The Thai Journal of Veterinary Medicine

Volume 45
Issue 2 *June, 2015*

Article 19

6-1-2015

ECG Quiz

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The ECG waveforms on day 1 (A) and day 3 (B,) and day 5 (C, D, E) after correction of gastric dilation volvulus

An eleven year old intact male Labrador retriever dog weighing 42 kg was present to the Small Animal Teaching Hospital, Chulalongkorn University, with the signs of depression and abdominal distension with severe pain. The symptoms were started right after the dog was running and playing after meal. The gastric dilatation volvulus (GDV) was diagnosed while abdominocentesis to relief gas was performed by a private veterinarian before he was sent to the hospital. The CBC was within normal limits except the elevated ALT (1,034 unit/L). From echocardiogram, the dog had early stage of dilated cardiomyopathy.

The surgical correction of GDV was performed which showed a 180˚ clockwise volvulus of stomach and spleen with mild congestion. Few ventricular premature beats were found during surgical procedure. Antibiotics and analgesic drugs were used during post-operative care. Continuous ECG monitoring was recorded for the entire days. The ECG on day 1 after surgery was shown in tracing A. Carvedilol was then started at the dose of 0.15 mg/kg twice a day to control arrhythmia. However, the ECG still showed abnormal arrhythmia on two day after while the animal was on antiarrhythmic drug (tracing B) On day 5 , the ECG recordings showed variable waveforms (tracing C, D, and E) with serious tachycardia (tracing D and E). Therefore, lidocaine was given once to the dog intravenously to control arrhythmia while the dose of carvedilol was increased for another 50%.

On day 8 after surgery, the ECG was almost normal which electrical impulses were originated from the sinus. The carvedilol's dose was tapered down to the initial dose and continued for another 10 days while the animal was discharged from the hospital.

Please answer before turning to the next page.

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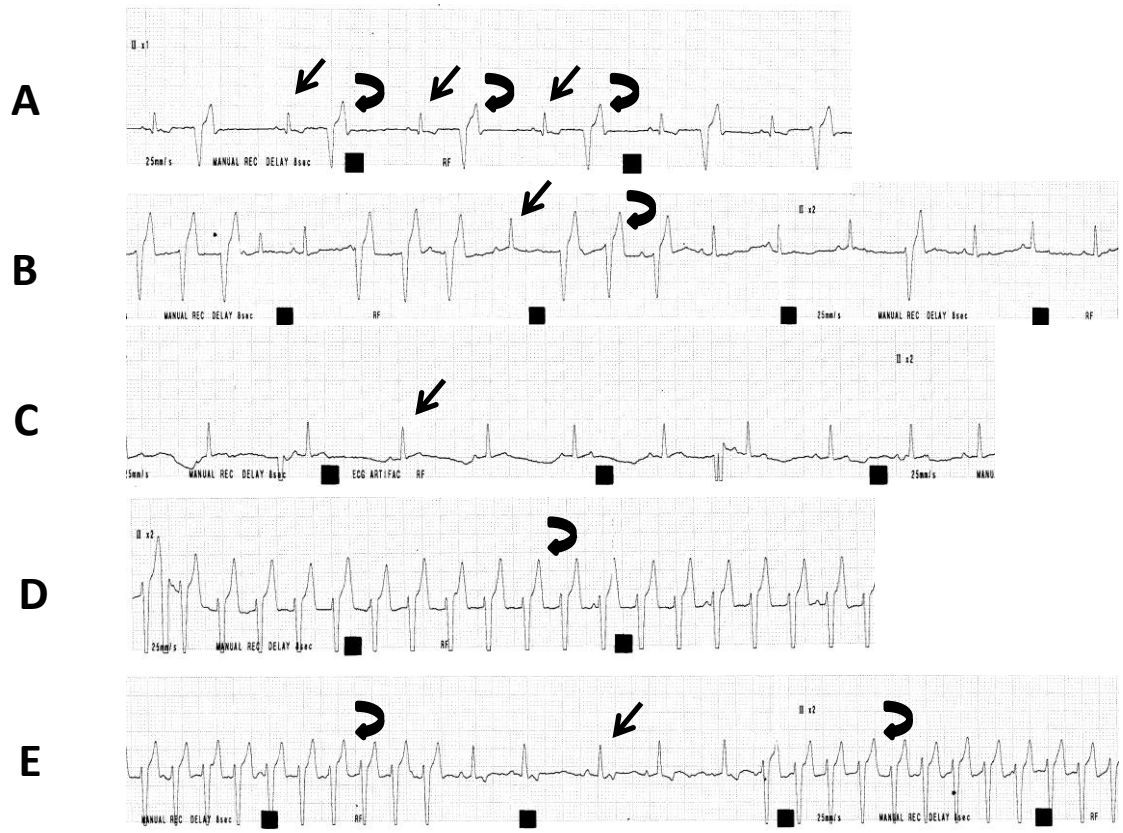
Interpretation

Tracing A	**Sinus arrhythmia with ventricular bigeminy**
Tracing B	**Sinus arrhythmia with ventricular ectopic foci**
Tracing C	**Normal sinus rhythm**
Tracing D	**Ventricular ectopic rhythm**
Tracing E	**Accelerated idioventricular rhythm**



One of the problem in the large breed dog was the disease called "gastric dilatation volvulus; GDV" in which the stomach is malpositioned and rotated which may be from mild to severe depending upon the degree of rotation. The disease was involved the dogs that usually have overactivity such as running or flipping their bodies after eating the large amount of food. During the volvulus, the animal will be in severe pain and continue to vomit due to the accumulation of gas in the stomach. The food including the gastric tube could not be able to pass through the gastrointestinal tract in severe displacement. Thus, the emergency procedure to relief gas inside the stomach is to perform abdominocentesis. The operation to correct the stomach malpositioning and the fixing of stomach in place known as gastroplexy is required. The rotation of abdominal organ is involved the occlusion of vena cava, therefore, the cardiac output was reduced dramatically. The operation may be simple or complicated base on the severity of stomach rotation and other complications including the vessel perforation or whether the internal organ such as spleen being necrosis. Although the operation is usually performed as soon as possible, the correction does not return cardiac output to the original value. Some dogs may suffer from the ischemic process of the internal organ and even low perfusion of the vital organs including the heart itself. One of the most common complications after surgical correction of GDV is animal usually encounters the arrhythmia. Most of the ectopic beats were ventricular in origin. Although this dog had mild dilated cardiomyopathy, the ECG waveform showed a couple of premature ventricular complexes (VPCs) during the entire surgery. The continuous ECG monitoring was attached and recorded throughout the recovery period. One day after surgery (tracing A), the bizarre ECG waveforms (curve arrows) were present in alternating to the normal sinus complexes (straight arrows). The impulses were originated somewhere inside the ventricle and the impulses were propagated via myocardial tissue rather than passing along the normal conducting tissue. Since the duration between the normal sinus and the ventricular ectopic beats was constant, the ectopic beats occur as a result of reentry circuit. The reentry at the level of Purkinje tissue may be due to the myocardial anoxia during GDV. The class III antiarrhythmic drug, carvedilol was prescribed with a low dose to control arrhythmia. This drug is a beta-adrenergic blocking agent that possesses the action for antioxidant activity. It will be a drug of choice for the disease related to ischemic-reperfusion process. It also reduces heart rate with a minor action on cardiac contractility.

Although the antiarrhythmic agent was prescribed, the ectopic beats were still persisted. After

3 days of operation, the multiple consecutive ventricular ectopic beats appeared along with the normal sinus complexes (tracing B). Some p-waves could not conduct through AV conducting pathway and reached the ventricle. The heart rate was approximately 110 beats per minute and the animal could remain calm without symptoms. On day 5 after surgery, the ECG waveforms showed varying pattern throughout the day (tracing C, D and E). At 13:12, the ECG showed normal sinus rhythm (tracing C). However, on 13:42, the train of ventricular ectopic rhythm was seen with the heart rate of 150 beats per minute (tracing D). The higher heart rate with ectopic ventricular pacemaker made the clinician aware for the possible development of ventricular tachycardia. The lidocaine (antiarrhythmic agent class Ib) was infused intravenuously and the trains of ventricular ectopic beats were less frequent with shorter duration. Tracing E showed the train of ventricular ectopic rhythm occurred in alternating with the normal sinus rate. Please notice that the normal sinus rate was slower than the ventricular ectopic beats (90 vs 200 beats per minute). The acceleration of ventricular ectopic rate overcomes the rate of the sinus resulting in emerging ventricular rhythm call "accelerated idioventricular arrhythmia". If arrhythmia is not self-limiting or the medication is ineffective, the ventricular tachycardia or R on T phenomenon may develop. In this case, the occurrence of ventricular arrhythmia was reduced and terminated on day 8 after correction of GDV. The carvedilol was continued at home for another 10 days to maintain normal sinus rhythm.