Vitamin D (25(OH)D and 1,25(OH)$_2$D$_3$) levels and abdominal aortic calcification in patients with chronic kidney disease

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Background

- Vascular calcification is an independent risk factor for cardiovascular disease, which is the leading cause of death in patients with chronic kidney disease (CKD). Low vitamin D levels might have affected vascular calcification. CKD patients revealed a high prevalence of vitamin D deficiency.

- The aim of this study was to investigate the abdominal aortic calcification according to vitamin D levels in patients with advanced kidney disease.

Method

- **Study design**: retrospective

- **Study period**: Jan. 2011 ~ Aug. 2012

- **Inclusion**
  1. Patients of CKD stage III-V in single center (N=149)
  2. age ≥ 20

- **Exclusion**
  1. acute infectious disease
  2. liver disease
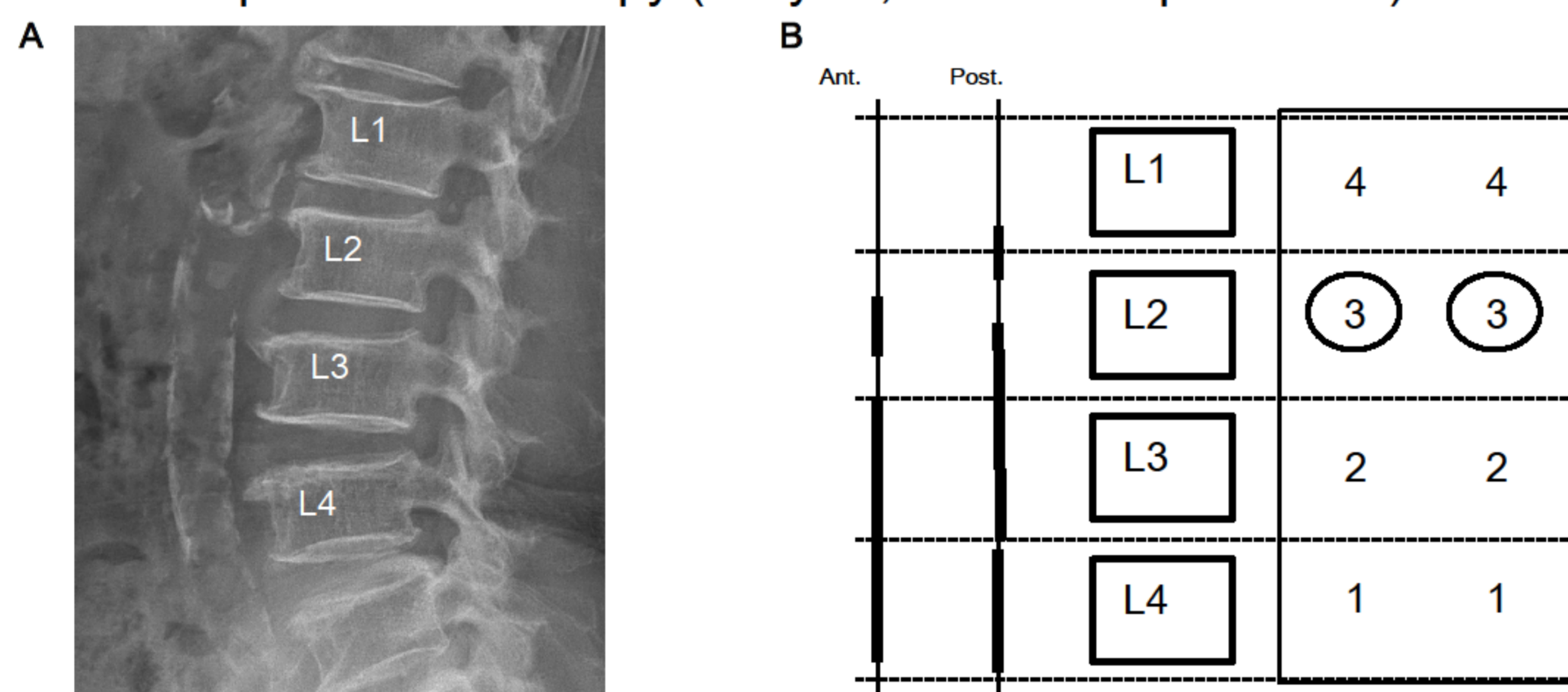 3. renal replacement therapy (dialysis, renal transplantation)

Figure. 1 A) Abdominal aortic calcification (AAC) was shown on plain radiography of lateral lumbar spine view. B) Grading of calcification was assessed at the ant. (anterior) and the post. (posterior) walls of the abdominal aorta adjacent to vertebrae L1-L4 and the composite score determined. AAC score of this patients were 6.

Results

Table 1. Demographic of total subjects (N=149)

Variables	Mean±SD or n (n of patients = 149)
Age, years	64.5±13.0 (20-88)
Male : Female (%)	90 (60.4) : 59 (39.6)
eGFR, mL/min/1.73m^2	12.5±9.0
CKD stage (%)	
III, IV	40 (26.8)
V	109 (73.2)
Cause of CKD (%)	
DM	95 (63.8)
HTN	18 (12.1)
CGN	24 (16.1)
others	12 (8.1)
AACS, 0-8 (%)	
AACS, 0-3	117 (78.5)
AACS, 4-8	32 (21.5)

Table 2. Laboratory parameters of patients with advanced kidney disease

Variables	Mean±SD (n of patients = 149)
Hemoglobin, g/dL	8.8±1.8 (4.1-13.7)
Albumin, mg/dL	3.3±0.5 (1.8-4.7)
BUN, mg/dL	73.4±35.0 (19.5-194.5)
Creatinine, mg/dL	6.6±4.2 (1.5-25.6)
Alkaline phosphatase	248.6±124.9 (83-904)
Calcium, mg/dL	7.8±0.9 (3.7-10.0)
Phosphate, mg/dL	5.3±2.1 (1.8-15.1)
Calcium X Phosphate, mg^2/dL^2	41.1±14.1 (12.3-95.1)
Intact PTH, pg/mL	229.1±182.9 (5.3-973.9)
25(OH)D, ng/mL	8.7±5.5 (4.0-52.0)
1,25(OH)$_2$D$_3$, pg/mL	9.6±7.8 (1.6-56.2)
1,25(OH)$_2$D$_3$/25(OH)D	1.28±1.09 (0.06-7.40)
eGFR, mL/min/1.73m^2	12.58±9.0 (2.0-48.9)

Table 3. Comparison of clinical and laboratory parameters of patients stratified according to advanced kidney disease

	CKD stage III, IV	CKD stage V	P value
Patients (%)	40 (26.8)	109 (73.2)	
Age, years	68.0±11.4	63.2±13.4	0.047*
Male (%)	22 (55.0)	68 (62.4)	0.414
Diabetes (%)	24 (60.0)	71 (65.1)	0.563
WBC, 10^3/μL	8890.0±4853.9	8247.7±3950.9	0.456
Hemoglobin, g/dL	9.6±1.8	8.6±1.7	0.001*
Albumin, mg/dL	3.2±0.5	3.3±0.4	0.105
BUN, mg/dL	47.7±21.3	82.9±34.4	<0.001*
Creatinine, mg/dL	2.6±0.6	8.0±4.1	<0.001*
Alkaline Phosphatase	256.1±135.8	245.8±121.3	0.658
Calcium, mg/dL	8.1±0.7	7.7±1.0	0.012*
Phosphate, mg/dL	4.0±0.9	5.8±2.2	<0.001*
Calcium X Phosphate, mg^2/dL^2	33.2±8.6	44.1±14.6	<0.001*
Cystatin-C, mg/L	3.1±1.7	4.4±1.3	<0.001*
CRP, mg/L	29.5±49.4	29.0±47.4	0.960
Intact PTH, pg/mL	118.6±92.3	270.4±191.3	<0.001*
25(OH)D, ng/mL	8.5±3.6	8.8±6.0	0.717
1,25(OH)$_2$D$_3$, pg/mL	11.3±8.4	8.9±7.5	0.097
1,25(OH)$_2$D$_3$/25(OH)D	1.46±1.12	1.22±1.07	0.233
AACS, 0-8	2.1±2.1	1.9±2.0	0.616
eGFR, mL/min/1.73m^2	24.8±8.3	8.0±3.3	<0.001*

Table 4. Comparison of demographics and clinical laboratory parameters of advanced kidney disease patients stratified according to abdominal aortic calcification score (0-8)

	AACS≤3	AACS>3	P value
Patients (%)	117 (78.5)	32 (21.5)	
Age, years	62.9±13.1	70.1±11.0	0.005*
Male (%)	71 (60.7)	19 (65.6)	0.893
Diabetes (%)	74 (63.2)	21 (65.6)	0.804
CKD stage V (%)	86 (73.5)	23 (71.9)	0.854
eGFR, mL/min/1.73m^2	12.6±9.2	12.3±8.5	0.870
WBC, 10^3/μL	8099.1±4091.7	9593.7±4467.0	0.075
Hemoglobin, g/dL	8.8±1.7	8.9±1.8	0.748
Albumin, mg/dL	3.3±0.5	3.2±0.5	0.609
BUN, mg/dL	72.7±34.9	76.2±35.8	0.619
Creatinine, mg/dL	6.6±4.3	6.4±4.0	0.811
Alkaline Phosphatase	245.2±120.8	260.8±140.5	0.534
Calcium, mg/dL	7.8±1.0	7.8±0.7	0.791
Phosphate, mg/dL	5.3±2.0	5.5±2.4	0.620
Calcium X Phosphate	40.8±13.7	42.5±15.5	0.551
Cystatin-C, mg/L	4.0±1.6	4.1±1.1	0.638
CRP, mg/L	27.2±44.8	36.3±57.8	0.348
Intact PTH, pg/mL	234.2±178.3	210..7±200.4	0.522
25(OH)D, ng/mL	8.8±6.0	8.5±2.9	0.757
1,25(OH)$_2$D$_3$, pg/mL	10.3±8.4	6.9±4.1	0.034*
1,25(OH)$_2$D$_3$./25(OH)D	1.39±1.15	0.87±0.48	< 0.001*
AACS	1.06±1.00	5.47±1.27	< 0.001*

Table 5. Pearson's Correlation Coefficient

	Cr	BUN	Ca	P	iPTH	25(OH)D	1,25(OH)2D3
BUN	0.701**						
Ca	-0.418**	-0.323**					
P	0.742**	0.633**	-0.382**				
iPTH	0.541**	0.465**	-0.360**	0.519**			
25(OH)D	0.036	0.056	-0.005	-0.010	-0.062		
1,25(OH)2D3	-0.235**	-0.171*	0.085	-0.194*	-0.052	0.045	
VitD ratio	-0.195*	-0.166*	0.006	-0.096	-0.010	-0.283**	0.849

Table 5. Multivariate analysis of risk factors for abdominal aortic calcification score > 3

	Odd Ratio	95% CI	P value
Male	0.782	0.283-2.161	0.636
Age	1.075	1.026-1.126	0.002*
DM	0.925	0.352-2.432	0.874
CKD stage V	1.338	0.405-4.417	0.633
Calcium	0.820	0.469-1.432	0.485
Phosphate	1.205	0.869-1.671	0.263
Cystatin-C	1.149	0.827-1.596	0.407
Intact PTH	0.999	0.996-1.002	0.606
25(OH)D	0.988	0.915-1.067	0.758
1,25(OH)$_2$D$_3$	0.888	0.796-0.991	0.033*

Conclusions

These results suggest that vitamin D deficiency was common, and age and serum 1,25(OH)$_2$D$_3$ level were independent risk factors for vascular calcification in patients with advanced kidney disease.