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Diagnostic Value of Histopathology, Radiography and Computed Tomography for Diagnoses of Canine Osteo-Arthritis

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Abstract- Osteoarthritis is a common orthopedic problem in the small animals patients. In most cases, the degenerative changes in the joint are secondary to some predisposing cause. The objective of this case study was to assess Diagnostic Value of Histopathology Radiography and Computed Tomography for Diagnosis of Canine Osteo-arthritis The study was conducted in Police Dogs Administration (Ministry of Interior, X-ray Department), included Female German Shepherd dog which diagnosed radiographically for hip dysplasia and osteoarthritis. Using conventional radiography and CT images It concluded that conventional radiography is the most common method used to evaluate osteoarthritis, there has been an increase in the application of other imaging technologies (CT) during the past several years. These modalities and thehistopathology can provide the clinician with additional information that can improve case management.

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I. Introduction

Osteoarthritis is the most common rheumatic disease encountered in small animal practice. No longer is osteoarthritis regarded as a simple consequence of aging and cartilage degeneration, but rather, the pathologic changes of osteoarthritis may result from active biochemical and biomechanical processes partly due to disturbances of the homeostatic mechanisms of anabolic and catabolic pathways. As to the cause of osteoarthritis, there is no etiology and its cause may be multifactorial. While there are many initiating causes, osteoarthritis is an irreversible process that often results in an end-stage clinical syndrome of the joint. Osteoarthritis exhibits varying degrees of severity, ranging from a mild, intermittent condition that causes mild discomfort and minimal disability, to a clinical state characterized by constant pain and severe disability. Clinically, osteoarthritis can be a challenging diagnosis to make. The disease is typically a slowly progressive problem. Consequently of the wide range of presenting signs, osteoarthritis is likely one of the most underdiagnosed syndromes in dogs and, especially, in cats.(1,2) It afflicts at least 20% of the canine population at any time.(1,3) This translates to roughly 10 to 12 million dogs in the United States.

There are no accurate estimates of the number of cats with osteoarthritis. A single definition of osteoarthritis remains elusive.

At a 1995 workshop, the American Academy of Orthopaedic Surgeons proposed the following consensus definition: Osteoarthritic diseases are a result of both mechanical and biologic events that destabilize the normal coupling of degradation and synthesis of articular cartilage chondrocytes, extracellular matrix, and subchondral bone.Although they may be initiated by multiple factors, including genetic, developmental, metabolic, and traumatic factors, osteoarthritic diseases involve all of the tissues of the diarthrodial joints.

Ultimately, osteoarthritic diseases are manifested through morphologic, biochemical, molecular, and biomechanical changes in both cells and matrix that lead to softening, fibrillation, ulceration, articular cartilage loss, sclerosis and subchondral bone eburnation, and osteophyte production.When clinically evident, osteoarthritic diseases are characterized by joint pain, tenderness, movement limitation, crepitus, occasional effusion, and variable degrees of inflammation without systemic effects.(4) For simplicity, think of osteoarthritis progression in three broad stages.(5) Research also has shown some continuity between bone and cartilage changes in osteoarthritis, suggesting an interaction between these tissues.(6)

II. Case Presentation

The study was conducted in Police Dogs Administration (Ministry of Interior, X-ray Department). included Female German Shepherd dog which diagnosed radiographically for hip dysplasia and osteoarthritis. Using A Poly mobile Siemens X-ray Machine was used. It has 2.5 KW output, with a KV range 40 – 100 in 21 Steps, and mA range 100 – 200. The exposure time mm–8 max. 5s. The X-ray tube has fixed anode tube 100/ 20 and focal spot 1.4 IEC – 336/ 1982. The anode angle is 14° and the inherent filtration is 3.2 mm aluminum equivalent value and weight153 Kg (Siemens, 2003), with Exposure factors(kV: 66,mAs:

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12.5,Film: 12x12 inches,Green Kodak X ray film,FFD: 100 cm)

The Kodak green X-ray film of size 12 × 15 inches was placed on Kodak medical X-ray cassette 12 × 15 inches with Kodak green 400 screen. A grid was used with a grid ratio 10/ 1 to improve the image quality. Focal distance 100 cm and grid lines 34 lines/ cm. Right and Left metal marker was used as an identification device. A three lead aprons were used for radiation protection. Digital camera model (E 4600, Size: 340 Kb and type: JPEG), was used for photographic purposes.The film was processed using automatic processor (Kodak x Omat 2000).

Histophology was done and shows that there is no change at the level of bone cells. However there are poly morph cells ,andmost of themarelymphocytewhich indicate chronic inflammation.

pelvic radiography including Ventro-dorsal extended view external rotation(VD2)projection,Dorso-Ventral flexed hips and knees(DV) projectionand CT Studies were done

III. Results

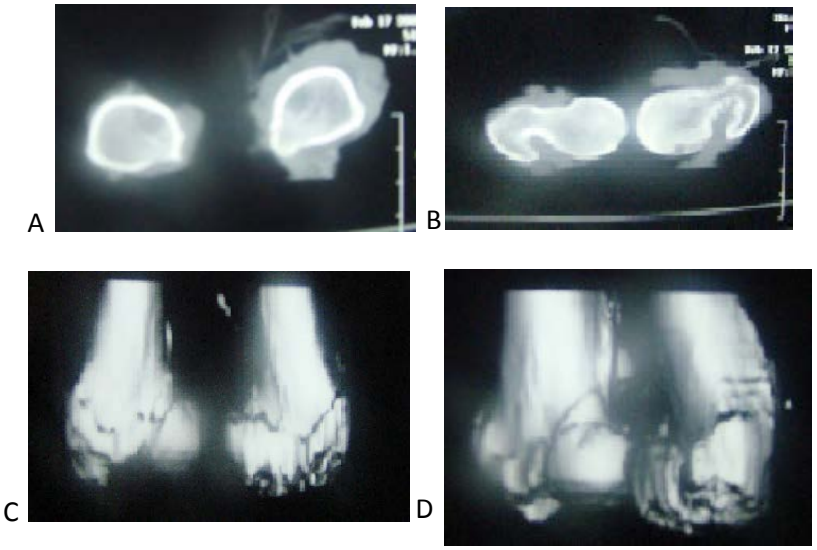
Conventional radiography is an excellent imaging technique for imaging bony structures but is a limited method for imaging soft tissue structures. It displays a greater spatial resolution than either MRI or CT. The disadvantage is that, the two dimensional displays of three-dimensional structures, results in superimposition that can obscure important findings. Details that can be derived from plain radiographs include information on the size, contour, density, and location of changes that are present in or around the joint. The areas that can be evaluated include the subchondral bone plate, trabecular subchondral bone, articular margins, and areas where ligaments, tendons, and the joint capsule is attach. Figures (1,2)

Figure 1 : Radiograph of Ventro-dorsal extended view external rotation shows shallow acetabulum, degenerative changes of the acetabulum , head of femur , greater and lesser trochanter marked in the Right and mild in the Left, absence of the right joint space, tight joint, no laxity, and marked osteoarthritis

Figure 2 : Shows X-ray radiograph for both femurs (post mortum)

Computerized tomography (CT) has been introduced in the seventies in human medicine and has been more readily available to veterinarians over the last decade. It is a cross-sectional imaging technique using x-rays and computers. Better soft-tissue differentiation and absence of superimposition are the major advantages of CT over conventional x-ray techniques. Although the spatial resolution of CT images is poorer when compared with classical film-screen radiography. The cross-sectional image displays a superior discrimination of tissue attenuation enables differen-tiation of soft tissues structures that can not be perceived on

conventional radiographs. Subtle new bone formation and bone lysis are better identified on CT images when compared with conventional radiography because of their greater physical density discrimination,and the ability to manipulate the grey scale of the digital image, along with the elimination of overlying structures. Whilea loss of 30% of bone density is often required for a lesion to be visible on conventional radiographs. CT is able to detect density changes of only 0.5–2%. Another advantage is that the transverse CT images can be reformatted in multiple anatomic planes. In the stifle, compared to radiographic examination, Figures (3) (A, B, C&D), figure4.



Figures 3 : (A.B.C,D) CT images(A,B) shows CT scan Axial cuts of proximal ends of both femurs of 8 years German Shepherd canine, the left femur is normal but the right is affected. (C, D) shows: (3D) three Dimensional CT image of proximal ends of both femurs

Figure 4 : Shows reformatted coronal view of proximal ends of both femurs

IV. Discussion

Generally, plain radiography has been in many cases the only imaging modality for the diagnosis and follow-up of stifle abnormalities. Over the years, however, radiologists and orthopaedic surgeons became aware of the importance of the diagnosis of not only bony conditions, but also of a diverse variety of soft-tissue conditions. Besides plain radiography, the veterinary profession nowadays gets access to the following imaging modalities: scintigraphy, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound (US). Also arthroscopy has moved into the interest of veterinary orthopaedic surgeons for diagnosis and treatment of several stifle diseases and has become a routine procedure in several orthopaedic clinics.

In this case, conventional techniques like radiography are excellent methods to investigate morphologic changes in bones (figure(1). In people and horses joint space narrowing has been a well-accepted indicator of articular cartilage degeneration and is considered as a cardinal radiographic feature of disease. In small animals the loss of joint space is not a reliable sign as the radiographs are taken non-weight-bearing. Individual soft tissue structures are not visualised as easily as the bony structures unless they are bordered by fat . Indirect information on articular soft tissues structures can be present in case of calcification within these structures, mostly a sign of degeneration

but can also sometimes be an incidental finding. Also using stress radiographs, an indirect evidence of articular ligament rupture, can be obtained.

CT provides additional useful information in all processes where avulsions or fragmentation are involved. These disorders are not always visible on radiographs. CT proved to be extremely useful in the detection of avulsion fractures of intra-articular ligaments like the cranial cruciate ligament and the tendons of the extensor digitorum longus and the popliteus muscles (Figures 3,4). In this case, CT confirmed the diagnosis. Compared to radiography, the use of CT could detect many more intra-articular fragments, which provides important information to the surgeon, especially when arthroscopic treatment is envisaged. The intra-articular administration of iodinated contrast medium (computed tomographic arthrography) enables the identification of several ligamentous structures within the hip joint. Degenerative changes can be identified in an earlier stage than on conventional radiographs. In cases where treatment of bone tumours is considered, CT enables a more exact demarcation of the affected tissues and helps to decide to what extent the tumour has to be excised. In such cases, CT guided biopsies can be accurately obtained.

V. Conclusion

The current study concluded that:Histopathology, Radiography and Computed Tomography each of them has a diagnostic value in diagnoses of canine osteo-Arthritis, Althoughconventional radiography is the most common method used to evaluate osteoarthritis.

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