Knee dislocation

Jan Lindahl

Helsinki University Central Hospital, Helsinki, Finland

Acute knee dislocation is an uncommon injury. They are orthopaedic emergencies because they might have associated vascular or nerve damage. Because they often spontaneously reduce before initial evaluation, the true incidence is unknown. The dislocation should be reduced as soon as it is recognized. Unless the popliteal artery injury is recognized and the appropriate vascular repair performed within 6-8 hr from the time of injury, amputation is almost unavoidable. Dislocation usually involves injury to both cruciate ligaments, and they are often combined with a disruption of the medial collateral ligament and posteromedial structures or lateral collateral ligament and posterolateral complex. Definitive management of knee dislocation remains controversial. Many authors have noted superior results of surgical treatment compared to nonsurgical treatment. In most cases early ligament surgery (within 7-21 days of injury) seems to produce better results compared to late reconstructions. However, controversies persist regarding surgical timing, surgical technique, graft selection, and rehabilitation.

Complete dislocation of the knee is an uncommon injury (1,2). Because of the potentially severe neurovascular damage, knee dislocation can be limb-threatening, and it is important to make the correct diagnosis without delay. Presentation with the knee still dislocated gives a correct diagnosis. However, knee dislocation might spontaneously reduce before initial evaluation, in which case, the severity of the ligamentous disruption may be underestimated.

Dislocation of the knee usually results from high-energy trauma such as motorcycle and motor vehicle accidents or a sports-related injury (1–3). However, if the knee dislocation is due to an unusual cause, such as a simple fall in an obese patient, the correct diagnosis may be more difficult to make (4).

Dislocation involves injury to multiple ligaments of the knee. Dislocation usually involves injury to both anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL). In addition a disruption of the medial collateral ligament (MCL) and/or posteromedial complex or lateral collateral ligament (LCL) and/or posterior lateral complex (PLC) are frequent (5). Associated neurovascular, meniscal, and osteochondral injuries are often present and complicate treatment.

Classification

Anatomical classifications are based on either the position of the displaced tibia on the femur, as described by Kennedy (6), or on the pattern of ligamentous and associated injuries (2,7). In Kennedy's classification system, five types of dislocation are described: anterior, posterior, medial, lateral, or rotational. Both cruciate ligaments might be disrupted in all these injuries. A rotatory knee dislocation occurs around one of the collateral ligaments (LCL) leading to a combined ACL and PCL injury and a rupture of the remaining collateral ligament. Knee dislocations that spontaneously reduce are difficult to classify.

A more recent classification system assesses the pattern of ligamentous disruption and the presence or absence of an associated intra-articular fracture (Table 1), providing a clearer guide to the nature and severity

of the injury and options for treatment (2,7).

Dislocation of the knee may be regarded as acute (seen < 3 weeks), or chronic (>3 weeks).

Initial evaluation and management

The vascular status of the limb must be determined quickly and managed appropriately. The knee should be reduced immediately through gentle traction-countertraction with the patient under anesthesia. After reduction, vascular examination should be repeated. If the limb is ischemic, emergent surgical exploration and revascularisation is required. Postreduction a formal angiogram, MR angiography or CT angiography should be done especially if the patient has a high velocity injury, is polytraumatized or has altered mental status and the clinical evaluation of the vitality of the leg is uncertain. Compartment syndrome, open injury, and irreducible dislocation are other indications for emergent surgery.

A spontaneously reduced knee dislocation can be overlooked especially when evaluating a multiply traumatized patient. A complete physical examination of the knee, including neurovascular assessment, is essential for all high-energy trauma victims. If laxity of two or more of the major ligaments of the knee is found, even in low energy trauma cases, a probable diagnosis of knee dislocation should be made. The physical signs of these cases include a large knee effusion, and overall swelling of the extremity, an abnormal degree of recurvatum, varus/valgus instability with the knee in full extension, and grossly abnormal Lachman test in both directions.

Definitive treatment

Many authors have noted superior results of surgical treatment of knee dislocation when compared to nonsurgical treatment (5,8–10). In most cases early ligament surgery (on the second or third week post injury) seems to produce better results compared to late reconstructions (11,12). However, Engebretsen et al. (13) reported lower knee function in patients with high energy trauma compared to low energy trauma, but acute vs. chronic surgery did not have an effect on the outcome. The management of knee dislocations remains controversial. Controversies persist regarding surgical timing, surgical technique, graft selection, and rehabilitation. The goal of operative treatment is to retain knee stability, motion, and function.

The most common injury patterns include both cruciate ligaments and either medial collateral ligament (MCL) and posteromedial structures or lateral collateral ligament (LCL) and/or posterolateral structures (PLC). Less commonly both cruciates and both collateral ligaments are disrupted. Our policy has been early (from 7 to 21 days) simultaneous reconstruction of both cruciate ligaments and repairing or reconstruction of grade III LCL and PLC injuries. Most of acute grade III MCL tears are successfully treated with brace treatment when ACL and PCL are reconstructed early (9,12).

Most cruciate ligament injuries are midsubstance tears that need to be reconstructed with tendon autografts or allografts (5,11). Repairs can be done in cases of bony avulsion of cruciate ligaments or grade III avulsion injuries of the collaterals or capsular inju-

Table 1. Classification of dislocation of the knee based on the extent of ligamentous injury

Classification	Associated ligamentous injury
KD-I	Dislocation without both cruciates involved
KD-II	Dislocation with bicruciate disruption only
KD-III	Dislocation with bicruciate + posteromedial or posterolateral disruption
KD-IV	Dislocation with bicruciate + posteromedial and posterolateral disruption
KD-V	Dislocation with fracture
KD-V1	Dislocation without both cruciates involved
KD-V2	Bicruciate disruption only
KD-V3M	Bicruciate + posteromedial disruption
KD-V3L	Bicruciate + posterolateral disruption
KD-V4	Posteromedial and posterolateral disruption

ries. Intrasubstance grade III tears of the LCL might be possible to repair (in early state), but often need to be augmented with tendon allograft. The PLC and the popliteofibular ligament are reconstructed with tendon allografts (14).

Operative technique

Both cruciate ligaments are reconstructed arthroscopically. The ACL tunnels are placed in the center of its anatomic insertion in tibia and femur (anteromedial portal technique). A double bundle PCL reconstruction with transtibial tunnel technique is used. The PCL tibial tunnel is drilled first under arthroscopic guidance using the PCL guide. The ACL tibial guide is drilled at least 2 cm proximal to the PCL tunnel to ensure that wide enough bone bridge remains between these tunnels. Fluoroscopy is used to ensure the right PCL guidewire placement.

Sequence of arthroscopic bicruciate ligament reconstruction (Author's technique)

Step 1 Drill PCL tibial tunnel first, then ACL tibial tunnel
Step 2 Drill two PCL femoral tunnels, then ACL femoral tunnel (anteromedial portal)
Step 3 Pass PCL graft through tibial tunnel and fix posteromedial bundle in femoral tunnel
Step 4 Fix PCL graft in tibial tunnel with anteromedial step off
Step 5 Fix anterolateral bundle of the PCL graft in femoral tunnel
Step 6 Pass ACL graft through tibial tunnel and fix in femoral tunnel
Step 7 Fix ACL graft on tibia at slight flexion

Töölö Hospital experience

Early ligament surgery (within 7–21 days of injury) seems to produce better results compared to late reconstructions (12). Early bicruciate reconstruction with repair or reconstruction of lateral and posterolateral structures (LCL and PLC) offers the best chance for an optimal outcome. Primary repair of grade III LCL avulsion injuries (from the fibular head) may be performed if surgical treatment is undertaken during the second or the third week after injury. The nonoperative treatment of acute grade III MCL injury with a hinged brace renders good knee stability when both cruciate ligaments are reconstructed early. Delayed surgical treatment of collateral ligament injuries usually requires reconstructive procedures.

Rehabilitation

Our protocol after bicruciate ligament reconstruction has been active. Progressive range of motion is started after 2 weeks with an unlocked functional brace. Posterior splint immobilization is used for the first two weeks. If simultaneous suturation of a meniscus tear has been performed, motion is limited to 60° of flexion during the first 4 weeks. Progression from partial to full weight bearing is done over the first 6 weeks. Quadriceps exercises are progressed to open-chain knee extension exercises early as well as closed-chain hamstring exercises. Brace is discontinued after 12 weeks.

References

1. Armstrong PJ, Franklin DP. Management of arterial and venous injuries in the dislocated knee. Sports Med Arthrosc Rev. 2001;9:219-226.

2. Robertson A, Nutton RW, Keating JF. Aspects of current management. Dialocation of the knee. J Bone Joint Surg Br. 2006;88-B:706-711.

3. Hollis JD, Daley BJ. 10-year review of knee dislocations: is arteriography always necessary? J Trauma. 2005;59:672-676.

4. Peltola EK, Lindahl J, Hietaranta H, Koskinen SK. Knee dislocation in overweight patients. AJR. 2009;192:101-106.

5. Rihn JA, Groff YJ, Harner CD, Cha PS. The acutely dislocated knee: evaluation and management. J Am Acad Orthop Surg. 2004;12(5):334-346.

6. Kennedy JC. Complete dislocation of the knee joint. J Bone Joint Surg Am. 1963;45-A:889-904.

7. Wascher DC, Dvirnak PC, DeCoster TA. Knee dislocation: initial assessment and implications for treatment. J Orthop Trauma. 1997;11:525-529.

8. Mariani PP, Margheritini F, Camillieri G. One-stage arthroscopically assisted anterior and posterior cruciate ligament reconstruction. J Arthroscopic Rel Surg. 2001;17(7):700-707.

9. Fanelli GC, Edson CJ. Arthroscopically assisted combined anterior and posterior cruciate ligament reconstruction in the multiple ligament injured knee: 2- to 10-year follow-up. J Arthroscopic Rel Surg. 2002;18(7):703-714.

10. Wong CH, Tan JL, Chang HC, Khin LW, Low CO. Knee dislocations: a retrospective study comparing operative versus closed immobilization treatment outcomes. Knee Surg Sports Traumatol Arthrosc. 2004;12:540-544.

11. Harner CD, Waltrip RL, Bennett CH, Francis KA, Cole B, Irrgang JJ. Surgical management of knee dislocations. J Bone Joint Surg Am. 2004;86-A:262-273.

12. Lindahl J, Hietaranta H, Koskinen Seppo, Hirvensalo E. Knee dislocations: Outcome of surgical treatment. Finnish J Orthop Traumatol. 2008;31(1):31-35.

13. Engebretsen L, Risberg MA, Robertson B, Ludvigsen TC, Johansen S. Outcome after knee dislocations: A 2-9 years follow-up of 85 consecutive patients. Knee Surg Sports Traumatol Arthrosc. 2009;17:1013-1026.

14. LaPrade RF. Posterolateral knee injuries. Anatomy, evaluation, and treatment. 1st. ed. New York, Stuttgart: Thieme, 2006.