Introduction

Patella luxations occur frequently in dogs (primarily medial (MPL) [1]) and less commonly in cats [2]. It is normally seen in small breed dogs but is becoming more common in dogs such as the Labrador retriever. It can be unilateral or bilateral (50-65%) of cases. Both conservative and surgical methods are used for correction of patella luxation and this decision-making usually depends on the severity of the luxation (grade> 2 usually requiring surgical correction). Surgical correction of the luxation has a very high failure rate with up to 48% of cases having recurrent luxation of the patella reported in one study (although concurrent lameness was not observed [3]). A more recent study reports overall complication rates of 18% and a reluxation rate of 8% [4]. It is not clear why this failure rate is so high but failure to correct the underlying abnormalities (i.e. decision making errors rather than technical ones) is a likely cause.

Patella luxations may be medial or lateral, congenital/developmental (most common) or traumatic. Traumatic patella luxation is rare, generally seen in older dogs and can be due to stretching of the lateral aspect of the joint. A recent study reports traumatic aetiology to be 17% in cats with MPL [2]. MPL has also been reported secondary to the surgical correction of cranial cruciate ligament rupture (CCLR) with extracapsular techniques [5]. In most cases they are developmental and tend to be medial. A weak association with hip dysplasia and MPL has been identified in cats [6] and dogs with a high grade MPL (Grade IV) are more likely to have a CCLR [7]. 15-20% of older dogs with a chronic MPL are reported to have a CCLR, this can increase up to 50% in large breed dogs. The underlying cause of medial patella luxation (MPL) is a lack of alignment of the quadriceps mechanism. This may be due to one or a combination of the following:

- Coxa vara – decreased angle of inclination of the femoral neck (normal 130-145 degrees)
- Reduced angle of anteversion of the femoral neck (normal 27-32 degrees)
- Medial displacement of the quadriceps muscle group
- Shallow trochlear groove
- Lateral torsion or bowing of the distal femur
- Femoral epiphyseal dysplasia
- Medial torsion or bowing of the tibia
- Rotational instability (i.e. secondary to a CCL rupture)

The extent of the musculoskeletal deformities varies with the severity of the luxation. The skeletal deformities will often occur secondary to changes induced in the growth plates by the abnormal biomechanical forces. Medial malalignment of the quadriceps in dogs with MPL produces sufficient forces on the growth plate to retard growth. At the same time reduced forces on the lateral side of the growth plate causes accelerated growth. This causes lateral bowing (femoral varus) of the femur, the severity of which is dependent upon the severity of the luxation and the patient’s age at the time of the luxation. Tibial deformities are the result of abnormal forces acting on the proximal and distal physes of the tibia. The articular development is also affected by forces, or lack of, acting upon the
surfaces. Luxation of the patella leads to abnormal development of the trochlear groove with variations from normal to the complete absence of a groove.

Classification

Patella luxations can be classified into FOUR grades [8]:

Grade I: Manual luxation of the patella is possible however the patella reduces when pressure is released. Lameness is uncommon except for an occasional skipping gait in small dogs. (ALWAYS IN)

Grade II: Patella is predominantly reduced but can be manually luxated or may luxate when the stifle is flexed. Patella remains luxated until manually reduced or stifle extended. Mild tibial rotation and slight angular torsional and rotational deformities may exist. Intermittent skipping lameness. (MAINLY IN BUT NEED TO MANUALLY REDUCE/MANIPULATE JOINT IF OUT)

Grade III: Patella is luxated and remains so unless manually reduced. Stifle flexion causes relaxation. Medial quadriceps displacement is apparent. A greater degree of tibial torsion (30-60°) with moderate torsional and angular limb deformities exists. Lameness is usually persistent with a characteristic gait with a semi flexed stifle joint. (OUT BUT CAN REDUCE WITH DIFFICULTY)

Grade IV: Patella is luxated and cannot be reduced. Marked tibial torsion (60-90°), angular and torsional deformities exist. Persistent lameness with crouched gait if bilateral. (OUT AND CANNOT GET BACK IN)

Diagnosis:

This is based on history, gait evaluation, clinical examination (examine both stifle joints in flexion/extension whilst palpating the patella and check for a positive cranial draw and tibial thrust test) and possibly radiography. Radiography is useful, though not essential, for surgical planning especially if there are marked bony deformities of the tibia and femur (as with with higher grade luxations). It can also be useful in the identification of other problems such as CCLR and hip dysplasia/OA. In our clinic we would normally obtain both views of both stifle joints and a ventrodorsal pelvis. Computed tomography can be also useful to assess conformational abnormalities. The quadriceps angle (Q-angle) has been measured in normal and affected MPL dogs and found to be increased in the MPL group (12-36 degrees vs 10 degrees) [9] [10].

Surgical decision making

The choice between surgical or conservative management of patella luxation is dependent upon several factors; clinical history, age, severity, owner considerations. Owners should be warned that the complication rate can be high with in high grade luxations.

Conservative management is usually indicated in dogs with grade I luxation with few clinical signs or very mildly affected older animals. Surgery is generally recommended in animals (developmental and traumatic cases) with clinical signs associated with grade II-IV luxations. In immature animals, the deformities may deteriorate with maturity therefore If
owners opt for conservative management in these cases it is imperative they are made aware of the potential for progression of the condition with growth. In these cases soft tissue procedures such as trochlear chondroplasty can be performed but further surgery may be warranted.

Those skeletally mature animals that present with a sudden deterioration may have other soft tissue injuries such as cranial cruciate ligament rupture (CCLR). In a recent study 41% of dogs with MPL had a CCL rupture due to the increased strain placed on the ligament due to the internal rotation of the tibia and loss of cranial support from the patella tendon. CCLRs tended to occur in older dogs and with grade IV luxations [7].

Surgery is aimed at realigning the quadriceps mechanism and retaining the patella within the trochlear groove. Several techniques have been described and a combination of those is usually required. The most commonly performed techniques include soft tissue imbrications, tibial tuberosity transposition (TTT), and femoral trochlea deepening techniques. Tibial and femoral osteotomies are generally only performed in cases with higher grade or recurrent luxations [11].

In almost all cases it is insufficient to surgically treat patella luxations with soft tissue procedures alone and can result in increased complications/reluxation [4]. FAILURE TO ADDRESS THE UNDERLYING SKELETAL ABNORMALITIES WILL RESULT IN SURGICAL FAILURE AND RELUXATION AFTER SURGERY.

The three main procedures discussed here are:

- Imbrication of the soft tissue retinaculum
- Trochlear wedge sulcoplasty
- Tibial Tuberosity transposition

1. Imbrication of the soft tissue retinaculum – can be used in isolation for traumatic ruptures (rare) but generally used to augment the following two techniques. The lateral retinaculum (for a medially luxating patella) is sutured using PDS in a vertical mattress pattern (so called ‘vest over pants’) in order to shorten the tissues on that side and so tighten the lateral aspect of the joint.

2. Trochlear wedge sulcoplasty – this is used in cases where the groove is insufficiently deep to accommodate the patella. This is a subjective assessment but ideally the groove should be at least 50% as deep as the patella. A wedge is usually cut in order to deepen the groove but this has little effect on the depth at the proximal end of the groove. A block offers better deepening of the proximal section although is technically more difficult to perform and is better performed in large dogs with sufficient bone stock [12-13]. A recent study reports a 19.8% relaxation rate without trochlear deepening procedures and suggests that OA does not progress post-operatively when these techniques are not performed [14].

3. Tibial tuberosity transposition – this involves relocating the tuberosity more laterally (for an MPL) in order to align the quadriceps mechanism. It achieves this by relocating the insertion of the patella tendon and thus the pull of the quadriceps muscle. Ideally as large a piece of bone as practical should be osteotomised in order to maximise the purchase of the pins (1.1- 2mm arthrodesis wires). The pins should
eb located at the insertion of the patellar tendon. In large dogs (>15kg) a TENSION BAND WIRE is recommended, even if the distal attachments feel secure.

The prognosis for patella luxation surgery is good, especially for the lower grades if the correct procedures are performed. The majority of cases will require ALL three of the above.

**Surgical techniques:**

1) Trochlear wedge recession sulcoplasty
   - Inspect the patella cartilage
   - Make incisions along the axial borders of the trochlear ridges with a scalpel blade – curve them distally and proximally so that they meet. Leave some height on the medial trochlear wedge.
   - Cut the bone using a Hacksaw or Hobby saw, so that the incisions meet and so that a wedge is removed- taking care not to cut all the way through the femur…judge your angles accurately!
   - Trim the “point” off the wedge so that it will seat in the trochlear properly
   - Replace the wedge in the trochlear- if a broad hacksaw has been used this may be sufficient to deepen the groove alone, if not make a second cut, parallel to the first to remove a slice of bone on one side of the trochlea
   - If the wedge moves- score the edges of the trochlear with the blade to enhance friction between the two bony surfaces
   - Replace the wedge and check the patella for stability throughout a range of movement
   - When closing the joint capsule and fascia, remove an appropriate amount to “imbricate” the lateral tissues, thereby further preventing medial patella luxation

2) Tibial tuberosity transposition
   - Incise the medial aspect of the joint, to perform a medial release.
   - Elevate the tibialis cranialis muscle from the tibial crest and score the osteotomy line with a scalpel blade
   - Pass a hacksaw blade/osteotome/bone cutters through the joint, under the straight patella tendon.
   - Attach the handle and cut down onto the tibial tuberosity- take care not to cut through the straight patella tendon or the menisci.
   - Leave enough of a bony attachment distally so that the tibial tuberosity can be moved laterally, but is still attached
   - Remove the spike of bone on the craniolateral aspect of the tibial osteotomy (on the main body of the tibia). Retain this bone- it can be sued to pack the osteotomy site with bone graft.
   - Displace the tuberosity laterally and hold with a pair of bone holding forceps- check that medial patella luxation does not occur during normal movement- if it does, move the tibial crest further laterally. I also “eyeball” this until I can see the alignment is straight.
   - When the desired position is attained, drill two K wires through the tuberosity (one in small dogs) at the insertion of the straight patella tendon into the tibia, taking care not to penetrate the joint, and also not to exit the caudal cortex too far
- Tighten the figure of 8 wire around the two arthrodesis wires.
- Bend the arthrodesis wires so that they are parallel to the straight patella ligament and cut short

**Post-operative management:**

**Analgesia** - epidural analgesia will generally provide adequate pain relief for 18 hours post-operatively depending on the drugs used. However if this is not available then full opioids agonists (morphine/ methadone) every 4 hours or partial agonists (buprenophine-“Vetergesic”) every 6-8 hours for the first 24 hours at least. NSAIDs are administered pre and post-operatively for 10 days to 2 weeks, we also give paracetamol (+/-codeine) 10mg/kg tid (DOGS ONLY) for the first 5 days post-operatively.

**Exercise** - strict cage/room rest for first 10 days –until stitches are removed then very short on-lead walks until post-operative check in 4-6 weeks. We normally repeat radiographs at this stage to check for implant placement and osteotomy healing. If this is progressing then the on-lead walks can be increased.

**Complications:**

An overall complication rate has been reported at 18% with a reluxation rate of 8% in 109 dogs [4]. Reluxation was lower when a TTT and trochlear deepening procedure was performed in this study. Occasionally the tibial pin will need to be removed after the osteotomy has healed if the dog/cat experiences recurrent lameness or if it backs out. Recurrent luxations or fragmentation of the tibial tuberosity associated with failure of MPL surgery can be treated with a patellotibial suture and transarticular external skeletal fixator [15]. A recent study has revealed that 2/3rd of dogs have patella cartilage erosions following MPL surgery [16] and femoropatellar pain could be associated with continued lameness. Cases with severe trochlear erosions and deformation have been recently treated with patellar groove replacement (Kyon) (Tepic, BVOA 2012; Egan, BSAVA 2012).

**References:**