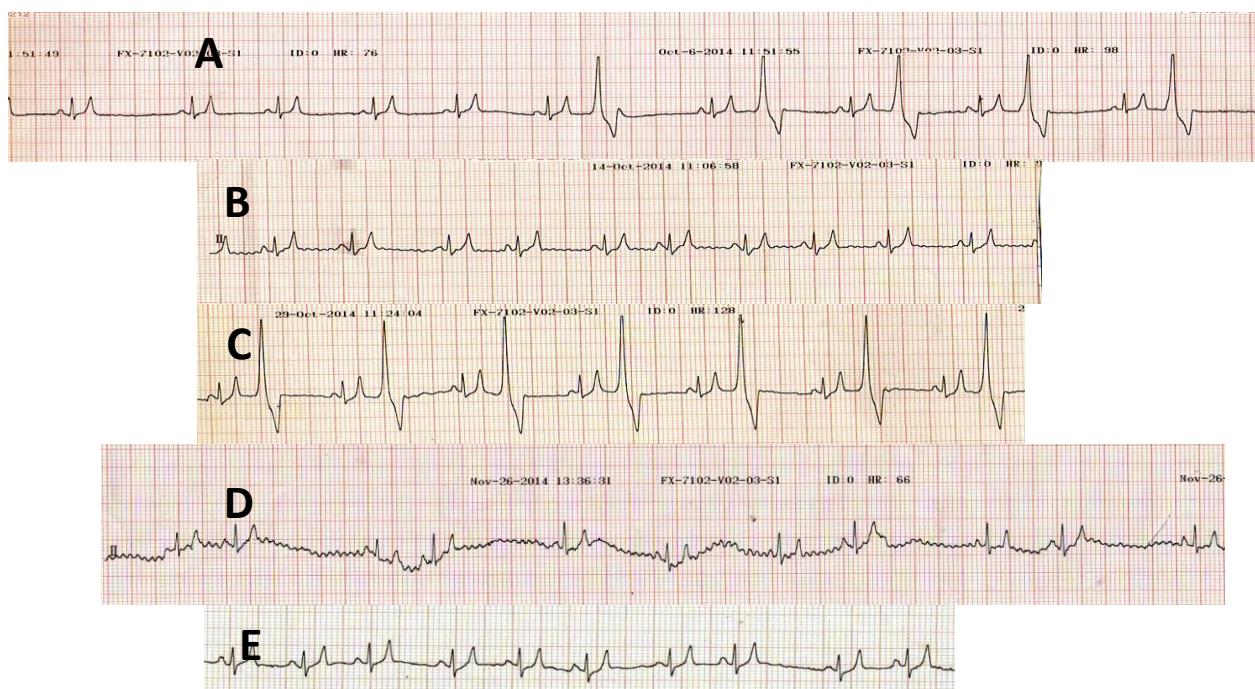


ECG Quiz

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The ECG waveforms before (A) and after (B, C, D, E) amiodarone treatment

These ECG strips belong to a 14-year-old female Labrador weighting 22.5 kilograms that was presented at the Small Animal Teaching Hospital, Chulalongkorn University. One year ago, the dog had two wide surgical mass removal in which the biopsy results revealed low grade mast cell tumor and cavernous hemangioma at the left lateral and the back areas, respectively. The dog also received chemotherapies and other supportive medications. The radiographic findings at that time indicated normal intrathoracic organ appearance with neither evidences of lung and abdominal metastasis nor lymph node enlargement.

The dog presented again 4 months ago with a new small mass at the right axilla area that was diagnosed from cytology of spindle cell tumor. The dog was assessed for anesthesia risk by ECG which was presented in the ECG strip A. The heart and lung sounds were normal. The complete blood count and renal function were within normal limits while liver

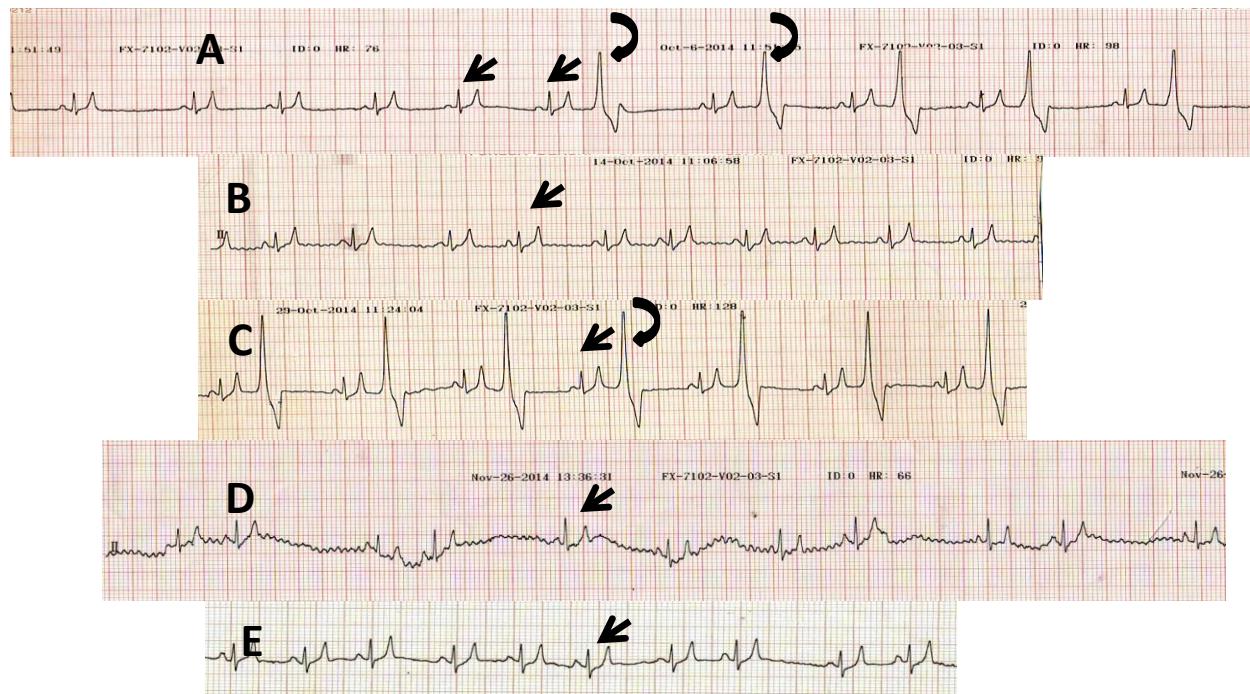
enzymes were slightly elevated. The echocardiography was performed and the results showed systolic dysfunction with fractional shortening 28.78%. The LA/Ao was 1.46 while the left ventricle was also dilated suggesting the dog had dilated cardiomyopathy. Furthermore, the mild to moderate mitral regurgitation was also presented. The dog was prescribed with angiotensin converting enzyme inhibitor, diuretic and positive inotrope. The amiodarone was also prescribed at the loading dose of 9 mg/kg twice a day for 7 days and the ECG was re-recorded in tracing B. The maintenance dose of amiodarone was prescribed at 6.5 mg/kg/day while ECG was performed 15 day later which was shown in tracing C. However, amiodarone was continued and the ECG was re-performed after approximately 1.5 and 4.5 months of drug treatment, respectively, which were shown in tracing D and E. The dog showed signs of more energetic with higher activity after medication but the hindlimb weakness was persisted thereafter.

Please answer before turning to the next page.

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Interpretation

Tracing A	Sinus arrhythmia with periodic ventricular bigeminy
Tracing B	Sinus arrhythmia
Tracing C	Ventricular bigeminy
Tracing D and E	Sinus arrhythmia



Tracing A showed that the dog had sinus arrhythmia with a rate of 75 beats/minute. However, at the end of tracing, the sinus complexes (straight arrows) were followed immediately with the complexes with bizarre shape which ectopic foci were originated from ventricle (curved arrows). The duration between the ventricular ectopic beats and the preceding sinus complexes were constant indicating a possible cause of re-entry. The close couple complex with different in origin was called "bigeminy". It was noticed that the re-entry loop could be emerged for an instantaneous time without organic disease of the heart. The reentry is existed when the pathway of cardiac impulse was blocked in one direction which is known as unidirectional block. Moreover, the conduction pathway where the impulse reaches the block may be long or the refractory period of the site of re-entry may be shortened. The dog may show sign of discomfort if bigeminy is presented for a long period of time. Blood pressure should be evaluated along with the clinical signs. The cause of bigeminy was unknown by may be related to myocardial anoxia. Oxygen supplementation may be required in severe case. Calcium channel blocker is one of the drug of choice for treatment. Although the dilated cardiomyopathy was diagnosed in this dog, the arrhythmia may not be related to this underlying problem. The amiodarone, a class III antiarrhythmic agent that has mixed effects of class I, II, III, and IV antiarrhythmic agent was

prescribed. Although, calcium channel blocker and beta adrenergic blocker are commonly used for bigeminy treatment, they can suppress systolic function more than amiodarone. Moreover, amiodarone can control several reentry situations such as atrioventricular reentry tachycardia, ventricular tachyarrhythmia, and atrial fibrillation. It acts specifically by blocking the I_{Kr} and I_{Ks} channels which were responsible for repolarization. The action potential duration may be prolonged suggesting the long refractory period. Amiodarone, although is safe for controlling the ventricular arrhythmia, the drug was excreted by the liver and the toxic effects may be overwhelm in animals with liver dysfunction. Moreover, since the molecular structure is resemble the thyroid hormone, the thyroid profiles both thyroxine and thyroid stimulating hormone should be monitored after using the drug every 6 months. After continued amiodarone by using the maintenance dose for 15 days, the bigeminy was still persisted (tracing C). Evaluating ECG several months later after amiodarone administration revealed the pattern of sinus arrhythmia without bigeminy (tracing D and E). The overall clinical signs of heart failure were improved with combination of heart medications. However, the existing heart problem of DCM may diminish heart function making the persisting exercise intolerance and weakness at the end of the disease process.