

PRELIMINARY RESULTS OF Dialysis STUDY: SINGLE POOL VARIABLE-VOLUME CALCIUM KINETIC MODEL

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OBJECTIVES

The work presented here is part of the international study Dialysis (Dialysis therapy between Italy and Switzerland). This study is aimed at evaluating and validating a single-pool kinetic model used to assess the intradialytic calcium balance when the nominal concentration of calcium dialysate was 1.5 mmol/L. The main hypothesis is that the infused calcium will be distributed in a volume assimilable to the extra cellular volume.

METHODS

34 patients undergoing chronic bicarbonate high-flux hemodialysis with nominal total calcium concentration in the dialysate of 1.5 mmol/L were studied for 6 consecutive treatments each. Ionized calcium concentrations of plasma water (Ca^{2+pw}) and dialysate (Ca^{2+D}) were determined at the beginning and end of each session; calcium dialysance (D_{Ca}) was estimated from conductivity dialysance. We applied a Donnan's factor equal to 0.938.

The accuracy of the model was evaluated by comparing the end-dialysis ionized plasma water calcium concentration (Ca^{2+pwtM}), normalized to pH 7.40 and the predicted plasma values (Ca^{2+pwtP}). Mobilization outside Extra Cellular Water (ECW) is defined as the difference between predicted and measured concentration times ECW. Results shown as mean \pm standard deviation.

RESULTS

The pre-dialysis plasma water ionized calcium concentration (Ca^{2+pw0}) indicate the absence of hypercalcemia in the sample (1.17 ± 0.07 mmol/L). Global Ca^{2+MB} , as an average value, was negative. When individual patient were considered, 77% of patients confirmed the negative Ca^{2+MB} ; the remaining 23% showed a positive Ca^{2+MB} .

According to the variable $Ca^{2+pwt} (P-M)$, dialysis sessions were divided into two groups:

- Group 1 : $Ca^{2+pwt} (P-M) \leq 0.05$ mmol/L;
- Group 2 : $Ca^{2+pwt} (P-M) > 0.05$ mmol/L.

This threshold arise from considerations about the analyzer's imprecision ($CV 2\% \pm 0.05$ mmol/L). Results shown in Table 2.

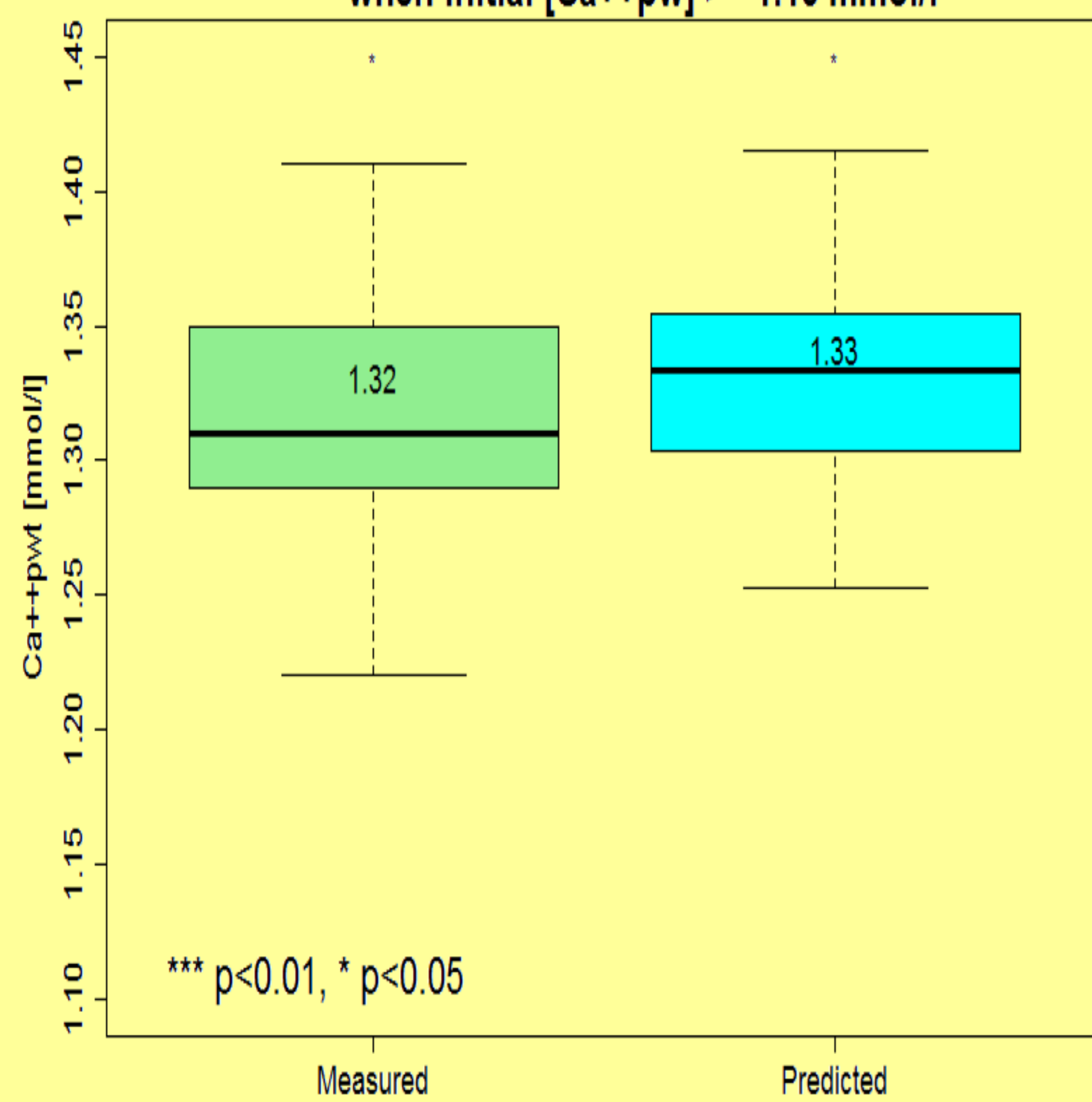
N of sessions	Ca^{2+pwtP} (mmol/L)	Ca^{2+pwtM} (mmol/L)	$Ca^{2+pwt} (P-M)$ (mmol/L)	p value
240				
mean	1.33	1.30	0.02	<0.01
SD	0.04	0.05	0.04	

Table 1. Mean values and standard deviation of end-dialysis plasma water calcium activity predicted (Ca^{2+pwtP}), measured (Ca^{2+pwtM}) and the difference between predicted and measured values, $Ca^{2+pwt} (P-M)$

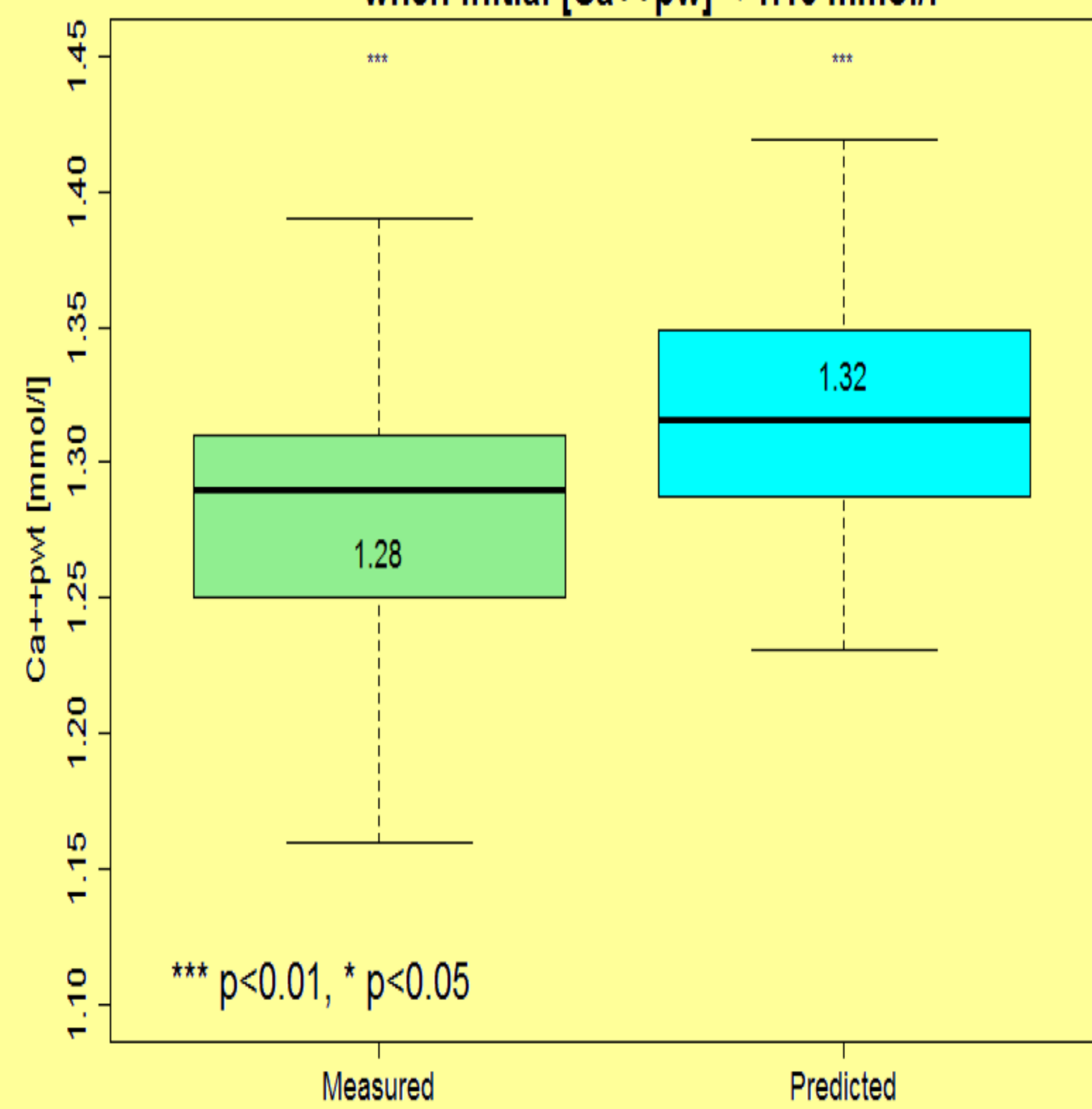
Group	n of sessions	Ca^{2+pwtP} (mmol/L)	Ca^{2+pwtM} (mmol/L)	$Ca^{2+pwt} (P-M)$ (mmol/L)	p value
1	180	1.32 ± 0.04	1.31 ± 0.04	0.01 ± 0.02	NS
2	60	1.34 ± 0.04	1.28 ± 0.06	0.07 ± 0.05	<0.01

Table 2. Model results after division in subgroup

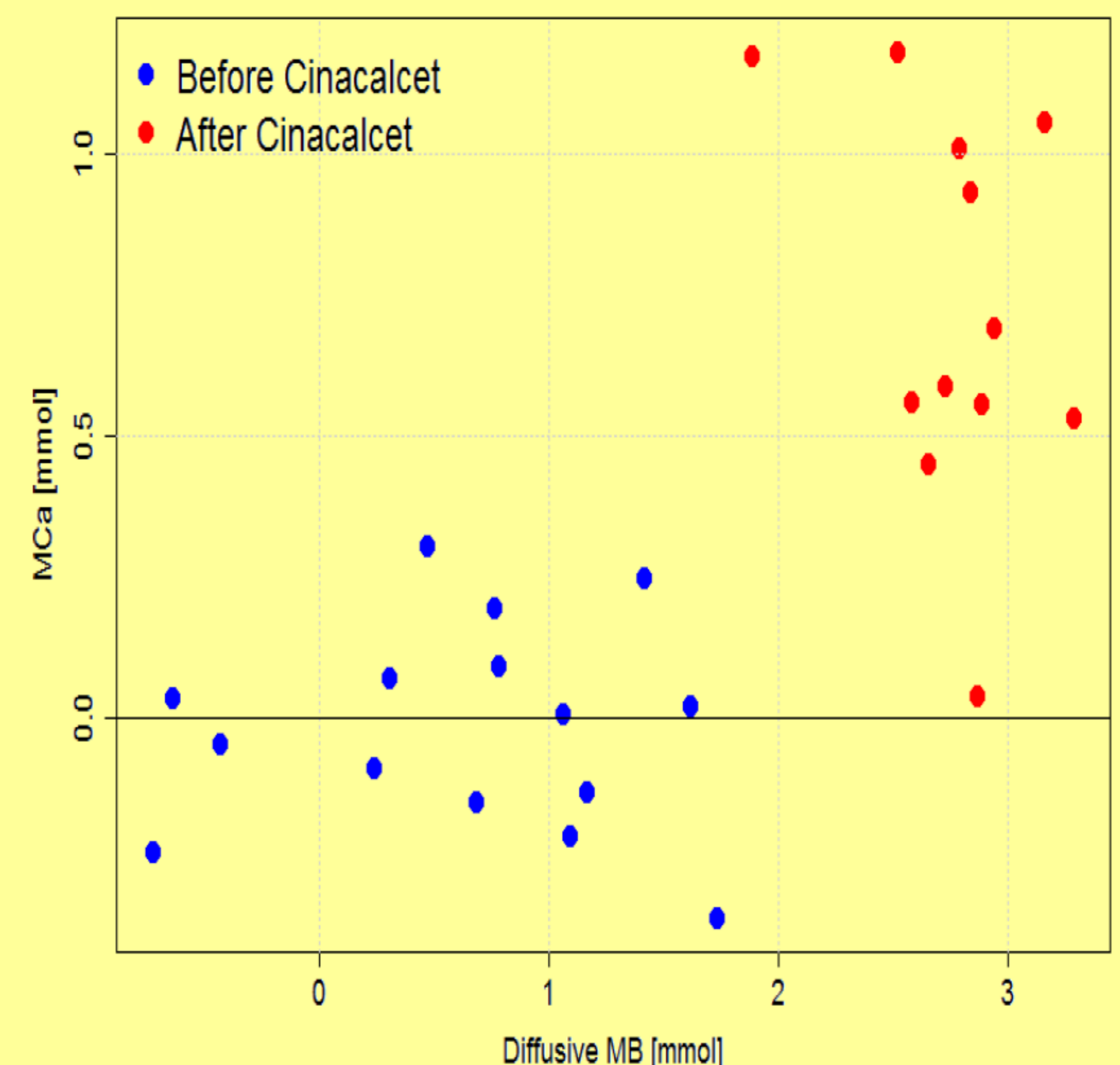
Measured vs Predicted End-Treatment [Ca^{++pw}] when Initial [Ca^{++pw}] ≥ 1.15 mmol/l



Measured vs Predicted End-Treatment [Ca^{++pw}] when Initial [Ca^{++pw}] < 1.15 mmol/l



Difference between Pre- and Post- Cinacalcet Mobilization Outside ECW in function of the Diffusive Mass Balance



CONCLUSIONS

The very low differences between predicted and adjusted plasma water ionized calcium concentrations supports the validity of the model when applied to patients with a nominal dialysate calcium concentration of 1.5 mmol/L and a final calcium level in physiological range. Therefore the proposed SPVV-CaKM allows an accurate prediction of calcium exchange during hemodialysis.

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