PRELIMINARY RESULTS OF DIALYSIS STUDY: ACCURACY OF A SINGLE POOL VARIABLE-VOLUME CALCIUM KINETIC MODEL WITH DIFFERENT CALCIUM DIALYSATE CONCENTRATIONS

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Introduction and Aims: The primary aim of the international DialysIS study (Dialysis therapy between Italy and Switzerland) is to improve the personalization of hemodialysis treatments through a modeling approach. Within the DialysIS study, we compared the accuracy of a single pool variable volume calcium kinetic model (SPVV-CaKM) using two different dialysate calcium concentrations (CaD).

Methods: Pre- and post-treatment relevant variables of 31 patients treated with nominal CaD of 1.5 mmol/l (Group 1) and 22 patients with nominal CaD of 1.75 mmol/l (Group 2) were analyzed. The accuracy of the model was evaluated by determining the difference between predicted (Ca2+pwtP) and measured (Ca2+pwt) plasma water ionized calcium concentrations at the end of the dialysis sessions. To account for the changes in blood pH during dialysis session, which is known to affect plasma water ionized calcium concentrations, Ca2+pwt values were normalized at pH of 7.40.

Results: In Group 1 we found: Ca2+D = 1.26 ± 0.04 mmol/l; a rise in Ca2+pw from 1.18 ± 0.07 at the start to 1.32 ± 0.04 mmol/l at the end of the dialysis session with a mean difference between Ca2+pwtP (1.33 ± 0.04 mmol/l) and Ca2+pwt of 0.01 ± 0.04 mmol/l. In Group 2 we found: Ca2+D = 1.41 ± 0.04 mmol/l; a similar rise in Ca2+pw (from 1.18 ± 0.07 mmol/l to 1.36 ± 0.06 mmol/l) but with a mean difference between Ca2+pwtP (1.58 ± 0.04 mmol/l) and Ca2+pwt of 0.12 ± 0.05 mmol/l.

Figure 1 indicates that the predicted values almost overlapped the normalized values in Group 1, while they were significantly higher (p<0.01) in Group 2. The difference between predicted and normalized values in Group 1 was significantly different (p<0.01) from the difference in Group 2.

Conclusions: The SPVV-CaKM was highly accurate when using a dialysate calcium concentration of 1.5 mmol/l while it wildly overestimated the post-treatment plasma water concentration when using a higher dialysate calcium concentration; the measured post-treatment values in the two groups did not seem to account for the increased dialysate calcium concentration, suggesting the presence of an additional compartment. We hypothesize that the administered calcium that according to our model did not appear in the plasma could be deposited in bones and/or soft tissues. It is then theoretically possible to estimate the total calcium deposition or accumulation from the difference between predicted and measured post-treatment in Ca2+pw values.