TRADITION AND MODERNITY IN VETERINARY MEDICINE, 2023, vol. 8, No 1(14): 31–34

COMPARATIVE ECHOCARDIOGRAPHIC STUDY BETWEEN MALE AND FEMALE DOGS WITH MYXOMATOUS MITRAL VALVE DISEASE – STAGE B (B1+B2)

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ABSTRACT

Female and male dogs respond differently to cardiac volume overload as a result of stage B (B1+B2) Myxomatous mitral valve disease. The differences are more strongly related to the thickness of the heart walls in systole and diastole and less to the left ventricular internal diameter. They are similar to the differences found between women and men in people with low-grade mitral regurgitation.

Key words: echocardiographic, mitral, sex, dogs.

Introduction

Myxomatous mitral valve disease (MMVD) is the most common heart disease, affecting mainly small breeds of dogs. In male animals, the disease is detected at an earlier age and tends to progress faster. When examining the relationship between breed, sex and mitral valve disorders in dogs, an assessment of the probability ratio was performed. They found statistically significant positive relationships between valvular insufficiency and some small and medium-sized dog breeds. Significant negative associations have also been found between some large dog breeds and valvular insufficiency. The analyzed probabilities determined for each breed and sex show that male dogs are more susceptible to this heart disorder than females (Thrusfield et al. 1985).

A study of cardiac mortality in mostly uncastrated, insured Swedish dogs younger than 10 years of age found that mortality in males was higher than in females. The cause of this gender effect is still unknown (Egenvall et al. 2006).

The problem is similar in human medicine. Moderate and severe mitral regurgitation affects women to a lesser extent than men, but women account for a significant proportion of patients with clinically significant regurgitation. These basic characteristics can lead to differences in the treatment and outcome of the disease (Avierinos et al. 2008). This makes the study of myxomatous mitral valve disease depending on gender particularly relevant.

We aimed to determine whether there were differences in M-mode echocardiographic size in dogs in the early stages of the disease, when there was still no evidence of signs of left-sided heart failure.

Materials and methods

The dogs were included in the study based on clinical and echocardiographic evidence of MMVD and a lack of evidence of episodic or persistent heart failure. During the examinations, they were not sedated and detained in a right-lying position. Measurements of left-sided heart size were performed in M-mode from the right parasternal short-axis view guided by 2D echocardiography. The values of the echocardiographic dimensions in centimeters were normalized by indexing them to the weight idealized aortic size (Brown et al. 2003).

All indicators representing cardiac left echocardiographic M-mode indexed dimensions were analyzed using a computer program (StatMost). We used the parametric method (One-way ANOVA) and the non-parametric method (Mann Whitney U-test) to determine the reliability of the differences. The values of the indicators are presented as the mean value and its arithmetic standard deviation (SD).

Results

Table 1: Comparative study of M-mode echocardiographic dimensions indexed to weight-idealized aortic size between female and male dogs with MMVD stage B (B1+B2).

M-mode echocardiographic dimension	Female dogs with MMVD stage B (B1+B2) (n = 6)		Male dogs with MMVD stage B (B1+B2) (n = 13)		Reliability P
	$\bar{X}$	SD	$\bar{X}$	SD	
IVS-d/Aow	0,445	0,038	0,507	0,044	0,0089♦♦ 0,0179*
LVID-d/Aow	1,748	0,251	1,856	0,258	0,4036 0,4829
LVFW-d/Aow	0,399	0,029	0,443	0,039	0,0254♦ 0,0253*
IVS-s/Aow	0,745	0,092	0,827	0,073	0,0485♦ 0,0794
LVID-s/Aow	0,909	0,207	0,958	0,143	0,5483 0,661
LVFW-s/Aow	0,656	0,057	0,717	0,062	0,0583 0,0655
LA/Aow	1,143	0,166	1,238	0,148	0,2262 0,3347

Statistically significant difference determined by the one way ANOVA parametric method: ♦ – p <0,05; ♦♦ – p <0,01; ♦♦♦ – p <0,001.

*Statistically significant difference determined by the non-parametric method Mann – Whitney U-test: * – p <0,05; ** – p <0,01.*

The results of M-mode echocardiographic transverse dimensions of female and male dogs with MMVD in stage B (B1+B2), indexed to the weight idealized aortic size (Aow) are shown in Table 1 from which it is seen that the thickness of the weight-indexed end-diastolic interventricular septum (IVS-d / Aow) was statistically significantly smaller in female dogs (0,445 ± 0,038) than in male dogs (0,507 ± 0,044). This was found by both methods for calculating the statistically significant difference.

The size of the weight-indexed end-diastolic left ventricular internal diameter (LVID-d / Aow) was statistically slightly smaller in the group of female dogs (1,748 ± 0,251) compared to the group of male dogs (1,856 ± 0,258).

The thickness of the weight-indexed end-diastolic left ventricular free wall (LVFW-d / Aow) was statistically significantly lower in female dogs (0,399 ± 0,029) than in male dogs (0,443 ± 0,039). This was found by both methods for calculating the statistically significant difference.

The size of the weight-indexed end-systolic interventricular septum (IVS-s / Aow) in the group of female dogs was statistically significantly smaller (0,745 ± 0,092) than that of males (0,827 ± 0,073). This was determined by the one way ANOVA parametric method.

The size of the weight-indexed end-systolic left ventricular internal diameter (LVID-s / Aow) was statistically insignificantly lower in female dogs (0,909 ± 0,207) than in males (0,958 ± 0,143).

The thickness of the weight-indexed end-systolic left ventricular free wall (LVFW-s / Aow) was statistically insignificantly smaller in the group of female dogs (0,656 ± 0,057) compared to the group of male dogs (0,717 ± 0,062).

The value of the weight-indexed left atrial diameter (LA / Aow) in the group of female dogs was 1,143 ± 0,166 and was statistically insignificantly lower than that in the group of male dogs (1,238 ± 0,148).

Discussion

In our study comparing indexed M-mode echocardiographic sizes between male and female dogs with MMVD stage B (B1 + B2), we found significant differences for indexed IVS-d / Aow, LVFW-d / Aow, and IVS-s / Aow. For the LVFW-s / Aow size, we found a trend very close to the significant difference. With regard to left ventricular diameters, both in systole and diastole no significant differences were found between male and female animals, but trends similar to those found for left ventricular walls were found. For all sizes studied, female dogs with MMVD stage B (B1 + B2) were found to have thinner walls and smaller ventricular diameters. These differences are observed in both diastolic and systolic sizes. Statistically significant differences in the diastolic dimensions of the left ventricular walls between male and female dogs and the lack of similar significant differences between diastolic left ventricular diameters show the different responses of the hearts of female and male dogs to volume overload as MMVD progressed from stage B1 to stage B2.

Our results from this study are similar to the results of a study conducted in human medicine, which compares the differences between men and women in the progression of mitral regurgitation. In the mild form of mitral regurgitation, the authors found that the left-sided heart sizes (LV-ESD, LV-EDD, LA) in women were with lower values compared to men. The study found that in mild form of mitral regurgitation, survival in women is about 10% higher than in men. In the medium form, this percentage decreases to 5%. In severe mitral regurgitation, the trend is reversed and the survival rate for women is already 8% lower than for men (Avierinos et al. 2008). Such detailed studies among the sources we studied are lacking in veterinary medicine. However, higher mortality was found in male dogs than in female dogs with heart disease (Egenvall et al. 2006).

Additional evidence to support the existence of gender differences in LV adaptation to volume overload has been studied in rats (Gardner et al. 2002). The authors found that female rats adapted more favorably to volumetric congestion caused by infrarenal aortic fistula than male rats. Hearts in female rats developed concentric hypertrophy without impaired cardiac function, minimal ventricular dilatation, and no changes in myocardial compliance 8 weeks after fistula. In contrast, the hearts of male rats had significant dilatation caused by fistula and reduced ventricular compliance. In addition, mortality is 10 times higher in males than in females (25% vs. 3%), despite a similar volume overload. These findings suggest that in the presence of volume overload, women's hearts develop appropriate concentric hypertrophy sufficient to maintain a stable compensated state, preventing the development of ventricular dilatation and heart failure (Piro et al. 2010).

Our results showed that the division of animals by sex in the initial stages of the disease occurs with similar left ventricular changes found by research in human medicine. The hearts of male and female animals in stage B (B1 + B2) myxomatous mitral valve disease respond differently to volume overload. This can be crucial in the prevention and selection of different treatment regimens for dogs with this disease, which are tailored to the sex of the animal.

Conclusion

1. Female and male dogs respond differently to cardiac volume overload as a result of stage B (B1 + B2) MMVD. These differences are more strongly related to the thickness of the heart walls in end-systole and end-diastole and less to the left ventricular internal diameter.

2. Differences in changes in M-mode left ventricular size as a result of MMVD stage B (B1 + B2) between female and male dogs are similar to the differences found between women and men in humans with low-grade mitral regurgitation.

Acknowledgments

I would like to thank the team of the veterinary clinic CITY CLINIC and personally Dr. Rosen Tsokev for their assistance.

References

1. Avierinos, J. F., Inamo, J., Grigioni, F., Gersh, B., Shub, C., Enriquez-Sarano, M. (2008). *Sex differences in morphology and outcomes of mitral valve prolapse*. Annals of internal medicine, 149(11), 787–794.
2. Brown, D. J., Rush, J. E., MacGregor, J., Ross Jr, J. N., Brewer, B., Rand, W. M. (2003). *M-mode echocardiographic ratio indices in normal dogs, cats, and horses: a novel quantitative method*. Journal of veterinary internal medicine, 17(5), 653–662.
3. Egenvall, A., Bonnett, B. N., Häggström, J. (2006). *Heart disease as a cause of death in insured Swedish dogs younger than 10 years of age*. Journal of veterinary internal medicine, 20(4), 894-903.
4. Gardner, J. D., Brower, G. L., Janicki, J. S. (2002). *Gender differences in cardiac remodeling secondary to chronic volume overload*. Journal of cardiac failure, 8, 101–107.
5. Piro, M., Della Bona, R., Abbate, A., Biasucci, L. M., Crea, F. (2010). *Sex-related differences in myocardial remodeling*. Journal of the American College of Cardiology, 55(11), 1057–1065.
6. Thrusfield, M. V., Aitken, C. G. G., Darker, P. G. G. (1985). *Observations on breed and sex in relation to canine heart valve incompetence*. Journal of Small Animal Practice, 26(12), 709–717.