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## PCL Mechanisms of rupture and Epidemiology

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## Background

- The study of Posterior Cruciate Ligament (PCL) injuries has attract much less interests in the orthopaedic literature than studies on Anterior Cruciate Ligament (ACL) and knowledge regarding PCL injuries is still limited.
- Reported incidence of PCL ruptures ranges between **1%** and **44%** of all acute knee ligament injuries!

Hamer CD, Huber J (1998) Evaluation and treatment of posterior cruciate ligament injuries. *Am J Sports Med* 26:471-482

Fanelli GC (1993) Posterior cruciate ligament injuries in trauma. *Arthroscopy* 9:291-294

Shelbourne KD, Davis TL, Patel DV (1999) The natural history of acute, isolated, nonoperatively treated posterior cruciate ligament injuries. A prospective study. *Am J Sports Med* 27:276-283

## Background

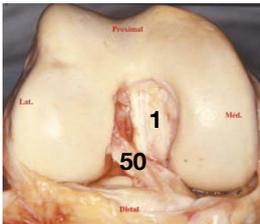
- This variability is probably due to differences in the patient populations studied, as PCL injury rates are likely to vary when comparing polytraumatized patients to an athletic population
  - In a general population, Miyasaka and Daniel reported the incidence to be **3%**.
  - Fanelli and Edson reported the incidence to be **37%** of all cases with acute hemarthrosis.
- In many cases the PCL injury is missed despite typical injury mechanisms and symptoms
- and it is critical to distinguish between PCL lesions that are isolated and those combined with other ligament injuries

Miyasaka KC, Daniel DM: The incidence of knee ligament injuries in the general population. *Am J Knee Surg* 4: 3-8, 1991

Fanelli GC, Edson CJ: Posterior cruciate ligament injuries in trauma patients: Part I. *Arthroscopy* 11: 526-529, 1995

## Comparaison PCL / ACL

- In a sports medicine clinic, the ratio of ACL to PCL is about 50 to 1.



## Avulsion fragments?



## Diagnosis ++

- History and Clinical examination
- Posterior test radiography (Telos)
  - Strobel (2003): A side-to-side difference (SSD) of posterior tibial displacement of  $\geq 5$  mm on posterior stress-radiographs in 90° of flexion was considered diagnostic for a PCL tear according to the amount of laxity on posterior drawer testing
- MRI?
  - Miller et al.





### Partial Tears

- Criteria of diagnosis?
- Patients who had MRI images that indicated a rupture of the PCL but had a SSD of posterior displacement of less than 5 mm were determined to have partial ruptures

- grade 1: < 5 mm posterior displacement
- grade 2: 5 to 10 mm of posterior displacement
- grade 3: > 10 mm of posterior displacement.

### Combined injuries

- Strobel (2003): "a SSD of 5–12 mm of posterior tibial displacement on stress-radiographs was classified as an isolated injury, whereas a displacement of more than 12mm was considered to be a combined injury"

- Based on cadaveric studies



M. S. Schulz · K. Russe · A. Weiler · H. J. Eichhorn  
M. J. Strobel Arch Orthop Trauma Surg (2003)

### Epidemiology of posterior cruciate ligament injuries

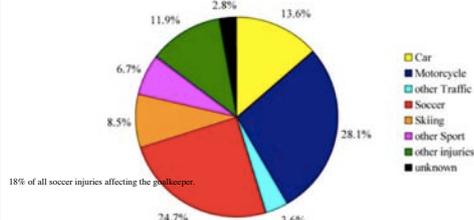
- 494 complete PCL ruptures

	All patients (n=494)
Time between injury and first visit (months)	44.4±68.6
Age at time of injury (years)	27.5±9.9
Male/female (percent)	392/102 (79.4/20.6)
Injury mechanisms:	
Traffic accident	224 (45.3%)
Athletic injury	197 (39.9%)
Other	59 (11.9%)
Unknown	14 (2.8%)

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### Epidemiology of posterior cruciate ligament injuries

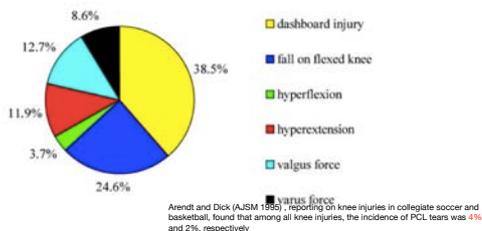
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### Epidemiology of posterior cruciate ligament injuries

- Among all 494 patients 244 (49.4%) were able to give additional information about the injury mechanism.



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### Epidemiology of posterior cruciate ligament injuries

- The mean posterior displacement on stress-radiographs (90° of flexion) was 13.4 ± 4.7 mm.

	All patients (n=494)
Posterior displacement (SSD) ±SD (mm)	13.4±4.7
Range (mm)	(5–30)
Isolated PCL lesion/combined posterior instability (percent)	232/262 (47.0/53.0)

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 M. J. Strobel Arch Orthop Trauma Surg (2003)

### Epidemiology of posterior cruciate ligament injuries

- A combined PCL insufficiency was found in 143 (63.8%) of the 224 patients who were injured in traffic accidents, whereas in athletic injuries combined injuries represented 47.5% (107 of 197)

Injury Mechanism	Isolated PCL Lesion	Combined PCL Insufficiency
Traffic Accident	81	143
Athletic Injury	107	90

**Fig. 5** Isolated PCL insufficiency versus combined instability with respect to injury mechanism

### Activities?

- Motor vehicle accident: 50%
- Athletic injury: 40%
- Others: 10%

Clancy WG Jr, Sutherland TB (1994) Combined posterior cruciate ligament injuries. Clin Sports Med 13:629-647

### Sports Specificities?

- Motorcycle accidents
- Soccer injuries (Goalkeeper > 18%)
- Rugby players
- Skiers
- American football

### Gender

- Male 80%
- Sports activities

### Acute and Chronic

- Acute: 70% Athletic injuries
- Chronic: 60% Motor vehicle accidents
- Patients injured in high-energy motor vehicle accidents suffer a higher incidence of additional life-threatening injuries, and ligamentous knee injuries can be easily overlooked

### Mechanisms of PCL rupture (1)

- The most common injury mechanism is the 'dashboard injury/anterior tibial blow injury' (38.5%). In this setting the knee is in a flexed position and a posteriorly directed force is applied to the proximal tibia as the knee strikes the dashboard.
- The PCL is the primary restraint to straight posterior translation of the tibia at most positions of knee flexion
- With the knee in external rotation, the traumatic forces are directed toward the posterolateral and lateral structures of the joint
- 38%

### Mechanisms of PCL rupture (2)



- Fall on the flexed knee with the foot in plantar flexion.
- In this setting the site of impact is the tibial tubercle, and the proximal tibia is driven posteriorly relative to the femur.
- 25%

### Mechanisms of PCL rupture (3)



- Sudden violent hyperextension of the knee joint.
- may result in disruption of the posterior capsule as well.
- 12%

### Conclusion

- PCL injuries tend to occur in the setting of high-energy trauma such as motor vehicle collisions or lower-energy sports-related mishaps in young, active individuals.
- In terms of biomechanical mechanism, the "dashboard,"/anterior tibial blow with a flexed knee, is most common, followed by falling on the flexed knee with the foot plantar flexed, and sudden violent hyperextension of the knee.
- Specific mechanisms ==> History +++
- The PCL is most often injured in association with other ligamentous structures about the knee. The most common combined instability pattern involves the posterolateral corner (PLC) and PCL.