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Assessment of left ventricular function in healthy Great Danes and in Great Danes with dilated cardiomyopathy using speckle tracking echocardiography

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Abstract *Objectives:* Assess global circumferential and radial systolic and diastolic myocardial function with speckle tracking echocardiography (STE) in healthy Great Danes (GD) and in GD diagnosed with dilated cardiomyopathy (DCM).
Animals: Eighty-nine GD were included in the study: 39 healthy (normal group [NORMg]) and 50 diagnosed with DCM (DCMg).
Methods: This was a retrospective study. Signalment and echocardiographic diagnosis were obtained from the medical records of GD assessed between 2008 and 2012. Speckle tracking echocardiography analysis of circumferential (C) and radial (R) strain (St) and strain rate (SR) in systole (S), early (E) and late (A) diastole was performed at the levels of the mitral valve (MV), papillary muscles (PM) and apex (Ap) of the left ventricle. Univariable and multivariable analysis was performed to identify differences between groups.
Results: Speckle tracking echocardiography variables increase from the MV towards the Ap of the left ventricle in both NORMg and DCMg dogs, some reaching statistical significance. Most of the variables (28/31) were lower in DCMg than in NORMg dogs: statistically significant variables included radial SR at the Ap in systole (p=0.029), radial strain at the PM (p=0.012), circumferential SR at the PM in systole (p=0.031), circumferential and radial SR at the MV in early diastole (p=0.019 and p=0.049, respectively).

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Conclusions: There are significant differences in STE variables between NORMg and DCMg Great Danes, although the overlap between the two groups may indicate that these variables are not sufficiently discriminatory. STE variables are not sufficiently sensitive to use in isolation as a screening method.

Abbreviations

A	late diastole
Ap	apical level
C	circumferential
CSRA	circumferential strain rate in late diastole
CSRE	circumferential strain rate in early diastole
CSRS	circumferential strain rate in systole
CSt	circumferential strain
CV	coefficient of variation
DCM	dilated cardiomyopathy
DCMg	group considered affected by dilated cardiomyopathy
E	early diastole
GD	Great Danes
LV	left ventricle
MV	mitral valve level
NORMg	normal group
PM	papillary muscles level
R	radial
ROI	region of interest
RSRA	radial strain rate in late diastole
RSRE	radial strain rate in early diastole
RSt	radial strain
S	systole
SR	strain rate
St	strain
STE	speckle tracking echocardiography

Introduction

Dilated cardiomyopathy (DCM) is one of the most common acquired cardiac diseases in dogs [1]. It is characterised by ventricular dilation and systolic dysfunction with normal left ventricular wall thickness [2]. There are two stages of DCM: a clinical or overt phase, that is preceded by an initial preclinical or occult phase (detected only by careful screening) [3]. Progression to congestive heart failure commonly occurs after a variable but prolonged asymptomatic period [4].

Great Danes are a commonly affected breed and it has recently been shown that the prevalence of DCM in the United Kingdom population of Great Danes (GD) is higher than previously suggested [5]. Little is known about the underlying genetic mutations that lead to the disease and its progression from sub-clinical to clinical stages [5–7]. Identification of animals with preclinical DCM is important and due to proposed mechanisms of inheritance, affected dogs should be excluded from the breeding pool. Furthermore, early medical therapy may slow the progression from preclinical to clinical DCM [8,9]. In the absence of a reliable genetic test, identification of preclinical animals is accomplished by Holter and echocardiography [5,10].

Speckle tracking echocardiography (STE) is a recent technique for myocardial function assessment [11,12]. The magnitude of myocardial deformation is described by systolic strain (St) and the rate of deformation is described by strain rate (SR) [13]. Radial St (RSt) represents myocardial thickening and thinning; circumferential St (CSt) is defined as the change of circumference in the short axis, perpendicular to the radial and long axis [14–16]. Strain and SR can be measured in three different axes, from 2D echo images for longitudinal, radial and circumferential myocardial motion [11,12]. In addition, from 3D echo, area strain can be calculated [17]. The main advantages of STE are related to the fact that it is less load dependent than other echocardiographic variables [18], semi-automated and not dependent on insonation angle, unlike tissue Doppler imaging [19,20]. In humans, STE has been shown to be useful not only in patients with clinical signs (reduced RSt [21–23]; and CSt [23]), but also in the detection of sub-clinical left ventricular dysfunction in patients with normal ejection fraction [24–26]. In veterinary medicine, STE differences were noted in dogs with different classes of congestive heart failure due to myxomatous degenerative valvular disease [27–30]; St and SR may be useful in detecting early myocardial impairment in dogs with Duchenne muscular dystrophy [31].

To the authors' knowledge, no studies using STE to assess left ventricular mechanics in dogs with naturally occurring DCM have been published. The purpose of this study was to assess global

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