



Successful Management of Congenital Radial Head Subluxation in a Juvenile Dog Using Ultra-High Molecular Weight Polyethylene Suture Toggle

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Abstract

Congenital humeroradial subluxation was diagnosed by clinical examination and radiography in a 16-week-old female dog that presented for left forelimb lameness. This was treated surgically by open reduction followed by placement of an ultra-high molecular weight polyethylene suture from the cranio-lateral aspect of the proximal radius to the caudomedial aspect of the ulna, secured with a toggle and suture button. Postoperative findings were consistent with clinical improvement and radiographs were compatible with resolution of elbow subluxation. To our knowledge, this is the first case report of congenital humeroradial subluxation to be managed with an ultra-high molecular weight polyethylene suture toggle.

Keywords

- ▶ humeroradial
- ▶ UHMWPE
- ▶ elbow
- ▶ dogs
- ▶ subluxation

Introduction

Congenital or developmental forms of elbow luxations have been classified according to variations in luxation anatomy, including humeroradial (type 1), humeroulnar (type 2), and combined humeroradial and humeroulnar (type 3) luxations, with the humeroradial form being the most common.^{1,2} In congenital humeroradial luxation or subluxation, the radial head is displaced in a caudolateral direction.³ Treatment for this condition is generally invasive, with limited case reports in the veterinary literature describing ostectomy of the radial head,^{2,4} closing wedge ostectomies with internal plate fixation,^{3,5} or oblique proximal radial osteotomy and gradual craniomedial traction of the radial head using an external skeletal device.¹ Another less invasive alternative involved ulnar osteotomy and transarticular pinning.⁶ The etiopathogenesis of this luxation has been proposed to be genetic; however, some patients may have asynchronous radioulnar growth secondary to growth plate injury at a very young age and hence may have a developmental origin.⁶ Early surgical correction has been proposed to allow remodelling of the

humeroradial articulation and to reduce the risk of secondary osteoarthritis.³ We report the successful use of an ultra-high molecular weight polyethylene suture (UHMWPE; 250lb Liga-Fiba hip toggle system, Veterinary Instrumentation, Sheffield, United Kingdom) in maintaining reduction following open reduction of congenital humeroradial subluxation in a juvenile dog.

Case Description

A 16-week-old female 15 kg Border Collie presented to the Animal Referral Hospital Canberra for the evaluation of left forelimb lameness with no observed or known traumatic event. The lameness was reported to be more severe after prolonged periods of rest. Physical examination revealed mild muscle atrophy of the left shoulder with full range of motion of the elbow joint. The radial head was abnormally prominent and easily palpable. Pain was elicited on pronation and supination. Craniocaudal and mediolateral radiographic projections revealed a caudolateral subluxation of the left radial head and mild subtrochlear sclerosis (▶ **Fig. 1**).

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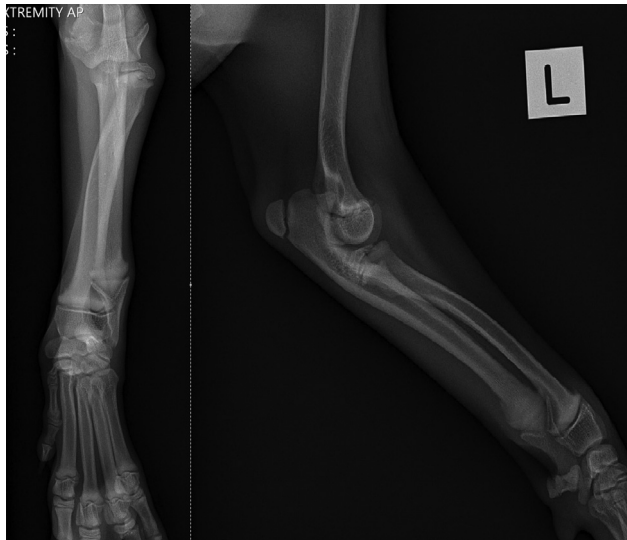


Fig. 1 Preoperative radiographs showing caudolateral displacement of the radial head.

Based on physical examination and radiographic findings, type 1 humeroradial elbow subluxation was diagnosed.

The dog was placed in lateral recumbency following general anaesthesia and routine surgical preparation. A curved lateral incision was made from the lateral epicondyle of the humerus extending to the proximal third of the radius. The antebrachial fascia was incised and the lateral digital extensor muscle and extensor carpi ulnaris muscles elevated and retracted, allowing visualization of the joint capsule and radial head.⁷ Two pairs of pointed bone reduction forceps were used to manipulate and compress the radial head into a craniomedial position. A 2.5 mm drill-bit was used to drill the proximal radius just distal to the physis from the cranio-lateral surface into the ulnar. A 20 g cerclage wire was prepared into a loop and passed through the drill tunnel. A separate incision was made on the caudomedial aspect of the proximal ulnar. The free ends of a UHMWPE suture (250lb LigaFiba, Veterinary instrumentation, Sheffield, United Kingdom) were passed through a toggle, and then passed through the loop of the cerclage wire which was then pulled through to the cranio-lateral aspect of the proximal radius and tied over a suture button. The two-pointed bone reduction forceps were released and no movement of the radial head was noted. The joint capsule and muscular and fascial separations were closed with 3-0 polydioxanone, followed by subcutaneous tissue and intradermal skin sutures.

Immediate postoperative radiography (→Fig. 2) revealed reduction in the radial head in the desired direction. The dog was discharged with oral analgesia comprising of meloxicam (0.1 mg/kg q24hr) for 5 days and gabapentin (10 mg/kg q8hr) for 5 days, as well as postoperative antibiosis with cephalexin (22 mg/kg q12) for 5 days.

Outcome

Clinical review occurred at 6 weeks postoperatively with the owner reporting a good return to function with no further



Fig. 2 Immediate postoperative radiographs.

requirements for analgesia. Final follow-up occurred at 15 weeks postoperatively when the patient was 9 months of age. At this follow-up, using goniometry, 150 degrees were measured in extension and 50 degrees in flexion, bilaterally. Shoulder musculature was assessed as symmetrical. A Liverpool Osteoarthritis in Dogs (LOAD) score questionnaire⁸ was used for final outcome evaluation; The owner was asked to retrospectively assess the patient preoperatively, compared with patient's status at the final follow-up. Retrospective preoperative LOAD score was 11, compared with the final LOAD score at 9 months of 2. Radiographic examination at this point in time (→Fig. 3) showed a congruent humeroradioulnar joint. All antebrachial growth plates were closed, and clinical function was considered excellent.

Discussion

Despite the variety of correction techniques previously described using various modalities, all were case reports of one to three cases only, limiting their value as clinical evidence.¹⁻⁷ The complexity of surgery required depends on the patient's age, degree of discomfort, degree of subluxation, degree of radial head hypoplasia and concurrent angular limb deformities. No clinical guidelines exist on the best correction technique. Surgical corrective osteotomies are complex and potentially expensive, and, if done at an early age between 4 and 5 months, may necessitate revision surgeries as asynchronous growth continues between the radius and ulnar.⁶ In contrast, delayed surgery may result in radial head dysplasia, leaving a convex surface that creates a misarticulation with the opposing humeral articular cartilage.² As such, an ideal surgical technique



Fig. 3 Fifteen-week postoperative radiographs showing maintenance of elbow congruency. Note closure of antebrachial growth plates.

would be one which could be performed at an early age, is relatively simple and is not likely to require revision surgeries.

The use of UHMWPE suture (Tightrope Vet Systems, Naples, Florida, United States) has previously been reported to maintain radial reduction in Monteggia injuries in one dog and one cat.⁹ Compared with traditional positional screws across the radius and ulnar in maintaining radial reduction, radioulnar polyethylene suture seems sufficiently strong, avoids the risk of screw breakage, and has less restriction of supination and pronation by allowing some motion at the radioulnar articulation.⁹ Similar to the Tightrope implant, the LigaFiba UHMWPE suture is braided, requiring strict aseptic technique to prevent any surgical site infection.⁹

We postulate that the more flexible fixation provided by the polyethylene suture in our case also afforded some compensation with regard to asynchronous radioulnar growth, and may have contributed to the elbow joint congruity noted at the 15 weeks follow-up radiographs (►Fig. 3). This surpassed our clinical expectations, as the preoperative assumption was to only limit the degree of radial head subluxation by the polyethylene suture, because we were expecting the necessity of further corrective osteotomies during skeletal growth.

The timing of surgery relative to the patient's stage of growth, as well as to the degree of subluxation, likely aided in our ability to reduce the radial head with only instrument compression. This situation is not common, and radial head reduction normally necessitates either ostectomy of the radial head,⁴ proximal radial wedge osteotomy³ or an oblique osteotomy to the proximal radius and ulna.¹ A simpler alternative may be to perform a proximal ulnar osteotomy to facilitate proximal ulnar displacement to allow radial head reduction if manual reduction is unsatisfactory,⁶ followed by implantation of the UHMWPE suture.

In respect to surgical correction of congenital humeroradial subluxations, it should be considered that the spectrum of clinical signs of these patients can vary from mild lameness to non-weight bearing.¹⁰ The former may tempt a clinician into pursuing conservative medical treatment, reserving surgery for cases with progressive discomfort or subluxation of the elbow. In doing so, the prognosis may be worsened by progressive osteoarthritis, radial head dysplasia and may limit the ease of radial reduction without invasive osteotomies. Some authors suggest that realistic expectation of surgery for this condition should be the long-term improvement in limb function with reduction in pain as opposed to restoration of full athletic function.^{1,6} Should there be progressive clinical dysfunction, salvage procedures such as radial head ostectomy or elbow arthrodesis could be considered, with the former reported to provide pain free function despite weight bearing entirely reliant on the semilunar notch of the ulna.^{2,4,6}

The technique described here adds to the armoury of surgical options in a juvenile dog; it is relatively easy to perform, requiring only routine surgical tools. For favourable outcome with remodelling of the articulating surfaces, we believe that the reported technique should be applied well before skeletal maturity, as shown at late follow-up, when all antebrachial physes were closed and the articulating surfaces of the elbow joint were congruent.

In conclusion, we describe in a case of congenital humeroradial luxation early intervention with a simpler surgical option that led to successful reduction and to gain of full elbow joint function. This technique warrants further investigation by means of a case series to elucidate the limits of patient age for which this technique may be appropriate.

Authors' Contribution

All authors contributed to the management of the case, acquisition of data, drafting and revision of the manuscript.

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Conflict of Interest

None declared.

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