

Follow up the Treatment Process of Mitral Valve Diseases by Radiography and Echocardiography in Dogs

Leila Mohammadyar¹, Mohammad Molazem², Mohammad Reza Esmaili Nejad³, Aryo Parseh⁴

¹Department of Pharmacology, Faculty of Veterinary Medicine, Islamic Azad University of Garmsar, Semnan, Iran

²Department of Surgery and Radiology, Faculty of Veterinary Medicine, University of Tehran, Tehran, Iran

³DVSc/Phd student of Veterinary Diagnostic Imaging, Department of Surgery and Radiology, University of Tehran, Tehran, Iran

⁴Doctorate of Veterinary Medicine

Abstract:

BACKGROUND: Mitral valve disease is the most common acquired heart disease in dogs. Mitral valve regurgitation (MR) due to endocardiosis is an important cause of morbidity and mortality in dog. Echocardiography as a non-invasive tool is routinely used to evaluate and diagnose different disorders in the heart.

OBJECTIVES: The purpose of this study is to determine the efficacy of medical treatments and follow-up administration by the veterinarians in Tehran, using radiography and echocardiography.

METHODS: A total of 35 dogs from various breeds with cardiac heat failure (CHF) because of MR were selected for prospective randomized study. After clinical examination and radiography, progressive mitral endocardiosis was confirmed by echocardiography. After that, patients were treated by a routine plans recommended by the general practitioners (12 active small animal clinicians). Follow-up radiography and echocardiography were performed again after 3 months for checking the efficacy of treatment protocol on cardiac output.

RESULTS: None of the medically treated patients statically showed significant improvement in their radiographic or echocardiographic parameters, that can be the outcome of incompatibility of using protocols with the standard ones.

CONCLUSIONS: Although more studies are needed, based on the present results there was no significant change in cardiac parameters after 3 months of treatment. It seems that the current routine medication used by the active practitioner is not effective and cannot make a better quality of life in short term and requires changing the dose, the drugs producers or use of different prescription items.

Keywords:

Radiography, Echocardiography, Endocardiosis, Mitral, Dog

Correspondence

Mohammad Reza Esmaili Nejad, DVSc/Phd student of Veterinary Diagnostic Imaging, Department of Surgery and Radiology, University of Tehran, Tehran, Iran

Tel: +98(21) 61117079, Fax: +98(21) 66933222, Email: esmaili.mreza@yahoo.com

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Introduction

Myxomatous mitral valve disease (MMVD) is the most common congenital heart disease in dogs accounting for more than 70% of all canine heart disease (Atkins et al. 2012). The disease is chronic and progressive with initial signs, usually a heart murmur, developing after the age of six years. Approximately 30% of dogs with MMVD progress to mitral regurgitation (MR) and eventually chronic heart failure (Borgarelli and Haggstrom 2010). The incidence is particularly high in some breeds such as the Cavalier King Charles spaniel (CKCS) with as many as 90% developing MMVD by the age of 10 years (Borgarelli and Haggstrom 2010). Evidence from highly susceptible breeds such as the CKCS and dachshund shows a strong inherited component to the disease and suggests a polygenic mode of inheritance (Lawrance et al. 2017). M-mode, color flow Doppler and pulsed wave Doppler echocardiography are used to diagnose mitral regurgitation in combination with electrocardiography and auscultation (Burchell and Schoeman 2014). Typically, echocardiography is used to evaluate the structure and function of the heart. It could diagnose and document different disorders such as mitral leaflets degeneration, the severity of regurgitation flow and valve prolapse, individual chamber dilation and pulmonary hypertension (Hezzell et al. 2012). Medical therapy that neutralizes the increasing MR, lung edema and cardiac remodeling processes should theoretically have the potential to delay the onset of death (Atkins et al. 2012).

The hypotheses behind this article is that insufficient caring and medication in the dogs suffering from different levels of MR

by the general veterinary practitioners in Tehran may lead to unclear improvement in the patient's clinical condition. Therefore, the purpose of this study is to determine and assess the medical treatments and follow ups administrated by the veterinary clinicians practicing in Tehran, Iran and to check if this medication might be sufficient to reduce the progression speed of mitral valve regurgitation in dogs or not.

Material and Methods

A total of 35 dogs (20 males and 15 females) with symptomatic mitral valve regurgitation were selected. The mean body weight, age and numbers for each breed are shown in Table 1. These patients were included from a larger population referred to the Small Animal Teaching Hospital, University of Tehran and Tehran Azma Veterinary Diagnostic Center, Tehran, Iran for evaluation of mitral regurgitation and potential of starting medical treatment plans. Those with clear clinical, radiographic and echocardiographic signs for endocardiosis were entered to the study. Patients with previous medication were excluded.

All cases underwent right parasternal short and long axis and apical views echocardiography by restraining and without using any sedative or anesthetic drugs (Vivid 7; GE Medical Systems, USA), connected to a multi-frequency (6-13 Mhz) phased-array transducer. The B.Mode and M.Mode subjective and objective measurements on the heart chambers, wall and mitral valve were saved (Fig. 1). Standard digital radiographs (Direct-View, Classic CR System; Care Stream, Canada) were taken in right lateral and dorsoventral (DV) projections were also performed with measuring heart/

Table 1. Mean body weight, age and numbers of the dogs with symptomatic mitral valve diseases.

Breeds	Number	Age (years)(M)	Weight(Kg)(M)
Pug	2	8.5	7.2
Dachshund	2	1	8.7
Miniature pincher	3	3	5.8
Terrier	15	10	7.3
Shih Tzu Terrier	4	7.5	6.1
Spitz	2	1.5	10.4
Chihuahua	3	3	2.6
Rottweiler	2	2	12.3
Pekingese	2	2	4.2

Table 2. M. Mode echocardiographic parameters before and after 3 months of receiving medication for mitral valve disease.

parameters	Before		After		P.Value
	Mean	Std. Error	Mean	Std. Error	
SV	19.263	3.216	19.703	3.148	0.326
EPSS (cm)	0.263	0.029	0.262	0.029	0.336
La/Ao	4.682	2.949	4.686	2.949	0.330
EF%	80.743	8.248	79.836	8.350	0.465
FS%	43.097	2.371	43.217	2.377	0.892
LVPWs (cm)	1.165	0.071	1.177	0.066	0.668
LVPWd (cm)	0.897	0.058	0.930	0.056	0.106
LVIDs (cm)	1.571	0.118	1.614	0.129	0.282
IVIDd (cm)	2.511	0.166	2.555	0.166	0.126
IVSd (cm)	0.829	0.048	0.850	0.048	0.465
IVSs (cm)	1.132	0.047	1.146	0.049	0.501

Table 3. Radiographic assessment of the thorax of the dogs with mitral valve disease.

Index	Before		After		P.Value
	Mean	Std. Error	Mean	Std. Error	
Heart/Thoracic Ratio	0.625	0.014	0.625	0.013	0.906
VHS	10.800	0.228	10.809	0.228	0.713
Lung Pattern	Interstitial	-	Interstitial	-	-

thoracic ratio, vertebral heart scale (VHS) and presence of lung patterns related cardiogenic pulmonary edema (Fig. 2).

Afterward, the medication and the plans recommended by the general practitioners (12 active small animal internist) were recorded and regardless of the type and dose of the drugs, the same follow up radiography and echocardiography protocol have been performed with the same radiologist after 3 months, and the findings were com-

pared to the initial ones.

Statistical analysis: Statistical analysis was performed using SPSS version 22 for comparison and average (paired t-test) and (McNamara). Furthermore, the confidence level of 95% was used in all test subjects.

Results

A total of 35 dogs with the symptomatic mitral valve diseases were found. The sample population consisted of the following

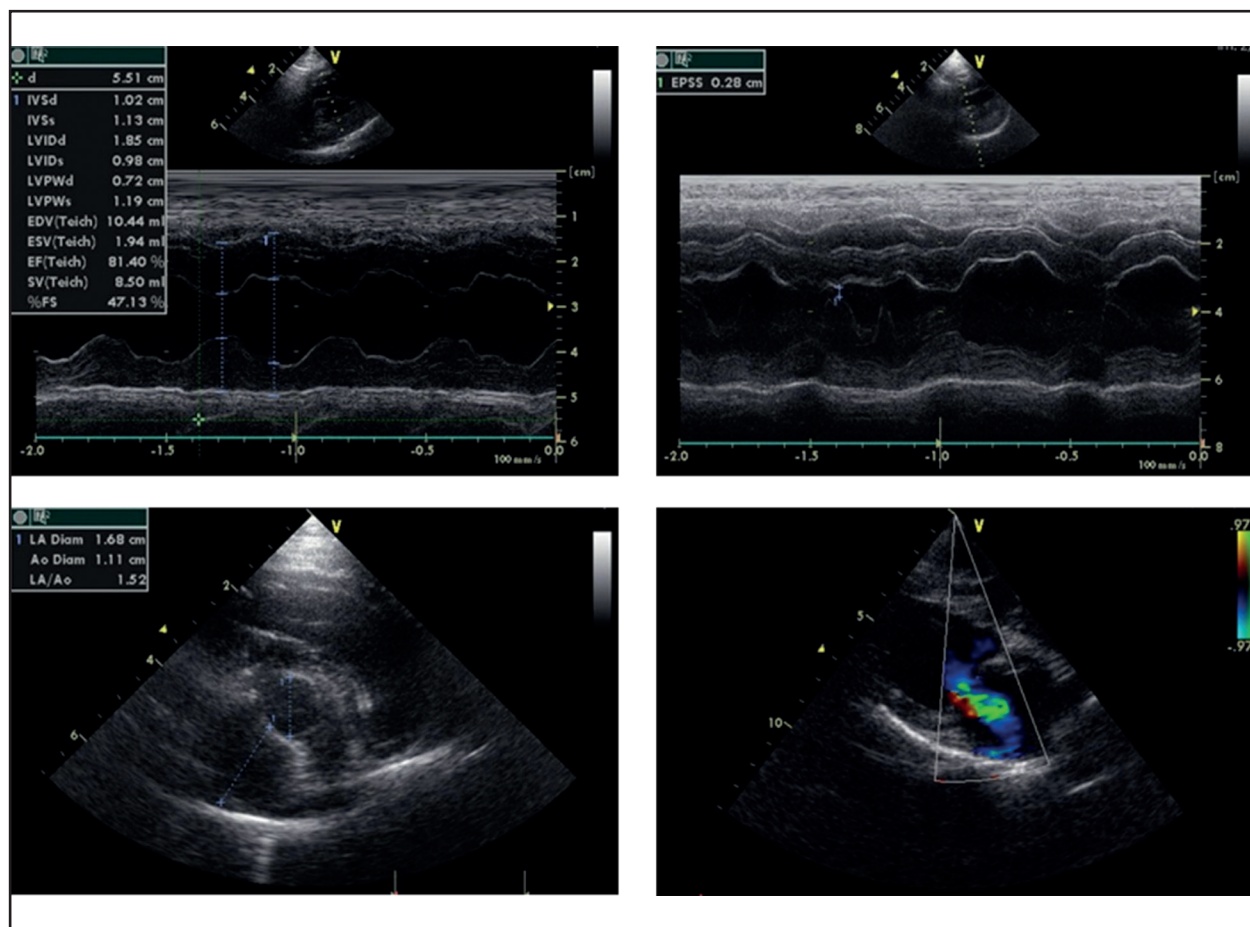


Figure 1. B.Mode, M.Mode and Doppler echocardiographic images of mitral valve disease.

breeds: 2 Pugs, 2 Dachshunds, 3 Miniature pinchers, 15 Mixed Terriers, 4 Shih Tzu Terriers, 2 Spitz, 3 Chihuahua, 2 Rottweiler, and 2 Pekingese. None of the medically treated patients developed a significant change in echocardiographic and radiologic status at a follow up period of 3 months. Only mild increase in FS% and SV was visible after 3 months of treatment, which was not statically significant. However, on follow up cross sectional echocardiography, there were 25 patients whose ejection fraction (EF%) was unchanged from the baseline and 10 who showed deterioration. Other echocardiographic parameters were almost similar together in both studies. Furthermore, there were not significant differences in the cardiac silhouette size (VHS)

and lung changes in the follow up study. These echocardiographic and radiographic changes are shown in Tables 2 and 3.

Discussion

Drugs that have been suggested to counteract the increasing MR and cardiac remodeling, on the basis of experimental studies in dogs, include direct acting arterial vasodilators, such as amlodipine, beta-blockers, angiotensin converting enzyme-inhibitors and anti-aldosterone drugs (Lawrance et al. 2017; Reimann et al. 2017). Arterial vasodilators have been shown in acute experiments to increase forward stroke volume (SV) and decrease MR by allowing a more complete emptying of the left ventricle into the aorta, whether or not this is beneficial in

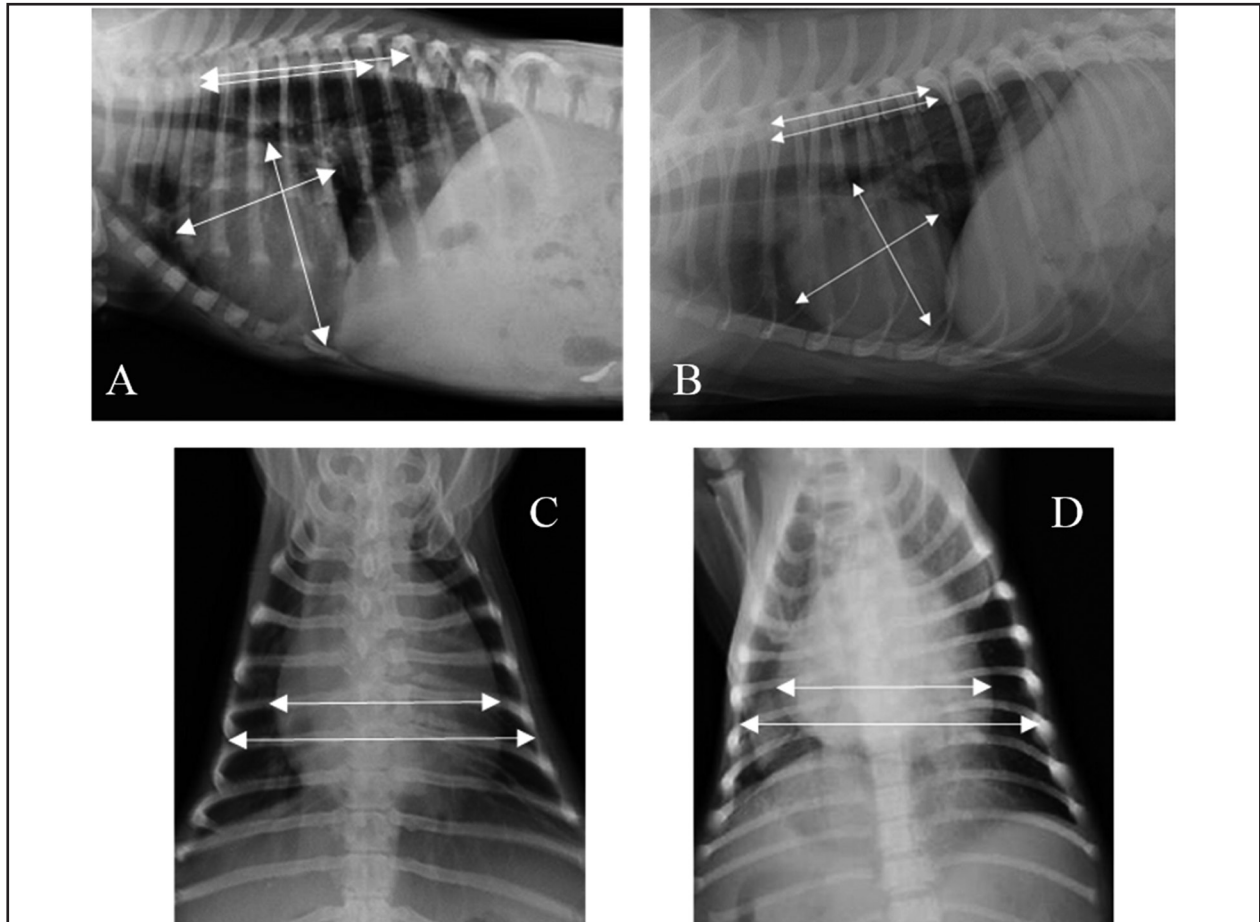


Figure 2. VHS (A and B) and heart/thoracic ratio (C and D) measurement in the dogs with progressive mitral valve disease.

asymptomatic MMVD remains to be proven. Moreover, recent research suggests that the hypertrophic response to MR is inadequate as a consequence of a comparably low afterload, which is considered one of the most important triggers for hypertrophy (Barnes et al. 2014). This argues against the preventive effect of reducing the afterload in chronic MR by use of an arterial vasodilator (Masami, 2012).

In the literature, the new treatment recommendations for the MVD rely on the classification of cardiac disease and an A-through-D categorization scheme is also published as follows:

Category A: dogs do not yet have a cardiac disease at the time but are at risk of developing it, i.e. predisposed breeds should

be screened regularly for the disease, including routine clinical examination, as well as thoracic cavity radiography, electrocardiography and echocardiography. Category B: dogs with mild heart disease; category B1: being reserved for dogs without and B2 with cardiomegaly, but with no history of present or past heart failure. For these patients there is no recommended treatment and only periodic assessment is recommended. Using angiotensin-converting enzyme inhibitors (ACE-I) in this period of the disease will be beneficial. Category C: includes dogs in heart failure, either ones with need of hospitalization (C1) or treated at home (C2). These groups need to be hospitalized for stabilization: besides the oxygen supplementation and nursing care,

furosemide (1-4 mg/kg IV, IM or SC) as bolus or 1 mg/kg CRI (constant rate) infusion. Number of dogs in class C2 was more and they were recommended therapy by furosemide (1-2 mg/kg, q12 h to 4-6 mg/kg, q8 h orally), ACE-I (dose depends of the drug used), pimobendan (0.25-0.3 mg/kg, q12 h) (Tham et al. 2015). Category D: is reserved for dogs in refractory heart failure and divided in D1 and D2 similar to the category C; for them, furosemide (1-6 mg/kg, q8-12 h) with careful monitoring of renal parameters and also additional diuretics like hydrochlorothiazide (1-2 mg, q12-24 h), spironolactone (2 mg/kg, q24 h) or torsemide (0.1 × dose of furosemide) are administrated. Depending on the severity, pleural or abdominal (due to hepatomegaly and hepatic congestion) paracentesis, oxygen therapy and nursing care are also recommended (Kvart et al. 2002; Pace, 2017; Atkins et al. 2009; Domanjko-Petrič, 2015; Tham et al. 2015).

In the present study, the clinicians administered the following protocols. Dogs in the weight range of 5 kg to 10 kg (at entrance to trial) received Enalapril (2.5 mg/kg body weight, P.O.) and dogs in the range of 10 kg to 15 kg received 5 mg/kg of Enalapril. Some dogs received only Furosemide (4 mg/kg P.O) for improving lung edema and some dogs received both drugs. The tablets were administered (3/4 tab P.O., BID) once a day for Enalapril and 4mg/kg for Furosemide, some dogs also received extra Calcium tablets, and all the owners had been advised to not put physical stress on the dogs. By comparing the performed administrations by the target clinicians to the literature, we found that they are not using the same protocol and also there was no sufficient recommendations for follow-ups. Nevertheless, in general, prognosis for dogs

with severe mitral regurgitation is rather poor with medical therapy alone and surgical mitral valve repair is already successfully described (Parker and Kilroy-Glynn 2012). To the best of our knowledge, none of the target clinicians had recommended or applied surgical intervention.

The first limitation of the present study is small group size with limited breeds, genius and age. The second is the lack of precise information about the life style of the animals, the way they had been receiving their medications and the amount of activity that they had which could influence the poor outcome of the treatment period.

Conclusion: Although the sample size of the cases may not be expandable to all general clinicians working in Tehran veterinary practice, it may signal the tip of the iceberg with regard to the reality which is poor outcome of advanced mitral valve disease (chronic progressive endocardiosis and insufficiency) treatment due to incompatibility of using these protocols with the standard ones.

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Conflicts of interest

The author declared no conflict of interest.

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پیگیری روند درمانی بیماری‌های دریچه میترال توسط رادیوگرافی و اکوکاردیوگرافی در سگ

لیلا محمدیار^۱، محمد ملازم^۲، محمد رضا اسماعیلی نژاد^۳، آریو پارسه^۴

^۱بخش فارماکولوژی، دانشگاه آزاد اسلامی دانشکده دامپزشکی واحد گرمسار، سمنان، ایران

^۲بخش رادیولوژی، دانشکده دامپزشکی دانشگاه تهران، تهران، ایران

^۳دستیار تخصصی تصویربرداری تشخیصی دامپزشکی، بخش رادیولوژی، دانشکده دامپزشکی دانشگاه تهران، تهران، ایران

^۴دکترای عمومی دامپزشکی

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چکیده

زمینه مطالعه: بیماری دریچه میترال شایع‌ترین بیماری قلبی اکتسابی در سگ هاست. نارسایی دریچه میترال به دلیل بیماری اندوکاردیوزیس یکی از مهمترین عامل‌های مرگ و میر در سگ هاست. اکوکاردیوگرافی به عنوان یک روش غیرتهاجمی به صورت روتین برای تشخیص و ارزیابی بیماری‌های مختلف قلبی مورد استفاده قرار می‌گیرد.

هدف: هدف از انجام این تحقیق بررسی روند پاسخ به درمان و موثر بودن پروتوکول‌های درمانی انجام گرفته توسط کلینیسین‌های فعال در درمان بیماری‌های دام‌های کوچک در شهر تهران توسط اکوکاردیوگرافی و رادیوگرافی می‌باشد.

روش کار: تعداد ۳۵ قلاده سگ از نژادهای مختلف که مبتلا به نارسایی مزمن قلب به دلیل بیماری اندوکاردیوزیس دریچه میترال بودند، به صورت تصادفی برای این مطالعه انتخاب شدند. بعد از معاینات بالینی و انجام رادیوگرافی، اندوکاردیوزیس پیشرفته دریچه میترال توسط اکوکاردیوگرافی تأیید شد. بعد از تشخیص اولیه، تمامی حیوانات توسط ۱۲ نفر از دامپزشکان فعال در حوزه دام کوچک مورد درمان روتین قرار گرفتند. مجدداً ۳ ماه بعد از تمامی حیوانات تصویربرداری تشخیصی شامل رادیوگرافی و اکوکاردیوگرافی صورت گرفت تا اثر بهبودی پروتوکول‌های درمانی انجام شده بر روی فاکتورهای خروجی قلب بررسی شود.

نتایج: هیچ کدام از حیوانات مورد مطالعه در این تحقیق، از لحاظ آماری بهبودی قابل ملاحظه‌ای را در پارامترهای اکوکاردیوگرافی و رادیوگرافی نشان ندادند، که این قضیه می‌تواند نتیجه ناسازگاری پروتوکول‌های مورد استفاده با موارد استاندارد باشد.

نتیجه گیری نهایی: اگرچه نیاز به مطالعه و بررسی‌های دقیق‌تری در این زمینه وجود دارد. با این حال باتوجه به یافته‌های این مطالعه در هیچ یک از شاخص‌های تشخیصی این بیماری قبل و بعد از درمان دارویی تفاوت معنی داری از لحاظ آماری مشاهده نشده است. در واقع اینطور به نظر می‌رسد که درمان روتینی که توسط دامپزشکان در حال حاضر انجام می‌شود، نمی‌تواند باعث افزایش کیفیت زندگی حیوان در کوتاه مدت شود و قطعاً نیاز به تغییر در نوع و دوز داروهای مورد استفاده وجود دارد.

واژه‌های کلیدی:

اکوکاردیوگرافی، رادیوگرافی، اندوکاردیوزیس، میترال، سگ