EFFECT OF DIALYSATE CALCIUM CONCENTRATION (dCa) ON PHASE ANGLE (PA), AS ASSESSED BY BIOELECTRICAL IMPEDANCE ANALYSIS (BIA), IN HEMODIALYSIS (HD) AND PERITONEAL DIALYSIS (PD) PATIENTS

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OBJECTIVES

The PA parameter, obtained by BIA, as a reflection of body cell mass, tissue hydration and membrane integrity, is a useful tool for identifying dialysis patients at high risk for malnutrition, a condition associated with high mortality in these patients. Also, elevated serum Ca (sCa) levels and treatment with high dCa (HdCa), both associated with an increased risk of Ca overload, have been linked with morbidity and mortality. In this study, we aimed to investigate the associations between dCa treatment and nutritional status, and specifically to explore the possibility whether treatment with a HdCa is causally associated with a low PA, indicative of malnutrition.

METHODS

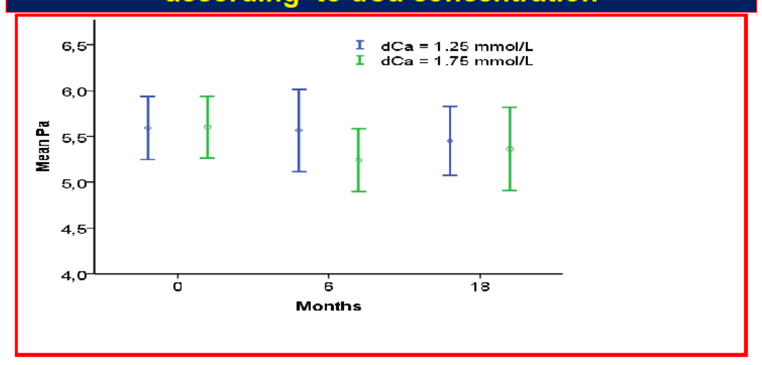
An 18-month prospective longitudinal study was performed on 45 HD and 49 PD patients, with an additional follow-up period of 2.5 years. Biochemical markers of nutrition and body composition (BIA) were measured at baseline and at 6 and 18 months following enrollment. Half of the patients (n=47) were treated with a low dCa of 1.25 mmol/L (LdCa) and the other half (n=47) were treated with a HdCa of 1.75 mmol/L. dCa prescription remained constant during the whole study period.

Table 1. Association of dialysate calcium concentration (dCa) with longitudinal changes in nutritional parameters (slopes) over 18 months, based on a mixed - effects model*

Variable	dCa				dCa x Time interaction			
	Estimate	95 % CI		P	Estimate	95% CI		P
		Lower	Upper			Lower	Upper	
Phase angle (º)	-0.57	-0.88	-0.25	0.001	-0.15	-0.25	-0.05	0.005
Albumin (g/dl)	-0.15	-0.28	-0.02	0.020	-0.02	-0.07	0.03	0.484
Creatinine (mg/dl)	-3.15	-3.88	-2.42	0.001	0.14	-0.14	0.41	0.324
Phosphorus (mg/dl)	-0.75	-1.14	-0.36	0.001	-0.07	0.490	-0.27	0.13
Ferritine (ng/ml)	46.82	-72.61	166.25	0.078	40.58	2.29	78.88	0.038
LDL (mg/dl)	-7.55	-11.13	-3.98	0.001	-1.81	-3.33	-0.30	0.020
Parathormone (pg/ml)	-89	-175	-2	0.044	-40	-155	75	0.488

* Fixed factors = age, sex, diabetes and CVD status, dialysis vintage and mode, serum Ca

Figure 1. Longitudinal changes of phase angle (Pa) according to dCa concentration



RESULTS

In a linear mixed-effect model adjusted for age, dialysis vintage, cardiovascular disease and diabetes at baseline, gender, mode of dialysis and sCa, PA changes were inversely related to dCa concentration (r adjusted = -0.57; p=0.001) and linear changes of sCa (r adjusted = -0.10; p=0.047) (Table 1). PA levels decreased over time (linear estimate: 0.22º /1.5 years; p = 0.009) and treatment with a HdCa was associated with a decrease in PA levels of 0.15°/1.5 years (p = 0.005 for dCa × time interaction) [Figure1]. During the 4-year follow-up, there were 24 deaths. In a Cox model , adjusted to the same covariates as mentioned above, the use of HdCa was significantly associated with a 3-fold increased all-cause mortality risk (HR: 3.06; 95% CI, 1.07-8.7), whereas, for each 1º increment of PA there was a significant 40% reduced risk for all-cause mortality (HR: 0.60; 95% CI, 0.39-0.92).

CONCLUSIONS

This is the first study to show that the use of a HdCa is causally related to low Pa levels over time, thus identifying HdCa as a new inducer of malnutrition. The mechanisms underlying this association, which are independent of increased sCa levels, remain to be elucidated. Apart from being a significant predictor of malnutrition, a HdCa also constitutes a strong and independent risk factor for mortality, and thus, the use of dCa as high as 1.75 mmol/L should be strictly avoided and a LdCa be used instead.

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