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## Radiological analysis of mitral insufficiency among dogs in Croatia

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### ABSTRACT

A sample of 317 dogs with radiologically diagnosed acquired heart diseases was studied. Of the above number, 225 (70.98%) had mitral insufficiency, 54 (17.03%) had dilation cardiomyopathy, 28 (8.83%) had cor pulmonale, 5 (1.58%) had pericarditis, 3 (0.95%) had arterial stenosis, and 2 (0.63%) had stenosis of the pulmonary artery. Mitral insufficiency is among the most frequent of acquired heart diseases. A strong predisposition to this disease among small- and medium-size breeds of dogs was observed. Thus, mitral insufficiency was diagnosed in 211 out of 238 dogs belonging to those breeds (88.66%), and only in 14 out of 79 of large breeds (17.72%). In the small- and medium-sized breed group the incidence was higher among males; (58.77% of males and 41.23% of females, respectively). Also, males show a tendency to develop more severe grades of the disease than females.

**Key words:** mitral insufficiency, dog, radiology

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### Introduction

In modern veterinary practice the diagnostics of heart diseases in dogs employ a range of diagnostic methods. Apart from general clinical examinations we use radiological methods (survey and contrast radiography), electrocardiography (ECG), echocardiography and the testing of enzymes in the blood. All of the above diagnostic methods complement each other. Radiological examination provides us with a direct insight into the changes in the heart itself, as well as extracardial changes. The basic radiological method is survey

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radiography, which can be complemented by contract radiography of the cardiovascular system (angiocardiography).

Mitral insufficiency is the most common disease of the cardiovascular system in dogs and accounts for up to 75% of all cardiovascular diseases in dogs (KITTLESON and KIENLE, 1998; DETWEILER and PATTERSON, 1965; DAS and TASHJIAN, 1965). The disease is most frequent in small- and medium-sized breeds of dog aged 5 years and more. Males are more prone than females and develop more severe forms (BUCHANAN, 1977). The predisposition for this disease is pronounced in the Poodle (small and medium), miniature schnauzer, Chihuahua, Fox Terrier, Dachshund and Yorkshire terrier. The disease is rare in large breeds of dog, such as Doberman Pinch, and exceptional in the German shepherd and Great Dane (BUCHANAN, 1977). The course of the disease is usually slow and consequently owners frequently report it only in the advanced stage.

Mitral insufficiency is caused by degenerative changes in the valves. More rarely, it is of an inflammatory nature. In the latter case we speak of endocarditis caused by an infectious agent producing inflammation and destruction of valve tissue. The essential pathogenesis of this disease is in the proliferation, shortening and thickening of mitral valves. Occasionally, the degenerative process involves chordae tendinae which become thickened and shortened. Degenerative changes on mitral valves begin at five years of age and progress with further aging of the animal (WHITNEY, 1974). In rare breeds, such as the Cavalier King Charles Spaniel, it appears at an even younger age, even less than one year (BEARDOW and BUCHANAN, 1993). Radiological classification of mitral insufficiency into four grades is based on a correlation of radiological findings and clinical manifestations of the disease (HAMLIN, 1968; ETTINGER and SUTER, 1970). The prognosis of this disease is relatively favourable. By reaching the right diagnosis, applying appropriate therapy and regular controls, heart insufficiency can be successfully controlled for many years.

Up until now the incidence of mitral insufficiency in dogs in Croatia has not been investigated. Our aim in this study was to analyse the frequency of this condition in relation to the overall incidence of cardiovascular diseases. Within the scope of this analysis we explored the frequency of its occurrence according to breed, sex, age and gravity of the disease. All diagnoses were made on the basis of survey radiography.

### **Materials and methods**

Research included patients with indications for examination of the cardiovascular system referred to us from the clinics of the Faculty of Veterinary Medicine, as well as from other clinics. All patients underwent radiological examination and a definitive diagnosis was established. In suspect cases the tentative diagnosis dilatatio cordis was used. Patients in which the diagnosis was absent even after radiological examination were monitored and radiologically controlled. In a three-year period from 2001 to 2003 a total of 317

patients of different breed, sex and age were radiologically diagnosed as having acquired heart diseases. From this number we selected for further study those patients in which the diagnosis of mitral insufficiency was reached, and the grade of severity determined by standard radiography in two basic projections.

## Results

In our study we analyzed 317 cases of acquired heart diseases as diagnosed by radiography

Table 1. Breeds and number of dogs examined

Large breeds of dog	N <sup>o</sup>	Small and medium breeds of dog	N <sup>o</sup>
German Shepherd dog	21	Poodle	59
Boxer	10	Small terriers	38
Labrador Retriever	6	Cocker Spaniel	29
Pit bull terrier	5	Pekingese	25
Newfoundland	4	Terriers	25
German pointer	4	Pinscher	24
Doberman	4	Dachshund	12
Bobtail	3	Shih-tzu	9
Rottweiler	3	Chihuahua	6
Big terriers	3	Spitz dog	3
Irish Setter	2	Maltese	3
Saint Bernard	2	Mops	2
Dalmatian	2	English Bulldog	2
Belgian Shepherd dog	1	Bichon	1
Basset	1	Total	238
Gordon Setter	1		
Siberian Husky	1		
Croatian Sheepdog	1		
Alaskan Malamute	1		
Mastiff	1		
Yug. Sheepdog	1		
Rough Collie	1		
Total	79		

Different heart diseases appeared in the following order of frequency: mitral insufficiency was diagnosed in 225 dogs (70.98%), dilated cardiomyopathy in 54 dogs (17.03%), cor pulmonale in 28 dogs (8.83%), pericarditis in 5 dogs (1.58%), aortic stenosis in 3 dogs (0.95%), and stenosis of pulmonary artery in 2 dogs (0.63%) (Table 2 and Fig. 1).

Table 2. Frequency of different heart diseases in the studied sample

Diagnosis	N <sup>o</sup>	%
Mitral insufficiency	225	70.98
Dilated cardiomyopathy	54	17.03
Cor pulmonale	28	8.83
Pericarditis	5	1.58
Aortic stenosis	3	0.95
Stenosis of the pulmonary artery	2	0.63
Total	317	100.00

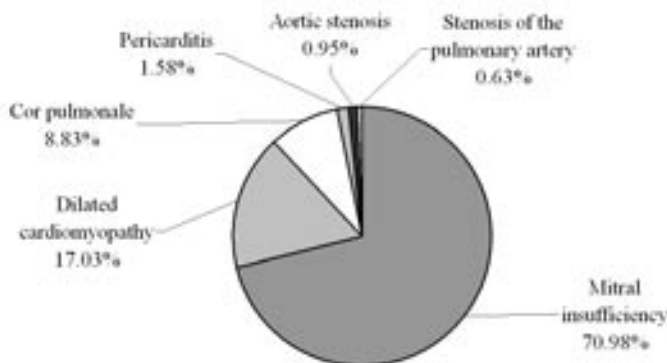


Fig. 1. Frequency of different heart diseases in the studied sample

In the next phase of the research we analysed mitral insufficiency as the most common heart disease (70.98%) in relation to age. As expected, a tendency of increased frequency with increasing age was shown (Fig. 2).

Mitral insufficiency is most frequent in small- and medium-sized breeds of dog. It is rare in large breeds. The analysis of the influence of breed on the frequency of mitral insufficiency within the total number of cardiovascular cases is shown in Table 3. Of the total number of 317 dogs, 238 were small- and medium-sized breeds. Mitral insufficiency

in this group was diagnosed in 211 dogs (88.66%). All other heart diseases were present in only 27 dogs (11.34%). In the overall sample heart diseases were diagnosed in 79 large breeds of dog. Of this number, 14 dogs (17.72%) had mitral insufficiency, all other heart diseases comprising 65 dogs (82.28%). Chi square analysis (144.88) shows a high statistical significance ( $P < 0.001$ ) in the predisposition of small- and medium-sized breeds of dog to mitral insufficiency.

Analysis of the frequency of mitral insufficiency in the sample of small- and medium-sized breeds of dog in relation to sex is presented in Table 4. Males have shown to be more prone to this disease than females (58.77%).

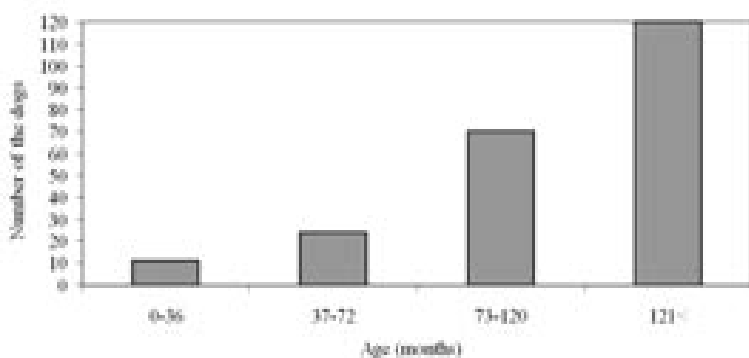


Fig. 2. Frequency of mitral insufficiency in relation to age

Table 3. Frequency of mitral insufficiency in small- and medium-sized breeds of dog on one hand, and large breeds of dog on the other

		Diagnoses					
Breeds of dogs	N° of dogs	Mitral insufficiency		Other diseases		Chi-square	P
		N° of dogs	%	N° of dogs	%		
Small and medium breeds	238	211	88.66	27	11.34	144.88	<0.001
Large breeds		14	17.72	65	82.28		
Total	317	225	100.00	92	100.00		

Table 4. Frequency of mitral insufficiency in small- and medium-sized breeds of dog, by sex

	N° of dogs	%
Male	124	58.77
Female	87	41.23
Total	211	100

Distribution of different grades of mitral insufficiency by sex and age is presented in Tables 5-8.

Grade I mitral insufficiency shows a similar distribution among both sexes (11 males and 12 females) (Table 5)

Table 5. Grade I/IV of mitral insufficiency in relation to sex and age

I/IV	Age (months)			
	0-36	37-72	73-120	>121
Male	3	1	2	5
Female	5	1	1	5
Total	8	2	3	10

In the group of grade II of mitral insufficiency no statistical significance is seen between males and females (31 and 25, respectively) (Table 6).

Table 6. Grade II/IV of mitral insufficiency in relation to sex and age

II/IV	Age (months)			
	0-36	37-72	73-120	>121
Male	1	8	10	13
Female		9	6	10
Total	1	17	16	23

With the progression of the disease by grades we see that males are afflicted with greater frequency than females. Thus, in the group of grade III of mitral insufficiency there were 40 males (60.60%) and 26 females (39.40%) (Table 7).

Table 7. Grade III/IV of mitral insufficiency in relation to sex and age

III/IV	Age (months)			
	0-36	37-72	73-120	>121
Male		3	23	14
Female		1	13	12
Total		4	36	26

In the group with the highest degree of severity of the disease (grade IV) the predominance of males is even higher (41 vs. 24 females; 63.08% vs. 36.92%, respectively) (Table 8).

Table 8. Grade IV/IV of mitral insufficiency in relation to sex and age

IV/IV	Age (months)			
	0-36	37-72	73-120	>121
Male			8	33
Female			3	21
Total			11	54

## Discussion

The study included patients with a radiological diagnosis of acquired heart disease. In the total number of 317 study subjects various heart diseases were diagnosed. The aim of the study was to examine the proportion of mitral insufficiency in the overall incidence of cardiac diseases, as well as the breakdown according to breed, sex, age, and grade of the disease. In the overall number of 317 diagnosed heart diseases mitral insufficiency was found in 225 cases (70.98%). This corresponds to the findings of other authors (DETWEILER and PATTERSON, 1965; DAS and TASHJIAN, 1965; KITTLESON and KIENLE, 1998). As the disease is strongly correlated to breed, the results may be influenced by the current popularity of particular breeds in various parts of the world. The disease is known to be more frequent in small- and medium-sized breeds of dog, occurring very rarely in large breeds (BUCHANAN, 1977). This finding was proven by our study, which showed a high statistical significance in the predisposition of small- and medium-sized breeds of dog to mitral insufficiency ( $P < 0.001$ ) (Table 3). Degenerative changes in mitral valves begin in the fifth year of life and progress with the aging of the animal (WHITNEY, 1974).

The trend of increased frequency of the disease with increasing age of the animal was also observed in our study (Fig. 2). Apart from breed, a difference in sex predisposition was also observed, males being more prone to the disease and developing more severe forms than females (BUCHANAN, 1977). 124 patients in our study were males (58.77%) and 87 were females (41.23%). Sex predisposition was not pronounced in milder grades of the disease (grades I/IV and II/IV) (Tables 5 and 6), but manifested in more severe grades (III/IV and IV/IV) (Tables 7 and 8).

### **Conclusion**

We conclude that radiological examination is one of the essential methods for accurate diagnosing of mitral insufficiency and for determining the grade of the disease. The results of this study can be of practical value to veterinarian clinicians. Knowledge of mitral insufficiency and of the predisposition of individual breeds, sex and age to this disease can help to reach a timely diagnosis and in the application of the appropriate therapy. In such a way the disease can successfully be compensated for over a long period of time.

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**SAŽETAK**

Na uzorku od 317 pasa rendgenološki su dijagnosticirane različite stečene bolesti srca. Mitralna insuficijencija dijagnosticirana je u 225 (70,89%) pasa, u 54 (17,03%) psa dijagnosticirana je dilatacijska kardiomiopatija, u 28 pasa (8,83%) cor pulmonale, perikarditis u 5 pasa (1,58%), stenoza aorte u 3 psa (0,95%) i stenoza arterije pulmonalis u 2 psa (0,63%). Najučestalija stečena bolest srca bila je mitralna insuficijencija. Od ove bolesti češće su oboljevali psi malih i srednje velikih pasmina. Mitralna insuficijencija dijagnosticirana je u 211 pasa (88,66%) od ukupno 238 malih i srednje velikih pasmina pasa i u 14 (17,72%) od ukupno 79 velikih pasmina. U skupini malih i srednje velikih pasmina učestalost je veća u mužjaka, 124 (58,77%) psa, u odnosu na 87 ženki (41,23%). Analizirajući učestalost prema stupnju težine bolesti i spolu mitralna insuficijencija ne samo da je učestalija u mužjaka već oni obolijevaju i od težeg stupnja bolesti.

**Cljučne riječi:** mitralna insuficijencija, pas, rendgenologija

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