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ECG Quiz

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History

A 10-year-old female Pomeranian dog was presented to the Small Animal Teaching Hospital, Chulalongkorn University, on December, 2018, with a history of anorexia, frequent vomiting, depress and oliguria. Physical examination revealed that the dog was depressed but responsive to the stimuli. The dog was dehydrated (7%) with pale-pink mucous membrane. The capillary refilling time of 1.5 seconds with strong femoral pulse were detected. The respiratory rate was 65 breath per minute with normal sound while heart rate was approximately 60 beats per minute without cardiac murmur from auscultation using stethoscope. The systolic blood pressure was 120 mmHg. The blood collection was performed and the results indicated the dog had anemia (PCV = 17%), thrombocytopenia (42,000 per μL) and mild elevation of ALT (348 Unit/L). The azotemia was found with BUN and creatinine of 127 mg/dL and 5.5 mg/dL, respectively. The concentrations of sodium (Na^+) and potassium (K^+) were 134 and 7.75 mM, respectively. Antibody test kit was positive for *Ehrlichia canis*. Electrocardiogram (ECG) was recorded as shown in Figure 1.

Figure 1 The ECG with a paper speed of 25 mm per second (A) and 50 mm per second (B) was recorded in a Pomeranian suffering from acute kidney injury.

Please answer before turning to the next page.

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Interpretation

Bradyarrhythmia without p-wave

These ECG tracings were recorded with a paper speed of 25 mm/second (A) and 50 mm/second (B) from a dog that was azotemia. The tentative diagnosis was acute kidney injury. The heart rate of this dog was approximately 55-60 beats per minute. Since heart rate is lower than 60 beats per minute with inconsistent rhythm, therefore, the bradyarrhythmia was called. The normal QRS complexes were followed by the T-wave (arrows). It was noticed that there was no p-wave in front of QRS complexes. The term atrial standstill is applied when p-wave was not seen. Factors that may be responsible for disappearance of p-wave can be the fibrosis of atrial tissue that can cause blockage, slow conduction and escape beats. However, one common cause is hyperkalemia. In this case, the dog had azotemia and acute kidney injury with oliguria was proposed. The limited urinary excretion of K^+ caused elevated serum concentration of K^+. Hyperkalemia can alter transmembrane resting potential and suppress excitability of myocardial tissue. Suppression of p-wave amplitude or loss of p-wave, widened QRS complexes and symmetric T-waves (narrow T-wave with tenting characteristic) have been reported. If hyperkalemia was very severe (i.e., more than 10.0 mM), nodal or ventricular arrhythmia may be developed and the final sine wave pattern with fibrillation and asystole can be encountered.

Although arrhythmia is found to be associated with hyperkalemia in dogs, the typical ECG pattern in hyperkalemia cannot be established. The arrhythmia may be exacerbated by other factors such as the presence of hyponatremia, acidemia and hypocalcemia. The Na^+: K^+ ratio in this case was 17.3 which was less than 25 that was reported to be associated with cardiac arrhythmias and ECG abnormalities. Thus, the interaction among many factors can modify type and pattern of arrhythmia.