



# Congenital Conditions: Patellar Luxation

By Peter J. Lotsikas, DVM, DACVS and Faith M. Lotsikas, DVM, CCRT

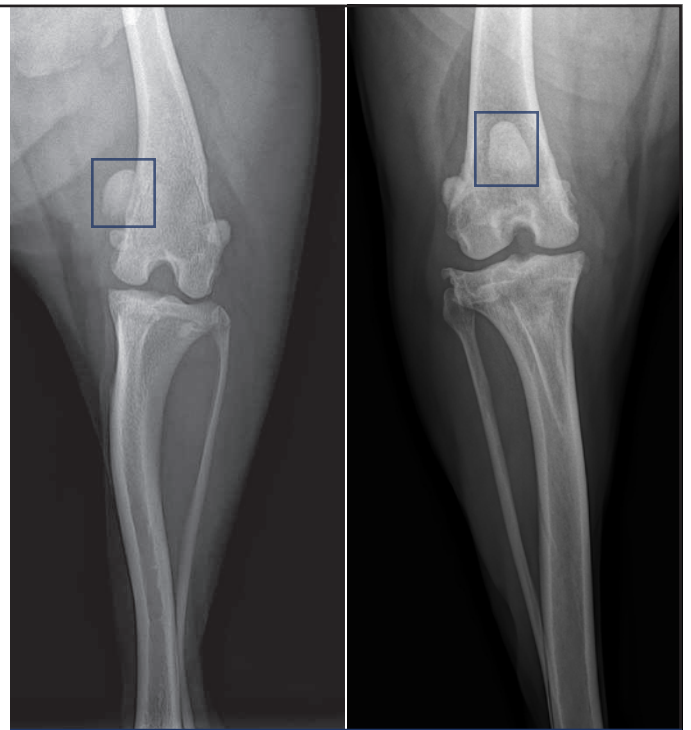
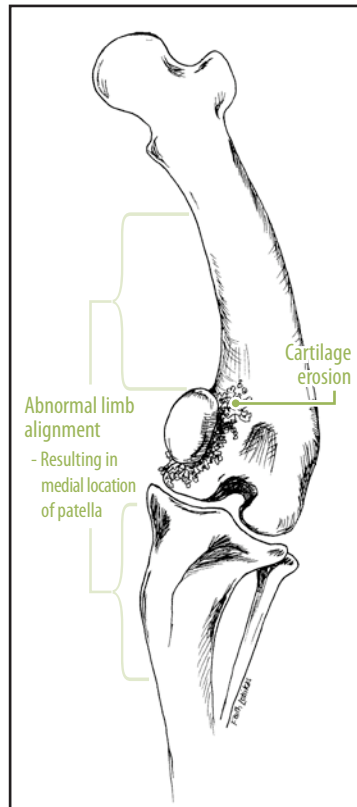
Recently, we were invited to perform an orthopedic clinic for a national specialty show. Specifically, I was asked to evaluate and document patellar luxation in this particular breed for the Orthopedic Foundation for Animals (OFA) database. At first, the participants in the event were delighted to see me and thanked me for helping out. However, by the end of the day, I had documented patellar luxation in 8% of the dogs evaluated, which represented the best of the breed. Many handlers questioned how their dog could be competing in agility at the national level with a patellar luxation, having never exhibited lameness in their life. For this reason, I felt it would be appropriate to discuss the development and implications of this condition.

Patellar luxation is a common condition seen in toy, miniature, and large breed dogs and is characterized by the kneecap dislocating or “floating” out of the trochlear groove. The kneecap can float either to the inside of the knee (medial luxation) or to the outside of the knee (lateral luxation). Medial luxations account for 80%-90% of all cases, regardless of the size or type of dog. When lateral luxations occur, they are almost exclusively found in large and giant breed dogs. Patellar luxation is further classified as either congenital or traumatic in nature. Most cases are congenital, meaning the abnormalities leading to patellar luxation are present from birth. It is reported that both knees are affected in 25%-50% of congenital cases. Certain breeds are over-represented for this abnormality, which would suggest that this is a heritable condition. (A complete breed ranking can be found at [www.offa.org/patluxstatbreed.html](http://www.offa.org/patluxstatbreed.html).) Ideally, dogs affected with congenital patellar luxation should not be used for breeding.

## Anatomy

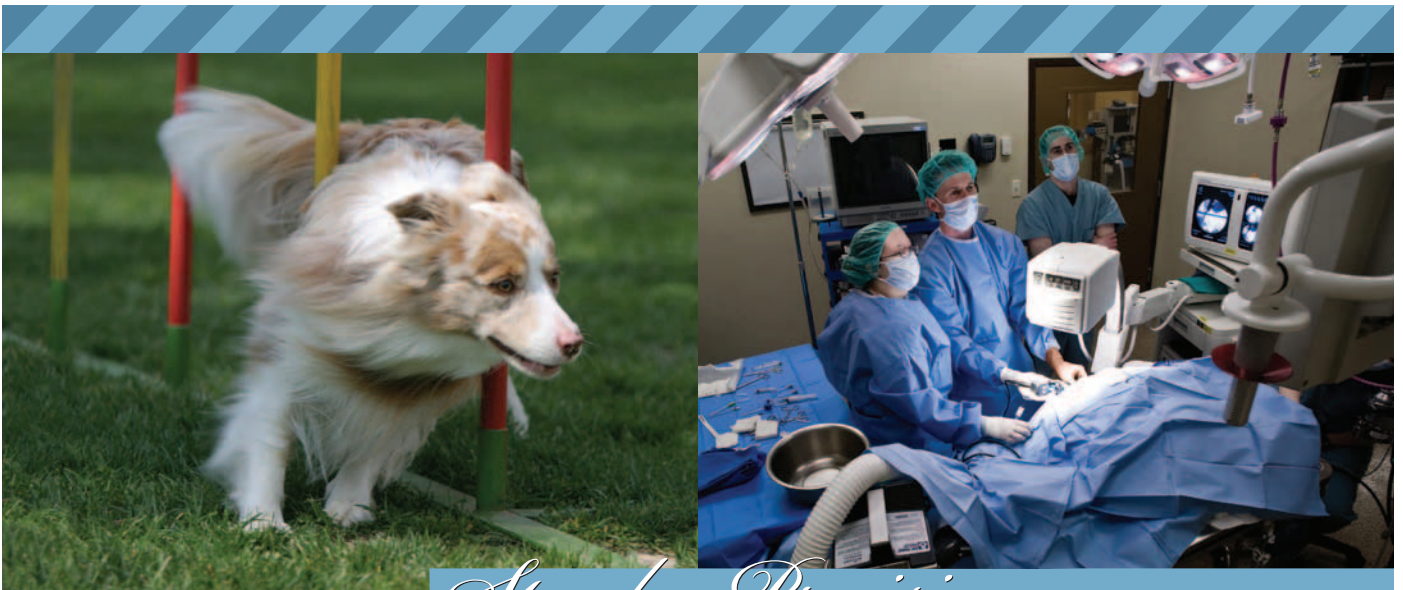
Anatomically, the patella is part of the pelvic limb extensor mechanism. This consists of the quadriceps muscle group (rectus femoris, vastus medialis, vastus intermedius, and vastus lateralis muscle) that conjoin to form a single tendon in which the kneecap is embedded. The quadriceps tendon courses over the end of the femur and inserts on the tibial crest. The normal femur is fairly straight, generally having less than 9° of medial to lateral deviation. At the distal end of the femur lies a groove, called the trochlea, which is covered with hyaline cartilage and articulates with the patella. The insertion point of the quadriceps tendon is called the tibial tuberosity and is located at the top portion of the tibia. The patella glides within the trochlear groove, which allows for fluid motion of the knee and maintains the normal tension needed to prevent collapse of the joint during forward motion.

Congenital patellar luxation develops secondarily to poor skeletal development, which can manifest as one or more of the following: hip dysplasia, an increased angle of femoral neck angulation, femoral valgus (abnormal outward turning of a bone) or varus (abnormal inward rotation of the bone or foot), and/or tibial torsion. This abnormal bone alignment does not allow for the quadriceps muscle/tendon unit to line up correctly over the trochlea. Without normal alignment, it is thought that the patella does not provide enough pressure on the distal femur during development, resulting in a shallow or absent trochlear groove, and a poorly developed or stretched patellar retinaculum (a band that helps to hold the kneecap in place).



Left: Leg with a patella luxation. X-ray beam is coming from the front to the back of the leg. Right: Same view, but no patellar luxation.

[Certain breeds are overrepresented for this abnormality, which would suggest that this is a heritable condition.]



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## Diagnosis

Diagnosis is made from the patient history, palpation, and diagnostic imaging (radiographs, CT scan, or MRI). Patellar luxation is graded on a scale from 1 (low) to 4 (more severe), based on severity of the luxation and anatomic bone deformity. The grade of luxation often correlates with the degree of lameness, but not always.

- Grade 1 luxations are where the kneecap can be manually pushed out of the groove, but otherwise stays in the groove during normal activity. This degree of luxation is often asymptomatic and typically does not require treatment. However, it may become apparent in a performance dog, because the stress on the stifle joint is greater during periods of high speeds and jumping with concurrent tight turns. This manifests as a hesitation to jump or an occasional “skip” stride.
- Grade 2 luxations float in and out of the joint on their own, but spend more time in the groove than displaced. Patients with this grade of luxation often carry the limb intermittently while walking or going up and down stairs.
- Grade 3 luxations float in and out on their own, but are displaced from the groove the majority of the time. These cases often are continuously non-weightbearing lame or have a crouched, knock-knee gait.
- Grade 4 luxations remain displaced from the groove, and cannot be manually replaced within the groove. Grade 4 luxations, especially in large breed dogs with lateral luxations, are often the result of severe bone deformities of both the femur and tibia. Clinically, grade 4 luxations are characterized by an abnormal stance and gait, with a significant amount of weight being transferred to the front limbs. They usually require extensive surgery to be corrected and carry a more guarded prognosis.

Patellar luxation is generally considered a mechanical lameness, in that it is not particularly painful (but is uncomfortable) when the kneecap is out of normal alignment. Lameness results because the dog is physically unable extend the knee in a normal manner. The condition can cause further discomfort because the chronic wearing away of normal cartilage from the ridges of the femur and patella subsequently results in the development of osteoarthritis. Medial patellar luxation also results in internal rotation of the entire knee, which can place additional stress on the cranial cruciate ligament and is a predisposing factor for developing a cruciate tear. Patellar luxation has also been noted secondary to severe hip dysplasia and subluxation (incomplete or partial dislocation) of the coxofemoral (hip) joint.

## Treatment

Surgery is not mandatory for all patellar luxations, and recommendations vary from case to case. In our practice, we base the need for surgery on the type of work the dog is asked to do, the degree of lameness, chronicity of the lameness, and the degree of patellar luxation. In general, surgery typically coincides with a grade 2 patellar luxation or greater in a young, active patient.

There are four key components that need to be assessed and corrected if abnormalities are found

1. Integrity of the structures within the stifle
2. Trochlear groove depth
3. Skeletal alignment
4. Joint capsule/retinaculum

The first portion of surgery is usually aimed at assessing the structures of the joint (cranial and caudal cruciate ligaments, menisci) and the trochlear groove. If the groove is shallow, then it is deepened surgically. There are four major ways to deepen the groove. The first is the abrasion trochleoplasty, which involves removing the joint cartilage and deepening the subchondral bone with either a bone rasp or a high-speed burr. While this is the easiest method of deepening the groove, it removes all of the natural cartilage that is in place (hyaline cartilage) and relies on the body's ability to cover the exposed bone with fibrocartilage. Fibrocartilage does not have the same characteristics as normal cartilage, and the chances of osteoarthritis (OA) development or progression is higher with this procedure. Therefore, this procedure is best reserved for severe cases of eburnated (exposed) bone where there is already an absence of normal cartilage and there is truly nothing left to “preserve.”

The next two options involve elevation of the contact portion of the cartilage with the underlying bone in either a wedge or block shape to create a recession. This allows the normal cartilage to remain relatively unharmed, while the underlying subchondral bone is removed. Once an adequate depth has been achieved, the wedge or block is replaced and is “press fit” into the recession or is held in place with a small pin. While both procedures allow for an adequate groove to be developed, research would suggest that the block shape allows for a deeper, wider groove and better contact at the apex of the trochlea, the location at which the patella is most likely to luxate. While this procedure is more technically demanding, it is my preferred method of deepening the trochlear groove. A fourth procedure available is chondroplasty, where a cartilage flap (without the underlying bone) is elevated. However, this procedure can only be performed in dogs less than 4-6 months of age and is rarely used.

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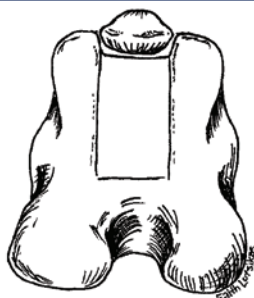
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X-ray following surgical correction, showing a block recession and tibial tuberosity transposition.



The patella is well seated within the surgically deepened groove

Once the groove has been addressed, the alignment of the tibia and femur are assessed. Femoral angulation correction (via a wedge osteotomy) is uncommon and generally reserved for cases with greater than 10°-12° of medial to lateral deviation of the femur. On the other hand, tibial correction is commonly performed and involves cutting the tibial tuberosity and moving (transposing) it either medially or laterally, depending on the nature of the abnormality. The tibial tuberosity is held in the new anatomic location with k-wires (pins). In large breed dogs, a figure-eight wire band is also placed to prevent avulsion (traction) on the tibial tuberosity.

Following correction of the groove and alignment, the knee should be able to be placed through a full range of motion without the patella luxating. If the patella dislocates with internal rotation of the knee, then an anti-rotational suture (placed around the lateral fabella or sesamoid bone through the tibial tuberosity) may be necessary. The final step of the procedure is to tighten the medial or lateral retinaculum (band within the joint capsule that helps to hold the kneecap in place). This can be performed by either imbricating (over sewing) the joint capsule or via a capsulectomy (removal of a portion of the joint capsule). In some cases, the side of the joint capsule in which the luxation has occurred needs to be “released” to allow for proper orientation of the kneecap. In these cases, the release site is left open to heal on its own, because surgically closing it may cause too much tension and cause relaxation.

Postoperatively, our patients are sent home on 10-14 days of an anti-inflammatory medication and a pain medication. We typically do not bandage the operated limb, as we want to encourage early limb usage. We also recommend a course of treatment with Adequan (a polysulfated glycosaminoglycan that may aid in cartilage healing), which is given intramuscularly every four days for the first month following surgery.

## Prognosis

The most common complication reported is relaxation of the patella and is often associated with failure to correct all affected components of the condition at the time of the initial surgery. In my opinion, an increase incidence of relaxation is also seen in severe cases of patella luxation (grade 4, significant angulation of the femur) or in cases with concurrent cruciate ligament tears (which should also be addressed at the time of initial surgery or as a staged procedure). However, the relaxation is usually a grade 1-2 and non-clinical, thus often does not need to be surgically addressed. Migration or loosening of k-wires can also occur (typically happens once the bone has healed). While implant removal is required in these cases, this is a minor procedure and has little to no affect on the long-term success of the procedure. Infection is always a risk with orthopedic surgery and is usually related to the patient licking the incision. This is best avoided with use of an Elizabethan or cone collar for 10-14 days following the procedure.

## Rehabilitation Therapy

In our practice, we attribute our high rate of success not only to the surgical procedure performed but also to the frequency with which we re-evaluate our postoperative patients



through our rehabilitation department. While not mandatory following surgery, rehabilitation therapy helps speed the rate of recovery. Speeding up recovery is achieved by decreasing inflammation and discomfort, restoring joint range of motion, building muscle mass, and encouraging limb usage. Therapy becomes particularly important in patients that continue to skip or carry the limb following a successful surgery. This behavior can develop out of habit (chronic luxations) or due to discomfort associated with severe cartilage defects/osteoarthritis that developed from a delayed surgical correction. We have also had success managing young dogs affect-

ed with grade 1-2 patellar luxation by using rehabilitation therapy alone. If the alignment is normal, we can sometimes physiologically tighten the knee by increasing the quadriceps muscle mass. Theoretically, this may also aid in the development of the trochlear groove in skeletally immature patients.

Patellar luxation is a common condition that many agility dog owners might encounter with one dog or another. If addressed early and properly, the prognosis for return to normal activity with surgical correction is excellent. 🐾

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*Dr. Peter Lotsikas is a Diplomate of the American College of Veterinary Surgeons. He graduated with a BS degree in Biology from Virginia Tech and a DVM degree from the Virginia-Maryland Regional College of Veterinary Medicine. He then completed a general small animal internship at Kansas State University, followed by a surgical internship at Dallas Veterinary Surgical Center. Dr. Lotsikas received his formal surgical residency training at Iowa State University. He now practices at the Veterinary Orthopedic & Sports Medicine Group (VOSM) in Annapolis Junction, Maryland. Additional information about Dr. Lotsikas is available at [www.VOSM.com](http://www.VOSM.com).*

*Dr. Faith Lotsikas earned her veterinary degree from the Virginia Maryland Regional College of Veterinary Medicine. She has always had a strong interest in whole pet wellness. For that reason, she became a certified canine rehabilitation therapist through the Canine Rehabilitation Institute. She now practices with her husband at the Veterinary Orthopedic & Sports Medicine Group (VOSM) in Annapolis Junction, Maryland. She is also an amateur veterinary medical illustrator. Additional information about Dr. Lotsikas is available at [www.VOSM.com](http://www.VOSM.com).*

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