The use of elements of the Stewart model (Strong Ion Approach) for the diagnostics of respiratory acidosis on the basis of the calculation of a value of a modified anion gap (AG$_{m}$) in brachycephalic dogs

P. Sławuta, K. Glińska-Suchocka, A. Cekiera

Department of Internal Diseases with Clinic for Horses, Dogs and Cats, Faculty of Veterinary Medicine, Wroclaw University of Environmental and Life Sciences, pl. Grunwaldzki 47, 50-366 Wrocław, Poland

Abstract

Apart from the HH equation, the acid-base balance of an organism is also described by the Stewart model, which assumes that the proper insight into the ABB of the organism is given by an analysis of: pCO$_2$, the difference of concentrations of strong cations and anions in the blood serum – SID, and the total concentration of nonvolatile weak acids – Acid total. The notion of an anion gap (AG), or the apparent lack of ions, is closely related to the acid-base balance described according to the HH equation. Its value mainly consists of negatively charged proteins, phosphates, and sulphates in blood. In the human medicine, a modified anion gap is used, which, including the concentration of the protein buffer of blood, is, in fact, the combination of the apparent lack of ions derived from the classic model and the Stewart model. In brachycephalic dogs, respiratory acidosis often occurs, which is caused by an overgrowth of the soft palate, making it impossible for a free air flow and causing an increase in pCO$_2$ – carbonic acid anhydride. The aim of the present paper was an attempt to answer the question whether, in the case of systemic respiratory acidosis, changes in the concentration of buffering ions can also be seen. The study was carried out on 60 adult dogs of boxer breed in which, on the basis of the results of endoscopic examination, a strong overgrowth of the soft palate requiring a surgical correction was found. For each dog, the value of the anion gap before and after the procedure was calculated according to the following equation: AG = ([Na$^+$ mmol/l] + [K$^+$ mmol/l]) – ([Cl mmol/l] + [HCO$_3$ mmol/l]) as well as the value of the modified AG – according to the following equation: AG$_{m}$ = calculated AG + 2.5 x (albumins – albumins$_d$). The values of AG calculated for the dogs before and after the procedure fell within the limits of the reference values and did not differ significantly whereas the values of AG$_{m}$ calculated for the dogs before and after the procedure differed from each other significantly. Conclusions: 1) On the basis of the values of AG$_{m}$ obtained it should be stated that in spite of finding respiratory acidosis in the examined dogs, changes in ion concentration can also be seen, which, according to the Stewart theory, compensate metabolic ABB disorders 2) In spite of the fact that all the values used for calculation of AG$_{m}$ were within the limits of reference values, the values of AG$_{m}$ in dogs before and after the soft palate correction procedure differed from each other significantly, which proves high sensitivity and usefulness of the AG$_{m}$ calculation as a diagnostic method.

Key words: acid-base balance, the Stewart model, brachycephalic syndrome

Correspondence to: P. Slawuta, e-mail: piotr.slawuta@up.wroc.pl