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OPEN REDUCTION METHODS OF LUXATIONS IN DOGS AND CATS: A COMPARATIVE STUDY

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Abstract

BACKGROUND: The most frequent luxations encountered in small animal pathology are located at the humero-radio-ulnar joint and tibio-tarsal-metatarsal joint, usually with traumatic etiology.
OBJECTIVE: The aim of this study is to determine which elbow luxation reduction method has the best advantages, taking into consideration some specific variables such as long term prognosis, post-operative lameness and the extent of soft-tissue trauma caused by the open reduction techniques.
MATERIALS AND METHODS: Two surgical techniques have been used comparatively: a technique using screws and cerclage wire and one using modified bone staples. This study was conducted on 12 cases, of which six being treated using screws and cerclage wire and six using metallic implants.
CONCLUSIONS: Surgical reduction of traumatic luxations in dogs and cats using modified bone staples has a better outcome with minimal damage on joint dynamics and soft-tissue trauma and should be considered as a reduction method of choice for all breeds of dogs and cats, having lower surgical costs, a shorter interventional time and a better post-operative recovery.

Key words: *cat, dog, elbow luxations, orthopaedics, veterinary surgery.*

INTRODUCTION

Because of the bony anatomy of the region and the inherent stability provided by the muscular and ligamentous structures of the joint, traumatic luxation of the elbow joint is usually uncommon in dogs and rare in cats (Tobias and Johnston, 2012).
Strong collateral ligaments (CL) provide stability and the anconeal process interlocking within the olecranon fossa prevents luxation when the joint is extended (Schaeffer, 1999).
The ulna is prevented to move medially by the medial epicondyle of the humerus, but the rounded shape of the lateral epicondyle permits the anconeal process of the radius to move off the lateral epicondylar crest when the elbow is flexed more than 90 degrees Medial luxations are usually accompanied by severe ligamentous damage (Piermattei et al., 1997). Recognition of collateral ligament damage is important for optimal management of elbow luxation. Diagnosis of rupture is based on physical examination after closed joint reduction and the need for further operative stabilization based on those findings (Billings et al., 1992). Integrity of the collateral ligaments could be assessed in the dog by the range of pronation and supination achieved during manual rotation of the manus with the elbow and carpus both flexed to 90 degrees to position the anconeus caudal to the olecranon fossa so that rotary joint stability was provided primarily by the CLs (Campbell, 1971).
Rupture or avulsion of the medial collateral ligament (MCL) increases pronation to 100 degrees, whereas rupture of the lateral collateral ligament (LCL) increases supination to 120-140 degrees (Farrell et al., 2007).
Closed reduction of luxations should first be attempted in elbow joints with good stability, but when this is not possible and ligaments are ruptured or avulsed, open reduction and stabilisation should be considered.
Most of recent literature has focused only on canine elbow luxation with just one report of a traumatic elbow luxation in a cat. This study has the purpose of evaluating presentation, post-operative lameness, the extent of soft-tissue trauma and limb function in two separate open reduction techniques for both dogs and cats with traumatic elbow luxation.

MATERIALS AND METHODS

The study was conducted on 12 cases, 9 dogs and 3 cats, with traumatic elbow luxation caused by car accidents, high-rise syndrome and dog attacks, treated by using two different open reduction techniques. Records of all animals were reviewed for history, clinical examination findings and treatments provided.

Diagnosis

Diagnosis of traumatic elbow luxation was made using both clinical and radiological findings. Patients had a history of recent injuries, such as car accidents or high-rise syndrome. All patients were non-weight bearing on the affected limb and carried the forelimb in a characteristic position - the antebrachium in abduction and external rotation and the elbow joint in slight flexion. The elbow was swollen and painful when palpated, revealing a proeminent radial head, an indistinct lateral humeral condyle and a lateral displacement of the olecranon. The range of motion was limited. Diagnosis is confirmed on a craniocaudal (CrCd) radiographic projection where a lateral displacement of the radius and ulna is apparent. The lateral view shows an uneven joint space between the humeral condyle and the radius and ulna. Considering the traumatic cause, patients were assessed for concurrent injuries before surgery.

Surgical management

As soon as preoperative assessments were complete and no contraindications were identified, the patients were anesthetized safely for both closed and open reduction procedure. If previous closed reduction failed to reduce elbow luxation, open reduction procedures were applied according to clinical status of the animal.

The surgical techniques used in this study consisted in placement of screws at the attachment site of the collateral ligament in both humeral epicondyle and radial neck and a cerclage wire looped around each screw in a figure of eight pattern or placement of modified bone staples in the radial head and the humeral epicondyle.

After surgical reduction and stabilization, the joint is evaluated for stability and radiographs are taken in order to assess bone alignment and implant positioning. A soft padded bandage is applied for 24 to 48 hours to improve the patient's comfort and to minimize soft tissue swelling.

Aftercare

In patients with mild to moderate post-reduction instability, the standard of care recommended consisted in providing external support in the form of a (spica) splint or a soft-padded bandage for at least 5 to 7 days. After removal of bandage or splint, owners were encouraged to initiate rehabilitation measures.

Six weeks post-operatively, owners were contacted by telephone and were asked to answer questions regarding function of the affected limb, 'excellent' being used to describe animals with no noticeable lameness, 'good' for slight lameness and 'poor' for failure to use the leg or in case of serious to severe lameness. (Table 1). Owner satisfaction was rated as ‘satisfied’ or ‘not satisfied'.

Table 1. Clinical parameters used for assessment of post-operative results

	Excellent	Good	Poor
Lameness	No lameness	Slight lameness	Serious to severe lameness
Weight-bearing	Full weight bearing	Weight bearing to tolerance	Standing with no weight bearing
Limitation of joint movement	No limitation of joint movement	Mild limitation of joint movement	Moderate to serious limitation of joint movement
Pain on movement	No pain on motion of affected joint	None to slight pain on motion of affected joint	Moderate to severe pain on motion of affected joint

RESULTS AND DISCUSSIONS

Individual case results for 9 dogs and 3 cats in this study are presented in Table 2.

Epidemiology and clinical signs

The study included several small and medium dog breeds, with a mean weight of 15.3kg, mostly being males (66%).

Table 2. Summary of signalment, clinical findings and treatment of the 12 cases presented with elbow luxation

Case no.	Breed	Sex	Age (years)	Weight (kg)	Concurrent injuries	Open reduction type	Stability following reduction	Lameness score
Dogs								
1	Bichon maltese	M	4.0	4.0	Radius and ulna fracture	Screws and cerclage wire	Good	Good
2	Crossbreed	M	2.0	25.0	None	Modified bone staple	Stable	Good
3	Crossbreed	F	7.0	22.0	Superficial wounds	Modified bone staple	Good	Excellent
4	Yorkshire terrier	M	0.1	1.0	None	Screws and cerclage wire	Good	Excellent
5	Beagle	M	4.0	18.0	None	Screws and cerclage wire	Stable	Poor
6	Crossbreed	F	6.0	15.0	None	Modified bone staple	Good	Excellent
7	Crossbreed	F	3.5	21.5	None	Screws and cerclage wire	Stable	Good
8	German shorthaired pointer	M	4.5	20.7	Superficial wounds	Modified bone staple	Good	Excellent
9	Crossbreed	M	11.0	10.5	Cranial dislocation of radius	Screws and cerclage wire	Stable	Poor
Cats								
1	DSH	F	2.0	3.0	None	Modified bone staple	Good	Excellent
2	DSH	M	0.3	1.5	Superficial wounds	Modified bone staple	Good	Excellent
3	Norwegian Forest cat	M	5.0	4.2	None	Screws and cerclage wire	Good	Good

Two of the cats in the study were Domestic Shorthairs (DSH), with a mean weight of 2.25 kg and one was a Norwegian Forest cat, two females and one male.
Most of the luxations were caused by car accidents (7 cases, 58%), other causes included high-rise syndrome and dog attacks. As concurrent injuries we found 3 cases of superficial wounds, one radius and ulna fracture and one cranial dislocation of radius. All cases sustained lateral elbow luxation, with obvious collateral ligament damage on physical examination (Figures 1 and 2).

Treatment

General anaesthesia was applied for closed reduction in order to achieve the profound muscle relaxation needed for manipulating the elbow into position. Neuromuscular blockage may be helpful in cases of concurrent fractures.
Closed reduction was the method of choice for all animals. If closed reduction failed to reduce elbow luxation, open reduction techniques were used.
Open reduction is also indicated in cases of avulsion, fractures of the origins of the collateral ligaments, articular fractures, intra-articular interposition of soft tissues, chronic luxations, marked instability or reluxation after closed reduction.
Anatomic landmarks for open reduction of elbow luxation are the radial head, olecranon and anconeal processes and lateral humeral condyle (Fossum, 2013).
The patients are positioned in lateral recumbency and the leg is prepped from the shoulder to the carpus.
Half of the patients were treated using a surgical technique that consists in exposing the elbow by using a limited approach to the head of the radius and lateral compartments of the elbow joint. This method is best suited in luxations with ligament damage but it can also be used in cases of minimal ligament damage.
Following reduction, stability can be enhanced by primary repair of the collateral ligament. If the ligament has torn from its attachment to the bone or it is completely destroyed it can be replaced using two screws, one in the humeral epicondyle and one in the radial head and a figure eight cerclage wire looped around each of them (Figure 3).
The other half of the patients was treated using a surgical technique that consists in a lateral, smaller approach of the elbow joint.
After reducing the luxation, a modified bone staple is used, one part of the implant being shorter than the other. The shorter part is inserted in the radial head and the longer one in

Figure 1. Lateral luxation of elbow in a 5yo Norwegian Forest cat, CrCd view

Figure 2. Lateral elbow luxation in a 3.5yo Crossbreed dog, lateral view

Figure 3. Reduced elbow luxation in a 4yo Beagle using the screws and cerclage wire surgical technique, CrCd view

the humeral condyles (Figures 4, 5 and 6). This method is used when there is minimal ligament damage, in order to increase stability of the joint and prevent relaxation.

Aftercare

The elbow is most stable when moderately extended to the normal standing angle of 140 degrees (Piermattei et al., 1997). After reduction, in order to maintain stability, a soft-padded bandage with lateral splint can be used for about 5 days. Exercise should be restricted within the house or leash for about 2 weeks post-operatively. Exercises of flexion and extension should be started after removal of the bandage in order to regain mobility of the joint. In cases of ligament damage, a more rigid immobilization is needed, using a spica splint, maintained for about 2 weeks. Exercise is restricted within the house or leash for 3-4 weeks. After splint removal, exercises of flexion and extension of the joint need to be started (Mitchell, 2011).

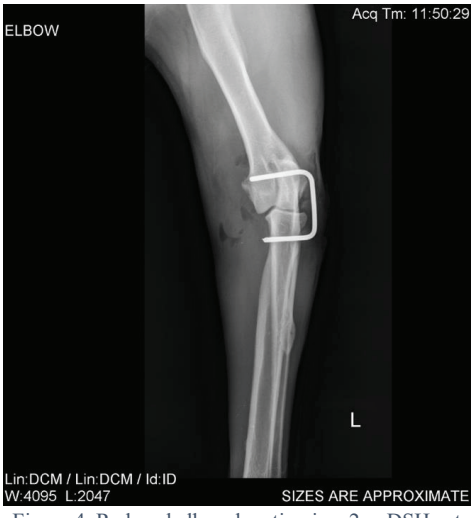

Figure 4. Reduced elbow luxation in a 2yo DSH cat using bone staples, CrCd view

Figure 5. Reduced elbow luxation in a 6yo Crossbreed dog using a modified bone staple, CrCd view

Figure 6. Reduced elbow luxation in a 6yo Crossbreed dog using modified bone staples, lateral view

Post-reduction results

After 6 to 9 weeks, all owners were contacted by telephone and were asked to rate the outcome of the intervention. 4 dogs and 2 cats were rated as 'excellent' (50%), meaning they regained full mobility after surgery, 3 dogs and one cat were rated as 'good' (33%), meaning they still had some slight lameness at the time we called and 2 dogs were rated as 'poor' (17%), meaning they had serious lameness of the affected limb.

Owners were mostly satisfied with the final outcome, except the owners of the 2 dogs that still hadn't regained full mobility.

CONCLUSIONS

Lateral luxation was diagnosed in all patients of this study, which is consistent with other studies that have reported between 92% and 100% (Billings et al., 1992; Schaeffer et al., 1999).

The aforementioned open reduction techniques had an overall good postoperative outcome (83% were either 'good' or 'excellent').

The method using bone staples is considered to be better than the one using screws and cerclage wire, with a better stability following reduction, a need for a shorter time of exercise restriction and a better post-operative lameness score and owner satisfaction. This should be considered the method of choice for open reduction of traumatic elbow luxations if there is minimal ligament damage.

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