# TITLE: Elbow joint luxation in a 1-month-old foal

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## ABSTRACT:

This paper reports on luxation of the elbow joint without concomitant fracture in a 1-month-old foal. Conservative treat- ment, with closed reduction and full-limb bandaging, including caudal and lateral splints, seemed successful initially, however, failed to provide enough stability and luxation recurred, and open reduction and surgical placement of prosthetic collateral ligaments was required. Luxation of the elbow joint should be considered when acute non-weight bearing forelimb lameness occurs associated with pain and swelling in the area of the elbow in young foals. Closed reduction failed to provide sufficient joint stability.

**KEY WORDS:** equine lameness, luxation, elbow, foal

## INTRODUCTION:

Luxation of the humeroradioulnar (elbow) joint has seldom been reported in horses.[1–3] Elbow luxation is commonly associated with concomitant fracture of the proximal radius, a separation of the radius and ulna, and/or fracture of the olecranon.[4,5] To our knowledge, elbow luxation without concomitant major ulnar or radial fracture, as in this foal, has only been reported twice in equids and[2,6] both cases were in foals aged 8 months. The aim of the present report is to describe the presentation and management of elbow luxation in a 1-month-old foal.

## CASE REPORT:

A 1-month-old Andalusian colt was presented to the Veterinary Teaching Hospital of the Universidad de Zaragoza for evaluation of acute left forelimb lameness. The foal had been healthy until that morning when it developed an acute non-weight bearing lameness. Trauma was suspected, but not witnessed. On present- ation, the foal was alert and responsive, with all the vital parameters, other than tachycardia (90 beats per minute) and tachypneoa (40 breaths per minute), within normal limits. The foal was non-weight bearing lame on its left forelimb, which was held in semiflexion and showed a dropped-elbow appearance. Severe swelling and deformation were noted at the left elbow region (Figure 1). Palpation of the affected area elicited a painful response; no crepitus or other audible sounds were noted. The skin was intact and no signs of external trauma were present. Mediolateral and craniocaudal radiographic views of the affected elbow showed luxation of the left elbow joint without

concomitant fracture. The humerus was displaced distomedially in relation to the radius and ulna (Figure 2).

Closed reduction of the luxation under general anaesthesia was attempted as previously described.6 After administration of phenylbutazone 4.4 mg/kg IV, the foal was premedicated with romifidine 0.05 mg/kg IV and buthorphanol 0.02 mg/kg IV, prior to induction of general anaesthesia with ketamine 2 mg/kg IV and diazepam 0.02 mg/kg IV. After endotracheal intubation, general anaesthesia was maintained with isoflurane in 100% oxygen. With the foal in dorsal recumbency, traction was applied to the distal left forelimb by means of an overhead hoist, while another person applied pressure on the proximal radius in a cranial to caudal direction.[6] Final radiographs showed that the luxation had been corrected, although a mild degree of subluxation was still present. A full limb Robert-Jones bandage was applied, incorporating two full splints on the lateral and caudal aspects of the limb. The lateral splint extended proximad until approximately the height of the withers in an attempt to prevent abduction of the limb. Systemic administration of phenylbutazone 2.2 mg/kg twice daily IV and omeprazole 2.0 mg/kg once daily orally were continued.

During the following days the foal continued to appear uncomfortable and was non-weight bearing on the left forelimb. There was severe joint instability, and 3 days after the closed reduction, elbow luxation recurred. At this time, avulsion fracture of the humeral origin of the lateral collateral ligament was evident radiographically.

The foal was anaesthetised as previously described for open reduction of the luxation and collateral ligament repair. Administration of sodium penicillin 23,000 UI/kg IV every 6 hours and amikacin 22 mg/kg once daily IV was initiated pre-operatively. The foal was placed in dorsal recumbency, with the left forelimb attached to an overhead hoist. The left elbow region was clipped and aseptically prepared. A 12 to 14 cm skin incision was made on both the lateral and medial aspects of the elbow joint, directly over the location of the collateral ligaments. Dissection was continued to expose the remnants of the joint capsule and collateral ligaments. The centre of ossification of the medial epicondyle of the humerus was found to be separated and was removed. Attempts at reduction of the luxation in the same manner as described above for the closed reduction were unsuccessful.

A 1 cm long piece of the tip of the anconeal process was removed, after which reduction of the fracture was possible. Four 6.5 cancellous bone screws were inserted at the level of the medial and lateral epicondyles of the humerus and the medial and lateral radial tuberosities, as close as possible to the attachments of the collateral ligaments. Eighteen-gauge stainless steel cerclage wire was used in a figure of eight fashion around the proximal and distal screws to create prosthetic collateral ligaments. Washers were used to provide more stability and to prevent the cerclage wire slipping over the screw heads (Figure 3). The elbow joint and subcutaneous tissue were flushed with 3 L lactated ringer solution. The joint capsule was sutured with number 0 monofilament polydioxanone in a simple interrupted pattern. Number 2/0 monofilament poly-glyconate suture was used to close the subcutaneous tissue in a simple continuous pattern. The skin was closed using stainless steel staples. A full limb Robert Jones bandage was applied, as for the closed reduction, with caudal

and lateral splints. Systemic administration of antimicrobials (sodium penicillin and amikacin), phenylbutazone and omeprazole were continued.

During the following days, no clinical improvement occurred. The foal was unable either to extend the limb or bear weight. Eight days later, severe painful hot inflammation developed over the left elbow. The foal remained recumbent and had an increased rectal temperature (40.5ºC). Infection of the left elbow was suspected. Severe lytic areas within the distal epiphysis of the humerus and proximal radius were evident on radiographs. Bone lysis was also evident around two screws, one of which had partly migrated back out of the bone. Clinical and radiographic signs were highly indicative of septic arthritis and osteomyelitis, and because of its poor prognosis, the foal was humanely euthanased. Infection of the elbow joint was confirmed on synovial fluid cytology. Necropsy examination of the foal was not available.

## DISCUSSION:

Elbow luxation occurs as a result of forceful abduction of the limb as would occur when a foot is caught in a fast, traumatic injury, or a fall.[3] In the case reported here, the exact cause of luxation is unknown. The clinical presentation of an elbow luxation is similar to an olecranon fracture or radial nerve paralysis, with acute non-weight bearing lameness, a dropped elbow, and an inability to extend the elbow and carpus. Primary differential diagnoses should also include fractures of the proximal radius or distal humerus. Other differential diagnoses for the dropped elbow appearance include carpal flexural deformity, carpal bone fractures, and myopathy.

In small animals, the prognosis for return to normal following elbow luxation is poor, and is dependent on the degree of reduction achieved, the extent of the damage to collateral ligaments, the joint capsule and articular cartilage, and any accompanying fractures of the ulna or radius.[7] In horses, the prognosis is considered guarded to poor.[3] Reduction, external immobilisation, and internal stabilisation are difficult to achieve and postoperative complications are common. Complications include persistent or recurrent luxation, degenerative joint disease, ankylosis, decreased range of motion, and persistent pain.[3,7] However, pasture soundness and pleasure riding soundness have been reported in two older foals with luxation of the elbow joint without concomitant major fracture.[2,6]

Closed reduction combined with splint bandaging was successful in an 8-month-old mule.[6] It has been proposed that the inter- digitation of the three bones of the elbow should provide sufficient stability,5 however, in the case reported here luxation of the elbow recurred despite the previous closed reduction. This is indicative of joint instability, which was also observed by Jones et al.[6] after closed reduction. Failure to achieve complete reduction using the closed technique could have been caused by the presence of blood clots or soft tissue entrapped between the articular bone surfaces at the elbow joint. Cartilage damage or eburnation during the traumatic event or during closed reduction manipulations could have reduced joint congruency, leading to imperfect anatomic reduction and instability. The procedure for closed reduction was very difficult and required forceful manipulations, which can have negative consequences such as fracture of the ulnar diaphysis.[6] These manipulations could have been the cause of the fracture of the centre of ossification of the

medial epicondyle of the humerus, or the avulsion fracture of the humeral insertion of the lateral collateral ligament, which were not evident at initial examination. It is possible that a non- displaced fracture of the centre of ossification was present initially; however, it would have been expected to become displaced during the closed reduction. Ultrasound evaluation of the affected elbow joint was not performed; however, this technique could have been valuable to evaluate the integrity of soft tissue structures such as the collateral ligament.[8]

Unfortunately, infection of the elbow joint occurred, which resulted in the foal being euthanased. The three main sources of orthopaedic infections are trauma, haematogenous spread and iatrogenic causes.[9] In the case reported here, no signs of skin disruption were evident. Iatrogenic origin of this infection is a possibility; however, prophylactic broad spectrum antimicrobials were administered to the foal before surgery and maintained postoperatively. The antimicrobial combination used in this case (penicillin and amikacin) provides broad spectrum antimicrobial coverage and is a common choice in foals.[10] Asepsis and sterile technique were maintained during the procedure, although intra-operative tissue irrigation with antimicrobial solutions could also have been used. Haematogenous spread of infection is common in foals, especially neonatal foals with failure of passive transfer of immunoglobulins and those with umbilical or systemic infections.[11] In this case, the foal was reported to have been healthy since birth and no systemic abnormalities were found on initial examination, however, other factors could have played an important role. Accumulated blood, blood clots, fibrin and devascularised tissue provide an excellent medium for organisms to grow, and haematoma formation and soft tissue damage at the elbow region during the closed reduction attempts could have provided such an environment. Systemic antimicrobials were not given at the initial examination because no clinical signs of systemic disease or infection were evident. In retrospect these may have decreased the risk of haematogenous organisms seeding the traumatised tissue. Unfortunately, necropsy examination was not permitted, but we speculate that the infection developed after the open surgical reduction, and that the existing tissue damage played a role. It is known that orthopaedic procedures in horses carry a higher risk of surgical site infections.[12]

Crawley et al[2] reported a similar case in an 8-month-old Appaloosa foal in which attempts at a closed reduction under general anaesthesia were unsuccessful. In that case, open reduction was eventually successful, using a similar surgical procedure. They removed a wedge-shaped portion of the cranial portion of the capitulum of the humerus, creating a ramp over which the radius could slide. In the case presented here, resection of a 1 cm long piece of the tip of the anconeal process facilitated the reduction. Muscle contraction may have accounted for the difficult reduction during surgery, which could have been facilitated by administration of neuromuscular blocking agents such as succinylcholine.[4] To the authors' knowledge, no previous reports have described removal of the anconeal process to help reduction of an elbow luxation, a procedure that greatly facilitated reduction in this foal. We do not consider it likely that removing the anconeal process had deleterious effects on joint stability.

Prosthetic collateral ligaments should be placed as close to the origin of the damaged ligament as possible in order to maintain the instant centre of motion of the joint.[2] Mechanical loss of joint mobility, or loss of stability which can lead to degenerative joint disease, may occur if prosthetic collateral ligaments are not in an anatomically correct position. Careful attention was maintained for accurate identification of collateral ligament insertions, but was difficult because of disruption of the soft tissues in the area. In the case reported by Crawley et al,[2] the stainless steel collateral prostheses failed following surgery, which was suggested to have occurred due to applied stress and metal fatigue from continued motion of the joint. In humans and different animal species, fresh and chemically preserved auto- and allo-grafts, and synthetic materials have been used for prosthetic ligaments and tendons, with varied success.[13–16] The aim of temporary implants is to provide initial mechanical joint stabilisation and then serve as scaffolding for the ingrowth of new collagen before implant failure occurs.

Although our experience from this single case is limited, and few cases have been reported in the literature, we believe that closed reduction can be attempted initially in clinical cases of elbow luxation. If forceful management is required, or in cases in which a complete reduction of the fracture is not observed after the closed reduction, surgical treatment should be considered. We do not think that the splints used in this case provided adequate elbow joint stability. This splint configuration is indicated for radial fractures, and has the objective of preventing the limb from abducting. Abduction increases the risk of an open fracture occurring if the fragment becomes exteriorised through the medial side of the antebrachium, where soft tissue is minimal. We used these splints in an attempt to prevent abduction and provide stability; however, obviously the limb was not prevented from adduction, and did not provide enough stability to prevent elbow luxation recurrence. Nevertheless, two other factors have to be considered. First, we did not achieve complete luxation reduction, which is necessary for the joint stability provided by interdigitation of the three bones at the elbow joint.[5] Possible causes for this have been discussed. Second, bilateral collateral ligament rupture was present in this foal, causing joint instability that required open reduction and prosthesis placement to provide sufficient stability and to prevent recurrence.

Luxation of the elbow joint should be considered when acute non-weight bearing forelimb lameness occurs associated with pain and swelling in the area of the elbow in young foals. Although closed reduction seemed initially successful, it did not provide sufficient joint stability and did not prevent recurrence. It also required forceful manipulation which can have negative consequences.

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**FIGURES:**

**Figure 1.** A 1-month-old Andalusian foal presented for evaluation of acute forelimb lameness. The left forelimb was held in semiflexion with a dropped-elbow appearance. Severe swelling and deformation were noted at the left elbow region.

**Figure 2.** Caudo-cranial radiograph of the left elbow region of the foal in Figure 1 at presentation. Luxation of the elbow joint is present. The humerus is displaced distomedially to the radius and ulna. The large radiolucency in the distal humerus corresponds to the normal olecranon fossa.

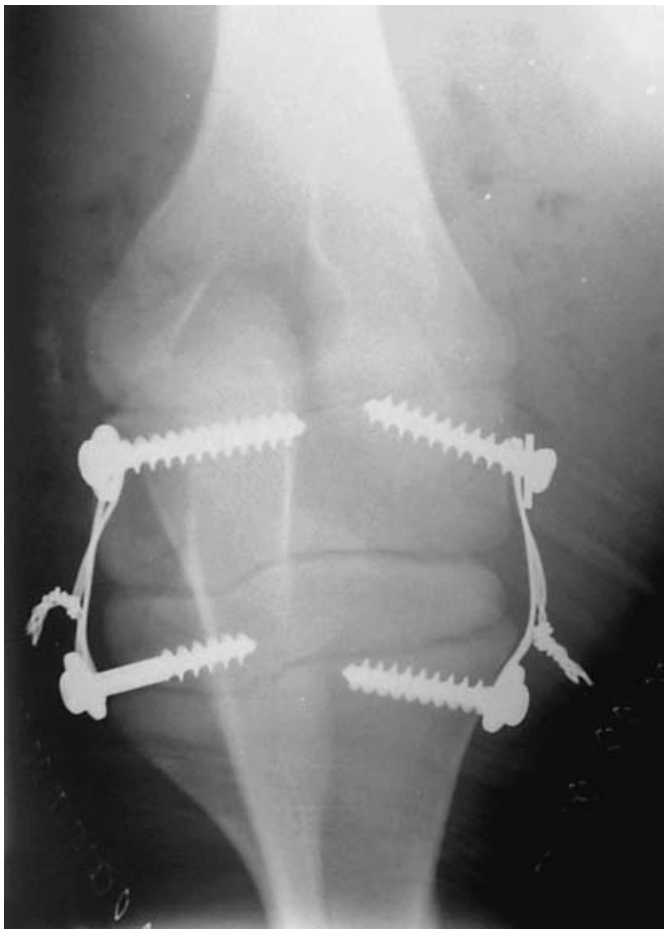

**Figure 3.** Caudo-cranial radiograph of the left elbow after open reduction and prosthetic ligaments placement.