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Short communication

Changes in the SUSPPUP ratio and fractional excretion of strong monovalent electrolytes in hospitalized dogs with canine babesiosis

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Abstract

In this study an increased SUSPPUP ratio and fractional excretion of potassium in dogs infected with *Babesia canis* suggested mineralocorticoid excess in canine babesiosis. A significant increase in strong monovalent electrolyte fractional excretions in azotaemic dogs infected with *B. canis* probably resulted from acute tubular necrosis.

Key words: canine babesiosis, SUSPPUP, fractional excretion, sodium, potassium, azotaemia

Introduction

The SUSPPUP ratio (serum sodium/urinary sodium to (serum potassium)^2/urinary potassium) is a useful tool in the initial diagnosis of mineralocorticoid excess in humans. This parameter increases in overproduction of mineralocorticoids (Willenberg et al. 2009). In canine babesiosis strong monovalent electrolyte (SME) changes were observed. The authors of this study hypothesized that some SME changes in canine babesiosis might result from increased production of aldosterone (Zygner et al. 2012). Therefore, the SUSPPUP ratio may be different in healthy dogs and dogs with babesiosis. Fractional excretion (FE) of sodium (Na^+), potassium (K^+), and chloride (Cl^-) reflects urinary excretion of these ions. FE(Na^+) and FE(Cl^-) are useful in acute tubular necrosis (ATN) diagnosis (Waldrop 2008), which has been observed in canine babesiosis (Máthé et al. 2007). The aim of this work was to evaluate the SUSPPUP ratio and fractional excretion of SMEs in dogs with canine babesiosis.

Materials and Methods

Seventeen samples of serum and urine were collected from dogs admitted to the hospital of the Multiwet Small Animal Health Clinic with babesiosis (Group A). *Babesia canis* infection was initially diagnosed by blood smear examination and confirmed using the PCR method described previously (Zygner et al. 2012). Duration of the disease before admission to the clinic amounted to 1 to 7 days. Twelve clinically healthy dogs were used as the control group (Group B). Urine supernatant was analyzed. Concentrations of Na^+, K^+, and Cl^- in serum and urine samples were determined by chemistry analyser (MEDICA

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Table 1. Significant differences in comparison of SUSPPUP ratio, FE(Na^+), FE(K^+) and FE(Cl^-) in groups A and B, and groups A1 (9 dogs) and A2 (8 dogs).

Parameter	Group	Median	25th% – 75th%	Min., Max.	*U*	*p*
SUSPPUP $(mEq/L)^{-1}$	A	11.21	4.43 – 15.02	0.49, 50.37	48.0	0.017836
	B	3.37	2.91 – 4.135	2.69, 4.42		
FE(Na^+) %	A1	1.35	0.66 – 22.53	0.14, 27.10	12.5	0.026886
	A2	0.19	0.15 – 0.45	0.05, 1.76		
FE(K^+) %	A	36.89	10.20 – 66.13	7.92, 78.18	1.0	0.000009
	B	4.455	3.265 – 5.975	2.00, 8.48		
FE(K^+) %	A1	66.13	51.86 – 68.04	21.38, 78.18	2.0	0.001266
	A2	9.61	8.645 – 15.805	7.92, 39.80		
FE(Cl^-) %	A1	4.85	1.06 – 26.69	0.43, 34.11	10.0	0.014138
	A2	0.39	0.26 – 0.595	0.20, 5.40		

EasyElectrolytes, The Netherlands). Concentrations of blood urea in serum samples and creatinine in urine and serum samples were determined by chemistry analyser (XL 640, Erba Mannheim, Germany). The results allowed serum samples from group A to be divided into 2 groups: azotaemic (A1) and non-azotaemic (A2). The results were analysed using the Statistica 8.0 program. The Mann-Whitney *U* test was used to compare FE(Na^+), FE(K^+), FE(Cl^-), and SUSPPUP between groups A and B, and groups A1 and A2. Correlations between duration of the disease before treatment and fractional excretions of SMEs in infected dogs were calculated. The value of $p < 0.05$ was considered significant.

Results and Discussion

Comparison of the SUSPPUP ratio, FE(Na^+), FE(K^+) and FE(Cl^-) between groups A and B, and groups A1 and A2 showed that the SUSPPUP ratio and FE(K^+) were significantly higher in group A than in group B, and FE(Na^+), FE(K^+) and FE(Cl^-) were significantly higher in group A1 than in group A2 (Table 1). Correlations between duration of the disease and FE(K^+), FE(Na^+) and FE(Cl^-) were positive and statistically significant (*r* amounted to 0.63, 0.89 and 0.79, respectively).

Significantly higher FE(K^+) in dogs infected with *B. canis* indicates renal loss of K^+. This may result from increased production of aldosterone, which is activated by hypotension and decreased renal perfusion (Stockham and Scott 2008). An increased SUSPPUP ratio in affected dogs confirmed the supposition that aldosterone might contribute to increased FE(K^+) in these dogs. Significantly increased fractional excretion of SMEs in group A1 in comparison to group A2 probably resulted from kidney injury. FE(Na^+) higher than 1% indicates kidney injury in azotaemic dogs and may result from ATN (Waldrop 2008). Thus, the significant correlation between duration of the disease and FE(Na^+) and FE(Cl^-) observed in this study may indicate that in canine babesiosis renal azotaemia is preceded by pre-renal azotemia. Comparison of the results of this study with the result of our previous study (Zygner et al. 2012), in which the serum sodium concentration was significantly lower in azotaemic dogs infected with *B. canis* than in non-azotaemic infected dogs, indicates that renal excretion of sodium contributes to hyponatraemia in azotemic infected dogs. Renal contribution to hyponatraemia was observed in Addison's disease and renal tubular disease (Stockham and Scott 2008). However, the results of our previous study suggested increased production of aldosterone in canine babesiosis (Zygner et al 2012). Thus, secondary Addison's disease in babesiosis can be excluded as the cause of hyponatraemia, and renal tubular disease seems to be the factor influencing hyponatraemia in azotaemic dogs infected with *B. canis*.

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