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STUDY OF THE CORRELATION BETWEEN A RADIOGRAPHIC SIZE AND TWO ECHOCARDIOGRAPHIC SIZES IN DOGS WITH MYXOMATOUS MITRAL VALVE DEGENERATION

Atanas Pankov

University of Forestry, Faculty of Veterinary medicine, Sofia, Bulgaria
E-mail: pannkov@abv.bg

ABSTRACT

In dogs with myxomatous mitral valve degeneration, the correlation between the radiographic left atrial dimension RLAD and two echocardiographic sizes has been examined. The dogs without pulmonary edema showed a low degree of correlation between RLAD and the linearly indexed left atrial size LA/Ao, and a high degree of correlation between RLAD and the linearly indexed diastolic size of the left ventricle LVD-d/Ao. The dogs with pulmonary edema showed no correlation between RLAD and the two echocardiographic sizes.

Key words: dogs, correlation, radiographic, echocardiographic, size.

Introduction

Radiography and echocardiography are non-invasive examination methods used for diagnosing myxomatous mitral valve disease (MMVD). According to the degree of development of the disease the two methods have different diagnostic value. Thoracic radiography provides an opportunity to determine the VHS size. At the same time, it allows the visualization of the pulmonary vessels and parenchyma. Echocardiography provides additional non-invasive examination of the mitral valve and the sizes of the cardiac structures. Radiography is useful for determining the size of the left atrium (LA) when echocardiography is not available (8).

A new method for radiographic measurement of the left atrium has recently been proposed via introducing a new size called by the authors radiographic left atrial dimension (RLAD). The RLAD measures the degree of „bulging“ of the left atrium and thus provides information about its size (9).

LA/Ao and LVD-d/Ao have been found to change along with the progression of the disease and are associated differently with the mortality rate in dogs with MMVD. An increase in the size LVD-d/Ao is associated with mortality from cardiac and non-cardiac causes and an increase in the size LA / Ao is only associated with mortality from non-cardiac causes (6). This circumstance makes the finding of correlations between the radiographic size and these two echocardiographic sizes particularly important not only in the monitoring of the disease but also in predicting its outcome.

The accurate diagnosis and selection of medications for the therapy and management of the disease requires a wide range of research methods. Radiography and echocardiography are complementary methods. The establishment of interconnections between the two methods will allow veterinarian doctors to reasonably recommend, on the basis of the results of the radiographic examination, the echocardiographic examination which is less accessible.

Materials and methods

Eighteen dogs from the small breeds with echocadiographically proven MMVD were divided into two groups on the basis of the presence or absence of radiographically established pulmonary edema. The group without pulmonary edema was composed of 7 dogs and the group with pulmonary edema – of 11 dogs. The lateral chest radiographs were obtained with a direct digital radiograph (Sedecal – DR X-ray system) from right side-lying position.

On radiographs we measured the length (L) and width (S) of the cardiac silhouette according to the accepted standard (1,2). As a starting point for measuring the wide axis of the heart, we chose the dorsal edge of *v. cava caudalis* at the location of its crossing the heart shadow. This point was chosen in order to include the body of the left atrium in the measurement. We measured the long axis of the heart from the ventral border of the tracheal bifurcation to the heart apex.

We obtained the size RLAD in accordance with the recommendations of the authors of the new size. We measured the length of the bisectrix of the right angle formed by the intersection of the L and S axes with an endpoint at the dorsal edge of the radiographic opacity above the left atrium. We applied this length to the thoracic vertebrae starting from the cranial edge of T4. The number of vertebral bodies and intervertebral discs over which the line extends to the nearest 0.1 V determined our size RLAD (8,9).

The echocardiographic examination was performed with the My Lab 70 vet XV apparatus on the right parasternal position, following the accepted standards (10).

The diagnosis of MMVD is based on the characteristic lesions of the disease and the establishment of systolic mitral valve regurgitation. LA/Ao was obtained by calculating the ratio of LA to the linear aortic size (Ao), measured by 2D echocardiography (3, 4, 5). The measurement was performed in early ventricular diastole. The size LVD-d/Ao was obtained by calculating the ratio of the end diastolic left ventricular diameter to the linear aortic size (Ao).

The linear regression analysis was performed with computer program Statistica, v. 6.0.1. Statistical reliability: C. I. Level 0,95; P<0,05. Degree of correlation in linear regression: (r) > 0.7 – strong correlation; 0.5 < (r) ≤ 0.7 – medium correlation; 0.3 < (r) ≤ 0.5 – weak correlation (r) < 0.3 – no correlation.

Results

The statistical data from the linear regression analysis between the radiographic size RLAD and the echocardiographic linearly indexed sizes LA/Ao and LVD-d/Ao of the examined dogs with MMVD are presented in Tables 1, 2 and 3.

Table 1: Linear regression analysis between the radiographic size RLAD and the echocardiographic linearly indexed sizes LA/Ao and LVD-d/Ao in dogs with MMVD without pulmonary edema (n = 7)

Radiographic size	Echocardiographic size		
independent	**dependent**	**Correlation, coefficient – r**	**P**
RLAD	LA/Ao	0.314	0.492
RLAD	LVD-d/Ao	0.731	0.061

Degree of correlation in linear regression (r) > 0.7 – strong correlation; 0.5 < (r) ≤ 0.7 – medium correlation; 0.3 < (r) ≤ 0.5 – weak correlation; (r) < 0.3 – no correlation.

Table 1 shows data from the linear regression analysis in dogs without pulmonary edema in which we found a weak linear correlation with a lack of statistical significance between the size RLAD and the size LA/Ao (r = 0.314; P = 0.492) and a strong degree of linear correlation with a lack of statistical significance between the radiographic size RLAD and the echocardiographic size LVD-d/Ao (r = 0.731; P = 0.061).

Table 2: Linear regression analysis between the radiographic size RLAD and the echocardiographic linearly indexed sizes LA/Ao and LVD-d/Ao in dogs with MMVD with pulmonary edema (n=11)

Radiographic size	Echocardiographic size		
independent	**dependent**	**Correlation, coefficient – r**	**P**
RLAD	LA/Ao	0.03	0.931
RLAD	LVD-d/Ao	0.13	0.704

Degree of correlation in linear regression (r) > 0.7 – strong correlation; 0.5 < (r) ≤ 0.7 – medium correlation; 0.3 < (r) ≤ 0.5 – weak correlation; (r) < 0.3 – no correlation.

In dogs with pulmonary edema (Table 2), we established a lack of linear correlation between the size RLAD and the two echocardiographic linearly indexed sizes LA/Ao (r = 0.03; P = 0.931) and LVD-d/Ao (r = 0.03; P = 0.931).

Table 3: Linear regression analysis between the radiographic size RLAD and the echocardiographic linearly indexed sizes LA/Ao and LVD-d/Ao in all dogs with MMVD included in the study (n=18)

Radiographic size	Echocardiographic size		
independent	**dependent**	**Correlation, coefficient – r**	**P**
RLAD	LA/Ao	0.379	0.12
RLAD	LVD-d/Ao	0.387	0.113

Degree of correlation in linear regression (r) > 0.7 – strong correlation; 0.5 < (r) ≤ 0.7 – medium correlation; 0.3 < (r) ≤ 0.5 – weak correlation; (r) < 0.3 – no correlation.

The linear regression analysis between the radiographic size RLAD and the echocardiographic linearly indexed sizes LA/Ao and LVD-d/Ao in all dogs with MMVD that were included in the study (Table 3) showed a low degree of correlation between the radiographic size RLAD and the two echocardiographic sizes LA/Ao (r = 0.379; P = 0.12) and LVD-d/Ao (r = 0.387; P = 0.113).

Discussion

The progression of the mitral regurgitation causes cardiac remodeling, characterized by left atrial (LA) and left ventricular (LV) dilation. This gives us reason to check the degree of correlation between a new radiographic size (radiographic left atrial dimension (RLAD) and two echocardiographic sizes LA/Ao and LVD-d/Ao, which are the most affected by the volume overload in patients with MMVD.

The lack of reliability for all the results obtained in the study, despite the established correlations, is due, according to us, to the small number of dogs that were included in the study.

In our patients without pulmonary edema, we found a weak correlation between RLAD and LA/Ao. This contradicts the results obtained by other authors who found a high degree of correlation between these sizes (8, 9). We assume this is due to the smaller number of dogs we have studied. This is confirmed by the very close mean values obtained by us and the other authors regarding the size RLAD. The high level of correlation we have established between the radiographic size RLAD and the echocardiographic normalized size LVD-d/Ao indicates that the size RLAD, although reflecting the size of the left atrium, may also be used to estimate the size of the left ventricle. In fact, our studies have shown that in dogs without edema, the correlation rate between RLAD and LVD-d/Ao is significantly higher than that of RLAD and LA / Ao. Of course, we should also take into account the small number of patients studied in this group, on the basis of which this result may be random.

The established by us lack of linear correlation between the radiographic size studied and the two echocardiographic sizes in dogs with pulmonary edema indicates that this method of size comparison is inappropriate in the dogs we examined. The thoracic radiographs are a sensitive tool for

evaluating left ventricular enlargement, especially when it is moderate to severe (7). But the progression of the disease to grades C and D leads to increased radiographic opacity in the dorsocaudal portion of the lung field. When the pulmonary parenchyma is edematized, the normal radiographic contrast of the soft tissues is lost and the ability to visualize the vessels is reduced. This has led to the difficulty and possibly inaccurate determination of the dorsal endpoint of the radiographic size RLAD in dogs with MMVD and with pulmonary edema.

The low degree of correlation between the examined sizes in all patients included in the study was the result of the simple summation of the results of the correlations of dogs without edema and dogs with edema.

Conclusion

1. The established linear correlation in dogs with MMVD without pulmonary edema between the radiographic size RLAD and the echocardiographic sizes LA/Ao and LVD-d/Ao indicates that the size RLAD may be useful to veterinarian doctors for the well-reasoned appointment of echocardiographic and other additional examinations. The lack of reliability of our results, however, indicates that this statement should be verified via more dogs with MMVD.
2. The established lack of linear correlation in dogs with MMVD with pulmonary edema between the radiographic size RLAD and the echocardiographic sizes LA/Ao and LVD-d/Ao indicates that a more radiographically distinct dorsal border for the size RLAD should be sought.

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