

ECG Quiz

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History

A 14-year-old neutered female mixed breed dog weighing 12 kg was admitted at the in-patient unit of The Small Animal Teaching Hospital, Chulalongkorn University in October 2017 with clinical signs of depressed, anorexia, weakness and continuous vomiting. However, no sign of abdominal pain was found.

History taking showed that the dog had gait disorientation due to central nervous system disorder. The dog also had murmur heart sound graded IV/VI without sign of cardiac disease since June 2017. The echocardiogram was performed which the results showed that the dog had moderate degenerative mitral valve disease (DMVD) with mild tricuspid regurgitation. The fractional shortening was 43% while the ratio of the diameter of left atrium and aorta (LA/Ao) was 1.24. The angiotensin converting

enzyme inhibitor and furosemide were prescribed since then.

Blood profiles indicated metabolic alkalosis (pH 7.488) with HCO_3^- of 29 mmol/L. All electrolytes were in normal range. Ultrasonography showed unremarkable findings except hyperechoic hepatopathy with cysts and nodules.

Physical examination revealed the dog had 5% dehydration. The tachycardia and systolic murmur heart sound graded IV/VI were also detected with normal lung sound. Cardiac auscultation revealed animal usually had tachycardia during vomiting episode. The electrocardiogram (ECG) was performed periodically. The dog received supportive therapy with antibiotic while continuing ECG was monitored. The example of ECG was shown in tracing 1A 4 days after treatment.

The dog was recovered five days after treatment. The ECG was re-recorded approximately 12 days after recovery (tracing 1B).

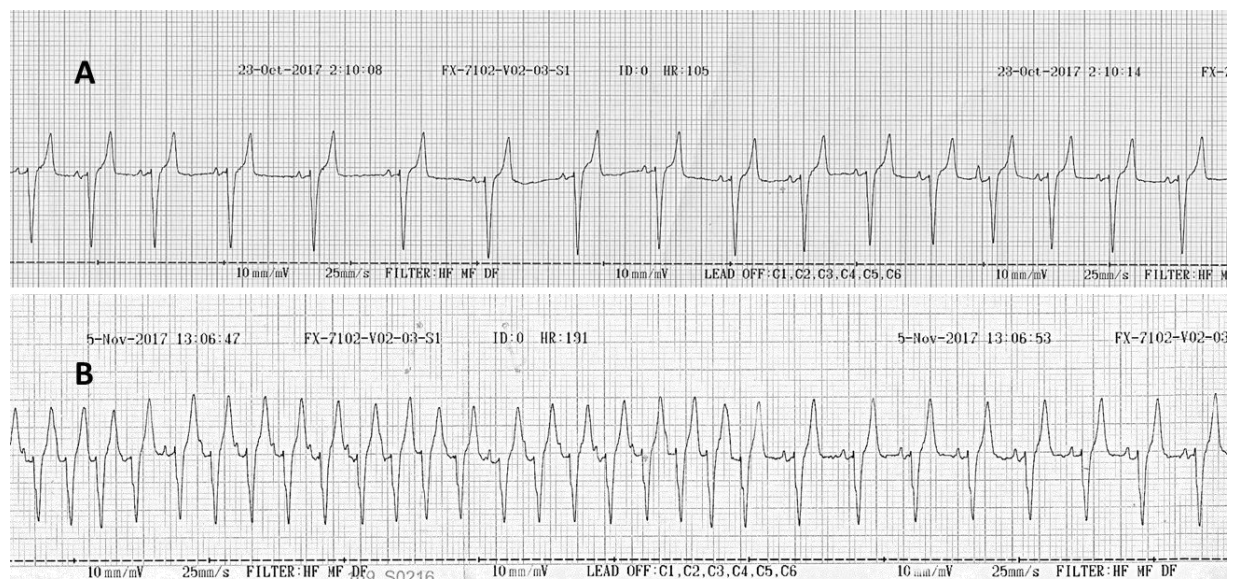


Figure 1 ECG recorded in a senile dog with moderate degenerative mitral valve disease that had severe vomiting and was admitted in the animal hospital. The ECG was recorded after receiving supportive treatment for 4 days (A) and 17 days (B)

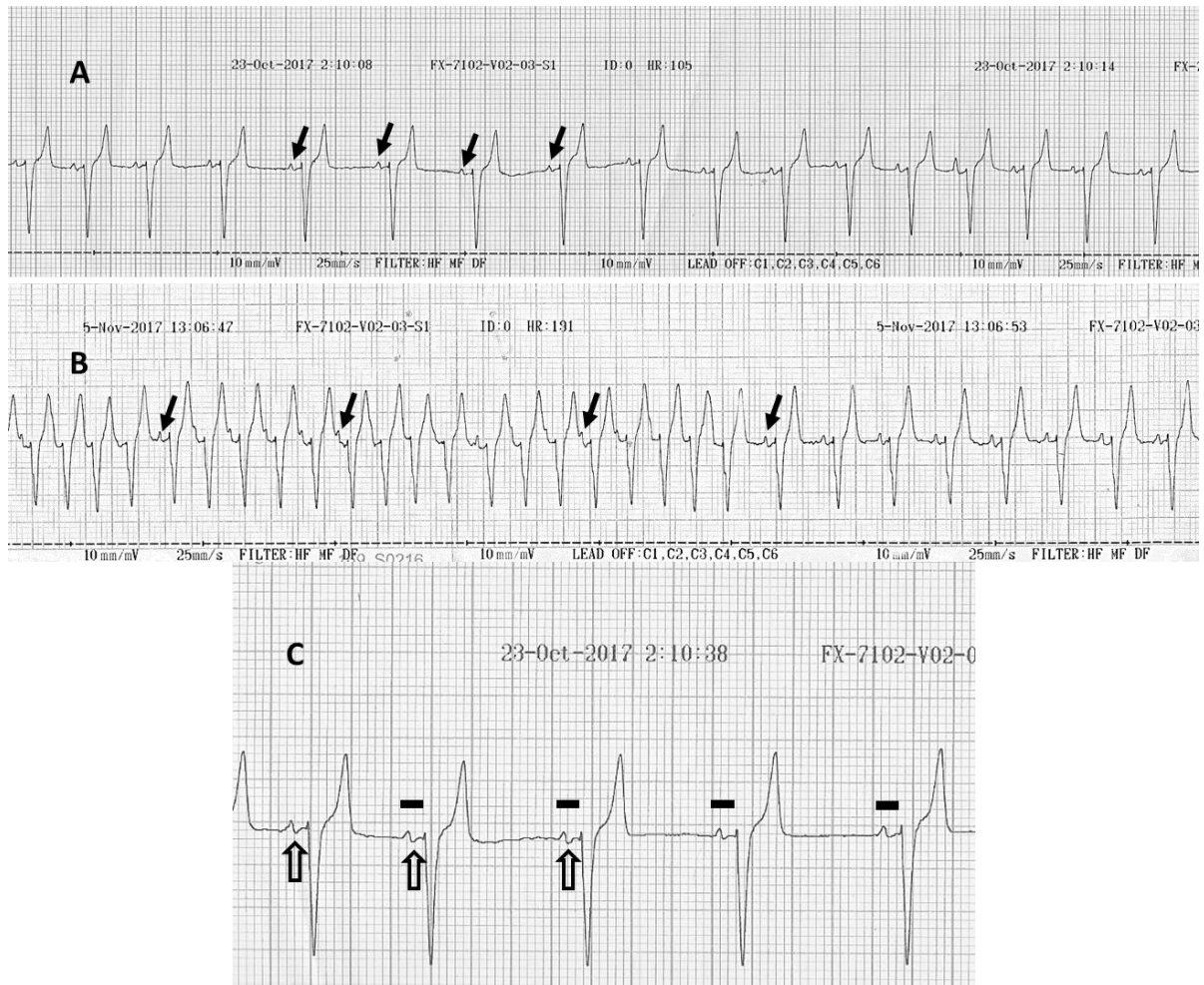
Please answer before turning to the next page.

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Interpretation

Figure 1A - Sinus arrhythmia with right bundle branch block (RBBB)

Figure 1 B - Sinus tachycardia alternating with slow heart rate



The tracings in figure 1A and 1B had paper speed of 25 mm/second. In tracing 1A, the ECG was recorded around 4 days after supportive treatment for severe vomiting. The heart rate is approximately 100 beats per minute (bpm). Although the dog had metabolic alkalosis, the electrolytes (Na and K) were in normal range which should not have any influence on heart electrical activity. Please notice that the QRS waveforms had a bizarre shape. The shape may look similar to the complexes originating from ventricular tissues called as "ventricular complexes". However, the preceding P-waves were found in all beats on both tracing 1A and 1B (solid arrows) with the constant PR interval as seen in tracing C with magnification (solid rectangular). The P-waves were also seen when the dog had a high heart rate as seen in Fig 1B. Some P-waves were concealed since they were superimposed on T-waves of preceding beats. Thus, all ventricular depolarized impulses were originated from sinoatrial node and travelling normally through the atrioventricular node and hence through the bundle branch. The QRS complexes with an abnormal shape with negative deflection suggesting the right axis deviation. This abnormal vector resembles the depolarization wave front was travelling away from the positive

electrode of lead II which is characteristic of blocking the impulse travelling through the right side of His bundle (right bundle branch block; RBBB). This shape of complexes may make confusion between RBBB and ventricular tachycardia. The important clue is the presence of preceding P-wave with constant PR interval in every complex.

In tracing B, the heart rate was accelerated to approximately 200 bpm and switched back to a lower rate (150 bpm). Since the animal had a chronic neurological problem and hyper-excitability, the autonomic imbalance of sympathetic and parasympathetic nervous system activity was suspected. However, no ectopic beats were found even in high heart rate during recording.

Tracing C is the magnification of tracing recorded the same day as Figure 1A. Please notice the repolarization of atrial tissue (Ta-wave) occurred at the end of P-wave (Hollow arrows). These Ta-waves were usually unseen which may be due to the cancellation of vector between repolarization and some part of ventricular depolarization after passing atrioventricular node. This small Ta-wave could be seen if ventricular depolarization impulses were blocked such as in the case of atrioventricular (AV)

block. In the present case, the Ta-waves were seen after blocking of the right branch of His Bundle. Thus, depolarization at the right side may responsible for the cancellation of vector or may delay depolarization impulse of the ventricle tissue.

The degenerative mitral valve disease and mild tricuspid regurgitation in this case may cause the low cardiac output without changing the pacemaker origin. Whether the disease involved the electrical disturbance such as RBBB needs further investigation.