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RESEARCH ARTICLE

ECHOCARDIOGRAPHIC EVALUATION OF PRE AND POST CAPILLARY PULMONARY HYPERTENSION IN DOGS

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Abstract

The present study is to assess right heart indices in dogs with elevated pulmonary arterial pressure associated with chronic mitral valve degenerative disease and chronic respiratory disorders. The study was conducted in 10 clinical cases of Spitz breed with Chronic Degenerative Mitral Valve Disease (CDMD), 10 clinical cases of Spitz breed with Chronic Respiratory Disorders (CRD) and 10 normal Spitz as control. The right heart indices were assessed by echocardiography. The data collected were statistically analysed and interpreted. A significant increase in MPA/Ao, TAPSE/Ao and RVd/LVd were observed in dogs with CDMD and CRD compared to normal dogs. In Doppler derived indices there was a highly significant increase in tricuspid regurgitant velocity in dogs with CRD and CDMD compared to normal dogs. It is concluded that Doppler derived indices more specifically tricuspid regurgitation velocity is a reliable indicator of pulmonary hypertension and the right heart indices can be used to identify right ventricular remodelling due to pre capillary and post capillary pulmonary hypertension.

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INTRODUCTION

Pulmonary hypertension can be defined as pulmonary arterial systolic pressure > 30 mmHg, pulmonary arterial diastolic pressure > 15 mmHg, or pulmonary arterial mean pressure > 20 mmHg. It is measured directly through right-sided cardiac catheterization, this procedure requires heavy sedation or anaesthesia, is considered high risk in unstable patients and can be costly. Alternatively, pulmonary arterial pressures can be assessed by transthoracic-echocardiography. Pulmonary hypertension can be a high diastolic or systolic pulmonary arterial pressure which may lead to right ventricular concentric or eccentric hypertrophy, right atrial enlargement and right sided heart failure (Serres *et al.*, 2006). Pulmonary hypertension in dogs has rarely been studied. Common secondary causes of pulmonary hypertension in dogs include left heart failure, increased pulmonary blood flow, pulmonary parenchyma disease etc. (Schober and Baade, 2006; Serres *et al.*, 2006). Chronic degenerative mitral valve disease (CDMD) can lead to left heart dilatation and increased left atrial pressure causing elevated pulmonary venous pressure, pulmonary edema and chronic post capillary hypoxia and post capillary pulmonary hypertension (Kellihan and Stepien, 2012). Chronic respiratory disease such as trachea-bronchial disease and interstitial lung disease can lead to chronic hypoxia, mechanical stress and inflammation which may cause pre capillary pulmonary hypertension (Schober and Baade, 2006). Doppler echocardiographic assessment of Tricuspid

regurgitation and pulmonary valve regurgitation have allowed non invasive estimation of pulmonary arterial pressure and evaluation of right heart structure (Johnson *et al.*, 1999; Serres *et al.*, 2006). In this backdrop, the present study was taken up with the objective to assess right heart indices in dogs with elevated pulmonary arterial pressure associated with chronic mitral valve degenerative disease and chronic respiratory disorders.

Materials and Methods:

Study was carried out at the Madras Veterinary College Teaching Hospital, Tamil Nadu Veterinary Animal Sciences University (TANUVAS). Ten apparently healthy adult dogs of Spitz breed of both the sexes and different age groups attending Madras Veterinary College teaching hospital were the control. 10 confirmed clinical cases of Chronic Degenerative Mitral Valve Disease (CDMD) and 10 confirmed clinical cases of Chronic Respiratory Disorders (CRD) of Spitz breed were the clinical material. They were grouped as follows:

Group 1	Normal Dogs - Control	10 cases
Group 2	Chronic Degenerative Mitral Valve Disease	10 cases
Group 3	Chronic Respiratory Disease	10 cases

They were subjected to thorough Doppler echocardiography and right heart indices were recorded.

Procedure of echocardiography:

Echocardiographic examination was performed in conscious dogs. The dogs were gently restrained in lateral recumbency and 2D, M mode and Doppler echocardiographic evaluation was done with 1.9MHz tissue harmonic phased array transducer in a Aloka SSD 3500 machine. In 2D echocardiography the main pulmonary artery / aorta root ratio (MPA/Ao) (Fig 1.) calculated using right parasternal short axis view at the level of aorta. In the apical four chamber view tricuspid annular plane systolic excursion (TAPSE) (Fig 2.) was acquired by using M mode cursor through the tricuspid annular movement between the end diastole and systole. The end diastole right to left ventricle base diameter ratio (RVd/LVd) (Fig 3.), the right ventricular diameter in diastole to the aortic root ratio (RVd/Ao) and TAPSE/Ao was also calculated. The diastolic tricuspid regurgitant (TR) flow velocity was measured using standard right parasternal short axis view (Fig 4.).

Results and discussion:

The mean $\pm$ SD of right heart indices in normal dogs, dogs with CDMD, and dogs with CRD are presented in Table. The mean $\pm$ SD of MPA/Ao were 1.00 ± 0.06 , 1.15 ± 0.13 and 1.17 ± 0.17 for normal, CDMD and CRD dogs respectively. The mean $\pm$ SD of TAPSE/Ao were 0.90 ± 0.21 , 1.12 ± 0.15 , 1.10 ± 0.15 normal, CDMD and CRD dogs respectively. The mean $\pm$ SD of RVd/LVd were 0.62 ± 0.10 , 0.84 ± 0.20 and 0.87 ± 0.23 normal, CDMD and CRD dogs respectively. The mean $\pm$ SD of RVd/Ao were 1.08 ± 0.27 , 1.8 ± 0.20 and 1.35 ± 0.25 normal, CDMD and CRD dogs respectively. The mean $\pm$ SD of tricuspid regurgitation (TR) were 1.0 ± 0.3 , 3.5 ± 0.4 and 2.3 ± 0.3 for normal, CDMD and CRD dogs respectively.

A Significant increase in MPA/Ao, TAPSE/Ao and RVd/LVd were observed in dogs with CDMD and CRD when compared the normal dogs. No significant difference was observed in RVd/Ao between normal dogs and in dogs with CDMD, whereas a significant increase was observed in RVd/Ao ratio in dogs with CRD. The tricuspid regurgitation velocity had highly significant increase in CDMD and CRD compared to control. In this study the significant changes in the right heart indices in dogs with CRD and CDMD was primarily due to pulmonary hypertension associated with these conditions. The pathological changes in pulmonary artery and right heart remodelling in CRD may be due to precapillary pulmonary hypertension and significant changes in right heart disease in cases of CDMD may be due to post capillary pulmonary hypertension. The findings are in agreement with Serres *et al.*, (2006) and Pariaut, *et al.*, (2012).

Kellihan and Stepein (2012) reported that post capillary pulmonary hypertension secondary to degenerative mitral valve disease has been recognized clinically for many years in veterinary medicine and clinical diagnosis of syndrome in dogs has been enhanced greatly by wide spread use of echocardiography and Thai and Huang (2013) evaluated right ventricular remodeling and right heart failure associated with different causes of elevated pulmonary arterial pressure in dogs with CRD and mild to moderate CDMD. They observed increased ratio

of right to left ventricular basal diameter in chronic respiratory disorders which is in accordance with the present study.

Mean $\pm$ SD of right heart indices in normal dogs, dogs with CDMD, and dogs with CRD

Indices	Group1	Group2	Group3
MPA/Ao*	1.00 $\pm$ 0.06 ^a	1.15 $\pm$ 0.13 ^b	1.17 $\pm$ 0.17 ^c
TAPSE/Ao*	0.90 $\pm$ 0.21 ^a	1.12 $\pm$ 0.15 ^b	1.10 $\pm$ 0.15 ^c
RVd/LVd*	0.62 $\pm$ 0.10 ^a	0.84 $\pm$ 0.20 ^b	0.87 $\pm$ 0.23 ^c
RVd/Ao*	1.08 $\pm$ 0.27 ^a	1.1 $\pm$ 0.2 ^a	1.35 $\pm$ 0.25 ^b
TR**	1.0 $\pm$ 0.3 ^a	3.5 $\pm$ 0.4 ^b	2.3 $\pm$ 0.3 ^c

Means carrying the same superscript do not vary significantly between columns

** (P<0.01) * (P<0.05)

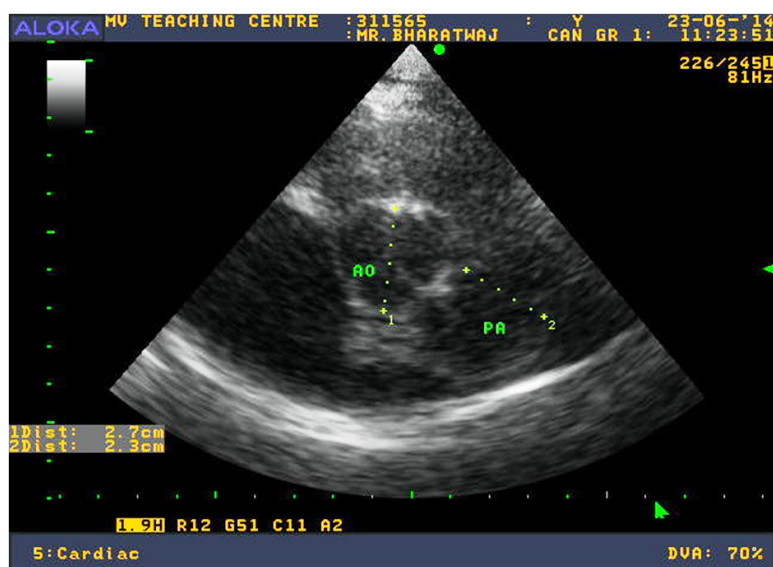


Figure 1 – The measurement of main pulmonary artery / aorta root ratio (MPA/Ao)

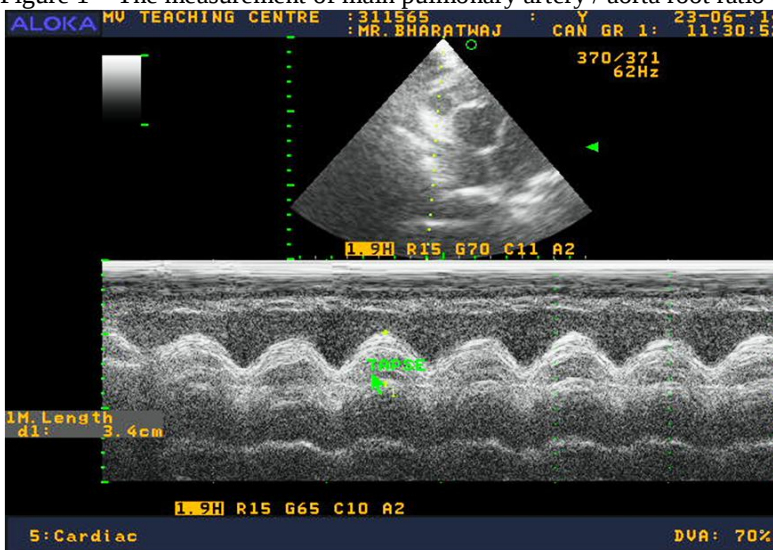


Figure 2 – Measurement of Tricuspid annular plane systolic excursion (TAPSE)

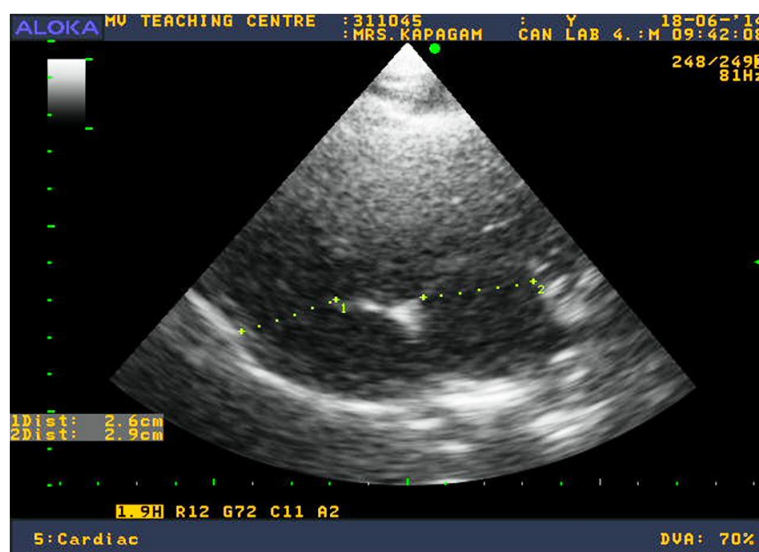


Figure 3 – Measurement of end diastole right to left ventricle base diameter ratio (RVd/LVd)

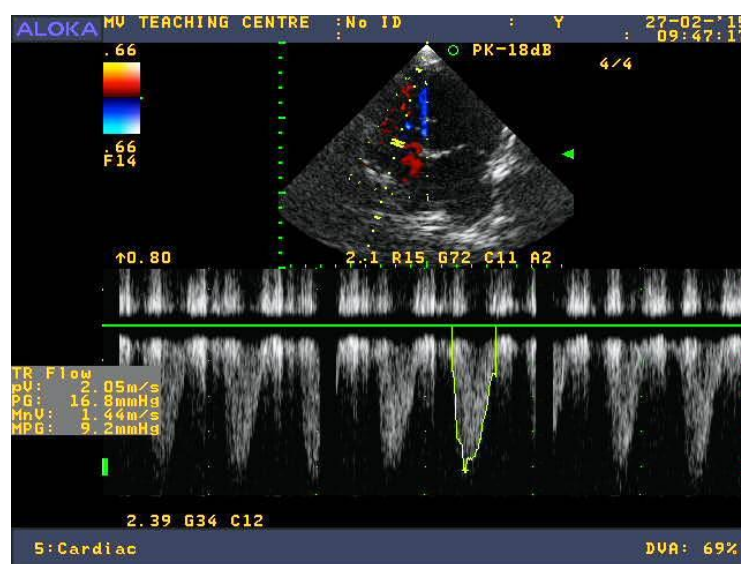


Figure 4 – Measurement of Tricuspid regurgitation velocity

Conclusion:

From the above study it was concluded that Doppler derived indices more specifically tricuspid regurgitation velocity is a reliable indicator of pulmonary hypertension and the right heart indices can be used to identify right ventricular remodelling due to pre capillary and post capillary pulmonary hypertension. Therefore, it is advised to address the co-existing pulmonary hypertension in the treatment of chronic cardiac and pulmonary diseases for better management.

References:

- Johnson, L., Boon, J and Orton, E.C. 1999. Clinical characteristics of 53 dogs with Doppler-derived evidence of pulmonary hypertension: 1992–1996. *Journal of Veterinary Internal Medicine.*, **13**: 440–447.
- Kellihan, H.B. Stepien, R.L. 2012. Pulmonary hypertension in canine degenerative mitral valve disease. *Journal of Veterinary Cardiology.*, **14**: 149–164.
- Pariaut, R. Saelinger, C. Strickland, K. Beaufriere, H. Reynolds, C and Vila, J. 2012. Tricuspid annular plane systolic excursion (TAPSE) in dogs: reference values and impact of pulmonary hypertension. *Journal of Veterinary Internal Medicine.*, **26**: 1148–1154.
- Schober, K.E. and Baade, H. 2006. Doppler echocardiographic prediction of pulmonary hypertension in West Highland White Terriers with chronic pulmonary disease. *Journal of Veterinary Internal Medicine*, **20**: 912–920.
- Serres, F. Chetboul, V. Gouni, V. Tissier, R. Sampedrano, C.C and Pouchelon, J-L. 2007. Diagnostic value of echo-doppler and tissue doppler imaging in dogs with pulmonary arterial hypertension. *Journal of Veterinary Internal Medicine.*, **21**: 1280–1289.
- Thai, C.T. and Huang, H.P. 2013. Echocardiographic assessment of right heart indices in dogs with elevated pulmonary artery pressure associated with Chronic Respiratory disorders , heart worm disease and chronic degenerative mitral valve disease. *Veterinari Medicina.*, **58**: 613-620.