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Prevalence and characteristics of osteochondrosis in 309 Spanish Purebred horses

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ABSTRACT

Articular osteochondrosis (OC) is commonly reported in horses but there are no reports of its prevalence in the Spanish Purebred (SP). The objective of this study was to assess the prevalence and characteristics of OC of the tarsocrural, dorsal metacarpo-metatarsophalangeal and femoropatellar joints in the SP in a retrospective study. The data were obtained from the radiographs of 309 SP horses and the prevalence and characteristics of lesions were calculated.

Osteochondral lesions at predilected sites were diagnosed in 48.8% of the horses. It was more common to find the presence of fragments (28.8%) than flattening of the subchondral bone contour (20.1%). The percentage with abnormal articular margins was 1.3% for the femoropatellar joint, 33.3% for the tarsocrural and 25% for the dorsal fetlock region, where flattening was more common than the presence of fragments; in the tarsus and stifle, fragments were more common. The severity of the disease in the dorsal fetlock area was higher in hindlimbs than in forelimbs. Femoropatellar lesions were rare. Osteochondrosis is a common disease in the SP and this study provides information about the prevalence of osteochondrosis lesions in the breed and the interrelationships between the joints.

Introduction

Articular osteochondrosis (OC) is a developmental disorder in the cartilage maturation and mineralization process causing structural abnormalities of bone and/or osseous fragments (Jönsson et al., 2011; Laverty and Girard, 2013). OC has been included in the group of juvenile osteochondral conditions as a focal failure of endochondral ossification (Denoix et al., 2013b). All species have characteristic predilection sites and there are differences in prevalence among breeds (Bertone et al., 2005; Denoix et al., 2013a).

The aetiopathogenesis of OC is still debated; the importance of alterations in the vascular supply during epiphyseal growth has been proven (Ytrehus et al., 2007) and histological examination of the micro-vasculature showed damage at the level of the arterial supply of the epiphyseal cartilage (Olstad et al., 2011); abnormal behaviour of chondrocytes (Henson et al., 1997) and alterations in collagen metabolism (Lecocq et al., 2008; Laverty and Girard, 2013) have also been proposed. It has been reported that trauma or biomechanical forces may affect the location or presentation of lesions (Henson et al., 1997). Although trauma has been considered one of the aetiological factors, more recent studies have suggested that microtrauma might be a secondary event (van Grevenhof et al., 2009) that can cause osteochondral fragmentation and the transformation of OC *latens* into *manifesta* or *dissecans* (van Weeren and Barneveld, 1999; Ytrehus et al., 2007) in abnormal growth cartilage. Moreover, a recently published study states that increased growth and reduced or irregular physical activity during the first weeks of life could be responsible for more severe lesions (Lepeule et al., 2013).

The development of primary radiological signs of OC may appear early in life and diagnosis has been reported in a 3-day-old foal (Strömberg and Rejnö, 1978). Lesions reach a final status (persistent or resolved) between 5 and 12 months of age and there is a period during which a high percentage of lesions heal (Dik et al., 1999; Jacquet et al., 2013). This period has been reported to be before 5 months for the hock and 8 months for the stifle (Dik et al., 1999). Certain variables such as weight gain, exercise and mineral imbalance may affect the progression of the lesion instead of regression during this window of susceptibility (Barneveld and van Weeren, 1999; van Weeren and Barneveld, 1999; van Weeren et al., 1999, 2003). For juvenile osteochondral conditions, the main risk factors leading to deterioration in the radiographic score between 6 and 17 months were associated with trauma (Praud et al., 2013).

The radiographic prevalence studies that have been performed in animals >1 year of age may have underestimated the prevalence of OC because the lesions may have healed and this may be one of the reasons why breeding programmes aimed at reducing OC are not entirely effective (Ekman et al., 2009), and highlight the

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need to perform progeny testing (Ekman et al., 2009; van Grevenhof et al., 2009). The genetic background of OC is complicated, with possibly different genes affecting the predilection sites and breeds (van Weeren et al., 1999; Dierks et al., 2007; Ekman et al., 2009). For genetic studies it is important to have a clear phenotypic definition of the disorder, knowing the prevalence and relationships of the various forms.

There are no previous reports on the prevalence of OC, distribution of lesions, and interrelations between lesions in different joints in Spanish Purebred (SP) horses. Our hypothesis was that the prevalence of OC in SP is high and the aim of the present study was to assess the prevalence of OC lesions in the SP and the distribution of different types of lesions among joints.

Materials and methods

Animals

Radiographic data were obtained from 309 SP horses >1 year of age (maximal age 12 years), randomly selected from five studs distributed in different and well separated areas of Spain. All horses had a certificate from the National Stud Book and had similar management. Males and females were weaned between 5 and 6 months of age, lived in fields and had free access to exercise; they were fed a range of different concentrate feeds.

Radiography

Radiographic examinations were conducted for commercial purposes and to analyse the status of adult mares and stallions for future genetic studies. Horses were radiographed at the stud with direct digital radiography (Tru Dr, Sound Ecklin). Prior to examination all horses were sedated by administration of 0.01–0.02 mg/kg IV of detomidine hydrochloride (Domidine, Divasa-Farmavic) and 0.02–0.03 mg/kg IV of butorphanol tartrate (Torbugesic, Fort Dodge Veterinaria). A total of 10 images of the left and right forelimbs and hindlimbs were taken: lateromedial of the metacarpo(tarso)phalangeal (MCP/MTP) joints, dorsal 45° lateral–plantaromedial oblique and plantar 45° lateral–dorsomedial oblique of the tarsocrural (TC) joint, and lateromedial of the femoropatellar (FP) joint.

Predilection sites and radiological interpretation

All images were read by both authors, one of them on three occasions, blinded with regard to each other's findings, and the final diagnosis was always approved by both observers with a consensual agreement when opinions were different. FP joints were evaluated for lesions in the lateral or medial trochlear ridges of the femur (LTF and MTF); TC joints for lesions of the dorsal aspect of the intermediate ridge of the tibial cochlea, lateral or medial trochlear ridges of the talus (LTT and MTT) and the medial (MM) and lateral (LM) malleolus of the tibia; and MCP and MTP joints for lesions of the sagittal ridge of the third metacarpal/metatarsal bone. Palmar/plantar osteochondral fragments in MCP/MTP joints were not included as these are considered by many author's to have a traumatic origin (Pool, 1993; Nixon and Pool, 1995); neither were osteoarthritis of the distal tarsal joints included even if both diseases were common.

Criteria for OC included alterations in the contour (flattening or depression) of the articular margins, irregularly shaped radiolucent zones in the subchondral bone and increased radiopacity surrounding lucent zones (Lykkjen et al., 2010). Osteochondral fragments at predilection sites were recorded as osteochondritis dissecans (OCD).

At the joint level, lesions were classified as previously described (Dik et al., 1999; van Grevenhof et al., 2009) into five grades (Fig. 1): 0, normal joint contours; 1, minimal (minimal and smooth flattening) (Fig. 2); 2, mild (irregularly flattening); 3, moderate (presence of small fragment, presence of small rounded defect); and 4, severe (large fragment or fragments, with a large irregular defect) (Fig. 3).

To assess the osteochondral status at the animal level, two grading systems were applied. The first one has been previously described (van Grevenhof et al., 2009) and grades animals according to the most severe grade found in any of the animal's joints. A further grading system (ratio system) was used in the present study, expressed as a ratio calculated with a quotient where the numerator is the summation of all grades found in all joints examined and the denominator is the number of affected joints.

Statistical methods

All data analyses (SAS, version 9.2. for Windows) and the prevalence of different lesions at each site, the prevalence of affected joints and the prevalence of the different grades were calculated. Association between different lesions was assessed by Spearman correlation coefficients. Values ranged from –1 (100% negative association) to +1 (100% positive association). A value of zero indicated the absence of association. A Chi-square or Fisher's exact test was used to test for association between prevalence of lesions and gender. A Wilcoxon Sum Rank Test was used to assess if a higher grade of the lesions was found when joints were affected bilaterally when compared with unilateral affected joints in FP and TC joints. For MCP and MTP joints, a Kruskal–Wallis test was used to find association between severity grade and the number of joints affected. The level of significance was set at $P < 0.05$.

Results

There were 309 horses in the study, comprising 195 (63.1%) males and 114 (36.9%) mares, ranging from 1 to 12 years of age (median 2.2). In 158/309 (51.1%) horses, no significant lesions were detected. In 151/309 (48.8%) horses, one or more lesions were identified. Among the 151 horses with lesions, 41 (13.3%) had grade 1 lesions, 21 (6.8%) grade 2, 54 (17.5%) grade 3 and 35 (11.3%) grade 4 (Table 1). For this grading system, the most frequent grade was 3. The frequency at joint level in the 151 affected animals is displayed in Table 2.

The same number of animals ($n = 53$; 34.87%) appeared with only one or two joints affected. This means that 65.13% of the affected animals had two or more joints affected (Table 3). According to the ratio system, the most frequently ratio found was 3/1 ($n = 23$) followed by 1/1 ($n = 20$), the maximum value obtained for an animal with most severe lesions was 14/4 joints and the horse with the highest number of joints affected presented a ratio of 11/7. Results of the calculated ratios are shown in Table 4.

Femoropatellar joints

In the FP joint, lesions were diagnosed in 16 horses (5.2% of the total population), with flattening observed in three horses and fragments in 13 animals. Ten horses had lesions in the FP joint in combination with lesions elsewhere. Bilateral lesions were seen in seven horses and unilateral lesions in nine horses. Grade 3 lesions were observed in 5/16 horses (31.2%) and grade 4 OCD lesions in 8/16 animals (50%) (Table 2). All lesions were found in the LTF.

Tarsocrural joints

In the TC joint, lesions were diagnosed in 103 animals (33.3% of the total population), alone in 69 and in combination with lesions in other joints in 34 horses (Table 2). Bilateral lesions were present in 51 horses and unilateral lesions in 52 horses. Seventy per cent of all OCD lesions were classified as grade 3 and 4 lesions. The most common lesion of the TC joint was the presence of an osteochondral fragment at the dorsal aspect of the intermediate ridge of the tibial cochlea ($n = 61/103$) (59.2%); 25% of these 61 horses had lesions in other joints. The second most common lesion was flattening of, or a concave depression in the distal intermediate ridge of the tibial cochlea ($n = 26/103$) (25.2%), bilateral in 42.3% of the 26 animals, followed (as the third most frequent lesion) by osteochondral fragments at the LTT ($n = 7/103$) (6.8%), bilateral in 28.6% of the seven individuals. No lesions were detected on the MM or LM of the tibia.

Dorsal metacarpo (metatarso) phalangeal joints

In the MCP joint, lesions were recorded in 38 horses (12.3% of the total population) with grade 1 lesions observed in 25, grade 2 in eight and grade 3 in five horses. In five animals the lesions were only in the MCP joint, 22 were found in combination with the MTP joint and in 11 horses with other lesions elsewhere. Bilateral lesions were found in 28.9% of the 38 affected horses. In the MTP joint lesions were recorded in 68 horses (22% of the 309 animals) with grade 1 lesions observed in 33, grade 2 in 19, grade 3 in 15 and grade 4 in only one horse. Bilateral lesions were found in 45.6% of these animals. The most common lesion was flattening or irregularity of the sagittal ridge of the third metacarpal or metatarsal bone in 62.6% of