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RESEARCH ARTICLE

STUDY OF LEFT VENTRICULAR SPHERICITY INDEX IN HEALTHY AND DILATED CARDIOMYOPATHY AFFECTED DOGS

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ABSTRACT

The study was conducted at Teaching Veterinary Clinical Complex Parel, Mumbai Veterinary College, and Bai Sakarbai Dinshaw Petit Hospital. The present research focused on study of Left Ventricular Sphericity Index (LVSI) in two groups of dogs *i.e* healthy dogs and those affected by Dilated Cardiomyopathy (DCM). Echocardiographic examinations were performed to analyse cardiac geometry changes using the LVSI. The control group comprised dogs without abnormalities, while the DCM group included dogs with DCM symptoms and heart enlargement. Results revealed that the LVSI was significantly lower in DCM-affected dogs (1.29 ± 0.03) compared to healthy dogs (1.95 ± 0.04), indicating ventricular enlargement. Echocardiography confirmed this trend, showing a substantial increase in left ventricular diastolic diameter (LVDd) in the DCM group. This study enriches the understanding of cardiac remodelling, contributing to the diagnosis and management of Dilated Cardiomyopathy in veterinary practice.

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INTRODUCTION

Cardiovascular diseases, particularly dilated cardiomyopathy (DCM), are a significant concern in veterinary medicine. DCM involves progressive heart chamber dilation and impaired function. The left ventricular sphericity index (LVSI) has emerged as a valuable parameter in assessing cardiac chamber geometry and evaluating ventricular remodelling. This study aims to bridge this knowledge gap by investigating the left ventricular sphericity index in both healthy dogs and those affected by dilated cardiomyopathy. By employing non-invasive imaging techniques such as echocardiography, this research endeavours to establish a comprehensive understanding of how LVSI evolves in the canine heart across health and disease states. Such insights could potentially lead to improved diagnostic accuracy, enhanced prognostic assessments, and the development of targeted interventions for dogs afflicted by DCM. In this study, we hypothesize that alterations in LVSI will be observed in dogs with dilated cardiomyopathy compared to their healthy counterparts. Furthermore, this investigation may contribute to the broader understanding of cardiac remodelling processes.

MATERIAL AND METHOD

Present study was carried out at Teaching Veterinary Clinical Complex Parel, Mumbai Veterinary College and the inpatient ward of Bai Sakarbai Dinshaw Petit Hospital - affiliated to the college. All history and clinical data were recorded on the separate history sheet. All pet owners were carefully enquired about the exercise tolerance of their pets. Echocardiographic examination n being a Gold standard test for diagnosis of DCM, was accomplished for all these dogs included in the study as per the standard procedure laid down by Nyland and Mattoon (1995). The dogs without any clinical, radiographic, electrocardiographic and echocardiographic abnormality were included in control group whereas those with clinical history of lethargy, weakness / fatigue, exercise intolerance and radiographic, electrocardiographic and echocardiographic evidence of heart enlargement (cardiomegaly) were included in

DCM group: All the M-Mode echocardiographic measurements made during this study were performed using MyLab40VET Esaote India. The echocardiographic examinations in the present study were performed with phased array Cardiac Probe PA320 with frequency ranged between 3.0 to 5.5 MHz.

Table 1. Left ventricular sphericity index in control and DCM group

Sr no	Parameters	Unit	Control group n=15		DCM Group n=30		Calculated "t" value	% Change	Correlation with B.Wt.	
			Range	Mean ± SE	Range	Mean ± SE			Control group	DCM group
1	LV Diastolic Length - A	cm	3.94 - 7.36	5.94 ± 0.22	4.34 - 8.44	6.40 ± 0.19	0.43^{NS}	0.43	0.70	0.46
2	M - Mode Diastolic dimension - B	cm	2.03 - 3.94	3.05 ± 0.13	3.00 - 7.00	5.02 - 0.17	7.26**	64.59	0.69	0.35
3	Sphericity Index A/B		1.67 - 2.37	1.95 ± 0.04	0.94 - 1.97	1.29 ± 0.03	10.11**	33.33	- 0.12	0.02

Left Ventricular Sphericity Index: It is calculated by dividing left ventricular diastolic length (A) obtained using right parasternal long axis four chamber in 2-D Echocardiography view (Fig. 1) by right short axis left ventricular diastolic diameter (B) using M Mode (Fig. 2). The ratios of A/B in healthy dog should be > 1.65, as per Dukes McEwan *et al.* (2003). Sphericity of the left ventricle (LV), can be assessed by comparing left ventricular length obtained from a right parasternal four-chamber view to the M-mode measurement of diastolic dimension (Boon, 2011).

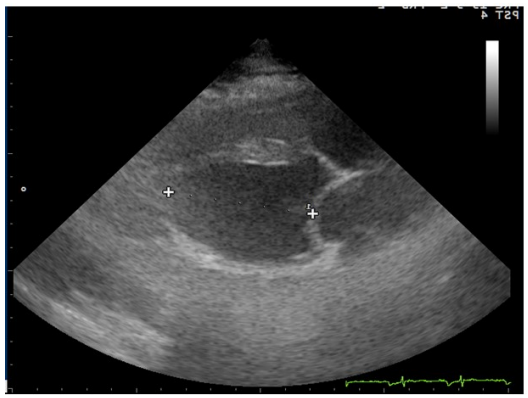

Fig.1. Right parasternal long axis four chamber

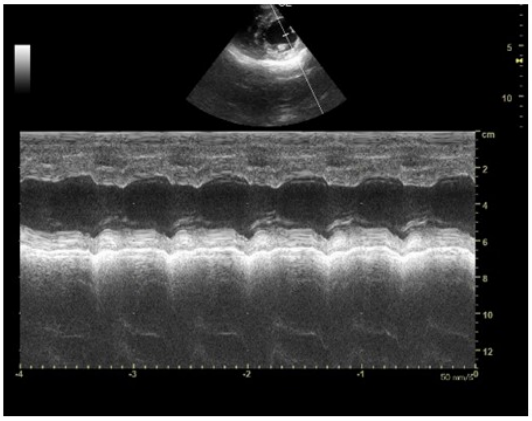

Fig. 2. Right short axis left ventricular diastolic diameter using M Mode

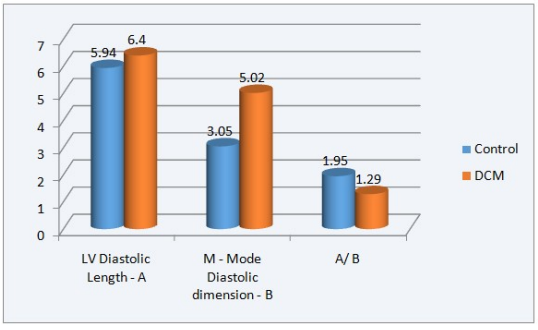

Fig. 3. Left ventricular sphericity index parameters in control and DCM group.

RESULTS AND DISCUSSION

Left Ventricular Sphericity index (LVSI) was calculated in all the dogs of both the groups.The mean LVSI in the control and DCM group of dog measured 1.95 ± 0.04 and 1.29 ± 0.03 mean ± SE respectively (Table 1 and Fig. 3). It was observed that the left ventricular sphericity index in control group was within the normal limit as specified by Dukes-McEwan *et al.* (2003) and Holler and Wess (2014) who recommended normal left ventricular sphericity index in healthy dogs to be >1.65. This means that all the dogs in Control group had normal LVSI and did not suffer from DCM. While mean LVSI in the DCM group was highly significantly lower ($p<0.01$) by 33.33% as compared to control group. The result was according to DuckesMc Ewan, (2003) and Holler and Wess (2014) and was suggestive of changes due to dilated cardiomyopathy and implied that all the dogs in DCM group had enlarged left ventricle. This was also confirmed by M - mode echocardiographic examination which indicated a highly significant increase ($p<0.01$) of 64.68% in left ventricular diastolic diameter(LVDd) in DCM group (Table1). Due to the increase in left ventricular diastolic diameter in DCM, it's rounding occurred and altered its sphericity. The present study reported the mean LVSI value in DCM group at 1.29 ± 0.03. The change in LVSI in DCM group due to increased LVDd was by 33.33%. These observations in the present study is in complete agreement with Velhankar (2013)who reported range and Mean ± SE values in dogs suffering from DCM as 0.85 - 1.60 and 1.20 ± 0.40, respectively. Khangal (2017) reported Sphericity index (SI) as 1.42 ± 0.05 in DCM affected dogs.

Correlation between left ventricular sphericity and body weight was calculated for both the groups. It was observed that LVSI correlated negatively with the body weight in control group and it positively correlated with body weight in DCM group(Table 1). These observations in present study are in partial agreement with Velhankar(2013) who observed positive correlation of LVSI with body weight in control and DCM group as against its negative correlation in control group in the present study. The possible reason for this variation could be due to difference in body weight of dogs, breeds and severity of the disease between the studies. In conclusion, the DCM in dog is a notable concern in veterinary medicine and involves heart chamber dilation and impaired function. The left ventricular sphericity index (LVSI), reflecting cardiac geometry, was studied in healthy and DCM-affected dogs using non-invasive echocardiography. The LVSI was significantly lower in DCM dogs (1.29 ± 0.03) compared to healthy ones (1.95 ± 0.04), signifying ventricular enlargement. The Echocardiography also confirmed the present observations. LVSI correlated negatively with body weight in healthy dogs and positively in DCM dogs. These insights contribute to understanding cardiac remodelling, aiding DCM diagnosis and management.

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