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ANALYSIS OF THE ECHOCARDIOGRAPHIC PROFILE OF DOGS EVALUATED AT A VETERINARY CLINIC IN PORTO ALEGRE/RS/ BRAZIL OVER A SIX-MONTH PERIOD

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Abstract: The echocardiogram has become an extremely relevant exam for veterinary cardiology. By measuring several parameters, it is possible to evaluate anatomy and function, making it a highly valuable technique for diagnosing cardiovascular diseases in domestic animals. Furthermore, the exam allows you to monitor the evolution of cardiac changes, making it very useful for progressive diseases.

Therefore, the objective of this work is to analyze the echocardiographic profile of dogs treated at a veterinary clinic specializing in cardiorespiratory conditions regarding the prevalence of diseases diagnosed through echocardiographic examination. To this end, a retrospective study was carried out on the echocardiographic profile of 771 dogs treated at the Sopro Vet Veterinary Clinic from October 2022 to March 2023. The animals were cataloged and classified according to breed, sex, age, size and age group, as well as cardiac changes and cardiovascular diseases identified in the examination. Of the dogs that took part in the study, animals of no defined breed, females, over eight years old and of small size prevailed. Mitral valve myxomatous disease was the most prevalent disease, affecting 70.9% of dogs, being most common in the mitral valve, followed by mitral and tricuspid valves simultaneously. This pathology occurred mainly in small, elderly animals and in similar percentages between males and females. Other diseases were also recorded, but with lower prevalence.

Keywords: Doppler echocardiogram, Veterinary cardiology, Endocardiosis

INTRODUCTION

Echocardiographic studies complement auscultation, electrocardiogram and chest x-rays, as well as representing the gold standard for the diagnosis and staging of most acquired congenital heart diseases

in dogs and cats. Echocardiography is indicated in the presence of signs of exercise intolerance, cough and syncope, in addition to being recommended before anesthetic procedures in case of clinical suspicion of a cardiological disease. In veterinary medicine, to perform traditional echocardiographic examination, one-dimensional (M-mode), two-dimensional (B-mode), and Doppler techniques are used (SOUSA et al., 2020).

It is estimated that approximately 10% of dogs clinically evaluated have some heart disease, and the most frequent cause is endocardiosis, which leads to morbidity and mortality in dogs (KEENE et al., 2019). The incidence and progression of this disease are often associated with sex, breed and age, tending to affect more male dogs, from small to medium breeds and older dogs (PETRUS, GIMENES, MANTOVANI, 2020). Myxomatous mitral valve disease (MVD) most commonly affects the mitral valve, however, in approximately half of cases, the tricuspid valve is concomitantly affected. In many cases, there is a long preclinical period, characterized by morphological changes observed only at necropsy, progressing to valve insufficiency and possible chamber dilation and hypertrophy. The death of these animals occurs mainly due to congestive heart failure (CHF) (ATKINS, 2009).

Among other cardiac conditions, we can highlight: dilated cardiomyopathy, more common in large dogs, characterized by a defect in the myocardium, making it structurally and functionally defective (MARTIN et al. 2009); pulmonary hypertension (PH), characterized by a persistent increase in pressure in the pulmonary vasculature (REINERO et al., 2020); and cardiac neoplasms, which occur mainly in the right atrium or heart base, with hemangiosarcoma being the most common (SARRAF, 2020).

Unlike most heart diseases that tend to affect older dogs, congenital heart diseases can cause morbidity and mortality in their first years of life. This group of illnesses occurs due to morphofunctional changes in the heart or large vessels, caused by malformations at specific stages of embryonic development that persist after birth. Among these diseases, persistence of the ductus arteriosus (PDA) stands out, characterized by the failure to adequately close the duct after birth, and pulmonary and subaortic stenosis, defined by failures in the opening and closing of the valves (LUCINA et al., 2021).

In this scenario, this work aims to analyze the echocardiographic profile of dogs treated at the Sopro Vet Veterinary Clinic, located in Porto Alegre, Rio Grande do Sul, regarding the prevalence of cardiac conditions diagnosed through the examination. Furthermore, the work aims to inform veterinarians about the importance of this examination for the clinical and therapeutic management of dogs with suspected cardiovascular diseases.

MATERIALS AND METHOD

This study was carried out through a retrospective analysis of dogs treated at the veterinary clinic specializing in cardiorespiratory conditions Sopro Vet, located in the city of Porto Alegre, Rio Grande do Sul. The data collection period ranged from October 1, 2022 to the 31 March 2023, totaling six months of research. Data were collected from reports and images provided by the clinic, and all dogs that attended cardiology services and underwent echocardiographic examination were included in the study. Patients of non-canine species were excluded and only the most recent examination of the same animal was considered. The data obtained were cataloged and classified, following the pattern observed in the literature, into sex parameters: male or female; age range: puppies, adults or elderly;

size: miniature, small, medium or large; and breeds: breeds that had at least ten specimens were considered relevant in data collection. Regarding echocardiographic parameters, morphological changes, presence of heart disease, valve insufficiency, probability of pulmonary hypertension and hemodynamic repercussions were analyzed. Furthermore, some correlations were made between the presence of endocardiosis, the most prevalent heart disease in dogs, with the sex, size and age profile of these patients, in order to compare with the literature. The exams were carried out by six veterinarians who work there and specialize in cardiology. The methodology and normal reference values used followed those recommended in the literature. Two ultrasound devices composed of M, two-dimensional and Doppler modes, ACUSON NX3 Elite and ACUSON Juniper, both SIEMENS, were used for echocardiography exams. Furthermore, the data was organized and compiled within the Excel 2019 program.

RESULTS

During the six months analyzed, 882 echocardiographic examinations were carried out, including one rabbit, 90 cats and 791 dogs. Of these, 20 were repeat exams of the same animal, and therefore only the most recent exam was considered. Therefore, the final number of cases included in the study was 771. Regarding the sex of the animals, 309/771 (40.1%) were males and 462/771 (59.9%) were females (Figure 1). The average age obtained was 10.7 years (ranging from one month to 18 years), with 13/771 (1.7%) being puppies (up to one year old), 169/771 (21.9%) adults (2 to 8 years) and 589/771 (76.4%) elderly (over 8 years) (Figure 1). The animals were classified according to weight and were distributed according to size: miniature (up to 4 kg) with 136/771 (17.6%), small size (4-10 kg) with 359/771 (46.6%), medium size (10-

25 kg) with 224/771 (29%), and large size (>25 kg) with 52/771 (6.8%). The average weight was 8.6 kg (ranging between 0.5 and 60 kg). (Figure 1).

Regarding breed, mixed breed dogs (SRD) accounted for 237/771 (30.7%) of visits. The most identified breed animals 534/771 (69.3%) were consecutively: shih tzu 116/771 (15%), yorkshire 69/771 (8.9%), poodle 49/771 (6.4%), German Spitz 33/771 (4.3%), Maltese 31/771 (4%), Pinscher 30/771 (3.9%), Dachshund 29/771 (3.8%), Lhasa Apso 27/771 (3.5%), French bulldog 15/771 (2.0%), pug 14/771 (1.8%), schnauzer 13/771 (1.7%) and labrador 10/771 (1.3%). The remaining 98/771 dogs (12.7%) belong to 30 other breeds with less than ten dogs each (Figure 2).

Regarding echocardiographic results, 67/771 (8.7%) of the animals had a normal heart from an anatomical point of view. Valvular insufficiencies are very common, with a total of 702/771 (91.1%) of dogs having insufficiency to some degree in at least one of the four valves, while 69/771 (8.9%) had all valves healthy.

Furthermore, only two animals showed changes in the semilunar valve without also showing changes in any atrioventricular valve. It is important to point out that two animals presented some heart disease without having any type of change in the valve, one case of cardiac-based neoplasia and one case of persistent ductus arteriosus, a congenital vascular anomaly. Furthermore, 18/771 (2.3%) of the dogs analyzed had some degree of alteration in the four valves. Regarding conditions in atrioventricular valves, some alteration was identified in 700/771 (90.8%) animals, 174/771 (22.6%) only in the mitral valve, 34/771 (4.4%) only in the tricuspid valve and 492/771 (63.8%) affecting both atrioventricular valves simultaneously (Table 1). In the semilunar valves, some alteration was identified in 184/771 (23.8%) animals,
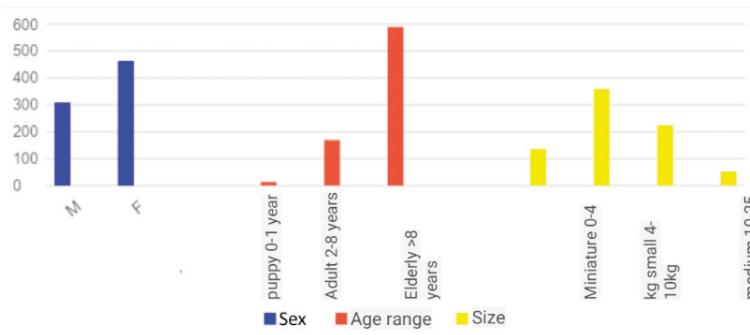
Figure 1- Chart demonstrating the sex profile, age range and size of dogs seen at the Sopro Vet Veterinary Clinic over a six-month period (October 1, 2022 to March 31, 2023) for echocardiographic examination.

Source: prepared by the author
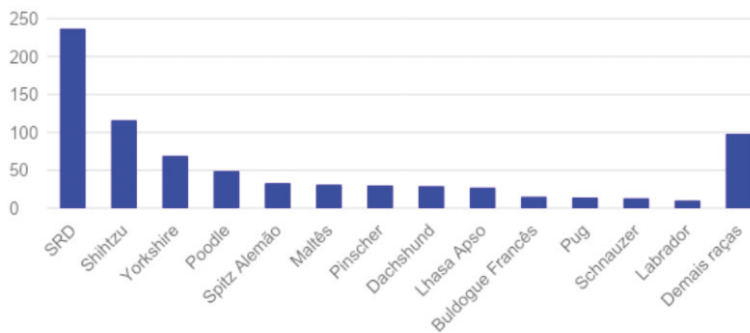
Figure 2- Chart demonstrating the breed profile of dogs seen at the Sopro Vet Veterinary Clinic over a six-month period (October 1, 2022 to March 31, 2023) for echocardiographic examination.

Source: prepared by the author.

45/771 (5.8%) only in the aortic valve, 119/771 (15.4%) only in the pulmonary valve, and in 20/771 (2.6%) affecting both valves simultaneously (Table 2).

Atrioventricular valve insufficiencies	Number of dogs	%
Mitral valve insufficiency	174	22.6%
Tricuspid valve insufficiency	34	4.4%
Mitral and tricuspid valve insufficiency	492	63.8%
Total AV valve insufficiency	700	90.8%

Table 1: Table of atrioventricular valve insufficiencies indicated in the echocardiogram reports of dogs seen at the Sopro Vet Veterinary Clinic over a six-month period (October 1, 2022 to March 31, 2023) for echocardiographic examination.

Source: prepared by the author.

Semilunar valve insufficiencies	Number of dogs	%
Aortic valve insufficiency	45	5.8%
Pulmonary valve insufficiency	119	15.4%
Aortic and pulmonary valve insufficiency	20	2.6%
Total semilunar valve insufficiency	184	23.8%

Table 2: Table of semilunar valve insufficiencies indicated in the echocardiogram reports of dogs seen at the Sopro Vet Veterinary Clinic over a six-month period (October 1, 2022 to March 31, 2023) for echocardiographic examination.

Source: prepared by the author.

Table 3 reveals endocardiosis as the most diagnosed heart disease, found in 547/771 (70.9%) dogs. The disease affected only the

mitral valve in 319/771 (41.4%), and only the tricuspid valve in 4/771 (0.5%) of the animals. Among patients who had more than one concomitant disease, endocardiosis of both AV valves was the most common, occurring in 224/771 (29.2%) animals.

Endocardiosis	Number of dogs	%
Mitral valve endocardiosis	319	41.4%
Tricuspid valve endocardiosis	4	0.5%
Endocardiosis of both valves	224	29%
Total endocardiosis	547	70.9%

Table 3: Demonstrative table related to the diagnosis of endocardiosis indicated in the echocardiogram reports of dogs seen at the Sopro Vet Veterinary Clinic within a period of six months (October 1, 2022 until March 31, 2023) for echocardiographic examination.

Source: prepared by the author.

Table 4 shows how the other diseases had a lower prevalence, occurring less than ten times each, namely: neoplasm 8/771 (1%), and dilated cardiomyopathy 4/771 (0.5%), in addition to congenital heart disease, pulmonary stenosis 7/771 (0.9%), subaortic stenosis 3/771 (0.4%), and patent ductus arteriosus 3/771 (0.4%).

Diagnosis	Number of dogs	%
Neoplasm	8	1.0%
Dilated cardiomyopathy	4	0.5%
Pulmonary stenosis	7	0.9%
Subaortic stenosis	3	0.4%
Persistent ductus arteriosus	3	0.4%

Table 4: Demonstrative table related to the diagnosis of other less prevalent cardiomyopathies indicated in the echocardiogram reports of dogs seen at the Sopro Vet Veterinary Clinic over a six-month period (October 1, 2022 to March 31, 2023) for echocardiographic examination.

Source: prepared by the author.

In Table 5, the probability of pulmonary hypertension was analyzed, which was present, to some degree, in 305/771 (39.5%) dogs, classified as low probability 260/771 (33.7%), medium 28/771 (3.6%), and high 17/771 (2.2%). It is possible to estimate the stage of heart disease by evaluating the remodeling of the heart through echocardiographic examination (KEENE et al. 2019). Significant enlargement of at least one heart chamber was found in 190/771 (24.6%) animals.

DMVM has some predispositions already described in the literature. In Tables 6, 7 and 8 below, some correlations were demonstrated between endocardiosis of atrioventricular valves and the parameters of sex, size and age group.

Probability of pulmonary hypertension	Number of dogs	%
Low probability	260	33.7%
Moderate probability	28	3.6%
High probability	17	2.2%
Total	305	39.5%

Table 5: Demonstrative table related to the probability of pulmonary hypertension indicated in the echocardiogram reports of dogs seen at the Sopro Vet Veterinary Clinic over a six-month period (October 1, 2022 to March 31, 2023) for echocardiographic examination.

Source: prepared by the author.

	Mitral	Tricuspid	Both	Total
Male	128	3	93	224
Female	190	1	132	323
Total	318	4	225	547

Table 6: Correlation between endocardiosis in atrioventricular valves and sex of dogs seen at the Sopro Vet Veterinary Clinic over a six-month period (October 1, 2022 to March 31, 2023) for echocardiographic examination.

Source: prepared by the author.

	Mitral	Tricuspid	Both	Total
Miniature	52	1	48	101
Small	164	two	132	298
Average	91	1	41	133
Big	11	0	4	15
Total	318	4	225	547

Table 7: Correlation between endocardiosis in atrioventricular valves and the size of dogs seen at the Sopro Vet Veterinary Clinic over a six-month period (October 1, 2022 to March 31, 2023) for echocardiographic examination.

Source: prepared by the author.

	Mitral	Tricuspid	Both	Total
Cub	1	0	0	1
Adult	30	0	11	41
Elderly	287	4	214	505
Total	318	4	225	547

Table 8: Correlation between endocardiosis in atrioventricular valves and age group of dogs seen at the Sopro Vet Veterinary Clinic over a six-month period (October 1, 2022 to March 31, 2023) for echocardiographic examination.

Source: prepared by the author.

DISCUSSION

Regarding the general characteristics of the animals that underwent the echocardiography examination during the analyzed period, female dogs, small dogs and over eight years old predominated. This balance did not take into consideration, the conditions found or clinical signs, but rather the profile of the animals that attended the services of the veterinary clinic in question and underwent the echocardiographic examination.

These data corroborate the study by Freitas et al. (2020), who, when carrying out a retrospective study with 2703 dogs in order to determine the prevalence of the most diagnosed heart diseases, observed percentages close to those of the present study (DE FREITAS et al., 2020).

When analyzing the size of the dogs that underwent the echocardiographic examination during the analyzed period, small size was more prevalent (46.6%), followed by medium size (29%). The largest racial group was mixed breeds, followed by shih tzu, yorkshire, poodle and German spitz. The racial profile of the dogs analyzed is formed by the profile of the dog breeds of the region's population, added to genetic factors that predispose certain breeds to have cardiological diseases (ATKINS 2009).

The vast majority of dogs 702/771 (91.1%) presented some degree of valve insufficiency. The atrioventricular valves were the most affected 700/771 (90.8%), with greater involvement of the mitral valve. Many of these cases can progress to myxomatous valve disease, which explains the higher prevalence in the mitral valve. (PETRUS, GIMENES, MANTOVANI, 2020). The semilunar valves were also affected, but to a lesser extent, occurring in 184/771 (23.8%) of the dogs, with a higher prevalence in the pulmonary valve.

It is known that endocardiosis represents the most prevalent cardiac pathology in dogs, accounting for around 75% of heart diseases (Keene et al. 2019). The 2019 consensus states that the pathology predominantly affects the left atrioventricular (mitral) valve, but in at least 30% of cases, the right atrioventricular (tricuspid) valve is also affected. In this study, a total of 547/771 (71%) of dogs presented with the disease. The mitral valve was affected in 543 dogs, and of these 224/543 (41.3%) also manifested the disease in the tricuspid valve. The percentages of valve involvement are moderately in line with the literature, except for the case of tricuspid disease only, which affected 4/771 (0.5%) animals, a percentage well below the 10% reported in the literature (ATKINS 2009).

Regarding the general characteristics of animals carrying the disease, it is reported that the disease affects male dogs 1.5 times more than females (ATKINS, 2009). This statistic

differed from the present study, as both sexes had similar percentages of involvement, affecting 224/309 (72.5%) males and 323/462 (70%) females. Another echocardiographic evaluation study to list the main heart diseases in dogs also found no statistical difference between the sexes in relation to the prevalence of myxomatous valve disease (CASTRO, 2009).

The data obtained demonstrated that the disease is more predisposed to small animals 298/359 (83%) and miniature 101/136 (74.3%), followed by medium sized dogs 133/224 (59.4%) and large 15/58 (25.9%). Regarding the age of animals with endocardiosis, it was more prevalent in elderly people 505/589 (85.7%), followed by adults 41/169 (24.3%), and puppies 1/13 (7.7%). The results correspond to those in the literature, which indicate that there is a greater predisposition for smaller dogs, although it still occurs in larger animals, and predominates in older animals (BORGARELLI; BUCHANAN, 2012).

Another heart disease that commonly affects dogs is dilated cardiomyopathy. This pathology mainly affects large and giant dogs (WESS et al. 2017). This disease was present in 4/771 (0.5%) dogs in this study, of the Fila, Labrador, Doberman and mixed breed breeds, all males, weighing more than 30 kilos and between ten and 12 years of age. The profile of affected animals is in accordance with the literature, but with a much lower prevalence. The percentage of disease being lower than expected may be related to the low number of large animals in the present study (MARTIN et al. 2009).

Neoplasms in the thoracic region were found in 8/771 (1%) of the dogs, three French bulldogs and one shih tzu, in addition to four mixed breed dogs. All animals were at least ten years old and the mass was located at the heart base. Although hemangiosarcoma is up to ten times more prevalent in relation to underlying neoplasms, it is also much more aggressive, with low survival, which may be one of the reasons for the low incidence in this study (SARRAFF, 2020).

Among congenital alterations, 7/771 (0.9%) cases of pulmonary stenosis and 3/771 (0.4%) subaortic stenosis were found, characterized by failures in the opening and closing of the valve and 3/771 (0.4%) %) cases of patent ductus arteriosus (PDA), in which there was no adequate closure of the duct after birth. Diagnosing these anomalies early is extremely important, as many of these changes require surgical intervention (UMBELINO; LARSSON, 2015; PEREIRA, 2020). Pulmonary stenosis was the most prevalent among congenital heart diseases. The disease affected seven animals, one French bulldog and one English bulldog, both of which have a racial predisposition (PEREIRA 2020), in addition to specimens of the Shih Tzu, German Spitz (two), American Bully and SRD breeds. Subaortic stenosis was detected in two golden retriever dogs, which have a genetic predisposition, (PEREIRA 2020) and in an American bully. The animals affected by PDA were two German spitz and a Yorkshire, known to be more prone to the disease. Two animals presented two diseases concomitantly, one with pulmonary stenosis and PDA and one with pulmonary and subaortic stenosis. The prevalence results of this study differed from those of a 2015 survey that, when carrying out a retrospective study in order to define the most common congenital heart diseases, found PDA to be the most common (UMBELINO; LARSSON, 2015).

To make a definitive diagnosis of pulmonary hypertension (PH), the standard method is the direct assessment of pulmonary arterial pressure through cardiac catheterization. As this method is rarely used in veterinary medicine, echocardiography is the tool of

choice used to predict the probability of PH non-invasively (PETRUS, CASTRO, 2020). In the present study, 305/771 (39.6%) animals were found with some possibility of having the condition, divided into low probability 260/305 (85.2%), moderate probability 28/305 (9.2%), and high 17/305 (5.6%).

Another parameter evaluated was the presence of hemodynamic repercussions, present in 190/771 (24.6%) dogs. This change occurs in a more advanced stage of heart disease, characterized by eccentric hypertrophy of the heart chambers and involves structural changes in the myocardium, with the formation of fibrous tissue (PEREIRA, YAMATO, 2020). This assessment is important because, depending on the progression of the disease, the animal may be at greater risk of developing congestive heart failure (SOUSA et al., 2020).

CONCLUSION

According to the results obtained in this study, it is possible to conclude that the profile of the animals that underwent the echocardiographic examination in the period from October 2022 to March 2023 is predominantly composed of females, of no defined breed, of small size and at least eight years old. deity. Myxomatous disease of the mitral valve is the most diagnosed disease, mainly in the mitral valve, and occurs more in small, elderly animals and with similar percentages between males and females. Other diseases such as cardiac neoplasms, dilated cardiomyopathy and congenital heart defects were also compiled and had a low frequency. Pulmonary hypertension parameters were also evaluated and among the animals that showed signs, those with a low probability of having the disorder prevailed. Furthermore, staging can be performed according to echocardiographic findings, evaluating the results together and verifying the presence of cardiac remodeling. Finally, the echocardiogram has proven to be extremely useful in providing important information for the cardiological diagnosis and prognosis of canine patients.

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