Stabilization of Recurrent Medial Shoulder Luxation by Use of Three Bone Anchors in a Dog

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Abstract: A 12-year-old male poodle weighing 2.0 kg presented for evaluation of right thoracic limb lameness. The owner reported that the dog showed recurrent bilateral shoulder joint luxation after a car accident for a year. Recently, the left shoulder joint appeared well maintained, but right shoulder joint luxation was exacerbated. On physical examination, the dog showed non-weight bearing lameness on the right thoracic limb. Craniocaudal radiographic views revealed medial displacement of the right humerus. Mediolateral radiographic views revealed overlap of the glenoid cavity and humeral head. Muscle atrophy of the right thoracic limb, reduced biceps brachii muscle tendon tone, a tear of the medial glenohumeral ligament, and a rupture of the subscapularis tendon were identified intraoperatively. Transposition of the biceps muscle tendon was performed. However, at 7 days, there was evidence of right shoulder reluxation on radiographs. The second surgery was performed with two 2 mm × 6 mm cortical bone anchors and a 4 mm × 6 mm cancellous bone anchor placed in the cortical bone of the distal scapula and the cancellous bone of the proximal humerus respectively. Two scapular bone anchors were then connected with a humeral bone anchor using heavy nylon suture to minimize shoulder abduction range of motion. On radiographs right after surgery and 6 weeks after surgery, the affected limb revealed no evidence of medial shoulder luxation. At 6 months, no evidence of lameness was noted on the right thoracic limb.

Key words: recurrent medial shoulder luxation, bone anchor, dog.

Introduction

Glenohumeral joint luxation is uncommon abnormality in dogs and rarely occurs in cats (4,5,7,8). Trauma and congenital malformation are most common causes of the joint luxation (1-3). Medial and lateral luxations are the most frequently observed, followed by cranial and caudal luxations (10,15). Several treatments have been described, including closed reduction and temporary immobilization with a spica splint or Velpeau sling, transposition of the bicipital or supraspinatus tendon, imbrication of the subscapularis muscle tendon of insertion, capsulorrhaphy, suture stabilization, prosthetic ligament repair, and temporary transarticular stabilization with a locking plate (3,9,11,12,14,16). Although a few case reports of surgical treatment of medial shoulder luxation have been reported in dogs, to the authors’ knowledge, there is a lack of information on clinical presentation and treatment with a combination of cancellous and cortical suture anchors (3,11,12). In addition, indications for each surgical technique are not well outlined. The purpose of this case report is to describe the clinical presentation and successful surgical management by use of a cancellous suture anchor and two cortical suture anchors in a dog with recurrent medial shoulder luxation and recommend indication for surgical management using bone anchors.

Case

A 12-year-old male poodle weighing 2.0 kg presented to the Duckso Animal Hospital for evaluation of right thoracic limb lameness. The owner reported that the dog showed recurrent bilateral shoulder joint luxation after a car accident for a year. Recently, the left shoulder joint appeared well maintained, but right shoulder joint luxation was exacerbated. On physical examination, the dog was reluctant to walk and showed non-weight bearing lameness on the right thoracic limb. Pain was elicited on the right shoulder joint manipulation and marked muscle atrophy of the right thoracic limb was obvious. Routine blood examination consisting of hemogram and serum biochemistry was unremarkable. Cranio-caudal radiographic views revealed medial displacement of the right humerus (Fig 1a). Mediolateral radiographic views revealed overlap of the glenoid cavity and humeral head (Fig 1b). A diagnosis of medial shoulder luxation was made. Surgical stabilization was indicated to treat medial shoulder luxation.

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Muscle atrophy of the right thoracic limb, reduced biceps brachii muscle tendon tone, a tear of the medial glenohumeral ligament, and a rupture of the subscapularis tendon were identified intraoperatively (Fig 2). The ruptured glenohumeral ligament and subscapularis tendon were secured to the proximal humerus using two holes and 3-0 nylon suture. The biceps tendon was transposed and then secured to the humerus with a screw and washer. The shoulder joint was well maintained on joint movement. The limb was supported in a spica splint. At 7 days, there was evidence of right shoulder reluxation on radiographs. The second surgery was decided on.

The dog was premedicated for surgery with atropine sulfate (0.02 mg/kg subcutaneously; Atropine sulfate inj®, Je Il Pharm. Co., Ltd, Korea), followed by anesthetic induction with propofol (6 mg/kg intravenously; Provive 1%, Myungmoon Pharm. Co., Ltd, Korea). The dog was intubated and anesthesia was maintained with isoflurane (Isoflurane®; Choongwae. Co., Ltd, Korea) and oxygen. Lactated Ringer’s solution was administered intravenously at a rate of 10 mL/kg/h until completion of the surgical procedure. The dog received cefazolin (20 mg/kg intravenously; Saffin®, Daehan Newpharm. Co., Ltd, Korea) at the time of anesthetic induction. A cranio-medial approach to the shoulder joint was performed with the dog in dorsal recumbency. Transposition of the biceps brachii muscle tendon was well maintained with a screw and washer. However, biceps brachii muscle tendon tone was reduced more than the previous one and medial luxation of the shoulder joint was identified on joint movement. The medial glenohumeral ligament and the parts of the glenohumeral joint of the humerus and scapula were identified to place bone anchors. Two 2 mm × 6 mm cortical bone anchors (Suture Anchor; Imedicom, Korea) were placed in the cortical bone of the distal scapula, craniodistal and caudodistal edges of the scapula (Fig 2). A 4 mm × 6 mm cancellous bone anchor (Suture Anchor; IMEX™, USA) was placed in the cancellous bone of the proximal humerus, the site of insertion of the medial glenohumeral ligament (Fig 2). Two scapular bone anchors were then connected with a humeral bone anchor using heavy nylon suture. The sutures were tightened to minimize shoulder abduction range of motion. Closure was routine.

On radiographs right after surgery and 6 weeks after surgery, there is no evidence of medial shoulder luxation on the affected limb.
the affected limb revealed no evidence of medial shoulder luxation (Fig 4). The dog was discharged 3 days after surgery. Owner was instructed to administer cefalexin (30 mg/kg orally twice daily; Cefacin®, Kyongbo. Co., Ltd, Korea) for 11 days, firocoxib (5 mg/kg orally once daily; Previcox®; Merial, France) for 25 days, and tramadol (3 mg/kg orally twice daily; Tridol®; Yuhan. Co., Ltd, Korea) for 4 days postoperatively. The limb was supported in a spica splint for 4 weeks. After splint removal, the amount of exercise was gradually increased with leash walks for another two weeks. Muscle atrophy still was present; however, palpation of the right shoulder joint revealed no pain and a good range of motion. Normal limb function was regained within 8 weeks postoperatively. At 6 months, no evidence of lameness was noted on the right thoracic limb.

Discussion

The shoulder joint is highly mobile diarthrodial joint connecting the scapular glenoid and the humeral head (9). Shoulder joint stability is dependent on a complex interaction between the active (dynamic) and passive (static) stabilizers of the joints (13,14). Active stabilizers are glenohumeral and periscapular muscles including the infraspinatus, supraspinatus, subscapularis, teres minor, and biceps brachii. Passive stabilizers are composed of the glenoid fossa, joint capsule, and medial and lateral glenohumeral ligaments (14). Injuries to active stabilizers or passive stabilizers are associated with mildly (joint laxity and subluxation) or severely (luxation) displaced humeral head respectively (13). Joint laxity and subluxation are commonly caused by heavy exercise and labor. Luxation can be acquired from trauma such as a car accident, jumping down from furniture, or being kicked. Exercise, labor, and trauma, however, could result in both active and passive stabilizers injuries. In the present case report, medial shoulder luxation occurred from a car accident that caused passive stabilizer injury and active stabilizer injury including a tear of the medial glenohumeral ligament and rupture of the subscapularis tendon respectively.

The broad, flat subscapularis muscle lies in the subscapular fossa, becomes narrower, and is partly tendinous as it passes over the shoulder joint medially (6). The tendon inserts on the minor tubercle of the humerus as a short, strong tendon and unites intimately with the joint capsule and medial glenohumeral ligaments (6). A rupture of the subscapularis tendon, therefore, is intimately associated with injuries of the glenohumeral ligament and joint capsule. In the present case report, there was evidence of injuries of the subscapularis tendon, glenohumeral ligament, and joint capsule.

There are a few treatments described in the literature related to management of the shoulder luxation (3,9,11,12,14, 16). Presently available options include closed reduction and temporary immobilization with a spica splint or Velpeau sling, transposition of the bicipital or supraspinatus tendon, imbrication of the subscapularis muscle tendon of insertion, capsulorrhaphy, suture stabilization, prosthetic ligament repair, and temporary transarticular stabilization with a locking plate. Closed reduction and temporary immobilization with a spica splint or Velpeau sling has been described for traumatic luxation presented for treatment soon after injury (7). This technique, however, should not be performed in a case of shoulder luxation in which there is an accompanying humeral or scapular fracture or glenoid dysplasia. In the 1950s and 1960s, suture stabilization was performed for both medial and lateral shoulder luxations (3). In this technique, stabilization of the shoulder joint is achieved by use of nylon tape guided though bone tunnels in the scapular spine and proximal humerus, the infraglenoid tubercle and proximal humerus, or the coracoids process and proximal humerus. Transposition or imbrication of muscle tendon, capsulorrhaphy, and prosthetic ligament repair have been described for cases in which closed reduction fails or the luxation is chronic (11,16). In one report in 2008, temporary transarticular stabilization with a locking plate was performed to treat canine shoulder joint luxation with severe tissue damage (12). In the case reported here, prosthetic ligament repair technique using three bone anchors provided adequate stabilization of the shoulder joint in a dog that underwent transposition of the biceps brachii muscle tendon previously. Prosthetic ligament repair technique using three bone anchors can be helpful in cases where previous surgical treatments fail to completely provide joint stabilization or in cases where transposition or imbrication of the muscle tendon is not available due to severe muscle atrophy caused by recurrent luxation.

Suture anchors are placed at the shoulder articular margin consisting of cancellous bone to act as origin and insertion points for sutures used in reconstruction of the glenohumeral ligament. The suture anchors, therefore, should be characterized by a relatively thin core and a wide and deep thread (called a cancellous suture anchor in the present case report). In the case reported here, a cancellous suture anchor was screwed at the proximal humerus; however, the articular margin of the scapula was too small to accommodate two cancellous suture anchors since the dog weighed 2.0 kg. Suture anchors characterized by a narrow thread (called a cortical suture anchor in the present case report) were used in the cortical bone, distal part of the articular margin, which provided appropriate space for two suture anchors.

In conclusion, this case report described the clinical presentation and successful surgical management by use of three bone anchors in a dog with recurrent medial shoulder luxation. Surgical management using three bone anchors can be recommended in cases where previous surgical treatments fail to provide joint stabilization or in cases where transposition or imbrication of the muscle tendon is not available due to severe muscle atrophy caused by recurrent luxation. A study of large case series with long-term follow-up is warranted to better determine the overall success of surgical management using a combination of cancellous and cortical suture anchors in dogs with recurrent medial shoulder luxation.
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References