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Use of Ultrasonography in Diagnosis of Medial Compartment Disease of the Elbow in Dogs

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Abstract

Objective The objective of this prospective study was to evaluate the use of ultrasonography in the diagnosis of medial coronoid process disease in unclear cases.

Study Design Fifteen elbows (on thirteen dogs) for which radiography and computed tomography did not lead to a clear diagnosis of medial coronoid process disease were included. On each elbow, ultrasonography was performed with a high frequency linear transducer (12–18Hz). Then, arthroscopic examination of the joint was performed by a surgeon who was unaware of ultrasonographic findings to confirm medial coronoid process disease.

Results At least one ultrasonographic lesion was detected in 13 out of 15 elbows. The main reported ultrasonographic lesions were joint effusion (10/15 elbows) and an abnormal shape of the medial coronoid process (irregular, ill-defined or fragmented) (9/15).

Conclusion Ultrasonography can be a helpful additional diagnostic tool to confirm medial coronoid process disease of the elbow joint before performing arthroscopy in unclear cases. Further studies will be needed to evaluate the use of higher frequency transducers and determine if it could improve the diagnostic value of ultrasonography.

Keywords
- arthroscopy
- dog
- ultrasonography
- elbow dysplasia
- coronoid process

Introduction

Ultrasonography is a non-invasive diagnostic technique relatively uncommon in cats and dogs to diagnose osteoarticular diseases. However, it is more commonly used in humans and horses to investigate joint disorders.[1–4] In dogs, even if it can have indications in the stifle joint and the shoulder, very few studies were reported in elbows.[5–8]

Medial coronoid process disease of the elbow is frequent in large and giant-breed dogs and is represented by different stages of lesions on the medial coronoid process including chondromalacia, fissures, fragments and cartilage erosion. Diagnosis may be difficult because of limited clinical or radiographic signs or a combination of both.[9] Thus, diagnosis based on radiography and computed tomography (CT) can be challenging when the medial coronoid process is not displaced or only fissured, and when few osteoarthritic lesions are present.[5,10,11] Radiography and CT scan have a reported sensitivity of 56.7 and 86.7% to detect a medial coronoid process disease respectively.[12,13] Moreover, neither radiography nor CT scan can directly identify cartilage erosion.[14] Arthroscopy allows the direct observation of primary elbow dysplasia lesions as well as evaluation of articular surfaces. Arthroscopic evaluation of the joint is therefore still considered the gold standard for clinical evaluation of cartilage lesions and more generally for the diagnosis of medial

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coronoid process disease that can be purely cartilaginous in early stages.[8,14]

The first description of ultrasonographic anatomy of the elbow was only made in 2005 in dogs and precise correlation between anatomic sections and ultrasonographic images has been reported.[15,16] In 2009, Seyrek-Intas and colleagues made the unique study assessing the accuracy of ultrasonography in detecting fragmentation of the medial coronoid process in dogs.[5] This study revealed that only 55% of free fragments and 9% of nondisplaced fragments were detected using ultrasonography. These authors concluded that ultrasonography was of limited diagnostic value in detecting fragmentation or fissuring of medial coronoid process in dogs.[5] However, this study mainly reported the identification of fragments which are not always present. Thus, we believe that availability of higher frequency transducer may improve the diagnostic value and usefulness of ultrasonography in medial compartment disease especially in dogs with few radiographic and CT abnormalities.

The purpose of this prospective clinical study was to determine if ultrasonography could complement radiographic and CT imaging techniques to confirm medial coronoid process disease in dogs with a challenging diagnosis.

Materials and Methods

Inclusion Criteria

This clinical study was performed prospectively, between November 2016 and January 2021 (Vetagro Sup, Marcy l'Etoile, France). All owners gave full consent for inclusion in the study. Each dog was presented for the complaint of unilateral or bilateral thoracic limb lameness. History was recorded and full clinical and orthopaedic examinations were performed by the same surgeon (TC, board-certified surgeon). For each elbow, lameness duration, lameness score at a walk and at a trot (from 0 (no lameness) to 5 (continuous non-weight-bearing lameness)), elbow palpation (joint effusion, pain upon palpation, pain during hyperflexion and/or hyperextension, decreased range of motion, crepitus) and Campbell test (internal and external carpal rotation) were appreciated. An exhaustive grid was completed for each elbow and all data were recorded in a computer database (4D Clovis, ►**Supplementary Table S1**, available in the online version). Each elbow included in this study was suspected of having a medial coronoid process disease based on these data. For each dog, three radiographic views, a CT scan and a complete ultrasonographic examination of both elbows were obtained. Elbows were systematically examined with ultrasonography, and all of the anatomic structures were appreciated. Then, elbows were explored through arthroscopy to confirm the medial coronoid process disease and to provide surgical treatment. To meet the inclusion criteria, no lesion or only minor lesions that did not allow for definitive diagnosis of medial coronoid process disease (ulnar subtrochlear sclerosis or medial coronoid process lucency) must have been detected on radiography and CT scan. Definitive inclusion was made when arthroscopy confirmed a medial coronoid process disease. Elbows with clear lesions of the medial compartment using radiography, CT scan or a combination of both modalities were excluded.

Radiography and Computed Tomography

Under sedation, three radiographic views (craniolateral-caudomedial oblique, 45 degrees flexed mediolateral and extended 15 degrees supinated mediolateral) were made for each elbow with clinical suspicion of medial coronoid process disease, as recommended by the International Elbow Working Group for the screening protocol to detect elbow dysplasia.[17,18] Lesions of osteochondritis dissecans, medial compartment disease, elbow incongruency (humeroradial, humeroulnar), ununited anconeal process, joint effusion, periarticular tumefaction, osteophytes and their description, ulnar subtrochlear sclerosis and measurement of its percentage and eventual kissing lesions (medial humeral sclerosis, subchondral bone flattening or irregularity) were investigated. The subtrochlear sclerosis percentage was measured in the mediolateral view in flexion, as described in the literature.[19,20] Every visible lesion was noted in an exhaustive grid for each elbow (►**Supplementary Table S2**, available in the online version).

A CT examination was performed after the radiographs under general anaesthesia, using a General Electric Brightspeed Elite 16-slice helical CT scanner, with 120 kV and 150 mA parameters. Entire thoracic limbs including the shoulder and carpal joints were systematically examined to eliminate other pathology that could explain the lameness. Transverse images with 0.625 mm and 1.25 mm slice thickness were obtained of the elbow and shoulder. Medial coronoid process fragmentation, fissure, sclerosis or lucency, subchondral sclerosis of the ulnar trochlear notch, irregularity of the radial incisures of the ulna, subchondral defect of the medial part of the humeral condyle, subchondral sclerosis of the humeral condyle and humero-radio-ulnar incongruity were investigated. Exhaustive grids were completed for each elbow (►**Supplementary Table S3**, available in the online version).

Two experienced observers judged the radiographic and CT images (MH, imaging specialist and VL, surgeon specialist respectively). When radiography and CT scan showed only minor modifications (subtrochlear sclerosis and/or medial coronoid process lucency) or did not reveal any abnormality, ultrasonography of the elbow was performed.

Elbow Ultrasonography

A high frequency 12 to 18 MHz linear matrix transducer (Aplio 500; Toshiba) was used. After a slight sedation and local clipping, dogs were first positioned in right lateral recumbency to evaluate the lateral part of the left elbow. Gel was applied and no stand-off pad was necessary. Triceps muscle tendon, anconeal process, lateral humeral epicondyle and lateral collateral ligament were evaluated. Then, the medial part of the right elbow was assessed, with evaluation of medial coronoid process (►**Fig. 1**), medial collateral ligament, medial humeral epicondyle, tendons of the flexor muscles and of the brachial biceps. The medial coronoid process was considered abnormal when it appeared irregular, ill-defined or fragmented. The dog was finally positioned