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A report of the Maquet procedure for the management of cranial cruciate ligament rupture in a dog - a case report

Técnica de Maquet tratamento da ruptura do ligamento cranial em cão - Relato de Caso

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Abstract

Cranial cruciate ligament rupture is the major cause of lameness and degenerative joint disease in the canine stifle. The cause of this disease is multifactorial, especially involving degenerative and inflammatory changes. Many techniques have been described for the management of this condition, and current recommendations include the use of corrective osteotomies, most recently using the Maquet (or modified Maquet) procedure. This technique is fundamentally similar to the classical tibial tuberosity advancement (TTA), but without the use of the bone plate. The main advantages of using this technique are a shorter operative time and less use of implants. The main complication of this technique is an increased risk of tibial crest fracture. This report describes the Maquet technique for the treatment of a three-year-old male West White Terrier dog with rupture of the cranial cruciate ligament. Cruciate ligament rupture was diagnosed by a positive cranial tibial drawer test. Mediolateral stifle radiography performed under anesthesia with the stifle in 135° of extension demonstrated a tibial plateau angle of 22°. A cage of six millimeters was necessary to allow advancement. The Maquet technique produced excellent post-operative results, including early weight-bearing and neutralization of the cranial tibial drawer. The consolidation time of the osteotomy was 63 days.
Key words: Canine. Knee. Orthopedics. Osteotomy.

Resumo

A ruptura do ligamento cruzado cranial em cães é a principal causa de claudicação do membro posterior e leva ao desenvolvimento da doença articular degenerativa. A causa da doença é multifatorial, principalmente alterações degenerativas e inflamatórias. Muitas técnicas já foram descritas para o seu tratamento, mas atualmente se preconiza a utilização das osteotomias corretivas, sendo a técnica de Maquet a mais recente utilizada. Essa técnica apresenta os mesmos fundamentos da técnica clássica de avanço da tuberosidade tibial, mas não é utilizado a placa. As principais vantagens do uso dessa técnica são menor tempo cirúrgico e menor uso de implantes. A principal complicação dessa técnica é a fratura da crista da tíbia. O objetivo desse trabalho é descrever o caso de um cão, macho, três anos de idade, da raça West White Terrier com ruptura do ligamento cruzado cranial e utilização da técnica de Maquet

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para o tratamento. O diagnóstico da ruptura foi realizado pelo teste de gaveta e tibial cranial positivos. O planejamento cirúrgico da osteotomia através da radiografia medio-lateral. Com animal anestesiado realizou-se radiografia na projeção médio-lateral em extensão de 135°, encontrando o ângulo de platô tibial em 22°. Utilizou-se um cage de seis milímetros para permitir o avanço necessário. O uso da técnica de Maquet proporcionou excelente resultado, apoio precoce do membro e neutralização do tibial cranial. O tempo de consolidação da osteotomia foi de 63 dias.
Palavras-chave: Canino. Joelho. Ortopedia. Osteotomia.

Introduction

Joint diseases provide a significant proportion of the clinical surgical caseload in small animal practice. Rupture of the cranial cruciate ligament (CCLR) is a common disorder of the canine stifle, and in many cases surgical joint stabilization is indicated to prevent, or delay, the development of degenerative joint disease (JOHNSON et al., 1994). CCLR is a multifactorial disease, influenced by plasmocytic lymphocytic synovitis, trauma, an abnormal tibial plateau angle, endocrine diseases e.g. hypothyroidism and obesity, and advancing age (COOK, 2010; GRIFFON, 2010). The main clinical sign is the "toe-touching" gait in the affected limb, although some animals show more chronic lameness (GUERRERO et al., 2011).

The choice of surgical technique can be influenced by body weight, the activity level of the patient, temperament, chronicity and surgeon preference (SELMI et al., 2003). The osteotomy techniques eliminate cranial tibial displacement due to changes in bone geometry in the proximal tibia (KIM et al., 2009). A number of osteotomies have been described for the treatment of CCLR, including the Maquet technique (ETCHEPAREBORDE et al., 2011).

The Maquet technique is fundamentally similar to tibial tuberosity advancement (TTA), with both techniques effectively neutralizing *tibial thrust*, the difference being that the Marquet technique does not require placement of a bone plate and only a cage implant is used. In this technique, a tibial crest osteotomy is performed by drilling the distal tibial crest, thus enabling its advance. This technique produces results similar to TTA with the advantages of decreased surgical time, no requirement for placement of a bone plate on the tibia crest, and a decreased incidence of osteomyelitis (ALLAN, 2014; ETCHEPAREBORDE et al, 2011). The main disadvantages of this technique are that is not possible to make large advances of the tibial crest (when the tibial plateau has a wide angle) and an increased risk of tibial crest fracture (BRUNEL et al., 2013).

This case report describes the use of the Maquet technique for the treatment of cranial cruciate ligament rupture in a dog.

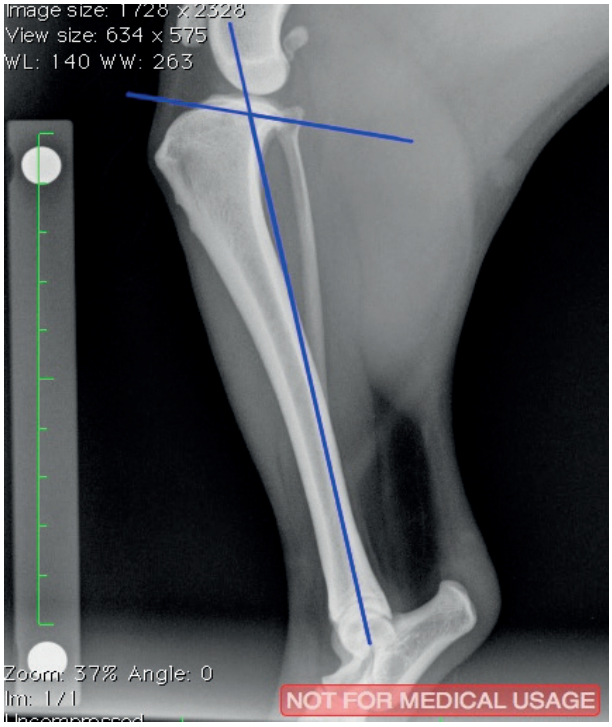
Case Report

A three-year-old male West White Terrier (9.2 kg) was presented to the Veterinary Hospital of the Federal University of Paraná (UFPR - Curitiba Campus) with right hindlimb lameness. On clinical examination a diagnosis of CCLR was made on the basis of positive cranial drawer and cranial tibial thrust tests. Mediolateral stifle radiography performed under anesthesia with the stifle in 135° of extension demonstrated a tibial plateau angle of 22° using OSIRIX software (Figure 1). Orthomed was used to determine the cage size required in this case.

The Maquet technique was performed as follows. Cephalothin (2.2 mg/kg, IV) was administered at induction and repeated every 90 minutes during the procedure. Skin was incised over the craniomedial tibia and, on arthrotomy, debris from the damaged left cranial cruciate ligament was removed and the menisci inspected. The joint capsule was sutured with 2.0 polidioxanone sulfate. The subcutaneous

tissues were dissected and the periosteum elevated with a periosteal elevator.

Figure 1. A tibial plateau angle of the 22° using OSIRIX software.



A four millimeter orthopedic drill was used distal to the osteotomy line (in the caudal portion of the tibial crest) to allow for tibial tuberosity advancement. The tibial crest osteotomy was performed with an oscillating saw. The tibial tuberosity was carefully advanced from proximal to distal with the aid of an osteotome, and the osteotome remained in place until the 316L 6 mm steel cage was placed. A 2.0 mm locking drill guide was placed in the cage ears, and 1.5 mm drill holes made. (Figure 2). Simple interrupted 2 mm polydioxanone sutures were placed in the periosteum and the subcutaneous tissues closed with similar sutures. The skin was closed with 3/0 polyamide simple interrupted sutures. Immediate post-operative mediolateral and craniocaudal stifle radiographs verified the position of the implant. Surgical time was 56 minutes from the first incision to placement of the last suture.

Post-operatively, the animal was medicated with cephalexin (30 mg/kg, PO, BID) for seven days, carprofen (2.2mg/kg, PO, BID) for six days, tramadol (3 mg/kg, PO, BID) for five days, and dipirona (25 mg/kg, PO, TID) for seven days. The wound was lavaged with 0.9% saline every eight hours. Radiographs were repeated every 21 days until complete healing of the osteotomy was observed.

The patient was re-examined at the HV-UFPR ten days after the surgical procedure, at which time there was full weight-bearing on the operated limb. The cranial tibial thrust and the drawer tests were decreased and there was no pain on palpation of the stifle. Sutures were removed at that examination.

No complications (either intra- or post-operative) were observed. The osteotomy presented a good state of bone healing, but was not fully consolidated after 63 days (Figure 3). Four months after the surgical procedure, the patient was walking normally, and the cranial tibial drawer sign and cranial tibial thrust tests were negative. The owner was fully satisfied with the outcome.

Figure 2. Intraoperative view of the Maquet technique, showing the cage positioned after the osteotomy.

Figure 3. 63 days post-surgery, with good osteotomy consolidation.

Discussion

The classical TTA technique gives good results for the treatment of CCLR in dogs. The Maquet technique described in this report utilizes the technical principles of TTA, but with the use of fewer implants (ALLAN, 2014; BRUNEL et al., 2013).

Dogs with CCLR typically present with lameness as the primary clinical sign (GUERRERO et al., 2011), as seen in the dog in this report. The clinical diagnosis of CCLR can be made on the presence of a positive cranial drawer test. However, radiographic examination is very important for the evaluation of the angle of the tibial plateau and to diagnose degenerative joint disease (PALMER, 2005). In this case, radiography ruled out degenerative joint disease and permitted the calculation of the angle of the tibial plateau, as required for the technique.

Measurement of the angle of the tibial plateau (TPA) is very important when selecting the osteotomy technique of choice, and the Maquet technique is not indicated if this angle is very large, due to the high probability of fracture of the tibial crest (ALLAN, 2014; HOFFMANN et al., 2006). In this case, the Maquet technique was appropriate as the TPA was low. The TTA or Maquet technique is indicated when the APT is a maximum of 26º (LAFAVER et al., 2007; BRUNEL et al., 2013). Tibial Plateau Leveling Osteotomy (TPLO) is indicated when the APT is more than 26º (BOUDRIEAU, 2009).

Prior to performing the Maquet technique, the menisci were inspected. Direct evaluation of the menisci, via arthotomy (or arthoscopy), with removal of any damaged menisci along with fragments of the torn CCL is important since meniscal injury is present in 70% of patients with CCLR (GUERRERO et al, 2011; PALMER, 2005).

Specialized cages are available for the Maquet technique (SAMOY et al., 2015), but in this case a cage for a conventional TTA technique was used.

The surgical time in this case was short, i.e. less than one hour. The Maquet technique has the benefit of reducing post-surgical complications as a result of the shorter surgical time and fewer implants placed, thereby decreasing the chances of developing osteomyelitis (ALLAN, 2014).

A recent study investigated the use of bone grafting in TTA procedures and concluded that there was no need for bone grafting to achieve good radiographic healing (GUERRERO et al., 2011). In this case, we did not use a bone graft. Future studies may reveal the benefits of using cancellous bone in the Maquet technique.

Moreover, this technique permits bone growth in the space created in the tibia crest, thus minimizing loosening of the implant (ETCHEPAREBORDE, 2011). In this case, there was excellent integration of bone tissue into the cage, and was significant 63 days after surgery, at which time the osteotomy appeared healed. In a study by Samoy et al. (2015), the mean time for osteotomy healing in 50 cases was 1.5 months (range, one to three months).

One of the disadvantages of this technique is that large advances of the tibial crest are not possible (BRUNEL et al., 2013), but this was not a factor in this case due to the low angle of the tibial plateau, which required little crest advancement.

One of the potential complications of this technique is fracture of the tibia crest. The incidence of this can be reduced by the use of a figure of eight cerclage wire in the distal tibial crest (ETCHEPAREBORDE, 2011). Cerclage placement was not necessary in this case, primarily due to the low weight of the animal and the fact that only a small tibial crest advance was required.

This work reports the use of Maquet technique in a single dog; thus, further studies are required to evaluate the long-term effects and incidence of complications.

Conclusion

The use of Maquet technique provided satisfactory results for the treatment of cranial cruciate ligament rupture in this dog.

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