# Use of a Plate and Screws to Repair Lateral Humeral Condylar Fractures in 10 Dogs

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## ABSTRACT

Fracture of the lateral humeral condyle (HCF) is a common injury, and the treatment by lag screw fixation is accepted as the method of choice. If the screw breaks, however, the dog will not have a satisfactory outcome. Screws can break due to nonunion, long periods of cyclic loading, and insufficient diameter. A plate can be applied to the lateral aspect of the humerus utilizing the bottom plate hole as the transcondylar screw hole and another screw in the more proximal plate hole to share loading and distribute the forces of cyclical loading. The results from using a lateral plate on the distal humerus in the 10 cases in this study are encouraging and warrant further investigation.

## INTRODUCTION

Shear forces on the relatively small lateral epicondylar crest can lead to lateral humeral condylar fracture (HCF) once the condyles are unattached. This shear stress is further compounded by incomplete ossification of the humeral condyles (IOHC), leaving the lateral epicondylar crest solely supporting the humeral capitulum.[1,2] Spaniels are predisposed to IOHC and intercondylar/unicondylar fractures.[1,3] Implant failure following HCF repair has been reported and may be associated with nonunion.[4,5] A high incidence of screw failure has been reported in repair of HCF in Springer Spaniels.[6] This paper describes a novel technique for repair of HCF using more implants than just a lag screw in the belief that there should be a lower incidence of screw breakage. The authors cannot claim that this technique is better at preventing screw breakage as the case number and postoperative time are not sufficiently high in this study to make this conclusion, but the authors are of the opinion that the results do warrant further investigation of the technique.

## METHODS

All 10 dogs were English Springer Spaniels (6 male, 4 female); the average age was 4 years and the age range was 2 to 8 years. There was no history of a major traumatic incident; 1 dog sustained the fracture whilst jumping (Figure 1). Although prodromal lameness was noted, no cases had radiographs taken at that point to check for IOHC of the opposite leg. Routine anaesthesia, analgesia, and aseptic procedures were followed for each case and all operations were performed by the same surgeon (W McC). A caudolateral approach to the elbow was made and the fracture site/surface and lateral humerus were cleared of any tissue that would either hinder healing or plate application. Any tissue, such as fibrocartilaginous tissue, on the fragment surfaces was curetted away to leave a bleeding bone surface. Using pointed reduction forceps and confirming alignment by reference to the lateral epicondylar crest, the fracture was held in reduction. A 1.1-mm short pin was drilled parallel to the projected direction of the transcondylar lag screw and keeping reference to where the plate would be lying so as not to impede its contouring. An incision was made from the lateral epicondylar eminence cranially in a 45-degree angle and the muscles retracted to allow visualization of the site on the lateral epicondyle for lag screw placement. A pilot hole for a 3.5 mm or 4.5-mm screw was drilled, following by over drilling of the lateral epicondyle portion in preparation for lag screw insertion. A pre-contoured pre-cut 3.5-mm reconstruction plate (RCP) was trial fitted to the lateral aspect of the humerus allowing for at least one hole above the proximal fracture line (Figure 2). The RCP was cut and contoured in the craniocaudal plane using the contralateral limb x-ray prior to surgery. It should be noted that a 3.5-mm and a 4.5-mm screw will fit into the hole of a 2.7-mm RCP and 3.5-mm RCP, respectively (Figures 3 and 4). To assist intraoperative contouring, the distal hole was pressed firmly onto the center of the lag screw hole already created. Additionally partial placement of a screw into the transcondylar hole through distal RCP hole was helpful to assess degree of contouring needed, which was always significant. Once this stage of contouring was finished, the screw was inserted into the bottom screw

**Figure 1.** Radiograph of fracture sustained from jumping.

**Figure 2.** Lateral view of repair.

hole and fully tightened; if further contouring was deemed necessary at this point, the screw was either partially unscrewed to allow more contouring in situ or removed and free hand contouring applied. Once the plate was lying against the bone along the lateral humerus, the top 3.5-mm screw or screws as the case concerned were inserted. Following routine closure, the leg was bandaged for 5 days and passive flexion and extension was started by the owner on the fifth day.

**Figure 3.** Radiographic view showing a 4.5-mm screw used in the distal hole of a 3.5-mm reconstruction plate.

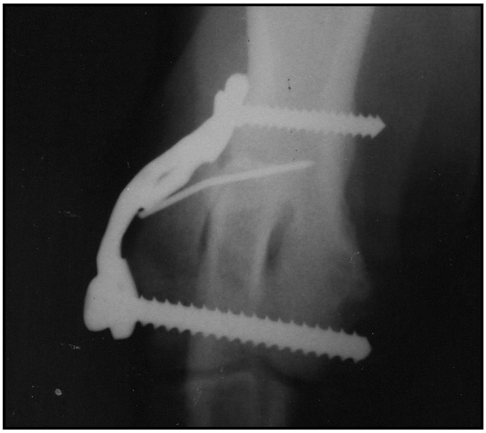

**Figure 4.** Radiographic view showing a 3.5-mm screw in the distal hole of a 2.7-mm reconstruction plate.

## RESULTS

There were no incidences of implant failure after 1 year follow-up in the 7 cases where contact was possible. Postoperative radiographic examination was used to confirm fracture healing, and no persistence of the fracture was found postoperatively. Six of the cases had intermittent stiffness and all dogs had reduced range of motion by approximately 15%-20% as judged by the surgeon at the last follow-up exam. The degree of post traumatic osteoarthritis in all cases was classed as either mild or minimal using the last postoperative radiograph. The postoperative follow-up examination was in the period 16 weeks to 6 months postoperative, and long-term follow-up was 1 year for 7 cases.

## DISCUSSION

A single transcondylar lag screw with an optional anti-rotational k wire is the recommended method of repair for lateral HCF.[3] Implant failure of the transcondylar lag screw is a recognized problem but its incidence is unknown, though it may be associated with non-union of the fracture.[4] Implant failure by screw breakage is a devastating complication which is difficult to resolve satisfactorily.[4,7] There maybe a higher incidence of implant failure in English Springer Spaniels from the authors experience and others.[5] For this reason, the authors used a lateral plate and screws to provide additional stability to HCF in English Springer Spaniels.

There is a high incidence of post traumatic osteoarthritis (PTO) following HCF repair, and limb function should be expected to decline over time.[8] Additionally, it is expected that all dogs will have reduced range of motion following HCF repair.[8] This finding does not correlate with other studies,[9,10] were the incidence of PTO is much lower. However, the case types are not the same between these studies and it would seem to indicate that young dogs and dogs weighing more than 7 kg will have better outcomes with less PTO and reduced range of motion. The technique described in this study was not used in young dogs and is not suitable for use in small breeds. Only larger dogs were candidates for the technique described here, which would mean that the outcomes will expect to have higher PTO and reduced range of motion. The effect of the plate lying over the extensor muscle origins is unknown, but there was no clinical evidence of a problem at the site by evidence of thickening, swelling, or pain.

The presence of IOHC could lead to a non-union in some cases of HCF and these dogs could be candidates for implant failure. In 2 reports in the literature involving treatment of IOHC,[2] some cases that had lag screws inserted still had a radiolucent line long after surgery. Continued repetitive loading could lead to a stress raiser fracture of the screw at the fracture line. Adding an additional pin would share some of the loading with the screw but migration can be a problem.[11] The technique described here and used by other surgeons (M. Glyde, personal communication) could help in the prevention of screw breakage following HCF treatment, and warrants further investigation.

## REFERENCES


1. Marcellin-Little DJ, DeYoung DJ, Ferris KK, Berry CM: Incomplete ossification of the humeral condyle in spaniels. *Vet Surg* 1994;6:475-487.
2. Butterworth SJ, Innes JF: Incomplete humeral condyle fractures in the dog. *J Small Anim Pract* 2001;8:394-398.
3. Denny HR: Condylar fractures of the humerus in the dog: a review of 133 cases. *J Small Anim Pract* 1983;4:185-197.
4. Denny HR, Butterworth SJ: *A Guide to Canine and Feline Orthopaedic Surgery*. 4th edition. Oxford: Blackwell; 2000:352-357.
5. Glyde M, Connery N, Doyle R: Humeral condylar fractures in dogs. *Irish Vet J* 2003;3:158-165.
6. Murtagh K, Guerin S: Incomplete ossification of the humeral condyle in a Springer Spaniel. *Irish Vet J* 2006;399-401.
7. Meyer-Lindberg A, Heinen V, Fehr M, Nolte I: Incomplete ossification of the humeral condyle as the cause of lameness in dogs. *Vet Comp Orthop Traumatol* 2002;3:187-194.
8. Gordon WJ, Besancon MF, Conzemius MG, Miles KG, Kapatkin AS, Culp WTN: Frequency of post traumatic osteoarthritis in dogs after repair of a humeral condylar fracture. *Vet Comp Orthop Traumatol* 2003;1:1-5.
9. Cook JL, Tomlinson JL, Read AL: Flouroscopically guided closed reduction and internal fixation of fractures of the lateral portion of the humeral condyle; prospective clinical study of the technique and results in ten dogs. *Vet Surg* 1999;28:315-321.
10. Guille AP, Lewis DD, Anderson TP, Thompson MS, Wheeler JL: Evaluation of surgical repair of humeral condylar fractures using self compressing orthofix pins in 23 dogs. *Vet Surg* 2004;33:314-322.
11. Morshead D, Stambaugh JE: Kirschner wire fixation of lateral humeral condylar fractures in small dogs. *Vet Surg* 1984;13:1-5.