

ABSTRACT

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## **RECONSTRUCTION OF CRANIAL CRUCIATE LIGAMENT IN DOGS**

**With the synthetic ligament STIF-VETLIG GLOBAL-**

**PROSPECTIVE STUDY FROM 2012 TO 2021 IN 107 CASES**

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### **INTRODUCTION**

For surgery of the cranial cruciate ligament (CCL) deficiency in dogs, the most common techniques are compensatory, modifying the biomechanics of the stifle. The dynamic stabilizations of the stifle (TPLO, TTA) are quite invasive (tibial osteotomies), with major complications, although rare, that can potentially be dramatic, but moreover the recovery can be very restricting for the dogs and their owners. The extra-articular techniques are often source of disappointing results in big dogs. Concerning the intra-articular autogenous transplants, despite the difficulties linked to the donor site, the 6 to 9 months needed for recovery by the transplant of an acceptable mechanic solidity, makes them unusable in veterinary surgery.

The experience gained in human surgery for over 25 years using the last generation of synthetic implants (LARS) to perform an intra-articular reconstruction, showed that they are reliable and perfectly tolerated. The same technology, with specific implants adapted to dogs (STIF-VETLIG GLOBAL tm) was applied for this prospective study that begun in 2012 to try to improve CCL\_surgery meaning by reconstructing the ruptured ligament itself to treat the pathological laxity and restore the physiological biomechanics of the stifle.

The 15 first cases of this study were the subject of a veterinary doctoral thesis (Dr PAGES) at VETAGROSUP LYON and its results encouraged us to pursue it.

### **MATERIAL AND METHOD**

Under general anesthesia (specific protocol for each patient), a large shaving and a careful preparation of the skin are made. A prophylactic antibiotherapy is initiated at the induction (Augmentin, 15 mg/kg IV).

The surgical technique duplicates the one used in humans., A medial arthrotomy is made by an antero medial approach of the stifle. The patella is laterally dislocated, and the resection of the infra patellar fat pad allows a complete intra-articular exploration. The CCL rupture is confirmed.

If existing, the meniscal lesions are treated by a partial meniscectomy. The hyper flexion of the stifle enables to properly see the bottom of the inter condylar notch and then to insert, from inside out a 2mm K-wire into the lateral femoral condyle from the center of the attachment of the CCL towards the upper external lateral cortex. The lower one-third of the lateral edge of the caudal cruciate which is crossed by the K wire is a good landmark for its insertion.

A cannulated drill bit is used according to the animal's weight and the size of the ligament guided by the K-wire, is used to create a femoral tunnel. The same surgical pin is then inserted through the femoral tunnel, into the tibial insertion of the CCL to come out distally on the medial face of the tibial metaphysis. This K-wire is used to guide the drilling of the tibial tunnel from outside-in.

Two transversal bony tunnels are then drilled (not done at the beginning of our study), proximally and distally to the previous ones, in the femur and the tibia. With the help of a thin tube and a metallic loop, the STIF-Vetlig Global ligament is passed through the tunnels.

The intra articular part of the implant is only made of longitudinal fibers so called "free fibers" that are the particularity of this implant, giving its resistance to the fatigue due to the physiological stresses while flexing and turning.

Therefore, the free fibers need to be well adjusted in the joint and the braided area placed in the bony tunnels. Then the implant is fixed in the femoral tunnel using an appropriate interference screw. After reduction of the patella, the isometry during complete range of motion is checked.

The implant must control the anterior drawer, but it must not be tight under any position ie it must not slide into the tibial tunnel during motion. Once this adjustment is made, the implant is fixed in the tibial tunnel. For an immediate solidity, this primary fixation is doubled by the passage and the fixation of the implant by two interference screws in the two transversal tunnels perpendicular to the femoral and tibial axis.

After a careful cleaning with a saline solution the joint is closed layer by layer. We finish by a humid cotton bandage slightly compressive for 48 hours.

No immobilization is needed for the animal and it will resume its normal activity when he feels like it.

Only a bandage and a moderate rest (to ensure the healing of the soft tissues) are recommended until the skin sutures are removed. The removal of the sutures is done 10 to 12 days after surgery, an orthopedic control at 1, 3 and 6 months post-surgery and a survey is sent later if the animal cannot be seen at the clinic.

101 dogs with a total of 107 CCL ruptures presented at the Veterinary Clinic La Cardelle (06 France) between December 2012 and November 2019 were included in the study, with the owners' clear consent.

The smallest dog was 6kg (Shih-tzu), the largest 81 kg (mastiff – bilateral), the majority was over 20 kg, 5 dogs were over 70 kg.

2 dogs had a TPLO before on the other side.

47 % were male, 53 % female. Average age was 5,3 years.

All the dogs had a functional disability, with limping and partial weight bearing and an anterior drawer evaluated +++, meaning over 10 mm.

Dogs that had a previous surgery on the affected stifle were excluded from the study.

## **RESULTS**

101 dogs presenting 107 reconstructions, with a 1 to 9 years post-operative follow up (mean 44 month) were included in this study.

The anterior drawer is absent in 94 cases (87,8%). It was evaluated + (less than 5 mm) in 8 cases (7,4%).

The mechanical result is excellent or good in 95,2% of the cases.

In 2 cases (1,8%), the anterior drawer is marked ++ (between 5 and 10 mm) but without functional disability., the affected dog does not show any signs of limping. The owner does not report any impact on its quality of life.

Globally the anterior drawer has been improved in 97 % of the cases.

There are 3 failures (2,8%), with an anterior drawer >10 mm as the pre-operative situation. In 2 cases the implant slid during the 2 first months after surgery, at the beginning of our experience before performing the systematic double fixation in transversal tunnels.

1 case is due to implant removal for severe staphylococcus infection.

It has been possible to examine 3 dogs on a force plate 15- and 60-days post operatively.

At D+15, 2 dogs presented 95% weight bearing, 1 dog 85%.

At D+60, 1 dog presented 100%, 2 dogs 95%.

The survey was completed by a questionnaire to the owners. 70/101 have responded, representing 74 reconstructions, with an average of 18 months post op.

- Weight bearing was back on the first day for every dog over 20 kg. The smallest dogs of 13 kg or less recovered weight bearing later, around day 4.

- For 70 ligaments/74 reconstructions, the owners just found excellent the simplicity of the post-operative period. The dog recovers immediately its autonomy and does not need any special attention once the wound healing is complete. This follow up simplicity was particularly well noticed by the owners that had already been through the TPLO experience that was considered way more complicated, with an average of 8 weeks of very restrained activity, often necessitating mild sedation.
- The dog's owners estimated that their dog had fully recovered within 2 months.
- In total 70 reconstructions / 74 (94,5%) led to a total satisfaction. 2 owners were not entirely satisfied, 1 of them as his dog that used to follow him on a 20-km bike ride before injury, now starts to snort after 10 km. 1 owner is not satisfied as his dog has a sporadic limp.

### **COMPLICATIONS**

- Out of the 107 ligaments operated there were 3 superficial skin infections that were all cured with local treatment and antibiotics (cephalosporine) without any other surgery.
- 1 severe staphylococcus infection led to revision for implants removal, cleaning of the joint and tunnels, antibiotherapy. Total healing was obtained in 3 weeks with no major disfunction.
- 2 primary fixations have been inefficient in the 2 months post-operatively between 2012 and 2014 and 1 in 2019; which led to a revision of the technique with the systematic doubling of this fixation in transverse tunnels and the insertion of longer screws in bone tunnels. Ever since then no other problem of this kind has occurred.
- No reaction of intolerance to the implant was noted.

### **DISCUSSION**

The bad reputation of the synthetic implants of the 1980's has brought a lot of doubts within the human and veterinary surgeons who have refused to use them. However, the results obtained in human surgery for over 25 years, with the last generation implants are very positive.

As shown by some post-operative biopsies the very porous intra articular area of the free fibers seems to favour the fibroblastic invasion and the reconstruction of a

collagenic structure, as it seems to increase the lifetime of the implant due to a better resistance to flexion and torsion as demonstrated by mechanical in vitro testing.

If the TPLO gives good results, we must admit that it does not solve the laxity problem, that can only be solved by the reconstruction of the cruciate ligament itself. The TPLO procedure is quite an invasive technique, creating irreversible changes which cannot sometimes be easily cured in case of complications, as opposed to the intra articular reconstruction with synthetic fibers which needs only small bone tunnels.

### **CONCLUSION**

The reconstruction of the CCL by the STIF- Vetlig Global intra articular synthetic implant gives good to excellent results in 97% of cases. This sustains the comparison with the current recognized techniques. It is a minor invasive surgery that we can consider performing under arthroscopy, which consists in creating only small bone tunnels without any other irreversible damage. The instruments are simple and not costly. The surgical procedure has rules, like rigorous asepsis, isometry, strong fixation, but is easily reproducible. Finally, the fast recovery and the easy post-operative period are the two major advantages for the owners, which is the frequent feedback, in particular when they had already undergone a different surgery on the contralateral member (TPLO).

All the owners emphasize that they were concerned about a demanding attention to their dog after surgery and that they were extremely happy to see that the dog could do anything without any problem.

According to the authors the reconstruction of the CCL using a STIF implant deserves definitely to be looked at by the veterinary surgeons.