

Review Article

Traumatic knee dislocations: immediate interventions and long-term outcomes

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Received: 28 November 2024

Accepted: 18 December 2024

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ABSTRACT

Traumatic knee dislocations are severe orthopedic injuries that result from high-energy trauma and involve complete disruption of the tibiofemoral joint. These injuries are rare but represent a significant clinical challenge due to the risk of associated vascular, nerve, and soft tissue damage. Early diagnosis and timely intervention are critical for reducing the risk of permanent disability. The immediate management involves a comprehensive assessment, including history, physical examination, and imaging, followed by the restoration of joint alignment through reduction techniques. Proper management of associated vascular injuries, particularly popliteal artery damage, and nerve injuries, such as peroneal nerve damage, is crucial to prevent long-term complications. Following reduction, knee stabilization and immobilization are necessary to promote healing. Long-term outcomes can be challenging, with complications such as joint instability, post-traumatic arthritis, chronic pain, and the potential for recurrent dislocations. Rehabilitation, which includes range of motion exercises, strength training, and proprioceptive training, plays a vital role in restoring function. In some cases, surgical intervention, including ligament reconstruction or total knee arthroplasty, may be required. This review examines the immediate interventions for traumatic knee dislocations, the associated complications, and long-term outcomes, highlighting the importance of a multidisciplinary approach for optimal recovery and functional restoration.

Keywords: Knee dislocations, Traumatic injury, Reduction techniques, Rehabilitation, Long-term outcomes

INTRODUCTION

Knee dislocations are severe orthopedic injuries that involve the complete disruption of the tibiofemoral joint. These injuries are typically caused by high-energy trauma such as motor vehicle accidents, sports injuries, or falls from significant heights. Although knee dislocations are

rare, they represent one of the most critical orthopedic emergencies due to the associated risk of neurovascular and soft tissue damage.¹

Prompt diagnosis, accurate management, and optimal long-term rehabilitation are essential for ensuring functional recovery and minimizing long-term disability.

A knee dislocation refers to the complete displacement of the tibia relative to the femur, and these injuries can occur in various directions depending on the forces applied to the knee joint.² The tibiofemoral joint can be displaced anteriorly, posteriorly, laterally, or medially, and the specific direction of dislocation has significant implications for treatment and prognosis. Anterior dislocations occur when the tibia is displaced forward relative to the femur. Although this type of dislocation is less common, it can result from a direct blow to the posterior aspect of the knee or hyperextension injuries.³ Anterior dislocations are typically associated with significant soft tissue damage and often require prompt surgical intervention. On the other hand, in posterior dislocations, the tibia is displaced backward relative to the femur. This is the most common form of knee dislocation, and it is often caused by high-energy trauma, such as a motor vehicle accident where the knee is forced into hyperflexion. Posterior knee dislocations are often associated with popliteal artery injury and peroneal nerve damage, making timely intervention crucial.⁴

In addition to the direction of dislocation, knee dislocations are also classified based on associated injuries, including damage to the knee ligaments, nerves, and blood vessels. The most commonly used classification systems for knee dislocations are the Lachman classification, Schneck classification and the Schatzker classification, which both take into account the direction of dislocation and the extent of associated damage.⁵

Table 1: Schneck classification of knee dislocations.⁵

Type	Description
I	Injury to a single cruciate ligament (ACL or PCL)
II	Injury to both cruciate ligaments (ACL and PCL) only
IIIM	Injury to the ACL, PCL, and medial collateral ligament and posteromedial corner
IIIL	Injury to the ACL, PCL, and lateral collateral ligament and posterolateral corner
IV	Injury to the ACL, PCL, medial collateral ligament and posteromedial corner, and lateral collateral ligament and posterolateral corner
V	Multiligament knee injury with periarticular fracture

Knee dislocations are often associated with serious complications, including vascular injury, nerve damage, ligament rupture, and post-traumatic arthritis, all of which can significantly impact patient outcomes.²

This review explores the immediate interventions required for traumatic knee dislocations, the complications that may arise, and the long-term outcomes for patients who sustain this injury. It will also discuss current treatment strategies and rehabilitation practices aimed at optimizing recovery and improving the quality of life for affected individuals.

METHODS

This study is based on a comprehensive literature search conducted on 06 December 2024, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed traumatic knee dislocations. There were no restrictions on date, language, participant age, or type of publication.

DISCUSSION

The immediate goal of management in traumatic knee dislocations is to restore the anatomical alignment of the knee joint while preventing or minimizing the risk of permanent damage to the neurovascular structures. Prompt and appropriate interventions are critical in preventing complications such as limb ischemia, nerve paralysis, and long-term functional deficits. The approach to managing traumatic knee dislocations can be broken down into four key steps: initial assessment, reduction of the dislocation, management of associated injuries, and stabilization.

Initial assessment and diagnosis

The first priority in managing a knee dislocation is conducting a comprehensive assessment, which includes both a detailed history and a thorough physical examination. Given the high-energy nature of the trauma that typically causes knee dislocations, it is essential to assess for signs of neurovascular compromise and any associated injuries. The physical examination should focus on evaluating the vascular status of the affected limb, including the presence of distal pulses, capillary refill, and skin temperature. Additionally, motor and sensory function should be assessed to detect any potential nerve injury.⁶

Diagnostic imaging plays a crucial role in confirming the diagnosis and determining the extent of the injury. X-rays are generally the first-line imaging modality to evaluate for fractures and confirm the dislocation. Advanced imaging, such as computed tomography (CT) scans or magnetic resonance imaging (MRI), may be employed to assess the extent of ligamentous, meniscal, and soft tissue damage, as well as to identify associated fractures.⁷ These imaging techniques are also essential for detecting vascular or nerve injuries that may accompany the dislocation.

Reduction of the dislocation

After diagnosing the knee dislocation, the next critical step is to restore the joint's normal anatomical alignment. Ideally, this should be done within six hours of the injury to minimize the risk of permanent joint or neurovascular damage.⁶ Closed reduction, typically performed under

general anesthesia or sedation, is the first attempt at restoring the knee joint. The traction-countertraction technique is commonly used, where traction is applied to the tibia while countertraction is applied to the femur.⁸ This method helps align the femur and tibia, reducing the dislocation and restoring joint congruency.

Once the reduction is achieved, post-reduction imaging is necessary to ensure proper alignment and rule out other injuries, such as fractures, that may require further intervention. If closed reduction is unsuccessful or if there is significant soft tissue or bone involvement, open reduction may be required. This technique, performed under general anesthesia, involves a surgical incision to directly visualize and reposition the joint surfaces.⁹ Open reduction is generally indicated in cases of complex knee dislocations with associated fractures or significant ligament damage.

Management of associated vascular and nerve injuries

Knee dislocations are frequently accompanied by significant vascular and nerve injuries, which can result in long-term disability if not addressed promptly. The most commonly injured vascular structure in knee dislocations is the popliteal artery. Injury to this artery can lead to limb-threatening ischemia.¹⁰ Therefore, it is vital to conduct a thorough examination of the vascular system, including palpation of distal pulses and using Doppler ultrasound or angiography to assess the extent of arterial injury. Immediate intervention is necessary to restore blood flow, which may involve surgical repair of the popliteal artery or endovascular techniques such as angioplasty or stent placement. In more severe cases, a bypass graft may be necessary to restore perfusion to the affected limb.¹¹

Nerve injuries, particularly to the peroneal nerve, are also common in knee dislocations. Peroneal nerve damage can result in motor deficits, such as foot drop, as well as sensory loss in the lower leg and foot.¹² Early recognition and management of nerve injuries are crucial to optimizing recovery. While nerve decompression surgery may be required if there is significant compression, many cases of peroneal nerve injury improve with conservative management and time.

Stabilization and immobilization

Once the knee is reduced, stabilization is required to prevent further injury and facilitate healing. Immediate immobilization of the knee joint is typically achieved with a knee splint or brace. This serves to prevent excessive movement and provide support to the joint as the soft tissues heal.¹³ A splint is generally used for the first few weeks following the injury. During this period, weight-bearing should be avoided to allow for proper healing and to prevent reinjury. Crutches or a walker may be used to assist with mobility. Regular follow-up visits are necessary to monitor the healing process, identify any complications, and guide the rehabilitation plan.

Long-term outcomes following knee dislocations

Although immediate interventions aim to restore the knee's anatomical alignment and prevent complications, the long-term outcomes of knee dislocations can be complex. Several factors influence recovery, including the severity of the injury, the presence of associated fractures or ligamentous tears, the timeliness of reduction, and the effectiveness of rehabilitation.¹⁴ Common long-term outcomes include joint instability, post-traumatic arthritis, chronic pain, and disability.

Rehabilitation plays a critical role in the recovery process following knee dislocations. It helps restore strength, range of motion, and overall function.¹⁵ The rehabilitation process typically begins with early exercises aimed at restoring range of motion and preventing complications such as joint stiffness. This is followed by strengthening exercises targeting the quadriceps, hamstrings, and calf muscles. Strengthening the quadriceps is particularly important as these muscles provide support to the knee joint and help protect against instability. Proprioceptive training, which helps patients regain a sense of joint position and control, is also an important aspect of rehabilitation.¹⁶

As the patient progresses, functional training exercises aimed at improving gait, balance, and mobility are incorporated.¹⁷ The duration of rehabilitation can vary based on the severity of the injury and the patient's response to treatment, with some individuals requiring several months to a year or more to fully recover. Successful rehabilitation can significantly improve functional outcomes, but the recovery process can be lengthy, and not all patients regain full function.

Knee dislocations are associated with a high risk of long-term complications, particularly if the injury is not properly managed. The most common complications include post-traumatic arthritis, chronic pain, and knee instability.¹⁴ Damage to the articular cartilage, combined with joint instability, can lead to the development of osteoarthritis, a condition that often results in chronic pain, stiffness, and reduced range of motion.¹⁸

Even after successful treatment, some patients may experience ongoing pain, weakness, and instability in the knee, especially if there is residual ligament damage or insufficient rehabilitation.

Vascular and nerve damage can also result in persistent long-term deficits. If arterial injury is not treated promptly, it can lead to chronic ischemia.^{19,20} Nerve injuries, particularly to the peroneal nerve, can result in persistent motor deficits, such as foot drop, and sensory loss in the lower leg and foot. In some cases, knee dislocations may recur, especially if there is incomplete healing or inadequate rehabilitation, leading to further joint instability and the need for additional interventions.

Table 2: Long-term complications and surgical management.^{14,18}

Complications	Impact on patient	Surgical management
Post-traumatic arthritis	Development of osteoarthritis in the knee joint leading to pain, stiffness, and reduced range of motion.	Total or partial knee arthroplasty (TKA) to relieve pain and improve function.
Chronic pain and instability	Persistent pain, weakness, and knee instability, especially with incomplete ligament healing.	Ligament reconstruction (e.g., ACL, PCL) to restore stability.
Vascular and nerve damage	Arterial injury can lead to chronic ischemia; nerve injury (e.g., peroneal nerve) can cause foot drop and sensory deficits.	Nerve grafting or decompression surgery for severe nerve damage; revascularization or bypass surgery for arterial injury.
Recurrent dislocations	Recurrent knee instability and further joint damage due to incomplete healing or inadequate rehabilitation.	Surgical repair or reconstruction of ligaments; possible additional stabilization procedures.

Surgical management of long-term complications

In cases where patients experience persistent knee instability, chronic pain, or functional deficits following a knee dislocation, surgical intervention may be necessary. Common surgical options include ligament reconstruction, which is required when torn ligaments such as the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), or collateral ligaments fail to heal adequately.²¹ Restoring knee stability through ligament reconstruction can help improve function and reduce the risk of recurrent dislocations.

For patients with advanced post-traumatic arthritis, total knee arthroplasty (TKA) or partial knee replacement may be considered to alleviate pain and improve function.²² These procedures can significantly enhance mobility and quality of life in patients who have developed severe joint degeneration following a knee dislocation.

In cases of severe nerve damage, nerve grafting or nerve decompression surgery may be necessary to restore motor function or alleviate pain.²¹ Surgical management of these long-term complications can be effective in improving outcomes, but the decision to proceed with surgery depends on the specific deficits and the patient's overall health and rehabilitation progress.

CONCLUSION

Knee dislocations are severe injuries that require prompt and comprehensive management. Immediate reduction, appropriate management of associated vascular and nerve injuries, and stabilization of the knee are critical in preventing long-term complications. While many patients recover successfully with early intervention and rehabilitation, knee dislocations are often associated with long-term complications such as chronic pain, instability, and post-traumatic arthritis. Rehabilitation plays a vital role in recovery, and in some cases, surgical intervention may be required to address long-term deficits. Advances in surgical techniques, imaging modalities, and rehabilitation practices continue to improve outcomes for patients with

knee dislocations, but careful management remains essential for achieving the best possible recovery.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Aborukbah AF, Anbarserri FM, Almutairi MK, Elbashir HA, Aldawood SM, Aljabri AS, et al. Traumatic knee dislocations: immediate interventions and long-term outcomes. *Int J Community Med Public Health* 2025;12:504-8.