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Lower serum calcium is associated with a faster kidney function decline in individuals with chronic kidney disease

Introduction

Disturbances in calcium are common in patients with chronic kidney disease (CKD) but whether they associate to renal function decline is less clear.

Objective

To investigate the association between serum calcium and renal function decline in non-dialysis dependent patients with CKD stages IIIa, IIIb, IV, and V separately.

Methods

Design: Observational study.

Setting: The Stockholm CREAtinine Measurements (SCREAM) project, a healthcare utilization cohort from Stockholm, Sweden, covering the period 2006-2011.

Participants: 15.755 individuals with eGFR <60 ml/min/1.73 m^2 and concurrent calcium tested at cohort entry.

Exposure: Serum calcium in different CKD severity stages (III-V).

Main Outcomes and Measures: The change in rate of renal function decline during the subsequent (median) 4.3 years, using linear mixed models. Dose-response relationships were investigated via multiplicative interactions with eGFR levels.

Results

- Mean baseline calcium level was 9.6 (SD 0.5) mg/dl.
- Mean eGFR decline was -0.82 (95% confidence interval [CI] -0.903; -0.738) mL/min/1.73m^2/year.
- In advanced CKD stages, a higher serum calcium was associated with a less rapid renal function decline.
- The crude change in eGFR decline associated with a unit increase in calcium at baseline was -0.10 (95% CI -0.36; 0.17, p=0.47), 0.52 (0.20; 0.84, p=0.002), 0.43 (0.09; 0.77, p=0.01) and 0.65 (0.32; 0.98, p=<0.001) mL/min/1.73m^2/year for patients in CKD stage IIIa, IIIb, IV, and V, respectively.
- Adjustment for baseline confounders did not modify these associations.
- Interaction terms confirmed a dose-response relationship, i.e. the lower the baseline eGFR, the stronger the effect of low calcium on subsequent eGFR decline.

Conclusion

"Low serum calcium was associated with more rapid CKD progression in stages IIIb to V".

Table 1. Association between serum calcium levels with the subsequent rate of renal function decline (95% CI)

		CKD IIIa (n=9286)	P*	CKD IIIb (n=4190)	P*	CKD IV (n=1784)	P*	CKD V (n=495)	P*
Change in eGFR decline per each mg/dL higher albumin-corrected calcium (negative = extra decline)[a]									
	Crude	-0.098 (-0.362; 0.165)	0.46	0.515 (0.196; 0.835)	0.002	0.428 (0.085; 0.772)	0.01	0.649 (0.323; 0.975)	<0.001
	Model 1	-0.031 (-0.299; 0.237)	0.82	0.380 (0.063; 0.697)	0.02	0.358 (0.001; 0.715)	0.05	0.681 (0.355; 1.007)	<0.001
	Model 2	-0.033 (-0.302; 0.235)	0.81	0.382 (0.065; 0.699)	0.02	0.379 (0.021; 0.738)	0.04	0.676 (0.344; 1.009)	<0.001

[a] In mL/min/1.73 m^2 per year; serum calcium concentrations were albumin-corrected
Model 1 adjusted for age, sex, blood pressure, DM, CVD, serum albumin and haemoglobin
Model 2 adjusted for covariates in model 1 plus serum phosphorus and active vitamin D therapy
*P-value for difference in the change in the rate of renal function decline with one unit higher serum calcium

Relevance

These results underscore the need to monitor calcium levels in clinical practice and to better delineate its role in the course of disease.

References

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