DOI:
https://doi.org/10.61900/SPJVS.2025.04.01

LONG-TERM OUTCOMES OF UHMWPE IMPLANT FOR CANINE CRANIAL CRUCIATE LIGAMENT RECONSTRUCTION: A TWELVE-MONTH CASE REPORT

Eusebiu-Viorel ȘINDILAR[1], Iulian MIHĂILĂ[1], Alexandra CIUBOTARIU[1]

e-mail: eusebiu.sindilar@iuls.ro

Abstract

Extra-articular reconstruction of the cranial cruciate ligament (CrCL) using ultra-high-molecular-weight polyethylene (UHMWPE) implants demonstrated encouraging clinical outcomes in a Labrador Retriever presenting with an acute, complete CrCL rupture. Although this surgical approach is not yet widely implemented, it offers several noteworthy clinical advantages.

Positive long-term outcomes were recorded at twelve-month follow-up. Only minimal craniocaudal joint laxity was noted, indicating sustained mechanical stability provided by the implant. The stifle joint remained pain-free, with no clinically significant complications. Radiographic evaluation confirmed preservation of joint congruency and no progression of osteoarthritic changes.

Key words: Cranial cruciate ligament rupture, Extra-articular reconstruction, UHMWPE implant, Canine orthopedics, Joint stabilization

Introduction. Cranial cruciate ligament (CrCL) rupture is a common orthopedic condition in dogs, affecting up to 5% of the canine population (Buttin et al 2022). It is the most frequent stifle injury requiring veterinary intervention. This pathology predominantly affects middle-to-large breed, older, and/or overweight dogs (Cocostîrc et al., 2023). The CrCL plays a critical role in maintaining craniocaudal stability of the stifle joint, preventing internal rotation and hyperextension of the tibia relative to the femur (Chanutin et al 2015). Its rupture results in joint instability, significant pain, lameness, and contributes to the onset or progression of osteoarthritis (OA), often accompanied by meniscal damage (Buttin et al., 2022; Marti et al., 2013).

In large-breed dogs (>15 kg), surgical stabilization is commonly employed to restore joint stability, slow OA progression, and prevent further meniscal injury (Buttin et al., 2023; Guerrero et al., 2011). Proximal tibial osteotomies modify the biomechanics of the stifle, reducing the need for a functional CrCL during weight-bearing (Pinna et al., 2020). These procedures provide dynamic cranio-caudal stabilization during locomotion (Pozzi et al., 2008). The primary techniques include tibial plateau leveling osteotomy (TPLO) and tibial tuberosity advancement (TTA) (Sammarco et al., 2020). Less frequently used techniques are Cora-based leveling osteotomy (CBLO), tibial tuberosity osteotomy (TTO), and cranial closing wedge osteotomy (CCWO) (Arican et al., 2024; Kapatkin et al., 2020; Reif et al., 2003).

Extra-articular stabilization using sutures or implants is generally less invasive than tibial osteotomy methods (Cook et al., 2010; Harms et al., 2024). Extra-articular stabilization techniques include lateral fabello-tibial sutures, performed using materials such as polyester, high-molecular-weight polyethylene, or nylon secured with crimps (Căsălean et al., 2025; Igna 2018). Ultra-high-molecular-weight polyethylene (UHMWPE) sutures can also be used externally, as seen in other systems implant (Griffon et al., 2011; Pinna et al., 2020).

Recent advancements in polymer science and synthetic implants have driven the increased adoption of new techniques for anterior cruciate ligament (ACL) reconstruction in animals. Similarly, extra and intra-articular CrCL reconstruction in veterinary medicine has gained growing attention, although it is still infrequently performed in routine practice (Bertocci et al., 2016; Reif et al., 2010).

The use of UHMWPE implants fixed with interference screws has demonstrated promising ex vivo biomechanical results in canine stifles. Moreover, these implants have shown satisfactory clinical outcomes in the reconstruction of the canine caudal cruciate ligament and in managing complex stifle injuries in both dogs and cats (Ödman et al., 2024).

[1] Clinics Department, Faculty of Veterinary Medicine, "Ion Ionescu de la Brad" Iasi University of Life Sciences,Iasi, Romania

CASE PRESENTATION

A 5-year-6-month-old male dog weighing 44 kg, with a body condition score (BCS) of 2/5, primarily kept as a companion animal, was presented with a one-month history of right hind limb lameness and abnormal weight-bearing posture. The clinical signs had an acute onset following a play session.

The general physical examination revealed no significant abnormalities. Weight-bearing lameness of the right pelvic limb was assessed at 1/4 during both walking and trotting. In a standing position, the dog intermittently bore weight on the affected limb.

Manipulation of the stifle joint in flexion, extension, and internal rotation elicited pain, scored at 1/3. No crepitus or meniscal clicks were detected during examination. These clinical findings were consistent with a rupture of the cranial cruciate ligament (CrCL).

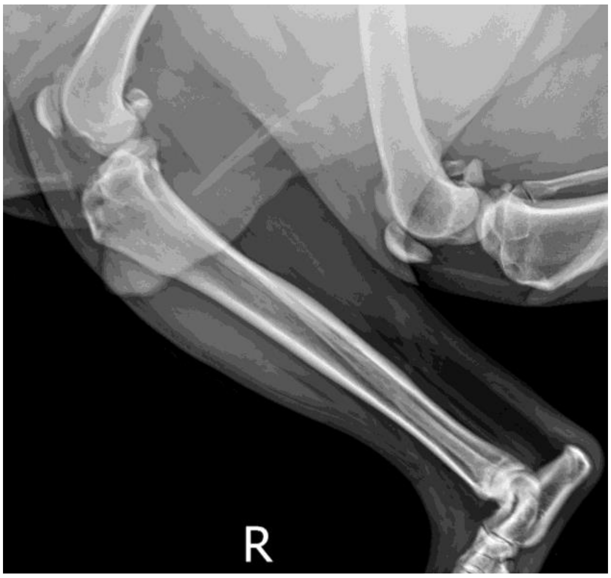

Figure 1 **Preoperative mediolateral radiograph of the affected hindlimb.**

Diagnostic Imaging

Under general anesthesia, compression stress radiographs (Radiographic equipment to be specified) demonstrated cranial displacement of the tibial plateau relative to the femoral condyles. No evidence of bone fractures was observed.

Additionally, enthesophytes were noted at the apex of the patella and on the tibial condyles *(Figure 1)*. A marked increase in intra-articular soft tissue opacity was observed, resulting in cranial displacement of the intra-articular fat pad and distension of the caudal synovial joint capsule — findings consistent with moderate joint effusion. These imaging results corroborated the orthopedic examination and confirmed the diagnosis of cranial cruciate ligament rupture, indicating the need for extra-articular synthetic reconstruction.

Key characteristics of the implant include *(Figure 2):* high tensile strength and abrasion resistance, porous structure to promote tissue ingrowth, 2 mm width and 60 mm needle length, 2 mm bone tunnel requirement.

Figure 2 **Synthetic UHMWPE ligament with cortical button and interference screw**

Anesthesia Protocol

Premedication was administered using diazepam (Terapia SA, Romania) and ketamine (Ketamidor, Richter Pharma AG, Austria), followed by induction with propofol (Fresenius SE&C, Germany). General anesthesia was maintained with isoflurane (Anesteran, Rompharm Company, Romania) and oxygen.

The dog was placed in dorsal recumbency, with the right stifle secured. The surgical site was prepared using standard aseptic techniques. A lateral approach to the stifle joint was employed, and the procedure was performed by the same surgical team *(Figures 3 and 4)*.

Figure 3 **Lateral approach to the stifle joint**

Femoral Tunnel Drilling

A trocar K-wire was inserted on the lateral aspect of the femoral condyle, just distal and cranial to the sesamoid. The wire was directed proximally and cranially, emerging through the craniomedial portion of the distal femoral shaft. The femoral tunnel was drilled over the previously placed K-wire using a drill bit sized to accommodate the planned interference screw. The tunnel was then pre-tapped to facilitate screw insertion *(Figures 5 and 6).*

Figure 4 **Soft tissues incision**

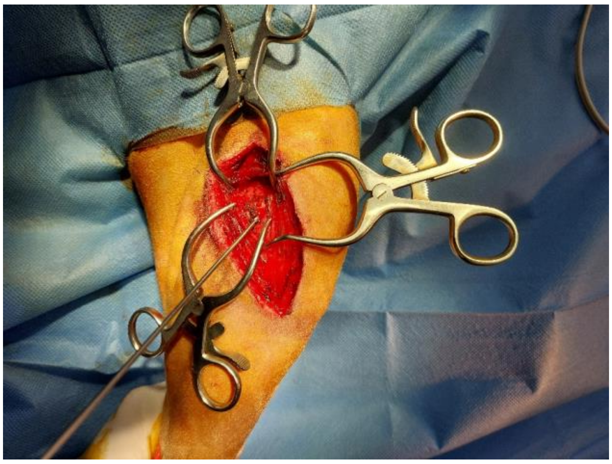

Figure 5 **Femoral Tunnel Drilling**

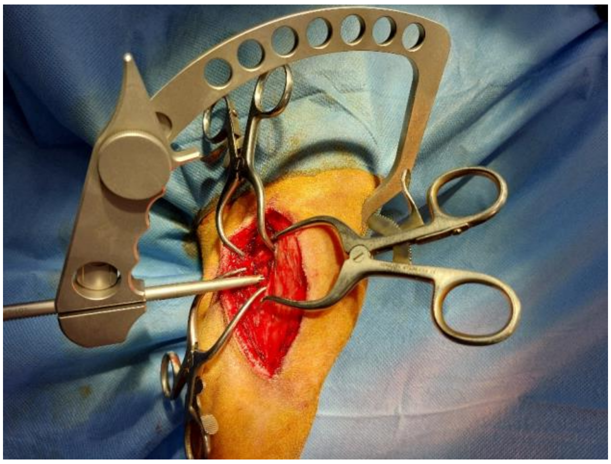

Figure 6 **Femoral Tunnel Drilling**

A specific tap was then used to pre-form the lateral end of the femoral tunnel prior to ligament placement *(Figure 7).*

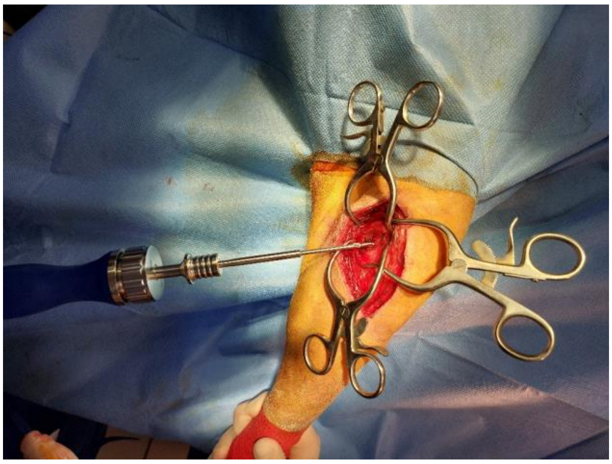

Figure 7 **A specific tap used to pre-form the lateral end of the femoral tunnel**

Tibial Tunnel Drilling

The K-wire was inserted proximal and caudal to the tendon of the long digital extensor. The exit point was positioned on the medial aspect of the tibia beneath the Sartorius muscle. The tibial tunnel was drilled with a cannulated bit guided by the K-wire *(Figures 8 and 9).*

Figure 8 **Tibial Tunnel Drilling**

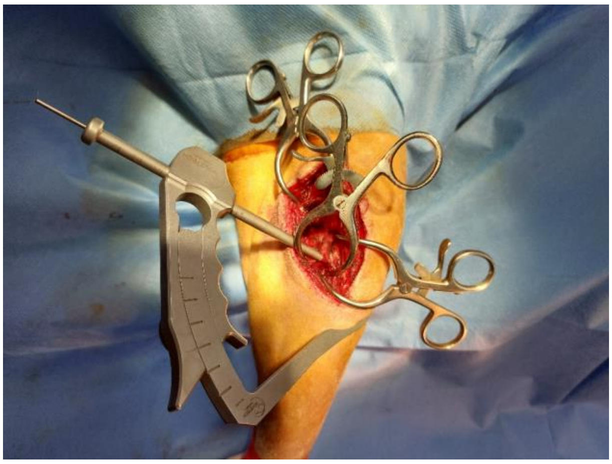

Figure 9 **Tibial Tunnel Drilling**

Ligament Insertion and Fixation

The ligament needle was inserted through the tibial tunnel from the medial side, followed by passage through the femoral tunnel from lateral to medial (*Figures 10 and 11).* Before tensioning, the correct positioning of the cortical button against the medial tibial cortex was verified. Tension was applied, and the stifle joint was mobilized to pre-stress the implant. Joint stability and range of motion were assessed, and the ligament was adjusted as needed.

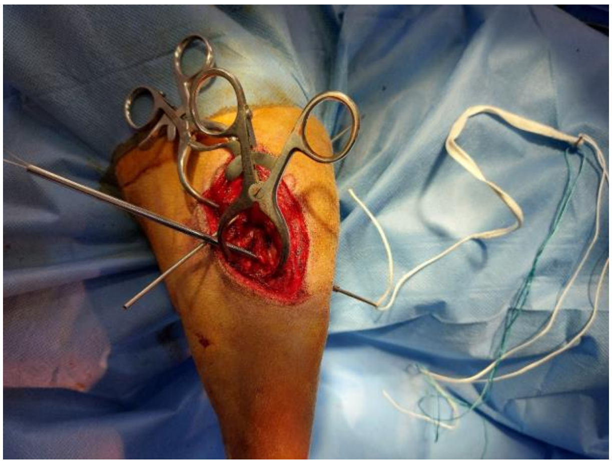

Figure 10 **Tibial ligament insertion and fixation**

Figure 11 **Femoral ligament insertion and fixation**

An interference screw was placed in the femoral tunnel *(Figure 12).* Once proper implant positioning was confirmed, the excess ligament was trimmed on the medial side of the femoral tunnel. The surgical site was flushed with sterile solutions and closed in anatomical layers using interrupted sutures and staples *(Figure 13).*

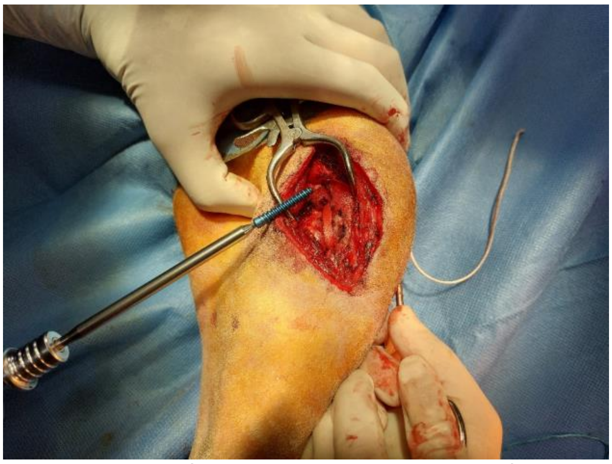

Figure 12 **Interference screw placed in the femoral tunnel**

Figure 13 **Closure in anatomical layers using interrupted sutures and staples**

Postoperative radiographs were taken to confirm correct implant positioning.

At the twelve-month follow-up, the dog maintained a normal standing posture and physiological gait (scored 0/4), with the muscle mass difference reduced to 0.5 cm compared to the contralateral limb. No signs of pain were noted (pain score 0/3), and joint mobility was symmetrical. The direct drawer test still revealed slight craniocaudal translation (~5 mm), but the indirect drawer test remained negative. Moderate synovial effusion persisted. No complications were observed.

CONCLUSIONS

Cranial cruciate ligament (CrCL) rupture in a large-breed dog was successfully managed via extra-articular reconstruction using a UHMWPE implant secured with an interference screw in the femoral tunnel. Six months postoperatively, the clinical outcomes were as follows: Pain-free stifle joint with normal gait during ambulation, minimal craniocaudal translation only detectable during the direct drawer test, and no signs of infection, osteoarthritis, or excessive joint effusion

The operated stifle showed joint function comparable to the contralateral limb and aligned with the best clinical outcomes reported for CrCL reconstructions using grafts, various synthetics, or UHMWPE sutures.

These preliminary findings suggest that this technique offers a promising surgical approach for managing CrCL ruptures in dogs. The procedure, when guided appropriately, respects canine stifle anatomy and may promote enhanced recovery and joint stability.

However, further validation through broader clinical studies and long-term follow-up is required to confirm the reliability and efficacy of this method. Expanding clinical trials will help refine surgical protocols and strengthen the evidence base for this reconstruction technique.

REFERENCES

Arican M., Ozdil B., Uzunlu E., Zamirbekova N., Gümüş F., 2024 – Cranial cruciate ligament rupture in dogs: Evaluation of postoperative results of the CBLO technique. Acta Scientiae Veterinariae, 52(1).

Bertocci Gina., Brown N., Neil, Embleton N., Barkowski Veronica., 2016 – Canine stifle biomechanics associated with a novel extracapsular articulating implant predicted using a computer model. Veterinary Surgery, 45(3): n/a–n/a. (Model study – Golden Retriever; EAI Simitri Stable in Stride™.)

Buttin P., Goin B., et al., 2023 – Ex vivo biomechanical analysis of an original repair of canine calcaneal tendon rupture using a synthetic implant as mechanical support. Open Veterinary Journal, 13(5): 645–653.

Buttin P., Santoro V., Agbalé M., et al., 2022 – Long-term outcome following synthetic reconstruction of the medial collateral tarsal ligament in a dog. Open Veterinary Journal, 12(3): 375–382.

Căsălean T., Zaha C., Schuszler L., et al., 2025 – Thermographic evaluation of the stifle region in dogs with a rupture of the cranial cruciate ligament. Animals, 15(15): 2317.

Chanutin S., Johnson M.D., Travers C.J., et al., 2025 – Biomechanical comparison of four isometric prosthetic ligament repair techniques for tarsal medial collateral ligament injury in dogs. American Journal of Veterinary Research, 86(1).

Cocostîrc V., Paştiu A.I., Doboşi A.A., Lucaci F.D., Turcu M.C., Borzan M.M., Pusta D.L., 2023 – Molecular surveillance of canine degenerative myelopathy in breeding kennels from Romania. Animals, 13(8): 1403.

Cook J.L., Luther J.K., Beetem J., Karnes J., Cook C.R., 2010 – Clinical comparison of a novel extracapsular stabilization procedure and tibial plateau leveling osteotomy for treatment of cranial cruciate ligament deficiency in dogs. Veterinary Surgery, 39(3): 315–323.

Griffon D.J., Aikens J.E., Brown D.C., Farese J.P., Palmer R.H., Hoffman W.E., 2011 – Evaluation of a lateral suture technique employing ultra-high molecular weight polyethylene for stabilization of the cranial cruciate-deficient stifle in dogs. Veterinary Surgery, 40(6): 654–662.

Guerrero T.G., Montavon P.M., 2011 – Advances in extra-articular techniques for the repair of cranial cruciate ligament rupture in dogs. Veterinary and Comparative Orthopaedics and Traumatology, 24(2): 91–98.

Harms O., et al., 2024 – Biomechanical evaluation of a novel ceramic implant for canine cranial cruciate ligament rupture treatment: A finite element analysis approach. Animals, 14(22): 3296.

Igna C., 2018 – Argumente pentru selecţia metodei chirurgicale de tratament al rupturilor ligamentului cruciat cranial la câine. Practica Veterinară, 30(1).

Kapatkin A.S., Arbittier G., Kass P.H., Hurley K., 2020 – Comparison of short- and long-term function and radiographic osteoarthritis in dogs treated for cranial cruciate ligament rupture by tibial plateau leveling osteotomy or extracapsular repair. Journal of the American Veterinary Medical Association, 257(3): 291–299.

Marti J., Tinga S., Schmidlin A., Basile S., Schawalder P., Forterre F., 2013 – Intra-articular stabilization of the canine stifle joint after cranial cruciate ligament rupture using a synthetic ligament: A pilot study. Veterinary and Comparative Orthopaedics and Traumatology, 26(3): 171–177.

Ödman S., Martenne Duplan A., Finck M., Crumière A., Goin B., Buttin P., Viguier E., Cachon T., Julinder K., 2024 – Intra-articular reconstruction of a canine cranial cruciate ligament using an ultra-high molecular weight polyethylene ligament: Case report with six-month clinical outcome. Veterinary Sciences, 11(8): 334.

Pinna Stefania., Lanzi F., Tassani Chiara., Mian G., 2020 – Intra-articular replacement of a ruptured cranial cruciate ligament using the Mini-TightRope in the dog: A preliminary study. Journal of Veterinary Science, 21(5): e53.

Pozzi A., Hildreth B.E., Rajala-Schultz P.J., 2008 – Comparison of arthroscopy and arthrotomy for the diagnosis of medial meniscal pathology in dogs with cranial cruciate ligament disease. Journal of the American Veterinary Medical Association, 232(4): 546–550.

Reif J.L., 2010 – Cranial cruciate ligament disease in dogs. Veterinary Clinics of North America: Small Animal Practice, 40(1): 203–215.

Reif U., Probst C.W., 2003 – FiberWire for extracapsular stabilization of the canine cranial cruciate ligament-deficient stifle joint. Veterinary and Comparative Orthopaedics and Traumatology, 16(4): 203–206.

Sammarco J.L., Kass P.H., Pires C.G., 2020 – Comparison of lateral fabellar suture and tibial tuberosity advancement techniques for the treatment of cranial cruciate ligament rupture in dogs. Journal of the American Veterinary Medical Association, 256(5): 566–574.