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Management of cranial cruciate ligament ruptures in dogs

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ABSTRACT: Cranial cruciate ligament rupture is the most common cause of non-traumatic lameness in dogs. It can affect any breed of dog; however, large to giant breeds are most commonly affected. There are multiple treatment options from conservative management to a number of surgical stabilisation techniques. The aim of this article is to inform the reader of the different treatment methods available, their benefits and discuss post-operative care when surgical intervention is performed.

Keywords: cruciate; rupture; dog; surgery; management

Introduction

The cranial cruciate ligament (CCL) is an important structure within the knee (stifle) joints of dogs. The ligament plays an important role in stabilising the stifle during weight-bearing, as it prevents the tibia moving forwards past the femur (tibial thrust) when weight is applied to the hindlimb.

Rupture of the CCL is the most common cause of non-traumatic hindlimb lameness in dogs. Any breed can suffer from this injury, however, large and giant breeds tend to be more affected.

CCL rupture occurs most frequently through progressive degenerative rupture (i.e. cranial cruciate ligament disease); although, acute traumatic rupture is also observed in dogs (Nanda & Hans, 2019).

Due to CCL rupture occurring through a degenerative process, concurrent osteoarthritis is typically present within the stifle joint.

Following CCL rupture; stiffness in the hindlimb, and difficulty jumping (bilateral CCL rupture) can be reported findings by the owner. Pain on manipulation and muscle atrophy can be considered as clinical findings on examination by a veterinary surgeon. Although, the degree of muscle atrophy would be relative to the period of time lameness has been present.

The prognosis of cruciate rupture is excellent with appropriate surgical management in the vast majority of cases, irrespective of the presence of osteoarthritis in the joint. A variety of treatment options are available from conservative management to a number of surgical techniques.

Conservative management

Dogs with an early, partial thickness CCL rupture can be suitable candidates for conservative management. Strategies are focused on controlling the effects of inflammation (Canapp, 2018), whilst also maintaining the patient's weight, or following a weight loss programme until an appropriate body condition score is achieved. Obese dogs are almost four times as likely to suffer from cranial cruciate ligament disease as those of normal weight (Adams et al., 2011). The use of nonsteroidal anti-inflammatories (NSAIDs) and cold compression over the affected area can counteract the effects of inflammation within the joint.

Exercise restriction for a period of three to six weeks is recommended, however, various rehabilitation therapies such as physiotherapy and hydrotherapy may assist in stabilising the joint by increasing muscle tone and mass.

Dogs weighing less than 15 kg tend to have a more successful response to conservative management than larger breed dogs. Only a few peer-reviewed reports exist on the outcome associated with conservative management of canine CCL rupture. However,

Vasseur (1984) extensively and retrospectively evaluated the outcome of over 80 dogs with CCL ruptures that were treated with conservative management. He concluded that 75% of dogs weighing less than 15 kg were found to be clinically normal after an average follow-up of three years. Conversely, only 7% of the dogs weighing 15 kg or more were found to be normal after an average of 4.1 years. It was concluded the reason smaller breeds had a higher success rate was likely linked to their less active lifestyle in comparison to larger breeds, and the fact that CCL rupture in small dogs tends to occur at an older age when they are becoming less active.

Conservative management may be an elective treatment option for multiple reasons: owner preference, patient age and financial restrictions may preclude proceeding with surgical stabilisation.

Surgery

While conservative management of CCL rupture may result in an acceptable outcome, especially in dogs less than 15 kg, surgical management remains the gold standard (Fauron & Perry, 2017) and is the preferred treatment choice for a CCL rupture, providing a better long term outcome for all patients.

There are multiple surgical techniques which can be performed to stabilise the affected stifle.

These surgeries do not directly repair the ruptured cruciate ligament, but instead aim to alter the biomechanics of the stifle joint and neutralise cranial tibial thrust during weight bearing. These alterations include altering the angle of the tibial plateau (the smooth upper surface of the tibia which adjoins to the stifle), or by advancement of the tibial tuberosity, (the oblong elevation on the proximal, cranial aspect of the tibia).

There is currently no known evidence that surgery to stabilise the stifle, delays or inhibits progression of osteoarthritis within the affected joint.

Tibial Plateau levelling osteotomy

A Tibial Plateau Levelling Osteotomy (TPLO) procedure is one of most commonly performed surgical procedures seen amongst orthopaedic referral hospitals.

Slocum and Slocum (1993) explains the tibial plateau, is cut and rotated so that its slope is altered to approximately five degrees from the horizontal plane. This alteration neutralises cranial tibial thrust during weight bearing.

Once the bone has been rotated, it is stabilised in it is new position with a plate and screws.

This technique is the most favoured amongst present-day surgeons, due to TPLO surgeries presenting outstanding clinical results when compared to other surgical options

Tibial tuberosity advancement/modified Maquet procedure

The Tibial Tuberosity Advancement (TTA) was introduced in 2002 in veterinary medicine (Montavon et al., 2002), and although, the biomechanical result is the same as a TPLO, the method of achieving this outcome differs.

The advancement of the tibial tuberosity changes the angle of the patellar ligament to neutralise tibial thrust when weight bearing.

A mediolateral osteotomy is performed by cutting the tibial tuberosity and advancing cranially (Tepic et al., 2002), which subsequently advances the patella tendon to create a patellofemoral angle of 90 degrees. The traditional procedure involves advancement with a titanium cage that is used to hold the tibial tuberosity in its advanced position, and secured with screws. This procedure stabilises the stifle without compromising joint congruency.

The Modified Maquet Procedure (MMP) uses the same principle as a TTA, but is a modification of this established technique. The titanium cage is replaced with a titanium foam wedge, which allows ingrowth of bone resulting in better osteointegration (Trisciuzzi et al., 2019).

Cranial closing wedge osteotomy

The cranial closing wedge osteotomy (CCWO) can be considered a variation from the TPLO.

It is considered a surgical technique for any patient but favoured for breeds that have a steep tibial plateau such as West Highland White Terriers.

The aim of CCWO is to reduce the angle of the tibial plateau or joint angle. To achieve this a small triangular piece of bone is removed from the cranial aspect of the tibia, and then, closing the wedge that has been created. This closure is supported by a small plate and screws, cerclage wire can also be used for stabilisation.

The outcome of this procedure is to abolish tibial thrust during weight bearing.

Post-operative management

Post-operative pain management is influenced within the pre-operative period. On admission into the veterinary surgery, the patient should be assessed for pain. Some patients may have already begun a course of oral NSAIDs or opiods, so it is important to remember that pain assessment is subjective to each patient, and each veterinary surgeon.

Mishra et al. (2013) explains that pre-emptive analgesia, initiated before the surgical procedure to prevent pain in the early post-operative period has the potential to be more effective than a similar analgesic treatment initiated after surgery.

Some patients may have received a peripheral nerve block or a lumbosacral epidural. Goddard (2012) states that peripheral nerve blocks commonly used in the hind limb block the sciatic nerve and femoral nerve, desensitising the stifle area and distal hind limb. Dependant on the agents used, these nerve blocks can remain in effect for a period of up to 12 hours post-operatively.

Care should be taken if the patient has received an epidural, especially if the patient is aggressive or a heavy large breed of dog. These patients are less likely to be ambulatory within the first six hours post-operatively, so may need assistance with a lifting aid to enable safe and comfortable manipulation of the patient (Chase, 2017). Management of the urinary bladder may also be required post-lumbosacral epidural, either by manual expression on recovery prior to extubation, or by management of an indwelling urinary catheter. Aggressive patients may be less tolerant to being washed or lifted with assistance if they have soiled themselves.

In the first 24 hours after surgery, appropriate analgesia for the patient is greatly important. A post-operative pain management plan is essential to devise between the veterinary surgeon and veterinary nurse before the patient is recovered from anaesthesia. The veterinary surgeon can prescribe an opioid to the patient, who can either be pain assessed during recovery or receive opiates every four to six hours for the first 12–24 hours following surgery. The plan can

be set in place, and the nurses in charge of recovering the patient can ensure they are kept comfortable and do not endure any prolonged period of pain.

In addition to analgesic agents, NSAIDs can be prescribed, or a current course can be continued to reduce inflammation within the joint and around the surgical area.

Cryotherapy, or cold therapy, is the least expensive and easiest method to decrease acute inflammatory pain induced by surgery, or for patients under conservative management. Post-operative orthopaedic patients can receive immediate cold therapy around their surgical sites. Swelling and bruising directly around the surgical site, and down the limb is common following surgical intervention. Cryotherapy can significantly decrease pain, swelling and increase the joint's range of motion (Gomez, 2017).

Commercial canvas packs wrapped in a towel, or specific stifle icer packs can be used for 10 to 20 minutes every six to eight hours when hospitalised.

Owners can be instructed to continue cold therapy at home, using a bag of frozen peas wrapped in a towel until any swelling and oedema diminishes – usually for up to seven days post-surgery.

Lameness is common following surgical intervention for CCLR. Shortly, if not immediately after surgery, all patients should be willing to walk outside for toileting. Most patients quickly gain stability temporarily walking on three legs; however, large breeds of dog may require assistance with a sling when being walked. A small number of patients will attempt to weight bear when walking slowly. The majority of patients should be willing to touch their toes to the ground when standing in the first 72 hours following surgery.

In the first six weeks following surgery, a strict exercise regime should be implemented for owners to follow at home. Short walks outside for a maximum of 10 minutes, three times a day always on a harness or lead and no free running and jumping should be stressed as highly important. The stifle takes significant impact on the patients weight when running and landing on the ground after jumping and until the surgical site has stabilised there is high risk of implant failure, associated fractures and surgical site seroma formation if dogs are not correctly rested.

Physiotherapy and hydrotherapy are also beneficial as additional treatments during the recovery period. Physiotherapy can be started once the patient has been discharged. Passive range of motion excersices (PROM), can help increase the range of motion within the joint following surgery. Flexion extension exercises can be performed on all the joints of the affected limb, for a maximum of 10 minutes, three times a day.

This can be continued until the patient is constantly using the operated limb.

Hydrotherapy is effective at building up muscle on the affected limb six to eight weeks post-surgery, once the initial recovery phase has ended. A discussion with the veterinary surgeon and independent research into a suitable hydrotherapy centre can be arranged.

Conclusion

Rupture of the CCL is the most common cause of non-traumatic hindlimb lameness in dogs.

While there is no right or wrong method in treating patients, the owner should be made aware of the advantages and disadvantages of each treatment option.

There is evidence to show larger breeds of dogs benefit from surgical intervention with the preferred method being a TPLO. However some owners may wish to initially trial conservative management for multiple reasons; finances, owner preference, patient diet trials and patient age.

Smaller breeds of dogs have a higher recovery rate in conservative management, in comparison to large breeds however surgical intervention is still considered gold standard and may be a preferred option initially.

With a strict exercise regime and owner compliance, recovery from a CCL rupture with surgical intervention is generally successful and many dogs can return to normal routine from six to eight weeks post-surgery. However unfortunately there is no evidence to show that surgery slows down the progression of osteoarthritis within the affected limb, so owners should be reminded that care should always be taken once the dog has suffered ligament damage.

Disclosure statement

No potential conflict of interest was reported by the author.

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