Assessment of Respiratory Rate in Dogs during the Sleep with Mitral Valve Endocardiosis, Complicated by Congestive Heart Failure Syndrome: the Degree of Adherence for this Test by Animal Owners and its Impact on Patient Survival

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ABSTRACT

Relevance: Congestive heart failure in dogs is an urgent problem for Doctor of Modern Veterinary cardiology. Endocardiosis, or myxomatous mitral valve degeneration, is the most common acquired heart disease of dogs that has a potential adverse outcome. Accurate and timely diagnosis for this cardiopathology in dogs, and also effective monitoring of the progression of congestive heart failure syndrome are the most important problems of veterinary medicine.

Purpose of research: To study the commitment of owners whose dogs with mitral valve endocardiosis to assess the respiratory rate of their pets during sleep and its impact on the survival of sick animals.

Materials and methods. A prospective study of the survival rate of 181 dogs with mitral valve endocardiosis, complicated by congestive heart failure syndrome.

Results: It was found that the degree of owners' commitment to assess the respiratory rate during sleep has a significant impact on the survival of dogs with mitral valve endocardiosis. The median life expectancy of sick dogs whose owners had a high commitment to monitoring respiratory function was significantly high. The survival time of sick dogs whose owners showed high adherence to the test was on average 604.8±53.1 days (variation from 0 to 1378; median – 452 days). In sick animals whose owners showed low adherence to assess the respiratory rate, the life expectancy was significantly low and averaged 279.9±28.9 days (variation from 0 to 1156; median – 122 days). In the Mann-Whitney test, this difference was found to be significant (p<0.0001). When evaluating the survival curves of dogs with endocardiosis complicated by congestive heart failure, and with

different owners' commitment to assess the respiratory rate during sleep, according to the Kaplan-Meyer method using the Gehan criterion, a highly reliable difference was found (p<0.0001). According to the results of multiple analysis of proportional Cox intensities, three independent predictors of fatal mitral valve endocardiosis in dogs complicated by congestive heart failure syndrome were identified: low adherence of dog owners to assess the respiratory rate during sleep; the presence of a decrease in the shortening fraction below 35%; an increase in the rate of tricuspid insufficiency above 4 m/s.

Conclusion: The low degree of adherence of owners of sick dogs to assess the respiratory rate during sleep is the most powerful independent predictor of the fatal outcome of congestive heart failure in mitral valve endocardiosis. It is recommended to identify factors of low diagnostic adherence in owners in a timely manner and conduct explanatory work to improve it.

Keywords: Dogs, Owners, Endocardiosis, Adherence to Diagnosis, Congestive Heart Failure, Prognosis, Survival Rate, Respiratory Rate During Sleep.

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INTRODUCTION

Congestive heart failure in dogs is an urgent problem for Doctor of Modern Veterinary cardiology.[1,2,3] This is due to the high prevalence of nosological forms, improved diagnostics, and optimization of therapeutic approaches.[1,4] The frequency of detection of cardiopathology in dogs tends to grow, which is associated with an increase in the level of knowledge of veterinary medicine doctors, and the widespread introduction of instrumental diagnostics methods, especially echocardiography, into a wide clinical practice. Since the introduction of the echocardiography method into clinical practice, dog cardiology has been developing intensively. At the same time, despite the improvement in the quality of diagnostics and the

improvement of therapeutic approaches, the mortality rate of dogs from congestive heart failure is still very high.[1,5]

Congestive heart failure in dogs is a complicated clinical syndrome that is caused by a decrease in the pumping function of the left and right ventricles, an increase of pressure in the Atria, a violation of cardiohemodynamics, activation of complex neurohumoral systems of the body, blood congestion in the veins of the large or small circulatory circles and manifests shortness of breath as a result of pulmonary edema, ascites, heart rhythm disorders and cachexia.[6,7,8]

Congestive heart failure in dogs occurs in the background of mitral valve endocardiosis, primary and secondary cardiomyopathy, myocarditis, endocarditis, pericarditis. In the primary cardiomyopathies in dogs, dilated and

arrhythmogenic right ventricular cardiomyopathy are common.[1,3] Secondary cardiomyopathies occur against the background of arterial hypertension, chronic kidney disease, hypothyroidism, lymphoma, diabetes, corticosteroid and antitumor therapy. The introduction of screening echocardiography for preoperative assessment of the structural and functional state allowed detecting pathologies of the cardiovascular system in dogs at early stages and reducing risks during planned surgical interventions.[9,10]

Endocardiosis, or myxomatous mitral valve degeneration, is the most common acquired heart disease in dogs. The prevalence of this pathology can reach 14-40% in the population of small dog breeds.[2,3,11] In endocardiosis, occurs thickening and incomplete closure of cusps of the left atrioventricular valve, and develops mitral insufficiency, the severity which is the main predictor of disease progression.[7,9,12] However, most dogs with mitral valve endocardiosis have a long preclinical course for many years or even for a lifetime.[2,3,4] However, with progressive mitral regurgitation, severe complications may occur in the form of development, in the beginning left-sided and then right-sided congestive chronic heart failure, secondary to high pulmonary arterial hypertension syndrome.[13,14,15] With endocardiosis in dogs, the tricuspid valve is also affected frequently, which leads to the development of tricuspid regurgitation.[16,17,18] The progressive course of the disease eventually leads to the death of the animal or euthanasia due to severe symptoms, a sharp deterioration in the quality of life, or the development of cardiac decompensation that is refractory to therapy.[19,20,21] Predictors of an adverse outcome in dogs with mitral valve endocardiosis are the absence of early therapy with pimobendan,[2,3,24] a significant increase in the plasma concentration of natriuretic atrial peptide NT-proBNP,[5] an increased vertebral size of the left atrium on a thoracic radiograph by 2.3 units,[6] aldosterone hyperproduction,[7] left atrial dysfunction,[11,17,20,22,25,26,27] echocardiographic ratio of the size of the left atrium to the diameter of the aortic root with more than 1.6 units, the ratio of the end-dystolic size of the left ventricle to the diameter of the aortic root with more than 2.87 units,[12] right ventricular systolic dysfunction,[16,30] significant volume of mitral regurgitation,[18] high pulmonary hypertension,[21,26] high plasma lactate concentration,[23] instability of the QT interval on an electrocardiogram,[24] high troponin I concentration in serum,[28] pronounced left ventricular myocardial dysfunction,[29] mitral regurgitation jet area with more than 50%,[31] presence of pulmonary edema.[32]

Based on the potential adverse outcome and high prevalence of endocardiosis in dogs, its accurate and timely diagnosis, and also effective monitoring of the progression of congestive heart failure syndrome, are the most important problems of veterinary medicine.

Recently, veterinary cardiologists have developed a valuable clinical indicator — the respiratory rate during sleep.[33,34,35,36,37] Increase in frequency of respiratory movements makes it possible to predict the risk of developing pulmonary edema in dogs with high sensitivity and specificity in various cardiopathologies, including mitral valve endocardiosis. This indicator is easily registered by pet owners. Monitoring the respiratory rate during sleep makes it possible to evaluate the effectiveness of diuretic therapy in dogs with congestive heart failure and select the minimum effective dose of loop diuretic. However, not all owners whose pet with congestive heart failure show a good commitment to evaluating this valuable diagnostic indicator.

Adherence to therapy and performance of prescribed procedures represents compliance of the animal owner's behavior with the recommendations of a veterinarian, including taking pharmacological agents, performing diagnostic procedures, diet therapy, and changing the pet's lifestyle.[37,38,39,40,41,42,43,44,45] During the routine of prescribing therapeutic and diagnostic measures in dogs with mitral valve endocardiosis complicated by congestive heart failure syndrome, we found a variable adherence of owners to assess the frequency of respiratory movements during sleep. Therefore, the topic of this article is extremely relevant.

OBJECTIVE

To study the commitment of owners whose dogs with mitral valve endocardiosis complicated by congestive heart failure syndrome to assess the frequency of respiratory movements during sleep and its impact on the survival of sick animals. The object of the study was dogs with congestive heart failure syndrome, which occurred against the background of mitral valve endocardiosis, as well as their owners.

MATERIALS AND METHODS

The diagnosis of mitral valve endocardiosis in dogs was made comprehensively taking into account the data of anamnesis, clinical research methods, echocardiography, electrocardiography, thoracic radiography.[2] Stages of endocardiosis in sick dogs were determined according to the classification of the American College of veterinary internal medicine (ACVIM):[4] a (risk group) - clinically healthy dogs with genetic determinism to endocardiosis (for example, dachshunds, Pekingese, Chihuahua, poodles, Yorkshire Terriers); B-asymptomatic stage; C-patients with symptoms of congestive heart failure; D-dogs who develop untreatable (refractory) heart failure. It should be noted that, in turn, stage B is divided into two sub – stages: B1 – endocardiosis without signs of remodeling of the left chambers of the heart (does not require therapy) and B2-a disease accompanied by an expansion of the left atrium and eccentric hypertrophy of the left ventricle (a preclinical stage of pathology that requires preventive therapy).

The main criterion for inclusion of dogs in the study was the presence of symptoms of compensated or decompensated congestive heart failure in the form of pulmonary edema, dilated pulmonary veins during radiography or echocardiography, shortness of breath, tachypnea (stage C according to the ACVIM classification). To relieve pulmonary edema, all dogs were prescribed furosemide by a daily dose of 4-10 mg/kg (intravenously bolus), oxygenotherapy; nitrates were applied to the oral mucosa in 58.0% of cases, and in 16.0% of cases, dobutamine was used as a constant-rate infusion (at a dose of 5 micrograms / kg / min). In the presence of a clinically significant hydrothorax, thoracocentesis was always performed. The study excluded animals at A, B1, B2, D stages and with mitral valve

endocardiosis, effusions into the pleural cavity that occurred against the background of cancer in the chest, pleuropneumonia, injuries, and infectious diseases. Also, from the studies, animals with non-cardiogenic pulmonary edema, pulmonary embolism, dirofilariosis, inversion of the lung lobe, and left atrial rupture were excluded.

After stabilization of the General condition, all animals underwent clinical, anamnestic, laboratory and instrumental research with the mandatory use of methods of thoracic radiography in direct and lateral projections, echocardiography, electrocardiography, tonometry, standard clinical and biochemical blood analysis. After discharge from the hospital, all dogs are recommended long-term therapy for chronic heart failure using the following drugs: pimobendan (100%), furosemide (61.8%) or torasemide (38.2%), spironolactone (87.9%), enalapril (47.6%), ramipril (30.9%) or benazepril (21.5%), sildenafil (22.7%), aspirin (19.3%), digoxin (7.7%), amlodipine (3.9%) and diltiazem (2.7%).

All the sick dogs were subjected to echocardiography by the Aloka ProSound Alpha 6 device (Japan) using a phased multi-frequency ultrasound sensor with a base scanning frequency of 5 MHz. The size of the aortic root (AO) and left atrium (LA) were determined in the right parasternal projection along the short axis at the level of the heart base. The degree of left atrial dilatation was assessed by the ratio of LA/AO.[1,2,12] Using M-mode echocardiography in the right parasternal projection along the short axis, the following parameters were evaluated: the left ventricle internal diameter at end-diastole (LVIDd) and the left ventricle internal diameter at end-systole (LVIDs). To reduce the effect of body weight (MT) on these parameters, the normalized LVIDd (LVIDdN) and normalized LVIDs (LVIDsN) were calculated using the following formulas: LVIDdN = LVIDd(cm) /(MT (kg)0.294 and LVIDsN = LVIDs(cm) / (MT)0.315.[2,3] The shortening fraction (FS) was calculated using the formula: FS = (LVIDd - LVIDs)×100% / LVIDd.[4,20] Using M - and B-modes of echocardiography in the right parasternal four-chamber projection along the long axis of the left ventricle, the maximum dimensions of the pulmonary vein (LV) and the right branch of the pulmonary artery (RBPA) were measured. The degree of congestive left ventricular heart failure was determined by the LV/RBPA ratio.[1,11] Using a four-chamber apical projection in a constant-wave Doppler mode, the rate of mitral and tricuspid regurgitation was measured. The restrictive and pseudonormal pattern of diastolic transmittal flow was evaluated in the pulse-wave Doppler mode in a four-chamber apical projection.[18]

All sick dogs underwent a classic electrocardiographic study in the right-side position using the EC1T-04 "Midas" electrocardiograph (speed 50 mm/s, gain 1 mV = 1 cm) with the implementation of six frontal leads from the extremities. All owners received recommendations about assessing the frequency of breathing movements during sleep of the dog and explanations about the method of performing the test and goals. All owners are assigned a repeat appointment in 14 and 30 days. Monitoring the effectiveness of therapy, assessing the owners' commitment to count the frequency of respiratory movements during sleep, as well as analyzing the survival time of sick dogs was carried out by assigning repeated visits to the clinic and phone calls. Some owners were contacted via social networks (Facebook, Instagram, Vkontakte, Odnoklassniki) and services (Viber, WhatsApp). The low degree of adherence of owners to diagnostic monitoring was determined by the lack of data provided on the control of respiratory rate during sleep at the time of repeated admission.

The end point of the study was considered as cardiac death (sudden cardiac death or the death of a dog from severe cardiac decompensation). Euthanasia due to progressive congestive heart failure also served as the end point of the study. Cases where the death of an animal occurred from non-cardiac causes were included in the study up to the last time point of control with further censorship procedure. If there was a loss of feedback from the owner or the fact of the dog's survival at the time of completion of the study, the animals were included in the study until the last time point of control with the censoring procedure. The duration of the study was 1378 days.

The $\chi 2$ criterion was used to compare groups by the frequency of the trait, if necessary, with the Yates correction. The Kaplan-Meyer method was used for statistical estimation of survival time. The survival time of the group was compared using the Gehan criterion. Predictors of cardiac death were determined by analyzing proportional Cox intensities. First, we analyzed the impact of each individual indicator from the beginning of the observation to the occurrence of the event (univariant analysis). We determined the risk ratio indicator (HR). After that, a multiple analysis model was created, which according to the generally accepted method, included all the indicators and also according to the univariant analysis, significantly affect the occurrence of the event (p<0.05). Indicators that significantly influenced the occurrence of the final event during multiple analysis were determined as independent predictors of this event.[2,3] All calculations were performed on a personal computer using the statistical program STATISTICA 7.0 (StatSoft, USA).

RESULTS

The clinical characteristics of sick dogs, depending on the degree of commitment of their owners to assess the frequency of respiratory movements during sleep, are shown in (TABLE 1). According to the inclusion and exclusion criteria, during 2015-2019, 181 cases of mitral valve endocardiosis manifesting as congestive heart failure syndrome in dogs (stage C according to the ACVIM classification) were registered. The study covered 119 miles (65.7%) and 62 females (34.3%).

Table 1: Clinical characteristics of sick dogs depending on the degree of adherence of their owners to the assessment of the frequency of respiratory movements during sleep (abs. number / percentage)

Characteristics of dogs		Owners ' commitment to evaluating their breathing rate during sleep		Validity of the difference (**p**)
		High (n=81)	Low (n=100)	
Breed	dachshund	19 / 23,5	27 / 27,0	0,58
	yorkshire terrier	13 / 16,0	7 / 7,0	0,054
	chihuahua	12 / 14,8	9 / 9,0	0,22
	maltese	4 / 4,9	7 / 7,0	0,56
	poodle	5 / 6,2	8 / 8,0	0,63
	pekingese	3 / 3,7	6 / 6,0	0,48
	Cavalier King Charles Spaniel	4 / 4,9	5 / 5,0	0,98
	Jagdterrier	2 / 2,5	2 / 2,0	0,83
	Jack russell terrier	4 / 4,9	4 /4,0	0,76
	Shih Tzu	4 / 4,9	0 / 0	0,08
	Cocker Spaniel	2 / 2,5	4 / 4,0	0,56
	Japanese Chin	2 /2,5	2 / 2,0	0,83
	Zwergpinscher	2 / 2,5	3 / 3,0	0,83
	Zwergschnauzer	1 / 1,2	2 / 2,0	0,69
	Spitz	1 /1,2	5 / 5,0	0,16
	mongrel	3 / 3,7	9 / 9,0	0,15
Gender	males	51 / 63,0	68 / 68,0	0,47
	females	30 / 37,0	32 / 32,0	0,47
The presence of a gallop rhythm		10 / 12,3	9 / 9,0	0,46
The presence of fainting spells		2 / 2,5	7 / 7,0	0,16
Presence of atrial fibrillation		7 / 8,6	7 / 7,0	0,68
LVIDdN more 2,0		8 / 9,9	9 / 9,0	0,84
LVIDsN more 2,2		11 / 13,6	11 / 11,0	0,59
The shortening fraction is less than 35 %		15 / 18,5	12 / 12,0	0,22
LA/Ao more 2,0		12 / 14,8	16 / 16,0	0,82
The velocity of tricuspid regurgitation is more than 4 м/с		16 / 19,8	25 / 25,0	0,40
The velocity of mitral regurgitation is less than 4,5 м/с		31 / 38,3	27 / 27,0	0,11
PV/RBPA more 1,9		8 / 9,9	18 / 18,0	0,12
Restrictive pattern of the transmitral blood flow		21 / 25,9	30 / 30,0	0,54

Most often, mitral valve endocardiosis, complicated by congestive heart failure, was found in dogs of the following breeds: Dachshund (25.3%), less often – Chihuahua (11.6%), Yorkshire Terrier (11.1%), poodle (7.2%), maltose (6.1%), mongrel (6.6%), Pekingese (5.0%), Cavalier king Charles Spaniel (5.0%), rarely-Jack Russell Terrier (4.4%), Cocker Spaniel (3.3%), Spitz (3.3%), Zwergpinscher (2.8%), Jagd Terrier (2.2%), Shih Tzu (2.2%), Japanese hin (2.2%), Zwergschnauzer (1.7%).

The average age of sick dogs was 4092 ± 94 days (1434-6583). The $\chi 2$ criterion did not reveal a significant difference between the incidence of congestive heart failure in dogs of different breeds, ages and sex and owners who showed different degrees of adherence to the assessment of the frequency of respiratory movements during sleep.

The $\chi 2$ criterion revealed no significant difference between the frequency of occurrence of these clinical and echocardiographic signs and syndromes, as the Presence of gallop rhythm, fainting, atrial fibrillation, LVIDsN more than 2.0 condit: units, LVIDdN more than 2.2 conditi: units, shortening fraction less than 35 %, the ratio of left atrium to aortic root more than 2.0 conditi: units, the velocity of tricuspid regurgitation of more than 4 m/s, the velocity of mitral regurgitation less than 4.5 m/s, the ratio of the pulmonary vein to the right branch of the pulmonary artery more than 1.9, the presence of restrictive type of transmitral blood flow in sick dogs whose owners showed varying degrees of commitment to assess the frequency respiratory movements during sleep.

Table 2: Characteristics of owners of sick dogs depending on the degree of adherence to the assessment of respiratory rate during sleep

Characteristics of owners		Owners ' commitment to evaluating their breathing rate during sleep		Validity of the difference (p)
		High (n=81)	Low(n=100)	
Age category, years	10–20	8 / 9,9	9 / 9,0	0,84
	21–30	15 / 18,5	22 / 22,0	0,56
	31–60	31 / 38,3	26 / 26,0	0,08
	older than 60	27 / 33,3	43 / 43,0	0,18
Gender	Man	19 / 23,5	62 / 62,0	0,001*
	Woman	62 / 76,5	38 / 38,0	0,001*
Experience in dog care, years	Up to 1	14 / 17,3	8 / 8,0	0,06
	1–4	11 / 13,6	25 / 25,0	0,08
	5–10	25 / 30,9	23 / 23,0	0,30
	11–15	22 / 27,2	33 / 33,0	0,38
	more than 15	9 / 11,1	11 / 11,0	0,98
Experience with cardiopathology in dogs in the past	Yes	5 / 6,2	4 / 4,0	0,50
	No	76 / 93,8	96 / 96,0	0,50
The recommended frequency of evaluation the frequency of breathing during sleep	0,5	8 / 9,9	17 / 17,0	0,17
	1	60 / 74,1	31 / 31,0	0,001*
	2	11 / 13,6	26 / 26,0	0,04
	3	2 / 2,5	26 / 26,0	0,001*

Note: * significant difference (p <0.05)

For clinical practice, it is also important to evaluate the characteristics of dog owners (TABLE 2). According to the data shown on table 2, it can be seen that the age of owners of sick dogs was represented by the following categories: 10-20 years (9,4%); 21-30 (20,4%); 31-60 (31,5%) and over 60 years of age (38.7%). There are no significant differences in the age groups of dog owners, depending on their degree of adherence to the assessment of the frequency of breathing during sleep. However, the female gender of the owner was associated with a high degree of commitment, and this difference was found as highly reliable (p<0.001) when evaluated using the χ2 criterion.

The length of time spent caring for dogs also did not have a significant impact on the degree of owners' commitment to daily monitoring of their pet's respiratory function. The presence of a close to reliable trend (p=0.06) of a lower degree of adherence was found in the group of animal owners who had caring experience up to one year.
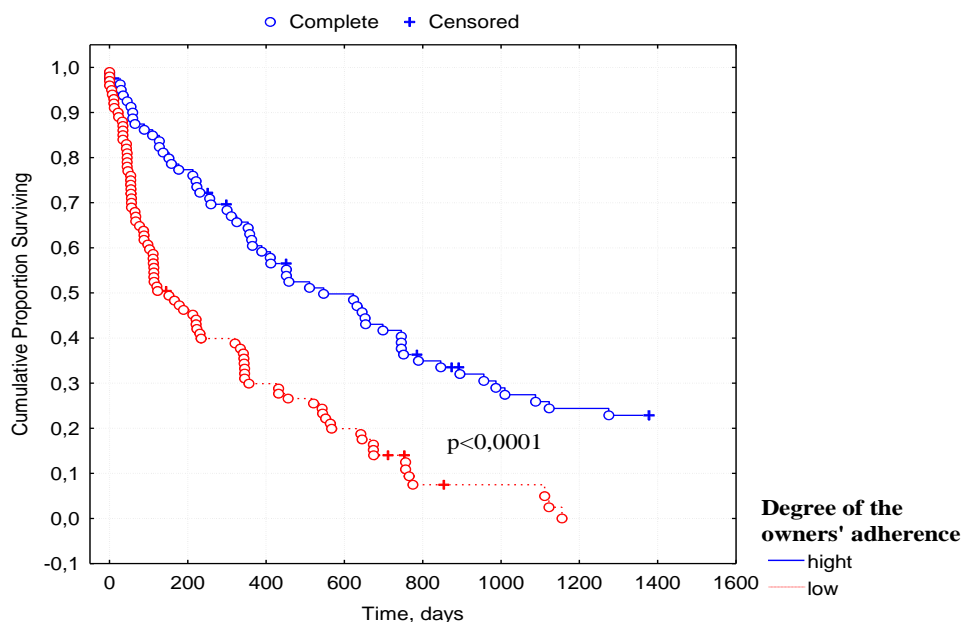

Figure 1: Cumulative proportion of survival of dogs with mitral valve endocardiosis complicated by congestive heart failure syndrome, depending on the degree of owners ' commitment to assessing respiratory rate during sleep

When assessing the survival time of sick dogs, it was found that it varied between 0-1378 days (arithmetic mean – 422.5; median – 259.0 days). The survival time of sick dogs whose owners showed high adherence to the test was on average 604.8±53.1 days (variation from 0 to 1378; median – 452 days). In sick animals whose owners showed low adherence to the assessment of respiratory rate, the life expectancy was significantly lower and averaged 279.9±28.9 days (variation from 0 to 1156; median – 122 days) In the Mann-Whitney test, this difference was found as significant (p<0.0001). When evaluating the survival curves of dogs with endocardiosis complicated by congestive heart failure FIG. 1, and with different owners' commitment to assess the respiratory rate during sleep, by the Kaplan-Meyer method using the Gehan criterion, a highly reliable difference was also found (p<0.0001).

To determine the predictors of death in dogs with mitral valve endocardiosis complicated by congestive heart failure syndrome, an analysis of proportional coke intensities was performed, which included the following parameters: the owners' adherence to the assessment of the frequency of respiratory movements in sleep, the presence of a gallop rhythm, fainting, atrial fibrillation, LVIDsN more than 2.0 units, LVIDdN more than 2.2 units, left ventricular shortening fraction less than 35%, the ratio of LA/AO more than 2.0, increasing the velocity of tricuspid regurgitation more than 4 m/s, reducing the velocity of mitral regurgitation less than 4.5 m/s, PV/RBPA ratio more than 1.9, restrictive type of transmittal blood flow, gender, breed, age of the dog, age category and gender of dog owners, experience in dog care, experience with Cardiopathology in dogs in the past, the recommended frequency of evaluating the frequency of Respiratory movements during sleep. According to the generally accepted method, only the parameters (for which p<0.05 was found to be reliable) were subjected to multiple analysis of proportional Cox intensities (TABLE 3).

Table 3: Predictors of cardiac death in dogs with congestive heart failure on the background of mitral valve endocardiosis

Predictor	Predictorvid of analysis of proportional Cox intensities			
	Univariate		Multiple	
	HR	p	HR	p
The commitment of the owners to assess the frequency of breathing during sleep	2,44	<0,0001	2,74	<0,0001
the presence of a gallop rhythm	0,55	<0,05	0,55	<0,1
presence of fainting spells	0,92	<1	–	–
presence of atrial fibrillation	0,86	<1	–	–
LVIDsN more 2,0	0,92	<1	–	–
LVIDdN more 2,0	0,75	<0,5	–	–
The shortening fraction is less than 35%	0,20	<0,0001	0,14	<0,001
LA/Ao more 2,0	0,88	<1	–	–
The velocity of tricuspid regurgitation is more than 4 m/s	0,48	<0,001	0,56	<0,01
The velocity of mitral regurgitation is less than 4.5 m/s	0,64	<0,05	0,79	<0,5
PV/RBPA more 1,9	0,71	<0,5	–	–
Restrictive type of transmittal blood flow	1,08	<1	–	–
gender of the dog	0,96	<1	–	–
Breed	1,05	<0,01	1,04	<0,1
age of the dog	0,99	<1	–	–
age category of dog owners	0,96	<1	–	–
the gender of the owner	0,64	<0,001	0,89	<1
experience in dog care	1,03	<1	–	–
Experience with cardiopathology in dogs in the past	0,85	<1	–	–
Frequency of sleep respiratory rate estimation	1,32	<0,01	1,13	<0,5

As shown in (TABLE 3), a number of clinical and instrumental parameters were associated with an increased risk of death during univariate analysis. These adverse factors are the owners' commitment to assess the frequency of respiratory movements in sleep, the presence of a gallop rhythm, a shortening fraction of less than 35%, the tricuspid regurgitation velocity of more than 4 m/s, the mitral regurgitation velocity of less than 4.5 m / s, the breed, gender of the owner, and the frequency of evaluating the respiratory rate in sleep. However, according to the results of multiple analysis of Cox proportional intensities, only three indicators were served by independent predictors of fatal outcome of the disease: in particular the commitment of the dog owners to assess the frequency of sleep apnea, the presence of a reduction of the shortening fraction below 35% and increase the velocity of the tricuspid insufficiency higher than 4 m/s. The most powerful predictive value was the dog owners' commitment to evaluate their sleep

breathing rate. Thus, the presence of a high commitment to home monitoring of the respiratory function of their Pets is accompanied by a reduction in the risk of death of the disease by 2.74 times.

DISCUSSION

This article describes the results of a prospective study of the survival rate of dogs with mitral valve endocardiosis, complicated by congestive heart failure syndrome, taking into account the degree of commitment of owners to assess the frequency of respiratory movements during sleep. According to the inclusion and exclusion criteria, 181 sick dogs were subjected to statistical analysis. In our study, congestive heart failure on the background of mitral valve endocardiosis was registered in dogs of small and dwarf breeds, but most often in dachshunds, which are quite popular in the Russian Federation. At the same time, the disease was more common in males, which corresponds to the data presented in the literature.[2,12,14]

In recent years, practitioners of veterinary medicine have developed a valuable indicator-the frequency of respiratory movements during sleep, which allows monitoring the effectiveness of therapy for dogs with congestive heart failure, rational use of diuretics, predict the onset of decompensation and timely adjust treatment tactics.[36,37] Using this test can reduce the frequency of hospitalization of sick dogs in cardiopathology and significantly increase their life expectancy. However, in our practice, it was noticed that not all owners whose dogs with mitral valve endocardiosis show the same commitment to evaluate this parameter. Therefore, the aim of the work was to study the owners' commitment to home monitoring of the respiratory function of dogs with congestive heart failure against the background of mitral endocardiosis in the aspect of assessing their survival.

In human medicine, there is a concept of compliance, or adherence to therapy, as the degree of compliance between the patient's behavior and the recommendations received from the doctor.[38,41,43,47] It should be noted, that little attention is paid to this aspect in veterinary medicine.

Since this study covered only dogs with mitral valve endocardiosis complicated by congestive heart failure syndrome, we selected somewhat inflated diagnostic limits relative to echocardiographic parameters that characterize the degree of left atrial dilation, eccentric hypertrophy, systolic and diastolic left ventricular dysfunction and venous pulmonary congestion. The following echocardiographic criteria were used as independent predictors of death: LVIDsN >2.0 conditi. units, LVIDdN >2.2 conditi. units left ventricular shortening fraction <35 %, LA/AO ratio >2.0unit, tricuspid regurgitation rate >4 m / s, mitral regurgitation rate <4.5 m/s, PV/RBPA ratio >1.9 conditi. ed., the presence of a restrictive type of transmittal blood flow.

When evaluating the clinical and instrumental characteristics of sick dogs, depending on the degree of adherence of their owners to the assessment of respiratory rate during sleep, there were no significant differences in almost all clinical and echocardiographic parameters. The exception was the identification of a close to reliable trend of increasing incidence of the disease in a group of dogs of the Yorkshire Terrier breed with a high diagnostic commitment of their owners. The age of the dog owner did not significantly affect the degree of its diagnostic adherence, however, female owners significantly better performed home monitoring of their pet's respiratory condition. It was found that the experience of caring for dogs did not have a significant impact on the degree of commitment of owners to daily monitoring of respiratory function during sleep.

According to the results of multiple analysis of proportional Cox intensities, three independent predictors of fatal endocardiosis of the mitral valve in dogs complicated by congestive heart failure syndrome were identified: 1) low adherence of dog owners to the assessment of the respiratory rate during sleep; 2) the presence of a decrease in the shortening fraction below 35%; 3) an increase in the rate of tricuspid insufficiency above 4 m/s. A decrease in the fraction of left ventricular myocardial shortening in dogs with mitral valve endocardiosis and congestive heart failure indicates a significant decrease in systolic function. Expressed systolic dysfunction as an independent predictor of death in dogs with endocardiosis has also been shown in other studies.[16,29,30] The high velocity of the tricuspid regurgitation jet in sick dogs indicates the development of high cardiogenic pulmonary hypertension. High and critical pulmonary hypertension is also an independent predictor of death in dogs with mitral valve endocardiosis.[21,26] A decrease in the velocity of the mitral regurgitation jet in dogs with mitral valve endocardiosis may indicate, on the one hand, a significant increase in the end-diastolic pressure in the left atrial cavity, and on the other hand, a clinically significant decrease in the systolic function of the left ventricle. However, in our study, a decrease in the rate of mitral regurgitation of less than 4.5 m/s did not prove to be a reliable marker of prognosis in dogs with endocardiosis. This aspect requires further active study.[48,49,50,51,52,53,54,55,56]

The assessment of the survival time of sick dogs showed that the median life expectancy of dogs whose owners had a high diagnostic commitment to monitoring respiratory function was significantly (p<0.0001) more than 3.7 times. It was also found that poor adherence to the assessment of respiratory rate by dog owners is the most powerful independent predictor of death in mitral valve endocardiosis. Similar research in veterinary medicine has not been conducted before.

The main limitations of this study are some subjectivity, heterogeneity of the subpopulation of dogs with mitral valve endocardiosis complicated by congestive heart failure syndrome, and a relatively small number of clinical observations. It is also possible that low adherence to the assessment of respiratory rate during sleep is associated with poor implementation of therapeutic recommendations. Little attention is paid to timely identification of factors of low compliance among owners and conducting explanatory work to improve it. Further theoretical and clinical justification of the degree of compliance of dog owners whose dogs with cardiological pathologies is required, which will make it possible to solve the above problems.

CONCLUSION

The degree of commitment of owners to assess the frequency of respiratory movements during sleep has a significant impact on the survival of dogs with congestive heart failure syndrome, which is caused by mitral valve endocardiosis. The median lifetime of dogs with congestive heart failure whose owners had a high diagnostic commitment to monitoring respiratory function was significantly (p<0.0001) more than 3.7 times. The low degree of adherence of owners of sick dogs to the assessment of the respiratory rate during sleep is an independent predictor of death in congestive heart failure.

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CONFLICT OF INTEREST

The authors have no conflict of interest.

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