Shahid Bahonar University of Kerman

Veterinary and Comparative Biomedical Research

Original Research

Doi:10.22103/Vcbr.2024.23282.1014

Radiological study of the incidence of coxofemoral joint dysplasia in dogs using Norberg angle index method

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Article history:

Received: 11 March 2024
Revised: 28 April 2024
Accepted: 06 May 2024
Published: 12 May 2024

Keywords:

Coxofemoral Joint
Dogs
Dysplasia
Norberg Index

Abstract Canine hip dysplasia is a joint laxity and osteoarthritis (OA) of the coxofemoral joints in dogs. The aim of this study was to investigate the incidence of hip dysplasia in suspected cases of the disease. A total of 91 litters of dogs with clinical signs of sacroiliac joint dysplasia referred to the Radiology Department of the Urmia Branch of the Faculty of Veterinary Medicine between April 2021 and June 2023 were examined using the Norberg angle radiography method. According to the results of this study, the incidence of this disease was higher in large breed dogs (90.55%) than in small breed dogs, and among large breed dogs, the highest incidence of this disease was observed in the German Shepherd breed (37.12%). The incidence of this disease in puppies under one year of age (55.12%) was higher than in other age groups, and the incidence in females (38.46%) was lower than in males. The bilateral form of this disease (89.25%) predominated over the unilateral form, and in the unilateral form, the left pelvic joint (60.15%) was more commonly affected than the right pelvic joint. The highest incidence of this disease has been observed in large breed dogs, but it has also been observed in medium and small breed dogs such as Shih Tzu, Pomeranian and Yorkshire Terrier. Primary complications of dysplasia of the sacroiliac joint include the development of osteoarthritis and/or degenerative joint disease, while secondary complications include displacement and subluxation of the sacroiliac joint. It is necessary to screen both male and female dogs for this disease prior to mating, and if positive, breeding should be prevented.

Introduction

Hip dysplasia is one of the most common joint diseases in dogs, causing pain and functional impairment [4, 8]. This condition is congenital and hereditary, is typically seen in large breeds, and breeds with rapid growth (over 12-15 kg). In this condition, the acetabulum does not develop properly and the femoral head undergoes incomplete or complete subluxation [9]. As the disease is progressive and its complications increase over time, degenerative joint disease manifestations are also observed in the affected joint. Genetics (85-25%), nutritional conditions, and rapid growth are important factors that contribute to the development of this disease

[1, 5, 13]. The presence of any of the main risk factors can lead to weight-bearing problems on the affected limb, resulting in joint laxity and subsequent osteoarthritis [14]. Radiological evaluation, such as the Norberg angle, is a useful method of assessing canine hip dysplasia in puppies under 6 months of age [6, 7, 11]. The aim of this study was to prediction of the canine hip dysplasia in different dog breeds.

Materials and Methods

Animals

In this study, we used 91 litters of dogs from different breeds with clinical signs of hip dysplasia that were referred to the radiology department of the specialized small animal clinic of the Faculty of Veterinary Medicine, Islamic Azad University, Urmia Branch, from April 2021 to June 2023. The dogs were suspected of having hip dysplasia and the Norberg angle radiographic method was used to confirm the clinical diagnosis of the disease.

Study protocol

For this purpose, the animal was injected with a sedative (Acepromazine: 0.5-2.2 mg/kg) to prevent additional movement during radiography and to ensure accurate positioning. If the thickness of the pelvic region exceeded 15 centimeters, a grid was used. The animal was placed in ventrodorsal recumbency with the hind limbs were parallel to each other and pulled backward. This position ensured that the inner cortex of each femur rested on the femoral head prominence. The hind limbs were rotated slightly inward to bring the trochanter to the forefront of the femur. Internal rotation of the stifle joint allowed the neck of the femoral head to be clearly visualized on the radiograph. The two halves of the pelvis were placed completely parallel and symmetrically, and the tail should not be positioned upwards during radiography. The center of the X-ray beam was directed at the hip joint during radiography.

The Norberg angle radiological method was used to assess hip dysplasia. After obtaining a ventrodorsal pelvic radiograph with fully extended hind limbs and perfectly symmetrical pelvic halves, a line was drawn from the center of one femoral head to the center of the other femoral head on the radiograph. A line was then drawn from the center of each femoral head to the anterior edge of the acetabulum. An angle was formed between these two lines, and if this angle was less than 105 degrees, it indicated hip dysplasia (Figure 1).

Fig. 1. Ventrodorsal recumbency from the pelvic region with fully extended hind limbs and symmetrical

Statistical analysis

Data were expressed as mean values ± standard deviation (SD). All Statistical analyses were performed using SPSS 20 (SPSS for Windows, SPSS Inc, Chicago, Illinois). Differences were considered statistically significant when the calculated P value was less than 0.05.

Results

Out of a total of 91 dogs screened for hip dysplasia using the Norberg angle radiographic method, the incidence of this disease was observed in the following breeds German Shepherd (37.12%), Labrador Retriever

(25.27%), Great Dane (9.50%), Shih Tzu (6.75%), Golden Retriever (4.60%), Rottweiler (4.44%), Doberman Pinscher (3.11%), Kangal (2.93%), Afghan Hound (2.70%), Dachshund (2.58%), and approximately one percent in other breeds (Table 1).

Table 1. The incidence of hip dysplasia in different breeds of dogs

Breed	Incidence of HD (%)	Mean age (year)	Mean weight (Kg)
German Shepherd	37.12*	2.90±0.11	29.20±2.01
Labrador Retriever	25.27	3.34±0.19	31.45±1.85
Great Dane	9.50	3.11±0.02	65.45±2.42
Shih Tzu	6.75	4.09±0.50	5.91±1.52
Golden Retriever	4.60	3.25±0.36	27.37±3.65
Rottweiler	4.44	4.33±0.12	41.21±2.09
Doberman Pinscher	3.11	5.01±0.19	45.02±3.19
Kangal	2.93	3.23±0.56	51.53±2.36
Afghan Hound	2.70	2.12±0.14	25.65±1.11
Dachshund	2.58	2.05±0.42	4.71±2.21
Other breeds	1	-	-

*All values were expressed as the Mean±SD, and P ≤ 0.05was used as statistical significance.

The incidence of this disease was higher in large breeds (90.55%) compared to small breeds, with the highest incidence observed in the German Shepherd breed (37.12%). The incidence of this disease was higher in young dogs under one year of age (55.12%) compared to other age groups. The prevalence in female dogs (38.46%) was lower than in male dogs. The bilateral form of the disease (89.25%) predominated over the unilateral form, with the left hip joint (60.15%) being more affected than the right hip joint. Examples of radiographs showing bilateral and unilateral forms of this disease are shown in Figures 2 and 3 respectively. Based on our results, there was no correlation between weight and incidence of hip dysplasia.

Discussion

The results of this study showed that the incidence of hip dysplasia was higher in large breeds (55.90%) than in small breeds, with German Shepherds (12.37%) having the highest incidence. This may be due to their greater body weight and size, or to the loss of muscular structures around the hip, particularly the pectineus muscle, and its effect on hip joint function. In affected dogs, the pectineus muscle is pulled in a particular direction, causing the femoral head to be pulled and dislocated from the acetabulum. Muscle stiffness is the main cause of joint laxity [10]. The incidence of this disease in the age groups was as follows: more than three months to one year (12.55%), more than one year to three years (70.14%), more than three years to six years (27.17%), more than six years to nine years (35.7%) and more than nine years (35.7%). The highest incidence of this disease was in the age group more than three months to one year, which is consistent with the study by King et al in 2017 [2]. The incidence of this disease in female dogs (46.38%) was lower than in male dogs, which is consistent with the study by Mikkola et al. in 2019 [3].

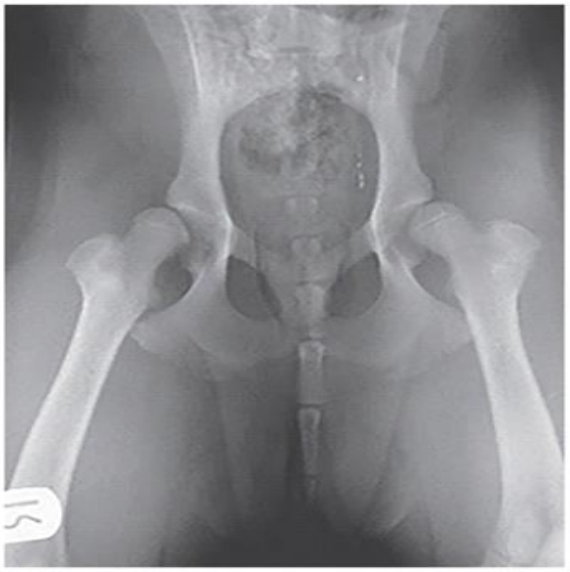

Fig. 2. Hip dysplasia and incomplete luxation in both hip joints in a 3-year-old female German Shepherd dog.

In this study, the bilateral form of the disease (25.89%) was more common than the unilateral form. In the unilateral form, the left hip joint disorder (15.60%) was more common than the right hip joint disorder. The most appropriate

time to evaluate this disease by radiographic method is in 5-6 month old puppies [12]. The primary consequences of hip dysplasia are the development of osteoarthritis and degenerative joint disease, while the secondary consequences include displacement and dislocation of the hip joint.

Fig. 3. Hip dysplasia in an adult Labrador Retriever dog. Severe changes are visible in the acetabular cavities and femoral heads. The right femoral head is more than 50% dislocated.

Conclusion

It is necessary to screen male and female dogs for this disease prior to mating and, if positive, to prevent mating. As the disease is hereditary, neutering of males and ovariectomy of females are recommended as preventative measures.

Acknowledgements

This study was supported by Faculty of Veterinary Medicine, Urmia Branch, Islamic Azad University, Urmia, Iran.

Conflict of interest

The authors declare that there is no conflict of interest.

Ethical approval

For this type of study formal consent is not required.

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How to cite this article:
Dadashzadeh, M., Alizadeh, S. Radiological study of the incidence of coxofemoral joint dysplasia in dogs using Norberg angle index method. Veterinary and Comparative Biomedical Research, 2024, 1(1): 78 – 82. http://doi.org/10.22103/Vcbr.2024.23282.1014