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Iliofemoral technique modification using an anchor screw as treatment of canine traumatic hip luxation – case report

[*Modificação da técnica de sutura iliofemoral com uso de parafuso âncora no tratamento da luxação coxofemoral traumática em cães – relato de caso*]

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ABSTRACT

Twelve dogs with traumatic hip luxation were selected for surgical intervention with a modified iliofemoral suture technique using an anchor screw to substitute the passage of suture material through a perforated tunnel in the ilium. Six procedures were performed with non-absorbable suture and other six with absorbable suture materials. These cases were evaluated at 15, 30, 60, and 90 days after surgery by performing an ambulation analysis and palpation of the joint. In all cases, there was a return of partial and total limb support in an average of 3 and 19 postoperative, respectively. The fixation strategy of the suture material in the ilium using an anchor screw proved to be efficient with a smaller surgical approach and lesser surgical difficulty, maintaining joint congruence in acute as chronic luxation cases. The use of absorbable and non-absorbable sutures had excellent clinical results, but there was a subjective superiority of the first ones, once 4 dogs of the non-absorbable group presented some discomfort during the postoperative palpation of the joint, 90 days after surgery.

Keywords: coxofemoral joint, trauma, surgical stabilization

RESUMO

Doze cães com luxação coxofemoral traumática foram submetidos à intervenção cirúrgica de sutura iliofemoral modificada com uso de parafuso âncora substituindo a passagem de fio através de túnel perfurado no ílio. Seis procedimentos foram realizados com fio não absorvível, e outros seis com fio absorvível. Os casos foram avaliados aos 15, 30, 60 e 90 dias após a cirurgia, por meio de análise de deambulação e palpação articular. Em todos os casos, houve retorno de suporte parcial e total do peso no membro operado, em média, aos três e 19 dias de pós-operatório, respectivamente. A estratégia de fixação do fio de sutura no ílio com parafuso âncora se mostrou eficaz, permitindo uma abordagem cirúrgica menos invasiva, com menor dificuldade na execução, garantindo manutenção da congruência articular tanto em quadros de luxação aguda como crônica. O uso de fio absorvível e não absorvível teve bons resultados clínicos, porém houve uma superioridade subjetiva do primeiro, uma vez que quatro pacientes do grupo fio inabsorvível mostraram desconforto à palpação da articulação aos 90 dias após a cirurgia.

Palavras-chave: articulação coxofemoral, estabilização cirúrgica, trauma

INTRODUCTION

Traumatic craniodorsal hip luxation is commonly diagnosed in the routine clinical care of small animals (Kieves *et al*., 2014). Usually the lesion is unilateral and external high energy traumas, such as car crash, are the main cause (Barbosa and Schossler, 2009; Kieves *et al*., 2014; Wardlaw and Mclaughlin, 2017). Currently, there is evidence through gene expression that shows that a delay in reducing the luxation greatly increases the risk of developing osteoarthritis (Harasen, 2005). Thus,

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early treatment is preferable to avoid continuous damage to the surrounding soft tissues, greater articular cartilage degeneration and greater difficulty in reduction (Korakot *et al*., 2013; Wardlaw and Mclaughlin, 2017).

Conservative treatment can be performed with closed reduction of the joint, rest and analgesics administration, however, this method presented a 47 to 65% rate of failure (Ash *et al*., 2012). Open reduction with surgical stabilization is preferable, since it allows joint exploration, removal of adhered tissues inside the acetabulum as well as application of internal fixation method, it presents a success rate of close to 85% (Demko *et al*., 2006; Wardlaw and Mclaughlin, 2017).

Iliofemoral suture, an extra-articular stabilization technique, is characterized by a suture between the ilium and the femur. Non-absorbable sutures or absorbable sutures can be used, and the technique is conducted by tunnels drilled in the ilium in a latero dorsal to middle ventral direction and another at the base of the femoral greater trochanter in a caudocranial direction (Wardlaw and Mclaughlin, 2017). The aim of the study was to report 12 cases using a modification of the iliofemoral suture technique in dogs as treatment of traumatic hip luxation using an anchor screw replacing the ilium tunnel with excellent clinical results.

MATERIAL AND METHODS

This study was approved by the Ethics Committee on the Use of Animals under protocol nº 19.194/16. The subjects selected for this study were 12 dogs, clinically (medical history and orthopedic examination) and radiographically diagnosed with traumatic hip luxation without breed, gender or weight preferences as luxation evolution time. Those who presented ipsilateral ilium fracture or clinical comorbidities diagnosed by clinical evaluation, hematological and cardiological exam were excluded from the study.

For the surgical procedure, patients underwent sedation composed of the combination of 0.05mg/kg of acepromazine (Acepram®, Vetnil, Louveira–SP, Brazil) and 0.3mg/kg of methadone (Mytedom®, Cristália, São Paulo-SP, Brazil) intramuscularly. After trichotomy of the operatory site, the anesthetic induction with 4mg/kg of propofol (Propovan®, Cristália, São Paulo-SP, Brazil) was performed intravenously and anesthetic maintenance with isofluorane inhalation associated with epidural anesthesia with 2mg/kg of lidocaine (Xylestesin®, Cristália, São Paulo-SP, Brazil) and 1mg/kg of tramadol hydrochloride (Tramadon®, Cristália, São Paulo-SP, Brazil). Patient was positioned in lateral decubitus with the affected limb up and surgical site antisepsis was performed.

The surgical approach to reduce the hip joint was performed as the standard technique. After surgical exposure, the interior of the joint cavity was inspected to remove all possible tissues or debris that might compromise good joint coaptation and the femoral head was reduced into the acetabulum. At this stage, extension, flexion, adduction, and abduction movements were performed to verify optimum relation between articular structures, as well as to expel any remaining intra-articular tissues. A 3.5-millimeter (mm) diameter drill hole was then made in the ilium body at the cranial portion of the proximal femoral rectus muscle insertion (Figure 1A). A titanium Ti-6A1-4V anchor screw® (Parafuso âncora, Cãomédica, Campinas-SP, Brazil) of 4.5mm diameter and 15mm length was placed in the drilled ilium. It is worth mentioning that previously the attachment, the suture material (a total of 4 sutures) was passed through the anchor screw's external orifice (Figure 1C and 1D), minimizing the surgical difficulty.

The femur was drilled at the height of the distal portion of the greater trochanter at a right angle to the femoral axis in a caudocranial direction, using a 2.5mm diameter drill (Figure 1B). One end of the suture was passed through this tunnel (Figure 1E), while the other extremity was passed below the gluteal musculature in the caudal direction, thus assuming a conformation to the number "8" over the hip joint (Figure 1F). With the limb in abduction and internal rotated, the quadruple square knot was attached.

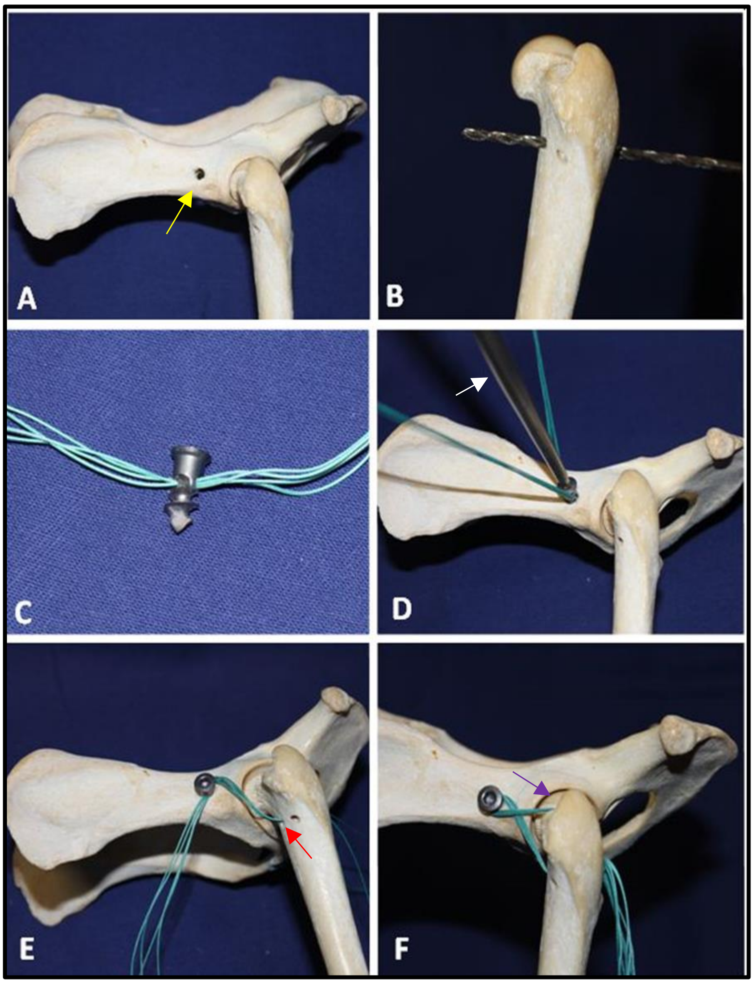

Figure 1. Stages of the modified iliofemoral suture technique with a titanium anchor screw and twisted polyester suture demonstrated in a canine skeleton model. (A) Drill perforation in the ilium body (yellow arrow); (B) Drill perforation performed at the femoral greater trochanter in caudocranial direction; (C) Four suture strands (absorbable or non-absorbable) are passed through the bore of the titanium anchor screw prior to its attachment to the ilium body; (D) The titanium anchor screw is attached with the aid of a hexagonal wrench (white arrow) in the hole drilled in the ilium body; (E) The quadruple suture is passed through the tunnel in the femur (red arrow); (F) The other suture extremities are passed under gluteal muscles on the medial side of the greater trochanter (purple arrow). After femoral internal rotation and abduction, the suture knots are made forming the figure "8" over the hip joint.

The suture materials used for fixation were divided into 2 groups, one of which comprised of 6 subjects treated with non-absorbable twisted polyester number 2 sutures and the other group of absorbable sutures, which the 6 remaining subjects were treated with polygalactin 910 number 2. The musculature and subcutaneous tissue were approximated using poliglecaprone 25. The skin was approximated with surgical nylon in a simple interrupted pattern.

The patients were discharged with analgesic and antibiotics prescriptions: tramadol hydrochloride (3mg/kg BID [Cronidor, Agender União Saúde Animal, União Química, São Paulo-SP, Brazil]), dipyrone (25mg/kg BID [Dipirona sódica, EMS, Hortolândia-SP, Brazil]) for 7 days and meloxicam (0,1mg/kg SID [Maxicam, Ouro Fino, Cravinhos-SP, Brazil) for 3 days, antibiotic: cephalexin (30mg/kg BID [Cefalexina, Teuto, Lins-SP, Brazil]) for 7 days, use of the protective collar and exercise restriction. Radiographs were performed in the immediate postoperative period and after 30, 60 and 90 days. A single surgical team member was responsible for subjects' postoperative clinical evaluation with respect to limb support and pain in the hip joint, using techniques of ambulation, palpation and anamnesis were also carried out in the same period.

RESULTS

The study had a total of 12 subjects (6 females; 6 males) belonging to different breeds, mean age 5.2 ± 3.7 years and weigh 20.5 ± 10.35 kilograms (kg) (Table 1). The cause of hip luxation was car crash (75%), falling off the couch (8.3%) and unknown causes (16.7%). Of these 12 subjects, right and left hip luxation was seen in 8 subjects (66.6%) and 4 subjects (33.4%), respectively, and all of them (100%) presented craniodorsal luxation. The time passed from the trauma to diagnose was 19 ± 25 days. Most of the subjects did not present any concomitant orthopedic finding (66.6%), while others (33.4%) had varied affections such as an ipsilateral femoral fracture, arthrosis of the contralateral hip joint, an avulsion of the ipsilateral fovea and a case of an ipsilateral sacral fracture (Table 1).

The immediate postoperative radiographic evaluation of all cases showed an effective reduction of the hip joint and an adequately sized implant fixed in the ilium. Subjects began to walk with load on the operated limb in about 1 to 13 days after surgery, with a mean of 4 ± 3.7 days. After 30 postoperative days, all subjects presented support from the operated limb, with only 2 presenting mild lameness (numbers 5 and 8; Table 1), whereas the others showed no degree of lameness (Del-Bo *et al*., 2014).

Table 1. Number, case review, hip luxation characteristics (etiology, side, preoperative clinical evolution), comorbidities, lameness degree and postoperative evolution of dogs subjected to the modified iliofemoral suture technique for canine traumatic hip luxation treatment using an anchor screw instead of sutures placed through an iliac bone perforation

Subject	Breed	Age	Gender	Weigh (kg)	Etiology	Side	Luxation evolution time (days)	Associated lesions	Preoperative lameness	Time to support limb load (days)	Postoperative lameness duration (days)
1	MB	2	M	15.5	Car crash	D	30	-	Severe	2	10
2	MB	8	M	13.2	Car crash	E	6	-	Moderate	3	12
3	Shar-Pei	1.5	F	19.7	Unknown	D	Unknown	Femoral fracture	Disability	5	30
4	Labrador	2	M	38	Car crash	E	1	-	Disability	2	5
5	MB	10	M	36	Car crash	E	10	HD	Disability	2	35
6	MB	13	F	7.8	Car crash	D	30	-	Moderate	10	25
7	Border Collie	2	F	17	Car crash	D	9	-	Severe	3	11
8	MB	3	M	24	Unknown	D	15	Fovea avulsion	Disability	13	40
9	Beagle	1	M	12	Car crash	E	2	-	Disability	3	8
10	MB	8	F	32	Car crash	D	92	Sacral fracture	Severe	2	30
11	Sheep dog	7	F	26	Car crash	D	12	-	Severe	2	15
12	Poodle	5	F	5	falling	D	3	-	Disability	1	4
Mean	-	5.2	-	20.5	-		19	-	-	4	18.7

MB = mixed breed
M = male
F = female
kg = kilogram
R = right
L = left
HD = hip dysplasia

Radiographic evaluation at 90 postoperative days did not show osteolysis around the implant in the ilium body. In addition, slight signs of joint degeneration were observed in some cases, especially in the subjects with more chronic luxation as intra-articular concomitant trauma (fovea avulsion) (Figure 2).

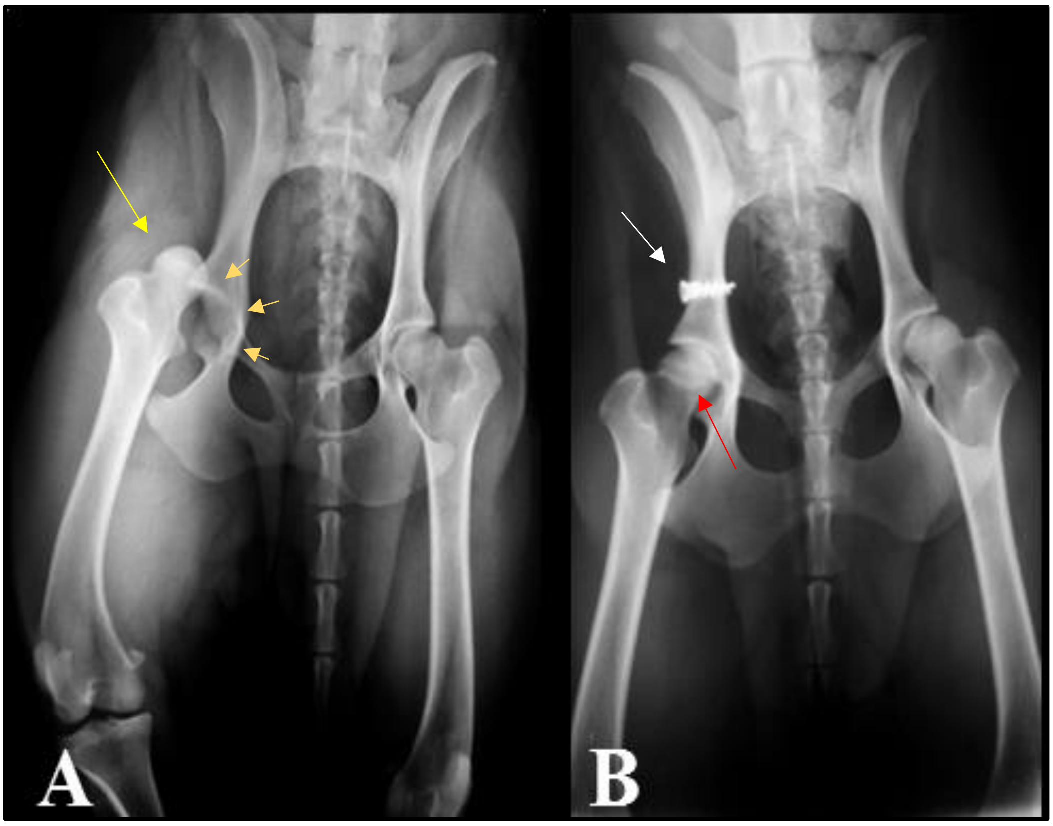

Figure 2. Radiographic images of the hip in ventrodorsal projections of a dog (subject number 7), after the iliofemoral suture technique with titanium anchor screw. (A) Preoperative: notice the femoral head (yellow arrow) displaced cranially to the acetabulum (orange arrows). (B) 90th postoperative day of the same subject: notice the long-term permanence of the hip-joint congruence after application of the modified iliofemoral suture technique with an anchor screw (white arrow), but with degenerative joint disease (Morgan line, red arrow).

DISCUSSION

The etiology of the majority of hip luxation cases was trauma by car crash, corroborating Meij *et al*. (1992) and Barbosa and Schossler (2009). Closed joint reduction performed prior to the surgical procedure itself, facilitated the surgical approach by the recovery of the anatomical references and has been reported by other authors (Meij *et al*., 1992; Martini *et al*., 2001; Wardlaw and Mclaughlin, 2017). The only case where the closed reduction was not achieved (number 10, Table 1), presented greater difficulty in surgical approach and procedure time. Possibly, the failure of the maneuver in this case was due to the long period of luxation (92 days) and the presence of debris attached to the joint capsule within the acetabular cavity, muscle contractions and fibrous tissue made the procedure harder (Korakot *et al*., 2013; Wardlaw and Mclaughlin, 2017).

The anchor screw technique required a minor surgical approach as compared to the original iliofemoral suture technique (Meij *et al*., 1992; Martini *et al*., 2001). This is probably due to the fact that there was no need to approach the ventral and medial portion of the ilium body to recover the suture material after its passage through the ilium tunnel in a lateromedial direction. The gripping of the suture extremity on the medial face of the ilium body is the most difficult step in the original technique, especially if the hole in not adequately drilled in the correct dorsolateral to ventromedial inclination.

Femoral internal rotation was fundamental in obtaining and maintaining the ideal position of the femoral head inside the articular cavity, corroborating Meij *et al*. (1992). The knot position varied between cases, with some knots placed on the caudal aspect of the greater trochanter while others between the cranial portion and the anchor screw. The location seemed to influence the joint stability, as the knot in the caudal aspect promoted greater firmness and maintenance of the internal rotation, corroborating Martini *et al*. (2001), who also presented this fact in their study. Despite this, there was no difference in the clinical evolution between the cases, and a biomechanical study was necessary to better conclude this question.

As a group of clinical cases, the selected cases were randomly divided into 2 groups to allocate the suture material to be used, which resulted in 6 subjects treated using non-absorbable twisted polyester number 2 sutures and other 6 with absorbable suture materials polyglactin 910 number 2. As for the tensile strength, it was possible to observe that the absorbable sutures maintained the position of internal rotation and greater firmness, perhaps due to greater initial elasticity of the polyester. Although these findings are of a subjective nature, the observations corroborate studies that concluded that the tensile strength of some absorbable sutures, especially polyglactin 910 and polydioxanone, is superior to non-absorbable suture such as polyester and polypropylene (Martini *et al*., 2001; Galga *et al*., 2016).

Subject number 1 of this study, who was submitted to stabilization with non-absorbable suture, presented a seroma development, after 90 postoperative days; this corroborated with the authors that cited the risk of late reactions (Martini *et al*., 2001). Except for this case, all the others evolved without any noteworthy event related to the suture material used. Capsulorrhaphy, which was not performed in any of the cases didn’t compromise the joint stability achieved by the modified iliofemoral suture technique, corroborating Galga *et al*. (2016). However, as some authors refer to capsular suture as a stabilization technique (Meij *et al*., 1992), its real contribution in these cases should be studied with a greater number of cases and association of techniques.

Although some authors indicate postoperative immobilization with Ehmer’s sling (Meij *et al*., 1992), in this study, the early limb load support was stimulated and occurred on an mean of 2.5 days after surgery; all the dogs at that time presented some degree of lameness and a total limb load support recovery was achieved in a mean of 18.7 postoperative days. Early limb support ensures muscle recovery and delayed onset of degenerative joint disease, corroborating Martini *et al*. (2001).

A slight superiority of the absorbable sutures was detected due to the greater execution of knot and hip joint stability. Additionally, in the last clinical-radiographic evaluation during the orthopedic examination, 4 subjects in the non-absorbable suture material group presented discomfort during operated hip manipulation that corroborated the fact that these sutures produced a greater local irritation for a longer time (Martini *et al*., 2001). Comparison with conventional iliofemoral technique was not the scope of this study and caution must be taken to affirm that this modification is better, equivalent or worse, making necessary comparative studies with surgical duration, surgical trauma and iatrogenic lesions risk between the techniques.

CONCLUSION

The titanium anchor screw attached to the ilium body as a suture fixation point with absorbable or non-absorbable suture materials showed excellent results as treatment of traumatic canine hip luxation with a less invasive approach and long-term efficient hip joint congruence maintenance in acute and chronic cases.

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