

**Clinica Ortopedica e Traumatologica**

**Universita' degli Studi di Pavia**

**I.R.C.C.S. Policlinico  
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**MULTI LIGAMENT INJURIES**

**ACUTE CASES**

**ACL/PCL (surgical) management ?**



**7<sup>th</sup> Advanced Course on Knee Surgery**  
14th to 18th January 2018  
Val d'Isère - France

# Topics

- Surgical/Conservative treatment
  - Surgical Timing
  - Graft selection
- Combined PCL-ACL Reconstruction  
Surgical Technique



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# Diagnosis First !

- Knee Dislocation: 0.02–0.2% of orthopaedic injuries suggested by the literature  
**Engbretsen 2009, Rihn 2015**
- Mechanism :
  - deceleration with extrarotation and valgus stress  
Posterior – Valgus - Rotational Dislocation
  - knee hyperextension >30°  
Anterior Dislocation
- Causes → trauma resulting in knee subluxation or dislocation

**Low energy mechanism:** sport accidents

+/- peripheral knee joint capsule and ligaments and,  
--- blood vessels and nerves

**High energy mechanism:** vehicular trauma

+++ peripheral ligament damage and disruption of blood vessels and  
nerves

# Treatment choices

- **Historical treatment: CONSERVATIVE** Tylor AR *jbjsBr* 1972  
Reduction under anaesthesia + well-padded cast in 30° knee flexion ->  
Swelling subside -> fitting cast from 4 to 12 weeks



FIG. 2

Posterior dislocation, an open injury with an associated fracture of the fibula. After wound toilet, treatment was conservative. Persistent posterior displacement necessitated arthrodesis after two years.



FIG. 1

Anterior dislocation, sustained in a road traffic accident. Treatment was conservative. At one year the range of flexion movement was from 0 to 70 degrees, with minimal laxity of the medial ligament.

## TRAUMATIC DISLOCATION OF THE KNEE

A Report of Forty-three Cases with Special Reference to Conservative Treatment

A. R. TAYLOR, AYLESBURY, G. P. ARDEN, WINDSOR, and H. A. RAINEY, EXETER, ENGLAND

*From the Royal Buckinghamshire Hospital, Aylesbury; Heatherwood Hospital, Ascot; and Princess Elizabeth Orthopaedic Hospital, Exeter*

# POOR RESULTS

# Treatment choices

## 1) EMERGENT SURGERY:

arterial injury repair, compartment syndrome fasciotomies, open knee dislocation with debridements, irreducible knee dislocation requiring open reduction



### Joint spanning External Fixation: controversial

Less DVT

Higher rate of Arthrofibrosis --> manipulation under anesthesia

## 2) ACUTE SURGERY (1-3 WEEKS):

Displaced meniscal tear preventing ROM, tibial plateau fractures, displaced fibular head fracture with FCL, Biceps femoris avulsion



Posterolateral capsule disrupted -> **suture** anchor tibial plateau

Meniscal capsular junction torn -> **reattach** meniscus

Popliteus tendon avulsed -> tendon anatomically **reattached**

Medial compartment lesion -> **ONLY** grade III and Stener lesion -> Medial **repair**



Consider augmentation with tendon graft (lateral compartment)

# Treatment choices

## 3) DELAYED SURGERY (more than 3 WEEKS):

If marked swelling, unacceptable soft tissue condition, recent vascular repair, distal femur or tibial plateau fracture requiring nailing or Ex Fix

**ACL + PCL RECONSTRUCTION**



**LATERAL POSTEROLATERAL REPAIR / RECONSTRUCTION**

RECONSTRUCTION better results

Stannard 2005, Levy 2010



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# Combined ACL/PCL lesions

- One-stage reconstruction of the ACL and PCL is the most common procedure for patients with multiligamentous knee injuries  
Panigrahi 2016, Wong 2004
- 78% associated with posterolateral corner or medial collateral ligament reconstruction
- **None of the reconstructions technique could restored the anterior and posterior stability of the intact knee**

# Graft Selection

- **PCL:** Achilles tendon allograft for **single-bundle +++**  
Tibialis anterior for double-bundle Fanelli 2012
- **ACL:** Achilles tendon allograft / tibialis anterior allograft  
BPTB ipsilateral autograft **single-bundle +++** Mariani 2001
- ACL+PCL: Autologous Hamstrings ipsi- and contralateral side Panigrahi 2016
- Lateral posterolateral reconstruction: allograft
- Medial side injuries: repair +/- capsular shift

## Our choice:

**PCL tibialis anterior allograft single-bundle**

**ACL tibialis anterior allograft single-bundle**

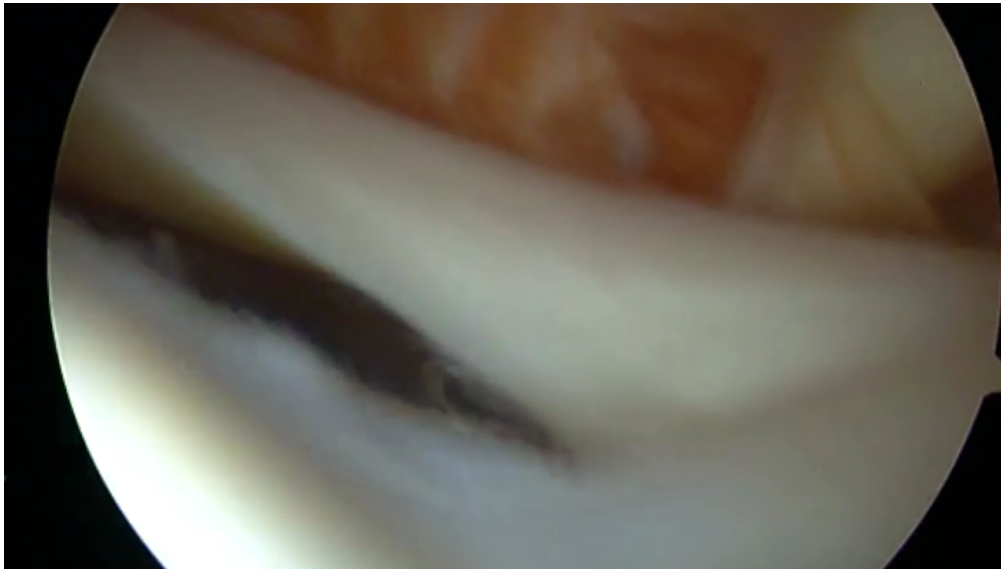


# Combined surgical technique step by step

1. Standard portals and confirmation of the diagnosis
2. Accessories portals: Postero-medial (only for tibial PCL tunnel drilling)
3. Intercondylar and footprints cleaning
4. PCL tibial tunnel → Image intensifier Needed + direct view
5. PCL femoral tunnel → in-out drilling
6. PCL tunnels smoothing
7. ACL femoral tunnel → AM approach drilling
8. ACL tibial tunnel
9. PCL passage and fixation → 2 interference screws
10. ACL passage and fixation → cross-pinning fixation at femoral side + interference screw tibial side
11. + Lateral – PLC reconstruction (Larson technique)
12. + rare medial side repair

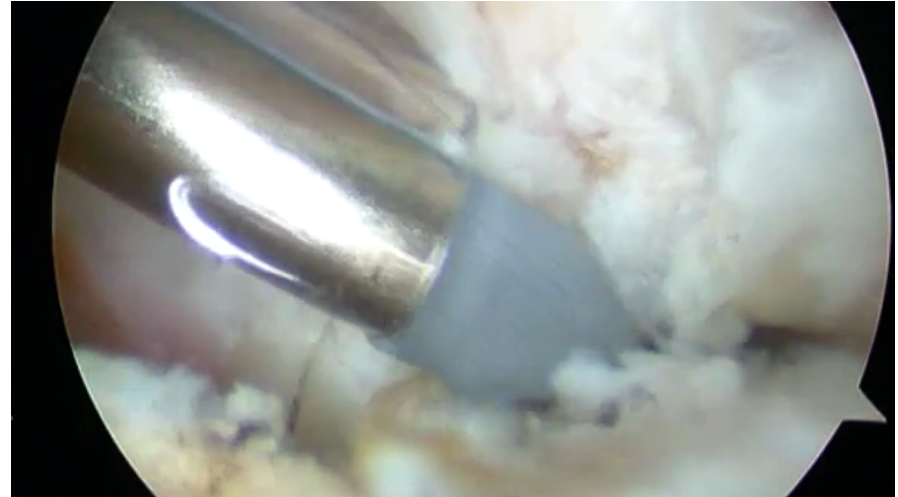
- Diagnosis confirmation: static and dynamic assessment

### **Identification of the lesions, Drive-through sign**



# PCL first

- Intercondylar debridement
- PM accessory portal  **High and posterior portal**



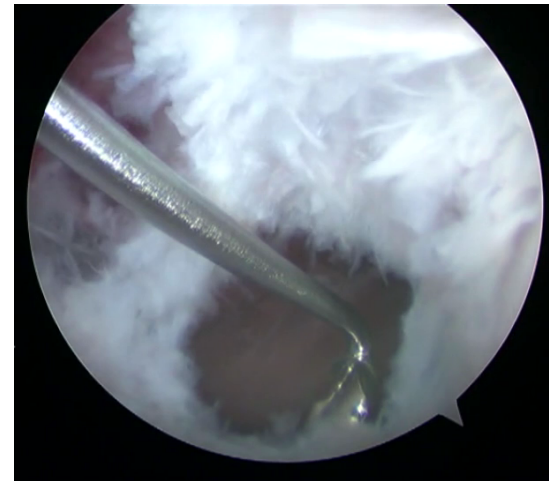
- PCL tibial footprint identification and cleaning

**Identify the shiny white fibers**

- **X-ray Image intensifier:**

**AP view:** medial aspect of the lateral tibial eminence, 2 mm distal to the joint line

**ML view:** 6-7 mm proximal to the champagne-glass drop-off



- PCL tibial tunnel drilling
- PCL tibial tunnel reaming

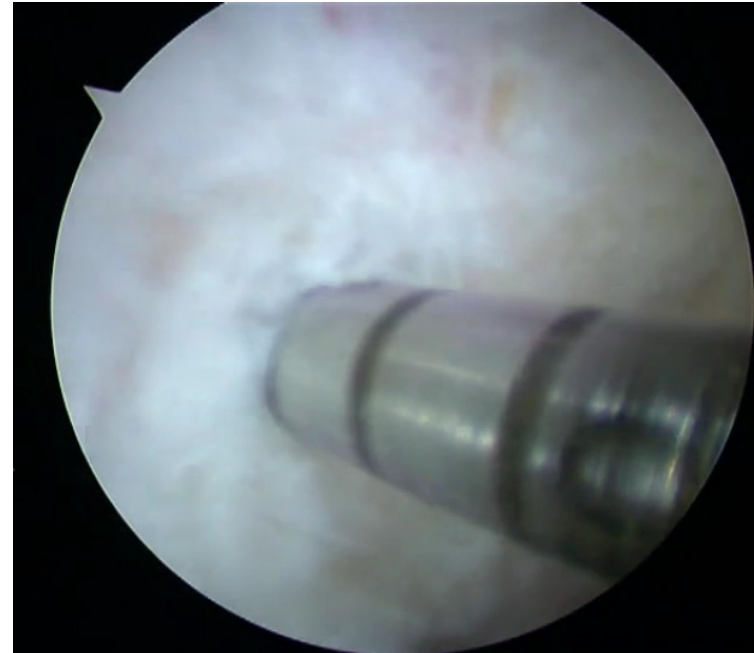
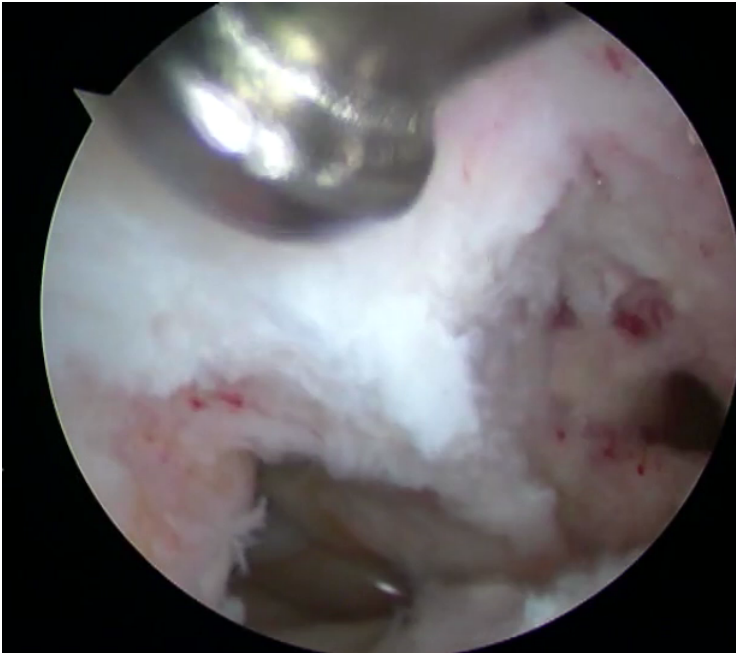


**Anterolateral approach:  
decreased risk of neurovascular  
bundle lesions and decreased  
killer turns**

- PCL tibial tunnel drilling
- PCL tibial tunnel reaming



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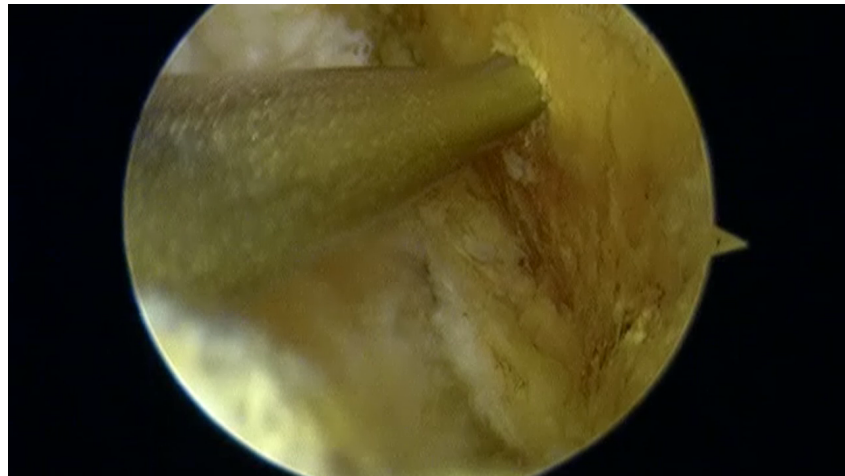
- PCL femoral tunnel drilling
- PCL femoral tunnel reaming



**In-out technique: direct view  
aiming the Antero Lateral Bundle  
footprint**

# ACL later

- ACL femoral footprint identification → **Midpoint of native footprint**
- ACL femoral tunnel drilling → **Antero Medial technique**
- ACL femoral tunnel reaming: pinning  
fixation guide insertion



- ACL tibial footprint identification → **Anterior horn of lateral meniscus landmark**
- ACL tibial tunnel drilling

- Smoothing PCL tunnels

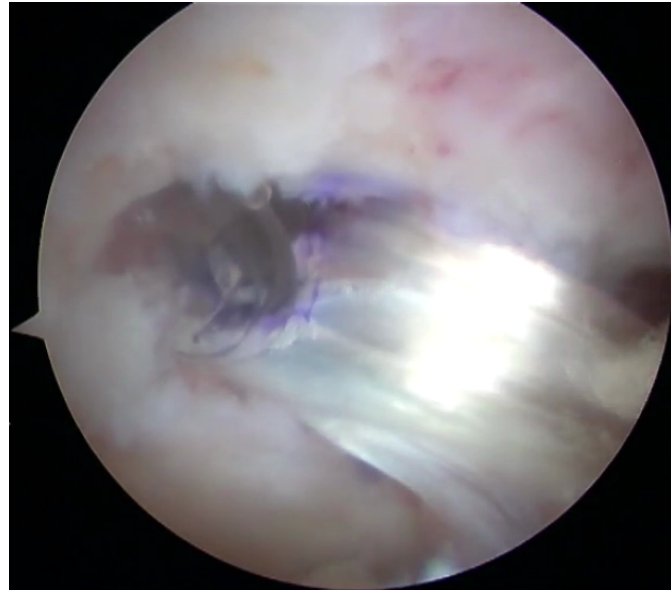
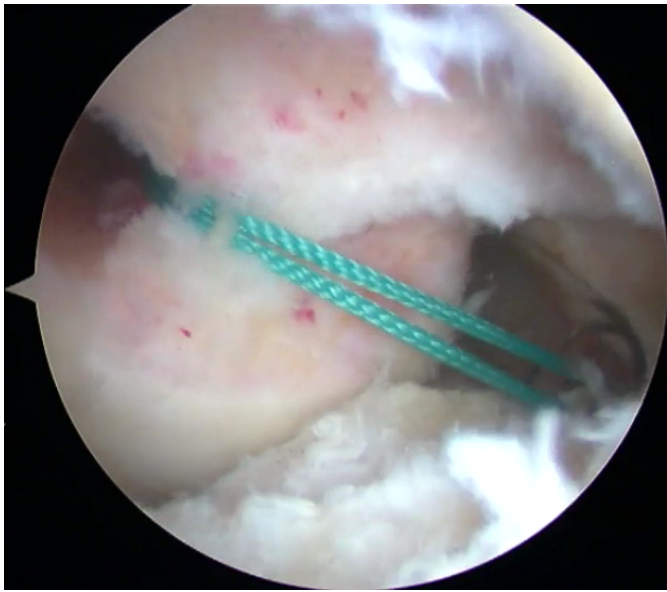


**Trying to avoid killer-turn related difficulties**

- PCL passage



**Help with a pulley-like system**



- PCL fixation



**Fixation at 90° degrees of flexion with a slight anterior drawer**

**Before ACL fixation: increased stability of the central pivot and more physiologic ACL tensioning**

- ACL passage → **Check for impingement before tibial fixation**
- ACL fixation → **Femoral cross-pinning fixation  
Tibial interference screw 10-20° of flexion**



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# Technical issues

There is **no consensus** on:

- the graft tension -> Simultaneous-tensioning ACL-PCL +++  
Lee 2015
- knee flexion angle during graft fixation
- order of graft fixation



May alter the position of the tibia on the femur and lead to tibiofemoral malalignment



graft loosening or abnormal knee kinematics



increased tibiofemoral contact pressure → early osteoarthritis

# Technical issues

## PCL first

- Achievement of better knee stability
- Lead to less AP translation compared to the ACL graft being fixed first

Fu FH et al. 2017

- Had to be tensioned first to consistently achieve the nominal combination of mean graft forces at 30° of flexion

Markolf KL et al. 2003

# Debate: technical issues

## ACL first

- Better clinical result (Lhysolm and IKDS)

Kim SJ et al. 2015

- Achievement of a tibiofemoral position closer to the intact knee
- Best for graft force restoring: consensual tensioning and 30° ACL fixation

no significant difference between fixation of the PCL graft at 30° or 90° of knee flexion when the ACL is fixed first at 30°

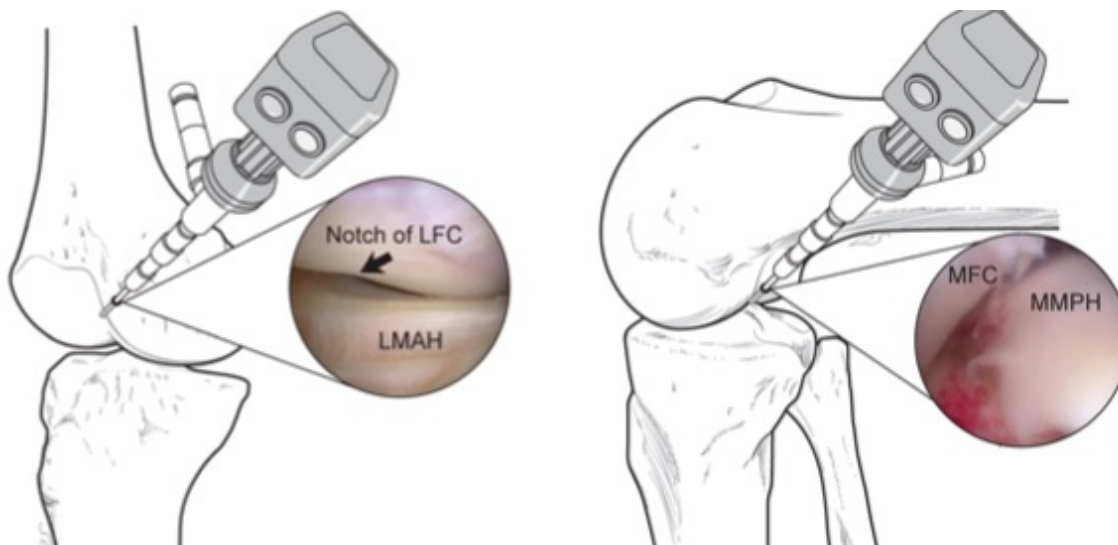
Fu FH et al. 2017

# Technical issues

It's impossible for the surgeon to determine nominal graft force levels and tension intraoperative

**Use intrarticular landmark** in an attempt to recreate the appropriate tibiofemoral relationship: **main landmark is the anterior horn of lateral meniscus at 30° knee flexion**

Mariani PP 2001



# Thanks



January  
14<sup>th</sup> - 18<sup>th</sup> 2018