Medial Patella Luxation: Tibial Crest Transposition and Sulculoplasties

Dr Arthur House
Specialist in Small Animal Surgery

October 2013
Medial patella luxation – tibial crest transposition and sulculoplasties

Dr Arthur House

Patella luxation is one of the most frequently reported orthopaedic problems in small animal practice. Patella luxation includes both medial and lateral displacement of the patella, affects both large and small breeds of dogs with a higher frequency in small breed dogs and is infrequently recognised in cats.

1) What are the classic clinical signs associated with patella luxation?

Broadly three groups of patients are recognised. Neonates and young puppies often with severe musculoskeletal deformities and gait abnormalities, the most common presentation of young mature dogs with an intermittent and potentially progressive lameness and the older dog with an acute presentation either following trauma or as a manifestation of degenerative joint disease. Consequently the clinical signs associated with patella luxation ranges from an incidental observation during a routine physical examination through to an inability to stand. The classical gait associated with patella luxation is a skipping lameness which the patient resolves by extending the stifle. As the severity of the patella luxation grade increases or as the associated cartilage erosion develops the lameness frequently becomes persistent. In patients in whom the patella luxation results in a severe loss of the quadriceps mechanism the patient will adopt a crouched gait – most typically observed in cats.

The clinical examination findings will reveal an intermittent or permanent luxation of the patella either medial or lateral. Evaluation of patella stability must be performed in the conscious patient as well as the anaesthetised patient. This is particularly true for cats that have a relatively mobile patella in comparison to dogs. In contrast brachycephalic breeds or dogs with well developed quadriceps musculature are easily overlooked or under interpreted in the conscious patient. These patients frequently have a patella luxation in which the patella displaces onto the trochlear ridge rather than displacing medial or lateral to the ridge and on physical examination is difficult to displace. Due to the contact of the patella with the trochlear ridge there is frequently severe cartilage erosion and femoropatella pain. This secondary cartilage erosion can result in a high level of limb dysfunction relative to what appears to be a low level of patella instability. Luxation of the patella is generally most easily achieved with the stifle in extension. In addition to assessment of patella instability, femoropatella pain should be assessed by direct compression of the patella against the trochlear sulcus. Identification of femoropatella pain gives an indication of potential femoral trochlear ridge or patella cartilage erosion.

Lateral patella luxation was originally cited as a large dog anomaly and medial patella luxation a small dog anomaly. However there is increasing reporting of lateral patella in all sizes of dogs and an increasing frequency of medial patella luxation in large breed dogs1,2.

In the younger dog stifle effusion and crepitus are uncommon findings. With chronicity degenerative joint disease does develop and crepitus might be identified. Medial patella luxation can occur in conjunction with cruciate disease and hence patients should be evaluated for cranial draw.
To assist in prognostication and decision making a grading system has been developed for medial patella luxation. There are minor variations of this grading system but it is generally based on:

- **Grade 1**
  - Can displace patella, spontaneously reduces
  - Normal for a cat!
- **Grade 2**
  - Patella spontaneously displaces but spontaneously reduces
- **Grade 3**
  - Patella permanently luxated but can be reduced
- **Grade 4**
  - Patella permanently displaced and can not be reduced

In addition to patella instability altered limb conformation may be identified. A correlation between genu varum and medial patella luxation and genu valgum with external rotation of the pes and lateral patella luxation has been suggested\(^1\,3\).

2) **What are the classic radiographic findings associated with patella luxation?**

As with clinical examination findings there is a wide range of potential radiographic anomalies associated with patella luxation. In many patients, particularly the young mature dog there are no radiographic abnormalities or only medial / lateral displacement of the patella in isolation\(^4\). With increasing chronicity periarticular osteophytosis and periarticular soft tissue thickening can be identified.

Coxofemoral deformities, specifically coxa vara with medial patella luxation and potentially coxa valgus (and concurrent hip dysplasia) with lateral patella luxation are recognised associations. Tibial and femoral deformities including sigmoid femoral / tibial deformity, tibial torsion, femoral torsion and distal femoral varus are all associated with patella luxation. Recently patella alta has been documented as associated with medial patella luxation and patella baja with lateral patella luxation\(^5,6,7\).

Of these deformities distal femoral varus / torsion and patella alta are both important to recognise as these both alter the management of the related patella luxation. Dogs with significant distal varus benefit from corrective distal femoral osteotomies and dogs with significant patella alta potentially benefit from distal displacement of the tibial crest in an attempt to bring the patella back into contact with the proximal aspect of the trochlear sulcus\(^6,9\).

Assessment of the trochlear groove can be made utilising skyline projections of the trochlear sulcus or via CT transverse slices. In reality trochlear groove assessment is unlikely to provide information that will influence surgical decision making beyond direct visualisation of the trochlear groove at surgery.

3) **When should I recommend surgery?**

The recommendation for surgery is predominantly based on the presence of lameness and clinical grade. Surgical correction of grade 1 medial patella luxation has been shown to result in similar outcomes to conservative management and hence surgery is not recommended for these patients in the absence of lameness\(^10\). One of the early publications regarding patella luxation concluded: ‘the grey zone involves small dogs with grade 2 / 3 medial patella luxation and only intermittent lameness. These dogs have mild degenerative joint disease and it does not appear to progress markedly’\(^10\). This statement is challenged by studies demonstrating concurrent cartilage erosion of the patella in cases with medial patella luxation in which the extent of the erosion correlates with the severity of the grade and weight of patient\(^11,12\). Unfortunately the suggestion that surgical intervention prevents progression of osteoarthritis is not supported by the literature\(^10,11\). The introduction of a block recession trochleoplasty or not performing a trochleoplasty might reduce the progression of osteoarthritis following surgery and hence justify
surgery as a mechanism to control progression of osteoarthritis. Frustratingly recurrent luxation (often to a lesser grade) is a recognised complication that has been cited to occur in as high as 48% of dogs and hence highlights the need for careful case and procedure selection\textsuperscript{10,13,14}.

In general the following is recommended:

- **Grade 1**: Not surgical
- **Grade 2**: Grey zone, surgery if lame
- **Grade 3**: Definitively surgical
- **Grade 4**: Early surgical intervention with guarded prognosis

4) **Could you please demonstrate the procedures for managing a medial patella luxation?**

There are numerous procedures available for management of patella luxation. The key procedures are tibial crest transposition, trochleoplasty, lateral imbrication and medial release. Soft tissue reconstructions performed in isolation are likely to fail and is not recommended\textsuperscript{10,13}. A combination of approaches based on individual dog is required and the choice of procedures remains subjective. Understanding the objective of each procedure facilitates decision making for each dog and are as follows:

- **Tibial crest transposition** – addresses tibial torsion or medially displaced tibial crest
- **Trochleoplasties** – address hypoplastic trochlear sulcus
- **Lateral imbrication** - assists patella stabilisation
- **Medial releasing incision** – allows lateralisation of the patella stabilisation ***care as can result in lateral patella luxation
- **Fabella to patella suture** - assist patella stabilisation
- **Anti-rotational suture** – assists transposition
- **Distal femoral osteotomy** – addresses distal femoral varus
- **Femoral trochlear implant** – absent or extreme trochlear sulcus hypoplasia
- **Patellectomy** – end stage femoropatella joint disease, rarely performed and results in loss of quadriceps power due to loss of the ‘pulley’ effect of the patella

5) **When should I perform a tibial crest transposition?**

Tibial crest transposition is the mainstay procedure for stabilisation of patella luxation. In a case series of 70 stifles with patella luxation, 68 of 70 stifles had a tibial crest transposition performed (Table 1.)\textsuperscript{14}. It is likely that this paper is representative of the choice made by the majority of surgeons. Additionally a retrospective review of a case series in which tibial crest transposition was performed without trochleoplasty the recurrence of luxation was similar to publications in which both procedures had been performed\textsuperscript{13}. Consequently it is rare to not perform a tibial crest transposition.
Table 1.: The distribution of each surgical technique in a case series of 70 stifles with medial patella luxation

<table>
<thead>
<tr>
<th>Surgical technique</th>
<th>Number of Stifles</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCT / trochleoplasty / soft tissue</td>
<td>50</td>
</tr>
<tr>
<td>TCT / soft tissue</td>
<td>18</td>
</tr>
<tr>
<td>Trochleoplasty / soft tissue</td>
<td>1</td>
</tr>
<tr>
<td>Soft tissue</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1.: The distribution of each surgical technique in a case series of 70 stifles with medial patella luxation

6) When performing a tibial crest transposition ……

- do you need to make a bed for the transposed crest? No
- should I use a tension band wire? If the dog is large or very active
- do I cut the pins flush or bend the pins? I prefer to bend the pin – not into the patella tendon
- should I transpose the tibial crest distally if patella alta exists? It is described but not yet considered a ‘main stream’ procedure

7) When should I perform a trochleoplasty?

There are no specific guidelines supported by clinical evidence with regards to the decision making as to when a trochleoplasty is indicated. The presence of a hypoplastic trochlear sulcus is frequently cited as an indication for trochleoplasty. Defining sulcus hypoplasia is challenging. CT evaluation of patients prior to surgery demonstrated approximately 20% of the patella seated in the trochlear sulcus resulting in the suggestion by some surgeons that a trochleoplasty is indicated if <30% of patella is seated in the sulcus. It is suggested that following trochleoplasty that 50% of the patella should be seated in the trochlear sulcus however this is based on surgeon opinion. CT has demonstrated that the modified wedge recession and block recession both achieve at least 50% of the patella to be seated. Trochleoplasty has been shown to improve patella stability, block recession more so that wedge recession. Additionally a lower frequency of recurrent luxation has been demonstrated in dogs which are managed with a combination of tibial crest transposition and trochleoplasty when compared to tibial crest transposition alone. Consequently it is indicated as an adjunct to tibial crest transposition if the patella is excessively mobile following flexion / extension and rotational stability tests.

8) Which trochleoplasty should I perform?

There are several trochleoplasty techniques described. These included abrasion trochleoplasty, trochlear chondroplasty, wedge recession (and its modification) and block recession trochleoplasty. Abrasion trochleoplasty should be avoided as it results in severe patella cartilage erosion within 4 weeks and inferior limb use when compared to the wedge recession trochleoplasty.

Trochlear chondroplasty is the technique of elevating the trochlear cartilage from the subchondral bone, deepening the sulcus with a rasp and then replacing the cartilage over the new sulcus. This technique requires both thick cartilage and soft subchondral bone and hence is limited to dogs who are < 6 months of age. Additionally the procedure must be performed with care as failure to preserve the cartilage results in a salvage to an abrasion trochleoplasty.
Wedge recession trochleoplasty and block recession trochleoplasty are the recommended trochleoplasty techniques as they achieve adequate deepening of the sulcus whilst preserving articular cartilage. Block recession trochleoplasty is the superior technique Figure 1. Wedge recession results in a degree of exposed subchondral bone within the femoropatella contact region and does not address the proximal aspect of the sulcus which is frequently the point of luxation17,21. Modification of wedge recession includes an abrasion trochleoplasty at this proximal aspect which can not be recommended on the basis of known consequences of a standard abrasion trochleoplasty.

Figure 1. Illustration showing how the TBR procedure is performed. (A) The first 2 parallel osteotomies have been made along the center of the trochlear ridges. The third osteotomy is completed to release the osteochondral block with either a sagittal saw or osteotome. (B) End-on view of the distal femur with the arrow indicating the portion of bone removed from the floor of the rectangular trough. (C) End-on view of the distal femur showing the completed TBR with the patella recessed in the proximal trochlea. (D) Cranial view of the femoral trochlea after TBR. From Johnson AL et.al. Comparison of Trochlear Block Recession and Trochlear Wedge Recession for Canine Patellar Luxation Using a Cadaver Model. Vet Surg 30:140–150, 2001

In comparison block recession trochleoplasty results in minimal exposed subchondral bone within the femoropatella contact region, addresses the proximal aspect of the trochlear sulcus, preserves 2 – 3.2 X more articular cartilage than a wedge recession and the percentage of recessed trochlear surface area is significantly greater (76% versus 49%). When block recession trochleoplasty is compared to wedge recession in the extended stifle position (patella in the proximal trochlea), patellar depth and patellar articular contact with the recessed trochlea are significantly greater. Additionally in the extended position, a smaller percentage of the patellae luxated within 40° of internal tibial rotation (8% versus 42%)17,21.

9) **How long should I leave between bilateral procedures?**

Bilateral patella luxation can be surgically stabilised concurrently however the majority of surgeons will elect to stage the procedures. Typically follow up radiographs are performed 6 – 8 weeks following surgery. If good limb function is present with radiographic evidence of bone healing across the tibial crest transposition then I will proceed with surgery on the second limb at this stage.
References:

8. Segal s., Or M., Shani J., Latero-distal transposition of the tibial crest in cases of medial patellar luxation with patella alta Vet Comp Orthop Traumatol 4/2012