Update on cranial cruciate ligament disease and rupture

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The most common causes of hindlimb lameness seen in small animals are injuries of the stifle joint, the most common injury being cranial cruciate ligament rupture (CCLR) [1]. This lecture will primarily review aetiology, diagnosis and management of canine cranial cruciate ligament rupture (CCLR) and meniscal injuries as well as updating new developments in this area.

A: CCLD

Aetiopathogenesis

This is a multifactorial disease in which factors such as breed, weight, age, conformation (both tibial and femoral) play a role leading to ligament degeneration and joint disease/osteoarthritis. It is most commonly degenerative, with a minor injury leading to ligament rupture (disease), but can also be purely traumatic in some dogs. The purely traumatic cases dogs present with acutely unstable stifle joints and have a severe lameness whereas where the degenerative/"diseased" ligaments have a more chronic/insidious lameness with a recent exacerbation. Recent work has concentrated on altered extracellular matrix proteins and different cell types in cruciate ligaments predisposed and non-predisposed dog breeds to rupture [2-3], conformational abnormalities in predisposed dogs such as the tibial plateau angle (TPA)[4-5] and altered muscle mass [6]. The aetiopathogenesis has been reviewed in depth recently by several authors [7-9] and further reading is recommended for in-depth information in this area.

History and clinical examination

Distant observation of your patient in the waiting/consulting room with special regard to partial weight bearing on one of the hindlimbs can often be very useful. History of dogs with CCLR will either indicate an acute presentation (purely traumatic aetiology) or a history of hindlimb stiffness then a mild traumatic incident resulting in an acute lameness (CCL disease).

A full orthopaedic examination is then performed with special attention to the hindlimbs. Palpation of both hindlimbs with particular attention to heat, swelling and pain (do this in both a standing and recumbent position and always compare the joints of both hindlimbs). Examine for: atrophy of the quadriceps muscle mass

- loss of definition of the borders of the straight patellar ligament - this is a sensitive indicator of stifte pathology (this has been shown in a recent study to be a reliable indicator of CCL injury [10])
- thickening of the tissues surrounding the joint, particularly on the medial aspect ("medial buttress")
- range of joint motion
- crepitus or a 'click' on joint manipulation - signs of osteoarthritic change or meniscal injury
- An increase in internal rotation of the tibia wrt. the femur
- collateral instability
- Tibial thrust and cranial draw (see Figure 1) and abnormal patella position.
Figure 1: a) Cranial draw and b) tibial thrust tests

Tibial thrust test is performed with the stifle in extension and the hock flexed and attention is paid to cranial movement of the proximal tibia if there is CCLD. This can be done in both the conscious and sedated dog. Cranial draw test should be attempted in the conscious dog and may indicate a source of pain; however it is often necessary to perform this in the sedated dog. It is very important to do this in flexion and extension to rule out a partial CCL tear. The craniomedial band of the CCL is most often ruptured in partial CCLD which is taut in flexion and extension but the caudal band is taut only in extension - this is why we must do a cranial draw in flexion. Cranial draw test in the immature dog with a normal CCL will indicate laxity but it has a definite end-point compared to dogs with CCLD.

**Radiography**

Radiographs of both stifle joints should be taken if you are suspicion of pathology in the stifle joint. **Good radiographic technique and positioning are essential to get good diagnostic radiographs.** At the UOL we will often obtain orthogonal radiographs of the coxofemoral joints and pelvis as part of the diagnostic investigation of CCLD. The most common views taken are mediolateral and craniocaudal or caudocranial. Most of the changes seen with CCLD are non-specific but the radiograph will confirm the stifle as a site of pathology. Special attention should be taken for evidence of a joint effusion (seen by loss of the infrapatellar fat pad) and osteophytosis - a joint
effusion and instability of the stifle joint are highly indicative of CCLD. Cats may demonstrate intra-meniscal mineralisation [11]. In the immature dog avulsion of the CCL may be present and an intra-articular mineralised fragment will be evident. Other imaging modalities such as magnetic resonance imaging (MRI), computed tomography (CT) and are being used in increasing frequency as part of a suspected CCLD/R work-up [12-13]. However these diagnostic tests are still very expensive in most cases.

**Arthrocentesis** - *This is probably an under used diagnostic test.* If there is a joint effusion present on the radiographs with no instability after manipulation of the stifle joint under sedation/anaesthesia - this is the next logical step. Arthrocentesis may help to rule out immune-mediated polyarthritis or sepsis. It is important to clip and clean the site for aspiration. Use a 19-21G 1-1/2” needle and 5-10ml syringe. Insert the needle in a proximal direction so as to enter the femoropatellar region. This will avoid the fat pad being sucked onto the end of the syringe. It is best to place the fluid in an EDTA and plain tube before submitting for cytology and culture/sensitivity. The total and differential cell counts are most helpful in cytological examination. The gross appearance of synovial fluid from cruciate cases can vary markedly. There is usually an increased volume of decreased viscosity fluid. It may be pale yellow to orange-red.

**Arthroscopy/Arthrotomy:** If you are suspicious of CCLD on your clinical examination, there is positive stifle joint laxity in flexion or all ranges of motion, presence of medial buttress and joint effusion with negative arthrocentesis findings then arthroscopy and/or arthrotomy is the next step. Arthroscopic examination of the stifle joint has become increasingly useful in diagnosis of CCLD and treatment for meniscal tears. It has been shown to demonstrate less morbidity than arthrotomy is an experimental model of CCLD [14]. However expensive equipment is required with a relatively steep learning curve. It is an excellent technique to visualise articular structures not visible on radiographs. More common is the use of lateral parapatellar arthrotomy to inspect the structures if the stifle joint and when learning arthroscopy it is common to convert to this procedure. Lateral parapatellar approach is still the most common approach in practice as it allows us access to the lateral fabella for placement of a fabellotibial suture. A medial approach is used in conjunction with a TPLO/TTA/MMP (see below) to inspect the meniscus. Instruments are useful when performing a stifle arthrotomy are 2 pairs of Gelpi retractors, a stifle distractor, some short tipped 12 or 18mm Hohmann retractors.

**Treatment:** The treatment of CCL rupture is still very controversial and can be divided into conservative/medical management.

**Conservative:** Useful in small dogs <15kg (85% of surveyed VS at a veterinary conference would still opt for this form of management in first instance (Forster, BSAVA 2012)). Advise rest and restricted exercise for 6-8 weeks with NSAIDs. 85% will have satisfactory outcome with conservative management but may have a quicker recovery with surgical treatment. May be the only option in large dogs where finance is a consideration. Weight-loss, analgesia, restricted (but gradually increasing exercise) and good physiotherapy/hydrotherapy may assist with conservative/medical management. Adjunct therapies, as listed above, are being more frequently used now (Forster, BSAVA 2012) compared to that previously reported.

**Surgical:** This can be loosely divided into three different types of techniques (which will be discussed in detail in the lecture), the main aim of which is to restore stability to the joint and to remove any damaged structures (e.g. medial meniscal tears):
**Intracapsular:** restores stability by replacing ligament with some type of graft (e.g. modified “over – the-top” (OTT) technique with a fascia lata graft).

**Extracapsular:** restores stability by using sutures or soft tissues as a sling (e.g. Fabellotibial suture with Leader line nylon or fibre wire, Tightrope ®)

**Periarticular:** Alter local anatomy to improve stability e.g. closing wedge osteomy (CWO) (usually only done is dogs with an excessive TPA e.g westies with deformed tibial plateaus, tibial plateau levelling osteotomy (TPLO) or tibial tuberosity advancement (TTA), modified maquet procedure (MMP), triple tibial osteotomy (TTO).

*There is currently no evidence that levelling or osteotomy techniques result in a better outcome for dogs with CCLD than extracapsular techniques. It is the author’s current opinion that each dog should be treated on an individual basis as the same surgical option does not suit all dogs. At UoL, we usually do arthroscopy and FT suture placement or arthrotomy and TTA (more recent MMP).*

**Partial CCL tears:**

Treatment of these injuries is very controversial. Mostly they are left undisturbed if a levelling procedure is performed however if an extracapsular technique is performed, it is the author’s opinion that the partial CCL should be cut and removed. This is because the CCL is damaged and will be expressing inflammatory mediators which may lead to joint inflammation and pain.

**Post-operative management:**

- **Analgesia** - as with patella luxation for first 24 hours. Then place on course of NSAIDs for 2-4 weeks depending on clinical progress. Ice packs can be useful in the first 72 hours [15].

- **Exercise** - short walks out to the toilet until stitches removed and then increase by 5 minutes each walk every 2-3 days- do this three times daily. Hydrotherapy/physiotherapy can start after s/o-passive range of motion (PROM) exercise can start 3-4 days after surgery. Try and encourage the dogs to walk very slowly to try and use the leg for at least one walk. Re-evaluate at 10 days, 4 weeks and then 8-12 weeks.

**Complications:**

- Suture breakage
- Infection (6.1% recently reported up to 6 months post-operatively [16]
- Meniscal tears
- Fractures post TPLO/TTA- most can be treated conservatively unless patellar mechanisms very disturbed.

**Prognosis:** Whilst most papers on treatment of cruciate disease will give success rates between 85% and 90%, these ‘successes’ will include dogs with continuing mild intermittent lameness. Most of these dogs will be of the chronic degenerative type cruciate disease and it may be that it is the osteoarthritic disease, which is limiting recovery. However, all dogs will have some degree of osteoarthritis and therefore there are clearly unknown factors producing this variability in outcome. However, the young large dog with bilateral degenerative disease has a much more guarded prognosis than the dog suffering an acute, truly traumatic rupture. It is wise to warn owners that full recovery will not be evident until 12-16 weeks following surgery with most techniques.
**B: MENISCAL INJURIES**

**Meniscal injuries**

**Aetiopathogenesis:** It is thought that the medial meniscus becomes trapped and injured by rotation of the femoral condyles at full extension. This can occur with rupture of the CCL, which is when we see most injuries to the medial meniscus. The medial meniscus is most commonly damaged as it is more firmly attached to the joint capsule and medial collateral ligament than the lateral meniscus. However lateral discoid tears, and longitudinal tears of the lateral meniscus are reported. Classification of meniscal injury detailing six types of tears has been reported in dogs [17]. The most common types are folding of the caudal horn and longitudinal tears of the medial meniscus. Other types include multiple longitudinal tears, fibrillation of the femoral surface, axial fringe tear and transverse tears.

**Pathology:** Injury to the meniscus is most commonly associated with complete or partial tears of the CCL. An incidence of 50-70% of meniscal injury, identified at the time of surgery for CCL reconstruction, has been reported in dogs appearing more common in chronic cases and heavier dogs [18-19]. Meniscal injury has been reported with partial tears [20]. Injuries to the lateral meniscus seem infrequent. “Late-meniscal” injury occurs a period of time after CCL surgery (approximately 15%) and can occur in 8-19% of cases depending on surgical technique used. These injuries have been reported to occur from 3 weeks to 9 months post-operatively, with an average of 6 months after the first surgical procedure. Some authors contend that most LMIIs are missed primary meniscal tears.

**Clinical signs:** These dogs will present suddenly lame several weeks to months after initial CCL surgery. The joint may have an effusion and be unstable upon cranial drawer test. A prominent medial buttress may be present and an audible click upon flexion/extension [20].

**Diagnosis:** The diagnosis of meniscal injury is based on history and clinical examination and the presence of a large joint effusion without an increased cell count. Ultrasonography is approximately 90% sensitive and specific in experienced operators’ hands [21]. Arthroscopy and MRI are also used for diagnosis.

**Treatment:** Severe meniscal tears in both man and dogs cause significant morbidity and surgical treatment to remove, repair or replace the damaged meniscus is usually required to maintain their function and prevent the progression of OA. **Conservative treatment** for 4-6 weeks including restricted lead exercise and analgesic medications has been suggested in the management of these injuries, however conservative treatment is generally not as successful as surgical treatment in alleviating clinical signs. **Partial, hemi and total medial meniscectomy** (n order of preference) have been advocated to remove either the entire affected meniscus or damaged portion of meniscus respectively.

It is very important to be able to inspect the menisci thoroughly either at arthroscopy or arthrotomy to determine if damage is present. Most surgeons will perform a lateral parapatellar arthrotomy, to facilitate placement of a lateral fabellotibial suture, however medial arthrotomy is also performed, particularly in association with closing wedge and tibial plateau levelling osteotomy. In order to inspect the medial meniscus with a lateral parapatellar arthrotomy, it is useful to place a Gelpi retractor from medial to lateral and either a stifle distractor in the intercondylar notch or large Hohmann retractor behind the tibia. The meniscus can be inspected by running a small blunt probe or dandy nerve hook along its ventral aspect. The portion of damaged meniscus is identified and removed with a small scalpel blade (no 11 or 15). It is essential to inspect the meniscus for damage and treat accordingly during most of the common procedures for management of a CCL rupture.
References: