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Summary

Knee dislocations are rare but challenging injuries. Approximately half of them originate from sports. This review describes the diagnostic work-up of knee dislocations. It covers their classification, the initial assessment during the first hours, the secondary assessment during the first two weeks and anatomical considerations. Determining a treatment strategy after knee dislocations requires recognizing the severity of the injury, specifying the extent and location of all damaged structures and understanding their combined effect on joint kinematics.

Keywords
Knee dislocation– diagnostics– multiligament knee injury– physical examination– imaging

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Klassifikation, Diagnose und anatomische Grundlagen von Knieluxationen

Zusammenfassung

Knieluxationen sind seltene, aber schwerwiegende Verletzungen, von denen ungefähr die Hälfte auf Sportunfälle zurückzuführen sind. Der Artikel beschreibt ihre Klassifikation sowie ihren diagnostischen und therapeutischen Algorithmus sowohl in der Akutphase als auch der sekundären Beurteilung in den ersten Wochen. Die Therapiestrategie hängt insbesondere vom anatomischen Verständnis der Verletzung und dem Zusammenhang der verletzten Strukturen mit der Gelenkkinematik ab.

Schlüsselwörter
Knie– Luxation– multiligamentäre Knieverletzung– klinische Untersuchung– Bildgebung

REVIEW / SPECIAL ISSUE

Classification, diagnosis and anatomical considerations in knee dislocations

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Introduction

Knee dislocations pose a challenge for orthopaedic surgeons and sports physicians. It is estimated that knee dislocations account for less than 0.02–0.2% of all orthopaedic injuries [21,38]. However, these estimations unlikely reflect the true incidence, since patients frequently present with a reduced knee and physical examination is considered notoriously unreliable to assess the severity of the injury [13,15,21,29,44,47,75,77]. High velocity injuries account for approximately half of the knee dislocations, particularly motorcycle injuries (18%), motor vehicle collisions (7%) and pedestrians struck by a car (7%) [13]. Sports injuries are another major cause of knee dislocations, accounting for approximately 47% of them [13] (Figure 1). For instance in rugby and football forced hyperextension may result from a direct tackle or from poor landing resulting in anterior dislocations. Posterior dislocations more likely result from a direct impact on the tibia in a flexed knee [18]. With the recent increase of extreme sports, more adolescents and young adults are prone to high velocity injuries. A recent epidemiological study demonstrated that knee dislocations in extreme sports were particularly more common among male skiers between 10 and 19 years old [64]. They therefore are likely to occur in remote areas.

When confronted with an acute knee dislocation, whether in the field or in the emergency department, treatment begins with recognizing the severity of the injury and avoiding detrimental delays. The extent of the injury is often not evident during the initial presentation, despite extensive multiligament disruptions and a high risk of limb threatening associated injuries. The distinction between an acute multiligament knee injury and a true knee dislocation is difficult. It is therefore more practical to apply the same high index of suspicion to the assessment of every acute multiligament knee injury. The aim

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Figure 1
Image capture of a dislocation of the left knee in a female gymnastic due to a hyperextension injury (courtesy of Dr. B. Galaud, France).

of this review is to provide a description of injury patterns after acute multiligament injuries, methods to reach a diagnosis and discuss the rationale behind the various treatment options.

Classification

Classification systems serve to determine the appropriate treatment strategy and prognosis and facilitate communication to enable comparison of cases. Kennedy classified knee dislocations based on the position of the femur relative to the tibia as: anterior, posterior, lateral, medial and rotatory [30]. Rotatory dislocations are further subdivided into anteromedial, anterolateral, posteromedial and posterolateral. The use of this classification in daily practice is however difficult if patients present with a reduced leg. Furthermore it does not specify the specific extent of the injury.

The anatomic Knee Dislocation (KD) classification introduced by Schenk and modified by Wascher provides a more detailed insight in the structures involved [66,78]. A knee dislocation (KD) type I involves a torn ACL, with a functioning PCL and variable collateral involvement. A KD-II is a knee dislocation with complete disruption of both cruciates, with functional collaterals. A KD-III is an injury to both cruciate ligaments and a disruption of either the posteromedial or posterolateral ligaments, with an uppercase L indicating lateral and an uppercase M indicating medial involvement. KD-IV is associated with tears of both cruciates and both the posteromedial as well as the posterolateral ligaments. A KD-V is a fracture dislocation involving multiple ligament injury, with further subclassification to reflect the number of ligaments involved. The added uppercase C indicates circulatory damage, while the uppercase N indicates a nerve lesion.

The anatomic KD classification is relatively straightforward to use. However, determining a treatment strategy requires differentiating between lesions requiring repair (tears) and those with a good likelihood of spontaneous healing (capsuloperiosteal detachment) [4]. The distinction between proximal detachment, midsubstance, or distal ligament detachment and tendon desinsertion, midsubstance and musculotendinous junction tendon injuries is therefore a valuable addition to the anatomic KD classification [86]. Finally, assessment of the severity of the laxity requires interpreting Magnetic Resonance Imaging (MRI) findings in light of stability tests or stress radiographs (X-rays).

Clinical assessment and imaging

Initial assessment

In case of a high-velocity knee dislocation, the first priority is primary assessment according to Advanced Trauma Life Support (ATLS) guidelines to rule out and treat life-threatening injuries. If possible, reduction should be performed in the field or directly in the emergency department to avoid ischaemic delays. Adjunctive examinations, such as X-rays, should not postpone reduction. After reduction, neurovascular status is assessed and X-rays are obtained to confirm an adequate reduction. CT imaging may be required to demonstrate associated fractures. Reduction may however be impossible due to impingement of soft tissues, which necessitates immediate surgical exploration. For example, during a posterolateral knee dislocation, the femoral condyle may buttonhole through the medial capsule, causing a dimple sign, an invagination of the medial structures. A true lateral dislocation or medial dislocation may however cause soft tissue impingement as well [61]. Although rarely encountered, open dislocations pose a high risk of infections and a reported neurovascular injury incidence of 63% [84]. In case of severe soft tissue compromise combined with gross instability or suspected vascular damage, immediate stabilization of the soft tissues with an MRI compatible external fixation device may be necessary [21,39].

Examination of knee stability in an acute situation is often impossible due to pain and swelling and should be done cautiously. The integrity of the collaterals is examined using valgus and varus stress and the Lachman test and the posterior drawer test are performed to assess the integrity of the cruciate ligaments. More extensive stability testing using combined varus/valgus and rotatory forces is however not sensible at this stage since it may cause re-dislocation or further displacement of initially undisplaced fractures. More extensive testing should be performed cautiously under