Posterior Cruciate Ligament Injuries in Trauma Patients: Part II

Gregory C. Fanelli, M.D., and Craig J. Edson, P.T., A.T.C.

Summary: The purpose of this article is to present the incidence of posterior cruciate ligament (PCL) injuries in trauma patients with acute hemarthrosis of the knee. There were 222 acute knee injuries with hemarthrosis presented to our regional trauma center over a 38-month period. PCL injuries occurred in 38% (85 of 222) acute knee injuries; 56.5% (48 of 85) were trauma patients, and 32.9% (28 of 85) were sports related. Higher energy mechanisms may account for the difference. Isolated PCL injuries were rare (3.5%, 3 of 85), whereas 96.5% (82 of 85) of PCL injuries occurred in combination with other ligament injuries. Trauma patients have a higher incidence of PCL injuries than do athletes. Acute knee hemarthrosis in trauma patients should elevate suspicion for multiple knee ligament injuries involving the posterior cruciate ligament. **Key Words:** Posterior cruciate ligament—Acute hemarthrosis—Trauma patients.

This is a follow-up to an article that appeared in *Arthroscopy* in 1993 in which we described the incidence of posterior cruciate ligament (PCL) injuries in 61 patients with acute traumatic hemarthrosis of the knee presenting to a regional trauma center.[1] A summary of that article is outlined in Table 1. At the 1994 American Academy Of Orthopaedic Surgeons Annual Meeting, we updated that series and presented the incidence of PCL injuries in 120 patients with acute traumatic hemarthrosis of the knee presenting to our regional trauma center.[2] A summary of that presentation is outlined in Table 2.

Our series has now been updated to include 222 acute knee injuries with hemarthrosis presenting to our regional trauma center over a 48-month period of time from August 1990 through August 1994. The purpose of this article is to evaluate the incidence of PCL injuries in patients presenting with acute traumatic hemarthrosis of the knee in a prospective study, and to show that the incidence of PCL injuries in trauma patients is consistently higher than the athletic injury patient population.

From The Sports Injury Clinic, Department Of Orthopaedic Surgery, Geisinger Clinic, Geisinger Medical Center, Danville, Pennsylvania, U.S.A.

Address correspondence and reprint requests to Gregory C. Fanelli, M.D., Sports Injury Clinic, Department Of Orthopaedic Surgery, Geisinger Medical Center, Danville, PA 17822-2130, U.S.A.

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MATERIALS AND METHODS

A total of 222 acute knee injuries with hemarthrosis presented to our tertiary-care referral center over a 38-month period with a variety of traumatic causes. These knees were evaluated by clinical examination in all cases. The knees were also evaluated by examination under anesthesia with diagnostic arthroscopy using the three-zone concept of PCL evaluation,[1,3] and/or magnetic resonance imaging. There were 162 males and 59 females, and there were 103 right, and 119 left knees (Table 3). Mechanisms of injury included motorcycle and motor vehicle accidents, sports-related injuries, pedestrian/automobile accidents, falls from heights, and farming/industrial accidents. These are outlined in Table 4. All patient evaluations were performed by a single orthopaedic surgeon.

TABLE 1. *PCL Injuries In Trauma Patients*

Acute knee injuries	61
PCL tears	27 (44.2%)
Multiple trauma	22 (81.5%)
Sports	5 (18.5%)
PCL/multiple ligaments	25 (92.5%)
PCL/isolated	2 (7.5%)

Data from Fanelli.[1]

RESULTS

The overall incidence of structural injuries are presented in Table 5. Structural injuries are defined as those involving the ligaments, meniscus, retinacular structures, extensor mechanism, articular surface, or bones about the knee. ACL tears were present in 148 of 222 knees (66.7%). PCL tears were present in 85 of 222 knees (38.3%). Medial collateral ligament tears were present in 50 of 222 knees (22.5%). Posterior lateral complex tears were present in 60 of 222 knees (22.5%). Lateral collateral ligament tears were present in 3 of 222 knees (1.4%). Other structural injuries included medial meniscus tears in 63 of 222 knees (28.4%), lateral meniscus tears in 34 of 222 knees (15.3%), medial retinacular tears in 14 of 222 knees (6.3%), patellar tendon rupture in 2 of 222 knees (.9%), patellar dislocations in 4 of 222 knees (1.8%), and chondral injuries in 37 of 222 knees (16.7%).

Patients with a PCL injury had a high incidence of multiple ligament injuries, with the isolated PCL tear being rare (Tables 6 and 7). In the 85 knees with PCL tears, associated ligament injuries included the following: 3 ACL/PCL tears, 18 ACL/PCL/MCL tears, 18 ACL/PCL/Posterior Lateral Corner tears, 35 PCL/Posterior Lateral Corner tears, 8 PCL/MCL tears, and 3 isolated PCL tears. It is interesting to note that the majority of PCL tears occurred in zone II which is a midsubstance rupture.[1,3] There was one zone I PCL tear in a patient with ACL/PCL/MCL injuries, and two zone III tibial bony avulsions. One in a patient with a PCL/posterior lateral corner tear, and one in an isolated PCL tear. The three-zone concept of PCL injury and evaluation is described in detail elsewhere.[1,3]

TABLE 2. *PCL Injuries In Acute Traumatic Hemarthrosis Of The Knee*

Acute knee injuries	120
PCL tears	46 (38.3%)
Multiple trauma	32 (69.6%)
Sports	14 (30.4%)
PCL/multiple ligaments	43 (93.5%)
PCL/isolated	3 (6.5%)

Data from Fanelli et al.[2]

TABLE 3. *Patient Population*

Acute knee injuries	222
Males	162
Females	59
Right knees	103
Left knees	119

Injuries also associated with PCL tears included 17 meniscal tears, 11 articular cartilage injuries, 5 medial retinacular tears, 1 patella tendon rupture, 1 femoral shaft fracture, 2 tibial plateau fractures, 1 tibial shaft fracture, and 3 pelvic fractures. Mechanisms of injuries associated with PCL tears were 43 motorcycle/motor vehicle accidents, 28 sports-related injuries, 3 pedestrian/automobile accidents, 9 falls, and 2 industrial/farming accidents (Table 4).

DISCUSSION

Acute traumatic hemarthrosis of the knee is associated with serious structural damage about the knee. In our initial report, we described a 44.2% incidence of PCL injuries.[1] This was higher than any other studies previously reported in the literature.[4-13] Trauma patients accounted for 81.5% of the PCL injuries, and sports accounted for 18.5% of the PCL injuries. The isolated PCL injury was rare (7.5%). The high incidence of PCL injuries in that series was attributable to our specific type of practice at a tertiary-care regional trauma center.

One criticism of our initial report[1] is that 61 acute knee injuries is a small sample population. Thus, our high reported incidence of PCL injuries may not remain relatively constant over time. The purpose for continuing this study was to see if the incidence of PCL injuries at our facility remained at about 40% in acute traumatic hemarthrosis of the knee.

The second phase of our study had 120 acute knee

TABLE 4. *Mechanisms Of Injury*

Motor vehicle/motorcycle accident	43
Sports	28
Pedestrian/automobile accidents	3
Falls	9
Farming/industrial accidents	2

TABLE 5. *Structural Injuries*

ACL	148/222	66.7%
PCL	85/222	38.3%
MCL	50/222	22.5%
PLC	60/222	27.0%
LCL	3/222	1.4%
MMT	63/222	28.4%
LMT	34/222	15.3%
MRT	14/222	6.3%
PTR	2/222	0.9%
PatDis	4/222	1.8%
Chondral injuries	37/222	16.7%

Abbreviations: MCL, medial collateral ligament; PLC, posterior lateral corner; LCL, lateral collateral ligament; MMT, medial meniscus tear; LMT, lateral meniscus tear; MRT, medial retinacular tear; PTR, patellar tendon rupture; PatDis, patellar dislocation; Chondral injuries, articular cartilage injuries.

injuries with hemarthrosis.[2] There were 46 PCL injuries giving an incidence of 38.3%; 69.6% (32 of 46) of the PCL injuries were secondary to multiple trauma mechanisms and 30.4% (14 of 46) of the PCL injuries were attributable to sports-related activities. Forty-three of 46 (93.5%) PCL injuries occurred in combination with other ligamentous injuries. The isolated PCL tear was rare (3 of 46, 6.5%). The findings in the second phase of our study were very consistent with respect to our initial investigation.[1]

The third phase of our study provided the results reported in this article. This consisted of 222 acute knee injuries with hemarthrosis. The incidence of PCL injuries remained constant at 38.3% (85 of 222); 56.5% (48 of 85) were secondary to multiple trauma-related mechanisms of injury and 32.9% (28 of 85) were secondary to athletic injuries. PCL injuries combined with other ligament injuries occurred in 96.5% (82 of 85), whereas the isolated PCL injury continued to be rare (3.5%, 3 of 85).

It is important to note that all PCL injuries were clinically detectable. This means that all knees had a decrease in their tibial step off compared with the uninvolved knee, and all knees had a positive posterior drawer. A potential criticism is that knees with subclinical PCL injuries may have been missed. Subclinical implies that the physical examination indicated no PCL laxity, but there may have been evidence of PCL injury shown on magnetic resonance imaging. This would give an even higher incidence of PCL injuries than we have reported here.

TABLE 6. *Associated Ligament Injuries With PCL Tears*

ACL/PCL	3
ACL/PCL/MCL	18
ACL/PCL/PLC	18
PCL/PLC	35
PCL/MCL	8
Isolated PCL	3

TABLE 7. *Associated Structural Injuries With PCL Tears*

Meniscus tears	17
Articular cartilage injuries	11
Medial retinacular tears	5
Patella tendon rupture	1
Femur fracture	1
Tibial plateau fracture	2
Tibial shaft fracture	1
Pelvis fracture	3

CONCLUSION

Acute traumatic hemarthrosis of the knee may indicate serious structural damage. Trauma patients presenting with acute traumatic hemarthrosis of the knee should be suspected of having a PCL injury. Our series from a regional trauma center has shown a consistent 38% incidence of PCL injuries in patients presenting with acute traumatic hemarthrosis of the knee. The PCL is injured more frequently in multiple trauma patients (56.5%) compared with athletic injury patients 32.9%). The isolated PCL injury is rare at our institution (3.5%), whereas PCL injury combined with other knee ligament injuries is much more common (96.5%). Higher energy injury mechanisms may account for the increased incidence of PCL injuries in multiple trauma patients.

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