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CASE REPORT

Minimally Invasive Arthroscopic-Assisted Reduction with TightRope® in a Dog with Coxofemoral Luxation

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ABSTRACT

An American Cocker Spaniel was referred for repair of a left coxofemoral luxation (CL). On physical examination, the patient showed intermittent, non-weight-bearing lameness and pain. Radiographs revealed a craniodorsal coxofemoral joint luxation. To correct the coxofemoral luxation, Minimally invasive arthroscopic-assisted reduction (MIAR) with toggle pin fixation (Mini TightRope®) was applied. A cranial lateral approach (incision <5 cm) to the coxofemoral joint was used. The torn round ligament of the femoral head was debrided under arthroscopy and no cartilage damage was found. The Suture-Button Kit was guided through the femoral bone tunnel to the pelvic cavity of the acetabulum under fluoroscopy and arthroscopy. At 3 months postoperatively, the patient showed normal ambulatory function without lameness. Coxofemoral joint luxation was corrected and stabilized successfully. MIAR with toggle pin fixation (Mini TightRope®) can be used for CL in veterinary orthopedics. This minimally invasive technique may reduce operative complications and postoperative morbidity.

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INTRODUCTION

Coxofemoral luxation (CL) in dogs and cats frequently arises from automobile trauma (Demko *et al*., 2006). This is one of the most common joint luxations in veterinary medicine, comprising up to 90% of all joint luxations (Martini *et al*., 2001). A variety of treatment methods have been applied for CL. Closed reduction with Ehmer sling is often used for initial treatment of CL in small animal practices; however, this treatment option reportedly has a higher recurrence rate than open surgical methods (Demko *et al*., 2006).

Open reduction for CL can be classified into intra-articular and extra-articular techniques. Intra-articular techniques include toggle pin fixation, fascia lata loop stabilization, transposition of the sacrotuberous ligament and transarticular pinning (Flynn *et al*., 1994; Pozzi *et al*., 2004). Extra-articular techniques include capsulorrhaphy, tenodesis of the deep gluteal muscle, flexible external fixation, prosthetic capsule technique, De Vita pinning and stabilization with sutures (Martini *et al*., 2001). Among those techniques, toggle pin fixation is commonly used for CL in small animal practices because of its effectiveness and positive clinical results (Ash *et al*., 2012). The procedure provided physiological stabilizing of the coxofemoral joint by a functional replacement of the round ligament of the femoral head until periarticular fibrous tissue around the coxofemoral joint matures (Flynn *et al*., 1994). However, toggle pin fixation showed a higher reluxation rate after surgery due to toggle pullout and suture breakage (Flynn *et al*., 1994). Many manufactured toggle pins have been developed for improvement of these problems and have showed good clinical outcomes (Demko *et al*., 2006).

Minimally invasive arthroscopic-assisted reduction (MIAR) is routinely performed for repair of ligament problems and intra-articular fractures in human medicine because of diagnostic accuracy, treatment and small surgical injury which lead to reduced operative complications and postoperative morbidity (Derner and Naldo, 2011). However, in veterinary medicine, arthroscopy is routinely used only for the diagnoses of joints and, therefore, a limited number of cases using MIAR have been reported (Capaldo *et al*., 2005). To the best of our knowledge, MIAR with toggle pin fixation for repair of CL has not been reported in a veterinary medicine clinical case.

In this case study we reported the surgical techniques and results of MIAR with toggle pin fixation (Mini TightRope® System, Arthrex, Naples, FL, USA) for reduction of craniodorsal CL in a dog.

History and clinical findings: An 8-year-old, 11 kg, castrated male American Cocker Spaniel with intermittent, non-weight-bearing lameness was referred for repair of a left CL. The cause of the left CL was unknown. On physical and orthopedic examinations, the patient showed pain and crepitus on the left coxofemoral joint during manipulation, but there was no neurological abnormality of the affected limb. The results of laboratory blood tests were within normal range. Radiographs of the left pelvis revealed a craniodorsal CL, and no degenerative changes at the femoral head and neck were observed (Fig. 1).

Patient preparation, anaesthesia and surgery: Prior to surgery, premedication with atropine (0.02 mg/kg SC, Atropine Sulfate Daewon®; Dae Won Pharm, Korea) and butorphanol (0.3 mg/kg IM, Butophan Inj®; Myung Moon Pharm, Korea) was administered. General anesthesia was induced with propofol (6 mg/kg IV, Anepol IN®; Ha Na Pharm, Seoul, Korea) and was maintained with isoflurane (Forane Soln®, JW Pharmaceutical, Korea) delivered in oxygen. The patient received epidural anesthesia with 2% lidocaine (1 mL/4.5 kg, Lidocaine HCl Dalhan Inj®, Dai Han Pharm, Korea). Cephalexin (22 mg/kg IV q 2 hours, Methilexin Inj®, Union Korea Pharm, Korea) was administered prior to induction of anesthesia.

The left hip was prepared for aseptic surgery. The patient was positioned laterally with the affected limb up. Cranial lateral approach (incision <5 cm) to the coxofemoral joint was performed and a 1.9-mm arthroscope was placed through the skin incision; an egress port was not placed. Fluid from the incision was aspirated using suction. Under arthroscopy, the hematoma was cleaned and the torn round ligament of the femoral head was debrided.No cartilage damage was found. We performed MIAR with Mini TightRope® Suture-Button Kit (Arthrex) (Fig. 2A). The bone tunnel was made from the third trochanter of the proximal femur through the fovea capitis to the acetabular fossa using a 2.7 mm drill bit. The Suture Kit (Mini TightRope®) was inserted via the bone tunnel and the end tip of the Suture Kit was connected to the coxofemoral joint cavity by the lead needle. In the cavity, the end tip was passed to the pelvic cavity through the acetabulum hole using grasping forceps under arthroscopy (Fig. 2B). After coxofemoral joint reduction, the Suture-Button Kit was pulled in order to place the end tip flat against the medial aspect of the pelvis. The fiberwire was tightened on the toggle button without impingement on the range of motion. The incision site was routinely closed. One month after surgery, radiographs revealed good congruity between the affected femoral head and acetabular rim, and the hip joint flexion and extension motions were normal. At 3 months postoperatively, the patient had normal ambulatory function without lameness. The owner reported that there were no complications from the surgery at 6 months postoperatively.

DISCUSSION

A craniodorsal CL in a dog was resolved and stabilized successfully using MIAR with toggle pin fixation

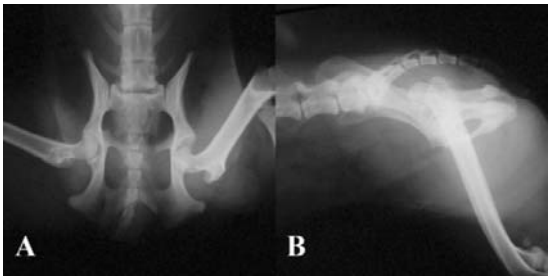

Fig 1: Preoperative radiographs (A) ventrodorsal (B) lateral showing the left coxofemoral luxation (CL) in a dog.

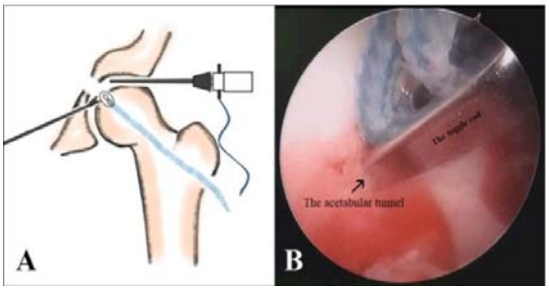

Fig. 2: (A) Schematic illustration of minimally invasive arthroscopic-assisted reduction (MIAR) with Mini TightRope™. (B) Arthroscopic view of the acetabular fossa. The toggle rod is passed through the acetabular tunnel by using grasping forceps.

Fig. 3: Three-month postoperative radiographs (A) ventrodorsal (B) lateral. There were no changes or failure of the Mini TightRope® in the left coxofemoral joint.

(Mini TightRope®). The toggle pin fixation is often used for the reduction of CL, and provides a physiological stability of the coxofemoral joint by a functional replacement of the round ligament of the femoral head until the periarticular fibrous tissue around the coxofemoral joint matures (Flynn *et al*., 1994). Numerous studies have reported that toggle pin fixation was used satisfactorily for all coxofemoral joint luxation types. However, complications including reluxation and problems with the surgical wound were also frequently reported. According to a study, a high reluxation rate of 11% after surgery and a postoperative complication rate of 9% associated with the surgical wound have been reported in toggle rod stabilization with open reduction (Demko *et al*., 2006). Therefore, reducing these complications should be considered in order to achieve a good surgical outcome.

The causes of reluxation when using toggle pin fixation are loosening and breakage of the sutures and failure of the toggle rod or pin (Demko *et al*., 2006). Mini TightRope® used in this case consisted of a steel button and a pair of Fiberwire® as the suture material. This

system was developed for cranial cruciate ligament deficiency in dogs. FiberWire® is a multi-stranded, long-chain, ultra-high molecular weight polyethylene core with a polyester braided jacket (Ash *et al*., 2012). FiberWire® was shown to be significantly stronger than other suture materials such as nylon, polyester or monofilament polydioxanone sutures for extra-articular stabilization in canine cruciate deficient stifles (Burgess *et al*., 2010). Although biomechanical testing with Mini TightRope® for CL has not been conducted, Mini TightRope® may have a higher load resistance. This hypothesis is in agreement with recent case reports using the TightRope system for correction of CL showing no reluxation even though only 9 cases were evaluated (Ash *et al*., 2012).

Postoperative complications associated with the surgical wound have been reported in toggle rod stabilization with open reduction (Demko *et al*., 2006). Recently, in human medicine, minimally invasive surgery has been performed often to reduce the postoperative complication rate. Therefore, minimally invasive surgery ideally can reduce postoperative complications in veterinary medicine. To date, previous studies in veterinary medicine have not documented open surgery with MIAR in the hip joint. Although our case study is limited to a single case, MIAR with Mini TightRope® was used successfully to repair CL in a dog. Furthermore, cartilage damage of the hip joint can be accurately evaluated under MIAR, which can lead to appropriate planning and precise surgical management. Our case report showed that MIAR techniques may reduce operative complications and postoperative morbidity. The results of this study suggest that short-term postoperative morbidity can be reduced in dogs with arthroscopic joint surgery with a limited approach for stifle stabilization as compared with traditional open arthrotomy (Hoelzler *et al*., 2004).

In our case study, MIAR with toggle pin fixation (Mini TightRope®) was used for correction of craniodorsal CL in a dog. MIAR with toggle pin fixation (Mini TightRope®) can be used for CL in veterinary orthopedics. The minimally-invasive technique may reduce operative complications and postoperative morbidity.

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