

Integrated Clinical and Paraclinical Evaluation of Dilated Cardiomyopathy in Dogs

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Abstract Dilated cardiomyopathy (DCM) in the dog is a severe myocardial disorder characterized by dilation of the cardiac chambers and impaired systolic function. The present study included 12 dogs, aged between 8 and 14 years and weighing between 7 and 34 kg, evaluated through clinical examination, electrocardiography, echocardiography, and measurement of cardiac troponin I (cTnI). The results revealed various electrocardiographic abnormalities, including sinus tachycardia, atrial fibrillation, and ST-segment changes, correlated with structural remodeling confirmed by echocardiographic assessment. Cardiac Troponin I values were significantly increased in severe cases (NYHA III–IV), suggesting progressive myocardial injury. The integration of these diagnostic methods provides a comprehensive evaluation of the cardiac patient and allows assessment of disease severity.

Keywords: myocardial injury, systolic dysfunction, chamber dilation, arrhythmias, biomarkers, remodeling

Introduction

Dilated cardiomyopathy (DCM) is considered one of the most important myocardial diseases in dogs, frequently progressing toward congestive heart failure and cardiac arrhythmias. The disease induces severe structural and functional myocardial alterations, significantly influencing the prognosis and survival of affected canine patients.

The diagnosis of dilated cardiomyopathy requires an integrated approach based on the correlation of clinical examination with electrocardiographic, echocardiographic, and biochemical investigations. Electrocardiography plays an essential role in the evaluation of cardiac electrical activity, allowing the identification of arrhythmias, conduction disturbances, and changes associated with myocardial remodeling, including atrial fibrillation, ventricular tachyarrhythmias, and alterations of the QRS complex.

In recent years, cardiac biomarkers have gained increasing importance in the assessment of myocardial injury. Cardiac Troponin I is considered a sensitive and specific marker of cardiomyocyte damage, useful both for the early detection of myocardial injury and for prognostic evaluation in patients with cardiovascular diseases. Increased serum troponin concentrations are associated with the severity of myocardial lesions and with the clinical progression of affected patients.

Atrial fibrillation represents one of the most frequent electrical complications associated with canine dilated cardiomyopathy and is mainly correlated with atrial enlargement and the severity of cardiac remodeling.

The aim of the present study was the integrated evaluation of clinical, electrocardiographic, echocardiographic, and biochemical changes in dogs diagnosed with dilated cardiomyopathy, in order to highlight the relationships between structural and functional cardiac alterations and biomarkers of myocardial injury.

Material and method

The study was conducted on a group of 12 dogs diagnosed with dilated cardiomyopathy, belonging to different breeds, with body weights ranging from 7 to 34 kg and ages between 8 and 14 years, selected to highlight the clinical and morphological variability associated with this cardiovascular disease.

Clinical examination included assessment of the general condition, heart and respiratory rates, cardiac auscultation, and identification of signs suggestive of congestive heart failure. Electrocardiographic evaluation was performed using standard bipolar and augmented unipolar leads to assess cardiac rhythm, electrocardiographic parameters, and arrhythmias associated with dilated cardiomyopathy.

Echocardiographic examination was performed using the X Vision MyLab 70 Vet and Chison Eco 2 Vet ultrasound systems in B-mode, M-mode, and Doppler modalities to evaluate cardiac chamber dimensions, systolic function, and intracardiac blood flow. The sphericity index and EPSS were analyzed as indicators of cardiac remodeling and systolic ventricular dysfunction.

Cardiac troponin I was determined from venous blood samples collected under standardized conditions, and the obtained values were used to assess myocardial injury and its association with the severity of cardiac impairment.

Statistical analysis included descriptive and comparative methods. Data were expressed as mean ± standard error, and differences between groups were evaluated using ANOVA, with significance set at $p < 0.05$, $p < 0.01$, and $p < 0.001$.

Conclusions

Dilated cardiomyopathy in dogs requires an integrated diagnostic approach due to its marked clinical variability. Electrocardiography is valuable for the early detection of arrhythmias and conduction disturbances, while echocardiography confirms the diagnosis and identifies the structural and functional changes associated with cardiac remodeling. Cardiac troponin I provides important information regarding the degree of myocardial injury and correlates with disease severity and prognosis. The combined interpretation of electrocardiographic, echocardiographic, and biochemical findings enables accurate diagnosis, assessment of disease severity, and optimization of clinical management in canine dilated cardiomyopathy.

Results and discussions

Paraclinical investigations revealed subclinical cardiac involvement, highlighting the progressive nature of the disease and the importance of early electrocardiographic evaluation.



Fig. 1. Right atrium cardiomegaly



Fig. 2. Atrial fibrillation

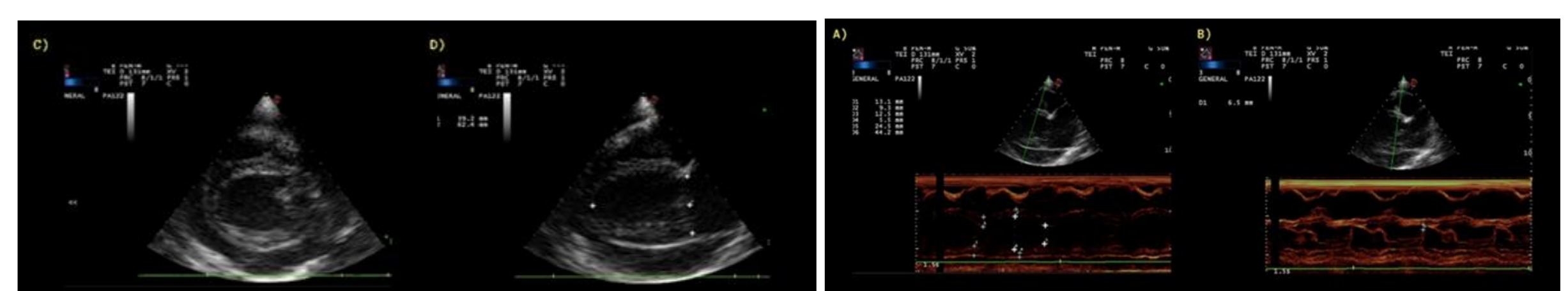


Fig. 3. Echocardiography in a Dog with Dilated Cardiomyopathy (B mode, M mode)

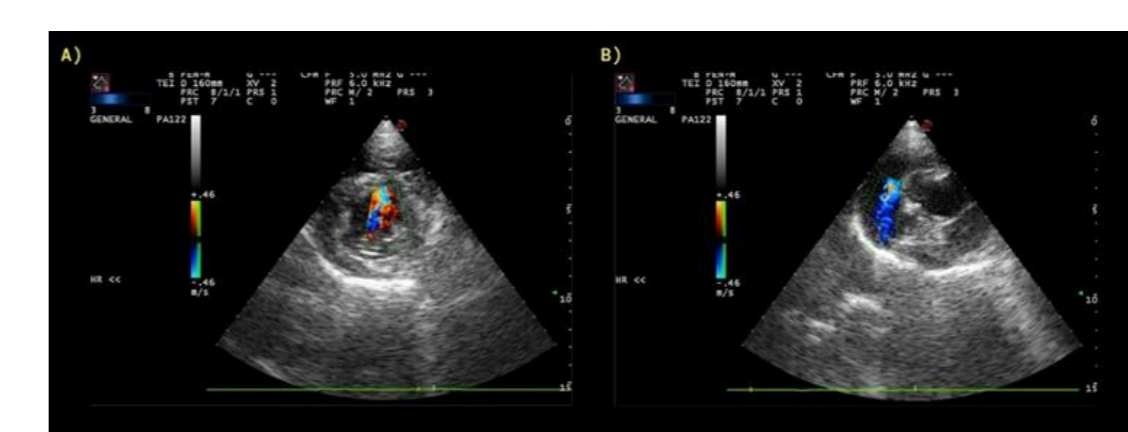


Fig. 4. Echocardiography in a Dog with Dilated Cardiomyopathy (Doppler color mode)

Paraclinical investigations revealed subclinical cardiac involvement, highlighting the progressive nature of the disease and the importance of early electrocardiographic evaluation.

ECG findings included increased and peaked P-wave amplitude suggestive of right atrial enlargement, sinus tachycardia of approximately 170 bpm, increased QRS complex amplitude, and mild ST-segment depression, indicating myocardial remodeling and subendocardial impairment (Fig. 1)

An increased LA/Ao ratio reflected left atrial dilation and advanced cardiac remodeling associated with an increased risk of atrial fibrillation (Fig. 2). Echocardiography also revealed pericardial effusion and degenerative mitral valve changes, suggesting complex structural cardiac impairment (Fig. 3).

The sphericity index was close to the upper reference limit, indicating altered left ventricular geometry characteristic of dilated cardiomyopathy. Although fractional shortening remained within the reference range, paradoxical myocardial motion suggested impaired ventricular synchrony. Color Doppler examination demonstrated turbulent transmitral and transtricuspid flow, consistent with altered intracardiac hemodynamics and secondary valvular dysfunction (Fig. 4).

The present study demonstrated a progressive increase in serum cardiac troponin I concentrations with the worsening of heart failure severity in both male and female dogs, with the highest values recorded in NYHA functional classes III and IV. These findings indicate a direct relationship between myocardial dysfunction severity and the degree of cardiomyocyte injury.

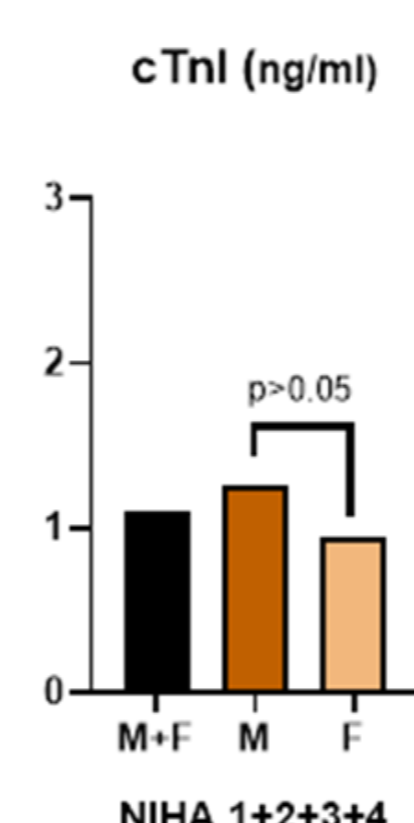


Fig. 5. Graphical representation of cTnI values in dogs with dilated cardiomyopathy.

Sex-related differences were also observed, particularly in advanced stages of the disease, suggesting the involvement of biological and hormonal factors in modulating myocardial response to injury. Female dogs showed comparatively lower cTnI values, which may be associated with the cardioprotective effects of estrogens, including modulation of ventricular remodeling, reduction of myocardial hypertrophy, and improved cardiomyocyte metabolic adaptation.