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Serum biochemical changes in arrhythmia in dogs

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Abstract

A study on the biochemical profile of dogs viz. calcium, sodium, potassium, chloride, aspartate transaminase, alanine transaminase and lactate dehydrogenase were measured using commercially available kits, from both apparently healthy dogs and dogs suffering from arrhythmia due to non cardiac causes. The tachyarrhythmic dogs were further evaluated for elevation of cardiac troponin using commercially available kits. There was no significant difference in biochemical parameters of arrhythmic and non-arrhythmic dogs. Among the tachyarrhythmic dogs, two dogs were found to be positive for cardiac troponin I and one dog showed positive for cardiac troponin T.

Keywords: Arrhythmia, biochemical profile, cardiac troponin I, cardiac troponin T

Introduction

Electrocardiography (ECG) is a non-invasive and relatively inexpensive technique which not only records the disturbance in electrical potential i.e. arrhythmia, but also serves as an indicator of electrolyte imbalance, drug toxicity and less precisely myocardial and pericardial affections of heart (Mattera *et al.*, 2012) [1]. Though, quite a few advances have been made in the field of cardiac study in dogs, yet in India, it is still in infant stage (Gupta *et al.*, 2007) [2]. This study evaluates some of the possible serum biochemical changes that may occur during arrhythmia in dogs.

Materials and Methods

A total of 695 dogs brought to the Teaching Veterinary Clinical complex of College of Veterinary science were screened randomly for the presence of arrhythmia, irrespective of breed, age and sex during the period from May, 2013 to April, 2015. A total of 27.05 per cent dogs showed arrhythmia.

a) Biochemical Profile: To estimate the serum biochemical profile approximately 5 ml of whole blood was collected randomly in a clot activator vial from 10 apparently healthy dogs and 40 dogs with various arrhythmias without concurrent heart disease. The vial was then allowed to stand for half an hour and serum was separated in an eppendorf tube. It was stored at -20°C till further analysis. The serum sodium, potassium, chloride, aspartate transaminase, alanine transaminase, calcium and lactate dehydrogenase values were estimated spectrophotometrically using commercially available kit from Coral and Seimens.

b) Cardiac Troponin: Based on ECG, a total of 25 dogs (both tachyarrhythmic and non-arrhythmic) were evaluated for the presence of myocardial damage using Cardiac troponin kit. Troponin I was estimated by Rapid cTnI detection test using EzDx Troponin I kit manufactured by Advy Chemical Private Limited, Mumbai and Troponin T was estimated by Cardiac Troponin T Quantitative reader (Roche Diagnostics, Switzerland).

Technique: Whole blood was collected in EDTA vial. The kit was first brought to room temperature and using a micropipette, 4 drops of whole blood was then transferred into the specimen wells. The results were read at the end of 15 minutes as presence of one control band (negative) or one control band and one test band (positive).

Statistical Analysis

All the statistical analysis were carried out by using Split jmp 10.0 of SAS 9.3 software available at Biostatistics Unit, C.V.Sc., Khanapara under NAIP (Comp-1), ICAR, Govt. of India.

Results and Discussion

While evaluating the serum biochemical changes in arrhythmic and non-arrhythmic dogs, it was observed that the arrhythmic dogs showed a non-significant decrease in the mean of sodium (133.75 ± 1.90 mEq/L), calcium (8.53 ± 0.22 mg/dL) and chloride (88.26 ± 1.12 mEq/L), along with a non-significant increase in the mean of potassium (3.81 ± 0.16 mEq/L). The mean of chloride in arrhythmic and non-arrhythmic dogs were 90.08 ± 1.73 mEq/L and 88.26 ± 1.12 mEq/L respectively (Table 1).

Table 1: Serum biochemical changes in arrhythmic and non arrhythmic dogs.

Parameters	Arrhythmic (n=40)	Non- Arrhythmic (n=10)
	Mean±S.E	Mean±S.E
Na (mEq/L)	133.75±1.90	136.00±2.10
Ca (mg/dl)	8.53±0.22	8.71±0.20
K(mEq/L)	3.81±0.16	3.47±0.23
Cl (mEq/L)	88.26±1.12	90.08±1.73
AST (U/L)	15.00±1.27	14.75±1.16
ALT (U/L)	45.38±1.63	33.33±5.79
LDH (U/L)	118.65±13.43	124.69±12.18

(n = total number of dogs in the group)

The mean value of AST in arrhythmic and non-arrhythmic dogs were 14.75 ± 1.16 U/L and 15.00 ± 1.27 U/L respectively. The mean value of ALT in arrhythmic and non-arrhythmic dogs were 33.33 ± 5.7 U/L and 45.38 ± 1.63 U/L respectively. The present finding was in corroboration with Changkija (2007) [3] and Kumar *et al.* (2014) [4], who observed no significant changes in the serum biochemical parameters of both the groups. The Previous studies on clinico-pathological changes in tachyarrhythmias showed increase in serum concentration of Na^+ , Ca^{++} and decrease in K^+ and Mg^{++} while dogs with bradyarrhythmias showed increased serum concentration of Na^+ , K^+ and Mg^{++} (Gupta *et al.*, 2007) [2]. In another study, a non-significant decrease in serum K^+ and Mg^{++} was found in dogs with ventricular fibrillation than the healthy control whereas the serum Ca^{++} was found significantly decreased than the healthy dogs (Salerno *et al.*, 1987) [5]. In dogs, a mild increase in plasma K^+ may lead to a variety of atrio-ventricular conduction abnormalities and changes in QRS which may simulate right bundle branch block or left bundle branch block in ECG recording if K^+ is in range of 8.4mEq/L (Fisch *et al.*, 1963) [6]. Only extreme increase in Ca^{++} concentration produces arrhythmia under natural conditions, however mild increase plays minor role in production of arrhythmia (Surawicz and Gettes, 1971) [7]. Similarly the arrhythmias due to hypo or hypernatremia are rare in clinical conditions (Garcia-Palmieri, 1962) [8]. The mean value of LDH in the arrhythmic dogs (118.65 ± 13.43 U/L) also remained at the normal level as compared to non arrhythmic dogs (124.69 ± 12.18 U/L).

Cardiac troponin test

The dogs showing tachyarrhythmia (excluding sinus tachycardia) and 20 non-arrhythmic apparently healthy dogs were also tested for increase in Cardiac troponin I and T using

commercially available kit. Based on ECG, 25 number of dogs (both tachyarrhythmic and non-arrhythmic) were tested for cardiac troponin I and T, out of which 2 dogs (8%) tested positive for Cardiac troponin I and 1 dog (4%) tested positive for cardiac troponin T. This is in corroboration with Kumar *et al.* (2014) [4], who reported 8.1% positive result for cardiac troponin I and 10.81% positive for cardiac troponin T. Wess *et al.*, 2010 [9], also reported an increase in cTnI in Doberman Pinchers suffering from dilated cardiomyopathy. The cardiac troponin I test was 95% sensitive for cardiac troponin levels $>0.6\text{ng/mL}$. Cardiac troponin I (cTnI) and T (cTnT) have a high sequence homology across phyla and are sensitive and specific markers of myocardial damage Burgener *et al.* (2006) [10]. Cardiac troponin (cTn) is a major component of the actin-myosin apparatus. Therefore, the concentrations of cTn proteins I and T in circulation are considered specific indicators of myocardial cell injury (Spratt *et al.*, 2005) [11]. The duration and concentration of cTn in circulation is directly linked to the type and severity of myocyte injury. Circulating levels of both cTn I and T are normally very low or undetectable by current assay methods. Elevated serum concentrations of cTn have been reported for dogs with CHF, hypertrophic cardiomyopathy (HCM), myocardial inflammation, and gastric dilatation/ volvulus. However, a direct correlation between cTn values and myocardial diseases or damage is not clear, because of the lack of a standardized method of analysis for dogs (Hyun and Lavulo, 2011) [12].

Conclusion

The present study deals with the biochemical parameters during arrhythmia and most of the parameters are non-significantly different as significant differences may be associated with concurrent diseases like cardiomyopathy. Yet, cardiac troponin was positive in a few cases. This field needs further study, so that more aspects of cardiac status of dogs, including serum biochemical changes in various heart diseases can be evaluated.

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