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Plasma N-terminal pro-brain natriuretic peptide concentrations before and after pericardiocentesis in dogs with cardiac tamponade secondary to spontaneous pericardial effusion

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Abstract *Objective:* To determine if concentrations of plasma N-terminal pro-brain natriuretic peptide (NT-proBNP) are increased in dogs with cardiac tamponade and if there is a significant increase in plasma NT-proBNP after pericardiocentesis.
Animals: Ten client-owned dogs with spontaneous cardiac tamponade.
Methods: Prospective clinical study. Cardiac tamponade was suspected from physical examination and confirmed with echocardiography. Blood was collected and plasma NT-proBNP concentrations were measured before and 30—60 min following pericardiocentesis and resolution of cardiac tamponade. Within-subject changes in plasma NT-proBNP were compared by the Wilcoxon signed-rank test.
Results: The plasma NT-proBNP concentrations measured within the reference interval in seven of 10 dogs before pericardiocentesis and in six of 10 dogs following pericardiocentesis. Following pericardiocentesis, there was a statistically significant increase in median NT-proBNP concentration (733 pmol/L, range 250—3,297) compared with the values measured before (643 pmol/L, range 250—3,210, $P = 0.004$). The NT-proBNP concentration increased in 90% of the dogs following pericardiocentesis.

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Conclusions: An upper reference limit of 900 pmol/L for plasma NT-proBNP is insensitive for the diagnosis of pericardial effusion and cardiac tamponade in dogs. Plasma NT-proBNP concentration commonly increases following pericardiocentesis, perhaps related to improved ventricular filling and stretch.
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Abbreviations

ANP	atrial natriuretic peptide
BNP	brain natriuretic peptide
NT-proBNP	N-terminal pro-brain natriuretic peptide

Introduction

Brain (B-type) natriuretic peptide (BNP) and atrial (A-type) natriuretic peptide (ANP) are endogenous peptides secreted in response to stretch of the heart [1]. Both ANP concentrations in dogs and BNP concentrations in humans increase after pericardiocentesis of spontaneously occurring pericardial effusions [2–4]. Natriuretic peptides are useful clinically for identifying heart disease and heart failure in dogs [5–11].

Pericardial effusion from multiple etiologies can cause cardiac compression, diastolic dysfunction, and signs of right-sided congestive heart failure. However, this pathophysiology does not necessarily involve stretching of the cardiac chambers. Once cardiac tamponade is resolved by pericardiocentesis, there is a rapid stretch of previously compressed ventricles. This change might be expected to stimulate an increase in plasma NT-proBNP concentrations. This study tested two hypotheses: 1) that in dogs with cardiac tamponade NT-proBNP concentrations are not consistently elevated relative to the test manufacturer's reference range; and 2) that NT-proBNP concentrations increase after pericardiocentesis.

Materials and methods

Animals

Dogs were prospectively recruited from October 2014 through June 2016 from the Veterinary Medical Hospital at Oklahoma State University and the Veterinary Teaching Hospital at Washington State University. Dogs were included in the study only after informed and signed pet-owner consent. Cardiac tamponade was defined as pericardial effusion causing diastolic collapse or inversion of the right atrium for one-third of the cardiac cycle or longer based on echocardiographic assessment [12]. Volume or etiology of the effusion was not considered as inclusion or exclusion criteria. Dogs were excluded if they had previously received diuretic therapy including furosemide, spironolactone, or hydrochlorothiazide. The study was approved by the respective institutional animal care and use committees.

Blood sampling and handling

Whole blood was collected with manual restraint and venipuncture of the lateral saphenous, cephalic, or jugular veins with a 20–22 gauge, 1-inch needle attached to a 6 ml syringe. A total volume of 5 ml of blood was collected from each dog before and between 30 and 60 min after pericardiocentesis. Blood was placed into potassium EDTA tubes and immediately centrifuged at 2,500 rpm for 10 min. Plasma was immediately separated, placed in commercially available tubes without additive, and refrigerated. No proteinase inhibitors were used. Samples were sent overnight on cold packs according to reference laboratory recommendations, which offers the NT-proBNP commercially.[c]

Statistical analysis

Statistical analysis was performed with commercial software.[d] The NT-proBNP concentrations were tested for normality using the Kolmogorov–Smirnov test. The data significantly deviated from the assumption of normality ($P < 0.01$) and summarized data for the time periods are therefore reported as medians (ranges). The within-subjects change in NT-proBNP concentrations before and after pericardiocentesis was compared

[c] IDEXX Laboratories, Inc. One IDEXX Drive, Westbrook, ME, USA 04092.
[d] SAS 9.3, SAS Institute Inc., Cary, NC, USA, 27513.

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