SUMMARY:

Metabolic acidosis (MAC) is a constant symptom of chronic kidney diesease (CKD) in advanced stages. The Siggaard-Andersen analysis is a traditional method of acid-base balance (ABB) assessment, assessing the metabolic component by means of the base excess and the anion gap (AG). Modern methods of ABB assessment draw upon the theory proposed by Stewart, which is based on the electric neutrality principle. Stewart distinguishes three independent variables determining plasmatic pH: pCO2, strong ion difference (SID) and 3) the total charge of non-volatile weak acids [Atot-].

The aim of this study was to assess the relationship between pH and plasma ion changes associated with ABB disorders in patients with chronic kidney disease using both methods of analysis, and subsequently compare both approaches.

The cohort of patients consisted of three groups: 1) the "CKD" group, 60 patients with CKD stage 3 to 4 according to the KDOQI; 2) the "HD" group, 68 patients on chronic hemodiafiltration using dialysate bicarbonate concentration of 32 mmol/L; 3) a control group, 19 healthy volunteers. In all patients we measured parameters necessary for both approaches, in the HD group before and after dialysis treatment.

We have found that MAC was present in two thirds of patients in the CKD group. A decrease of sodium-chloride difference (Diff(NaCl)) was the most significant factor associated with a decrease of pH and MAC; apart from the expected hyperchloraemia, this factor was also significantly influenced by hyponatremia. We have not demonstrated a significant contribution of retained unmeasured anions of strong acids (UA-). In the HD group, pre-dialysis MAC was only present in one third of patients, caused almost exclusively by UA- retention. We have not proven any correlation between Diff(NaCl) and MAC or intradialytic alkalinisation. Post-dialysis metabolic alkalosis was present in 4/5 of patients, caused by excessive elimination of UA- that were completely replaced by dialysate bicarbonate.

We can therefore conclude that SID changes within the metabolic component of ABB were a crucial determinant of the resulting pH value in chronic kidney disease patients. The variations between individual methods used to determine MAC in both groups were of about 10%. We have not found a difference between the conventional and modern methods that would be significant for clinical practice, provided that the conventional method considers AG corrected for albumin also in the case of normal pH, pCO2 and SBE values.

Key words: acid-base balance, strong ion difference, sodium-chloride difference, chronic kidney disease, haemodiafiltration, Stewart