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Magnetic resonance imaging: findings of osteochondrosis like-lesions in glenoid fossa and proximal humeral metaphyses in a dog: a case report

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ABSTRACT: Osteochondritis dissecans (OCD) of the humeral head is a common cause of forelimb lameness in dogs. OCD represents the late phase of osteochondrosis (OC). Magnetic resonance imaging (MRI) is a useful technique for detection and characterisation of this disease. The main objective of this study was to show MRI findings of OCD in the humeral head, OC like-lesions in glenoid fossa and proximal humeral metaphyses of a dog. MRI analysis revealed the extent and severity of the inflammatory changes within the subchondral bones in both the glenoid cavity and humeral head. OCD and OC like-lesions were also evaluated in histopathological studies.

Keywords: magnetic resonance imaging (MRI); osteochondritis dissecans (OCD); shoulder; dog

Shoulder canine osteochondritis dissecans (OCD) is a developmental disease caused by an abnormal articular cartilage differentiation, which appears as a cartilage fragment partially or totally detached on the caudocentral aspect of the humeral head (Piermattei et al. 2006). OCD is considered to be a late stage of osteochondrosis (OC), a common disorder of growing cartilage in young dogs (Ekman and Carlson 1998). Medium and large dog breeds are more predisposed to the condition and the humeral head is the most commonly affected site (van Ryssen et al. 1993b). However, other joints can be affected (elbow, knee and tarsus) (Ytreus et al. 2007) and OCD like-lesions have been reported in other joints (Altonaga et al. 2012). Moreover, the disease had also been reported in small breeds (Johnson and Dennis 1978; Bruggeman et al. 2010). Radiography, arthrography, and arthroscopy have commonly been used as diagnostic tools for canine shoulder OCD (van Bree 1993; Ekman and Carlson 1998). The use of magnetic resonance imaging (MRI) has also been reported for the evaluation of OCD lesions in canine shoulders (van Bree et al. 1993; 1995). MRI is a non-invasive technique that clearly reveals the extent and severity of the inflammatory changes within the subchondral bones in the area of osteochondral lesions (van Bree et al. 1993). Moreover, MRI shows intra- and extra-articular components and surrounding tissues (Schaeffer and Forrest 2006; Angello et al. 2008).

To our knowledge, MRI findings of canine OC like-lesions in glenoid fossa and proximal humeral metaphyses, as described in this case description, have not yet been reported.

Case description

A male Great Dane, 15 months of age, with severe lameness of the right forelimb which had first presented eight months previously was referred with clinical signs compatible with OCD of the humeral head. The dog was evaluated using MRI and was treated using arthroscopy; samples of the lesions were histologically evaluated.

The MRI study was conducted under general anaesthesia and was performed with a high-field 3T

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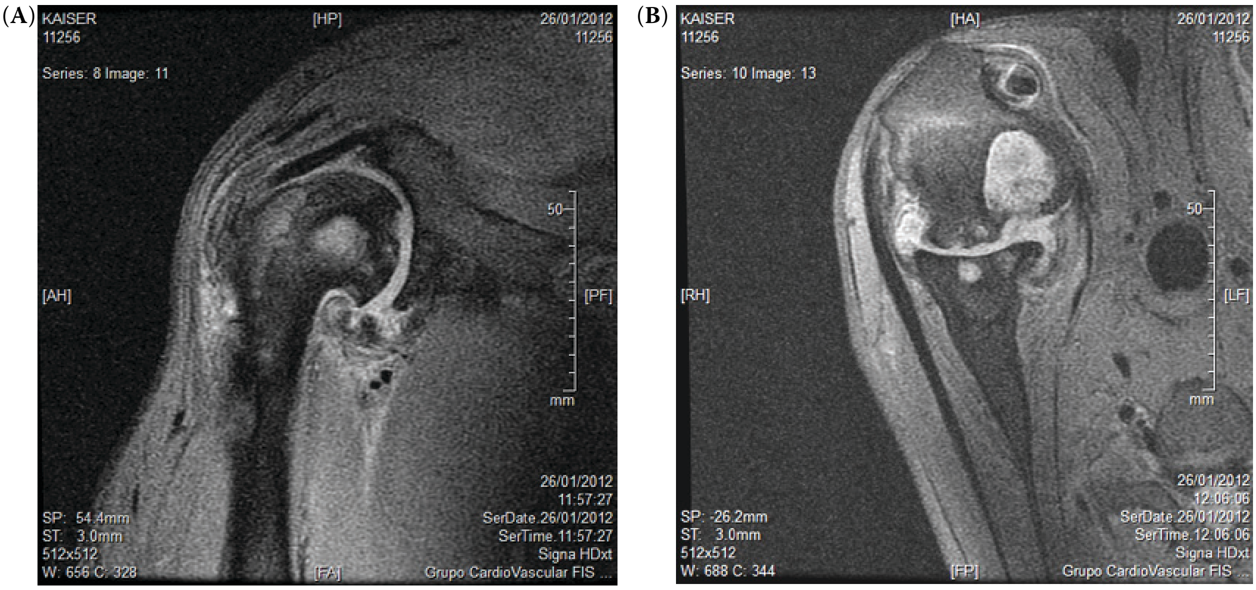

Figure 1. MRI FRFSE FSDPw sequence of right glenohumeral joint of a 15-month-old male Great Dane with 8 months lameness history. (**A**) Sagittal plane showing irregular surface with a subchondral hypointense faded area and circular hyperintense signal in proximal humeral metaphysis. Irregular and hypointense tissue is observed in the caudal joint pouch and intertubercular grove compatible with joint mice. (**B**) In the dorsal plane communication is shown between the subchondral metaphyseal cyst and the joint space, the subchondral bone of the glenoid cavity also shows a circular hyperintense signal, infraspinatus and biceps tendons have hyperintense signal intensity and the intertubercular grove shows an irregular and hypointense surface and a joint mice

(GE Medical system), using a multiarray coil (GE Healthcare Technologies). The dog was positioned in lateral recumbency. Different sequences were used for imaging acquisition: fast spin echo (FRFSE) T2 and fat saturated proton density (FSPD) weighted and spoiled gradient recalled echo sequence (SPGR) T2 weighted. The approximate parameters used in each sequence were: FRFSE T2w, (TR = 5000 ms, TE = 105 ms), FRFSE FSPDw (TR = 2000 ms, TE = 33 ms) and SPGR T2 × w was performed with flip angle 20° (TR = 35 ms, TE = 10 ms). The glenohumeral joint was scanned in dorsal, transverse and sagittal planes. Slice thickness was 3 mm for all images with a 0.3 mm inter-slice gap.

Diagnostic and operative arthroscopic shoulder procedures were performed on the lame limb, using a 2.7 mm 30° foreoblique arthroscope (Karl Storz), linked to a digital endoscopic camera (Karl Storz). The dog was positioned in lateral recumbency on the non-affected side, with the joint under examination in neutral position and a lateral approach was used as previously described (van Ryssen et al. 1993a). The osteochondral flaps were removed, fixed in 10% formalin solution and sent for histopathological study. The lesions were curetted (van Ryssen et al. 1993b).

In MRI and arthroscopic studies the dog was premedicated with midazolan (Midazolam Normon, Laboratorios Normon), butorphanol (Torbugesic, Fort Dogde Veterinaria), while anaesthesia was induced with propofol (Propofol Lipuro, B. Braun Vetcare) and maintained using inhaled isoflurane (Isovet, B. Braun Vetcare).

The histopathological samples were routinely processed and stained using haematoxylin and eosin.

The caudomedial area of the right humeral head presented irregularities in all MRI sequences and planes typical of OCD lesions. This was also well evidenced especially in the FRFSE FSPDw sequence, where a hyperintense giant methaphyseal cyst with real communication with the joint cavity was observed (Figure 1A). In this sequence the right glenoid fossa also showed an irregular articular surface with osteochondral defects and small subchondral cysts (Figure 1B). Increased signal intensity was observed at the insertions of rotator cuff muscles tendons. Insertions of brachial and deltoid muscles appeared hyperintense.

Histopathology of arthroscopic samples revealed hyaline cartilage with light erosion at the perichondrium, degenerated chondrocytes with pyknosis at

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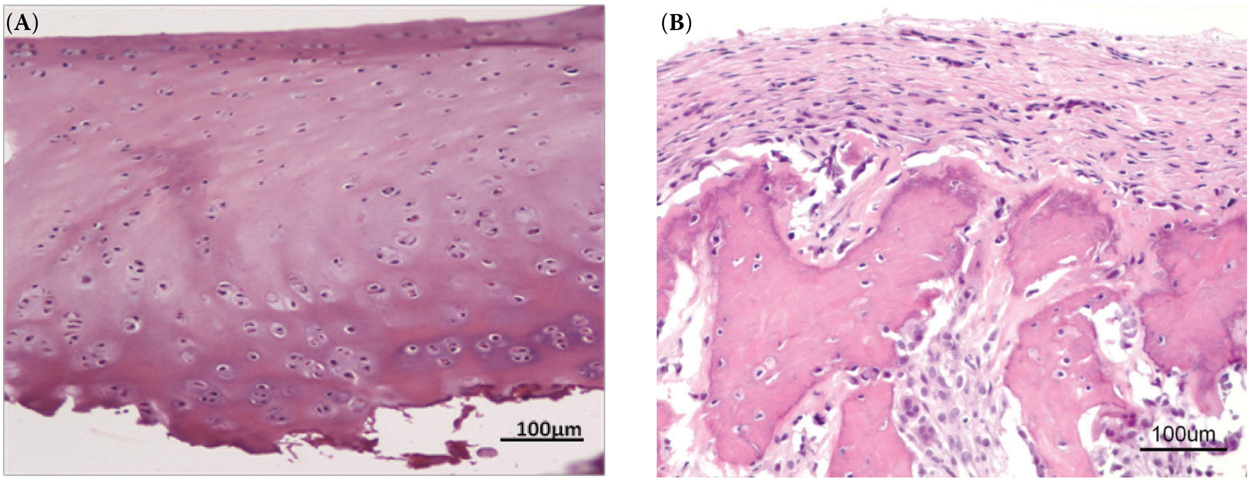

Figure 2. Histological examination. (**A**) OCD sample showing hyaline cartilage with light erosion at the perichondrium, degenerated chondrocytes with pyknosis in the deep layer and small quantity of subchondral bone with irregularities in the calcified layer. (**B**) Bone cyst sample with calcified osseous tissue and regular osteocytes and osteoblast arranged at the periphery with normal dense connective tissue surrounding it. Irregular osseous matrix with low areas of necrosis at the periphery or sometimes within connective tissue was identified

the deep layer and a small quantity of subchondral bone with irregularities in the calcified layer (Figure 2A). Histopathology of the giant cyst in chronic stages showed calcified osseous tissue with regular osteocytes and osteoblasts arranged at the periphery; neither pleomorphism nor dysplasia were observed. Around this layer a normal dense connective tissue was observed. Irregular osteoid with low areas of necrosis at the periphery or sometimes within connective tissue were present (Figure 2B).

After the medical procedures were conducted cefazolin was administered (Daren, Antibioticos Farma), carprofen (Rimadyl, Pfizer) and for one month glucosamine HCL, chondroitin sulphate and hyaluronic acid (Consequin, Bioiberica). The dog was kept at rest for two weeks and the owners were instructed to perform passive joint movements for five minutes and then a gradual resumption of normal activity.

It was not possible to perform the clinical follow-up as the patient died of gastric torsion.

DISCUSSION AND CONCLUSIONS

OCD is clearly seen as a change in the contour and signal intensity of articular surfaces (van Bree et al. 1993). Round areas of low intensity MRI signal were observed in subchondral bone due to sclerosis (de Maeseneer et al. 2008) and a high intensity T2-weighted signal within the lesion with intact articular cartilage are characteristic of OC lesions (O'Connor et al. 2002). The typical pattern of subchondral cysts associated with a well delimited high intensity signal can be associated with OC like-lesions secondary to the absence of endochondral ossification of epiphyseal cartilage in the glenoid fossa and proximal humeral metaphyses. OCD of the glenoid cavity has been described in humans (Suzuki et al. 2003; Koike et al. 2008), but in the veterinary literature this lesion seems to be an uncommon condition (Milton et al. 1981) and, to our knowledge, its MRI findings have never been reported. It has been hypothesised that a thickened anterior band of human inferior glenohumeral ligament can push the humeral head, creating a shearing and compression force on the glenoid fossa and resulting in OCD (Suzuki et al. 2003). Thickened capsule and glenohumeral ligaments in chronic stages could be responsible for glenoid cavity OC in dogs.

Histopathological findings include the presence of degenerated chondrocytes in the deeper cartilage layers at earlier stages, as well as areas of focal necrosis at later stages and different stages of OC-like lesion regeneration. The increased signal intensity between both articular surfaces and the capsular pouch is due to synovial membrane inflammation and joint effusion induced by the presence of joint mice. Accumulation of synovial fluid

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was more clearly observed on FRFSE DPW and T2w sequence images. Severe degenerative joint disease is a common sequela of osteochondrosis and is one of the most common causes of lameness in certain large breeds of dog (Ytreus et al. 2007).

In conclusion, MRI is an excellent technique for detecting OC, determining disease extension and assessing subchondral bone condition. FRFSE FSDPw was the best sequence for subchondral bone and metaphyseal cysts evaluation.

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