Use of elements of the Stewart model (Strong Ion Approach) – SID$_3$, SID$_4$, Atot/A$^-$, SID$_e$ and SIG for the diagnostics of respiratory acidosis in brachycephalic dogs

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Abstract

Buffer systems of blood and tissues, which have the ability to bind with and give up hydrogen ions, participate in maintaining the acid-base balance (ABB) of the organism. According to the classic model, the system of carbonic acid and bicarbonates, where the first component serves the role of an acid and the second a base, determines plasma pH. The so-called Stewart model, which assumes that ions in blood serum can be separated into completely dissociated – nonbuffer and not dissociated – buffer ions which may give up or accept H$^+$ ions, also describes the ABB of the organism. The goal of the study was to find out whether, during respiratory acidosis, the values of SID$_3$, SID$_4$, Atot/A$^-$, SID$_e$ and SIG change. The study was carried out on 60 adult dogs of the boxer breed (32 males and 28 females) in which, on the basis of an arterial blood test, respiratory acidosis was found. A strong overgrowth of the soft palate tissue requiring a surgical correction was the cause of the ABB disorder. Prior to surgery and on the 14th day after the surgery, venous and arterial blood was drawn from each dog. ABB parameters were determined in the arterial blood sample: the blood pH, pCO$_2$ and HCO$_3^-$.
In the venous blood, concentration of Na$^+$, K$^+$, Cl$^-$, lactate$^-$, albumins, and P$_{inorganic}$ was determined. On the basis of the obtained data, the values of SID$_3$, SID$_4$, Atot/A$^-$ and SIG, before and after the surgery, were calculated. In spite of the fact that the average concentration of ions, albumins, P$_{inorganic}$ and lactate in the blood serum of dogs before and after the surgical procedure was similar and within the physiological norms, the values of SID$_3$, SID$_4$ and SIG, calculated on the basis of the former, displayed statistically significant differences. Conclusion: On the basis of the results obtained, it can be stated that the values of SID$_3$, SID$_4$ and SIG change during respiratory acidosis and may be helpful in the diagnostics of ABB disorders in brachycephalic dogs.

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

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