EVALUATION OF LEFT ATRIUM AND AORTA IN TWO-DIMENSIONAL AND M-MODE ECHO-CARDIOGRAPHY IN FEMALE MALABARI GOATS

K.G. Tejaswini[1], N. MadhavanUnny[2], Usha Narayana Pillai[3], S. Ajithkumar[4] and Thirupathy Venkatachalapathy[5]
Department of Veterinary Clinical Medicine, Ethics and Jurisprudence
College of Veterinary and Animal Sciences, Mannuthy

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Abstract

Left atrial to aortic ratio was evaluated using two-dimensional and M-mode echocardiography in twelve healthy adult female Malabari goats. The normal values of left atrium to aortic ratio in healthyMalabari goats in both the techniques varied. Establishment of these values in Malabari goats would be beneficial in studying cases with cardiac diseases.

Key words:*Malabari goats, M-mode, Two-dimensional echocardiography*

Atrial size determined by echocardiography provides the representative measure of the hemodynamic burden of cardiac disease. In humans, left atrial (LA) measurement is an essential requirement in assessing atrial fibrillation, cardiomyopathies, vulvar insufficiencies and left ventricular diastolic dysfunction (Lang *et al.,* 2005) as left atrium serves as reservoir, conductand pumping system of cardiovascular system reflecting ventricular filling pressure (Piotrowski*et al.,* 2000). Atrial size is prognostically important, to determine atrial enlargement in people with dilated cardiomyopathy and hypertrophic cardiomyopathy in cats (Abbott and Maclean, 2006).

Left atrial size iscommonly expressed as a ratio of the atrium to aortic root dimensions which provides anindex of atrial size that is independent of body size.Application of left atrial to aortic ratio is better than using LA dimensions, as aorta (AO) is an internal reference, not likely to enlarge as a result of cardiac diseases (Boon *et al.,*1983) or may change little in patients with acquired cardiac disease (Abbott and Maclean, 2006).

Perusal of literature reveals that left atrium, aorta and their ratio in Malabari goats has not been reported. The aim of the present study, therefore, is to provide two-dimensional and M-mode LA:AO reference values for healthy Malabari goats.

1. MVSc Scholar
2. Assistant Professor
3. Professor and Head
4. Professor and Head, Teaching Veterinary Clinical Complex, Mannuthy,
5. Associate Professor, Goat and Sheep farm, Mannuthy.

Materials and methods

Twelve apparently healthy female Malabari goats aged one to two years andweighing 20-25Kg from Goat and Sheep farm, KVASU, Mannuthy were used for the study. All the animals were subjected to clinical examination and blood smear examination.

For echocardiography, Mindray Z6 ultrasound scanner with 3.2 -3.5 MHz phased array transducer were used. Right thoracic area from 2ndto 6th intercostal space was shaven and surgical spirit was applied and rinsed to remove wax. Acoustic gel was applied on the transducer head and the scanning area. Using right parasternal window, two-dimensional B and M-mode echocardiography wasperformed in right lateral recumbencyby placing the animal on echocardiography table used for small animals (Fig.1).

The M-mode images of the aortic valve were obtained from right parasternal caudal long axis of left ventricular outflow tract, by placing the cursor through the aortic valves (Fig. 2). Aortic root measurements were taken at diastole (AOd) from the top of the anterior wall to the top of the posterior wall followed by left atrium at diastole (LAd). Similar procedure was adopted by Singh *et al.* (2017) in a recent study of Pantja goats. Left atrial to aortic ratio were calculated by dividingLAd/AOd.

Measurement of left atrium and aorta in 2-D were measured at short axis view, at the level of aortic valve. Transverse measurement of the AO were done by connecting the line from the midpoint to the wall of the right aortic sinus to the intersection of the aortic wall and the merging point of the aortic non-coronary and left coronary cusps. LA were measured using the same intersection point and extending to the lateral wall of the LA (Fig. 3). The measurements were done at ventricular diastole, when the aortic valves were closed visually (Olsson *et al.,* 2001). Values of each parameter were determined by the average of three to five cardiac cycles (Boon, 2011).

Paired t-test were done to compare the ratios in 2-D and M-mode in normal healthy goats using SPSS version 24.0

Results and Discussion

The LA:AO in adult Malabari goats is as in table 1. The goats in this study had no history or evidence of cardiac dysfunction. No abnormalities were detected on clinical examination of cardiovascular system. Temperature and heart rate were in the normal range. The LA:AO ratio obtained in 2-D were 1.07±0.01 while those in M-mode were 0.74±0.02. There exist a significant difference in LA:AO in 2-D and M-mode and the values are significantly higher in 2-D compared compared to M-mode.

Fig.1. Echocardiography procedure in right lateral recumbency

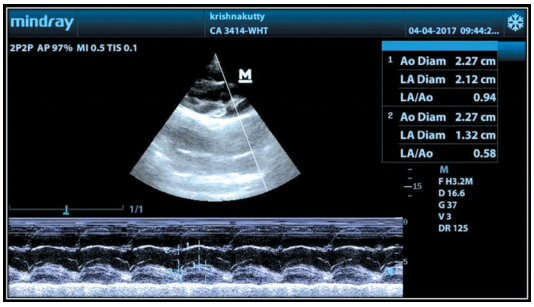

Fig. 2. Left atrium to aorta ratio in M-mode

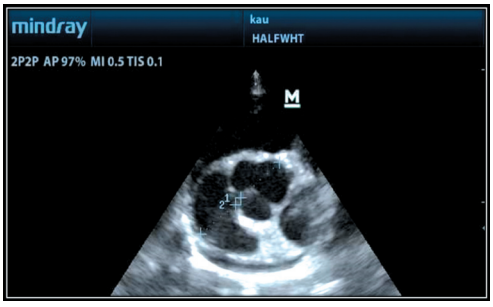

Fig. 3. Left atrium to aorta ratio in 2-D mode

Table 1. Comparison of LA/AO by 2-D and M-mode

Parameter	Mean± SE2-D mode	Mean± SE M-mode	t-value
LA:AO (cm)	1.07±0.01	0.74±0.02	22.65**

** Significance at 0.01 level

Evaluation of left-heart disease involves assessment of the size of the left atrium (Boon *et al.,* 1983) and this can be achieved using 2-D or M-mode by echocardiography (Oliveira *et al*., 2010) which helps to assess the severity and the risk of developing left-sided congestive heart failure. Calculation of LA:AO ratio are used as a index of predictor of left atrial size in humans, based on the assumption that LA and AO dimensions are proportional to each other (Hansson *et al.,* 2002).

The discrepancy between indices obtained by M-mode and 2-D mode can be presumablyexplained by differences in technique and measurement followed. Rishniw and Erb (2000) and Hollmer*et al.* (2016) reviewed four different techniques forobtaining LA:AO in dogs. Technique employed in current study were as per Olsson *et al.*(2001) which were on the similar grounds of Hansson *et al*. (2002).

Variation in M-mode and 2-D technique in obtaining LA:AO values were observed by Hansson *et al.* (2002) and Abbott and Maclean(2006). The ratio were higher in 2-D compared to M-mode and a biasof 1.11 were noted as a result, 11 per cent higher values were obtained in 2-D compared to M-mode (Hansson *et al.,* 2002) whereas bias of -0.13 with lower index were recorded in 2-D compared to M-mode (Abbott and Maclean, 2006).

The 2-D measurements of LA are significantly greater than the corresponding M-mode values. This could be explained by differences in how the measurements are anatomically defined. In M-mode, the LA diameter are underestimated while in 2-D, a more representative diameter of the LA body could be obtained. AO 2-D are measured at early diastole and AO-M-mode are measured at end diastole. This contributes to the higher AO 2-D value and thus leads to more variability in AO 2-D compared to AO M-mode (Hansson *et al.,* 2002).

2-D measurements are more accurate and superior compared to M-mode due to its fixed alignment with the direction of the ultrasound beam, thereby preventing the study of cardiac structures from alternate spatial directions (Oyama and Sisson, 2005). Inherentlimitations with M-mode method are difficulty in imaging the maximum diameter of the aorta and potentially transecting the left auricle rather than the LA body with the M-mode cursor and comparing the size of the left auricle to the aorta. Whereas 2-D measurements, incorporates a more representative dimension of the atrial body and are more accurate as LA body can be visualized(Rishniw and Erb, 2000). Technical difficulties, patient confirmation (cranially spaced heart in goats) and other factors are additional drawbacks associated with M-mode.

LA:AO was found to be 1.08±0.04 according to Singh *et al.* (2017) in femalePantja goats obtained by 2-D method. Perusal of

literature reveals that the LA:AOvalues has not been established in Malabari goats. The LA:AO values in 2-D and M-mode echocardiography in Malabari goats has thus been established and would serve as index values in evaluating cardiac diseases in goats.

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