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Case Reports

COUGHING SHIH TZU DOG DUE TO MYXOMATOUS MITRAL VALVE DISEASE STAGE C2

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SUMMARY

Myxomatous Mitral Valve Disease is a degenerative condition of the mitral valves leaflets. A 10-year-old male castrated Shih Tzu was presented with primary complaint of coughing. Clinical examination revealed normal heart rate, respiratory rate and rectal temperature. Systolic murmur Grade IV/VI was heard at the left heart apex. Thoracic radiographic findings were cardiomegaly with the vertebral heart score of 11.0 and had evidence of cardiogenic pulmonary edema. Echocardiographic examination revealed thickening mitral valves with evidence of moderate regurgitation observed. Based on the findings obtained, the dog was diagnosed with Myxomatous Mitral Valve disease stage C2. Dog was treated with benazepril (0.5mg/kg), pimobendan (0.2mg/kg) with a combination of furosemide (2mg/kg). Frusemide was gradually removed from the treatment regime as coughing improved over time. The dog was no longer lethargy and even gained weight.

Keywords: Myxomatous mitral valve disease, cardiac murmur, cardiomegaly, regurgitation

INTRODUCTION

Cardiovascular system comprises of the heart, veins and arteries. Atrioventricular (mitral and tricuspid) valves and semilunar (aortic and pulmonic) valves keep blood flowing in one direction (Borde *et al.*, 2018). In left ventricle, the inlet valve is known as the mitral valve while the outlet valve is aortic valve. As for right ventricle, the inlet valve will be tricuspid valve while the outlet valve is pulmonic valve.

Chronic degenerative valvular disease is characterised by the thickening the atrioventricular valves. Myxomatous degeneration of the mitral refers to thickening of mitral valves due to degeneration that leads to failure of the leaflets to close completely and resultant in turbulent flow during systole. Myxomatous mitral valve disease (MMVD) is most common heart disease (70%) in small breed dogs (Detweiler & Paterson, 1965 and Borgarelli *et al*., 2008).

Insufficiency of the thicken mitral valves to close completely would contribute to regurgitation of the blood flow that can further be described as mild, moderate and severe. The sound produced by the turbulence of the blood flow called as cardiac murmur can be heard upon auscultation. In mitral regurgitation, systolic murmur can be auscultated, louder especially at the left apical of the heart. The intensity of the murmur can be associated to the severity of the cardiac diseases. Relativity, dogs that have louder murmur would have a higher left atrium to aortic ratio, which signifies a more severe cardiac disease (Haggstrom *et. al*., 1995).

Previous report by Teoh and Khor (2017) noted the benefits of pimobendan in improving quality of life in patient diagnosed with MMVD stage D that were treated as outpatient. This case reports outline the benefits of pimobendan therapy in a dog diagnosed with MMVD stage C2.

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CASE REPORT

History and Physical Examination

A 10-year-old castrated male Shih Tzu dog was presented with a one month history of lethargic, coughing and exercise intolerance. Dog was hyporexia and observed to be duller during the one month period according to owner. Clinical presentation revealed normal rectal temperature (38.5°C), normal heart rate of 120 beats per minute and normal respiratory rate of 48 breaths per minute. Upon auscultation, a cardiac murmur Grade IV/VI was auscultated with the maximum point of intensity (PMI) at the left heart apex. Results of the complete blood count and serum biochemistry blood test were unremarkable.

Thoracic Radiography and Echocardiography

Two views thoracic radiograph were obtained (Figure 1). Right lateral thoracic radiograph findings revealed a cardiomegaly with a vertebral heart score (VHS) of 11.0 and an elevated trachea dorsally. There was bulge at 10 to 12 clock face; suggestive of right atrium enlargement. Besides that, there was an increased radiopacity noted at perihilar and cranial lung field with alveolar pattern suggestive of cardiogenic pulmonary edema. On the dorsalventral view of the thoracic radiograph, the evidence of pulmonary edema was more prominent on the left caudal of the lung. The cardiac outline of the left border of the heart was not very clear and the pulmonary veins on the left appeared more distended.

Echocardiography performed revealed that the anterior and posterior leaflets of the mitral valves are thickened (Figure 2) and mitral valve regurgitation was noted to be moderate. Other echocardiographic measurements were tabulated in Table 1. The final diagnosis was myxomatous mitral valve disease stage C2.

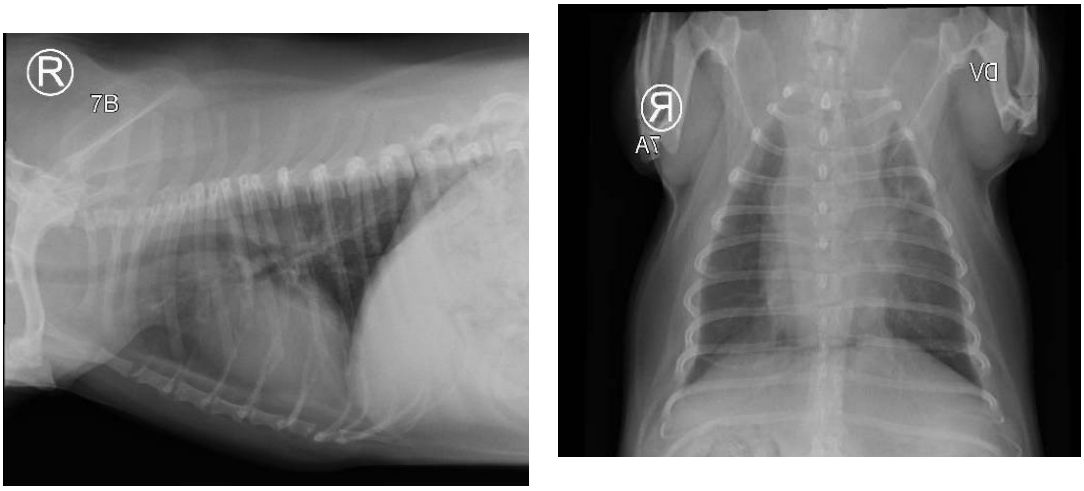

Figure 1. Thoracic radiograph at right lateral view, revealing elevated trachea, vertebral heart score of 11.0 and pulmonary edema at perihilar region. Thoracic radiograph at dorsoventral view, pulmonary edema can be seen at the left lung field.

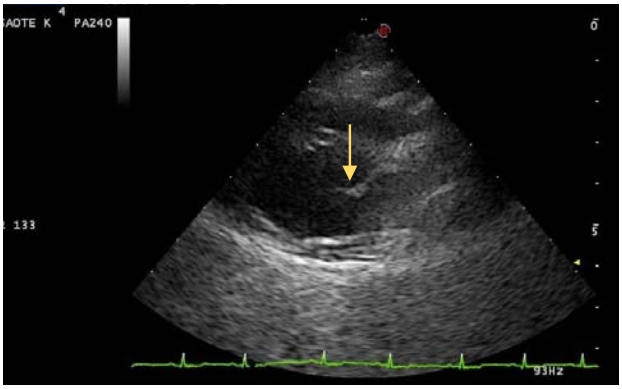

Figure 2. Echocardiography - Right parasternal long axis view. Both anterior and posterior leaflet of mitral valves are thickened.

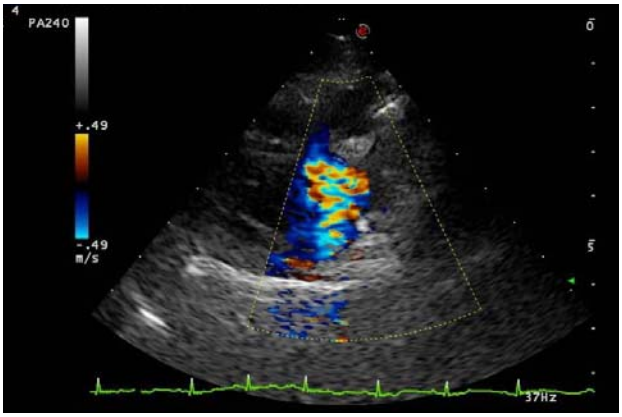

Figure 3. Echocardiography- Right parasternal long axis view. Moderate regurgitation was noted using the Dopper continuous wave.

Table 1. Echocardiographic measurements taken with reference to the M-mode image of the right parasternal short axis view.

Variable	Mean (cm)	Variable	Mean
IVSd	6.90		
LVIDd	19.50		
LVPWd	6.10		
IVSs	8.60	La:Ao ratio	1.50
LVIDs	13.2	% EF	64
LvPWs	9.10	%FS	32

LVIDd, LVIDs = left ventricular internal dimension at end-diastole and end-systole; IVSd, IVSs = interventricular septal wall thickness at end-diastole and end-systole; LVPWd, LVPWs = left ventricular posterior wall thickness at end-diastole and end-systole; La = left atrial dimension; Ao = aortic root dimension; %EF = percentage ejection fraction; %FS = percentage fractional shortening

Treatment and Progression

Dog was medicated with benazepril hydrochloride 0.5 mg/kg orally once a day (Fortekor 5 mg, Novartis, Canada) as a vasodilator for the treatment of MMVD. For pulmonary edema, a loop diuretic of furosemide 2 mg/kg (Rasitol 40 mg, Y.S.P. Industries (M) Sdn. Bhd., Malaysia) was given two times a day for 7 days, then once for 14 days, lastly followed by every other day for 7 days. However, the episodes of coughing did not resolve completely with the combination of the therapy, furosemide cannot be weaned off during the long term treatment period of 150 days in total.

An inodilator, a divided dose of pimobendan 0.5 mg/kg (Vetmedin® Chew 5 mg, Boehringer Ingelheim, Germany) was then advised and started on day-151 post-treatment of MMVC Stage C2. Benazepril and frusemide was maintained at the same dosage and interval for two weeks. Besides that, Hijuven (Tocopheryl nicotinate 1 capsule, Eisai (M) Sdn Bhd, Malaysia) was added as anti oxidant. Serratiopeptidase 1 tablet (Pepzen, Prime Pharmacy (M) Sdn Bhd, Malaysia) was given as anti-inflammatory while bromhexine hydrochloride 1 mg/kg (Bislan 8 mg, Y. S. P. Industries (M) Sdn Bhd, Malaysia) as mucolytic agents. Within 2 weeks of the treatment, the dog's condition improved with medications and episodes of cough was no longer heard after one week of the treatment. A thoracic radiography was taken on day-165. Findings revealed that there were improvement of the cardiogenic pulmonary edema and the vertebral heart score reduced to 9.0 post treatments (Figure 3). All the other medications were stopped and patient was only maintained with benazepril hydrochloride and pimobendan orally daily. To date after 180 days on the two dugs combination, the dog did not have any episodes of coughing and very active.

As for nutritional support and wellness of the heart condition, dog was maintained on Cardiac Diet (Royal Canine®, France) since the first day of treatment.

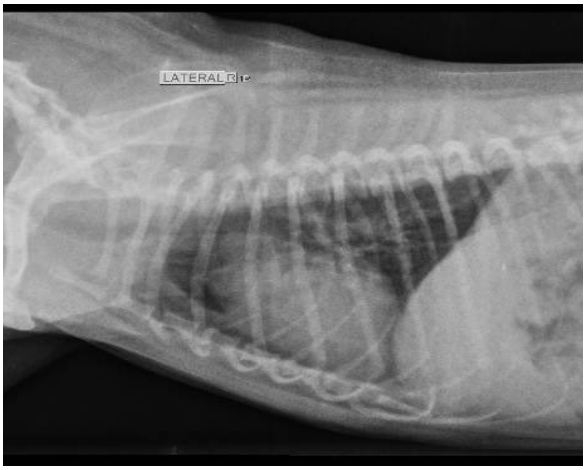

Figure 3. Thoracic radiograph post treatment, pulmonary edema improved and vertebral heart score of 9.0.

DISCUSSION

Atrioventricular valvular heart diseases are the most common heart disease (70%) in small breed dogs (Borgarelli *et al.,* 2008, Detweiler& Paterson, 1965). Mitral valves have been reported to be more susceptible than tricuspid valve to succumb to myxomatous degeneration resulting in myxomatous mitral valve degeneration (Disaltian, 2010). Approximately 30% of asymptomatic MMVD will have a progression heart failure and eventually death as consequences of the disease (Borgarelli & Haggstorm, 2010).

MMVD is mostly diagnosed in small breed dogs, predominantly the Cavalier King Charles Spaniel, ShihTzu, Poodles, Chihuahua, Pekingnese and Dobermann (Borgarelli & Haggstorm, 2010; Borgarelli *et al*.,2012; Borgarelli & Buchanan 2012). Males are more often presented than female (Borgarelli & Haggstorm, 2010; Borgarelli *et al*.,2012), and there is a strong correlation between the body weight and MMVD (Parker *et al.,* 2012). In this case, the patient was a male Shih Tzu.

The common presenting clinical signs of canine cardiac patients will be coughing (75%), syncope (49%), and cyanosis (14%) (Kim *et al.,* 2017). However, in the present case, the patient's condition was not severe. Only coughing, lethargy and hyporexia was observed. Dogs with MMVD are normally presented with systolic murmur which is best heard at the left cardiac apex and there is a strong correlation between the cardiac murmur and severity of MMVD (Disaltian, 2010).

Canine patients that have larger VHS of more than 10.5 had two times higher possibility of death compared to those that had VHS of less than 10.5 (Kim *et al.,* 2017). Presence of cardiogenic pulmonary edema, larger vertebral heart score and dyspnea are associated with shorter survival time (Kim *et al.,* 2017). As the cardiac disease progresses over time, the size of the left atrium will be larger, causing more clinical signs and reflecting a more severe cardiac disease. The patient in this case had a VHS of 11.0 and with evidence of pulmonary edema.

In any cardiac disease patient, echocardiography provides a definitive real-time diagnosis of the heart condition. Echocardiography evaluate the structure of the heart as well as provides more measurement details regarding the degree of right or left atria enlargement, end diastolic volume, ejection fraction and fractional shortening. The common echocardiographic findings of MMVD will be thickening or one or both mitral valves according to ACVIM consensus (adapted from the American College of Cardiology/American Heart Association classification system). A higher left atrium to aortic ratio is also associated with a more severe atrioventricular valvular heart disease (Borgarelli *et al*.,2012). Additionally, age, left atrial to aortic ratio, ejection fraction and left ventricular end diastolic volume had been associated with a higher risk of death (Kim *et al.,* 2017).

The ACVIM classification (Table 1) of cardiac disease uses an A through D categorization of cardiac disease and does not rely heavily upon exercise tolerance as a criterion, a weakness of previous schemes. It also includes a category (A) for dogs without heart disease but

who are at risk (e.g., Cavalier King Charles Spaniels at risk to develop MMVD). Category B identifies dogs with mild heart disease, without (B1) and with (B2) cardiomegaly, but without present or historical evidence of CHF. Category C identifies dogs with signs of heart failure, either hospitalized (C1) or treated at home (C2) and is similar to category D, which includes refractory or end-stage heart failure patients, treated in the hospital (D1) or at home (D2) (Atkins *et al.,* 2009). As in this case, the patient can be categorised into Category C2, which are dogs with signs of heart failure; including lethargy, coughing. The medications recommended by ACVIM consensus for patient stage C2 will be furosemide at 1-4mg/kg, dose can be adjusted as needed depending on the condition; pimobendan 0.2-0.3 mg/kg twice daily; and angiotensin-converting enzyme inhibitor (ACE-i) 0.5 mg/kg in MMVD dogs. Treatment should be individualised to minimise the clinical signs and improve quality of life (Borgarelli & Buchanan 2012).

Table 1. Classification for dogs affected by MMVD.Adapted from Atkins C, Bonagura J, Ettinger S, et al. (2019) Guidelines for the diagnosis and treatment of canine chronic valvular heart disease.

	Definition
Stage A	Dogs at risk for developing MMVD that have no identifiable cardiac structural disorder (ie, Cavalier King Charles spaniel, dachsunds)
Stage B1	Dogs with MMVD that have never developed clinical signs and have no radiographic or echocardiographic evidence of cardiac remodelling
Stage B2	Dogs with MMVD that have never developed clinical signs but have radiographic or echocardiographic evidence of cardiac remodelling (ie, left-sided heart enlargement)
Stage C	Dogs with MMVD and past or current clinical signs of heart failure associated with structural heart remodeling (dogs presenting heart failure for the first time may present severe clinical signs and may require hospitalisation)
Stage D	Dogs with end-stage MMVD and heart failure that is refractory to standard therapy (ie, furosemide, ACE-I, pimobendan , spironolactone)

Pimobendan is phosphodiesterase inhibitor acts as an inodilator. Its calcium sensitizing effects in conjunction with phosphodiesterase inhibition, results in reducing afterload by dilating the arteries and veins dilatation. In addition, it helps in improving cardiac contractility. Benazepril is ACE-I, it helps improving left ventricular compliances by inhibiting the production of angiotensin II and thus inhibiting the renin angiotensin activating system. Furosemide is a potent loop diuretics that prevent fluid build up by inhibiting reabsorption of sodium and chloride at the ascending loop of Henle. Several researches have shown the efficacy of ACE-I and Pimobendan in improving the quality of animals' life with clinical improvement seen in coughing, exercise load, CHF signs, and as well as survivability. One study even demonstrated that Pimobendan statistically brings more significant clinical as well as echocardiography measurements improvements in dogs with atrioventricular disease compared to ACE-I by improving the fractional shortening, left atrium to aortic ratio and smaller end diastolic volume (Lombard *et al.,* 2006). Similarly was observed in this patients as the clinical sign of coughing did not persist or reoccur during treatment with pimobendan.

Regular follow up visit with cardiologist to monitor the cardiac diseases progression is recommended. Regular blood check-ups are important to monitor the kidney functions as well as electrolyte balances. Chest radiographs are recommended to evaluate on the presence of recurrent sign of congestive heart failure. Dogs with MMVD generally have a guarded to poor prognosis depending on which stage referring to ACVIM staging.

Pimobendan is not registered for used in Malaysia and its' use is currently off labelled. This drugs has been marketed for more than a decade and much studies has been conducted to ensure its benefit in dogs diagnosed with MMVD. This medication is beneficial in many ways and hence, allowing its' availibilty for use as treatment of cardiomyopathy in dogs escpecially in MMVD is crucial.

CONCLUSION

MMVD is a common cardiac disease in geriatric small breed dogs, this disease can progresses into refractory heart failure and sudden death is one of the consequences of this disease. The treatment for MMVD dogs is life long, requires owner's compliances and it should be tailored according to the need of the animal.

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CONFLICT OF INTEREST

None of the authors has and potential conflicts of interest to declare.

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