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## Natural history after PCL rupture

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## Introduction

- The treatment of the PCL-injured knee is a controversial issue
- The literature on PCL injuries is confusing and contradictory
- The treatment should be based on the natural history of the PCL- deficient knee because this sets the baseline from which any interventions may be compared in terms of outcome
- However, there are very few true natural history studies on the PCL-injured knee, with most of the literature being retrospective and including a mixture of patients and injuries

## Retrospective studies: issues

- Mixed bag of subjects assessed together.
- Both subjects with acute and with chronic injuries,
- Isolated PCL tears and combined ligament injuries
- Various follow-up times, variable assessment criteria, small patient groups, and even different PCL injury types compared
- so the literature is unclear!

**TABLE 1. Retrospective PCL Studies in the Literature**

Reference	Numbers of Patients	Mean Follow-up	Findings	Recommendations
Satku et al <sup>10</sup>	48 (25 acute, 23 chronic)	4 yr	Most significant determinant of outcome was presence of associated ligament injuries. Subset of 13 patients with displaced avulsion PCL fractures, all surgically reattached. 10 excellent and 3 good results at final follow-up.	If combined injury, surgery indicated. Reattach displaced PCL avulsion fractures.
Torg et al <sup>11</sup>	14 isolated (group 1) 29 combined ligament (2) determined clinically	6.3 yr	<b>Good/excellent results:</b> 89% group 1 (12/14 patients) versus 48% in group 2 (14/29 patients). Poor: 7% group 1 (1/14 patients) versus 28% group 2 (8/29 patients). Functional result not related to KT-1000 posterior laxity. Combined instability had 40% greater chance of not having good/excellent results versus isolated PCL tear. Medial laxity, quadriceps atrophy, and patellar degenerative changes adversely affect outcome.	Isolated PCL tears, treat nonoperatively. Combined PCL laxity, surgically stabilize.
Dandy and Pusey <sup>12</sup>	20 chronic, isolated PCL symptomatic	7.2 yr	<b>Good functional result</b> in 18. But activity pain in 14. Functional result not related to degree of PCL laxity.	Questioned whether there is a place for repair in these injuries.
Clancy et al <sup>13</sup>	48 mixed instabilities (33 chronic, 15 acute)	2 yr	10 of 10 acute (minimum 2-yr FU) and 11 of 13 chronic (mean 31-month FU) <b>good or excellent static and functional results.</b> Increasing frequency of nonoperative and severe OA of tibial compartment with increasing follow-up.	Reconstruction provides stability; long-term effects not known.
Croce and Powell <sup>14</sup>	116 (55 sports injuries), 3 acute, 113 chronic	5-10 yr	83% (47/52 patients) sports PCL tears and 17% (5/29 patients) RTA. <b>PCL tears did well with nonoperative treatment.</b> Poor correlation between posterior laxity and functional result.	Eventual OA of the knee "probably inevitable"
Parilla and Bergfeld <sup>15</sup>	25 athletes, isolated PCL tears, nonoperative treatment	6.2 yr	<b>80% satisfied.</b> 64% returned to previous sport (64% same level, 16% lower level) at mean of 6 weeks postinjury. No relationship between knee laxity and functional/subjective outcome. No relationship between time from injury and radiographic OA. Better functional outcome if quad strength > 100% compared with other knees.	
Dejour et al <sup>16</sup>	47: 40 chronic, 7 acute; mixed isolated and combined, all nonoperative treatment	15 yr	<b>Worsening of stability and pain with time.</b> 3 phases of evolution of PCL injured knee: (1) functional adaptation in 3-18 months postinjury; (2) functional tolerance with progressive deterioration of PF and TF joints over next 15 yr; (3) frank OA after about 15 yr. Functional status deteriorated and increased OA with time. Greater posterior laxity caused greater subjective and functional complaints.	
Keller et al <sup>17</sup>	40 isolated PCL tears, nonoperative treatment	6 yr		

Abbreviations: FU, follow-up; RTA, road traffic accident; PF, patellofemoral; OA, osteoarthritis; TF, tibiofemoral.

Sheilbourne et al.

## Prospective studies

- 13 isolated PCL injuries in athletes treated conservatively.
- Seven injuries were complete PCL tears, and 5 were partial PCL tears. The mean follow-up was 2.6 years.
- Subjectively and functionally, all patients had a good result. Objectively, however, there were 3 good and 10 fair results. All patients returned to their preinjury activities without limitations. The subject's posterior laxity did not increase with time. MRI scans performed of 3 patients with a complete tear showed a healed PCL

Fowler PJ, Messieh SS: Isolated posterior cruciate ligament injuries in athletes. Am J Sports Med 15:553-557, 1987

## Prospective studies

- 34 patients with isolated PCL injury who underwent conservative treatment and performed follow-up evaluations at a mean of 8.6 years.
- They found that 75% of patients had experienced knee pain and had felt "insecure feelings" in their knees. They reported that gastrocnemius strength and degenerative changes of the medial and patellofemoral compartments affected prognosis.

Inoue M, Yasuda K, Ohkoshi Y, et al: Factors that affect prognosis of conservatively treated patients with isolated posterior cruciate ligament injury. Presented at AOS, San Francisco, CA, 1997

## Prospective studies

- 133 athletes with acute, isolated, nonoperatively treated PCL injuries. All patients were treated nonoperatively and prescribed a home rehabilitation program to decrease knee effusion and increase knee motion. Patients completed a subjective questionnaire each year for an average of 5.4 years (2.3 to 11.4 years). Sixty-eight patients returned for subjective evaluation, physical examination, KT-1000 arthrometer laxity testing, isokinetic strength, single-legged- hop test, leg press torque measurements, and radiographic assessment including stress radiography.
- Regardless of the amount of laxity, the investigators found that half the patients returned to the same sport at the same or higher level, one third to the same sport at a lower level, and one sixth did not return to the same sport.
- Overall, the investigators thought that athletically active individuals with acute, isolated PCL injuries treated non-operatively achieved a level of objective and subjective knee function that was independent of the grade of laxity

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

- In a follow-up in 2005, they assessed 271 subjects and reported that 76% of patients were able to return to sport or activity at a similar level.



## Literature

- Several series have described **intrinsic healing potential of the PCL**, return to competitive sport, lack of symptomatic instability, and good outcomes at mid-term follow-up.
- More recently, however, biomechanical studies have identified alterations in **contact area and loads after PCL injury**, particularly with flexion beyond 70 degrees.
- These effects occur in the medial and patello-femoral compartments and some clinical series also suggest progressive disability and **degenerative joint disease** with chronic PCL deficiency

Skylar MJ, Warren RF, Ortiz GJ, et al. The effects of sectioning of the posterior cruciate ligament and the posterolateral complex on the articular contact pressures within the knee. *J Bone Joint Surg Am*. 1993;75:694-699.

Van de Velde SK, Bingham JT, Gill TJ, et al. Analysis of tibiofemoral cartilage deformation in the posterior cruciate ligament-deficient knee. *J Bone Joint Surg Am*. 2009;91:167-175.

Dejour H, Walch G, Peyrot J, et al. The natural history of rupture of the posterior cruciate ligament. *Rev Chir Orthop Reparatrice Appar Mot*. 1988;74:35-43.

- A study has been made in a series of **45 patients**, 36 of whom were re-examined and 11 of whom replied to a questionnaire, of the fate of knees that had suffered a rupture of the posterior cruciate ligament which had not had a primary or secondary repair. The follow-up was between 5 and 44 years, with a mean of **15 years**. In the 36 who were reviewed, 21 showed an isolated posterior laxity, 8 a postero-lateral laxity and 7 a postero-medial laxity. Even though the posterior cruciate ligament is the strongest ligament in the knee, an isolated rupture of the ligament is often well tolerated after a mean period of adaptation of **12 months**. **This functional tolerance is remarkable since it allows a return to sporting activity, even at high level.** However, the disturbance of the kinematics of the knee resulting from the loss of the posterior cruciate ligament leads, after an average of 25 years, to **osteoarthritis**, either medial tibio-femoral or generalised depending on the morphological features of the patient. **These findings have stimulated us to repair fresh lesions in young persons, especially in the presence of combined lesions** but care needs to be exercised about the indications for surgery in chronic laxities during the first year of adaptation.

Dejour H, Walch G, Peyrot J, et al. The natural history of rupture of the posterior cruciate ligament. *Rev Chir Orthop Reparatrice Appar Mot*. 1988;74:35-43.

- In 1988, Dejour et al summarized the suspected natural history of isolated PCL deficiency as occurring in 3 phases:
- (1) functional adaptation lasting 3 to 18 months,
- (2) functional tolerance continuing for 15 to 20 years,
- (3) osteoarthritic deterioration that does not become disabling until after 25 years.

## Conclusion

- After an isolated PCL rupture, the **return to the sport** is possible in the majority of the cases.
- But **osteoarthritis** happens after long term FU.
- The factors that predict which patients are most likely to quickly progress to degenerative joint disease have yet to be elucidated...

How to avoid this osteoarthritis evolution?

