Patellar Luxation

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Patellar luxation is a common problem of both large and small dogs and may be seen in cats as well. (7, 15) The condition may be developmental or traumatic in origin. The classic presentation is for small dogs to have medial patellar luxations and large dogs to have lateral luxations. This, of course, is subject to many exceptions, and some small dogs are presented with lateral patellar luxation and vice versa.

**Anatomy**

The anatomy of the stifle joint has been described elsewhere (Chapters 30 and 80). The regional anatomy of interest in patellar luxations revolves around the relationships among the femur, tibia, pelvis, and hock joint. The special relationships among these structures determine the position of the soft tissues and therefore whether the patella sits within the trochlear groove or beside it. Much has been made of the medial and lateral femoropatellar ligaments, which are really just delicate bands of loose connective tissue that connect the patella to the fabella on the lateral surface and the periosteum of the epicondyle of the femur on the medial side. (18) These ligaments have been reconstructed to treat medial patellar luxation. (6, 31)

**Medial Patellar Luxation**

**ETIOLOGY, CLASSIFICATION, AND PRESENTING SIGNS**

Medial patellar luxation is seen most commonly in small breed dogs as a congenital or developmental problem. (24) Most animals that experience this condition can be diagnosed within the first 6 months of life. The severity of the condition seems to be related to the age of onset: the early cases result in the more severe disability and deformity. Although the cause of the condition has not been determined, most reports do not recommend the breeding of animals with patellar luxation. (5) It is interesting to note that the veterinary literature contains a paucity of information regarding cause and effect relationships. Putnam's thesis (24) represents an attempt to unravel the mystery of patellar luxation. His biometric study made use of both radiographs and specimens to analyze the hindlimb. His distinction between the terms anteversion and femoral torsion, although defined in the paper, was unfortunate, since it has led some readers to misquote the results of his study. When measuring the specimens directly, Putnam showed that the femoral anteversion was increased, which he claimed followed the clinical manifestations of the condition, namely, the inward rotation of the pelvic limb. The relative decrease in anteversion measured radiographically was related to the femoral torsion, which is usually considered part of femoral anteversion. The real conclusions of this study were that the relationships of the patella to the tibia, femur, pelvis, and soft tissues are complex. The relationships showed significant differences in the rate and pattern of pelvic limb development.
between normal and abnormal animals. Hypoplasia of the distal femoral epiphysis was found to occur in the abnormal group and was thought to be the primary reason for bowing of the distal femur. Other abnormalities of position were described.

Most of the other reports in the veterinary literature are case reports describing the deformities and technique papers designed to correct the deformity described. (1-17,19-32,34,36) The treatment regimens reported have included the use of counterirritants (17) and casting, (1) patellar desmotomy, 12 surgical replacement of the femoropatellar ligament, (5,11,14,23,31,32,33) transplantation of the tibial crest, (15,16,25,33,35,37) capsular tucking techniques, (4,10) patellectomy, (6,13) trochlear chondroplasty (10,16,25) or recession (31), trochlear ridge prostheses, (20,21) and osteotomy of the tibia and/or femur. (29)

A simple useful classification of medial patellar luxations was designed by Putnam. (24) It can be used for lateral luxations as well.

Grade 1. Animals in this group have a patella that can be luxated manually but returns to its normal position within the trochlear groove when released.

Grade 2. This group includes animals in whom the patella can be luxated manually or those animals in whom stifle flexion with or without internal rotation of the tibia will cause luxation of the patella. The patella once luxated remains so until it is replaced manually.

Grade 3. In this group of animals the patella remains luxated most of the time. It can be reduced manually but will reluxate when the manual pressure of reduction is removed.

Grade 4. In this group of animals the patella will be luxated all the time and manual reduction of the patella within the groove will be impossible even with the leg in full extension.

Grades 1 and 2 represent luxations of the recurrent type, while grades 3 and 4 represent the permanent type.

The deformities associated with medial patellar luxation are graded in each case but include one or more of the following: a shallow trochlear groove; compensatory bowing of the pelvic limb, with the femur bowed laterally in its distal aspect and the tibia bowed medially at its proximal aspect; increased laxity of the stifle joint, especially on its lateral aspect; internal rotation of the tibia; medialization of the tibial crest; distal displacement of the lateral femoral condyle; absence of the medial trochlear ridge; and instability of the patella in the medial to lateral directions or frank dislocation of the patella. In addition to these signs of patellar problems, the stifle joint may have concurrent problems of instability such as rupture of the cranial cruciate ligament.

Presenting signs associated with medial patellar luxation include transient pain and lameness. In grade 1 and 2 animals the gait may at times be normal. Initially some animals may yelp with pain when the luxation occurs. Many animals seem to accommodate to the condition and may be relatively pain-free on examination even if the patella is luxated. The more severe grade 3 and 4 dogs, especially if presented with bilateral disease, show flexion deformities of the stifle joint. The incidence of patellar luxation is unknown, but the majority of patellar luxations in small dogs occur medially, with approximately 25% of the dogs showing bilateral disease.

TREATMENT
Nonsurgical treatment of medial patellar luxation may be successful and may be useful in animals with grade 1 and 2, and sometimes even grade 3, luxations; such management consists of rest and analgesics. Some animals will have a very good result if the patella stabilizes in the reduced position. Equally good results may occur in the animal in whom the patella has stabilized in the luxated position. The progression is related to the age of the animal when first diagnosed as well as to the severity of the problem. It is not uncommon to discover during a general physical examination that an animal has a medial luxation of the patella and to learn from the owner that the dog has never had a problem with the limb or did have a transient problem as a pup. Thus, a good percentage of dogs with medial patellar luxations will survive in a relatively pain-free, fully functional manner if left untreated.

Many surgical treatments of medial patellar luxation are available and have been included above in the discussion of the veterinary literature. The sheer number of procedures makes a statement about the individual success of any single method. No procedures have been presented in the veterinary literature with good long-term follow-up information. The surgical treatments described here are not meant to be inclusive but will solve most of the problems associated with medial patellar luxation. The success rate of any one or combination of procedures cannot be assured and has not been documented adequately in the literature. Certainly the results are superior when dealing with the less severe grades, namely, grades 1 and 2. The complexity of the surgical considerations are also increased as the grades of luxation increase to grades 3 and 4. In general, the prognosis for a successful outcome decreases as the grade and physical signs of disability increase and is inversely
related to the age of the patient at the time of onset. Therefore, the younger the patient, the more guarded the prognosis. Since the problem is a developmental one, it is difficult to predict the severity of the end result. At the same time, the best results will occur the sooner the surgical procedure is carried out. The youngest dog in whom I have seen a successful outcome was 3 weeks of age and presented with one medial patellar luxation and one lateral luxation. In this case only a soft tissue refeeding of the joint capsule was necessary, since the dog did not yet have any discernible bony deformity. In very young dogs only soft tissue procedures are recommended because of the problems associated with growth deformities that occur with bonereconstructive procedures. The soft tissue "tuck" will often allow the animal to grow with little deformity; if and when a revision is necessary, the skeletal structures will be stabilized to allow for the definitive procedure.

Capsular overlap represents a simple technique for grade I patellar luxations and is especially useful for traumatic luxations. With this procedure a lateral parapatellar skin incision is made and the fascia and joint capsule are reopened parallel to the extensor mechanism about 3 mm lateral to the patella. The incision through the fascia and joint capsule is continued along the length of the joint capsule. The patella is then reduced and mattress sutures are placed along the base of the joint capsule near the patella and are then sutured over the patella and fascia over the patella. The free edge of the fascia and joint capsule is sutured to the patella and quadriceps mechanism about 3 mm lateral to the patella. The incision through the fascia and joint capsule is continued along the length of the joint capsule. The patella is then reduced and mattress sutures are placed along the base of the joint capsule near the patella and are then sutured over the patella and fascia over the patella. The free edge of the fascia and joint capsule is sutured to the patella and quadriceps mechanism about 3 mm lateral to the patella. The incision through the fascia and joint capsule is continued along the length of the joint capsule. The patella is then reduced and mattress sutures are placed along the base of the joint capsule near the patella and are then sutured over the patella and fascia over the patella. The free edge of the fascia and joint capsule is sutured to the patella and quadriceps mechanism about 3 mm lateral to the patella.

In these cases the object of surgery is to replace the patella within the trochlear groove by realigning the quadriceps mechanism over the front of the femur, thereby allowing proper positioning of the patella. One drawback to this procedure is the further medial rotation of the patella caused by transposing the tibial crest laterally. The lateral collateral ligament is stretched, increasing potential instability of the joint and creating a deformity of the lower limb. Most dogs in whom tibial crest procedures are performed will be able to extend the stifle normally but will have an internal tibial rotation deformity that produces its own peculiar gait, with the hocks pointing outward in external rotation. Combining this procedure with fibular head transposition will usually solve this problem.

Tibial crest transposition has been used when medial rotation of the tibia or medialization of the tibial crest is evident. In these cases the object of surgery is to replace the patella within the trochlear groove by realigning the quadriceps mechanism over the front of the femur, thereby allowing proper positioning of the patella. One drawback to this procedure is the further medial rotation of the patella caused by transposing the tibial crest laterally. The lateral collateral ligament is stretched, increasing potential instability of the joint and creating a deformity of the lower limb. Most dogs in whom tibial crest procedures are performed will be able to extend the stifle normally but will have an internal tibial rotation deformity that produces its own peculiar gait, with the hocks pointing outward in external rotation. Combining this procedure with fibular head transposition will usually solve this problem.

FIG. 81-1 A medial patellar luxation is repaired using tibial tuberosity osteotomy (A) and transposition laterally with fixation provided by a Kirshner wire (s). The soft tissue insertion of the quadriceps has been left intact. This procedure is usually done in conjunction with and at the same time as a capsular overlap repair to help stabilize the patella in the trochlear groove. (DeAngelis M, Hohn RB Evaluation of surgical correction in 142 cases of patellar luxation in the dog. J Am Vet Med Assoc 156 587-594, 1970)

Fibular head transposition is a technique adapted from humans. The procedure was designed to be a method of extracapsular repair of cranial cruciate ruptures. It has been used successfully for this condition in the dog as well but seems to find a natural place in the treatment of canine medial patellar luxation. The principle of the technique is to tense the lateral collateral ligament by moving the head of the fibula cranially with the ligament attached, thereby externally rotating the tibia and moving the tibial crest back into alignment so that the extensor mechanism is again in position with the patella in the trochlear groove. The procedure is accomplished by careful dissection around the head of the fibula to free the fibula and its attached collateral ligament from the tibia. Once the structure is freed it can be moved cranially and reattached to the tibia with a Kirshner wire or a cerclage wire. In tiny dogs the Kirshner wire may be placed behind the head of the fibula in its attached collateral ligament from the tibia.
new position, since the head itself may be too small to beanchored with a pin. The procedure is effective in derotatingthe tibia. Sometimes it is used in conjunction with the capsularoverlap described above(19) (Fig. 81-3).

FIG. 81-2 Cranial-caudal (A) andlateral (B) radiographs show a grade 3 medial patellar luxation. Note the rotation of the tibia in relation to the femur. The lateral view shows Superimposition of the patella over the trochlear ridge. Postoperative films show the results of atibial crest transposition after the crest has been completely removed and repositioned more laterally and distally (C,D). Two Kirschner wires and a single mattress suture are used to secure and stabilize the tibial crest. Moving the crest more distally is often helpful in improving the stability of the repair. In this case relocation of the patella within the trochlear groove has actually derotated the tibia even though the tibial crest was moved laterally. This occurs only when the crest is minimally displaced laterally as would occur with an incomplete osteotomy of the crest as described in the text.

FIG. 81-3 Cranial-caudal (A) and lateral (B) radiographs of a severe medial patellar luxation. The cranial-caudal projection demonstrates extensive degenerative changes associated with the medial patellar luxation. The lateral projection shows a great deal of rotational incongruence between the femur and tibia. The patellaiis not appreciated because of its Superimposition over the femur. Postoperative films (C,D) show reduction of the luxation and derotation of the tibia. This serious problem was solved by combining a tibial crest transposition (complete osteotomy of the crest) with a fibular head transposition. The combination was necessary to allow a functional leg. The fibula was positioned and held in place with a Kirschner wire placed caudal to it. The tibial crest was positioned using a 20-gauge wire suture and two small Kirschner wires to add support to the fixation. The end result was that the dog was able to use a leg that before surgery was almost useless.

FIG. 81-4 A cranial-caudal radiograph demonstrates a severe grade 4 luxation. Physical examination of the patient with patellar luxation is critical. This little poodle had severe gait abnormalities with flexorcontractions of the stifles bilaterally. The extensors of the knee were now part of the flexor group. Treatment of such a dog by tibial crest transposition is impossible, since the quadriceps group is not long enough to position the patella into the trochlear groove and allow the tibial crest to reach the tibia. (One would be lucky in a case such as this to have the tibial crest reach the trochlear groove, let alone the patella.) Thus, some animals will be presented that may not have a good result with surgery because the surgical procedures are not able to improve upon the underlying condition.

Trochleoplasties of the distal femur have been used to provide a deeper surface for the patella to track within. A number of
procedures have been described. In one, the groove is established or deepened using a bone file to rasp away the cartilage and some subchondral bone. Alternatives are to undermine the cartilage, lift it out of the way, and remove the bone under the cartilage to the desired depth and then replace the cartilage in this new groove. Recently a novel method of trochlear recession was added to the veterinary literature. With this method a V-shaped cut is made into the trochlea, beginning on the ridges and meeting in the depths of the bone. The amount of bone removed as swath material is just enough to allow the trochlea to settle into a deeper position, producing a good trochlear groove. The depth of the recession is controlled by the amount of bone removed in the saw cut. No fixation is needed to maintain the trochlea in position. It must be remembered that the trochlear groove develops in the young animal because of the presence of the patella in it. Therefore young animals that have grade 3 or 4 luxations will not have a ready-made trochlear groove (Fig. 81-4).

Lateral Patellar Luxation

Lateral luxation occurs in both large and small dogs (Fig. 81-5). When it is present bilaterally the animals have a crouched genu valgus-type stance. This condition has not received as much attention as medial patellar luxation in the dog. Lateral patellar luxation is the most common form of luxation in humans, and the literature, although more extensive, shows a similarity with the condition in the dog. (24, 36) Generally, lateral luxation is seen in older small breed dogs but occurs also in the young giant breeds. The large dogs usually have a conformational problem related to little angulation in the hip, hock, and stifle joints. It is not unusual for these dogs to present with rupture of the cranial cruciate ligament as well as the lateral patellar luxation.

Treatment of these dogs makes use of the techniques discussed under Medial Patellar Luxation except that fibular head transposition is not included and transposition of the tibial crest is medial rather than lateral. (33) Obviously the capsular procedures are reversed so that the overlap occurs on the medial rather than the lateral side. Severe cases of lateral patellar luxations are discussed in Chapter 56, "Genu Valgum."

Traumatic Luxation

Traumatic luxation of the patella can occur in both medial and lateral directions. The history usually relates an episode of pain followed by lameness. In some dogs a grade 1 luxation results, while other animals seem to have a much more severe problem. It is especially important to check these animals for rupture of the cranial cruciate ligament. If the cruciate ligament is intact, one of the above procedures will usually correct the problem. If the ligament is ruptured and the luxation is medial, fibular head transposition may solve both problems.

Feline Patellar Luxation

Patellar luxation has been reported in cats. (7, 15) The condition, although uncommon, can occur bilaterally and may be associated with hip dysplasia (bilateral subluxation). The luxation is usually medial, and surgical correction does not seem to have lasting value and thus is not recommended. Young animals subjected to bony reconstructive procedures are likely to develop deformities of the proximal tibia related to the surgeries. Most cats with patellar luxations seem to have the best results when treated conservatively.
References

29. Shuttleworth AC: Dislocation of the patella in the dog. Vet Rec1935

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