RESEARCH ARTICLE

Incidence and Echocardiographic Evaluation of Cardiac Diseases in Dogs: A Three Year Retrospective Study

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Abstract

Canine cardiac diseases are an emerging concern in small animal practice due to their increasing prevalence and impact on quality of life. This study aimed to assess the incidence and breed-wise distribution of cardiac diseases in dogs presented to Small Animal Outpatient of MVC Teaching Hospital, Chennai, between June 2022 and June 2025. A total of 44,058 dogs were presented during the study period. Comprehensive echocardiography including B-mode, M-mode, colour flow, and spectral Doppler was performed for all the suspected cases. The overall incidence of cardiac diseases was 2.28% confirmed by echocardiography. The present study analysed the incidence of cardiac diseases in dogs, comprising 1006 cases, of which acquired conditions predominated (89.66%). Dilated cardiomyopathy (49.50%) and mitral valve disease (28.92%) represented the most common acquired cardiac disorders, followed by pericardial effusion (4.67%) and hypertrophic cardiomyopathy (2.43%). Congenital cardiac anomalies accounted for 10.34% of cases, with tricuspid valve dysplasia (3.77%) and tetralogy of Fallot (3.25%) being the most frequently diagnosed. The findings emphasize the predominance of dilated cardiomyopathy and mitral valve disease in canine populations. This study highlights the incidence and distribution of congenital and acquired cardiac conditions based on the echocardiographic findings, to record various types of heart diseases in relation to age, breed, sex; and to emphasize the importance of early diagnosis, breeds-based screening to improve outcome in canine cardiac care.

Key words: Age, Breed, Cardiac diseases, Dogs, Incidence, Sex.

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Introduction

Cardiac diseases represent a significant health concern in the canine population, with an estimated 10-15% of dogs affected globally (Rush, 2002; MacPete, 2018). These conditions are broadly classified into congenital and acquired heart diseases. Acquired heart diseases are more prevalent and predominantly include valvular disorders, cardiomyopathies, and pericardial effusion (Bodh *et al.,* 2016). The terms myxomatous valvular degeneration (MVD), myxomatous transformation, mucoid degeneration, endocardiosis, chronic valvular disease, and degenerative valvular disease all refer to the same disorder (Abbot, 2008). MVD is a sterile, degenerative disease that bears no known relationship to endocarditis (Haggstrom *et al.,* 2000). Assessment of the severity of regurgitation can be evaluated quantitatively or more often, semi-quantitatively by Doppler echocardiography. Tidholm *et al.* (2001) stated that the canine idiopathic dilated cardiomyopathy (DCM) was characterized by chamber dilatation and myocardial systolic and diastolic dysfunction, and carries a poor prognosis. Meurs *et al.* (2001) stated that DCM might be an x-linked recessive trait in Great Danes.

Echocardiography has emerged as a cornerstone diagnostic modality in veterinary cardiology due to its non-invasive nature and real-time assessment capabilities. It is invaluable for diagnosing both congenital abnormalities like obstruction of the ventricular outflow, Patent ductus arteriosus, ventricular septal defect, Atrial septal defect, teratology of fallot, dysplasia of the mitral and tricuspid valves and acquired cardiac abnormalities like valvular disease, dilated cardiomyopathy, hypertrophic cardiomyopathy (HCM), pericardial effusion etc (Muzzi *et al.,* 2006; Gugjoo *et al.,* 2014). Lang *et al.* (2006) stated that the volume determination by 2D echocardiographic images seemed to be more accurate, as they involve more direct measurements and fewer geometric assumptions. M-mode echocardiography, in particular, provides unidimensional imaging that captures cardiac structural motion throughout the cardiac cycle (Cornell *et al.,* 2004). This technique enables clinicians to

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visualize and evaluate cardiac conditions with accuracy and precision. The objective of the study was to evaluate Incidence and echocardiography of cardiac diseases in dogs.

Materials and Methods

The present study was conducted from 2022 to 2025 at the Cardiology Unit of Madras Veterinary College Teaching Hospital, Chennai, India. A total of 44,058 dogs were presented to the hospital during the study period. Out of these, 2,532 dogs exhibiting clinical signs suggestive of cardiac involvement such as exercise intolerance, dyspnoea, coughing, abdominal distension, and syncope were referred to the cardiology unit for further evaluation by echocardiography. A higher proportion of male dogs were represented in the study population compared to females.

Echocardiographic examination was performed with AEROSCAN CD 25 ultrasound machine by using phased array probe having frequency of 4.0 to 8.0 MHz. Both two-dimensional (2D) real-time imaging and motion-mode (M-mode) echocardiography were performed following standard protocols (Smith *et al.,* 2015). M-mode echocardiography was employed to assess cardiac chamber dimensions and quantify left ventricular systolic function, particularly in cases of suspected dilated cardiomyopathy (Sleeper *et al.,* 2002; Rao *et al.,* 2008). Two-dimensional imaging was used to visualize anatomical structures, identify valvular abnormalities, evaluate heart size, and detect lesions such as pericardial effusion and cardiac tumors. Standard imaging planes and conventions were followed as recommended by Thomas *et al.* (1993). Conventional echo-Doppler studies were performed in all suspected cases to assess blood flow patterns and diagnose congenital and acquired cardiac diseases in accordance with the procedures outlined by Chetboul *et al.* (2004).

Results and Discussion

Echocardiographic examination confirmed cardiac diseases in 1006 dogs, resulting in an overall incidence of 2.283 % (1006/44,058) in the college hospital population. This prevalence aligned closely with the findings of Kumar *et al.* (2011), who reported a cardiac disease prevalence of 1.65% in dogs. However, other studies found approximately 10% prevalence (Atkins *et al.*, 2009). These variations could be attributed to differences in the population studied, referral bias, or regional breed distribution. In the current study, out of the 1006 confirmed cardiac cases, 104 cases (10.33%) were identified as congenital heart diseases (CHDs), 902 cases (89.66%) were acquired cardiac diseases (Table 1). Among the congenital defects, mitral and tricuspid valve dysplasia were the most frequently encountered conditions, particularly in dogs aged 4-7 years, followed by the above 10 year age group. Other congenital anomalies, such as ventricular septal defect (VSD), atrial septal defect (ASD), patent ductus arteriosus (PDA), and Tetralogy of Fallot (TOF), were more common in younger dogs aged 1-3 years (Fig: 1-9). These findings aligned with previous studies which report congenital heart diseases

Table 1: Incidence of various cardiac diseases in dogs

Cardiac diseases	No. of dogs affected	Incidence among cases (%)	Incidence among CD (%)
Acquired			
Dilated cardiomyopathy	498	1.130%	49.50%
Mitral valve disease	291	0.666%	28.92%
Pericardial effusions	47	0.106%	4.67%
Hypertrophic cardiomyopathy	33	0.074%	3.28%
Tricuspid valve disease	21	0.047%	2.08%
Intra cardiac mass & around pericardium	12	0.027%	1.19%
Total	**902**	**2.026%**	**89.66%**
Congenital			
Tricuspid valve dysplasia	38	0.086%	3.77%
Mitral valve dysplasia	17	0.038%	1.68%
Pulmonic stenosis	14	0.031%	1.39%
Aortic stenosis	8	0.018%	0.79%
Ebstein's anamoly	8	0.018%	0.79%
Atrial septal defects	7	0.015%	0.69%
Ventricular septal defects	5	0.011%	0.49%
Patent ductus arteriosus	4	0.009%	0.39%
Tetralogy of Fallot	3	0.006%	0.29%
Total	**104**	**0.233%**	**10.33%**
Total cardiac cases	**1006**	**2.283%**	**100%**

more prevalent in younger dogs, with a prevalence ranging from 0.5-1.0% in general canine populations (Chetboul *et al.*, 2004; Gugjoo *et al.,* 2014).

The predominance of acquired heart diseases supports earlier reports by Rush (2002) and Martin *et al.* (2009), who noted that 95% of canine cardiac diseases are acquired, with valvular insufficiencies and dilated cardiomyopathy (DCM) being the most common. In the present study, among the acquired cardiac diseases, dilated cardiomyopathy (DCM) was the most frequently observed, followed by mitral valve disease, pericardial effusion, hypertrophic cardiomyopathy, tricuspid valve disease, and intracardiac or pericardial tumours (Table 1, Fig. 10-14). However, these findings contrast with those reported by MacPete (2018), who noted that myxomatous mitral valve disease (MMVD) accounts for approximately 70-75% of all canine cardiac cases, while DCM represents only about 8% of the total.

The age-wise distribution of congenital and acquired cardiac diseases in dogs (Table 2) revealed notable differences between the two categories. Among the congenital cardiac cases (n=104), the highest incidence was observed in the age group of 1-3 years, accounting for 50.96% (53 cases). This was followed by 21.15% (22 cases) in the 3-7 years age group, 16.34% (17 cases) in the 7-10 years group, and 11.53% (12 cases) in dogs older than 10 years. In contrast, acquired cardiac diseases (n=902) were most prevalent in the 7-10

Fig. 1: Mitral valve dysplasia with dilated left atrium and ventricle

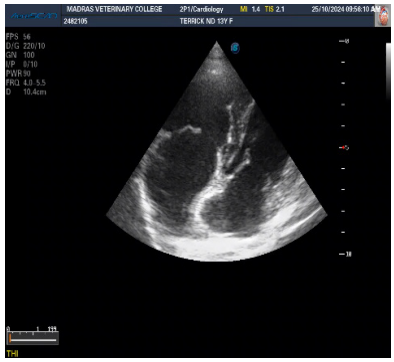

Fig. 2: Tricuspid valve dysplasia

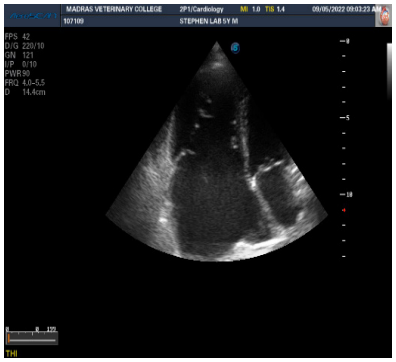

Fig. 3: Ebstein's anomaly (apical displacement of tricuspid valve)

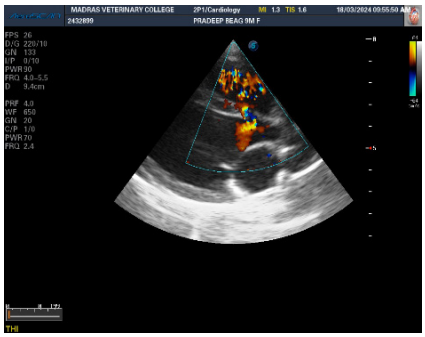

Fig. 4: Ventricular septal defect with left to right shunting

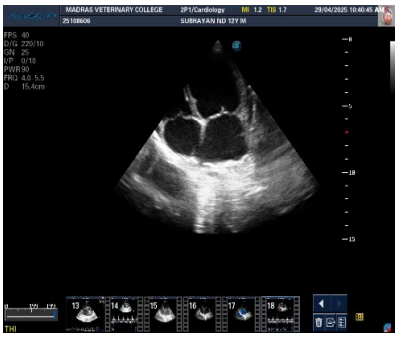

Fig. 5: Atrial septal defect

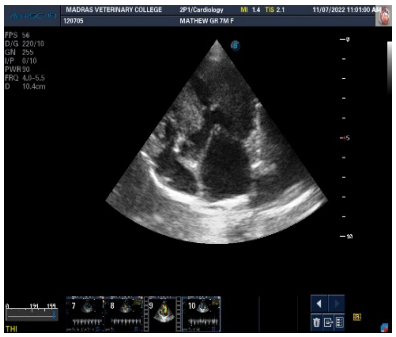

Fig. 6: Aortic stenosis with hypertrophy of left ventricle

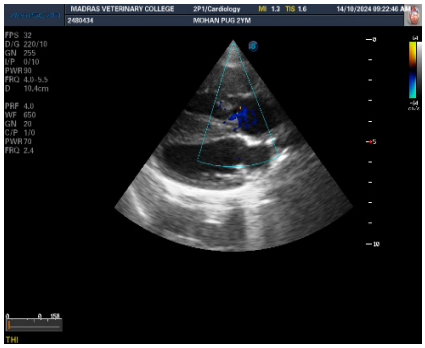

Fig. 7: Pulmonic stenosis with right ventricular hypertrophy

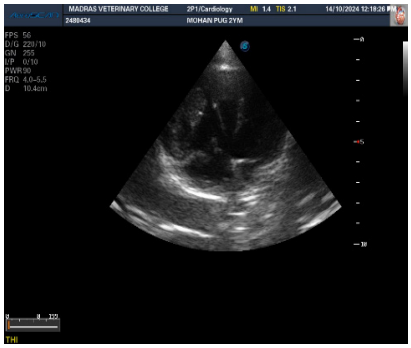

Fig. 8: Dextroposition of aorta

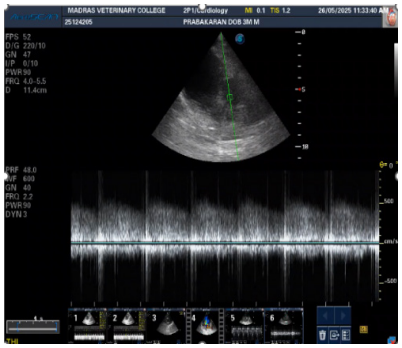

Fig 9: Continuous wave Doppler tracing of the PDA jet obtained from the left heart base demonstrating continuous flow and a peak velocity of around 5.0 m/s

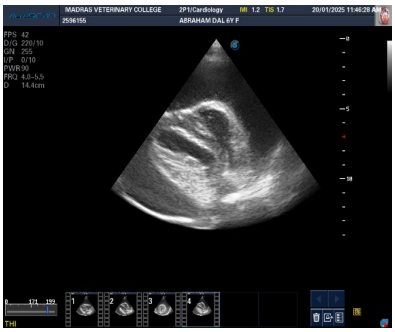

Fig. 10: Pericardial effusion with collapsing of right atrium

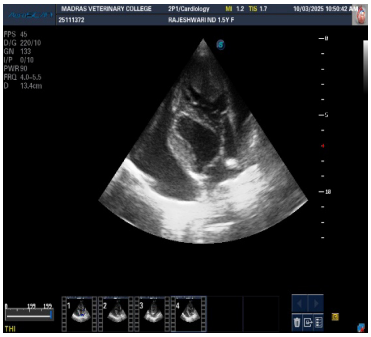

Fig. 11: Pericardial effusion with collapsing of right atrium

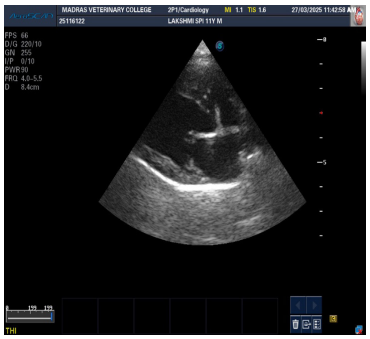

Fig. 12: Degenerative changes in the mitral valve

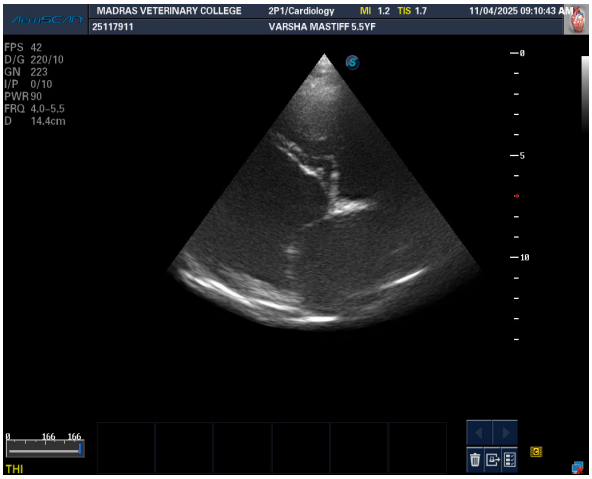

Fig. 13: Dilated cardiomyopathy

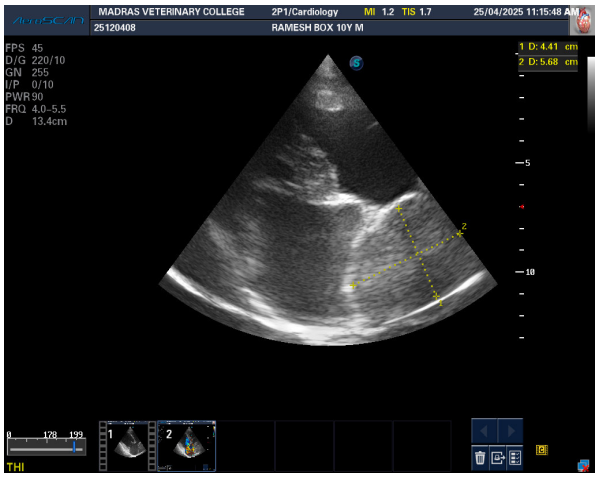

Fig. 14: Heart based tumor

Table 2: Age and sex wise distribution of cardiac diseases

Age	Congenital		Percent	Acquired		Percent	Total (%)
	Male	Female		Male	Female		
1-3 Yr	29	24	50.96	36	18	5.98	10.63
3-7 Yr	13	9	21.15	101	57	17.51	17.89
7-10 Yr	11	6	16.34	329	175	55.87	51.78
>10 Yr	8	4	11.53	104	82	20.62	19.72
Total	**61**	**43**	**100**	**570**	**332**	**100**	**100**

years age group, comprising 55.87% (504 cases), followed by 20.62% (186 cases) in dogs older than 10 years. The 3-7 years age group contributed to 17.51% (158 cases), and only 5.89% (54 cases) of acquired cases were seen in dogs aged 1-3 years. The age wise occurrence of acquired cardiac diseases was parallel with the previous reports by Petric *et al*. (2002), who reported the average age of Doberman Pinchers affected with DCM as 6.5 ± 1.9 years. Martin *et al*. (2010) in a study of 367 clinical cases of DCM observed the mean age at the time of diagnosis as 78 months with a range of 56 to 102 months. Jeyaraja *et al.* (2015) stated that the average age of affected dogs with DCM was 6.68 ± 0.47 years. When combining both congenital and acquired conditions (total n=1006), the highest number of cases were recorded in the 7-10 years age group (51.78%, 521 cases), followed by the >10 years group (19.72%, 198 cases), 3-7 years group (17.89%, 180 cases), and the 1-3 years group (10.63%, 107 cases). These findings are in accordance with earlier reports by Morales *et al.* (2002) and Jeyaraja *et al.* (2009), who observed that middle-aged dogs, with an average age of around 8.5 years, were most commonly affected.

In the present study, incidence of cardiac diseases in male and female dogs accounts of 62.72% and 37.28%, respectively. Martin *et al.* (2009) stated that in terms of sex distribution, male dogs accounted for 62.83% of the cases, while females comprised 37.17%. Similar sex predilections were reported by Castro *et al.* (2009) and Jeyaraja *et al.* (2015), who noted a higher frequency of cardiac diseases in male

Table 3: Breed wise distribution of cardiac diseases

S.No	Cardac disease	Breed affected
1	Dilated cardiomyopathy	Labrador (276), Doberman (72), Non descriptive (51), Boxer (28), Golden Retriever(22), German shepherd (16), Rottweiler (9), Great Dane (8), Shih tzu (6), Spitz (5), Pug (5)
2	Mitral valve disease	Spitz (85), Non descriptive (48), Labrador (33), Pomeranian (24), Doberman (21), Lhasa apso (16), Golden Retriever (14), Dachshund (14), Boxer (8), German Shepherd (8), Shih tzu (6), Rottweiler (6), Beagle (5), Dalmatian (3),
3	Pericardial effusion	Non Descriptive (15), Rottweiler (6), Retriever (5), Boxer (5), Golden Doberman (4), Labrador(3), German Shepherd (3), Pug (3), Spitz(2), Dalmatian(1),
4	Hypertrophic cardiomyopathy	Pug (11), Non Descriptive (9), Bull dog (3), Labrador(3), Shih-tzu (3), Boxer(2), poodle (1), Great Dane (1)
5	Tricuspid valve disease	Spitz (6), Non Descriptive (5), Labrador (3), Doberman (2), Shih tzu (3), pug (2)
6	Intra thoracic & pericardial tumour	Boxer (4), Spitz (2), Golden Retriever (2), Bull dog (2), Non Descriptive (1), Labrador(1),
7	Tricuspid valve dysplasia	Non Descriptive (9), Spitz (8), Pomeranian (5), Labrador(4), pug (4), Golden Retriever (3), Boxer (3), beagle (2)
8	Mitral valve dysplasia	Spitz (7), Pomeranian (3), Non descriptive (2), Shih-tzu (2), Dachshund (2)
9	Pulmonic stenosis	Bull dog (4), Cane Corso (2), Doberman(2), Pug (2), Boxer (1), Cocker Spaniel (1), Beagle (1), Golden Retriever (1)
10	Aortic stenosis	Boxer (2), Bull dog (2), Poodle (1), Golden Retriever (1), Labrador(1),Doberman (1)
11	Ebstein's anomaly	ND (3), Spitz (2), Golden Retriever (1), Rottweiler (1), German Shepherd (1)
12	Atrial septal defect	Boxer (2), Doberman(1), Yorkshire Terrier (1), Labrador (1), Pug(1), Spitz(1),
13	Ventricular septal defect	Beagle (2), Cocker Spaniel(1), Cane Corso(1), Jack Russel Terrier(1)
14	Patent ductus arteriosus	Doberman (2), Dachshund (1), German Shepherd (1)
15	Teratology of Fallot	Non descriptive (1), Chihuahua (1), Doberman (1)

dogs, particularly those of large and giant breeds. Although male predisposition is notable, it may not be statistically significant in the present study.

Breed wise distribution of cardiac diseases is represented in Table 3. Among all the breeds, Labrador was the most affected breed, accounting for 35.09% of all followed by Spitz (11.6%), Non-descriptive (10.09%), Doberman (8.52%), and Boxers (7.06%). This finding was consistent with studies by Jeyaraja *et al.* (2015), who highlighted a high prevalence (6%) of DCM in Labrador Retrievers, potentially due to a common ancestral link with the Newfoundland breed and the breed owned by most of the people in that location. Conversely, breeds like Great Danes, Bulldogs, and Terriers showed the lowest incidence, likely due to their smaller representation in the local population.

Conclusion

Overall, the prevalence and distribution of cardiac disorders in the present study reaffirm that both breed predisposition and age are significant risk factors. The variations observed across studies also underscore the importance of considering population demographics, breed popularity, and diagnostic access when interpreting prevalence data.

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