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Calcium isotopes as a biomarker for vascular calcification in chronic kidney disease

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Calcium balance is abnormal in adults with chronic kidney disease (CKD) and is associated with the development of blood vessel calcification. It is currently not routine to screen for vascular calcification in CKD patients. In this study, we investigate whether the naturally-occurring calcium (Ca) isotope ratio, $^{44}Ca/^{42}Ca$, of serum could be used as a non-invasive marker of vascular calcification in CKD. This is to date, the largest clinical study of human subjects that investigates Ca isotopes in blood and urine, and the first of a CKD population that utilises Ca isotopes.

A total of 78 participants were recruited from a tertiary hospital renal centre. For each participant, systolic blood pressure, ankle brachial index, pulse wave velocity and estimated Glomerular Filtration Rate (eGFR) were measured, along with serum markers. Calcium concentrations and isotope ratios were measured on urine and serum.

Calcium isotope compositions in serum were significantly different between healthy controls, patients with CKD and those undertaking dialysis ($p<0.01$). Receiver operative characteristic (ROC) curve analysis shows that the diagnostic utility of serum Ca isotopes for detecting medial calcification was determined as very good (AUC = 0.818, $p<0.01$).

Serum Ca isotopes are associated with vascular calcification and perform better than existing biomarker to detect medial calcification. In addition, because Ca isotopes can be measured in a small blood sample (≤1 mL), this study suggests there is a significant potential for using serum Ca isotopes for the early detection and management of vascular calcification in the context of CKD.