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Supraventricular trigeminy in a dog with myxomatous mitral valve disease

Frederico Aécio Carvalho Soares[1]

[1]Faculdade de Veterinária, Centro Universitário Ritter dos Reis - UniRitter, Avenida Manoel Elias, 2001, 91240-261, Porto Alegre, RS, Brasil. E-mail: fredaecio@gmail.com. *Corresponding author.

ABSTRACT: *Supraventricular trigeminy is an uncommon cardiac impulse formation disturbance. Detecting and treating cardiac arrhythmias is an important therapeutic goal in cardiology. The aim of this note is to report an occurrence of supraventricular trigeminy in a dog with myxomatous mitral valve disease (MMVD). A 15-year-old intact male mongrel dog weighing 13kg and with a history of heart murmur, cough, dyspnea, and ascites was referred for cardiac evaluation. Echocardiographic findings were consistent with a diagnosis of myxomatous mitral and tricuspid valves disease with a severe hemodynamic compromise. Electrocardiography (ECG) revealed a sinus arrhythmia with isolated supraventricular premature complexes, supraventricular couplets, and periods of supraventricular trigeminy. Previous retrospective and prospective studies that evaluated cardiac arrhythmias in dogs have not reported supraventricular trigeminy. The present report showed that supraventricular trigeminy may occur in dogs with MMVD with severe hemodynamic compromise, probably related to atrial enlargement. In addition, this case reinforces the importance of performing ECG in dogs with MMVD, since it complements the echocardiogram and enables a better therapeutic approach.*
Key words: ***a**rrhythmia, canine, electrocardiography, endocardiosis.*

Trigeminismo supraventricular em um cão com doença mixomatosa da valva mitral

RESUMO: *O trigeminismo supraventricular é um distúrbio incomum de formação do impulso elétrico cardíaco. Detectar e tratar arritmias cardíacas são um importante objetivo terapêutico em cardiologia. O objetivo desta nota é relatar a ocorrência de trigeminismo supraventricular em um cão com doença mixomatosa da valva mitral (DMVM). Um cão sem raça definida, macho, inteiro, 15 anos de idade e 13kg foi levado para avaliação cardíaca com um histórico de sopro cardíaco, tosse, dispneia e ascite. Os achados ecocardiográficos foram compatíveis com doença mixomatosa de valvas mitral e tricúspide com comprometimento hemodinâmico severo. A eletrocardiografia (ECG) revelou arritmia sinusal com presença de complexos supraventriculares prematuros isolados, aos pares e períodos de trigeminismo supraventricular. O trigeminismo supraventricular não é relatado em estudos retrospectivos e prospectivos que avaliaram arritmias cardíacas em um grande número de cães. O presente relato evidencia que o trigeminismo supraventricular pode ocorrer em cães com DMVM e comprometimento hemodinâmico severo, provavelmente relacionado à dilatação atrial. Ainda, reforça a importância da realização do ECG em cães com DMVM, complementando as informações ecocardiográficas e possibilitando uma melhor abordagem terapêutica.*
Palavras-chave: *arritmia, canino, eletrocardiografia, endocardiose.*

Supraventricular or atrial trigeminy is an impulse formation disturbance characterized by a condition in which every third beat is a supraventricular premature beat (BOLTON, 1975). Although, isolated supraventricular premature complexes are common in dogs, trigeminy is rare. To the author's knowledge, based on a literature review, this is the first report of supraventricular trigeminy in a dog. Myxomatous mitral valve disease (MMVD) is the most common cardiac disease in dogs and prevalence is greatest in small geriatric populations. Cardiac arrhythmias can complicate prognosis in dogs with MMVD (BORGARELLI et al., 2008; JUNG et al., 2016). The aim of this note is to report an occurrence of supraventricular trigeminy in a dog with MMVD.

A 15-year-old intact male mongrel dog weighing 13kg and with a history of heart murmur, cough, dyspnea, and ascites was referred for cardiac evaluation. Although, the dog was being treated with 5mg of enalapril twice daily for a year, he had never been subjected to ancillary tests for cardiac evaluation. On physical examination, cardiac auscultation revealed a grade V/VI systolic murmur at the mitral area and a grade IV/VI systolic murmur at the tricuspid area. His heart rate was 130 beats per minute and consisted of an irregular rhythm, hypokinetic and asynchronous femoral pulse.

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Mucous membrane color and capillary refill time (1 second) were normal, besides abdominal distention characteristic of ascites.

For Doppler echocardiographic examination (Sonosite Micromaxx, sector transducer frequencies of 1-5MHz), M-mode, two-dimensional, and spectral Doppler were used. The patient was not sedated and gently restrained in left and right lateral recumbency to obtain images of the right parasternal, left caudal (apical) parasternal, and left cranial parasternal locations. The examination revealed: a thickened and prolapsed mitral valve with severe regurgitation; a thickened tricuspid valve with severe regurgitation and a pressure gradient of 41.9mmHg, which is characteristic of mild pulmonary hypertension; severe left atrial enlargement (LA/Ao ratio of 2.4); right atrial enlargement; eccentric hypertrophy of the left ventricle; and preserved systolic function. These findings were consistent with a diagnosis of myxomatous mitral and tricuspid valves disease with a severe hemodynamic compromise.

For electrocardiographic evaluation (ECG-PC TEB), the dog was not sedated and gently restrained in right lateral recumbency. The ECG tracing was obtained from leads I, II, III, aVR, aVL, and aVF. Examination revealed a sinus arrhythmia with isolated supraventricular premature complexes, supraventricular couplets, and periods of supraventricular trigeminy lasting up to fifteen seconds (Figure 1).

Treatment consisted of ascites drainage, digoxin (0.004mg kg^{-1} twice daily), furosemide (1.5mg kg^{-1} twice daily), spironolactone (1.9mg kg^{-1} once daily), pimobendan (0.15mg kg^{-1} twice daily), and sildenafil (1.0mg kg^{-1} twice daily). Furthermore, it was recommended to repeat the electrocardiogram after 30 days of treatment and to collect blood samples for a complete blood count and biochemical profile. However, the patient did not return and died after 60 days owing to pulmonary edema.

Myxomatous mitral valve disease is the most common cardiac disease in dogs and prevalence is greatest in small geriatric populations. In most cases, the tricuspid valve is affected, such as in the present case. Cardiac arrhythmias may complicate prognosis of mitral endocardiosis. Most often, arrhythmias have a supraventricular origin reflecting atrial stretch (TILLEY, 1992; CROSARA et al., 2010). Some echocardiographic parameters (e.g., LA/Ao ratio) provide valuable prognostic information for dogs with MMVD (BORGARELLI et al., 2008; SARGENT et al., 2015). Furthermore, echocardiographic abnormalities may be associated with a risk of developing arrhythmias. The LA/Ao ratio is a measure that evaluates atrial stretch. Dogs with MMVD that showed a LA/Ao>1.7 had more supraventricular rhythm disturbances, suggesting that this parameter is associated with a risk of developing arrhythmias of supraventricular origin (CROSARA et al., 2010). Electrophysiological mechanisms by which atrial stretch leads to supraventricular arrhythmias are not fully understood, but studies suggest that volume and pressure overload in the heart can activate stretch-activated ion channels inducing atrial premature beats (NAZIR & LAB, 1996; KAMKIN et al., 1999). Another risk factor for the arrhythmogenic substrate in the dog of the present report is the presence of pulmonary hypertension, which can modulate autonomic activity and delay cardiac repolarization (HONG-LIANG et al., 2009; RAJDEV et al., 2012).

Besides atrial enlargement secondary to valvular insufficiency, supraventricular premature complexes can be associated with conditions such as atrial neoplasia, congenital cardiac defects, drug toxicities (e.g., general anesthesia, diuretics and digitalis), and electrolyte imbalances (TILLEY, 1992). In the present report, the patient's clinical history and echocardiogram refute all of these potential causes except electrolyte imbalance, since he did not undergo a blood draw to evaluate his biochemical profile.

Supraventricular trigeminy has not been reported by retrospective (APTEKMANN et al., 2010) and prospective (VARSHNEY et al., 2013; KUMAR et al., 2014) studies that evaluated cardiac arrhythmias in dogs. In studies evaluating cardiac arrhythmias in dogs with MMVD using conventional and Holter (24 hours) ECG, despite the higher incidence of arrhythmias of supraventricular origin, supraventricular trigeminy is not reported. One of the studies revealed that a significant percentage (69%) of dogs demonstrated isolated supraventricular premature complexes; however, the Holter monitoring did not indicate trigeminy (CROSARA et al., 2010; RASMUSSEN et al., 2012; OLIVEIRA et al., 2014). Some studies reported the occurrence of trigeminy; however, it was of ventricular origin (CROSARA et al., 2010). In veterinary medicine, there is one report of supraventricular trigeminy in a foal (RISBERG et al., 2005).

Detecting and treating cardiac arrhythmias is an important therapeutic goal in cardiology. Digoxin is an inotropic positive and antiarrhythmic agent that acts by inhibiting sarcolemmal Na+/K+-ATPase, resulting in increased intracellular sodium. Additionally, the drug slows conduction through the atrioventricular node. Digoxin is administered to patients with congestive heart failure and supraventricular arrhythmias (ATKINS & HÄGGSTRÖM, 2012). The lack of a 24-hour Holter

Figure 1 - ECG tracing (leads I, II, III, aVR, aVL e aVF) of a 15-year-old male mongrel dog demonstrating a period of supraventricular trigeminy characterized by a condition in which every third beat is a supraventricular premature beat (arrows).

ECG and a second electrocardiogram to evaluate the effectiveness of digoxin antiarrhythmic therapy for supraventricular trigeminy are limitations of the present report.

The present report indicated that supraventricular trigeminy may occur in dogs with MMVD with severe hemodynamic compromise, and is probably related to atrial enlargement. Also, this case reinforces the importance of performing ECG in dogs with MMVD, since it complements the echocardiogram and enables a better therapeutic approach.

BIOETHICS AND BIOSSECURITY COMMITTEE APPROVAL

The authors of the article titled "Supraventricular trigeminy in a dog with myxomatous mitral valve disease" declare that for all due purposes, the project that gave rise to the present data has not been submitted to the Ethics Committee of the University / Research Institute "Centro Universitário Ritter dos Reis" for evaluation, but they are aware of the content of the Brazilian resolutions of the Conselho Nacional de Controle de Experimentação Animal (CONCEA) <http://www.mct.gov.br/index.php/content/view/310553.html> if it involves animals.

Thus, the authors assume full responsibility for the presented data and are available for possible questions should they be required by competent authorities.

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