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**Scientific Report**

# Concurrent atrioventricular block, sinus arrest and pneumothorax in a dog secondary to vehicle accident

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## Summary

In human several kinds of electrocardiographic findings have been reported in association with pneumothorax such as decreased and/or alternating QRS amplitude (electrical alternans). However, electrocardiographic changes concurrent with pneumothorax have rarely been discussed in veterinary literature. A 3-year-old male crossbreed dog was presented with a history of car accident. Thoracic auscultation revealed decreased lung sounds. Heart sounds were also markedly muffled bilaterally. An electrocardiogram revealed sinus arrest in association with first degree atrioventricular block. Pneumothorax was the main finding in thoracic radiographs. Seven days after initial admission, thoracic radiographs revealed that pnuemothorax was resolved and all electrocardiographic abnormalities returned to normal limits.

**Key words:** Atrioventricular block, Sinus arrest, Pneumothorax, Dog

## Introduction

Traumatic pneumothorax is the most frequent type of pneumothorax in dogs. It has been estimated that 10% of trauma admissions to urban veterinary emergency practice had thoracic injuries. Traumatic pneumothorax is usually closed (there is no free communication between the pleural space and external environment) and most often occurs as a result of blunt trauma (Fossum, 2000; Brockman and Puerto, 2004). In human patients, several kinds of electrocardiographic findings have been reported in association with pneumothorax (Feldman and January, 1984; Paige and Spalding, 1996). However, electrocardiographic changes concurrent with pneumothorax have not been discussed in veterinary literature. This report describes concurrent atrioventricular block and sinus arrest secondary to pneumothorax in a crossbreed dog.

## Case history

A 3-year-old male crossbreed dog was presented with a history of car accident. On physical examination, the dog was mildly dyspnoeic with respiratory rate of 42 breaths/min. Rectal temperature and hydration situation were normal. Thoracic auscultation revealed decreased lung sounds. Heart sounds were markedly muffled bilaterally but no heart murmur was detected. The mucous membranes were pink with a capillary refill time of <2 sec. Thoracic radiographs showed bilateral pneumothorax (Fig. 1). The initial ECG tracing revealed an irregular sinus rhythm with mean heart rate of 60 beats/min. Evaluation of tracing indicated that the P-R intervals were longer than normal in some P-QRS-T complexes (first degree atrioventricular block). Furthermore, intermittent pauses were observed between P-QRS-T complexes. These pauses were

greater than twice the normal R-R intervals which indicating sinus arrest. Other electrocardiographic criteria were within normal limits. Electrocardiographic findings were first degree heart block concurrent with sinus arrest (Fig. 2). Laboratory evaluations, including complete blood count, serum biochemistry and electrolytes were all within normal limits. Initial treatments included supplementation of oxygen via a mask (approximately 60% oxygen content) for two h, and intravenous hydrocortisone (2 mg/kg).

Due to mild nature of clinical signs and the absence of life-threatening cardiorespiratory signs such as cyanosis and syncope, the dog was discharged from clinic, but his monitoring was continued by telephone follow up. In the second and third day following the initial examination, the dog was re-examined again. Pneumothorax was present in thoracic radiographs and the same ECG findings were noted on the electrocardiograms. Thoracic radiography still showed pneumothorax in the fourth day. Electrocardiographic examination indicated that the sinus arrest was disappeared but first degree heart block was still present in ECG tracing (Fig. 3). Seven days after initial admission, the dog re-evaluated again. Heart and respiratory sounds were normal on thoracic auscultation. Thoracic radiographs revealed that the pneumothorax was resolved and all electrocardiographic criteria returned to normal limits.

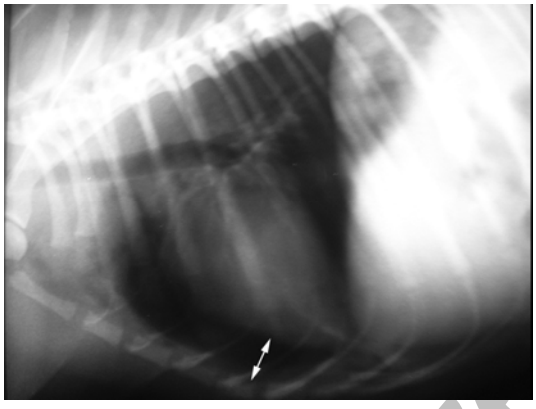

**Fig. 1: Lateral radiograph of the thorax region of the dog showed distinct increased distance between cardiac silhouette and sternum (arrow), typically indicative of pneumothorax**

## Discussion

In the presented case, initial ECGs in the first, second and third day of admission revealed that first degree atrioventricular block and sinus arrest were the most important electrocardiographic findings during the presence of pneumothorax. The recorded electrocardiogram in the seventh day following admission showed that these conduction disturbances were disappeared

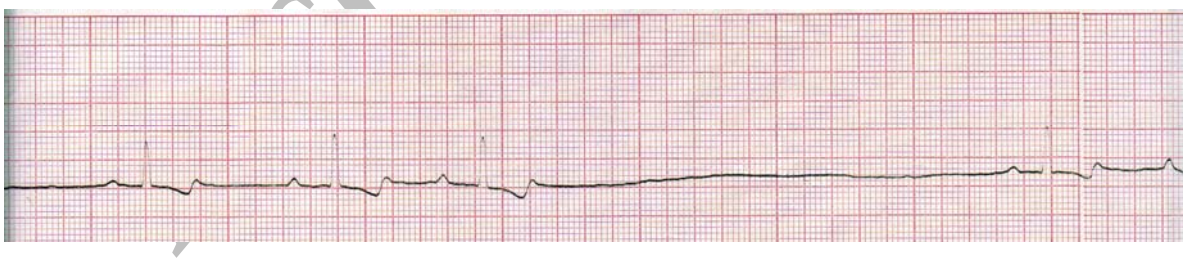

**Fig. 2: Electrocardiogram on the first day of admission shows PR interval prolongation in second (0.16 sec) and third (0.16 sec) complexes. A long pause between third and fourth complexes represents sinus arrest. (Lead II, calibration was 1 cm = 1 mV with paper speed of 50 mm/sec)**

**Fig. 3: This recording which was taken on the fourth day after initial admission shows normal sinus rhythm with increase PR intervals (0.14 sec) (Lead II, paper speed 50 mm/sec, 1 cm = 1 mV)**

and all eletrocardiographic parameters returned to normal limits. It seemed that concurrent first degree atrioventricular block and sinus arrest were secondary to pneumothorax. Sinus arrest is recognized when the sinus node fails to discharge as expected, a pause in the rhythm will occur. The duration of the pause is at least twice the preceding R-R interval. In severe form, the duration of pause may be 5 to 12 sec (Tilley and Goodwin, 2001). In our case, based on recorded ECGs the duration of pauses were generally less than 5 sec. Our findings in regard to prolongation of P-R interval in some P-QRS-T complexes indicate the presence of first degree atrioventricular block. This type of atrioventricular block is defined in ECG when the duration of P-R interval increased longer than 0.13 sec. Increased vagal tone and carotid sinus pressure are important causes of atrioventricular block and sinus arrest in dogs (Tilley, 1992; Kittleson and Kienle, 1998).

In this case, it seemed that intermittent failure in sinus node's rate of discharge and alterations in A-V conduction patterns were induced by stimulation of thoracic vagal nerve.

Wei and Shen (1985) described that the collapse of the lungs caused by artificial pneumothorax produced continuous discharges in vagal fibres and inflation of collapsed lungs by an artificial respiration pump stopped the sustained discharges immediately. Our finding in regard to the resolution of ECG abnormalities following remission of pneumothorax is consistent with their results.

The dog of the present report, showed mild respiratory signs (42 breaths per min), so we did not perform thoracentesis for treatment of respiratory abnormalities. Pneumothorax is potentially life-threatening condition and affected patients are advised to stabilize immediately by thoracentesis. However, thoracetensis is generally indicated if the respiration rate of 45 to 60 breaths per min or more is observed in clinical examinations (Murtaugh and Kaplan, 1992). In conclusion, this report highlights the importance of electrocardiographic studies in dogs with pneumothorax to detect the presence of arrhythmias or conduction disturbances.

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