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INFORMATION FOR PET OWNERS

PATELLAR LUXATIONS

Overview

The patella, or knee cap, is a small bone buried in the tendon of the extensor muscles (the quadriceps muscles) of the thigh. The patella normally rides in a femoral groove within the stifle (knee). The patellar tendon attaches on the tibial crest, a bony prominence located on the tibia, just below the knee. The quadriceps muscle, the patella and its tendon form the “extensor mechanism” and are normally well-aligned with each other. Patellar luxation is a condition where the knee cap rides outside the femoral groove when the stifle is flexed. It can be further characterized as medial or lateral, depending on whether the knee cap rides on the inner or on the outer aspect of the stifle.

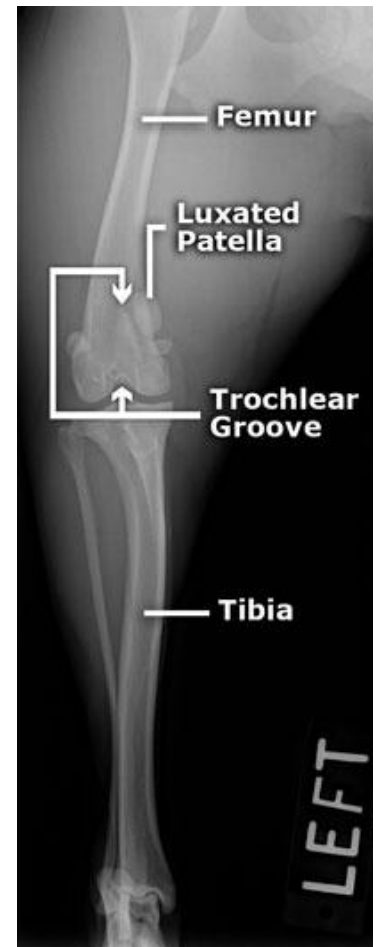
Incidence of Patellar Luxation

Patellar luxation is one of the most common congenital anomalies in dogs, diagnosed in 7% of puppies. The condition primarily affects small dogs, especially breeds such as Boston terrier, Chihuahua, Pomeranian, miniature poodle and Yorkshire terrier. The incidence in large breed dogs has been on the rise over the past ten years, and breeds such as Chinese shar pei, flat-coated retriever, Akita and Great Pyrenees are now considered predisposed to this disease. Patellar luxation affects both knees in 50% of all cases, resulting in discomfort and loss of function.

Non traumatic patellar luxation is commonly associated with other disorders:

These include:

- Cranial cruciate deficiency
- Hip dysplasia
- Abnormal conformation (angulation) of the upper (proximal) portion of the tibia
- Abnormal conformation (angulation and torsion) of the femur, either congenital or subsequent to a fracture
- Tightness of the quadriceps muscle
- Elongated patellar ligament



Causes of Patellar Luxation

Patellar luxation occasionally results from a traumatic injury to the knee, causing sudden non-weight-bearing lameness of the limb. It may also develop subsequent to cranial cruciate deficiency in dogs that will typically have a chronic history of lameness. However, the cause remains unclear in the majority of dogs. The femoral groove into which the knee cap normally rides is commonly shallow (Figure 2a, Figure 2b) or absent in dogs with non-traumatic patellar luxation. Early diagnosis of bilateral disease in the absence of trauma and breed predisposition supports the concept of patellar luxation resulting from a congenital or developmental misalignment of the entire extensor mechanism. Congenital patellar luxation is therefore no longer considered an isolated disease of the knee, but rather a component/consequence of a complex skeletal anomaly affecting the overall alignment of the limb, including:

- Abnormal conformation of the hip joint, such as hip dysplasia
- Malformation of the femur, with angulation and torsion (Figure 3)
- Malformation of the tibia
- Deviation of the tibial crest, the bony prominence onto which the patella tendon attaches below the knee
- Tightness/atrophy of the quadriceps muscles, acting as a bowstring
- A patellar ligament that may be too long

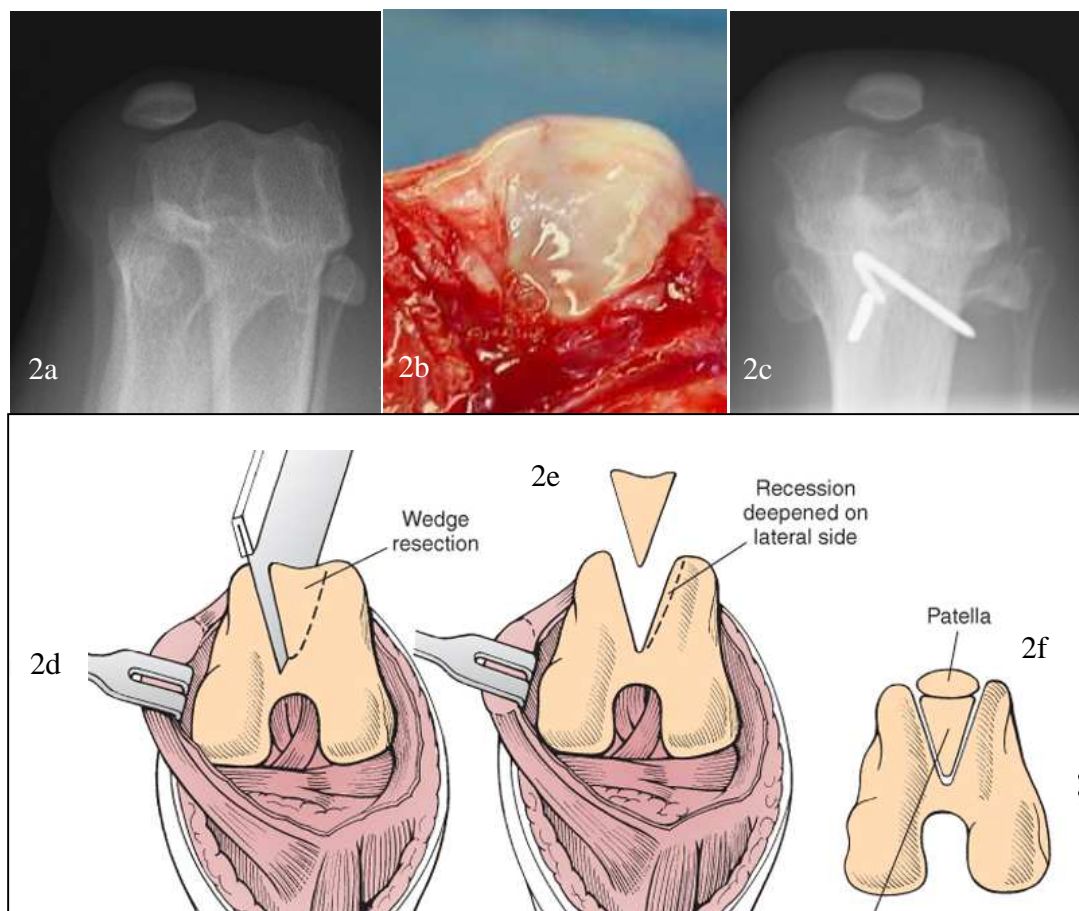


Figure 2a: Pre-operative radiographic (skyline) view of the knee femoral trochlea: Shallow femoral groove with a knee cap riding outside of its groove. **2b:** Intra-operative view of the same femoral

groove prior to correction. 2c: Post-operative view: The femoral groove has been deepened so that the knee cap now appears well-seated. The tibial crest has been moved toward the outer aspect of the knee to restore the alignment of the patella tendon and thigh muscles. Wires (arrow) have been inserted into the tibia to immobilize the tibial crest in its new position. 2d-f: To deepen the femoral groove a trochlear wedge was created and then flattened to allow for deeper secure seating of the patella.



Figure 3: Pre-operative computed tomographic evaluation of a dog with severe patellar luxation of both knees and malformation of the femur in each limb.



Figure 3a: If the angulation of the knees is too severe, a corrective osteotomy of the femur may need to be considered to align the patella adequately.

Signs and Symptoms

Clinical signs associated with patellar luxation vary greatly with the severity of the disease: this condition may be an incidental finding detected by your veterinarian on a routine physical examination or may cause your pet to carry the affected limb up all the time. Most dogs affected by this disease will suddenly carry the limb up for a few steps, and may be seen shaking or extending the leg prior to regaining its full use. As the disease progresses in duration and severity, this lameness becomes more frequent and eventually becomes continuous. In young puppies with severe medial patellar luxation, the rear legs often present a “bow-legged” appearance that worsens with growth. Large breed dogs with lateral patellar luxation may have a “knocked-in knee” appearance, combining severe lateral patellar luxation and hip dysplasia.

When to Seek Veterinary Advice

You should seek veterinary surgical advice if you have any concern about the gait of your pet or if your primary veterinarian advises you to do so. The severity of patellar luxation has been graded on a scale of 0 to 4, based on orthopedic examination of the knee (Figure 4). Surgical treatment is typically considered in grades 2 and over:

Grade I	Knee cap can be manipulated out of its groove, but returns to its normal position spontaneously
Grade II	Knee cap rides out of its groove occasionally and can be replaced in the groove by manipulation
Grade III	Knee cap rides out of its groove most of the time but can be replaced in the groove via manipulation
Grade IV	Knee cap rides out of its groove all the time and cannot be replaced inside the groove

Exam, Screening Tests, and Imaging

The diagnosis of patellar luxation is essentially based on palpation of an unstable knee cap (Figure 4) on orthopedic examination. Additional tests are often required to diagnose conditions often associated with patellar luxation and help the surgeon recommend the most appropriate treatment for your pet. These may include:



Figure 4

- Palpation of the knee under sedation to assess damage to ligaments
- Radiographs of the pelvis, knee and occasionally tibias to evaluate the shape of the bones in the rear leg and rule out hip dysplasia (Figure 5)
- 3-dimensional computed tomography to provide an image of the skeleton of the entire rear legs. This advanced imaging technique helps the surgeon plan surgery in cases where the shape of the femur or tibia needs to be corrected (Figure 3 and 3a)
- Blood work and urine analysis as a precaution before anesthesia



Figure 5: Radiographs of a dog with a patellar luxation on the right limb: the knee cap can be visualized on the inner aspect of the knee on one side (plain arrow). The dog had undergone surgical treatment of a patellar luxation on the left limb six weeks earlier. The knee cap (dashed line) is in normal position. Wires (block arrow) were placed to transpose the tibial crest toward the outer aspect of the knee.

What Will Happen if Patellar Luxation is Left Untreated?

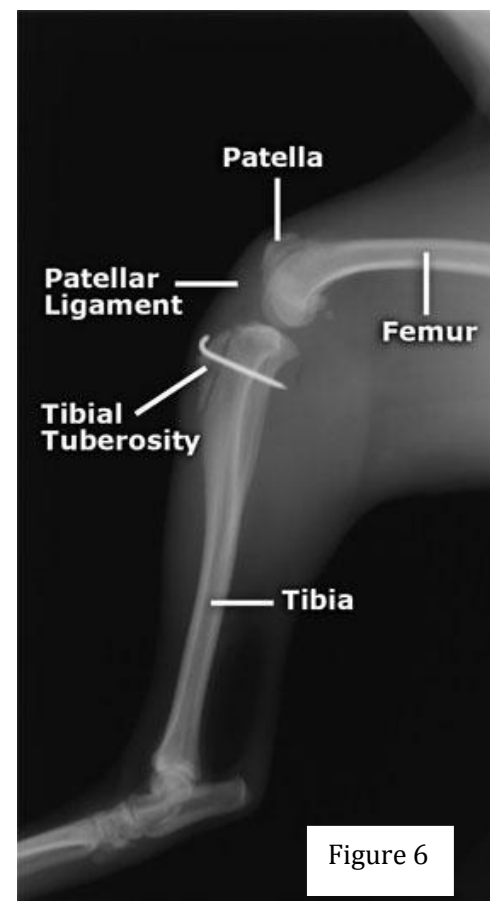
Every time the knee cap rides out of its groove, cartilage (the normal lining of bones within joints) is damaged, leading to osteoarthritis and associated pain. The knee cap may ride more and more often out of its normal groove, eventually exposing areas of bone. In puppies, the abnormal alignment of the patella may also aggravate the shallowness of the femoral groove and lead to serous deformation of the leg. In all dogs, the abnormal position of the knee cap destabilizes the knee and predisposes affected dogs to rupture their cranial cruciate ligament, at which point they typically stop using the limb.

What Options are Available for Treating Patellar Luxation?

Patellar luxations that do not cause any clinical sign should be monitored but do not typically warrant surgical correction, especially in small dogs. Surgery is considered in grades 2 and over (see above). Surgical treatment of patellar luxation is more difficult in large breed dogs, especially when combined with cranial cruciate disease, hip dysplasia or angulation of the long bones.

One or several of the following strategies may be required to correct patellar luxation:

- Reconstruction of soft tissues surrounding the knee cap to loosen the side toward which the patella is riding and tighten the opposite side.
- Deepening of the femoral groove so that the knee cap can seat deeply in its normal position. (Figure 6) This was previously achieved by rasping the cartilage, leaving exposed bone in contact with the patella. Surgeons now recess a wedge or rectangular block of cartilage and bone over the femoral groove to preserve contact between the knee cap and underlying cartilage.
- Transposing the tibial crest (Figure 5), the bony prominence onto which the tendon of the patella attaches below the knee (see first paragraph). This will help realign the quadriceps, the patella and its tendon.
- Correction of abnormally shaped femurs is occasionally required in cases where the knee cap rides outside of its groove most or all the time. This procedure involves cutting the bone, correcting its deformation and immobilizing it with a bone plate (Figure 3a).



The procedures that will best address the problem are selected on an individual basis by the surgeon that has examined the patient.

Post-Operative Care

The surgeon that has operated on your pet will best be able to advise you and establish a personalized post-operative treatment plan. For example, pain medications may be prescribed for a week after surgery. Physical therapy, with compresses and gentle, passive flexion and extension of the knee, may be recommended shortly after surgery. Exercise is typically limited to leash walks for 6 to 14 weeks depending on the procedures performed and factors affecting the healing capacities of your pet. Radiographs may be repeated at regular intervals to monitor bone healing.

Prognosis

Over 90% of owners are satisfied by the progress of their dog after surgery. The prognosis is less favorable in large dogs, especially when patellar luxation is combined with other abnormalities, such as angulation of the long bones or hip dysplasia.

Complications

Osteoarthritis is expected to progress on radiographs. However, this does not necessarily mean that your dog will suffer or be lame as a result. Keeping your pet trim and encouraging swimming/walking rather than jumping/running will help prevent or minimize clinical signs of osteoarthritis. Oral supplements and/or a specific diet may be recommended to promote cartilage function and minimize the progression of osteoarthritis.

Some degree of knee cap instability will persist in up to 50% of cases. This does not cause further lameness in the majority of cases. Migration or breakage of surgical implants used to maintain bones in position occurs rarely. Infection is a rare complication.

Prevention

Because it seems likely that this condition could be passed genetically, dogs diagnosed with patellar luxation should not be bred.

Based on information on orthopedic diseases published on ACVS webpage (www.acvs.org, by *Dominique Griffon, DMV, MS, PhD, Diplomate ACVS*)