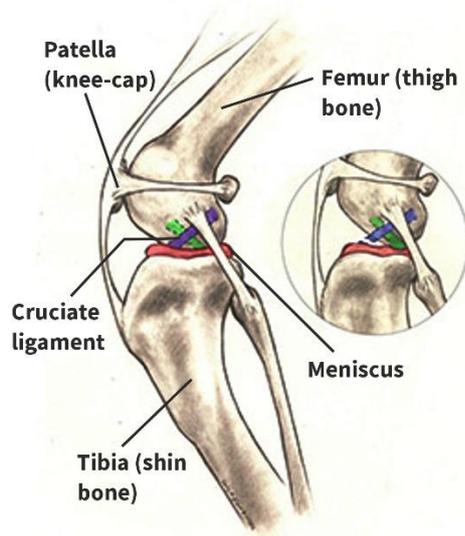


CRUCIATE LIGAMENT DISEASE IN DOGS



The condition known as ‘cruciate disease’ refers to failure or rupture of the Cranial Cruciate ligament (CCL) – also called frequently called the Anterior Cruciate Ligament (ACL). It is the most common cause of hindlimb lameness in pet dog and it affects the stifle joint, the equivalent of our knee. The CCL can rupture suddenly due to a single traumatic injury, as is usually the case in humans, but most commonly in dogs we see a progressive degeneration of the ligament due to a combination of factors including age, breed, lifestyle and environment. This progressive onset is why the condition is commonly referred to as ‘cruciate disease’, rather than ‘cruciate rupture’.

The CCL is an important primary support mechanism for the knee. It prevents excessive forward and backward sliding of the femur (thigh bone) on the tibia (shin bone) known as ‘Tibial Thrust’ and limits internal rotation of the joint (‘Pivot Shift’). When the ACL tears it is painful and the joint becomes profoundly unstable, resulting in a severe loss of function in the affected limb. The instability can also damage the meniscal cartilage in the knee which is the primary ‘cushion’ between the femur and the tibia. Untreated legs usually become very arthritic and painful from the instability.

Does my dog need surgery?

The primary concern is arthritis will progress more rapidly if the joint is not stabilised. In dogs weighing less than 10kg, some studies have suggested that strict cage confinement for 8 weeks may allow a reasonable recovery but even so arthritis can be expected to develop more quickly than if the joint is stabilised. For larger dogs there is no benefit to a “wait and see” approach and corrective surgery should be performed promptly even for partial tear cases. With surgical intervention, a good to excellent outcome can be expected in over 90% of dogs.

Surgical options

An injured Cruciate Ligament can only be corrected by surgery. There are a number of different techniques that have been used over the years and these have broadly evolved into two classes – the ‘osteotomy’ (which literally means ‘bone-cutting’) techniques and the ‘lateral suture’ techniques. The latest osteotomy techniques work by changing the angles within the middle of the knee joint so that the cruciate ligament is no longer required. The lateral suture techniques aim to provide stability by replacing the torn cruciate ligament with a loop of synthetic material around the outside of the joint. It is generally acknowledged that the osteotomy techniques (TPLO and TTA) are superior to the lateral suture techniques, particularly for dogs weighing over 10kg. However they are more expensive and more invasive so there may be some instances in which a lateral suture technique is recommended.

Osteotomy techniques

The Tibial Plateau Levelling Osteotomy (TPLO) and Tibial Tuberosity Advancement (TTA)

The osteotomy procedures are the newest techniques and have proven to be the most successful in terms of achieving the best long-term outcome. These techniques work by changing the forces acting within the stifle joint so that the cruciate ligament is not needed at all. The knee joint is formed by the rounded bottom of the femur (the femoral ‘condyles’) and the flat top of the tibia (the tibial ‘plateau’). In nearly all dogs the tibial plateau is tilted back so that there is a tendency for the femoral condyles to slide backwards off the top of the tibia. The anterior cruciate ligament (ACL) prevents this from happening but a steep tibial plateau puts the ACL under a lot of strain so that it eventually fails.

The TPLO works by making a cut in the tibia below the tibial plateau, tilting the tibial plateau forward until it is effectively flat, and then applying a plate to hold everything in the new position until the bone heals. The TTA is different in that it works by making a cut through the front edge of the tibia (the tibial ‘crest’ or ‘tuberosity’) and moving the attachment of the kneecap/patella forward so that the very strong patella tendon then pulls against the backwards slope of the tibial plateau. Both techniques mean that the knee can then function normally without the ACL as there is no force pulling the femoral condyles off the tibial plateau. More details of each technique are given below.

Opinion varies as to whether a TTA or a TPLO is the better technique - both carry a similar success rate and any differences between the two are very small. Some recent studies have suggested that the TPLO achieves better long-term outcomes - however this is likely a result of the fact that there are many different types of TTA, some of which are performed poorly by inexperienced surgeons. Other research has also indicated that the risk of post-operative meniscal tears may be slightly greater with TTAs. Conversely, some papers have proposed that the TPLO results in more long-term rotational instability and that this may exacerbate the progression of arthritis as the dog ages. Ultimately it often comes down to the personal preference of the surgeon and the individual anatomy of the dog. In very giant breeds the TTA is often

preferred as it does not completely cut through the full bone length of the tibia and the risk of catastrophic failure (i.e. a broken leg!) is therefore reduced. The physics of the osteotomy procedures is explained below.

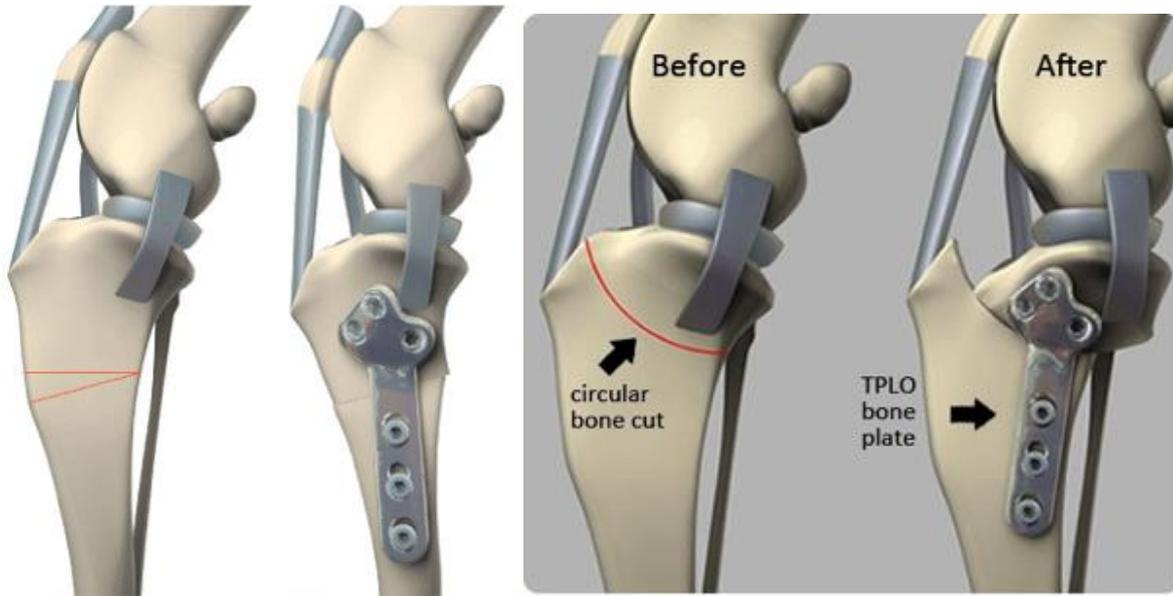
The Tibial Plateau Levelling Osteotomy (TPLO)

As previously mentioned, the floor of the knee (the tibial plateau) in dogs is tilted backwards creating a downslope which results in a tendency for the femur to slide backwards off the tibia – a force resisted by the anterior cruciate ligament. The angle of this down-slope is usually about 25 degrees, but in some breeds like West Highland White Terriers it can be 40 degrees or more. This is known as the ‘tibial plateau angle’ or TPA. A TPLO aims to reduce this slope to something in the region of 5 degrees. This allows dogs to use the knee despite the ruptured cruciate ligament since the femur no longer slides backwards when weight is put through the affected limb.

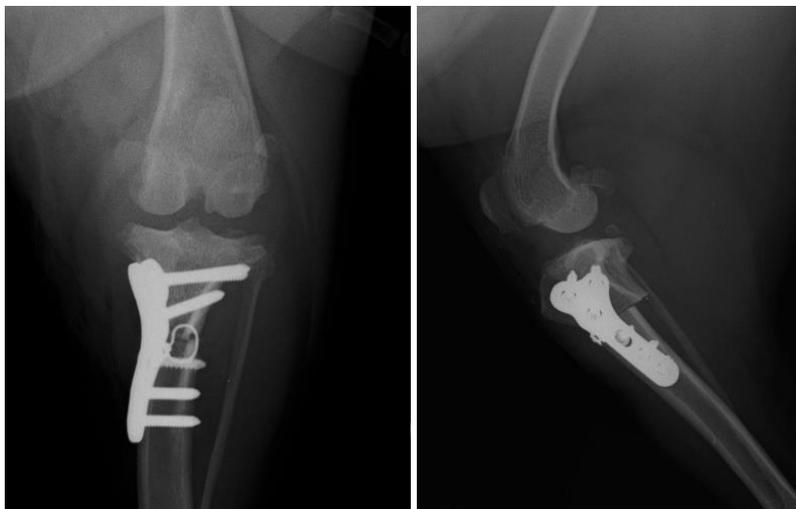
There are a couple of different ways of performing a TPLO. One involves making a curved cut in the bone beneath the tibial plateau and then rotating the whole tibial plateau forward until the tibial plateau angle is sufficiently reduced – this is known as a Slocum TPLO (named after the early pioneer of this technique). Another means of levelling the tibial plateau involves cutting a thin wedge of bone from the front edge of the tibia and then closing the gap to tilt the whole tibial plateau forward. This is known as a closing-wedge TPLO (cwTPLO) or a cranial closing wedge osteotomy (CCWO). In both cases a very strong steel plate is applied to the inside edge of the tibia to hold the cut bone ends in the correct position until healed (which typically takes around 8 weeks).

Both TPLO techniques achieve the same thing in terms of tilting the floor of the knee forward to negate the need for an anterior cruciate ligament. Success rates are equally high for both methods, with over 90% of dogs regaining excellent limb function with minimal ongoing trouble. The pictures below illustrate the two different techniques:

The two techniques – a closing wedge TPLO and a slocum TPLO



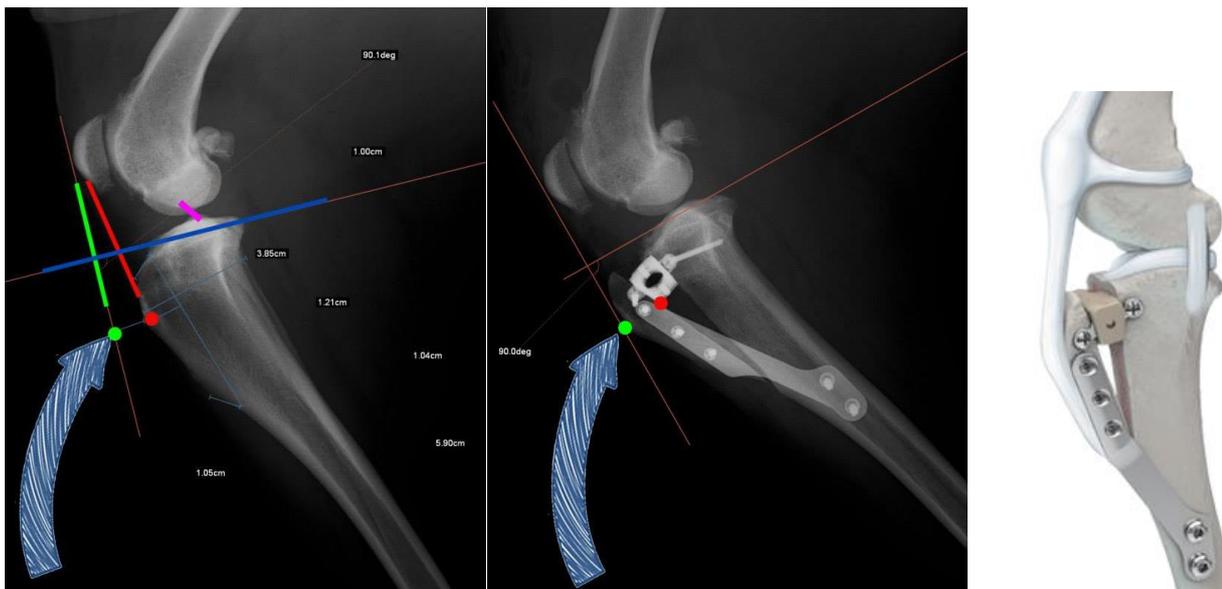
TPLO appearance on x-ray



The Tibial Tuberosity Advancement (TTA) procedure

The TTA is another osteotomy technique that works by harnessing the power of the very strong tendon that attaches the kneecap (patella) to the front edge of the tibia (the tibial 'tuberosity'). The patellar tendon needs to be so strong because it is the main anchor point for the large group of quadricep muscles which form the front of the thigh.

The principle behind the TTA technique is that if you cut and move the tibial tuberosity forward it has the effect of pulling the whole knee forward and acts to pull the femur upwards against the downslope of the tibial plateau so that this rearward force is cancelled out or 'neutralised'. In doing so, it renders the ACL redundant. The x-rays below show the calculation used to work out how far forward the tibial tuberosity (marked by the red and green dots) needs to be moved to neutralise this force:



A specialised and pre-measured titanium 'cage' is then inserted in the gap at the top of the detached tibial tuberosity to act as a spacer and the whole arrangement is secured to the body of the tibia with a strong titanium plate. The patella tendon exerts a huge upward force on the tibial tuberosity and a secure attachment is essential. Failure of this plate is a rare complication of surgery and can result in the tibial tuberosity being pulled off the bone completely, which invariably requires corrective surgery.

Lateral Suture Systems (LSS) or Extracapsular Repair

There are numerous different methods that have been employed to stabilise the stifle joint by effectively replacing the ruptured ACL with a prosthetic implant. Traditionally a loop of normal suture material or thick nylon line have been placed around the outside of the joint and then tightened. However thick nylon is a very rigid material which can be quite uncomfortable and the cut ends can cause irritation. It also suffers from fatigue due to the constant movement and pressure resulting in early failure in some cases. Due to these issues, many surgeons now prefer to use a synthetic braided ligament made from ultra-high molecular weight polyethylene (UHMWPE) material which is softer and tends to be better tolerated. It is also much stronger and has a small amount of elasticity or 'give' which is more akin to a real ligament. Furthermore, rather than just tying it superficially around the outside of the joint it is anchored more internally with a titanium toggle which improves the alignment of the implant so that it better mimics the role of the torn ACL.

The LSS technique is also associated with a high success rate (over 90%) and remains an excellent choice for many smaller dogs and cats. It is also an acceptable technique for much larger dogs as well but there is an increased chance that the outcome may not be as good as with the osteotomy techniques. After all, the osteotomy techniques correct the underlying cause of the ligament failure whereas the LSS techniques are trying to provide support to compensate for the loss of the ligament – clearly these forces are much greater in bigger dogs and the risk of implant failure is greater as a result. Nonetheless it still gives good results in the majority of cases and being about half of the cost of a TTA or TPLO is certainly a good option where affordability is a concern.

Lateral suture technique



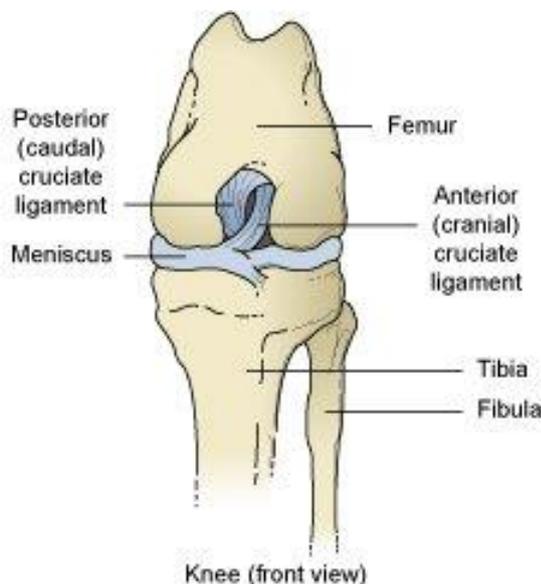
The arthrotomy

Regardless of which of the above techniques are used, an important part of the surgery in all cases involves performing an 'arthrotomy', which refers to the opening of the knee joint capsule itself. This is important because it allows the inside of the knee to be inspected for damage and appropriate measures taken to improve the recovery of the joint following surgery. This will often involve removing the torn ends of the ACL to prevent them interfering with joint movement.

A major part of this internal joint inspection involves checking the menisci for damage. The menisci (singular meniscus) are important C-shaped disks of fibrocartilage that help cushion the floor of the knee. Damage to the meniscus is seen in about 30% of cases of cruciate disease as the excessive movement in the joint can result in tears to these cushions.

Tears in the menisci are painful and limit recovery so it is important to carefully remove the torn areas – if damage is very severe it may even be necessary to remove the whole meniscus (a 'meniscectomy'). In some cases damage may result in tears appearing at a later date and cause complications in the recovery from surgery or even some years later – these are known as 'late meniscal tears'. If there is extensive damage to the menisci this can affect the prognosis for recovery from surgery and will tend to result in increased arthritis in later years.

Internal anatomy of the stifle joint



AFTERCARE

What to expect?

Your pet will almost certainly be hospitalised overnight following the surgery so they can receive medication, intravenous fluids and pain relief as required so be prepared to collect them the day following surgery.

It is important to remember that your pet will be recovering from a major surgical procedure and the after effects of the anaesthetic can make them a bit subdued and disorientated for few days so do not worry if they seem out of sorts and are not their normal self during this period. They will almost certainly also be feeling rather sore and uncomfortable so will need to be encouraged to settle quietly in a warm, familiar spot and sleep it off. The first few days are always the hardest in this respect but once the first 4 to 5 days have passed their behaviour should slowly return to normal. A thick duvet or memory foam mattress should be provided for bedding to help cushion the area and any bedding should be thoroughly washed to reduce the risk of infection. They will need to be kept in a very clean, dry environment at all times during the first 14 days whilst the skin incision heals to minimise the risk of any infection entering the wound.

They may also be a bit nauseous for a day or two so we usually recommend dividing their usual portion into several smaller meals for the first couple of days. Offering something palatable and easily digested like cooked chicken, white fish, cottage cheese or a chopped boiled egg with either rice, pasta or mashed potato is often advised - we can provide you with a tasty, high energy tinned diet for this period if requested.

It is quite normal after being starved for an anaesthetic for animals not to pass any stools for a few days so this should not be concern as long as they are eating well and drinking and urinating normally.

They must also not be allowed to lick the area excessively. A small t-shirt or buster collar must be used to keep the area protected if they are left alone for long periods.

The surgical site will need to be checked regularly in the first few days - at least twice a day. A slight ooze of blood is normal in the first two to three days and a degree of redness, bruising and a fluidy swelling may develop over a period of 4 to 5 days. This can be quite marked around the ankle area as gravity causes the fluid to gather below the operation site and is nothing to worry about. However if the ooze of blood seems excessive or the wounds appears to be opening up then we should be contacted. Any discharge can be cleaned away with cotton wool and a saline solution made by adding two teaspoons of salt to a pint of cool, previously boiled water. Any adhesive dressings applied to the wound post operatively may come unstuck in the days following surgery and there is no need to replace them as long as the incision looks clean and dry.

Post-op checks

These are often carried out by a veterinary nurse after 4-5 days and then again after 10-14 days by a vet. Post-operative x-rays are performed 8 weeks after surgery – these are essential in the case of the osteotomy techniques but not always needed in the case of the lateral suture systems. If the x-rays reveal that healing is satisfactory then it is a case of 4 further weeks of controlled lead exercise before a gradual resumption of normal activity.

REHABILITATION:

ICE/COLD THERAPY (DAYS 1 to 3): To reduce swelling and discomfort we recommend applying a soft ice pack to the area for the first 3 days. A suitable ice pack can be made from a bag of peas wrapped in a clean hand towel and should be applied to the area for 10 minutes three times a day. Alternatively an ice cube can be gently moved across the skin surface around the outside of the wound.

WARM COMPRESS (DAY 5-14): This can be started after the first op check and only if the incision is clean and dry. Use a hot water bottle (with cover on ie not too hot - it should be comfortable to touch) to warm the knee for 10 minutes.

RANGE OF MOTION EXERCISES (DAY 5-28): These should be very gentle with no attempt to go beyond what is comfortable. Get them to lie on their good side and gently flex and extend the affected knee while supporting the leg. Being very patient and careful, perform 10 slow repetitions. Repeat this three times daily. You should only do this if it is within your pet's comfort level

CONTROLLED EXERCISE PROGRAM:

Your pet will need to be restricted to house and garden rest for the first 14 days following surgery. They should be encouraged to get up and walk around every few hours rather than lying completely still as this will help reduce stiffness and improve the circulation to the area. They should be kept on a lead when visiting the garden to avoid any sudden movements. They should also be carried up any high steps or staircases for the first 6 weeks and any sofas/chairs etc should be out of bounds during this time as well.

Exercise in the form of controlled lead walking should be introduced as follows (days following surgery):

0-14: House/garden rest only (taken outside every few hours as above)

Expect a fair amount of swelling and very little weight-bearing on the leg in the first 7 days; over the course of the second week they should be increasingly happy to put the leg to the ground and use it when walking.

14-28 days (2-4 weeks): 5-10 minutes slow lead walking two to three times a day.

During this period they will begin to use the leg most of the time but will be stiff and sore after resting.

28-42 days (4-6 weeks): 10-15 minutes lead walking two to three times a day. You can also start doing some sit/stand exercises to improve the range of motion and reduce stiffness by getting them to repeatedly sit and stand for 10 repetitions twice daily. Use of a small treat can help with this! This should only be performed voluntarily - do not push down on the rump.

During this period they can be expected to be increasingly confident on the leg, generally using it fairly normally and will be gradually less stiff on it.

42-56 days (6-8 weeks): 15-20 minutes lead walking twice a day

By now they will begin to think that they can go back to normal but it is still very important to keep to the exercise plan as in the case of a TTA/TPLO bone healing will not be complete and in the case of ligament replacement the repair will not have attained full strength. Follow up x-rays are normally performed at the end of this period.

56-84 days (8-12 weeks): Allowed off the lead but exercise should be 'controlled' (no balls or chasing squirrels etc) and limited to a maximum of 30 minutes two to three times a day for a further 4 weeks. Gentle swimming may be permitted during this period but only if it can be carefully controlled in a proper pool with clean water and if they can be carefully led into the water avoiding any big leaps etc.

After 12 weeks: They should be weight bearing fully on the leg now and can gradually go back to normal levels of exercise.

Remember that every dog is different and some take longer to recover than others – if there is a lot of arthritis present in the joint then recovery can take much longer and there may be a need for ongoing treatment for lameness. Likewise some dogs are very comfortable on the leg within a matter of days and may feel like using the leg normally. However always remember that with a TTA or TPLO the cut bone takes at least a couple of months to heal and in the case of the ligament replacement it takes a similar time for the implant to attain full strength - the consequences of over exertion could be very serious indeed so stick to the exercise plan!

MEDICATION AND ONGOING CARE

Your pet will be sent home with some anti-inflammatory medication, painkillers and antibiotics which should be given as advised - be sure to check when each medication should be given and complete the full course prescribed.

We usually recommend giving a 4 week course of pentosan polysulphate injections (eg Cartrophen) to assist the healing process commencing with the second post-operative check-up. This has a multitude of benefits including the repair of damaged cartilage and ligaments as well as reducing scar tissue and inflammation. It can also help limit the development of arthritis in later years - indeed many cases may benefit from these injections on a regular basis

We are now also offering post-operative K-laser therapy which can also improve healing times and reduce pain following the surgery. Laser can be used alongside the cartrophen for maximal recovery from surgery and can also form part of the longer term management plan for arthritis - visit www.natterjacksvet.com/laser for more.

Good quality glucosamine and chondroitin supplements as well as oils rich in Omega 3 can also help support joint function in the longer term – ask at the surgery for more details of individual products.

COMPLICATIONS

With any surgery complications can and do occur. Perhaps the most common is something known as a 'late meniscal tear'. This can occur in around 10% of cases and is due to a tear in the cartilage. This causes pain and discomfort. Cases often appear to be doing well but will suddenly become lame again. Sometimes your dog will require further surgery to remove the damaged piece of cartilage.

Despite every attention to sterility, surgical site infections can occur in approximately 5% of cases. These may resolve with antibiotics or require implants to be removed. Rare complications of surgery include a slipping knee cap (0.4%) and tibial fracture (0.08%).

Despite surgery, arthritis can also be expected to progress though this will be much reduced by stabilising the joint employing the methods described above. Nonetheless every dog is different in this regard and we will help you manage this condition in the months and years to come.

Also be warned - rupture of the ACL in the other leg has been reported to occur in over 40% of dogs within two years of the first leg. There is little you can do to avoid this but try to be prepared both emotionally and financially!