Knee dislocations – Acute treatment

Jan Lindahl
Helsinki University Hospital

Complete dislocation of the knee (KD) 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 general (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 as described by Schenck (7) and others (2,8,9). In Kennedy's classification system, five types of dislocation are described: anterior, posterior, medial, lateral, or rotational. Dislocation usually involves injury to both cruciate ligaments and therefore rupture of both cruciates should be considered as a knee dislocation (8). 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 with this system.

A more recent anatomic 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.

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. The most effective method for rapidly and accurately diagnosing arterial injury remains controversial.

Conventional angiography was once the gold standard for diagnosis vascular injury and was routinely ordered after knee dislocation. Now many authors recommend selective angiography for those patients with abnormal pulses or ankle-brachial indexes (ABIs) (3,10-12). Mills et al. showed in their prospective study that ABI can accurately predict whether patients with knee dislocations have sustained vascular injury (10). In their study, 11 patients with an ABI lower than 0.90 underwent angiography. All 11 had arterial injury requiring surgical treatment. The remaining 27 patients had an ABI of 0.90 or higher. None had vascular injury detectable by serial clinical examination or duplex ultrasonography.

CT angiography has now become the study of choice over conventional angiography and has been noted to be 100% sensitive and specific (13). MR angiography is the third imaging modality for diagnosis vascular injury (14). Pedal pulse examination alone or arterial duplex ultrasound alone are not sensitive enough and might fail to identify significant vascular injury because of rich collateral circulation.

If the limb is ischemic, emergent surgical exploration and revascularisation is required. Postreduction

Table 1. Anatomic knee dislocation classification system based on the extent of ligamentous injury originally described by Schenck[7] and modified by Wascher et al.[8] and Stannard et al.[9]

Classification	*Subclass*	*Injury pattern*
KD-I		Single cruciate dislocation (associated with MCL/POL and/or LCL/PLC)
KD-II		Bicruciate injury only: ACL and PCL
KD-III		Bicruciate with medial or lateral disruption
	KD-IIIM	Bicruciate with medial injury: ACL, PCL, MCL/POL
	KD-IIIL	Bicruciate with lateral injury: ACL, PCL, LCL/PLC
KD-IV		Bicruciate with medial and lateral injuries: ACL, PCL, MCL/POL, LCL/PLC
KD-V		Knee dislocation with associated fracture
	KD-V1	ACL or PCL with associated fracture
	KD-V2	ACL and PCL with associated fracture
	KD-V3M	ACL, PCL, and MCL/POL with associated fracture
	KD-V3L	ACL, PCL, and LCL/PLC with associated fracture
	KD-V4	ACL, PCL, MCL/POL, and LCL/PLC and associated fracture

a formal angiography, CT angiography, or MR angiography should be done especially if the patient has a high velocity injury, is polytraumatized or have altered mental status and the clinical evaluation of the vitality of the leg is uncertain. The vascular repair should be performed within 6 to 8 hours from the time of injury, because after that the patient is at significant risk of critical ischaemia in the lower leg, which can result in limb loss (15). Fasciotomies are made after vascular reconstruction. Open knee dislocation, compartment syndrome, and irreducible dislocation are other indications for emergent surgery.

Other potential complications seen in KDs include deep vein thrombosis, and neurologic injury. The common peroneal nerve is most commonly injured with a reported incidence of 25 % in a systematic review by Medina et al. (14). The presence of peroneal palsy should alert the examiner to the potential for multiple ligament disruption and potential vascular injury. In addition, Merritt and Wahl found in their material of 90 consecutive KDs that 38 % of patients presenting with a peroneal palsy suffered from a concomitant arterial injury (12).

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.

After closed reduction the knee joint is stabilized with a ligament brace. In overweight patients, especially in morbid obese patients, the use of a brace might be difficult and it does not stabilize the knee enough. In these cases a synthetic plaster cast is a better option for provisional stabilization of the knee joint. The cast should be open in front which make it possible to take it away every day and start knee range-of-motion exercises. Provisional stabilization with spanning external fixator is used after vascular reconstruction and fasciotomies.

Definitive treatment

Many authors have noted superior results of surgical treatment of knee dislocation when compared to nonsurgical treatment (5,16-18). In most cases early ligament surgery (on the second or third week post injury) seems to produce better results compared to late reconstructions (19,20). However, Engebretsen et al. (21) 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 (17,20).

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 injuries. 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 (22).

Conclusions

- KDs continue to represent a diagnostic and therapeutic challenge to trauma surgeons.
- KDs are orthopaedic emergencies because they might have associated neurovascular damage.
- The dislocation should be reduced as soon as it is recognized.
- Dislocation usually involves injury to both cruciate ligaments, and they are often combined with a disruption of the MCL and posteromedial structures or LCL and posterolateral complex.
- KDs often spontaneously reduce before initial evaluation, in which case, the severity of the injury may be underestimated.
- The vascular repair should be performed within 6 to 8 hours from the time of injury.

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