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Cardiovascular Images

Electrocardiographic, echocardiographic, and left atrial strain imaging features of a dog with atrial flutter and third-degree atrioventricular block[☆]

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KEYWORDS

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Strain;

Abstract A 14-year-old American Staffordshire terrier was presented for episodes of exercise-induced syncope. At admission, atrial flutter coupled to third-degree atrioventricular block was diagnosed electrocardiographically. On the second day of hospitalization, surface electrocardiogram revealed spontaneous conversion to sinus rhythm with persistence of atrioventricular block. Complete transthoracic echocardiograms were performed after each electrocardiographic examination.

[☆] A unique aspect of the Journal of Veterinary Cardiology is the emphasis of additional web-based images permitting the detailing of procedures and diagnostics. These images can be viewed (by those readers with subscription access) by going to <http://www.sciencedirect.com/science/journal/17602734>. The issue to be viewed is clicked and the available PDF and image downloading is available via the Summary Plus link. The supplementary material for a given article appears at the end of the page. Downloading the videos may take several minutes. Readers will require at least Quicktime 7 (available free at <http://www.apple.com/quicktime/download/>) to enjoy the content. Another means to view the material is to go to <http://www.doi.org> and enter the doi number unique to this paper which is indicated at the end of the manuscript.

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Myxomatous mitral valve disease;
Myocarditis

The combined use of conventional echocardiography with tissue Doppler imaging-based modalities allowed to investigate the atrial electromechanical correlation and function during typical atrial flutter and after its resolution.

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Abbreviations

3AVB	third-degree atrioventricular block
AFL	atrial flutter
ECG	electrocardiography
LA	left atrium
LAp4Ch	left parasternal apical 4-chamber
MMVD	myxomatous mitral valve disease
RA	right atrium
SR	sinus rhythm
TDI	tissue Doppler imaging
TTE	transthoracic echocardiography

A 14-year-old 25-kg male American Staffordshire terrier was presented to the Veterinary Teaching Hospital of the University of Bologna for episodes of exercise-induced syncope within a 2-day period. A diagnosis of decompensated myxomatous mitral valve disease (MMVD) with no evidence of rhythm disturbance had been made three months before and treated with furosemide^c (2 mg/kg PO q12h), benazepril^d (0.25 mg/kg PO q24h), and pimobendan,^{ef} (0.25 mg/kg PO q12h). On arrival, the patient was laterally recumbent and minimally responsive. Mucous membranes were pale with a capillary refill time of 3 s and rectal temperature was 37 °C. The femoral pulse was severely bradyarrhythmic (25 beats/min). A grade IV/VI holosystolic left-sided murmur was also auscultated.

Image interpretation: Fig. 1. Atrial flutter (AFL) with third-degree atrioventricular block (3AVB)—12-lead surface electrocardiography (ECG)

On 12-lead surface ECG, isoelectric baseline and sinus P waves were replaced by sequential sawtooth-shaped deflections (F waves). The atrial

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^e Vetmedin, Boehringer Ingelheim Vetmedica, Inc., Ingelheim, Germany.

^f iU22 ultrasound system, Philips Medical Systems S.p.A., Monza, Italy.

and ventricular rates were 365 and 25 beats/min, respectively, with lack of association between the F waves and QRS. The QRS complexes had normal amplitude (R wave, 1.8 mV; upper reference limit, <2.5 mV) and axis (100°; reference range, from 40° to 110°) but were wide (0.11 s; upper reference limit, <0.06 s). By means of these findings, AFL coupled to 3AVB was diagnosed [1,2].

Image interpretation: Video 1 and Figs. 2, 3. AFL with 3AVB—conventional transthoracic echocardiography (TTE) and LA deformation analysis

A standard TTE was performed with continuous electrocardiogram monitoring. The two-dimensional echocardiography recorded from the left parasternal apical four-chamber (LAp4Ch) view (Video 1) clearly depicted the remarkable asynchrony between the rapid atrial contractions and the extremely low ventricular response. Thickening and prolapse of atrioventricular valves coupled to left atrial (LA) enlargement was also noticed (LA-to-aorta ratio, 2; upper reference limit, <1.6), consistent with MMVD. Pulsed-wave Doppler interrogation of transmitral flow was also performed (Fig. 1, available in Supplemental Material on-line). Left atrial deformation analysis was carried using tissue Doppler imaging (TDI), as previously described in healthy dogs [3]. The TDI color sector was activated to include the entire LA wall obtained from an optimized LAp4Ch view. A videoclip was acquired and analyzed off-line using a dedicated software^g (Fig. 2). A region of interest (purple arrow) was drawn over the LA lateral wall segment. Then, the software automatically generated the strain time/intensity curve over each cardiac cycle (Fig. 3). Specifically, the strain profile expressed as a percentage over time showed a first positive wave during ventricular systole (s), a first deep negative deflection during early diastolic strain (e), and several negative waves in accordance to each F wave (f).

^g QLAB quantification software, version 9.1, Philips Healthcare.

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