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Incomplete ossification of the humeral condyle: outcomes and complications

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During development, the humeral condyle has two different centres of ossification (medial and lateral) separated by a cartilaginous intermediate zone. Normal ossification of the humeral condyle starts at 2 weeks of age and is usually completed between 8 and 12 weeks. After this period of time the presence of a sagittal radiolucent line (fissure) between the humeral condyles provides evidence of a failure in the fusion of the two centres of ossification. This pathological condition is named “Incomplete Ossification of Humeral Condyle” (IOHC). On a caudocranial projection, the fissure extends slightly obliquely from the articular surface to, or towards, the supratrochlear foramen. The fissure can therefore be missed if standard radiographic projections are used, and a 15° craniomedial-caudodorsal radiographic view has been recommended. In view of the risk of missing a fissure by positioning error and also the potential confusion of marked lines/ulnar articular cartilage lucency, either CT or MRI are the preferred imaging modalities. Incomplete ossification of the humeral condyle was first reported as an incomplete condylar fracture causing lameness in spaniels. A genetic predisposition with a polygenic recessive trait has been proposed for Cocker spaniels. IOHC has been reported in many breeds (Labrador retriever, Yorkshire terrier, soft coat W heaten terrier, Jack Russell terrier, Boston terrier, German shepherd dog, English pointer, Rottweiler, Pug, Tibetan mastiffs, giant Schnauzers, German wirehaired pointer, Newfoundland, Entlebucher Sennenhund, English setter, toy Poodles) but spaniels are particularly predisposed. When compared with other breeds, spaniels also have a higher incidence of humeral condylar fractures and animals with lameness due to IOHC often have active new bone formation along the lateral epicondyle. M any owners describe a lameness that precedes humeral condylar fracture and this supports the theory of a pre-existing pathological process. There is a high correlation between IOHC and fragmented medial coronoid process, radial deformities and humero-ulnar incongruence, suggesting that asynchronous radial and ulnar growth may change the distribution of forces about the elbow and predispose to IOHC. This may however simply be related to concurrent elbow dysplasia. Consequently many dogs have elbow osteoarthrosis at the time of diagnosis of IOHC or condylar fracture and this may account for the prodromal lameness in some cases.

The treatment of IOHC in lame dogs remains controversial. The environment at the site of the fissure is similar to that in an atrophic (fibrous) non-union and attempts to achieve fusion by drilling vascular access channels across the fissure did not produce satisfactory results. T here is a general consensus that it is better to stabilise the two portions of the condyle to prevent propagation to a complete uni or bicondylar fracture. Most surgeons employ a transcondylar screw and success rates (resolution of lameness) of 70% have been reported after lag screw fixation. T here is no evidence that lag screws are associated with better outcomes to position screws. It is the author’s experience that lag screws are associated with a reduced range of flexion in the elbow and greater post-operative discomfort. The former is thought to be due to the effect of compressing the condyle, resulting in a subtle change in its shape. The latter is thought to be due to the creation of tension on the microfractures in the supracondylar ridge as the condyle is “deformed”. It has become clear that simply stabilising the condyle does not lead to fusion. Consequently the implants are subjected to long term cyclical loading and screw failure is not uncommon. The diameter of the screw used needs to account for this. One recommendation is for a screw diameter equal to 30-50% of the diameter of the condyle at the fracture site. In a small number of cases union of the IOHC was confirmed by CT. Combined transcondylar screw and drilling of vascular access channels did not show any significant benefit. M ore recently the combination of a transcondylar core filled with autogenous bone graft and transcondylar lag screw (Acutrak) has been reported. Good elbow function was achieved without further treatment in the 78% of the cases. Partial or complete bone union was reported in 87% of the elbows assessed by CT scan, but image quality was suboptimal due to the presence of the screws and this may not be a reliable figure. Partially threaded titanium shaft screws have been advocated on the grounds that they are stronger than cortical/cancellous screws and should reduce the incidence of implant failure. It is the author’s experience that the incidence of wound related complications associated with transcondylar screw placement is disproportionately high for such a short and atraumatic surgical procedure. Of 28

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dogs that had a transcondylar screw placed for lameness due to IOHC, 13 had seroma/wound infection (46%). Of 21 dogs treated for a lateral condylar fracture that had known IOHC on the contralateral side, four developed seroma/wound infection (19%). Interestingly of 71 dogs treated for condylar fractures (both uni or bicondylar fractures) that had no sign of IOHC in the contralateral elbow, only two (2.83%) had seroma/wound infection. It is unclear why the figures are so much higher for IOHC related condylar fractures. One possibility is the persistence of instability/micromotion. Long term follow-up of the cases where a transcondylar position screw was placed for the treatment of symptomatic IOHC, revealed that six of 28 (21%) developed screw failure (fracture). These cases presented as a sudden deterioration in lameness associated with exercise with pain on elbow extension and transcondylar pressure. In most, radiographs did not show the fracture in the screw and this was only confirmed at surgery. All cases were revised by placement of the screw. In view of this high failure rate, the author uses either 4.5mm cancellous or 5.5mm cortical screws. Analysis of fractured screws revealed that they had failed as a result of multidirectional forces confirming persistent micromotion between the condyles.

Although many studies support IOHC as a risk factor for humeral condylar fracture, the benefits of surgical treatment of asymptomatic cases are not proven. With the increased risk of seroma/wound infection and screw failure, prophylactic screw placement cannot be considered a benign procedure.

REFERENCES