Incomplete humeral condylar fracture in two English Pointer dogs

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Summary
Incomplete humeral condylar fracture was diagnosed by means of radiology, CT, scintigraphy, arthroscopy and bone biopsy in two English Pointer dogs. In both cases an acute thoracic limb lameness, unrelated to a known episode of major trauma, was observed. Incomplete humeral condylar fracture, mainly described in the Spaniel breeds, has been recently diagnosed in Labrador retrievers, Rottweiler, German Wachtel and other breeds. The pathogenesis of the condition is still unknown, but incomplete ossification of the humeral condyle and mechanical stress, alone or associated, have to be considered. However, our clinical and histopathological data lead us to believe that in Pointers, high performance dogs, the mechanical stress can assume a critical ethiopathogenetic role.

Keywords
Humeral condyle, incomplete fracture, Pointer, dog


Introduction
Incomplete humeral condyle fracture (IHCF) has been recently described in Labrador Retriever (4), Rottweiler (5), Yorkshire Terrier (1), Tibetan Mastiff (1) and other breeds.

Marcellin-Little et al. (1994) hypothesized that the incomplete ossification of the distal humeral condyle (IOHC), predisposing spaniel breeds to humeral condylar fracture, might be related to a heritable condition.

Among the differentials, incomplete stress fracture of the humeral condyle should be considered (2). The causes could be related to repetitive mechanical stress acting on the elbow joint during intense athletic performances.

The development of a non-union fracture as a consequence of inadequate immobilization is a common event. The type of non-union fracture that occurs could be represented by a viable oligoarthritic non-union fracture (3) where fibrous tissue bridges the fracture gap (2).

Case history
Two English Pointer dogs are described, namely a three-year-old male (Case 1) and a five-year-old female (Case 2) dog. Clinically, the first case showed a ‘first degree’ (1–4 scale) lameness of the left thoracic limb. The second case was admitted with a third degree lameness of the left thoracic limb, and showed pain on supination/pronation of the left elbow.

Radiographic examination of the elbow joints was performed. In Case 1, as pain had not been identified on palpation of the lame limb, radiographic examinations of the entire limb were then performed. Next, bone scintigraphy examination with ⁹⁹ᵐ Te-MDP (0.44 mCi/Kg), was performed because it had not been possible to identify any bone lesion radiographically. A new radiographic examination performed after bone scintigraphy, using different angulation of the CrCdML O view, allowed visualization of a faint radiolucent condylar fracture line in the left elbow joint.

In both cases, transverse CT scans of both elbows were performed. Arthroscopic examination was performed in all affected elbow joints.

In the first case (Case 1), a bone biopsy technique was performed at the time of surgical repair by means of a Jamshidi bone biopsy needle (2.5-mm diameter) through the fracture line and the specimens obtained were submitted for histological examination. Haematoxylin and eosin (H & E) and Masson thichrome stains to better define the cartilaginous and fibrous tissue, were considered.

Results
In Case 1, an intercondylar fissure fracture was detected by means of scintigraphy and radiography (CrCdML 15°O) only in the left humerus. Bone scintigraphy also revealed an intense area of ⁹⁹ᵐ Te-MDP uptake at the level of the right elbow joint. CT scan revealed an incomplete intercondylar fracture in both humeri.

In Case 2, the radiographic examination and CT scan of the left distal humerus outlined an incomplete condylar fracture line (Fig.1).
Arthroscopy, performed in all affected elbow joints of the two dogs, clearly showed the incomplete condylar fissure fracture (Fig. 2).

In both dogs, the incomplete condylar humeral fracture was fixed with a transcondylar, lagged bone screw (Fig. 3). In both dogs, the fracture stabilization lead to a resolution of the lameness.

The histological sample obtained consisted of dense cancellous bone, showing a well defined fracture separating the two trabecular bone fronts. At the site of the lesion, a wide fracture gap filled by amorphous and necrotic material was observed. Some osteonecrotic areas (N in Fig. 4) were also evident at the trabecular front of the fracture. Signs of repair processes were not evident because of a significant formation of intermediate fibro-connective or cartilaginous tissue. In very few areas (A in Fig. 4), small groups of cells with morphological aspects of mesenchymal activity and proliferation were observed, indicating a limited and incomplete repair process. The adjacent trabecular bone showed an evident increase of density and thickening (S in Fig. 4).

Discussion

The pathogenesis of the incomplete condylar humeral fracture could be related to a failure of complete ossification of the two halves of the humeral condyle (2). It could be also related to a form of stress fracture, where the fracture develops after the complete ossification of the condyle. Condylar fractures usually result from a violent stress transmitted through the radius on to the capitulum which is only weakly supported by its lateral epicondyle and separated from the main shaft by the supratrochlear foramen.

The origin of such fractures in adult dogs has been speculated upon (2, 4, 5). IHCF has been frequently observed in Spanish dogs (2). It has been hypothesised that Spaniels are affected by an osteochondrotic disease (2). Bearing this in mind, IHCF could be an expression of the incomplete ossification of the condylar physis.

The histological features of the bone biopsy performed in the Pointer dog (Case 1) suggested a condition similar to an atrophic non-union fracture, with the absence of a successful repair and presence of cancellous bone at the fracture site, which is in accordance with a strong and repetitive mechanical stress that drastically compromises bone integrity and also the influx of mesenchymal cells, thus obstructing the bone repair process.

The osteosclerosis observed at the fracture site may represent not only a normal sequela to healing trabecular bone, but also the effect of an adaptive response to excessive and recurrent mechanical forces as an increase of bone remodelling. No histological evidence of the persistence of proliferative and hypertrophic cartilage was detected. These histological features are different from those observed by Marcellin-Little (2) but do not completely contradict his pathogenetic hypothesis concerning the relationship between incomplete ossification and humeral condylar fracture.
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IHCF may also be related to an incongruency in the elbow joint (1), causing a stress condition within the humeral condyle that either prevents ossification, or predisposes to fracture. If elbow incongruency is the cause, the incomplete ossification/fracture of the humeral condyle could be a manifestation of elbow dysplasia.

The breeds affected by IHCF are mainly chondrodystrophic and/or affected by elbow dysplasia (2, 5). In the chondrodystrophicoid breeds, a reduced growth of the ulna creates a condition of humero-ulnar subluxation, with most of the weight transferred across the elbow to the lateral part of the condyle predisposing to bone remodeling and stress fracture (1). This mechanism may not be invoked in non-chondrodystrophicoid breeds such as English Pointer dogs. Furthermore, a humero-ulnar subluxation would lead to a condition of clinical and radiographic signs of elbow degenerative joint disease, which was not the case in the two cases here described. We can then be fairly confident that elbow incongruence should not be considered as a possibility in the description of the causes of IHCF in the English Pointer dog.

The IHCFs were surgically treated by means of a cortical lag bone screw. The lag principle was used to encourage ossification of the tissue by making compression (1). If lameness exists a transcondylar lag screw fixation is suggested. Radiographically, bone fusion, due to fixation with screw has been observed by many authors (1); in some cases good results were not achieved (1). However, the radiographic evidence of the fissure line, still present after surgery, does not seem to be linked to a condition of lameness. The lag bone screw appears to act as a buttress in all sound dogs where a radiolucent fissure line is still visible after surgery (1).

Conclusion
The major problem that has always been present in studying condylar fracture is that histology has always been performed on specimens in the advanced stages of the disease (2). Unfortunately, dogs are usually only referred when chronic changes have already taken place, hence these changes have possibly masked more specific suspected conditions.

At the present time, even if we detected minor differences in the histopathological study of the condylar fissure fracture, compared to other authors (2), the pathogenesis of the condylar fracture can only be speculated upon.

However, our clinical and histopathological data lead us to consider that in Pointers, high performance dogs, the mechanical stress can assume a critical ethiopathogenetic role in association with IOHC.

References

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Fig. 4
Bone biopsy performed through the distal humeral condyle: N = osteonecrosis, S = osteosclerosis (Masson 40X). Picture A is a 200X magnification of the delimitated area.