DIAGNOSTIC IMAGING OF OSTEOCHONDROSIS IN THE DOG

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Osteochondosis (OC) is thought to be caused by a problem in the growth rate of the joint cartilage relative to the underlying subchondral bone. The cartilage over the bone in the joint becomes thickened and the growth of the underlying bone is altered. Because the joint is an area of movement and stress, this thickened cartilage is at risk of being torn, especially in the areas most subjected to trauma, stress and movement, such as the caudal area of the shoulder joint. When repeated trauma causes a flap of cartilage to detach from the underlying bone, the condition becomes osteochondritis dissecans (OCD). Because of the tear, the joint fluid can come in direct contact with the now-exposed underlying bone and can cause inflammation. Lameness will usually be present in the dog at this time. If the cartilage flap remains attached, it will not re-attach and heal back into its original position. Once the flap has been detached (spontaneously or surgicall), the subchondral lesion is filled in with fibrocartilage, a type of "scar" cartilage. Possible complications arise when joint mice become entrapped in the bicipital tendon sheath, causing irritation, obstruction of movement and pain. In approximately one third of the cases of OC, the disease is bilateral. Occasionally, it is present in several different joints in the same individual. It is seen twice as often in males as in females. This developmental disease occurs in rapidly growing medium to large breed dogs typically between 6 and 9 months of age, but can occur as late as 12 months or older. Today, the shoulder joint remains the most common localisation, being affected in 74% of the cases. The elbow joint is affected in 11%, the tarsal joint in 9%, and the stifle joint in 4% of the cases.

Diagnostic imaging techniques:

Scintigraphy

Scintigraphy is a useful technique to localise the cause of obscure lameness or in case of uncertain radiographic findings. The advantages of skeletal scintigraphy are its high sensitivity for detecting early disease and the ease of surveying the entire skeleton. Although it is very sensitive, it is not very specific. Also the spatial resolution offered by scintigraphy is not well enough to specify anatomic structures. The main drawback to joint imaging using 99m Tc-labeled phosphates is the normal uptake at the end of long bones, especially in immature animals. In some instances it is difficult to determine whether a difference in counts between two joints represents a meaningful finding. Comparison of bilateral images, acquired for the same time, and quantitative analysis of joint images by computer can provide diagnostic guidelines.

Conventional radiography

Conventional radiography is an excellent imaging technique for imaging bony structures. It displays a greater spatial resolution than either MRI or CT. The disadvantage is that the two-dimensional display of three-dimensional structures results in superimposition that can obscure important findings. This is especially an issue in smaller complicated joints like the elbow and tarsocrural joint. In the shoulder and stifle joint OC lesions can be detected radiographically in most of the cases. In the shoulder joint these lesions manifest themselves as a flattening in the caudal area of the humeral head. In the stifle joint, radiographic changes noted as a flattening on the medial aspect of the lateral femoral condyle can be observed. Caution: do not confuse the fossa of the long digital extensor tendon for an OCD lesion. Less often the lateral condyle is affected. Because osteochondrosis is often bilateral, it is necessary to take x-rays of both joints to evaluate the extent of the disease. Within the

elbow joint OC(D) can be detected on the cranio-caudal oblique view as a radiolucent defect surrounded by sclerosis. It is not always possible to distinguish between an OCD lesion and a “kissing” lesion. Within the tarsocrural joint the medial ridge of the talus is affected in 85% of the cases. The first radiographic sign of OC of the medial trochlear ridge is widening of the medial tibiotarsal joint space. When an OC lesion occurs on the lateral trochlear ridge, similar changes, located at the lateral trochlear ridge, can be seen but its detection is more difficult due to the superposition of the calcaneus. Radiographically a large number of OCD-lesions can be missed. Compared to OC of the shoulder joint, degenerative changes of the tarsal joint occur much sooner.

Arthrography

Arthrography is seldom used in small animal orthopaedics but is an interesting and simple technique readily available to most veterinarians. Although probably not as accurate as the newer imaging techniques (arthroscopy, MRI, and ultrasound), it provides information on intra-articular structures not seen on survey radiographs. Within the shoulder joint articular cartilage, biceps tendon, the extent of the joint capsule and the synovial surface outline can be roughly visualised on arthrograms. Cartilage fissuring and fragmentation such as occurs with osteochondritis dissecans can be demonstrated and identified as contrast material infiltrates beneath the articular cartilage. A distinction can be made between clinical and non-clinical lesions and can help in making therapeutic decisions. It can be used to visualise joint mice and can also help in the diagnosis of bicipital tendon problems.

Computerised tomography (CT)

Computerised tomography (CT) has several advantages over plain radiography. Better soft-tissue differentiation and absence of superimposition are the major advantages of CT over conventional x-ray techniques. CT greatly facilitates examining complex joint structures like the elbow and tarsus. Another advantage is that the transverse CT images can be reformatted in multiple anatomic planes. Subtle new bone formation and bone lysis are better identified on CT images when compared with conventional radiography because of their better physical density discrimination, the ability to manipulate the grey scale of the digital image, and the elimination of overlying structures. Ct has been proved to be superior in the diagnosis of fragmented coronoid process of the elbow joint and can discriminate between contact lesions and real OC of the medial humeral condyle. In tarsocrural OCD, CT is superior in the diagnosis of lateral ridge involvement. In tarsocrural OCD, CT allows to assess the exact localisation, the size and number of the fragments. It helps in decision making when using minimal exposure techniques to treat these lesions. CT-arthrography seems promising in evaluating fragment stability in the stifle- and tarsal joint.

Magnetic resonance imaging (MRI)

Unlike other imaging modalities such as radiography, arthrography, CT and scintigraphy, MRI is capable of directly visualising all components of the joint simultaneously and can detect a wide variety of joint abnormalities. With this technique multiplanar images can be obtaines and by using different sequences differentiation between different structures and pathologic processes is possible. MRI is especially sensitive to bone marrow alterations. In people, the current status of MRI suggests that it allows an evaluation of the appearance of normal and abnormal articular cartilage although the optimal sequencing for the detection of cartilage lesions still is undefined. The visualisation of cartilage and its lesions seems to be difficult in the dog probably because articular cartilage in dogs is very thin. Also the intra-articular administration of Gadolinium-containing agents is not helpful. The intravenous injection of such contrast agents can be useful in the detection of inflammatory processes. It is also a useful technique to reveal subchondral inflammatory lesions in cases of OCD. In humans it is also used to check stability of osteochondral fragments, which influences the therapeutic regime. The disadvantages are the same as with CT, the high cost of the equipment and its high maintenance cost. Also the full understanding of the physics behind this imaging technique is not obvious.

Ultrasound
Accurate examination of joints requires substantial ultrasonographic experience and a standardised examination procedure. In most of the joints even small amounts of fluid accumulation (hypo- to anechoic) can be easily demonstrated in the area of the joint pouches. The subchondral bone is visible as a hyperechoic line with a strong acoustic shadow. The surface of normal joint cartilage appears as an anechoic layer and can be examined for its integrity. Cartilage defects for example in the lateral femoral condyle or in the humeral head associated with OCD have irregular borders with pronounced contractions. The presence of second hyperechoic lines at the bottom of the subchondral defect seen on US is a pathognomic sign for the presence of a flap. Synovial proliferation can be evaluated as well. A major drawback of ultrasound is that not all joint areas are reachable with the transducer.

Suggested reading

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