



PATELLAR DISLOCATION AND PATELLAR INSTABILITY PANORAMIC REVIEW

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Article DOI: <https://doi.org/10.36713/epra13764>

DOI No: 10.36713/epra13764

SUMMARY

Introduction: Primary patellar dislocation is usually the initial manifestation of patellofemoral instability. Among the long-term repercussions of this disorder are recurrent dislocation and indefinable knee dysfunction. At present, there is no agreement on the optimal treatment of patellar dislocation.

Objective: to detail the current information related to patellar dislocation, epidemiology, mechanism of action, clinical evaluation, imaging evaluation, classification, differential diagnosis, treatment and complications of the disease.

Methodology: a total of 30 articles were analyzed in this review, including review and original articles, as well as clinical cases, of which 22 bibliographies were used because the other articles were not relevant to this study. The sources of information were PubMed, Google Scholar and Cochrane; the terms used to search for information in Spanish, Portuguese and English were: patella, knee anatomy, patellar dislocation, knee instability.

Results: Approximately 5% of the time it is related to osteochondral fractures. To define whether a patella is high or low, a lateral radiograph should be taken with the knee in 30° of flexion to determine Blumensaat's line. The increase in the Q angle facilitates patellar dislocation. Most patellar dislocations are related to congenital anomalies of the patella or trochlea, high patella, hypoplasia of the vastus medialis and hypertrophy of the lateral retinaculum.

Conclusions: Patellar dislocation is usual in individuals with connective tissue disorders and hypermobility, the patella can be dislocated laterally, superiorly or intra-articularly, presenting different mechanisms of action for each case. It is important to have a good knowledge of the anatomy and to measure the Q angle because the increase of this angle facilitates patellar dislocation. It is essential to establish the etiology of the dislocation, especially in those with recurrent dislocations as this may alter the management plan. In addition to the clinical evaluation it is important to request anteroposterior, lateral knee and axial projections. When conservative treatment is chosen, reduction and immobilization with a cast or orthosis should be performed with the knee in extension, the long knee brace can be used, with or without arthrocentesis to relieve the symptomatology; surgical treatment is mostly used in recurrent dislocations. At the moment, no surgical technique is able to correct all the problems of patellar alignment. It should be kept in mind that the surgical procedure should take into account the individual's age, diagnosis, activity level and the situation of the patellofemoral joint. Patellofemoral instability should be treated with the goal of correcting all of the alignment issues. The usual complications are loss of knee mobility, recurrent dislocation and patellofemoral pain.

KEY WORDS: dislocation, patella, knee, instability.



INTRODUCTION

Primary patellar dislocation is usually the initial manifestation of patellofemoral instability. Among the long-term repercussions of this disorder are recurrent dislocation and indefinable knee dysfunction. At the moment, there is no agreement on the optimal treatment of patellar dislocation(1).

Patellar instability is a condition in which the patella bone is pathologically disarticulated outside the patellofemoral joint, either by subluxation or complete dislocation. It is usually compromised by several factors, ranging from acute trauma, chronic ligament laxity, poor bony alignment, connective tissue disease or anatomic pathology. Individuals with patellar instability may manifest debilitating pain, limitations in basic function, as well as arthritis over time(2).

Modern literature expresses the importance of isometric strengthening of the quadriceps, especially the vastus medialis obliquus, and progression to more dynamic exercises involving the core and gluteal muscles. However, there is a lack of high quality evidence, international consensus or guidelines on conservative treatment(3-6).

METHODOLOGY

A total of 30 articles were analyzed in this review, including review and original articles, as well as cases and clinical trials, of which 22 bibliographies were used because the information collected was not important enough to be included in this study. The sources of information were Cochrane, PubMed and Google Scholar; the terms used to search for information in Spanish, Portuguese and English were: patella, knee anatomy, patellar luxation, knee instability.

The choice of bibliography exposes elements related to patellar dislocation, epidemiology, mechanism of action, clinical assessment, imaging assessment, classification, differential diagnosis, treatment and complications of the disease.

DEVELOPMENT

Epidemiology

Patellar dislocation is more common in women due to their physiological laxity, as well as in individuals with connective

tissue disorders and hypermobility as seen in Marfan syndromes, as well as Ehlers-Danlos(7).

The incidence of patellar instability in the general population is 5.8 per 100,000 and approximately 29 per 100,000 in the 10 to 17 year age group. Patellar dislocations account for approximately 3% of all knee injuries. Most of the injuries and pathologies occur in young individuals. Frequently, individuals with patellar instability are between 10 and 16 years of age and are female. The recurrence rate after conservative management is around 15 to 44%. Individuals with a history of 2 or more dislocations are twice as likely to have recurrent dislocations. An anterior patellar dislocation increases the risk of persistent patellar instability in the future. In addition, individuals with MRI-confirmed medial patellofemoral ligament injury further increase the likelihood of recurrence. Individuals who dislocate for the first time overtime may continue to present with functional limitations, pain and instability(8).

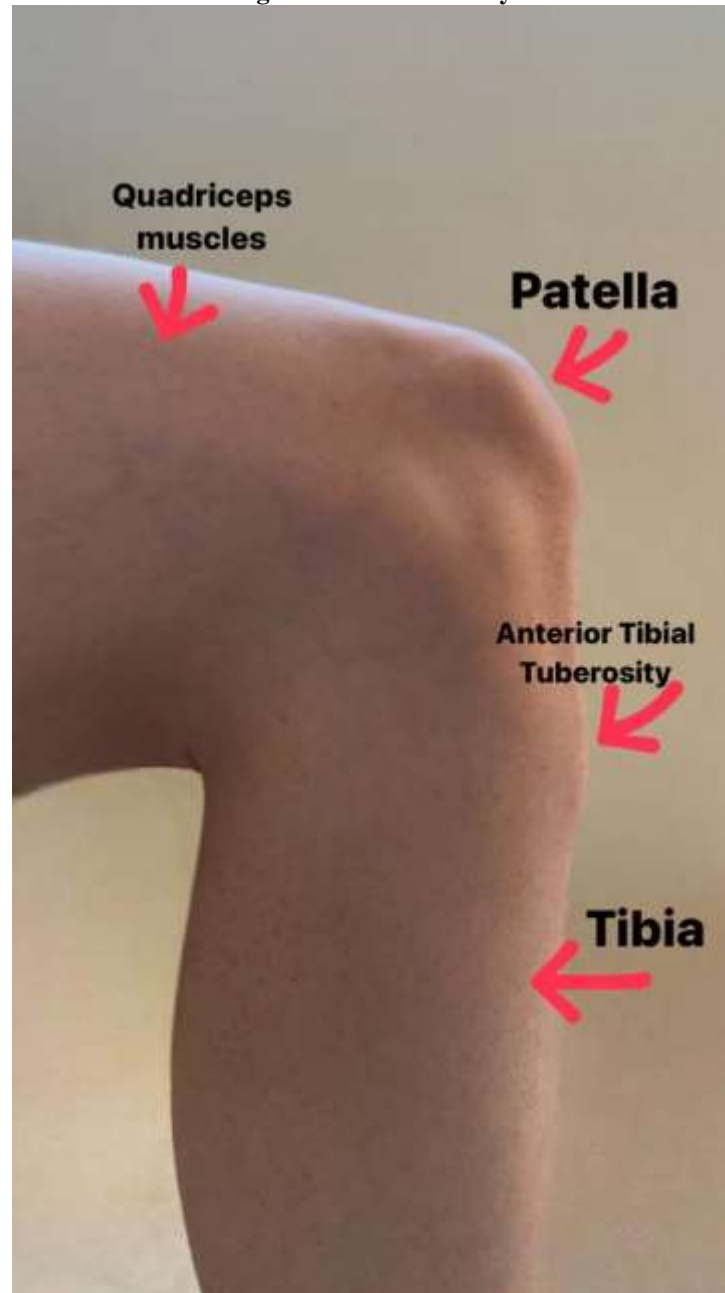
Anatomy

The patella is a lens-shaped bone located at the front of the knee. It attaches to the tendon of the quadriceps muscle of the thigh and travels within a groove located at the lower end of the femur. Patellar dislocation is generated by displacing the patella completely outside of this groove. The angle created between the line that runs from the anterior superior iliac spine to the middle of the patella and the line that joins the middle of the patella to the anterior tuberosity of the tibia is called the Q angle, which ensures that the traction vector from the quadriceps action provides a lateral direction. This lateral direction force is generally counteracted by the tibial-patellar, patellofemoral and patellofemoral connecting components, the retinaculum, as well as the interdigitation of the patella with the trochlear groove. The increase in the Q angle facilitates patellar dislocation. Most patellar dislocations are related to congenital anomalies of the patella or trochlea, high patella, hypoplasia of the vastus medialis and hypertrophy of the lateral retinaculum(7,9,10).

Congenital dislocations occasionally occur, frequently in individuals with Down syndrome; due to a small patella and a hypoplastic condyle, they usually require surgical intervention for reduction(8).



Figure 1. Knee Anatomy.



Source: Image courtesy Regiane Maximiniano.

Mechanism of Injury

Acute patellar dislocations usually result from trauma, often associated with a non-contact twisting injury to the knee, or from a direct blow to the medial aspect of the knee. A common mechanism of action is external tibial rotation with the foot fixed to the floor. So too, patellar dislocations often occur in individuals with generalized ligamentous laxity. However, these individuals are generally prone to recurrent patellar subluxations rather than outright dislocation(8).

- *Lateral dislocation:* the most common mechanism is forced internal rotation of the femur over the fixed tibia on the floor in external rotation and the knee in flexion. Approximately 5% of the time it is related to osteochondral fractures. Medial instability is infrequent, usually iatrogenic, congenital, traumatic or related to atrophy of the quadriceps femoris muscle.
- *Intra-articular dislocation:* unusual, however it can be observed in knee trauma, mostly in male adolescents. It



generates an avulsion of the patella from the quadriceps tendon, with rotation of the patella on the horizontal axis, so that the proximal pole is located in the intercondylar notch.

- *Superior dislocation*: usually in older adults due to forced hyperextension of the knee. The patella is located in the osteophytes of the anterior aspect of the femur(7,9).

Clinical Assessment

Usually affected individuals with unreduced patellar dislocation manifest hemarthrosis, knee flexion incompetence, in addition to a palpable patellar displacement. Lateral dislocations may also generate pain in the medial retinaculum. Affected individuals with reduced or chronic patellar dislocation usually show a positive apprehension test, which consists of performing a lateral force on the patella while the knee is in extension, causing a sensation of imminent dislocation, generating pain and contraction of the quadriceps to prevent patellar movement(7,9).

The Q angle should also be evaluated and the J sign or excessive lateral translation in extension should be taken into account, which causes the patella to "jump" towards the trochlear groove when the patella engages the trochlea at the beginning of flexion. In addition, the general alignment of the extremities should be evaluated, taking into account the rotation of the hip and knee, the presence of large hemarthrosis, sensitivity of the medial side on the medial patellofemoral ligament, increased passive patellar translation compared to the contralateral side(2).

Image Evaluation

For the evaluation it is important to request the anteroposterior and lateral projections of the knee, and in addition to the axial

projection also called sunrise of both the affected and unaffected patella. The bibliography shows other axial projections that could be used:

- *Hughston projection*: allows measurement of the groove angle and the patellar index. Knee flexed 55°.
- *Merchant projection*: allows measurement of the sulcus angle and the angle of congruence. Knee flexed 45°.
- Laurin projection: allows measurement of the patellofemoral index and patellofemoral angle. Knee flexed 20°.

To define whether a patella is high or low, the lateral radiograph should be taken with the knee in 30° of flexion to determine Blumensaat's line; the inferior pole of the patella should be located on the anterior projection line of the intercondylar notch. The Insall-Salvati ratio can also be performed, which is simply the quotient between the length of the patellar ligament measured from the inferior pole of the patella to the tubercle of the tibia with the length of the patella using its greater diagonal; the quotient must be equal to 1.0, if it is 1.2 it shows a high patella, if the measurement is 0.8 it shows a low patella(7,9).

The computed tomography can be used to evaluate the femoral anteversion, the tibial rotation, distance TT-TG (tibial tubercle to trochlear groove) that should be measured in axial images taking a line in an axial CT perpendicular to the posterior femoral condyles by means of the trochlear notch and a line crossing in the middle of the tibial tuberosity, it is normally of about 9 mm, greater to 20 mm is abnormal and greater to 90 % it presents relation with patellar instability. The resonance can also be used in certain cases(2).



Figure 2. Patella Dislocation



Source: Image courtesy S Bhimji MD. Hayat Z, El Bitar Y, Case JL. Patella Dislocation(8).

Classification

Usually a very simple classification system is used and can be:

- Acute or traumatic versus chronic or recurrent.
- Reduced versus unreduced.
- Congenital versus acquired.
- Lateral, medial, intra-articular, superior(7).

Differential Diagnosis

- Anterior cruciate ligament injury
- Medial collateral ligament injury
- Patellofemoral syndrome
- chondromalacia
- meniscal injury
- medial synovial plica(8).

Treatment.

The acute treatment of an acute patellar dislocation is early reduction of the dislocation. This is usually done in the emergency and under sedation as needed. Reduction consists of flexing the hip, exerting gentle pressure on the lateral pole of the

patella, medially, while slowly extending the knee. The reduction maneuver can also be performed with the affected individual seated with the legs hanging off the side of the table(8).

The rationale for treatment for first-time dislocations that have no evidence of free bodies or intra-articular damage is conservative, and should encompass analgesia, ice and NSAIDs to decrease pain and swelling, physical therapy and activity modification. Wearing a J-brace or a patellar stabilizing sleeve may help in the first 2 to 4 weeks as soft tissue healing proceeds. After this time, physical therapy with emphasis on quadriceps and vastus medialis oblique strengthening, in addition to core strengthening and proprioception, is appropriate. The affected individual can be allowed to bear weight according to tolerance(8,11,12).

Conservative Treatment

A reduction and immobilization with a cast or orthosis should be performed with the knee in extension, the long knee brace can be used, with or without arthrocentesis to alleviate the symptomatology. The affected individual can walk with the knee locked in extension for 3 weeks. Subsequently, progressive knee



flexion and quadriceps femoris muscle strengthening exercises are started. After 6 to 8 weeks, the removal of the orthosis should be evaluated according to tolerance. In acute dislocation, surgical treatment could be recommended depending on the level of activity, with restoration of the medial patellofemoral ligament. Surgical treatment is also indicated in case of a displaced osteochondral fracture, for intra-articular dislocations a reduction can be performed under anesthesia. The functional bandages presented in the physiotherapeutic literature show moderate results(7,9,13).

Surgical Treatment

Mostly used in recurrent dislocations. At present, no surgical technique is capable of correcting all the problems of patellar alignment; the surgical procedure must take into account the age of the individual, diagnosis, level of activity and the situation of the patellofemoral joint. Patellofemoral instability should be treated with the goal of correcting all of the alignment issues. Degenerative joint modifications have a direct impact on the surgical alternative for alignment. There are several surgical techniques among which are:

- *Lateral release:* this can be performed by open surgery or arthroscopy and is generally indicated when there is lateral inclination of the patella with patellofemoral pain, also when the patella is lateralized with pain in the lateral retinaculum, as well as in lateral patellar impingement syndrome.
- *Medial plication:* performed at the time of lateral release to center the patella.
- *Proximal realignment of the patella:* medialization of the proximal patellar traction site is indicated when lateral release with medial plication fails to center the patella. The proximal lateral components are released taut and the traction of the medial support components, primarily the vastus medialis oblique, is reinforced with the intention of decreasing lateral patellar friction as well as improving patellofemoral joint congruency. Indications for this procedure include:
 - a) Acute dislocation in a young, athletic individual, particularly in the presence of avulsion fractures of the medial part of the patella or a lateral subluxation-angulation on radiographs after closed reduction.
 - b) Recurrent dislocation of the patella that does not improve after conservative treatment.
- *Distal realignment of the patella:* may be performed to realign the patellar ligament and tibial tubercle in the adult individual with recurrent patellar dislocation, as well as patellofemoral pain caused by abnormal alignment of the extensor mechanism. This realignment is not indicated in individuals with an open physis and a normal Q angle. It is done to bring forward and center the tibial tubercle, restoring the high patella and normalizing the Q angle(7,9).

Studies show that medial patellofemoral ligament reconstruction significantly reduces recurrent dislocation compared to medial patellofemoral ligament repair or conservative treatment, however it has a higher complication rate. The repair is considered less technically demanding and has a lower morbidity rate, which leads to reduced redistribution, allowing activity levels to return to their pre-injury state. Similarly, medial patellofemoral ligament reconstruction is also an effective surgical technique, providing better long-term functional results(1,14-22).

Complications

Patellar dislocation presents some complications among the most common are:

- *Loss of knee mobility:* usually due to prolonged immobilization. The surgery can form adhesions and therefore arthrofibrosis. Therefore, intense and correct physiotherapy should be done to increase the tone of the quadriceps, preserve the alignment of the patella and the movement of the knee.
- Recurrent dislocation: generally in individuals under 20 years of age. It is an indication for surgical intervention.
- Patellofemoral pain: caused by the rupture of the retinaculum in the dislocation or by possible chondral alterations(7,9).

General surgical complications include infection, neurovascular injury, deep vein thrombosis or pulmonary embolism(8).

CONCLUSIONS

Patellar dislocation is common in individuals with connective tissue disorders and hypermobility, the patella can be dislocated laterally, superiorly or intra-articularly, presenting different mechanisms of action for each case. It is important to have a good knowledge of the anatomy and to measure the Q angle because the increase of this angle facilitates patellar dislocation. It is essential to establish the etiology of the dislocation, especially in those with recurrent dislocations as this may alter the management plan. In addition to the clinical evaluation it is important to request anteroposterior, lateral knee and axial projections. When conservative treatment is chosen, reduction and immobilization with a cast or orthosis should be performed with the knee in extension, the long knee brace can be used, with or without arthrocentesis to relieve the symptomatology; surgical treatment is mostly used in recurrent dislocations. At the moment, no surgical technique is able to correct all the problems of patellar alignment. It should be kept in mind that the surgical procedure should take into account the individual's age, diagnosis, activity level and the situation of the patellofemoral joint. Patellofemoral instability should be treated with the goal of correcting all of the alignment issues. The usual complications are loss of knee mobility, recurrent dislocation and patellofemoral pain.

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Conflict of Interest Statement

The authors report no conflicts of interest.

Funding

The authors report no funding by any organization or company.