# Dislocation of total knee arthroplasty

## A report of 6 cases with 2 patterns of instability

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We report 6 cases of dislocation of total knee arthroplasty (TKA). We identified 2 patterns of instability in the sagittal plane, one with posterior translation of the tibia, occurring mainly in the postoperative period and usually resulting from a trauma, and the other with anterior translation of the tibia, occurring 6 months to 7 years postoperatively and with no preceding trauma. In the latter group, instability was manifested gradually as a lengthening of the posterior cruciate ligament and the posterior capsule, leading to a recurvatum deformity of the knee.

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Dislocation of total knee arthroplasty (TKA) is a rare but serious complication. The dislocation may become manifest in an anterior or posterior manner. Only a few small series of posterior dislocation of TKA have been reported (Bargren 1980, DenHartog et al. 1987, Galinat et al. 1988, Sydney and Mallory 1989, Gebhard and Kilgus 1990, Sharkey et al. 1992). Likewise very few cases of anterior instability of TKA have been described (Insall et al. 1979, Sledge and Ewald 1979, Cameron and Hunter 1982). We report 6 cases of dislocation of TKA: 3 posterior and 3 anterior.

## Case reports (Table)

### *Case 1*

A 71-year-old woman underwent posterior cruciate-retaining TKA for arthrosis with 20° valgus deformity of the right knee. Ligamentous releases included the lateral collateral ligament, the popliteus tendon, the arcuate ligament complex and the lateral retinaculum. She was discharged 5 days postoperatively.

On the seventh postoperative day, the patient accidentally twisted her right knee while getting up from a chair and complained of pain and inability to extend the knee. Radiographs of the knee showed a posterolateral dislocation. The patient was treated with closed reduction and cast immobilization for 6 weeks.

At 2 years' follow-up, the knee was pain-free, with satisfactory stability and function. Knee and functional scores, based on the Knee Society Clinical Rating System (Insall et al. 1989) were 95 and 90, respectively.

### *Case 2*

An 84-year-old woman underwent posterior cruciate-retaining TKA for rheumatoid arthritis with 45° valgus deformity of the left knee. Extensive soft tissue releases included the lateral collateral ligament, the

**Evaluation of knee function at follow-up**

| Case | Age | Sex | Side | Type of dislocation | Trauma | Follow-up (months) | ROM [a] | Femorotibial valgus angle | Mediolateral instability [b] | Anteroposterior instability (mm) [c] | Knee score | Functional score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 71 | F | R | Posterior | Yes | 24 | 0–100° | 6° | <6° / <6° | 5–10 | 95 | 90 |
| 2 | 84 | F | L | Posterior | Yes | 16 | 0–95° | 7° | <6° / 6°–9° | 10 | 76 | 0 |
| 3 | 70 | M | R | Posterior | Yes | 3 | 0–100° | 6° | <6° / 6°–9° | <10 | 87 | 80 |
| 4 | 73 | F | R | Anterior | No | 20 | 0–105° | 6° | <6° / 6°–9° | 5–10 | 92 | 80 |
| 5 | 68 | F | R | Anterior | No | 16 | 0–100° | 5° | <6° / 6°–9° | 5–10 | 89 | 80 |
| 6 | 79 | M | L | Anterior | No | 12 | 0–100° | 5° | 6°–9° / >10° | 10 | 70 | 50 |

[a] Range of motion; [b] Measured in extension / at 30° flexion; [c] Measured in 90° flexion.

Figure 1. Case 3. Posterior dislocation of TKA.

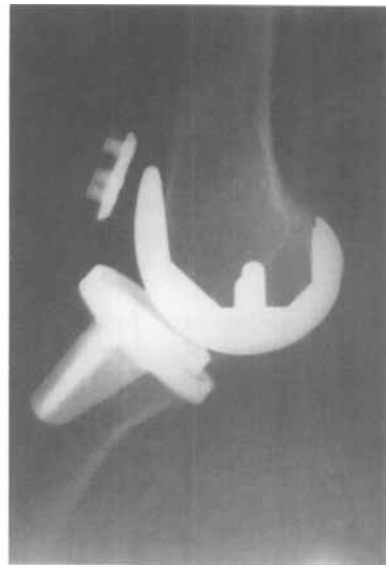

Figure 2. Case 5. Anterior translation of the tibial component.

popliteus tendon, the arcuate complex and the lateral retinaculum. Bone grafting was performed to restore bone stock deficiency of the lateral tibial plateau.

12 years postoperatively, the patient sustained a posterolateral dislocation of the TKA and a fracture of the left hip from a fall in the nursing home. The dislocation was treated by revision TKA after an unsuccessful closed reduction. The patella was not replaced because of inadequate bone stock.

At 16 months' follow-up, the knee was pain-free, with satisfactory alignment and stability. The knee score was 76, and the functional score was 0. The functional score was affected by the patient's poor general physical condition.

### *Case 3*

A 70-year-old man underwent revision of the right TKA for aseptic loosening and extensive wear of a 20-year-old TKA. A posterior stabilized prosthesis was implanted. The patient fell backwards and sustained a posterior dislocation of the TKA 8 days postoperatively. Neurovascular status of the leg was intact, although the patient noticed a transient tingling sensation in his right foot. Closed reduction and cast immobilization were performed.

At 3 months' follow-up, the right knee was pain-free with satisfactory stability and function. The knee score was 87, and the functional score was 80.

### *Case 4*

A 73-year-old woman underwent posterior cruciate-retaining TKA for osteonecrosis of the lateral femoral condyle and arthrosis with 18° valgus of the right knee. At surgery, an approximately 5 mm recession of the distal insertion of the posterior cruciate ligament was performed.

3 years postoperatively, the patient noticed increasing anterior knee pain and unsteady gait and complained that the knee frequently gave out. The knee was in recurvatum in the standing position. Mediolateral instability was < 6° on extension and 6°—9° at 30° of knee flexion. Anteroposterior instability was > 10 mm at 90° of knee flexion. Radiographs showed anterior translation of the tibial component. Revision TKA with a posterior stabilized prosthesis was performed. At surgery, the posterior cruciate ligament and the posterior capsule were grossly stretched, loose and non-functional, although the ligament appeared anatomically intact. Moderate wear was noted on the posteromedial aspect of the tibial insert and the patellar button.

At 20 months' follow-up, the right knee was pain-free with satisfactory stability and function. The knee score was 92 and the functional score was 80.

### *Case 5*

A 68-year-old woman underwent posterior cruciate-retaining TKA for rheumatoid arthritis of the right knee 6 years previously. The patient complained of increasing anterior knee pain, clicking and progressive instability of the knee. The knee was in recurvatum in the standing position. Mediolateral instability was 6° on extension and >10° at 30° of knee flexion. Anteroposterior instability was > 10 mm at 90° of

knee flexion. Radiographs showed anterior translation of the tibial component. At revision, the posterior cruciate ligament and the posterior capsule were severely stretched and non-functional although there was no gross disruption of the ligament.

At 16 months' follow-up, the knee was pain-free with satisfactory stability and function. The knee score was 89 and functional score 80.

### *Case 6*

A 79-year-old man underwent posterior cruciate-retaining TKA for a Charcot-like arthropathy of the left knee due to diabetes mellitus. Autografts were performed to restore the bone deficiency on the medial tibial plateau. 3 months postoperatively, the patient fell and sustained a sprain of the medial collateral ligament that was treated with a hinged knee brace and walker. The knee became progressively more unstable and moderately painful after 3 months of closed treatment. Radiographs showed severe anterior translation of the tibial component. The knee was in severe recurvatum in the standing position. At revision, the posterior cruciate ligament and the posterior capsule were grossly stretched and non-functional, although they appeared anatomically intact.

At 12 months' follow-up, the knee was mildly painful and moderately unstable with limited function. The knee score was 70 and the functional score was 50.

## Discussion

We identified two patterns of TKA instability in the sagittal plane, one with posterior translation of the tibia, mainly occurring in the postoperative period and usually resulting from a trauma, and the other with anterior translation of the tibia, occurring 6 months to 7 years postoperatively and with no preceding trauma.

The factors predisposing to posterior dislocation of TKA are valgus deformity of the knee, malposition of the components, extensor mechanism dysfunction, patellar instability and improper selection of prosthetic design. In valgus knees, excessive release of the lateral ligaments and over-resection of the posterior femoral condyle increase the flexion gap between the femur and the tibia and cause instability of the knee. Bargren (1980) describes the "contradictory rotation" in which the tibia is flexed and externally rotated in surgery, while the tibia rotates internally in flexion during normal walking. The tibial tubercle, not the posterior cortex of the proximal tibia, should be used as the reference for rotational alignment of the tibial component. Internal malrotation of the tibial component increases the lateral vector of the extensor mechanism and causes patellar instability. It also increases rotational movements of the tibial component on the femur beyond the normal 6°–13° "screw home" motion of the knee, as well as increasing the eccentric loading of the tibial component with flexion of the knee. The mechanism of posterior dislocation of TKA is flexion and external rotation of the knee when the lateral side of the knee is too loose. It frequently results from a trauma (Figure 1).

The anterior dislocation of TKA is a distinct entity. It occurs gradually and is not associated with trauma. The posterior cruciate ligament provides anteroposterior stability of the knee and assists in femoral rollback which is essential to extensor mechanism function. When the functional integrity of the posterior cruciate ligament is compromised, posterior control of the knee joint falls upon the patella and patellar tendon. Consequently, there is a large increase in force applied to the articular surface of the patella and the femoral trochlea. The extensor mechanism holds the tibia forward and controls extension of the knee (Kelman et al. 1989). Sledge and Ewald (1979) postulate a 4-bar linkage system; they showed that at 90° of knee flexion with a functioning patella, the patellar tendon is roughly parallel to the posterior cruciate ligament, and the quadriceps tendon is roughly parallel to the anterior cruciate ligament. When more than 2 bars are destroyed, the patella and the extensor mechanism are altered and anteroposterior instability results.

Stiehl et al. (1995) demonstrated abnormal kinematics in posterior cruciate-retaining TKA. In normal knee motion, the contact of the femur on the tibia is anterior to the midline of the tibia. In posterior cruciate-retaining TKA, the contact point between the femoral component and the tibial component is posterior to the midsagittal plane of the tibia. Without restraint by the ACL, the PCL tends to pull the femur posteriorly in the extended knee, resulting in anterior translation of the tibia and posterior translation of the femorotibial contact point. This abnormal motion of the prosthetic knee may cause gradual lengthening of the posterior cruciate ligament and the posterior capsule.

Typically the posterior cruciate ligaments of older patients undergo substantial changes in mechanical properties. Recession of the posterior cruciate ligament may violate the anatomic and functional integrity of the ligament. Over an extended period, the posterior cruciate ligament and the posterior capsule may gradually stretch in a prosthetic knee with abnormal kinematics. When mechanical loadings exceed the

threshold, the posterior cruciate ligament and the posterior capsule will yield and become non-functional. Consequently, anterior instability and eventual anterior luxation of TKA occur (Figure 2). When the integrity of the posterior cruciate ligament is in question, a posterior stabilized prosthesis should be used.

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