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Evaluation of Vertebral Heart Score and Cardiac Sphericity in Apparently Normal Dogs

Mu'azu Nuhu Bappah[1]*, Nuhu Donga Chom[2], Maruf Lawal[1], Abdullaziz Abdullahi Bada[1], Saidu Tanko Muhammad[3]

[1] Department of Veterinary Surgery and Radiology, Ahmadu Bello University, Zaria, Nigeria. [2] Department of Radiology, Ahmadu Bello University Teaching Hospital, Shika, Nigeria. [3] Veterinary Teaching Hospital, Ahmadu Bello University, Zaria, Nigeria.

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ABSTRACT

The objectives of this study were to evaluate the relationship between vertebral heart score and cardiac sphericity and to evaluate gender variation in both dimensions in apparently normal Nigeria indigenous dogs. Twelve (six males and six females) apparently normal Nigerian indigenous dogs were selected from dogs in Zaria, Nigeria. Radiographic evaluations involved left lateral views of the thoracic region of the dogs. The vertebral heart size was measured as the sum of the long-axis and short-axis at its greatest diameter then compared with the vertebra bones starting at T4. Cardiac sphericity was obtained by computing the ratio of the long-axis to the short-axis. The mean ± SD for vertebral heart score and cardiac sphericity index in apparently normal Nigerian indigenous dogs were 9.3 ± 0.44 and 0.77 ± 0.06 respectively. Pearson coefficient revealed a significant (p = 0.001) and very strong correlation (p = 0.81) between vertebral heart score and cardiac sphericity index in Nigerian indigenous dogs. There were no gender variations in both dimensions. This study revealed the existence of a strong relationship between vertebral heart score and cardiac sphericity index in dogs in apparently normal Nigerian indigenous dogs, and both dimensions demonstrated no gender variation. Vertebral heart score and cardiac sphericity index in apparently normal Nigerian indigenous dogs are expressed as ideal cardiac dimensions which are suggested to be useful quantitative and objective parameters in the diagnosis of cardiac disorders in dogs.

Introduction

Cardiac disorders had recently been implicated to be among serious health challenges in dogs.[1] Radiological examination was the most common modality for evaluating cardiac changes in small animals.[2] Vertebral heart score was the radiographical technique of choice for evaluating cardiac anomalies in dogs with no significant inter-observer variation.[3] Vertebral heart score was introduced by Bucheler and Buchanan,[4] as a convenient method to objectively assess cardiac size changes in relation to progression or

* Correspondence to: Mu'azu Nuhu Bappah, Department of Veterinary Surgery and Radiology, Ahmadu Bello University, Zaria, Nigeria. E-mail: mnbappah@abu.edu.ng

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response to treatment of cardiomegaly.[5] Vertebral heart score was considered as a breed-specific dimension[6] with no differences with age[7] and gender, and having a normal range between 8.5 to 10.6 vertebrae.[5] Its clinical application in dogs has been reported.[3,8-13] However, vertebral heart score has limited use, because it fails in the assessment of cardiac circularity.[14]

Cardiac sphericity index can be used to assess the globe-shaped heart as well as its chambers. Cardiac sphericity index of ≥ 1.0 translate into a near round figure which may suggest cardiac disorder and its clinical importance has already been reported in dogs.[15] There was a dearth of information regarding the vertebral heart score and cardiac sphericity index in Nigerian indigenous dogs, which these dimensions can be useful in the diagnosis and monitoring of cardiac diseases.[3,9,10,12,16,17] Therefore, this article was aimed to evaluate the relationship between vertebral heart score and cardiac sphericity, and evaluate gender variation in both dimensions in apparently normal Nigeria indigenous dogs.

Materials and Methods

Research Animals

Twelve (six males and six females) apparently normal Nigerian indigenous dogs were selected from dogs in Zaria, Nigeria. They were acclimatized for two weeks. Normal hemogram, 3 out of 5 body condition score and absence of physical deformities were the selection criteria.

Radiographic Procedure

Radiographic evaluations for vertebral heart score involved left lateral views of the thoracic region of the dogs. Each dog was physically restrained and positioned with the support of sandbags and ropes for the lateral radiographic views of the thoracic region. The head and neck were also extended and secured. The beam was centered between the fifth and sixth intercostal space and collimated from the caudal edge of the scapula to the cranial abdomen then expose at peak of inspiration. The focal film distance was set at 100 cm with zero degrees (0^o) tube head angulation. The exposure factors were set as follows: 60-75 kilovolts (kV), 25 milliamperes (mA) and 3 milliamperes per second (mAs) using mobile x-ray machine (Recorders and Medicare systems (P) Ltd model MDX-100) and processed digitally using Fuji® scanner.

Vertebral Heart Score and Cardiac Sphericity Index Determinations

Vertebral heart score was measured as the sum of the long-axis (ab) and short-axis (cd) at its greatest diameter then compared with the vertebra bones starting at T4, according to Bucheler and Buchanan.[4] While, cardiac sphericity index was obtained by computing the ratio of the long-axis (ab) to the short-axis (cd) (cd: ab) as described by Mostafa *et al*.[17] as demonstrated in Figure 1.

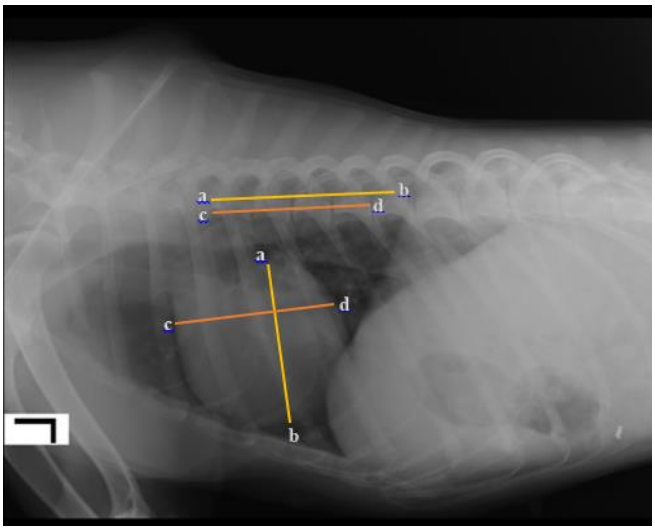

Figure 1: Measurement of vertebral heart score as sum of short axis (ab) and long axis (cd) to the nearest vertebrae

Data Analysis

Data collected from the vertebral heart score and cardiac sphericity index measurement in the dogs were subjected to statistical analysis using Graph Pad Prism® (version 4.0 for Windows, San Diego California, USA), and mean ± SD were determined. Pearson coefficient correlation was used to evaluate the relationship between vertebral heart score and cardiac sphericity index, and T-test was used to compare the sex variation in vertebral heart score and cardiac sphericity index. Value of $p \leq 0.05$ was considered significant.

Results

The mean ± SD for vertebral heart score and cardiac sphericity index in apparently normal Nigerian indigenous dogs were 9.3 ± 0.44v and 0.77 ± 0.06 with range limits between 8.7–10.2v and 0.69–0.92 respectively. The mean ± SD for vertebral heart score and cardiac sphericity index in the male Nigerian

indigenous dogs was 9.5 ± 0.51v (8.9–10.2v) and 0.78 ± 0.08 (0.69–0.92) respectively. While in the female Nigerian indigenous dogs, the mean ± SD for vertebral heart score and cardiac sphericity index were 9.3 ± 0.33v (8.7–9.6v) and 0.76 ± 0.03 (0.72–0.80) respectively.

Pearson coefficient revealed a significant (p = 0.001) and very strong correlation (p = 0.81) between vertebral heart score and cardiac sphericity index in apparently normal Nigerian indigenous dogs. There were no gender variations in the vertebral heart score (p = 0.21) and cardiac sphericity index (p = 0.75) in Nigerian indigenous dogs.

Discussion

In this research, it was observed that the mean ± SD for vertebral heart score and cardiac sphericity index in apparently normal Nigerian indigenous dogs were 9.3 ± 0.44v and 0.77 ± 0.06 respectively. Similarly, the mean of vertebral heart score in some breeds of dogs are as follows; 9.76 ± 0.68v in Khorasan indigenous dogs,[18] 9.72 ± 0.73v in Poodle,[19] 10.03 ± 0.11v in Spitz, 10.22 ± 0.20v in Labrador retriever,[20] 9.3v in Pekingese, 9.2v in Bichon, 9.8v in German Shepherd, 10.9v in German Brack and 9.5v in Mongrel dogs.[21] The variations in values of vertebral heart score in these various breeds of dogs could be attributed to differences in chest conformation[5] and length of vertebrae[22] among these various breeds of dogs. Though, Lamb *et al*. believed that the normal limit of vertebral heart score should be a breed-specific value which can be useful in the diagnosis of cardiac diseases.[22] To the best of our ability, there is limited information on cardiac sphericity index in the various breed of dogs but Mostafa *et al*. reported 0.77 (77%) and 0.81 (81%) as the mean of cardiac sphericity index in large and small breed of dogs respectively.[17]

It was also observed a very strong relationship between vertebral heart score and cardiac sphericity index in apparently normal Nigerian indigenous dogs. However, a poor relationship was reported between vertebral heart score and cardiac sphericity index in small-breed dogs.[16] There were no gender variations in both the cardiac dimensions in Nigerian indigenous dogs. Similar findings in vertebral heart score were reported in Poodle,[19] Spitz, Labrador retriever and Mongrel dogs.[20] Non-significant gender differences could be attributed to no distinct differences in body weight and size of males and females of the same breed.[20] However, Jepsen-Grant *et al*. reported gender variation in several dog breeds.[23] Vertebral heart score and cardiac sphericity index demonstrated as an ideal cardiac dimension with no gender variation that can be useful in the diagnosis and monitoring of cardiac diseases in dogs. Moreover, the vertebral heart score has been considered as the best cardiac dimension for diagnosis of cardiac anomalies in dogs with little interobserver differences[4,24] and also allow inexperience diagnosticians to recognize cardiomegaly.[5] Vertebral heart score was reported to have a good relationship with echocardiographic and electrocardiographic parameters.[3] Sleeper *et al*. reported vertebral heart score of more than 9.3v as specific for cardiac disease in cats.[25] Cardiac sphericity index is considered as a complementary parameter to evaluate the globe-shaped heart, which the vertebral heart score is deficient.[14] Cardiac sphericity index is an important parameter in cardiomyopathies involving left-sided and right-sided cardiomegaly[17] but may be less relevant in the case of generalizing cardiomegaly because both the long-axis and short-axis increases proportionally.[3] Right-sided cardiomegaly has increased cardiac sphericity than left-sided cardiomegaly which consequently means the right-sided cardiomegaly will be more spherical than left-sided cardiomegaly.[17] Vertebral heart score and cardiac sphericity index are suggested to be a useful quantitative and objective parameters in the diagnosis of cardiac disorders in dogs.

Conclusively, this study revealed the existence of a strong relationship between vertebral heart score and cardiac sphericity index in dogs in apparently normal Nigerian indigenous dogs, which translate both dimensions are suggested to be a useful quantitative and objective parameter in the diagnosis of cardiac disorders in dogs. Vertebral heart score and cardiac sphericity index in apparently normal Nigerian indigenous dogs are expressed as an ideal cardiac dimension with no gender variation.

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Conflict of Interest

There is no conflict of interest associated with this article.

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