Surgical management of traumatic elbow luxation in two cats using circumferential suture prostheses

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Summary
Two Domestic Shorthaired cats were admitted after sustaining a traumatic lateral elbow luxation. Non-surgical management with reduction and external coaptation was unsuccessful at maintaining reduction. At surgery, the lateral collateral ligament (LCL) was intact but grossly elongated in one case, and ruptured in the other. Trans-condylar, trans-radial and trans-ulnar tunnels were drilled from lateral to medial and a suture prosthesis was used in order to augment a suture imbrication of the LCL in the fist cat. The prosthesis was used as a stand-alone procedure in the second case. No postoperative complications occurred and both patients regained excellent elbow range of motion without any observable lameness.

Keywords
Cat, feline, elbow, luxation

Introduction
Traumatic elbow luxation has been described in numerous case series in dogs (1–6) but only a single feline report has been documented (2). In that case, a medial luxation, resulting from disruption of the medial collateral and annular ligaments, was treated by primary ligament repair and external coaptation, with excellent long-term results. In dogs, more than 90% of luxations occur laterally (2, 4), probably due to the medial part of the humeral condyle being larger than its lateral counterpart and its articular surface having a relatively more acute distal slope (2). The commonest cause of luxation is motor vehicle trauma (4), and luxation is thought to be the result of indirectly applied rotational forces, transferred to the elbow via bridging musculotendinous units or ligaments (7).

In the dog, closed reduction can be achieved in the majority of cases, and successful management has been documented with various modes of external coaptation (1–4). However, surgical repair of elbow joint collateral ligaments is recommended if gross instability remains after elbow reduction (4). The most frequently diagnosed types of collateral ligament (CL) injury are mid-substance tears, which are treated by primary repair with or without augmentation using synthetic or autogenous materials and avulsion injuries which are treated by reattachment through bone tunnels or by the use of screws and washers (3). To the authors’ knowledge, these are the first documented cases of the successful surgical management of traumatic lateral elbow luxation in the cat.
the elbow was made as previously described (8), with separation between the origins of the common digital extensor and long digital extensor muscles. The ulnaris lateralis origin was found to be avulsed and the LCL was intact but elongated to approximately twice its normal length. The LCL was imbricated with a single 2 metric polydioxanone II (PDS II) (Ethicon, Johnson and Johnson, Livingston, UK) horizontal mattress suture. A 2 mm bit and low speed air drill were used to drill three bone tunnels: 1 – humeral transcondylar (lateral to medial) at the origin of the LCL immediately craniodistal to the lateral epicondyde and directed towards a point immediately craniodistal to the medial epicondyde; 2 – trans radial (lateral to medial) at the insertion of the LCL on the radial head; and 3 – trans ulnar (lateral to medial) at the level of the mid-portion of the ulnar trochlear notch, midway between the articular surface and the caudal ulnar cortex (Fig. 3). A double loop of 4 metric PDS II was threaded onto a 1.6x100 mm round-bodied, straight, eyed-needle (Singer, UK) with the two free ends through the eye. The needle was passed through the humeral tunnel (lateral to medial), and a medial stab incision was made with a #11 scalpel blade in order to allow retrieval of the two strands. The needle was passed eye first (lateral to medial) through the radial tunnel to receive both suture strands, and was drawn back through the radius. A self-locking knot (9) was tied with five additional throws with the elbow in approximately 135° extension. This procedure was repeated for the ulnar tunnel using a single strand of suture material only and this suture was tied using a sliding half-hitch knot and five additional throws. Care was taken to pass the sutures under soft tissues. The deep antebrachial fascia was closed using simple continuous 2 metric PDS II and the skin was closed routinely.

Postoperative radiographs documented good reduction and bone tunnel location (Fig. 4). The patient was discharged after two days, with instructions given for strict cage confinement and analgesic medication consisting of meloxicam4 at a dose of 0.3 mg/kg once a day for two days, followed by 0.1 mg/kg once daily for eight days.

4 Metacam, Boehringer Ingelheim, Bracknell, UK.
At re-examination three and five weeks postoperatively lameness was not detected and comfortable range of elbow motion was reduced compared to the contralateral elbow by 10–15° in flexion, with normal range of extension. After five weeks, the patient was allowed unlimited house confinement. At this time the owners did not report any recurrence of lameness, however, long-term follow-up was unavailable due to a change of address.

Case 2

A 4.3 kg four-year-old neutered male Domestic Shorthaired cat was admitted within 12 hours of an airgun pellet injury resulting in non-weight-bearing left thoracic limb lameness. A previous diagnosis of traumatic elbow luxation had been made by the referring veterinary surgeon and the elbow had been reduced under sedation and placed in a soft padded bandage.

Under routine general anaesthesia, the elbow could easily be laterally luxated and reduced. A 1 cm skin wound was found adjacent to the medial epicondyle and the airgun pellet was palpable subcutaneously approximately 2 cm dorsal to the wound. Radiography demonstrated a complete lateral luxation without any visible evidence of bony avulsion. The deformed airgun pellet was seen dorsomedial to the medial epicondyle.

Surgical preparation and technique were the same as for Case 1, except that the lateral CL was completely ruptured and the edges were severely frayed. In this case the prosthesis was placed without any attempt to repair the CL. The airgun pellet was removed and the medial wound was debrided, lavaged and closed primarily.

Postoperative radiographs documented good reduction and bone tunnel location. Aftercare instructions were the same as for Case 1. At re-examination three weeks and six months postoperatively, lameness was not detected and comfortable range of elbow motion was the same as that of the contralateral elbow.

Discussion

Stability of the elbow is conferred by its inherent congruity, the locking mechanism of the anconal process within the olecranon fossa, and the integrity of the CLs (2, 3, 10, 11). The feline anconal process is relatively small compared to that of the dog, and the collateral ligaments have similar gross anatomy (7, 11, 12). Despite this, one study documented that feline elbows luxated significantly less consistently after transection of the CLs compared to canine elbows (7). This finding may be partly due to the relatively stronger olecranon ligament, which extends from the lateral side of the olecranon to the medial side of the humeral condyle. This ligament is twice as wide with only one-third of the length in the cat as compared to the dog, and is taut with the elbow in flexion (12). Such a morphological trait may be the result of evolutionary lifestyle adaptation (i.e. increased range of supination in the cat facilitates ambush of small prey) (13).

The importance of CL deficiency in traumatic elbow luxation is an area of controversy. In dogs, the incidence of CL involvement in traumatic elbow luxation varies from 18–100% (2–6). The frequency of CL lengthening has not been previously discussed, but might be under-diagnosed as many cases of luxation are treated successfully by closed reduction and external coaptation. The requirement for surgical intervention when only mild instability follows reduction is also controversial. One author speculated that radiographic evidence of degenerative joint disease in 100% of animals evaluated in the long-term, irrespective of reduction technique and post-reduction physical examination findings may have indicated persistent instability (1). The manipulative test originally reported by Campbell (2, 3) and used in Case 1 describes alterations in the range of pronation and supination achieved during manual rotation of the manus with the elbow and carpus both flexed to 90° to position the anconeus caudal to the olecranon fossa so that rotary joint stability is provided primarily by the collateral ligaments. In feline cadaver limbs, the approximate normal range for pronation was 30–70° and for supination, 110–150° (7). Transection of the medial collateral ligament (MCL) increased pronation to approximately 80–110°, whereas transection of the lateral LCL increased supination to 160–180°. In the author’s experience, elbows commonly re-luxate before these angles are reached. In the aforementioned study, luxation was not achieved in cadavers with normal CLs, so relaxation during Campbell’s test indicates functional deficiency of the LCL and is a surgical indication.

In our experience, when CLs are torn during traumatic elbow luxation they are frequently friable with reduced suture-holding capacity. In a non-destructive biomechanical study on cadaveric canine elbows after closure of a medial approach including MCL desmotomy, the elbows retained only 19% of their original stiffness and MCL desmotomy repair failed in all of the elbows from suture pullout (14). Thus, primary CL repair should be supported by external coaptation. The technique that we report for CL prosthesis may be most appropriate for CL augmentation or replacement in cases where both CLs are deficient. However, this technique was easy to perform from a solely lateral approach and was used as a standalone procedure, thus avoiding the potentially complicated maintenance of a bandage or management of a transarticular external skeletal fixator. This technique has also been applied by the authors to traumatic canine elbow luxations with similarly good results. The infrequent nature of this injury means that an accumulation of cases for clinical trials is challenging. However, this technique is recommended as an alternative treatment for clinical use, particularly when both CLs are deficient.

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References


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