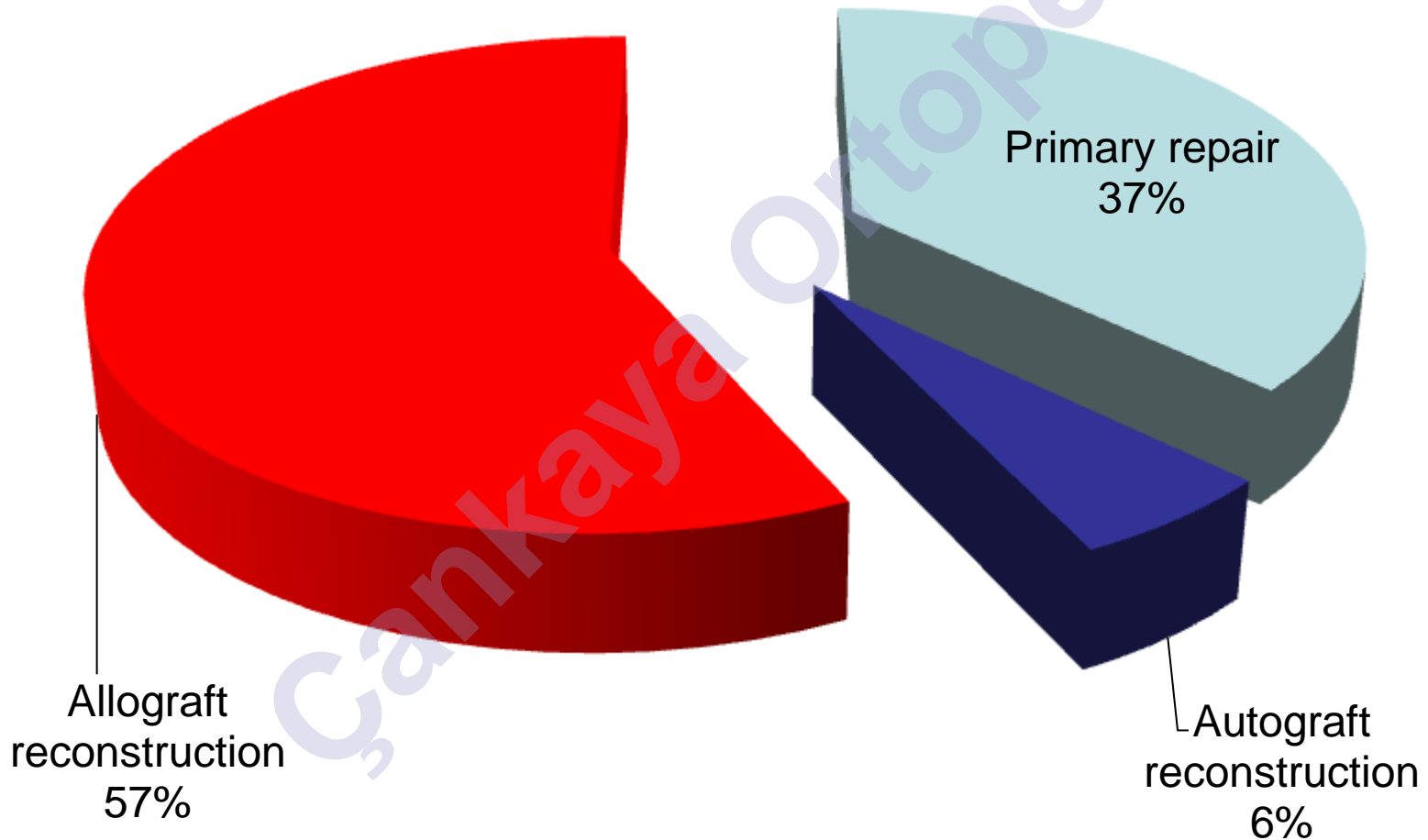


97 combined injuries

PCL treatment



Lateral side treatment

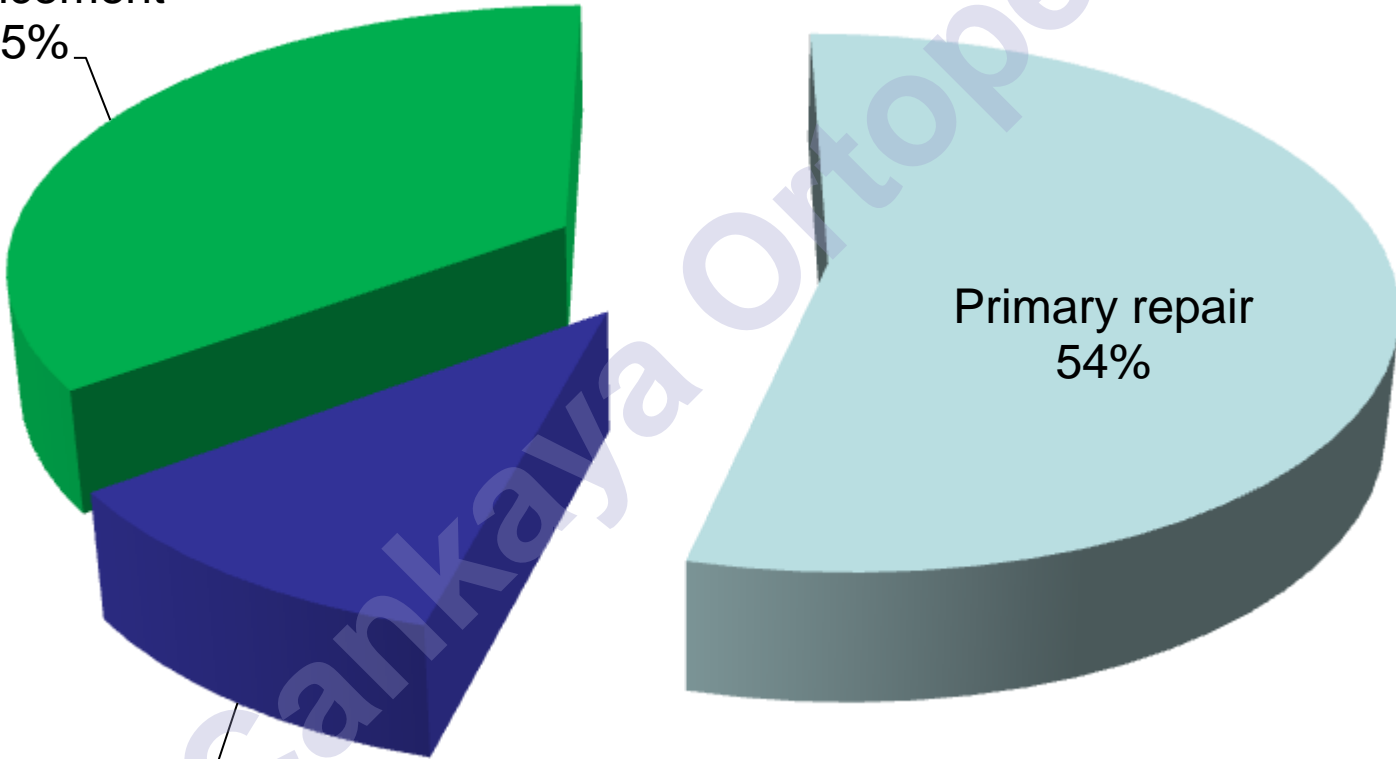


Medial side treatment

Proximal
advancement
35%

Autograft
reconstruction
11%

Primary repair
54%



Results

- Difficult to standardize because of variety of injury patterns and reconstruction techniques
- Acute surgery better than chronic reconstructions
- Primary repair works on the medial side
- Reconstruction more stable on the lateral side

Factors affecting outcome

- Worse outcome in
 - Low velocity injuries in obese patients
 - Severity of injury
 - Involvement of the posterolateral corner compared to medial side
 - Werner BC. Clin Orthop Relat Res. 2014 Feb 6.

Take home messages

- Correct all components of the instability in the same setting
 - Reconstruct cruciates
 - Repair collaterals
 - Preserve menisci
- Primary reconstruction of collaterals if tissues are of poor quality

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