The approach to the feline disrupted stifle joint

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SYNOPSIS

Stifle joint disruption is a severe injury which results in complete dislocation of the stifle joint and severe instability. The injury is caused by rupture of several of the ligamentous joint stabilisers including the collateral ligaments, cruciate ligaments and joint capsule. The most common combination of injuries is rupture of the cranial and caudal cruciate ligaments with rupture of the medial collateral ligament. Concurrent meniscal damage is also very common. The goal of surgery with these cases is to repair or replace all of the damaged structures and achieve anatomic joint reduction with adequate stability. In order to achieve this, a primary repair of all of the damaged structures is performed, with temporary immobilisation of the stifle joint to protect the repair for the first two-three weeks. This allows periarticular fibrosis to progress and stabilise the joint. Postoperative management involves cage rest for the first 6 weeks with continuing house rest for a further six weeks. Physiotherapy may also be beneficial following removal of the temporary stifle immobilisation device. The medium-long term prognosis for return to a functional and comfortable limb is good despite the severity of the injury.

ANATOMY

The stifle joint consists of the femorotibial and femoropatellar articulations. The primary stabilising structures are the cranial and caudal cruciate ligament and the medial and lateral collateral ligaments. The secondary stabilisers are the joint capsule, the menisci and the muscles and tendons that span the joint. The functions of each of these ligaments are as follows:

- Cranial Cruciate Ligament – prevents cranial translation of the tibia, excessive internal tibial rotation and stifle joint hyperextension
- Caudal Cruciate Ligament – prevents caudal translation of the tibia
- Collateral Ligaments – prevent valgus (medial collateral) and varus (lateral collateral) deviation of the stifle joint
- There are four sesamoid bones in the region of the stifle joint:
- The patella;
- The popliteal sesamoid (within the tendon of the popliteal muscle); and,
- The medial and lateral fabellae.

It is relatively common for the medial fabella to be radiolucent in cats – this is particularly true in pedigree cats. The bone is normally present in these cases but consists of fibrocartilage and is therefore not visible radiographically.

STIFLE JOINT DISRUPTION

Stifle joint disruption is more common in cats than in dogs. It is a severe injury which results in complete dislocation of the stifle joint and severe instability. The injury is caused by rupture of several of the ligamentous joint stabilisers including the collateral ligaments, cruciate ligaments and joint capsule.

PRESENTATION

Cats normally present with a non-weight bearing lameness of the affected limb with extensive soft-tissue swelling and obvious instability or luxation of the stifle joint. Any age or breed may be affected but some reports indicate that young male cats are overrepresented – possibly due to their increased propensity to roam. There may be a history of trauma but this is often not directly visualised due to the majority of cats spending a lot of time outside unaccompanied. For the vast majority of cats, heavy sedation or general anaesthesia is necessary to manipulate the limb and reach a definitive diagnosis. While instability will be evident during conscious examination, sedation or anaesthesia will be necessary to investigate exactly which structures have been affected as they are unlikely to tolerate detailed examination conscious. It is important to recognise that these cats have often undergone significant trauma and therefore this should only take place after appropriate cardiovascular and respiratory stabilisation. Concomitant injuries to the thorax, abdomen and urinary tract are not uncommon and management of these necessarily takes precedence. Under sedation, depending on the number and combination of structures injured, laxity medially, laterally and in cranial and caudal drawer may be

palpable. Secondary to the severe multidirectional instability of the stifle, it is also relatively common in the author's experience for patellar luxation to be present.
Several combinations of ligamentous injuries may be present but the most common is rupture of the cranial and caudal cruciate ligaments with rupture of the medial collateral ligament. Concurrent meniscal damage is very common in these cases and must be looked for. Complete peripheral avulsion of the meniscus is the most common type of injury seen and unlike in degenerative cruciate disease, both the lateral and medial meniscus are frequently affected.
Radiographs should be performed to exclude any additional injuries including periarticular or articular fractures. Valgus and varus stressed radiographs can be performed to evaluate the integrity of the collateral ligaments but a careful and systematic physical examination is normally definitive without these in the experience of the authors. Sometimes, injuries are diagnosed or at least confirmed during surgical exploration of the joint.

Figure 1 – Preoperative radiographs of a seven-year-old MN Domestic Long Hair Cat with Traumatic Stifle Disruption with rupture of the cranial and caudal cruciate ligaments and the medial and lateral collateral ligaments. From left to right – mediolateral view, caudocranial view, varus stressed caudocranial view, valgus stressed caudocranial view.

SURGICAL EXPLORATION AND REPAIR

The goal of surgery in these cases is to repair or replace all of the damaged structures and achieve anatomic joint reduction with adequate stability. In order to achieve this, a primary repair of all of the damaged structures is normally performed, but temporary immobilisation of the stifle joint is also required to protect the primary repair for the first two-three weeks. This allows periarticular fibrosis to progress to stabilise the joint without loss of reduction. External splints and casts do not provide sufficient rigidity for this purpose and in most cases an external skeletal fixator (the authors' preference), or a transarticular pin are placed for the first two-three weeks postoperatively. Cats normally tolerate this very well.

Figure 2 – The same seven-year-old MN Domestic Long Hair Cat as in Figure 1 48 hours following stabilisation of traumatic stifle disruption with the stifle immobilised at 110 degrees of flexion.

Adequate exploration of a disrupted stifle often necessitates both a medial and a lateral approach. The lateral approach is required for:

- Exploration and debridement of the joint;
- Application of lateral extracapsular sutures for treatment of cranial cruciate ligament rupture;
- Application of a fibulopatellar ligament suture for stabilisation of caudal cruciate ligament rupture; and,
- Repair of lateral collateral ligament injury.

The medial approach is required for:
Repair of medial collateral ligament injury
Meniscal lesions are treated first. If the injury is an avulsion of the abaxial margin of the meniscus from the joint capsule and the entire meniscus looks and palpates normally, then reattachment of the abaxial margin to the joint capsule may be an option. The authors have never seen a case where this is appropriate as there have always been additional injuries to the meniscus, either crush injuries or tears which have necessitated more aggressive treatment. If damaged portions of the meniscus are evident, partial or total meniscectomy is required. The remnants of the ruptured cranial and caudal cruciate ligaments should be debrided and the joint can then be flushed and closed. In some cases, the caudal cruciate ligament may be severely stretched but intact and in these cases the authors do not recommend debridement of the ligament but leave it in situ whilst also placing a stabilising fibulopatellar ligament prosthesis.

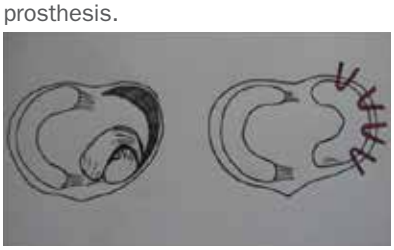

Figure 3 – Schematic diagram of a meniscal avulsion and subsequent repair via suturing of the abaxial margin to the joint capsule.

In cases of multiligamentous injury, the stifle is pronouncedly unstable and it can be difficult to place multiple stabilising prostheses and tension them all appropriately such that the stifle remains anatomically reduced. In order to facilitate this, the authors favour placement of a temporary transarticular K-wire. This is placed in the same way that a transarticular pin would be if it were going to be used as the primary method of stabilisation. A small K-wire (1.0-1.2mm in diameter), is placed from just proximal to the trochlear groove, across the stifle joint, to exit the tibia on the cranial aspect with the joint held at a normal standing angle. The pin is left long as it will be removed once the prosthetic ligaments have been placed and tensioned appropriately. With the temporary transarticular pin in situ, the individual structures can be addressed.

PRIMARY REPAIR AND PLACEMENT OF PROSTHESES

Cranial Cruciate Ligament

From the lateral parapatellar approach, the lateral retinaculum is undermined using blunt dissection until the lateral fabella is palpable. Take care not to confuse this with the head of the fibula which in these small patients with dramatic instability is possible. Using a fabella needle, either a strand of 4.5metric monofilament non-absorbable suture material (polypropylene) or a strand of 50-lb (23kg) breaking-strain nylon leader line is passed around the lateral fabella from caudoproximal to craniodistal. Take care not to take too large a bite with the needle as the peroneal nerve lies in relatively close proximity to the path of the needle in these small patients. The suture material is then passed from lateral to medial underneath the straight patellar ligament taking care to avoid any impingement on the ligament itself (depending on whether the proximal or distal strand is passed under the ligament, a loop or figure-of-eight configuration of suture respectively will be achieved). The prosthesis is then placed through a small bone tunnel (1.5-2.0mm) in the cranioproximal aspect of the tibial tuberosity. The stifle joint is then held in moderate flexion and slight external rotation as the prosthesis is tensioned and secured. I favour the use of the crimp-clamp technique for this but a knot can also be used. Knots using the 50lb nylon leader line can be very bulky in these small patients. In contrast to when isolated cranial cruciate ligament disease is treated, with the temporary transarticular pin in place, it is not possible to test range of motion or laxity in cranial drawer whilst tightening the suture. Therefore the degree of tension applied is subjectively assessed by the surgeon. The lateral fascia is then closed over the suture.

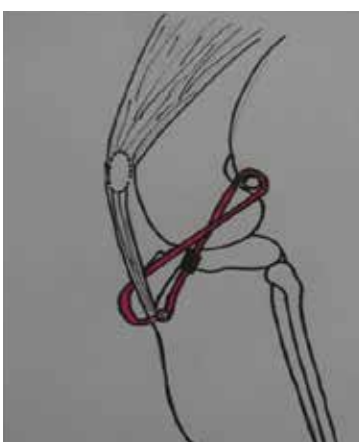

Figure 4 – Schematic diagram of extracapsular suture placement to compensate for cranial cruciate ligament rupture.

CAUDAL CRUCIATE LIGAMENT

This is also performed through the lateral parapatellar approach to the stifle. A suture is anchored around the fibular head and then through the proximal aspect of the patellar ligament. While placing the suture around the fibular head it is important to visualise the peroneal nerve to avoid involving this in the loop. For this procedure, either monofilament non-absorbable or slowly absorbable suture material should be used, normally of 4 or 4.5 metric. Take care not to overtighten this suture. If the patellar ligament is being visibly pulled towards the fibular head, the suture is too tight and should be loosened.

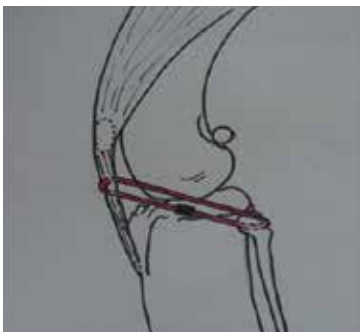

Figure 5 – Schematic diagram of fibulopatellar ligament suture placement to compensate for caudal cruciate ligament rupture.

MEDIAL COLLATERAL LIGAMENT

This is approached through the medial parapatellar approach. If possible, the ligament ends are sutured or imbricated using 1.5 metric monofilament slowly absorbable suture material in a locking-loop pattern. However, the ligaments are often shredded rendering primary repair impossible. When a prosthesis is being placed, 4.5 metric monofilament non-absorbable or slowly absorbable suture material is normally used. One 2.0mm screw or suture anchor is placed at the insertion site of the medial collateral ligament on the femoral condyle and one 2.0mm screw is placed in the proximal tibia. It is advisable to direct the screw in the tibia in a slightly proximal direction as this will discourage slipping of the prosthesis from the screw head. Stainless steel 2.0mm washers can also be used to prevent prosthesis slippage. The prosthesis is placed in a figure-of-eight around the screw heads before the screws are tightened.

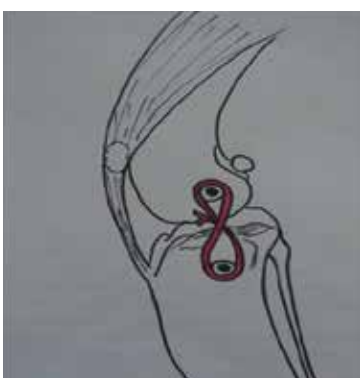

Figure 6 – Schematic diagram of medial collateral ligament prosthesis placement.

LATERAL COLLATERAL LIGAMENT

This is performed through the lateral approach using the same size suture material for primary repair of the ligament (if applicable) and the prosthesis as for the medial collateral ligament. For the prosthesis, one 2.0mm screw or suture anchor is placed into the lateral femoral epicondyle at the insertion site of the lateral collateral ligament. The prosthesis is placed around this screw and then through the gap between the fibular head and the tibia. Alternatively, for the distal point, a 1.5mm screw can be placed into the fibular head and be directed into the tibia. Do not use a 2.0mm screw here as the fibular head is too small to allow this and may fragment. A figure-of-eight suture is then applied around the two purchase points.

Figure 7 – Schematic diagram of lateral collateral ligament prosthesis placement.

Once all of the prosthesis have been placed and tensioned, the temporary transarticular pin can be removed and the stability and range of motion of the joint can be assessed. Closure is then routine.

For those cases which suffer concomitant patellar luxation, decision-making as to whether this also requires treatment can be complex. Often, once the required prosthetic ligaments have been placed, the patella will then be stable. However, if a recession sulcoplasty is to be performed, this is most easily achieved prior to placement of the prostheses. The authors use three factors to assist with decision-making in these cases:

Is there any history compatible with patellar luxation being present prior to the traumatic stifle disruption?

Is patellar luxation evident in the contralateral stifle?

Is there any evidence at surgery that patellar luxation has been a problem in the past? (e.g. shallow trochlear sulcus, erosions on underside of patella or over medial (or lateral) trochlear ridge).

IF THE DECISION IS MADE TO TREAT THE PATELLAR LUXATION

surgically, the author's preference is to perform a block recession sulcoplasty prior to placement of the temporary transarticular pin +/- medial fascial release and lateral imbrication as necessary to maintain reduction during closure. In our experience, tibial tuberosity transposition is not often required in these cases unless significant quadriceps malalignment is evident. The cranial cruciate ligament prosthesis likely assists with maintenance of reduction of the patella due to the external tibial rotation which it provides.

TEMPORARY IMMOBILISATION OF THE STIFLE JOINT

This can be performed using either a transarticular pin or a transarticular external skeletal fixator. Our preference is the external fixator as we perceive patients to be more

comfortable using this technique and removal of the frame is easier. However, both techniques are reported to be equally successful and it is a matter of surgeon preference which is used.

Figure 8 – A 1 year old MN Domestic Short Hair Cat 48 hours following stabilisation of traumatic stifle disruption with cranial cruciate ligament, caudal cruciate ligament and lateral collateral ligament rupture treated with prosthetic ligaments and a transarticular external skeletal fixator with the stifle immobilised at 130 degrees of flexion.

If a transarticular pin is chosen, this is placed exactly as described for the temporary intraoperative pin described above. A larger pin is required if it is to remain in situ for two-three weeks and normally this is 2.4-3.2mm in diameter. The pin should be left long enough to allow easy retrieval 2-3 weeks later via a small stab incision either over the distal femur or proximal tibia.

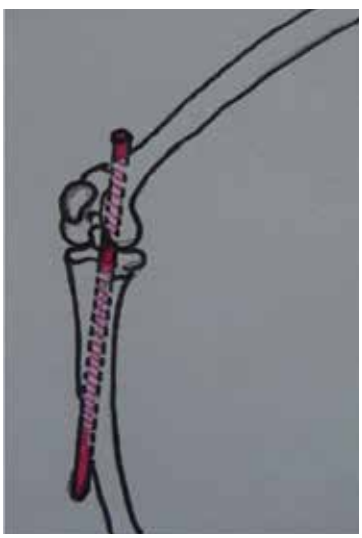

Figure 9 – Schematic diagram of temporary transarticular pin placement.

If a transarticular external skeletal fixator is chosen, a type I frame applied laterally is normally adequate. We normally also triangulate this frame using an additional connecting bar. 2.0mm positive threaded pins in the femur and 1.6-2.0mm positive threaded pins in the tibia are normally appropriate. The stifle should be stabilised at an angle slightly more flexed than the normal standing angle (it is useful to measure this from the contralateral side prior to anaesthetising the patient but the range used by the author depending on the cat is 110-135°). If the stifle is too extended then the patient will have difficulty ambulating during the ensuing two-three weeks. With the stifle at this appropriate angle, the patient will use the limb, albeit abnormally with pronounced circumduction of the limb. It is important that the frame spans a significant portion of the femur proximally and the tibia distally. The most proximal pin should be in the proximal third of the femur and the most distal pin in the distal third of the tibia. The frame can be removed under sedation two-three weeks later.

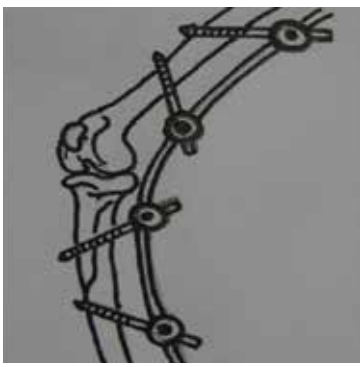

Figure 10 – Schematic diagram of transarticular external skeletal fixator placement.

Figure 11 - Postoperative radiographs of a 1 year old MN Domestic Short Hair Cat with Traumatic Stifle Disruption with rupture of the cranial and caudal cruciate ligaments and the lateral collateral ligament. This case also had a block recession sulcoplasty performed to stabilise concomitant patellar luxation.

It is worth considering the use of a hinged transarticular external skeletal fixator. Although joint immobilisation is necessary in these cases and is protective in the short term, it does have a deleterious effect on the joint. Immobilisation results in reduced synovial fluid production, reduced cartilage thickness and stiffness, cartilage fibrillation and cleft formation, intra-articular adhesions, periarticular contractures and the development of degenerative joint disease. The use of a hinged ESF provides stabilisation while maintaining relative freedom of movement in the joints natural plane of motion. This permits supported healing of the damaged structures while avoiding some of the deleterious effects of complete immobilisation. It is possible to treat these injuries without placement of prosthetic ligaments and with temporary immobilisation of the joint in isolation. This is not my method of choice, however, in cases where there are financial restrictions, or where the patient is not stable under anaesthesia, it does significantly reduce the time and cost associated with the

procedure. No studies have been performed comparing outcomes between these two techniques.

COMPLICATIONS

Possible complications associated with this procedure include:

- Loosening, bending or breakage of the transarticular pin;
- Loosening, bending or breakage of the transarticular external skeletal fixator pins;
- Femoral or tibial fracture through the pin holes;
- Damage to intra-articular structures through placement of the transarticular pin;
- Pin tract discharge from the ESF pins, particularly those in the femur, is expected due to the large volume of soft tissue penetrated by the pins and owners should be warned of this;
- Prosthesis failure for any of the ligaments;
- Ongoing degenerative joint disease;
- Loss of range of motion of the joint (less after hinged frames); and,
- Sepsis.

POSTOPERATIVE TREATMENT AND PROGNOSIS

The transarticular external fixator or transarticular pin are left in situ for two-three weeks. The cat should be strictly confined to a cage during this time but can be let out for supervised periods of controlled activity or harness walking to encourage limb use, which will hopefully decrease muscle and cartilage atrophy. It has been shown that the complication rate for these frames is significantly higher in cats which are not confined, with higher rates of pin breakage and loosening. Ensure that the cage is lined with cardboard to prevent the frame being caught, as these frames create a long lever arm and can result in coxofemoral disarticulation if they are caught and the patient struggles.

Figure 12 - A 7 year old MN Domestic Long Hair Cat enjoying supervised activity out of the cage 48 hours postoperatively following traumatic stifle disruption with rupture of the cranial and caudal cruciate ligaments and the medial and lateral collateral ligaments.

Appropriate analgesia should be administered for the first five-10 days as required to improve overall well-being and to encourage use of the limb. Options include meloxicam, robenacoxib, codeine and tramadol.

Following removal of the temporary immobilisation, the range of motion of the joint will be severely restricted. This tends to rapidly improve when the cat resumes activity. The authors often prescribe a few days of analgesia at this time to encourage ongoing limb use. Physiotherapy is beneficial with passive range of motion exercises if the cat will tolerate this. Exercise restriction remains paramount during the first 2-3 weeks after removal of the immobilisation as this allows gradual reorganisation and remodelling of the

Reader Questions and Answers

1. WHICH OF THESE IS THE MOST COMMON COMBINATION OF INJURIES FOR A FELINE TRAUMATIC STIFLE DISRUPTION?

a) Cranial cruciate ligament, medial collateral ligament and lateral collateral ligament
b) Cranial cruciate ligament, caudal cruciate ligament and lateral collateral ligament
c) Cranial cruciate ligament, caudal cruciate ligament and medial collateral ligament
d) Cranial cruciate ligament, caudal cruciate ligament, medial collateral ligament and lateral collateral ligament

2. WHICH OF THE FOLLOWING IS NOT A FUNCTION OF THE CRANIAL CRUCIATE LIGAMENT?

a) Preventing cranial translation of the tibia
b) Preventing caudal translation of the tibia
c) Preventing excessive internal rotation of the tibia
d) Preventing stifle joint hyperextension

3. WHICH OF THE FOLLOWING STATEMENTS REGARDING MENISCAL DAMAGE IN TRAUMATIC STIFLE DISRUPTION IS CORRECT?

a) Meniscal damage is uncommon in traumatic stifle disruption
b) Lateral meniscal damage occurs significantly less frequently than medial meniscal damage
c) Complete meniscal avulsion is the most common form of meniscal damage seen
d) Complete meniscal avulsion is always treated via total meniscectomy

4. WHICH OF THE FOLLOWING STATEMENTS REGARDING SURGICAL TREATMENT OF TRAUMATIC STIFLE DISRUPTION IS CORRECT?

a) A temporary transarticular pin of 2.4-3.2mm in diameter is recommended intraoperatively to facilitate placement and tensioning of prosthetic sutures
b) A 2.0mm screw in the fibular head can be used as the distal attachment point for a lateral collateral ligament prosthesis
c) If patellar luxation is evident preoperatively a block recession sulcoplasty should always be performed prior to prosthetic ligament placement
d) Temporary immobilisation of the stifle joint is always recommended for 2-3 weeks postoperatively

5. WHICH OF THE FOLLOWING STATEMENTS REGARDING POSTOPERATIVE CARE OF THE TRAUMATIC STIFLE PATIENT IS CORRECT?

a) The complication rate for cats with transarticular external skeletal fixators is higher in cases which are not appropriately cage rested
b) A rapid return to normal activity levels is recommended following external skeletal fixator frame removal
c) The prognosis for a comfortable and functional limb following this severe injury is guarded in cats
d) Physiotherapy is not recommended following frame removal as it can exacerbate cartilage atrophy

ANSWERS: 1, C. 2, B. 3, C. 4, D. 5, A.

fibrous scar tissue in response to the loads being placed upon it. Rapid and sudden remobilisation of joints following periods of immobilisation is also detrimental to cartilage health. Exercise restriction will also prevent fracture through the external skeletal fixator pin holes or the defect left following removal of the transarticular pin. Cats generally remain on house-rest for two-three months in total following the injury.

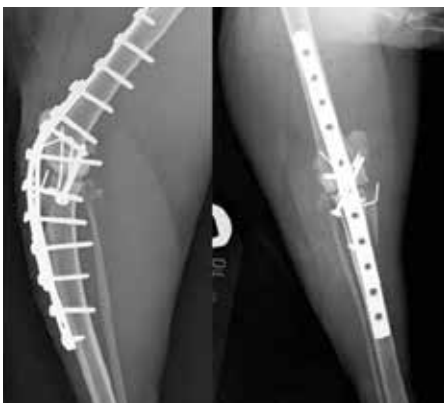

Figure 13 – Immediate postoperative radiographs of an 8 year old domestic short hair cat following stifle arthrodesis

The medium-long term prognosis for return to a functional and comfortable limb is good despite the severity of the injury. (It should be noted that the prognosis in dogs with this injury is not as favourable). Circumferential thickening of the joint and a moderately decreased range of motion will persist and the cat will develop a degree of degenerative joint disease. How much this will affect the cat is impossible to predict but the vast majority cope well with this and maintain an active lifestyle. In cases where the outcome is less favourable, salvage options including stifle arthrodesis or customised Total Knee Replacement (TKR) are available but these are very seldom indicated.

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