



Advance Modalities in Diagnosis and Prediction of Canine Cardiac Diseases

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ABSTRACT

Background: Cardiomyopathy is a significant health concern in dogs, affecting their heart function and overall well-being. This study aimed to explore the prevalence of cardiomyopathies, the role of thoracic radiographs in detecting cardiac diseases and the use of electrocardiographic and echocardiographic findings to understand the condition better.

Methods: A total of 40 client-owned dogs were included in this study, categorized into three groups based on their clinical condition: 18 dogs with a normal heart size (Group 1), 14 dogs in the preclinical stage of cardiomyopathy (Group 2) and 8 dogs with confirmed clinical cardiomyopathy (Group 3). Group 3 exhibited significantly higher VHS and CTR values, suggesting advanced heart disease. Echocardiographic measurements, including the Right Parasternal Short Axis (RPS) views, showed an increase in left atrial size and left atrial to aortic ratio (LA/Ao) in Groups 2 and 3.

Result: M-mode echocardiography revealed a decrease in ejection fraction (EF%) and fractional shortening (FS%) in the clinical group, pointing to poor heart function. Additionally, End-Point Septal Separation (EPSS) was significantly elevated in Group 3, indicating left ventricular dysfunction. The study concludes that regular monitoring of heart size through radiographs and echocardiographic parameters is essential for early detection and management of cardiomyopathies in dogs. The findings suggest that older dogs, particularly male dogs and certain breeds, are at higher risk of developing cardiomyopathies. Early detection using these diagnostic tools can improve the prognosis by allowing for timely intervention. This research emphasizes the importance of using a combination of radiographic, electrocardiographic and echocardiographic evaluations in managing and understanding cardiomyopathy in dogs.

Key words: Cardiomyopathies, Echocardiograph, Ejection fraction, Electrocardiograph, End point septal separation.

INTRODUCTION

Cardiac diseases in dogs are widespread, with studies indicating that approximately 10-15% of the canine population are affected by some form of heart disease (MacPete, 2018). The vast majority, 95% of them are acquired and rest 5% are congenital (Hoque *et al.*, 2019). Canine cardiac diseases encompass a broad spectrum of heart-related conditions that affect dogs, ranging from structural abnormalities to functional impairments of the heart. Congenital cardiac diseases (CHDs) include anomalies such as Patent Ductus Arteriosus (PDA), Pulmonic Stenosis (PS) and Subaortic Stenosis (SAS), Atrial septal defects (ASD), Ventricular Septal Defect (VSD), Tricuspid Dysplasia (TD) and Tetralogy of Fallot (ToF) (Buchanan, 1999; Baumgartner *et al.*, 2003; MacDonald, 2006; Oliveira *et al.*, 2011; Bellumori *et al.*, 2013; Kumar and Kumar, 2024a) while acquired diseases often include valvular diseases such as dilated cardiomyopathy (DCM) and myxomatous mitral valve degeneration (MMVD) (Janus *et al.*, 2016; Keene *et al.*, 2019; Kumar and Kumar, 2024b). Among these, MMVD is particularly common, especially in small breed dogs and it constitutes more than 70% of the cases of heart disease in these breeds. Heart diseases are classified into stage A, B,C,D with stage C showing clinical signs of congestive heart failure by MMVD and stage D denoting patients with end stage

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congestive heart failure (CHF) by MMVD (Atkins *et al.*, 2009; Keene *et al.*, 2019). For evaluating the accuracy of

radiographic diagnosis of cardiac diseases in dogs, various subjective and objective methods of calculation are used such as Vertebral heart score (VHS), thoracic depth/thoracic width, cardiothoracic ratio. VHS is the extrapolation of LA and SA of heart at the cranial 4th thoracic vertebrae (T4). Accepted normal VHS range is 9.7 ± 0.5 for dogs (Buchanan and Bucheler (1995); Bodh *et al.*, 2016; Saini *et al.*, 2023). Thoracic depth (TD): thoracic width (TW) describes the breed confirmation differences between dogs such as broad thorax and deep thorax with values ≤ 0.75 is for broad thorax and >1.25 are considered to be deep thorax. On the other hand, Two dimensional Cardiothoracic ratio (CTR) is the measure of cardiac area/ thoracic area *100. Normal CTR score is 0.42 and above 0.5 is abnormal and considered cardiomegaly (Torad and Hassan, 2014; Bodh *et al.*, 2016). Cardiac diseases in both human and canines are traditionally examined through physical examination, cardiac auscultation, radiography, electrocardiogram, ultrasonography and echocardiography and estimation of cardiac biomarker such as Troponin-I, C-reactive protein. Emerging methods on x-ray-based technologies (micro-CT and photon-counting CT), molecular imaging and low- and ultrahigh-field MRI, 2D speckle tracking echocardiography, ultrafast ultrasound are used now a days for better diagnosis. The goal of present research is to study prevalence of different cardiomyopathies and to access radiographic, echocardiographic and blood biochemical changes related to these diseases.

MATERIALS AND METHODS

The present research study was carried out at the Department of Veterinary Surgery and Radiology and Veterinary Clinical Complex (VCC), College of Veterinary Science and Animal Husbandry, Bhubaneswar, between January 2024 to November 2024. Preliminary patient data such as age, sex, breed, body weight, general physical examination (including auscultation, arrhythmia), clinical symptoms, radiographic and echocardiographic positioning were recorded in Table 1. The study population were divided into three groups; Group I are clinically healthy animals with normal heart size and echocardiographic findings; Group II with preclinical and clinical cardiac diseases with echocardiographic findings; Group-III animals are clinical cardiac diseases with confirmed cardiomyopathies requiring chronic medical management. Thoracic radiography with two orthogonal views (right lateral/ left lateral and ventrodorsal/ dorsoventral) was taken in animals for calculation of VHS, CTR and TD/TW in three groups. Electrocardiographic recordings were conducted on all dogs following the methodology outlined by Tilley (1992), employing the Magic Rx maestros four lead ECG machine. Preparatory phase of ECG involves removal of any metallic items worn by dog and its handler, dog to be in relaxed, calm state without panting. Electrodes were then affixed to the right foreleg, left foreleg, left hind leg and right hind leg following application of electroconductive gel at all these sites.

Parameters from the ECG were documented using a strip from lead II, with wave widths recorded in milliseconds and amplitudes in millivolts. Echocardiographic procedure was performed with Wipro GE Logiq F8 Expert ultrasound machine, equipped with a multifrequency (3-4 MHz) cardiac probe. Preparatory phase involves, thorough shaving and positioning the dogs in right lateral recumbency or left lateral recumbency on a specialised table with V"-shaped cutout in the tabletop, allowing heart to drop below the lungs and suitable for clear imaging. Some of the standard view recorded in this procedure are a) right parasternal long axis 4- chamber views, b) right parasternal long axis 5- chamber views/ left ventricle outflow view c) right parasternal short axis views d) left apical views. Two dimensional M- mode echocardiographic measurement placed at the Left ventricle (LV) level and mitral valve (MV) level records values for interventricular septal thickness at end diastole (IVSd), left ventricular internal diameter at end diastole (LVIDd), left ventricular posterior wall thickness in diastole (LVPWd), interventricular septal thickness at systole (IVSs), left ventricular internal diameter at systole (LVIDs), left ventricular posterior wall thickness in systole (LVPWs), Ejection fraction (EF%), fractional shortening (FS%), E-point septal separation (EPSS) in all the three groups.

Statistical analysis

The quantitative data in this study were expressed as Mean $\pm$ Standard Error (SE), while the qualitative data were represented in terms of frequency or percentage. The One-Way Analysis of Variance (ANOVA) with the Games-Howell post hoc test was utilized from the IBM SPSS software package, specifically version 20 of the Statistical Package for Social Sciences. Pearson's correlation coefficient was applied for variables with a normal distribution, whereas Spearman's correlation coefficient was used for variables that did not follow a normal distribution.

RESULTS AND DISCUSSION

The present study population comprises of 40 animals; Group I consists of 18 healthy dogs, Group II consists of 14 animals under preclinical group and Group III consists of 8 animals with clinical manifestations of confirmed cardiomyopathies. The general body condition parameters, breed distribution across the groups are presented in Table 2. Overweight animals are risk of developing heart diseases or cardiomyopathies. VHS are greater in dogs showing cardiomyopathies in Group III ($n=8$) with values 10.8 ± 0.48 (Fig 1a and 1c) $>$ Group II ($n=14$) $10.6 \pm 0.62 >$ Group I ($n=18$) 9.58 ± 0.5 (Chart 1). There was a significant ($P < 0.05$) difference between VHS values of clinical group with respect to values of normal heart sized group. CTR values for three groups are, Group I ($n=18$) $0.42 \pm 0.5 <$ Group II ($n=14$) $0.49 \pm 0.62 <$ Group III ($n=8$) (Fig 1b) 0.54 ± 0.48 (Chart 2). There was a significant ($P < 0.05$) difference between CTR values of clinical group with respect to values of normal heart sized group. Normal right parasternal long

Table 1: Preliminary patient data with signalment, clinical signs, biochemical analysis performed and radiography and USG positioning performed.

Signalment (Breed, Age, Sex, Body wt)	Clinical Sign	Biochemical analysis	Group	Radiography	Echo- cardiography
Labrador, 7.5 yrs, M, 25 kg	Coughing	Hb 11 TEC 6.54 PLT 2.95	1	VD	RPSSAx
Labrador, 5 yrs, M, 16 kg	Exercise intolerance	Hb 10.4 TLC 22130 PLT 2.6	1	Rt.Lat	M mode
Labrador	Dyspnoeacoughing		1	both	RPSSAx
8 yrs F, 17.2 kg Labrador	Intermittentcoughing	Hb 11.2 TEC 5.56 PLT 3.21	2	both	RPSSAx
5 yrs M, 34.1 kg Labrador	ascites	Troponin I 0.1	2	VD	RPSSAx
10 yrs, F, 35.2 kg Labrador	Abnormalbreathing		3	Rt.Lat	M mode
8 yrs M, 38.5 kg Labrador	Abdominal Distension	Hb 12.9, TLC 30490 PLT 2.2,	3	both	M mode
9.2 yrs, F, 30 kg	Anorexia Coughing Vomiting Weight loss dyspnoea	PCV 39% TEC 7.55, ALP 46 ALT 34, Creatine 1.07 Troponin I 0.1			
Rottweiler 11 yrs, M, 22 kg	Dependent oedema		1	VD	M mode
Rottweiler 4.6 yrs, M, 21.2 kg	Syncope	Creatine 1.02	1	VD	RPSSAx
Rottweiler 8.4 yrs, F, 16 kg	Tachycardia	Hb- 9.4 TLC 26420 PLT 2.23	1	VD	RPSSAx
Rottweiler 4.2 yrs, F, 33 kg	Weight loss		2	VD	RPSSAx
Rottweiler, 9 yrs, M, 33.6 kg	Fainting Fever	Hb 9.2, TLC 30210 PLT 2.23, PCV 42% TEC 7.21	3	Rt. Lat	M mode
Dobermann 7.3 yrs, M, 26 kg	Cyanosisjaundice	Total bilirubin 2.2	1	both	M mode
Dobermann 3 yrs, M, 12 kg	Heartmurmur	Hb 10.1, TLC 36180 PLT 2.9	1	VD	RPSLAX
Dobermann 8.5 yrs, F, 22.8 kg	Swelling inlimbs	Creatine 1.2	1	VD	RPSSAx
Dobermann 7 yrs, F, 28 kg	jaundice	Hb 8.2 TEC 5.12 PLT 2.95 PCV 41%	3	Rt. Lat	RPSLAX
Spitz, 4.6 yrs F, 8 kg	Exercise intolerance		1	both	RPSLAX
Spitz, 3.3 yrs F, 11 kg	Anorexia Coughing Vomiting Weight lossdyspnoea		1	Rt.Lat	RPSLAX
Spitz, 9 yrs M, 14 kg	Syncope Abnormal respiratory sounds		2	VD	RPSSAx
Spitz, 4 yrs M, 9.5 kg	AscitesJugular pulse	Total proteins 3.4	2	Rt.Lat	M mode

Table: 1 Continue....

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Spitz, 4.5 yrs F, 8.4 kg	Exercise intolerance	Hb 10.9TLC 31420	2	Rt.Lat	RPSLAX
Spitz, 12 yrs M,12.5 kg	Swollen limbs	PLT 2.6			
Golden retriever 4 yrs, F, 24 kg	Swelling inlimbs	Troponin I -0.08	3	VD	RPSSAx
Golden retriever 6.5 yrs,F, 28 kg	Heartmurmur		1	Rt.Lat	M mode
Golden retriever, 6 yrs, M, 28 kg	Swelling inlimbs	BUN 17.9	1	VD	RPSSAx
Golden retriever, 9.5 yrs, M, 22.5 kg	JaundiceSudden weight loss	Troponin I -0.07	2	BOTH	M mode
German shepherd, 4 yrs M, 21.3 kg	Exercise intolerance	Hb 11.1TLC 21180 PLT 3.1	3	Rt.Lat	M mode
German shepherd, 2.6 yrs F, 25 kg	Anorexiacoughing		1	both	M mode
German shepherd 8.3 yrs M, 28 kg	Jaundiceanorexia		1	Rt.Lat	M mode
German shepherd 6.2 yrs F, 29.6 kg	AscitesRespiratory distress	Troponin I 0.07	2	both	M mode
German shepherd 8 yrs M, 20 kg	Exercise intolerance		2	VD	RPSSAx
Pug 2.7 yrs M, 13 kg	intoleranceanorexia	Troponin I 0.12	3	both	M mode
Pug 4.6 yrs M, 8 kg	Anorexiacoughing	Hb10.2 TEC 6.12 PLT 2.55 PCV 35%	1	VD	RPSSAx
Pug, 7.5 yrs M, 13 kg	AscitesLimb oedema		1	Rt.Lat	RPSLAX
Pug, 8 yrs M, 10 kg	Heartmurmur		2	Rt.Lat	RPSLAX
Pug, 4.1 yrs F, 13 kg	Swelling inlimbs		2	both	M mode
Dachshund, 5 yrs M, 12 kg	Jaundice ascites	Hb 8.9, TLC 24490 PLT 2.2, PCV 35%TEC 6.43	2	Rt.Lat	RPSLAX
Dachshund, F, 8.5 yrs, 15.4 kg	Exercise intolerance Vomition		2	both	M mode
ND 3.4 yrs, M12 kg	Swelling in limbs	Hb 7.6 TEC 6.32 PLT 2.74 PCV 35%	3	VD	RPSSAx
Great Dane, M 6.4 yrs, 42 kg	Anorexia coughing		1	both	M mode
	Exercise intolerance	Troponin I 0.12	2	Rt. Lat	RPSLAX

axis 4- chamber echocardiographic views (Fig 2a), right parasternal short axis views with LA:Ao ratio 1.01 (Fig 2b) and colour doppler view of images at mitral valve (Fig 2c) are shown for reference guide. Two dimensional (2-D) right parasternal short axis view images had been recorded starting from the apex then papillary muscles and chordae tendon, mitral valve aorta-left atria and finally pulmonary artery. Left atrium: Aorta (LA:Ao) ratio greater than 1.6 (Fig 2d) is generally considered indicative of left atrial enlargement in dogs (Salguero *et al.*, 2018). LA:Ao ratio for three groups are, Group I (n=18) 1.20 ± 0.06 < Group II (n=14) 1.34 ± 1.50 <

Group III (n=8) 1.66 ± 0.09 (Chart 3). Values of LA and LA/Ao belonging to clinical group showed significant difference ($P < 0.05$) with respect to values of normal heart sized group and preclinical group. M-mode measurement of different parameters (IVSd, IVSs, LVIDd, LVIDs, LVPWd, LVPWs, EF%, FS% and EPSS) were compared between normal(G-I), preclinical and clinical cardiac diseases (G-II) and confirmed cardiomyopathies (G-III) in (Chart 4). A normal recording of M-mode reading in a labrador at LV level and power doppler reading at mitral valve level is shown in Fig 3a and 3b. ECG recording in Fig 4a described reduced P wave in a boxer

with irregular PP intervals resulting in dilated cardiomyopathy. Tachycardia and Arrhythmia can be easily identified in large breed dog such as labrador, bull mastiff (Fig 4b,c, and d) through 4 lead or 6 lead ECG machine (MR 900) which were again subjected to B-mode 2D-

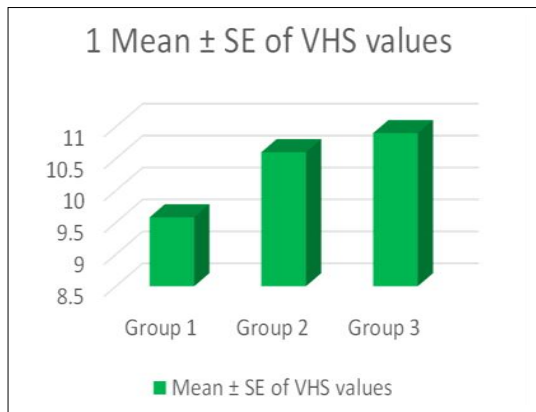


Chart 1: Mean±SE values for VHS across 3 groups.

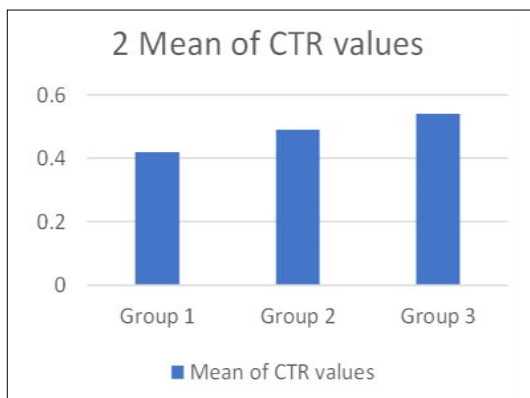


Chart 2: Mean of CTR values across 3 groups.

echocardiography or M- mode echocardiography for describing the animal as DCM and CHF as in the present case.

Measurements for the left ventricular study were taken from the papillary muscles level in the right parasternal short-axis image. EPSS for the mitral valve study was measured as the distance between the lowest part of the interventricular septum and the maximum excursion of the mitral valve. E- point septal separation (EPSS) is a measure of visual estimation of LVEF left ventricular ejection fraction, a healthy cardiac function. This is one of the visual estimations of LVEF without quantitative measurement. EPSS is measured in the parasternal long axis view (PLAX) of the heart, which gives a view of the left ventricle and is often used to assess its function. EPSS is obtained by placing the M-mode tracer over the distal tip of the anterior leaflet of the mitral valve, as in the Fig 5. The E-point Septal Separation (EPSS) is the very small space that exists between the E-point and the interventricular septum in a healthy heart. Consequently, there is a negative correlation between LVEF and EPSS. Reduced LVEF is indicated by an EPSS > 7 mm. In case, EPSS ≥ 13 mm correlates with severely decreased function, with an estimated LVEF of ≤ 35%. An abnormal EPSS of 0.816 cm is shown in Fig 5a and Fig 5b.

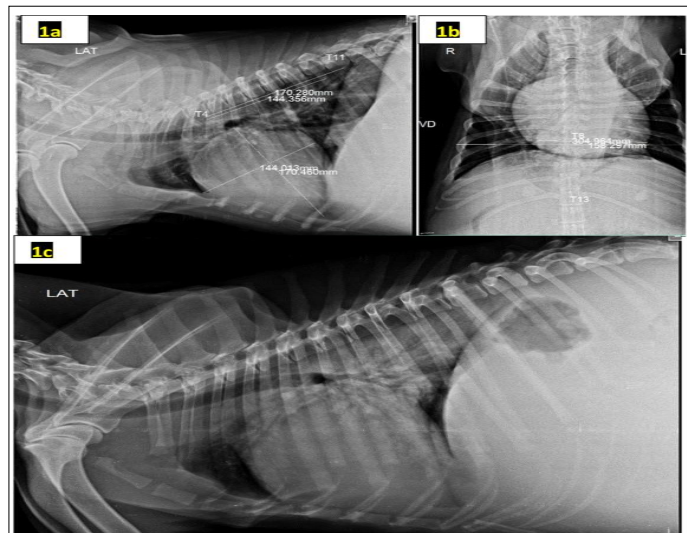
In the current study, the distribution across these groups was relatively balanced, with 45% of the dogs classified as having normal heart sizes, 35% falling into the preclinical category and 20% being in the clinical stage. These findings underline the critical need for early detection, regular monitoring and timely intervention in veterinary practice to manage and potentially prevent the progression of heart disease in dogs. The clinical group, comprising 8 animals with confirmed cardiomyopathies, had the highest mean age at 8.90±0.72 years. This trend highlights a clear progression, where advanced cardiac conditions are more

Table 2: Demographic data of patient studied under the work.

Parameter	Group 1 (N=18)	Group 2 (N=14)	Group 3 (N=8)
Number (%)	18 (42.33%)	14 (35.71%)	8 (21.42%)
Age (years)	5.50±0.88 ^a	6.30±0.90 ^{ab}	8.90±0.72 ^a
Bodyweight (kg)	18.52±3.05 ^a	22.13±4.21 ^{ab}	25.07±3.72 ^G
Breed			
Labrador (%)	3 (16.67%) ^a	2 (14.28%) ^a	2 (25.00%) ^a
Spitz (%)	2 (11.11%)	3 (21.42%)	1 (12.50%)
Pug (%)	2 (11.11%)	3 (21.42%)	0 (0.00%)
Golden retriever (%)	2 (11.11%) ^a	1 (7.14%) ^a	1 (12.50%) ^a
Rottweiler (%)	3 (16.67%) ^a	1 (7.14%) ^b	1 (12.50%) ^{ab}
GSD (%)	2 (11.11%)	2 (14.28%)	1 (12.50%)
Dobermann (%)	3 (16.67%) ^a	0 (0.00%) ^b	1 (12.50%) ^{ab}
Dachshund (%)	0 (0.00%) ^a	2 (14.28%) ^b	1 (12.50%) ^b
Non-descript (%)	1 (5.55%) ^a	0 (0.00%)	0 (0.00%)
Great dane (%)	0 (0.00%)	1 (7.14%)	0 (0.00%)
Gender			
Male (%)	10 (55.55%)	9 (64.28%)	5 (62.50%)
Female (%)	8 (44.44%)	5 (33.33%)	3 (37.50%)

commonly observed in older animals. Labradre retrievers, Rottweilers, Dobermans, Spitz and pugs are the common breed showing increased predisposition to age related cardiac conditions. In some cases, Doberman are found

with associated symptoms like cyanosis and jaundice suggesting a susceptibility to specific diseases. Pugs, showing signs such as heart murmurs, ascites and limb swelling, may point to their predisposition to heart issues



1a). Right lateral thoracic radiograph (French mastiff, 8 yr, M, 48 kg) showing elevated trachea, pulmonary vessel congestion, alveolar oedema and globoid heart. VHS (Short axis +Long axis of heart) measures $13 > 10.5$ clearly defining cardiomegaly and dilated cardiomyopathy (DCM). **1b).** Cardiothoracic ratio (CTR) calculation at the level of 8th vertebrae in ventrodorsal view (French mastiff, 8 yr, M, 48 kg) measuring >0.50 ($158/304 = 0.52$) describing as cardiomegaly. **1c)** Left lateral thoracic radiograph (Rottweiler, F, 6 yr, 40 kg) with elevated trachea, severe pulmonary and alveolar congestion and globoid heart indicating congestive heart failure. Ascitic fluid was detected on abdominal sonograph in both the dog breed.

Fig 1 a-c: Calculation of VHS and CTR in dogs in diagnosing cardiomegaly.

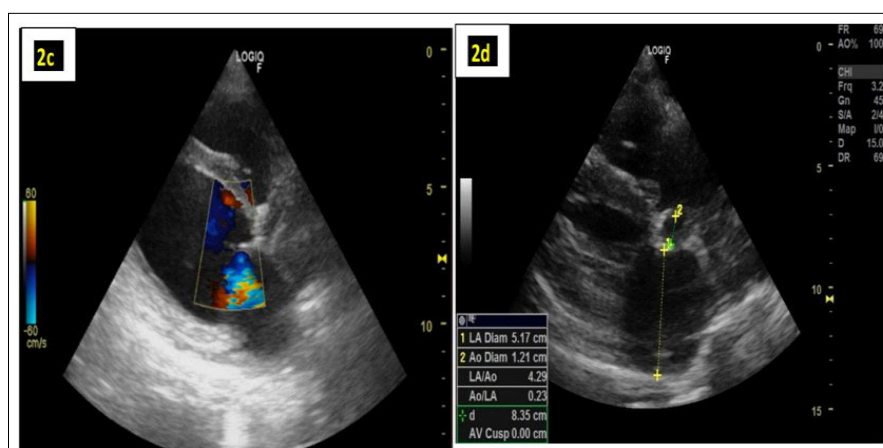


Fig 2a: Echocardiography B-mode images of Right parasternal 4-chamber long axis view in same dog with clear visualisation of LA (left atrium), LV (Left ventricle), RA (Right Atrium), RV (Right Ventricle), MV(mitral valve) and TV (tricuspid valve). **2b)** Normal LA/Ao ratio measurement in RPSSAx view with LA/Ao ratio=1.01. **2c)** Normal Colour flow doppler (CFD) echocardiography images at mitral valve recorded from LAp (Left Apical view) four chamber view at early diastole. **2d).** B-mode echocardiography right parasternal 5-chamber view showing left atrial enlargement (LA/Ao >1.5) with dilated cardiomyopathy (French mastiff, 8 yrs, M, 48 kg).

in middle to older age. Breeds like German Shepherds, Golden Retrievers and Dachshunds also featured, though in smaller numbers.

In this study, VHS values were measured and compared across three groups of dogs to evaluate potential cardiac abnormalities. Groups 2 and 3 demonstrated mean VHS values of 10.6 ± 0.62 and 10.8 ± 0.48 , respectively which are at the upper limit of the accepted range, suggesting a tendency toward cardiomegaly with underlying cardiac conditions, such as dilated cardiomyopathy (DCM). The increased VHS in Groups 2 and 3 highlights the potential of this method as a reliable diagnostic tool for early detection of cardiac abnormalities. The study also utilises cardiothoracic ratio (CTR) to assess heart size relative to the chest cavity, providing valuable insight into heart health and its potential compromise. Group 3 with mean CTR

0.54 ± 0.48 , exceeding the normal range indicated presence of cardiomegaly, consistent with the likelihood of underlying cardiac issues such as dilated cardiomyopathy (DCM) or other heart conditions. The elevated CTR in this group highlights a clear association with cardiac enlargement and the need for further diagnostic and therapeutic intervention.

In this study, the left atrium (LA) measurements showed a progressive increase across the groups. Group 3 demonstrated a marked rise in LA measurements indicating significant left atrial enlargement, likely associated with underlying cardiac conditions such as mitral valve disease or dilated cardiomyopathy. The LA/Ao ratio, an important diagnostic marker, also showed a clear trend of increase across the groups. In Group 3, the LA/Ao ratio was significantly higher at 1.66 ± 0.09 , clearly indicative

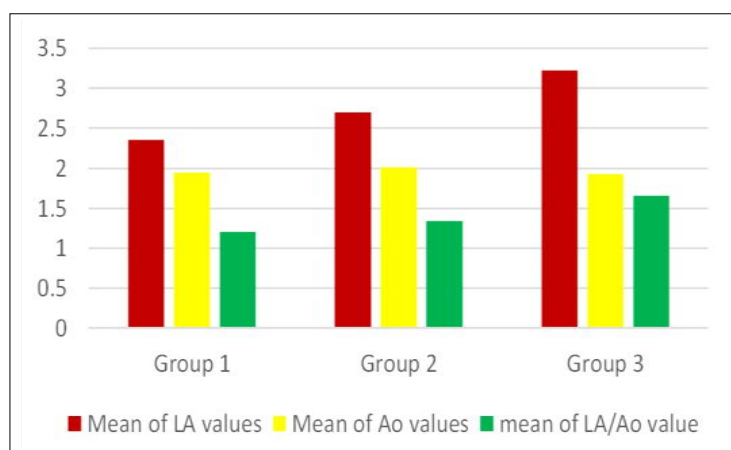
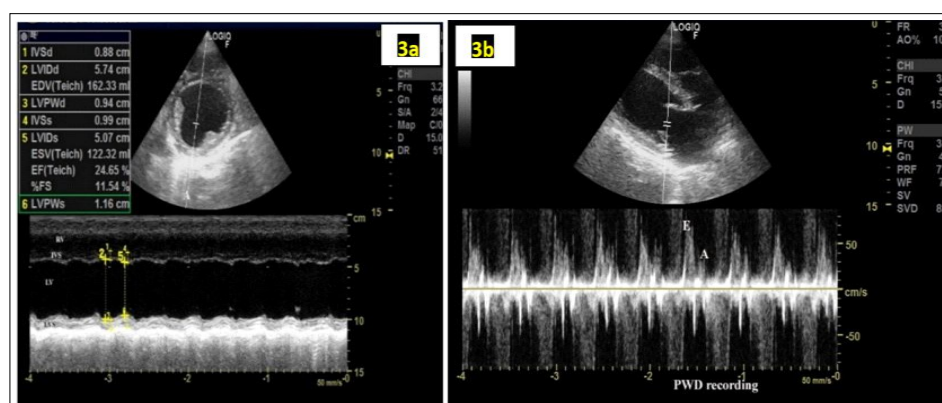


Chart 3: Mean+ SE values of RPS short axis view values.



of left atrial enlargement and a strong likelihood of underlying cardiac pathology.

End-point septal separation (EPSS) is a key echocardiographic measure used to assess the function of the left ventricle, particularly in relation to mitral valve motion. EPSS is measured as the distance between the interventricular septum and the mitral valve during early diastole. An increase in EPSS typically indicates left ventricular dysfunction and poor myocardial contractility, often associated with dilated cardiomyopathy (DCM) or other forms of heart failure. EPSS values in Group I and II are consistent with what is expected in healthy dogs or those with no significant cardiac dysfunction. Low EPSS values

generally imply that the left ventricle is functioning efficiently and the mitral valve is properly positioned with minimal separation during contraction, a hallmark of a healthy heart. However, Group 3 exhibited a markedly higher EPSS value of 1.40 ± 0.30 . This significant increase in EPSS is a clear indication of left ventricular dysfunction, likely due to myocardial dilation or reduced contractility. In dogs with conditions such as dilated cardiomyopathy (DCM), the left ventricle becomes dilated, leading to an increased distance between the interventricular septum and the mitral valve during diastole. This is consistent with the observed findings in Group 3, where the enlarged left ventricle is struggling to contract efficiently, resulting in a poor mitral

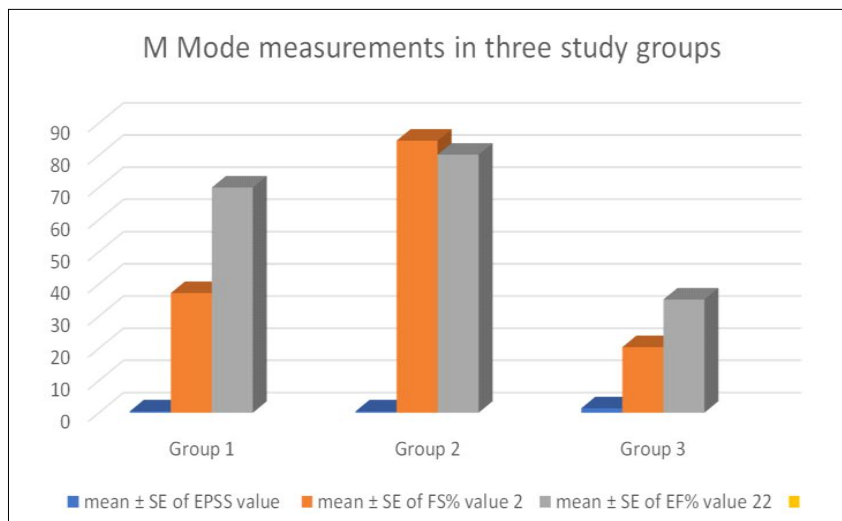


Chart 4: Mean±SE values of M-mode parameter.

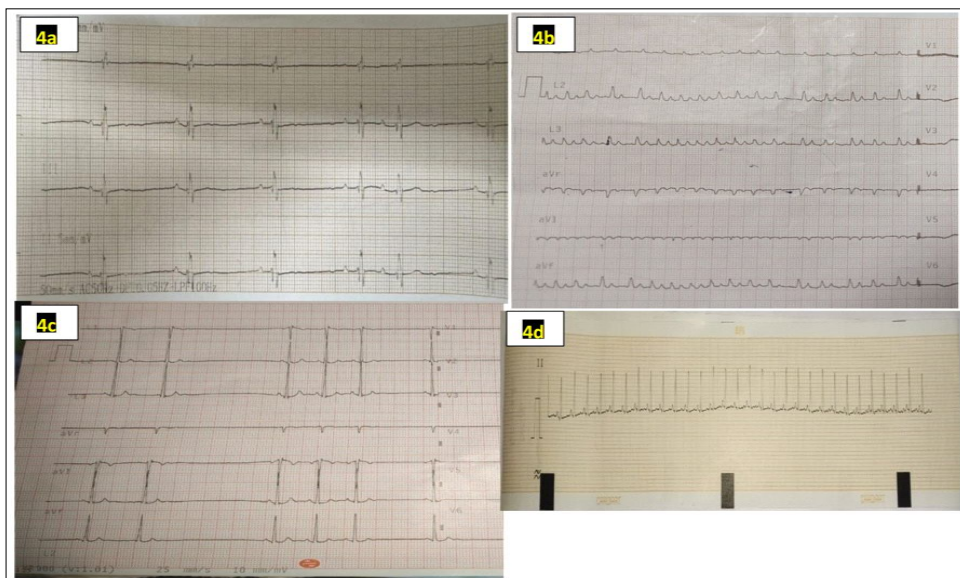


Fig 4a): Electrocardiogram image of a dog showing reduced amplitude of P wave and irregular PP interval may be indicative of either DCM or pericardial effusion. **4b).** Tachycardia with low voltage QRS complex and long PQ interval in a French mastiff (M,8 yr, 48 kg). **4c).** Arrhythmia in a labrador dog (6yr,M,28kg) with long QRS complex and irregular beats. **4d).** Tachycardia in a labrador dog (8 yr,M,24 kg) with heightened QRS complex and shortened PP intervals.

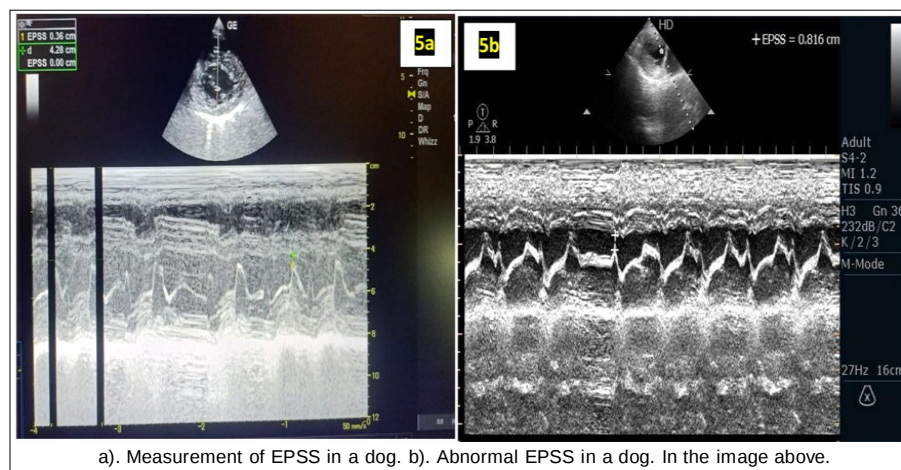


Fig 5 : EPSS is 8.16 mm, indicating abnormal systolic function.

valve closure and greater separation. The elevated EPSS value in Group 3 is therefore suggestive of more advanced cardiac pathology, likely indicative of congestive heart failure or other severe forms of cardiac dysfunction.

M-mode echocardiography provides critical insights into the structural and functional aspects of the heart, allowing for precise measurement of parameters such as interventricular septal thickness (IVSd, IVSs), left ventricular internal diameter (LVIDd, LVIDs), left ventricular posterior wall thickness (LVPWd, LVPWs), ejection fraction (EF%), fractional shortening (FS%) and the early diastolic mitral septal separation (EPSS). These parameters are crucial in evaluating the health of the heart and detecting various cardiac conditions, such as dilated cardiomyopathy (DCM) or heart failure, in dogs.

CONCLUSION

This study provides valuable insights into the progression of cardiomyopathies in dogs and highlights the importance of various diagnostic tools such as thoracic radiographs, electrocardiography and echocardiography in identifying and monitoring heart diseases. The data demonstrates that both preclinical and clinical signs of heart disease are associated with increased heart size and reduced heart function, with significant changes in echocardiographic parameters like EF%, FS% and EPSS in more advanced stages of the disease. The findings underscore the utility of these diagnostic tools for early detection, which is essential for better management of cardiac diseases in dogs. The increased prevalence of cardiomyopathies in older dogs, particularly male dogs and certain breeds, should be considered when assessing risk factors. Regular monitoring and early intervention are crucial in managing heart disease, improving the quality of life and extending the lifespan of affected dogs. Future studies with larger sample sizes and more diverse populations may provide additional insights into the specific breed and environmental factors contributing to cardiomyopathy in dogs.

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Ethical statement

The diagnostic modalities in these cases were performed in Veterinary Clinical Complex, College of Veterinary Science and AH, OUAT. The study does not need an Ethical approval, as all the procedure are part of routine clinical examinations.

Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

As the present study involves only diagnostic modalities, no invasive procedures were involved during the handling of animal for clinical examinations. As and when required appropriate ethical measures have been adopted by the authors.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

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