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Evaluation of the Prevalence of Dysplasia of the Hip in Belgian Malinois Dogs Used in Security Units in Turkey

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Abstract

This study aims to evaluate the prevalence of Dysplasia in Belgian Malinois dogs employed in security units using the British Veterinary Association (BVA)/Kennel Club (KC) scoring system. According to the Fédération Cynologique Internationale (FCI) pedigree, the study was conducted on 52 dogs registered to Kennel Club with A score hip joint structure. Standard ventrodorsal pelvis radiographs were taken by adduction with the hind limbs in full extension and femurs parallel to the spine of the dogs lying in the supine position using a stabilizer back support. Bilateral pelvic radiographs were transferred to the computer, and Norberg Angle (NA) measurements of the right and left coxofemoral joints were made on the digimizer program. Afterward, scoring was made according to the BVA/KC scoring criteria and evaluated in terms of Dysplasia according to the total score. In this study, 52 Belgian Malinois dogs were used, of which 21.1% were male, and 41% were female dogs. The average age of the dogs was measured as 1.41±0.35 years, and the average body weight was measured as 24.00±2.94 kg. Consequently, it was observed that hip joint compliance in animals was not included in the group at risk for Dysplasia, and the mean value of NA measurements was measured as 106.53 degrees for the right coxofemoral joint, as 105.74 degrees for the left coxofemoral joint, and the mean value of the total hip score was measured as 3.42.

Keywords: Belgian malinois, BVA/KC hip score, dysplasia of the hip.

INTRODUCTION

The use of dogs has an essential place in security units. These dogs are used to locate narcotic substances, explosives, and people trapped in the dent, which are of great importance to human safety. Because of all these reasons, athletic dogs that can smell good are preferred for safety. The Belgian Malinois dog, a protective, gentle, resilient, and energetic temperament, is one of these dogs. Because of all these features, it is frequently preferred in both herds and security forces due to their superior performance in search, rescue, and agility. These dogs are also used for essential duties as patrol and guard dogs. During their duties in the security forces, a significant load is placed on the musculoskeletal systems. Problems in the musculoskeletal system that prevent these animals from performing their duties cause them to leave active service for this reason. It is reported that the most critical problem that causes Belgian Malinois dogs to leave their active duties or be euthanized is Dysplasia of the hip and secondary osteoarthritis. Dogs with dysplasia of the hip due to radiographic examination are generally not selected as military or police dogs, but some dogs with mild to moderate Dysplasia of the hip are admitted into security units training programs (Banfield et al., 1996; Moore et al., 2001). A study conducted reported that the number of months in which dogs with degenerative joint disease from Dysplasia of the hip can work is not significantly different compared to the number of months in which dogs without Dysplasia can work (Banfield et al., 1996).

Dysplasia of the hip is the abnormal development of the coxofemoral joint characterized by subluxation / luxation of caput femoris in young animals and mild/severe DJD in older animals. It is a multifactorial disorder inherited, and environmental factors play a role in abnormal bone and soft tissue development (Fossum, 2013). Although many theories explain joint degeneration, joint laxity and irregular/delayed endochondral ossification are the most popular among them (Todhunter and Lust, 2003). Due to the abnormal stress in the joints as a consequence of delayed endochondral ossification, partially ossified hip joint structures may be disrupted. Structures that make up the hip joint may be more defenceless to damage from normal joint kinetics before endochondral ossification is complete (Madsen et al., 1991).

In Dysplasia of the hip, stability is reduced due to excessive looseness of joint capsule and ligaments and incompatibility of caput femoris with acetabulum (Stock and Distl, 2010). The disorder is painful in young animals, as the erosion of the joint cartilage exposes pain fibers in the subchondral bone, and the laxity causes the soft tissues to stretch. In the elderly, the disorder causes pain because it causes osteoarthritis (Fossum, 2013).

Different methods are used to determine Dysplasia of the hip in dogs. The Pennsylvania Hip Improvement Program (PennHIP) system tests the hip joint capsule for passive laxity (PennHip, 2007). Fédération Cynologique Internationale (FCI), Orthopedic Foundation of Animals (OFA), and British Veterinary Association/Kennel Club (BVA/KC) allow the determination of both bone conformation and osteoarthritis and coxafemoral joint subluxation. Other methods that test functional subluxation include dorsolateral subluxation projection and the Flückiger method (Todhunter and Lust, 2003). The

Norberg angle (NA), which aims to measure the position of the femoral head relative to the acetabulum, is measured on a standard ventrodorsal stretched leg wide pelvis radiography (Henricson et al., 1966).

This study conducted using the BVA/KC scoring system, which is frequently used in diagnosing Dysplasia of the hip in dogs in recent years. It was aimed to evaluate Belgian Malinois dogs trained for use in security units in Turkey in terms of Dysplasia of the hip.

MATERIALS AND METHODS

Permission was obtained from the "Kırıkkale University Clinical Practices Ethics Committee," and the animal owners were informed about the study, and a consent form was obtained for this study. 52 Belgian Malinois dogs brought to our country from abroad for use in security units and requested to be examined for Dysplasia of the hip at the veterinary faculty constituted the study material. Brought animals were Kennel Club registered animals with A score hip joint structure according to FCI pedigree. Blood was collected from the animals before sedation, and the animals determined to be healthy in consequence of biochemical analysis were included in the study. Animal owners were informed about sedation one day before the procedure, and animals have fasted for 12 hours before sedation; no restrictions were made on water.

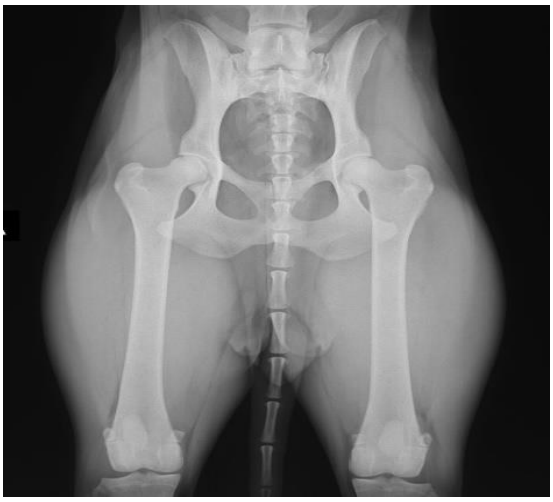

Figure 1. Standart ventrodorsal pelvis radiohraph

Animals had sedation with medetomidine (80 micrograms/kg) (Zoetis, U.S). Animals were placed in a supine position using stabilizing back support, posterior limbs caudally fully stretched in standard ventrodorsal position, the femurs were adducted until they were parallel to each other, and the spine and bilateral standard ventrodorsal (SVD) pelvis radiographs were taken (Figure 1). Care was taken to ensure that the pelvis radiographs were symmetrical, and re-radiographs were taken when necessary. The taken radiograms were transferred to the computer. NA measurements of the right and left coxofemoral joints of each animal were made in Digimizer (Digimizer version 5.6.0, Copyright © 2005-2021 MedCalc Software Ltd.) program (Figure 2), scoring was made according to BVA/KC scoring criteria, and scores of all criteria were summed up and evaluated in terms of Dysplasia according to the total score (Dennis, 2012; Flückiger, 2007) (Tables 1, 2 and 3).

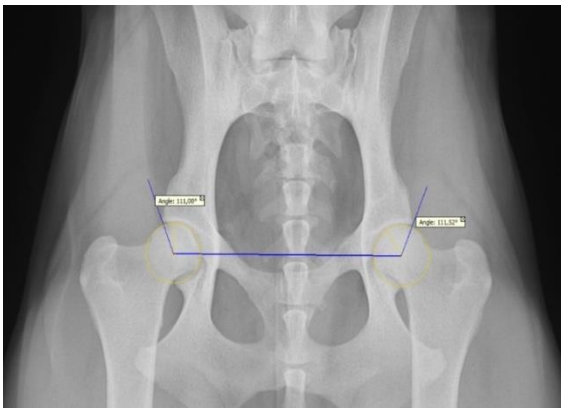

Figure 2. Measuring the Norberg angle of hip joints.

RESULTS

In the study conducted, a total of 52 Belgian Malinois dogs were used, and their ages and body weights were determined as 1.41±0.35 and 24.00±2.94 (mean±SD), respectively. Of the dogs, 11 (21.1%) were male, and 41 (78.9%) were female. The animals included in the study were evaluated according to the BVA/KC hip joint compliance score, and the total score was evaluated with NA values and NA scores of the right and left hip joints; and in general, it was observed that hip joint compliance in animals was not included in the risk group in terms of Dysplasia (Table 4). In the evaluation of Dysplasia with NA measurement, varying degrees of Dysplasia were determined in 17 animals (32.6%). When considering Dysplasia by measuring the Norberg angle of the right coxofemoral joint, 1st-degree Dysplasia was detected in 8 animals (15.3%) and 2nd-degree Dysplasia 1 animal (1.9%). In the evaluation of Dysplasia of the left coxofemoral joint, on the other hand, 1st-degree Dysplasia was detected in 10 animals (19.2%), 2nd degree (1.9%) in 1 animal, and 3rd-degree Dysplasia in 1 animal (1.9%). Bilateral Dysplasia of varying degrees was observed in 4 (7.6%) of all animals. According to the result of the total scores, it was determined that 38 animals had a total score in the range of 0-4 (73.08%), 13 animals in the range of 5-10 (25%), and 1 animal in the range of 11-20 (1.92%).

Table 1. Scoring for hip dysplasia according to BVA/KC using 9 different criteria.

Score per parameter	Norberg Angle (°)	Subluxation	Cranial acetabular edge (CrAE)	Dorsal acetabular edge (DAE)	Cranial effective acetabular rim (CrEAR)	Acetabular fossa (AF)	Caudal acetabular edge (CaAE)	Femoral head and neck exostoses	Femoral head recontouring
0	105 and over	Femoral head well centred in acetabulum	Even curve, parallel to femoral head throughout	DAE has slight curve	Sharp, clean cut junction of the DAE and CrAE	Fine bone line curves medial and caudal from the caudal end of the CrAE	Clean line	Smooth, rounded profile	Nil

Table 1. (continued)

Score per parameter	Norberg Angle (°)	Subluxation	Cranial acetabular edge (CrAE)	Dorsal acetabular edge (DAE)	Cranial effective acetabular rim (CrEAR)	Acetabular fossa (AF)	Caudal acetabular edge (CaAE)	Femoral head and neck exostoses	Femoral head recontouring
1	100 to 104	Femoral head centre lies medial to DAE. Lateral or medial joint space increases slightly.	Lateral or medial ¼ CrAE flat and lateral or medial joint spaces diverge slightly	Loss of S curve only in the presence of other dysplastic change	Indistinct junction of the DAE and CrAE	Slight increase in medial bone density. The 'fine line' is hazy or lost	Small exostosis at the lateral edge	Slight exostosis in 'ring form' and/or dense vertical line adjacent to the trochanteric fossa ('Morgan line')	Femoral head does not fit in a circle due to exostosis or bone loss
2	95 to 99	Femoral head centre superimposed on DAE. Medial joint space increase obvious.	CrAE flat throughout most of its lenght	Very small exostosis on cranial DAE	Very small exostosis or very small facet	'Fine line' is lost and the ventral AE is hazy due to new bone. The notch at the CaAE is clear	Small exostosis at the lateral and medial edge	Slight exostosis visible on the skyline and/or density on the medial femoral head	Some bone loss and/or femoral head/neck ring of exostosis
3	90 to 94	Femoral head centre just lateral to DAE. ½ femoral head within acetabulum.	CrAE slight bilabiation	Obvious exostosis on DAE especially cranially and/or minör "loss of edge"	Facet and/or small exostosis and/or slight bilabiation	Incomplete remodelling of the acetabulum, with the medial face lateral to the AF. The ventral AE is lost, the AF is hazy and the notch is irregular	Large exostosis and narrow notch	Distinct exostosis in 'ring form'	Obvious bone loss and distinct exostosis giving a slight conical appearance
4	89 to 85	Femoral head centre clearly lateral to DAE. ¼ femoral head within acetabulum.	CrAE moderate bilabiation	Exostosis well lateral to DAE and/or moderate "loss of edge"	Obvious facet and/or obvious exostosis and/or moderate bilabiation	Marked remodelling. The medial face of the acetabulum is clearly lateral to AF. The ventral AE is lost and the notch is partly closed	Marked exostosis and 'hooking' of the lateral end	Obvious complete collar of exostosis	Gross remodelling. There is obvious bone loss and exostosis gives a mushroom-like appearance
5	84 to 80	Femoral head centre well lateral to DAE. Femoral head just touches DAE.	CrAE gross bilabiation	Marked exostosis all along DAE and/or gross "loss of edge"	Gross exostosis and/or facet and/or gross bilabiation	Gross remodelling, with dense new bone throughout the acetabulum. The CaAE notch is lost and the AF is obscured	Gross distortion due to mass of new bone in the acetabulum. The notch is lost completely	Massive exostosis giving a mushroom-like appearance	Very gross remodelling with marked bone loss and much new bone
6	79 and less	Complete pathological dislocation	Entire CrAE slopes cranially	Massive exostosis from cranial to caudal DAE	Complete remodelling. Massive exostosis and/or gross facet	Complete remodelling and new articular surface, well lateral to the AF. The notch is lost	Void	Massive exostosis and infill of the trochanteric fossa and below the femoral head	Femoral head is improperly shaped due to maldevelopment of the femoral head centre

Table 2. BVA/KC hip joint harmony criteria and score ranges for each criteria (Flückiger, 2007).

Criteria	Score
Norberg Angle	0 – 6
Subluxation	0 – 6
Cranial acetabular edge (CrAE)	0 – 6
Dorsal acetabular edge (DAE)	0 – 6
Cranial effective acetabular rim (CrEAR)	0 – 6
Acetabular fossa (AF)	0 – 6
Caudal acetabular edge (CaAE)	0 – 5
Femoral head and neck exostoses	0 – 6
Femoral head recontouring	0 – 6

Table 3. Evaluation of the hip joint in terms of dysplasia and degenerative joint disease according to total scores (Dennis 2012).

Total score	Dysplasia interpretation according to total hip score
0-4	Perfect or near perfect hips
5-10	Borderline changes that are unlikely to worsen with age
11-20	Mild changes that may worsen with age, sometimes developing into osteoarthritis
21-50	Moderate to marked hip dysplasia in which osteoarthritis is already a prominent feature, or severe hip dysplasia before arthritic changes
50+	Severe to very severe osteoarthritis secondary to hip dysplasia

Table 4. Norberg angle values of right and left hip joints with Norberg angle and total score according to the BVA/KC.

	N	Minimum	Maximum	Mean	SD
NA (R)	52	96.4	113.9	106.53	3.44
NA (L)	52	92.9	113.4	105.74	3.65
NA score (R)	52	0	2	0.21	0.45
NA score (L)	52	0	3	0.29	0.60
Total score	52	0	12	3.42	2.55

DISCUSSION AND CONCLUSION

Dysplasia of the hip is a developmental orthopedic disorder that can lead to coxofemoral subluxation and degenerative joint disease in the hip joint. Along with it can be observed in dogs of all breeds, it is reported that it is more common in some breeds. Therefore, many publications on race predisposition are encountered (Reagan, 2017). Different scoring techniques continue to be used in the diagnosis of Dysplasia of the hip. While some of the techniques can be used in dogs between the ages of 1 and 2, some can be used on dogs 2 years and older (Flückiger, 2007; Gibbs, 1997). In the study conducted, BVA/KC scoring technique was selected from the applications because the age range of the animals varied between 1-2. According to this scoring technique, animals must be at least 1 year old (Dennis, 2012). It is stated that the females of the Belgian Malinois dogs, which are healthy and fit, are in the range of 20-25 kg, and the males are in the range of 25-30 kg (Fogle, 2009). It is reported that animals should be under sedation or anesthesia to perform the radiological evaluation in the BVA/KC hip dysplasia score technique. Animals ready for radiographic imaging should be placed on their back to take a hips-extended ventrodorsal view (Gibbs, 1997). The animals in the study conducted are in the range of 1-2 years, the average body weight is 24 kg, and complies with the specified studies and data. Animals were placed under general anesthesia, and in the supine position, the hind limbs caudally stretched, ventrodorsal radiography was taken to include the entire pelvis and knee joint, under the studies indicated.

In many countries, there are many scientific publications in which epidemiological and genetic studies of Dysplasia of the hip are conducted to evaluate the Dysplasia of the hip using different scoring techniques. In these studies, the general condition of the hip joint and all problems related to the joint were examined radiographically. With the BVA/KC scoring technique, it is possible to calculate an average (mean) score for each dog breed and thus evaluate the hip condition relative to others in its breed. For most dog breeds, the average total scores are regularly published by the BVA. In the results published, in the review performed on 164 Belgian Malinois dogs, the average total score was reported to be 9. In the studies conducted, it was statistically demonstrated that there is a strong, positive association between hip scores of parents, grandparents, and young animals and that the genetic inheritance of Dysplasia of the hip is moderate to highly influential. It was reported that the total hip joint score, Norberg angle, and the degree of subluxation are fundamental in terms of genetic susceptibility (Lewis et al., 2010; Wood et al., 2000; Zhang et al., 2009). The dogs used in the study are the young animals of the genetically good FCI pedigree animals in different countries. The scoring technique used evaluates all the details of the hip joint and, as a result of this, generates a total score. Considering the obtained total hip scores, Norberg angles, and subluxation status, it is noticeable that the dogs used in the study were without risk in Dysplasia. It is thought that this situation may be related to the fact that the parents of the dogs received in the study were negative for hip dysplasia and supported the information that Dysplasia of the hip was inherited from the parents to the young animal. Besides, it is seen that the total hip scores are in accord with the total hip scores published by the BVA according to the races.

Studies were conducted on the prevalence of Dysplasia of the hip on different dog breeds in different countries. In the studies conducted, different scoring techniques were used. The A score in the FCI system, a perfect score in the OFA system, and a 0-4 score in BVA/KC system in these studies express the conditions that do not have Dysplasia of the hip radiographically and have excellent hip joint compliance. When a hip joint is more than 20 according to the BVA/KC system, C, D, or E in the FCI system and mild to a high degree affected in the OFA system, it is reported to be dysplastic radiographically. Thanks to the compatibility of these different scoring techniques, different scoring system data in different countries can be compared (Keller, 2006; Morgan et al., 1999; Swenson et al., 1997). In a study conducted by Coopman et al. (2008) on the prevalence of Dysplasia of the hip in dog breeds in Belgium, it was reported that 93% of 88 Belgian Malinois dogs were non-dysplastic, 7% were suspected Dysplasia, and 7% were mild to severe Dysplasia. The prevalence of hip dysplasia in dog breeds in different years in different countries has been investigated in another study, and according to this study, the prevalence of Dysplasia of the hip in Belgian Malinois breeds was determined as 7% in Belgium, 6% in the USA and 20% in the UK (Corley, 2000; Lawson, 2000; Morgan et al., 1999; Smith, 2005). The BVA/KC score system was used in the presented study, and according to the results obtained, the prevalence of Dysplasia of the hip was determined as 2%. The lower prevalence of Dysplasia of the hip in the study compared to previous studies in different countries is thought to be because the animals used in the study were Kennel Club registered and descended from animals with the best hip joint compliance according to the FCI pedigree. Even considering previous studies, Belgian Malinois dogs appear to have a lower prevalence of hip dysplasia than other breeds (Coopman et al., 2008).

Dysplasia of the hip can occur unilaterally or bilaterally in dogs. In the studies conducted, it is reported that the prevalence of Dysplasia of the hip in female dogs is higher than in male dogs. Nevertheless, it is stated that this situation may vary as it may be related to the sex ratio of the animals included in the study (Morgan et al., 1999; Wood et al., 2000). In their study on the prevalence of Dysplasia of the hip in German shepherd dogs, Han and Durmuş (2006) were determined that Dysplasia was seen more in female dogs and that unilateral Dysplasia of the hip was seen much more than bilateral Dysplasia. In their study on Sivas Kangal dogs, Bakır et al. (1992) were stated that Dysplasia of the hip was more common in female dogs. In the presented study, it is seen that the rate of Dysplasia is high in female animals. However, it is thought that this situation was taken form since the female animals

used in the study were relatively high compared to the males, and it may be misleading to determine the prevalence of Dysplasia by gender with this result. Considering the total number of dysplasia animals, it is seen that the prevalence of the number of bilateral dysplastic animals (7.6%) is much lower than unilateral Dysplasia.

Consequently, genetically problem-free animals are members of internationally recognized organizations such as the Kennel Club, with FCI pedigree, and the younglings thereof appear to have minimal hip dysplasia. It is seen that the selection and production of animals with a pedigreed and hip joint score near perfect can be beneficial in minimizing such problems.

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Conflict of Interest

The authors declared that there is no conflict of interest.

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