

PRACTICAL TECHNIQUES FROM THE NAVC INSTITUTE

SURGICAL CORRECTION OF PATELLAR LUXATION IN CATS



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Patellar luxation is a relatively uncommon cause of hindlimb lameness in cats. Many clinically normal cats have mild femoropatellar joint laxity, and during orthopedic examination patellar subluxation or even low-grade luxation can often be induced.¹ It is important to differentiate these clinically insignificant cases of patellar laxity from cases in which patellar luxation causes hindlimb lameness (**Table 1**).

Medial patellar luxation is more common in cats than lateral patellar luxation.³ In approximately 80% of cats, patellar luxation is bilateral, and its origin can be congenital

or traumatic.^{2,4} In cats with persistent clinical lameness attributable to patellar luxation, surgical correction is recommended.³

ASSESSMENT

Orthopedic Examination

During initial orthopedic examination, categorize the severity of the patellar luxation. A slightly modified 4-level grading scheme, originally developed to categorize patellar luxation in dogs, is commonly applied to cats (**Table 2**).⁴⁻⁶

Imaging

Before surgical correction of patellar luxation, obtain mediolateral and craniocaudal projection radiographic views of the affected stifle joint. Evaluate the radiographs for the presence or absence of degenerative changes and joint effusion, as well as the shape and size of the tibial tuberosity (**Figure 1**).

TABLE 1. Common Signs of Feline Patellar Luxation

- Intermittent or constant lameness
- Discomfort when affected stifle is manipulated or patella luxated
- Stifle locking when affected hindlimb is extended²
- Adoption of a crouching stance in affected limb²

TABLE 2. Grading Patellar Luxation in Cats

GRADE	DESCRIPTION OF PATELLA
Grade I	<ul style="list-style-type: none"> • Tracks normally in trochlear groove most of the time • Can be luxated with digital manipulation • Reduces when digital pressure is relaxed
Grade II	<ul style="list-style-type: none"> • Remains in trochlear groove most of the time • Can be luxated with digital manipulation • Stays luxated when digital pressure is relaxed
Grade III	<ul style="list-style-type: none"> • Remains luxated most of the time • Can be reduced into trochlear groove with digital manipulation • Reluxates when digital pressure is removed
Grade IV	<ul style="list-style-type: none"> • Remains luxated • Cannot be reduced with digital manipulation

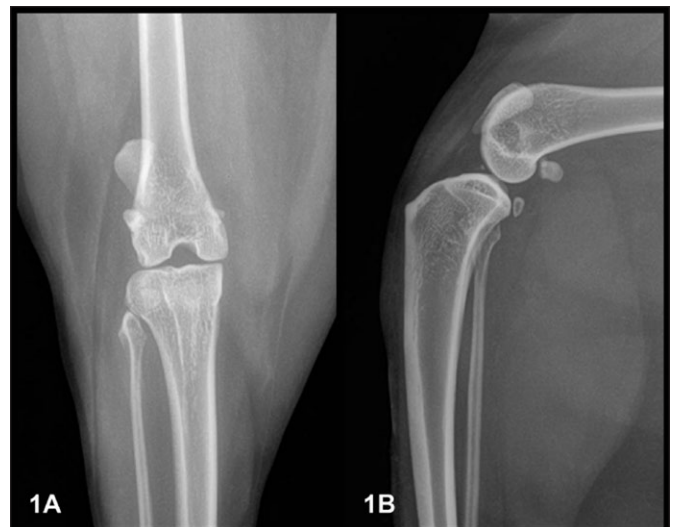


Figure 1. Craniocaudal (**A**) and mediolateral (**B**) projection radiographs of a patient with an acute, traumatic lateral patellar luxation. Consistent with the acute onset of clinical signs, minimal degenerative changes are noted in the stifle joint. On the mediolateral projection, a small radio-opaque region is present just proximal to the cranial aspect of the tibial plateau and is consistent with meniscal mineralization.

If desired, obtain a skyline view of the trochlear groove, which allows trochlear groove depth to be assessed before surgery (**Figure 2**).² The trochlear groove is an appropriate depth if 50% or more of the patella sits below the trochlear ridges.⁷

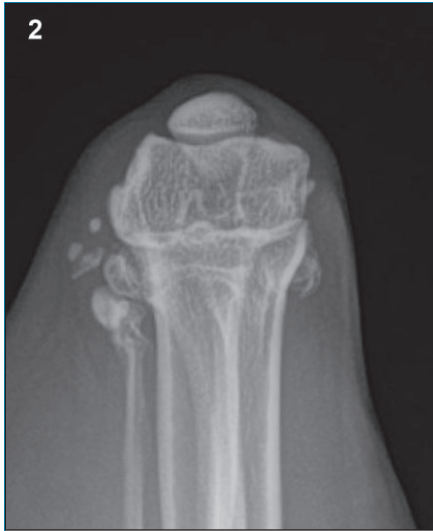


Figure 2. The skyline view of the stifle allows preoperative assessment of trochlear groove depth. In this patient, less than 50% of the patella sits in the trochlear groove, and a trochleoplasty procedure to deepen the groove is indicated. The skyline view is obtained by positioning the

patient in sternal recumbency on the radiography table. The stifle is flexed so that the cranial aspect of the crus can be placed on the radiographic plate and the radiographic beam is parallel with the trochlear groove.



Read **Small Animal Radiography: Stifle Joint & Crus**, published in the March/April 2012 issue of *Today's Veterinary Practice* and available at tvpjournal.com, for further information about imaging the stifle joint.

SURGICAL APPROACH

The surgical approach to the stifle joint for correction of patellar luxation is through either a lateral or a medial incision, as described by Piermattei and Johnson.⁸ I recommend the:

- *Lateral* incision for correction of *medial* patellar luxation
- *Medial* incision for correction of *lateral* patellar luxation.

1. Positioning

Position the patient in dorsal recumbency for either approach, with the affected limb clipped, prepped, and positioned off the end of the operating table (**Figure 3A**). A V-top surgery table is invaluable for maintaining the patient in dorsal recumbency during the operation.

2. Incising the Skin

Create a skin incision from the level of the tibial tuberosity proximal to the patella and then continue proximally a distance equal to the distance between the patella and tibial tuberosity (**Figure 3B**). Make the skin incision several millimeters lateral or medial to the patellar ligament and patella for the lateral or medial approach, respectively. Continue the skin incision through the subcutaneous tissue to the level of the fascia lata (laterally) or the medial femoral fascia (medially).

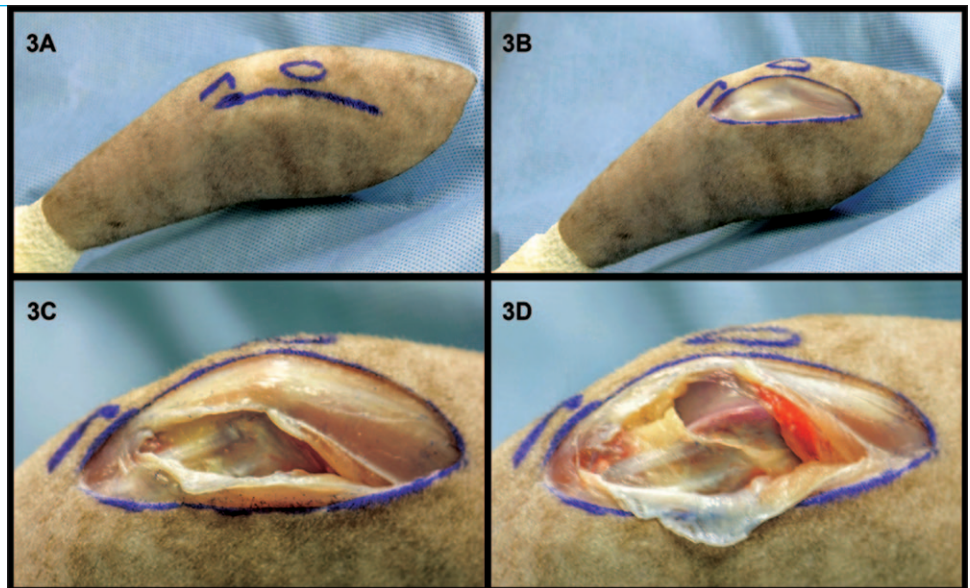
3. Incising the Fascia

Incise the fascia on the same line as the skin incision, taking care to stay several millimeters medial or lateral to the patellar ligament and patella (**Figure 3C**). Proximal to the patella, the fascial incision can be

Figure 3. Approach to the stifle joint through a lateral incision. Proximal is to the right and distal to the left in all 4 images.

With the patient in dorsal recumbency (**A**), the landmarks for the lateral approach (tibial tuberosity and patella) have been outlined with a purple marking pen, as has the recommended location of the parapatellar skin incision. The skin incision is created (**B**), starting just lateral to the tibial tuberosity and extending proximal to the patella equidistant to the distance between the tibial tuberosity and the patella. The skin incision stays several millimeters lateral to the patellar ligament and patella.

The fascia lata has been incised on the same line as the skin incision (**C**). Proximally, the fascial incision curves slightly caudally to avoid the bulk of the vastus lateralis muscle (which minimizes hemorrhage). The joint capsule has been incised on the same line as the skin and fascia lata, exposing the trochlear groove and infrapatellar fat pad (**D**).



angled slightly caudally to avoid the vastus lateralis muscle (lateral approach) or cranial part of the sartorius muscle (medial approach). Carefully dissect the fascia off the underlying joint capsule for several millimeters cranial and caudal to the fascial incision.

4. Incising the Joint Capsule

Incise the joint capsule and parapatellar fibrocartilage on the same line as the fascial incision, starting with a stab incision near the tibial tuberosity and continuing the incision proximally with blunt-tipped scissors to minimize the chance of damaging the underlying articular cartilage (Figure 3D).

5. Evaluation of the Joint

Once the arthrotomy is complete, luxate the patella contralateral to the side on which the arthrotomy was performed, and evaluate the:

- Articular cartilage surfaces of the patella and trochlear groove for wear
- Depth of the trochlear groove relative to the height of the patella
- Cranial and caudal cruciate ligaments and cranial pole of the medial and lateral menisci for damage.

With use of an open arthrotomy approach, if the cranial cruciate ligament is intact, a thorough evaluation of the caudal pole of the medial and lateral menisci is very difficult in the feline stifle.

SURGICAL TECHNIQUES

Block Recession

In patients with a shallow trochlear groove (Figure 4A, see SURGICAL APPROACH, Step 5. Evaluation of the Joint), a trochleoplasty procedure is recommended to deepen the groove. The block recession is my preferred technique because it maximizes articular cartilage contact between the patella and trochlear groove, particularly near the proximal and distal ends of the groove.⁹

To perform the block recession:

1. Use a fine-tooth hobby saw (X-ACTO blade; xacto.com) to create 2 abaxial osteotomies just axial to the highest point on the trochlear ridges (Figure 4B). Angle the osteotomies 10° axially, relative to the sagittal femoral plane. Osteotomy depth should allow the osteotomies to extend from the proximal to the distal end of the trochlear groove (Figure 4C).
2. Use a fine osteotome or Beaver scalpel blade (#376400 or #374562) to remove the block of trochlear bone and articular cartilage defined by the abaxial osteotomies. Intermittently advance the osteotome or Beaver blade from both the proximal and distal ends of the block to minimize the chance of fracturing the trochlear bone segment.
3. Once the block of bone and cartilage is removed (Figures 4D and 4E), deepen the abaxial osteotomies an appropriate amount (1–2 mm of bone in most cats) to allow ≥ 50% of the patella to sit in the

trochlear groove once the block of trochlear bone and cartilage is replaced. Evenly resect the subchondral bone base of the recipient trochlear site by using a fine osteotome, Beaver blade (#376400 or #374562), or a narrow bone rasp.

4. Replace the previously removed block of trochlear articular cartilage and subchondral bone and press-fit it into the recipient bed using firm finger pressure or a smooth-handled instrument (Figure 4F).¹⁰

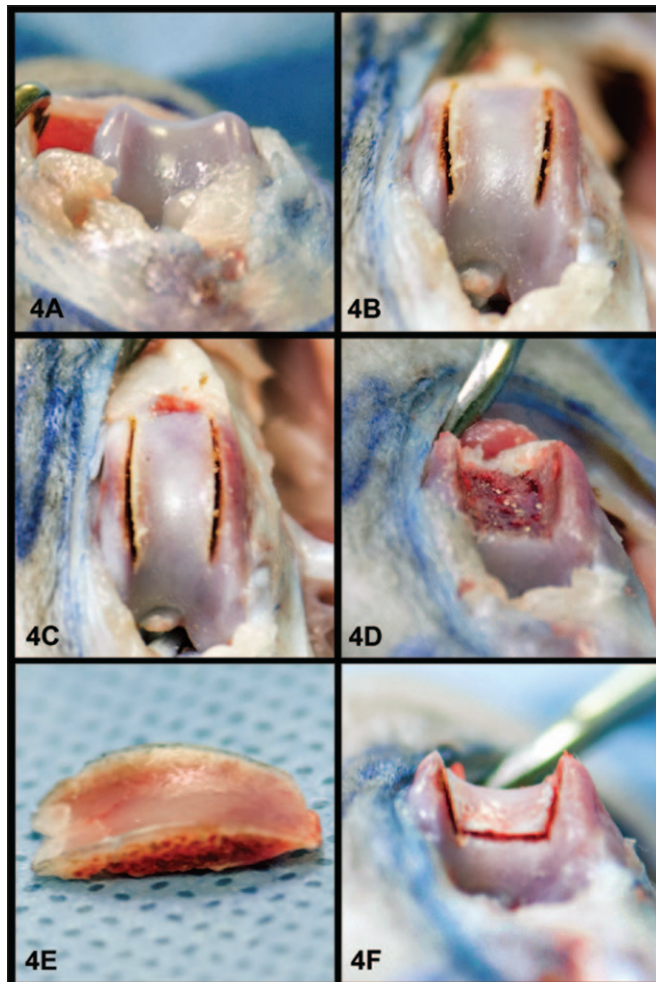


Figure 4. Assessment and surgical treatment of the trochlear groove (trochleoplasty) using a block recession technique. Depth of the trochlear groove is assessed by flexing the stifle to 90° and viewing the trochlear groove and ridges from distal to proximal (A). The groove should be deep enough to contain ≥ 50% of the patella.

Two abaxial osteotomies are created just axial to the highest point on the trochlear ridges (B), and should angle 10° axially relative to the sagittal femoral plane. Osteotomy depth should allow the osteotomies to extend from the proximal to the distal end of the trochlear groove (C). The recipient site in the femoral trochlea (D). The remaining subchondral bone surface has been rasped smooth in preparation for reinsertion of the trochlear groove osteochondral block. Trochlear groove osteochondral block is temporarily removed during the trochleoplasty procedure (E); then reinserted and press-fit into the femoral recipient site (F).

Retinacular Release & Tightening

Soft tissue techniques alter parapatellar soft tissue tension to help maintain the patella in the trochlear groove. In most cases of patellar luxation, perform these techniques as part of the correction, but not as the sole correction, except in cases of traumatic patellar luxation. Techniques include:

- Release of contracted parapatellar soft tissues on the side toward which the patella is luxated
- Tightening (imbrication or partial resection) of stretched parapatellar soft tissues opposite the direction of patellar luxation.

To perform a retinacular release:

1. Incise the contracted parapatellar soft tissue structures, including muscle fascia or joint capsule, starting several millimeters above the tibial tuberosity.
2. Extend the incision proximally to the patella, staying 2 to 4 mm away from the patellar ligament, and continue it for an equal distance proximal to the patella. If necessary to relieve tension on the patella, continue the desmotomy incision even farther proximally.
3. In less severe cases of soft tissue contraction, release of the joint capsule and parapatellar fibrocartilage is usually sufficient, while in more severe cases, the muscle fascia should be released as well.
4. Leave the released tissues unsutured to help minimize the redevelopment of contraction during the healing period.

To reduce parapatellar soft tissue laxity in the joint capsule and muscle fascia opposite the direction of luxation, perform a combination of tissue resection and imbrication. I usually reduce soft tissue laxity while closing my arthrotomy, because I perform the arthrotomy on the side of the stifle on which laxity should be reduced (lateral for a medial luxation and medial for a lateral luxation). To perform this technique:

1. Excise a section of joint capsule starting just above the tibial tuberosity and continuing proximal to the level of the patella; then extending an equal distance proximal to the patella. The amount of joint capsule removed corresponds to the amount of excessive laxity I believe to be present.
2. Appose the joint capsule edges by using an interrupted or cruciate mattress suture pattern of monofilament, long-lasting absorbable suture material.
3. To eliminate muscle fascia laxity, imbricate the muscle fascia by overlapping the fascial edges using a modified Mayo mattress (vest over pants) suture pattern with monofilament, long-lasting absorbable or nonabsorbable suture material (**Figure 5**). The amount of overlap varies from patient to patient and should be sufficient to remove laxity from the parapatellar soft tissues on the side on which the imbrication is performed while the patella is reduced (typically 3–6 mm of fascial overlap).

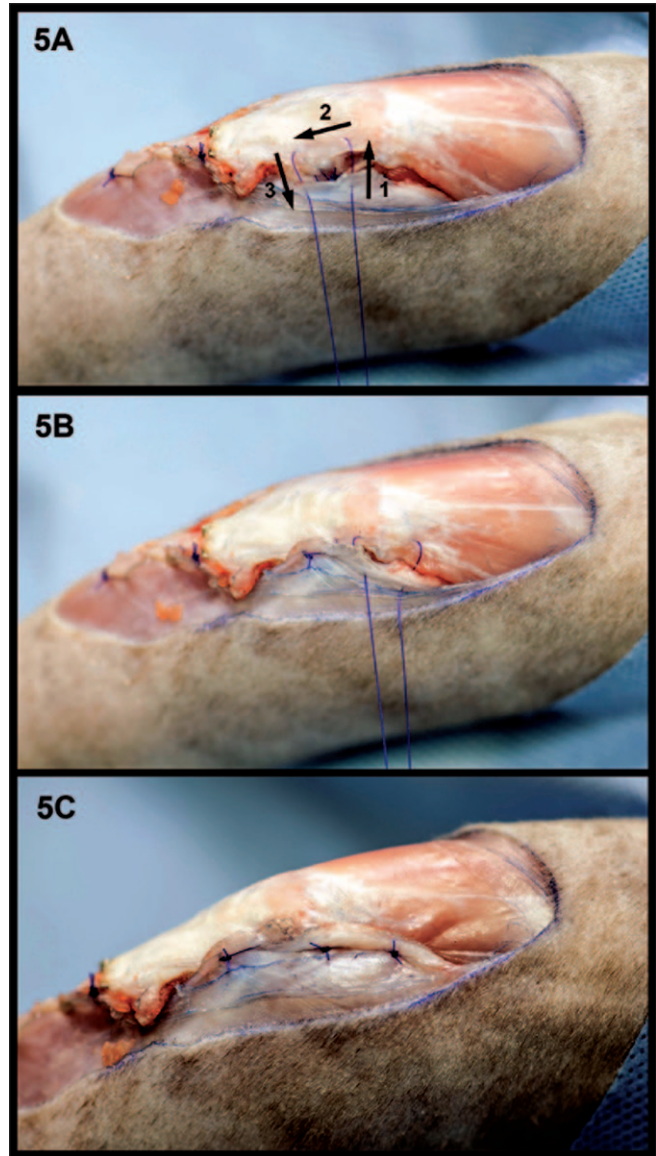


Figure 5. Imbrication of the fascia lata during closure of a lateral arthrotomy. The lateral imbrication technique is used to treat a medial patellar luxation. The suture pattern is a modified Mayo mattress (or vest over pants), which accomplishes imbrication by overlapping the cranial and caudal edges of the fascial incision. The first mattress suture is placed before tightening and tying. The black, numbered **arrows** demonstrate the sequence and direction of suture bite passage through the fascial tissue (**A**). The first mattress suture is tied and the second mattress suture placed (**B**). Note the fascial overlap after completed fascial imbrication (**C**).

Tibial Tuberosity Transposition

Tibial tuberosity transposition is a surgical technique that moves the attachment of the patellar ligament medially or laterally on the proximal tibia to help keep the patella aligned in the trochlear groove.

To perform a tibial tuberosity transposition:

1. Perform an osteotomy to free the tibial tuberosity and crest, using a sharp osteotome or a sagittal saw. Begin the osteotomy caudal to the attachment of the patellar ligament on the tibial tuberosity but cranial to the intermeniscal ligament, and then extend it distally and end at the distal end of the tibial crest. The cortical bone on the cranial aspect of the tibia at the distal end of the crest and the associated fascial attachments should be left intact (**Figure 6A**).
2. Shift the proximal end of the tibial tuberosity segment medially (for a lateral luxation) or laterally (for a medial luxation), allowing the origin of the quadriceps femoris muscle, the patella and trochlear groove, and the attachment of the patellar ligament to form a straight line (typically 1–3 mm).
3. Fix the proximal end of the tibial tuberosity in place by using 2 Kirschner wires inserted through the tibial tuberosity just distal to the attachment of the patellar ligament (**Figures 6B and 6C**).
4. Orient the Kirschner wires perpendicular to the long axis of the tibia to prevent accidentally penetrating the stifle joint, and angle them slightly axially in the sagittal plane to ensure good purchase in the tibia.
5. Advance the pins until they are seated in the caudal cortex of the proximal tibial metaphysis, cut off the protruding ends of the Kirschner wires close to the tibial tuberosity, and countersink or bend them over to stay close to the bone (**Figure 6D**).
6. If the cortical bone at the distal end of the tibial crest is transected during the osteotomy, place a tension band using 22- or 24-gauge orthopedic wire in a “figure 8” pattern around the Kirschner wires and through a bone tunnel in the tibial diaphysis distal to the tibial crest.

SURGICAL DECISION MAKING

Choosing which of the described surgical techniques to use in a given patient can be difficult. Most patients do not need to have all 4 of the described correction techniques performed in order to achieve appropriate patellar tracking without luxation. My approach is to:

1. Assess the depth of the trochlear groove: If the groove is shallow (see **SURGICAL APPROACH, Step 5. Evaluation of the Joint**), the first correction I perform is to deepen the groove by using a **block recession**.
2. After the trochleoplasty has been performed, reduce the patella into the trochlear groove and put the stifle through range of motion. If the patella cannot be reduced because of soft tissue tension, or if it reduces but easily relaxates, perform a **retinacular release**.

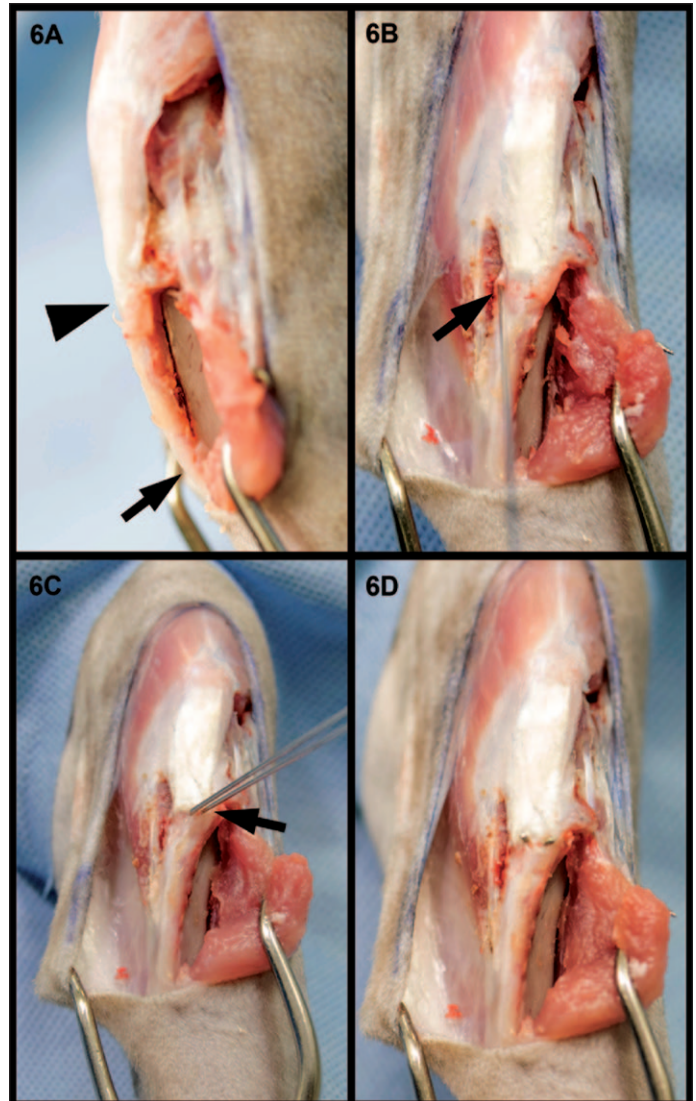


Figure 6. Tibial tuberosity transposition during correction of medial patellar luxation. The tibial tuberosity is being transposed laterally; proximal is toward the top in all 4 images.

An osteotomy has been created caudal to the tibial tuberosity and crest from proximal to distal (**arrowhead** denotes location of tibial tuberosity). The osteotomy angles slightly cranial as it continues distally and ends near the distal extent of the tibial crest. The cranial distal tibial cortex and associated fascial attachments have been left intact (**arrow**). In this image (**A**), cranial is to the left.

The tibial tuberosity has been transposed laterally and secured using a temporary Kirschner wire placed medial to the tuberosity (**arrow, B**). The stifle is put through range of motion, and the position of the patella is assessed before placing permanent Kirschner wires through the tibial tuberosity. The tibial tuberosity has been stabilized in the laterally transposed position using 2 Kirschner wires placed side by side through the tibial tuberosity (**arrow, C**) and into the proximal tibial metaphysis; note the slight axial angulation of the Kirschner wires to ensure good purchase in the tibia. The Kirschner wires are bent proximally and cut off short (**D**).

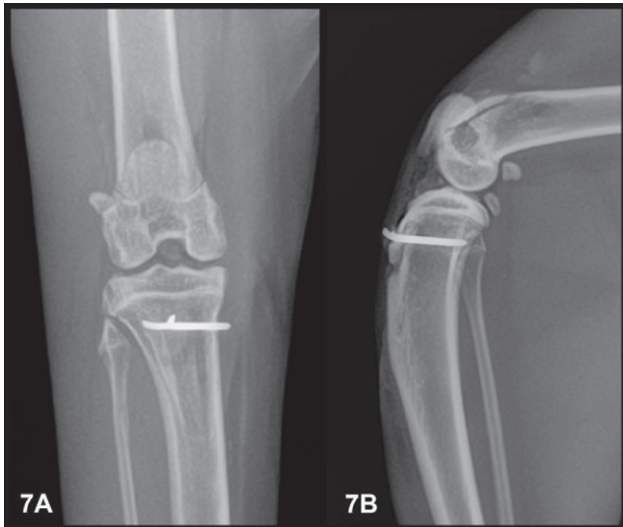


Figure 7. Postoperative craniocaudal (A) and mediolateral (B) projection radiographs of a patient treated with a trochlear block recession and tibial tuberosity transposition to correct medial patellar luxation.

3. Once the release is performed, try again to reduce the patella. Assess patellar tracking during stifle flexion and extension, and with tibial internal rotation. If the patella still luxates, perform a **retinacular tightening**.
4. After tightening is performed, repeat the stifle range of motion. If the patella will not luxate, the procedure is finished; however, if the patella still luxates, the last surgical correction to perform is a **tibial tuberosity transposition**.

POSTOPERATIVE CARE

Imaging

Obtain craniocaudal and mediolateral projection radiographs of the stifle joint (**Figure 7**) immediately postoperatively and at the 6- and 12-week recheck appointments. The radiographs should be critically evaluated, specifically:

- Assessing the location of the patella and position of any implants
- Evaluating the tibial osteotomy site for evidence of bone healing if a tibial tuberosity transposition has been performed.

Bandaging

I typically do not place a bandage on the hindlimb, although I do cover the skin incision with an adhesive wound dressing, which I leave in place for the first 3 to 5 days after surgery.

Pain Management

- Provide analgesia with injectable **IV buprenorphine boluses, 0.03 mg/kg Q 6 H**, for the first 12 hours.
- After 12 hours I switch to **sublingual buprenorphine, 0.01 mg/kg Q 8 H**.
- Dispense **sublingual buprenorphine, 0.01 mg/kg Q 8 H**, for 10 days after surgery.

- Treat the incision with **cold pack therapy, 10 minutes Q 6 H**, for 2 to 3 treatments.

Care & Follow-Up

Patients are typically kept in the hospital overnight and discharged the day after surgery. Postoperative activity is limited to strict crate rest for 8 weeks after surgery. Postsurgery recheck examinations are performed at 2, 6, and 12 weeks.

IN SUMMARY

Patellar luxation can cause clinically significant hindlimb lameness in cats. Patients with persistent lameness attributable to patellar luxation should be considered candidates for surgical therapy.

Surgical treatment of patellar luxation is typically a multistep process. The exact techniques required vary from patient to patient. The final decision about which surgical techniques to use in a particular patient is based on intraoperative assessment of patellar tracking in the trochlear groove.

Use of sound decision making and intraoperative attention to detail lead to consistently successful surgical correction of feline patellar luxation. ■

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