Dislocation of the knee is a medical emergency due to high risk of interruption of the vascular supply to the leg.

Introduction

Knee dislocation can be classified according to the position of the tibia in relation to the femur into anterior, posterior, medial, lateral and rotatory dislocations. Knee dislocation is marked by injuries to at least two ligaments out of four main knee ligaments. Posterior knee dislocation is the highest with the risk of injury to the popliteal artery. Blood supply of the lower limb originates from the femoral artery which continues as the popliteal artery in the leg. In the popliteal fossa, it gives off 5 collateral branches around the knee which makes it more vulnerable to knee injury and dislocation.

Moreover, the popliteal artery is attached to the adductor hiatus proximally and the soleus muscle holds it distally against the bone which increases its chances of injury at the popliteal fossa. The lateral popliteal nerve is another vital structure which crosses around the fibular head to the leg. It is responsible for dorsiflexion of the ankle and its injury with knee dislocation is associated with foot drop.
Anatomy of the Knee

Knee support is achieved mainly by **4 ligaments, 2 menisci and different groups of muscles and tendons all enclosed within the joint capsule**. The anterior and posterior cruciate ligaments, as well as the medial and lateral collateral ligaments, support the transverse and longitudinal movement of the knee. 2 menisci; the medial and lateral menisci provide axial support against rotational injury of the knee, as well as the muscular support of the knee from different groups of muscles. The tibial nerve is less likely to be injured in the popliteal fossa during knee dislocation as it is not firmly attached to the bone.

Tibia, femur, and patella are three bones that interact together for motion in knee joint supported by quadriceps and hamstring muscles.


Mechanism of Injury

High-velocity injuries cause knee dislocation with damage to many structures included in the joint, joint capsule, menisci, ligaments and cartilages, as well as the neurovascular complex in the popliteal fossa. Low-velocity injuries are common in athletes with less likely to cause damage to the joint structures and the extracapsular neurovascular complex.

Usually, the knee relocates itself by its own, if not, the joint is swollen and painful. Even the knee gets back to its position, there can be significant damage to the ligaments. The leg appears to be crooked or angulated.
It is believed that for knee dislocation to occur, **both cruciate ligaments and one or both collateral ligaments are torn.** Posterior knee dislocation is primarily caused by direct anterior trauma to the flexed knee. This is common in road traffic accidents when the knee of the passenger hits the dashboard or during falling on the flexed knee.

**Obesity is a risk factor for all types of knee dislocation** due to the weight stress on the muscles and ligaments of the joint. In terms of prognosis, high-velocity knee dislocations are associated with a less favorable long-term outcome and the patients are unlikely to be back to full sports activity after treatment. Low-velocity knee dislocation is associated with a better outcome as patients can return to full function and sports activity following adequate management and rehabilitation.

**Clinical Picture of Posterior Knee Dislocation**

Patients with knee dislocation will present with **severe diffuse pain and the inability to move following a pop sound of the affected knee.** Examination of the knee reveals ecchymosis of the skin with visible deformity according to the type of dislocation. Invagination of the joint capsule into the joint leads to a visible groove on the medial side known as dimple sign.

It indicates postero-lateral knee dislocation which cannot be reduced manually. Palpation is remarkable for the **limited range of extension and flexion of the knee.** Assessment of the joint ligaments should be performed during the examination. Anterior and posterior cruciate ligaments can be assessed with the Lachman and posterior drawer tests respectively, while the valgus and varus tests can be used to assess the medial and lateral collateral ligaments.

Some cases of knee dislocation may undergo **spontaneous reduction which might lead to the missing of associated injuries to the popliteal artery and peroneal nerve.** It becomes necessary for the physician to examine every case of suspected knee
dislocation for any neurovascular interruption. Palpation of the dorsalis pedis, posterior tibial arteries, capillary refill and examination for skin color and temperature, as well as a bilateral sensory examination of both limbs.

Physical examination of the skin and peripheral pulses may be normal despite the damage to the popliteal artery. It is recommended to perform a duplex scan, calculate the ankle-brachial index and perform an arteriogram to patients with suspected arterial damage even with intact peripheral pulsations. A venogram is also recommended for these patients due to the high risk of deep vein thrombosis following posterior knee dislocation. The vascular examination can be performed for days the following reduction to make sure the vascular supply of the leg is not interrupted.

To assess the ligament injury of the knee joint, magnetic resonance imaging can be opted to know the extent and location of the disruption of the ligament, meniscal tears and injuries to the bone involved with the determination of possibility of repair.

Complications of Posterior Knee Dislocation

Posterior knee dislocation is the most common type of knee dislocation associated with vascular injury. Interruption of the blood supply to the leg may lead to acute ischemia, gangrene, and amputation. Compartment syndrome may also complicate temporary interruption of arterial supply with swelling of the leg and pain with stretching of the muscles which may occur after surgical therapy before 2 weeks of knee dislocation. Deep vein thrombosis is also common and can complicate the dislocation. Foot drop is the result of common peroneal nerve injury lateral to the knee joint. Late complications of the knee joint involve joint stiffness, joint arthrosis, chronic pain, injury to the popliteal artery, pseudoaneurysm formation, muscular atrophy, inadequate management with instability and arthritis.

Imaging of Posterior Knee Dislocation

Imaging should only be performed in patients with intact neurovascular function with adequate peripheral pulses and stable general medical condition. Closed reduction should be performed first in case of neurovascular interruption of a dislocated knee.

Plain X-ray posteroanterior and lateral views are ideal for confirming the diagnosis in case the physical examination is inconclusive. A CT scan can give a quick assessment of the knee and the vascular tree with the use of CT angiography. It is sensitive and quick for an accurate diagnosis. MRI is only used after exclusion of any vascular injury that needs immediate intervention. MRI gives a detailed assessment of the knee structures including joint capsule, ligaments, cartilages, and menisci. MRI can help with good surgical planning about the injured structures and torn ligaments within the joint capsule.

Management of Posterior Knee Dislocation

Immediate splinting in the less painful position is performed at the scene to reduce the pain and prevent further damage. The patient is transferred to a medical facility where the closed or open reduction is performed. Adequate analgesia and sedation are given before reduction.

Conservative treatment with immobilization for an average of 5.5 weeks is recommended for patients with a stable joint after reduction and sedentary lifestyle. It can also be
implemented with intact collateral ligaments. Immobilization of the joint for more than 6 weeks is associated with future joint stiffness.

After two months of immobilization, patients are allowed to do minimal resistance exercises with the movement of both knees. The patient then is committed to a **long rehabilitation program that can last for almost one year** before restoration of the normal function and return to full activity.

Surgical intervention is deferred for young active individuals with grade III ligament injuries. Knee arthroscopy is not recommended in the duration of 2 weeks of knee dislocation because of extravasations of fluid in the leg due to tears present in the knee capsule. It may result in compartment syndrome. Avulsed ligaments are usually repaired, while mid-substance tears are usually reconstructed. Reconstruction using allografts is more favored due to a higher success rate.

Postsurgical rehabilitation begins as early as the first week. Even before surgery, patients are scheduled for minimal exercises for the affected knee with support and limitation of the range of motion. The patient is allowed to ambulate supported by crutches at first, then the range of motion exercises are allowed before strengthening exercises are started. The patient can return to full function and activity after the restoration of the full range of motion and strength with adequate rehabilitation and training.

References

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