

Abdominal Aorta Calcification on Plain Radiograph Strongly Suggests Coronary Artery Calcification in Hemodialysis Patients

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Introduction

- The reference standard in the detection of cardiovascular calcifications is the CT-based coronary artery calcium (CAC) score.
- The KDIGO recommended that a lateral abdominal radiograph be used to detect the presence or absence of vascular calcification. Plain radiographs may provide readily available information on coronary artery calcification.
- Therefore, we investigate the association between abdominal aorta calcification (AAC) on plain abdominal radiograph and CAC score determined by CT.

Methods

- A total of 64 chronic hemodialysis patients (42 men; 55.1 ± 11.1 years) who underwent abdominal radiography and CAC scoring at CT were included in this retrospective analysis.
- Lateral lumbar radiography of the abdominal aorta was used to evaluate the overall AAC score, which is related to the severity of calcific deposits at lumbar vertebral segments L1-L4. The extent of AAC on chest radiography was evaluated independently by two blinded observers using a semi-quantitative eight-point scale (0-3).
- Amount of AAC determined on radiography was correlated with CAC and ROC analyses performed to characterise the diagnostic performance of AAC grading.

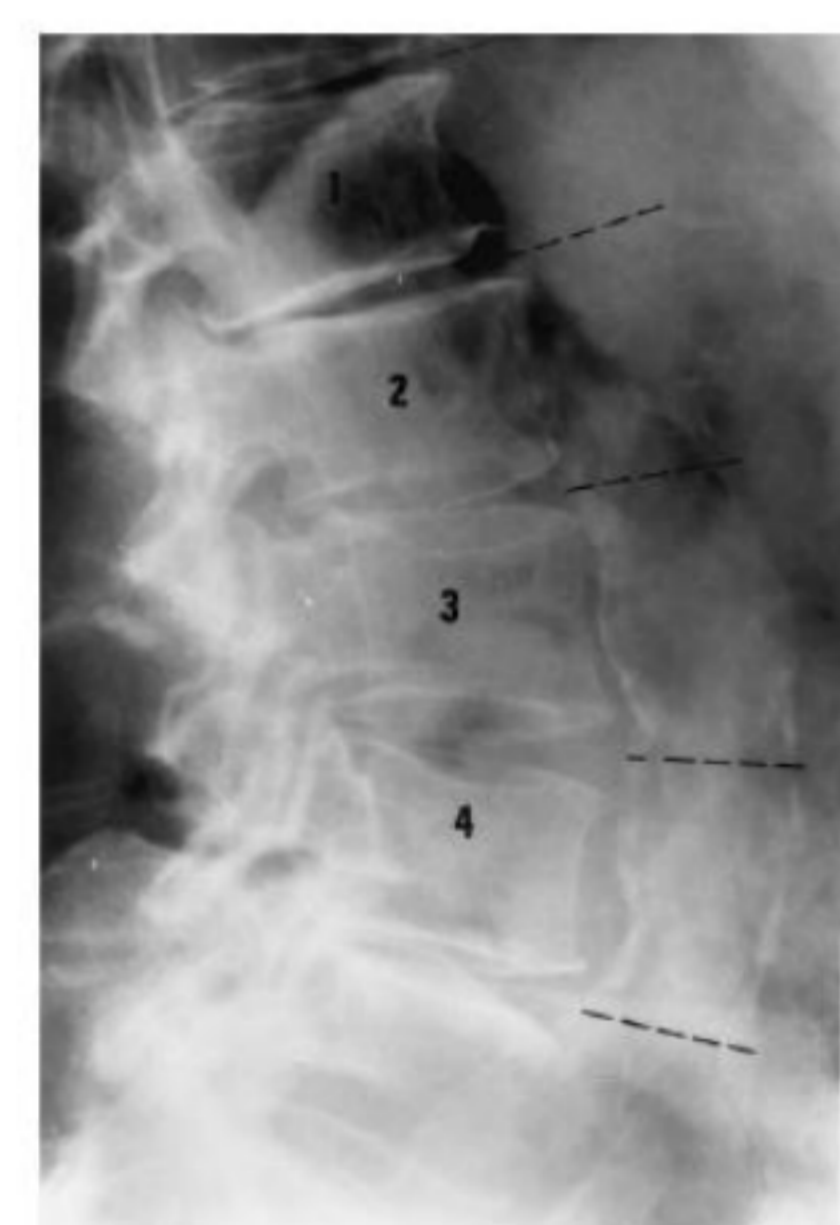


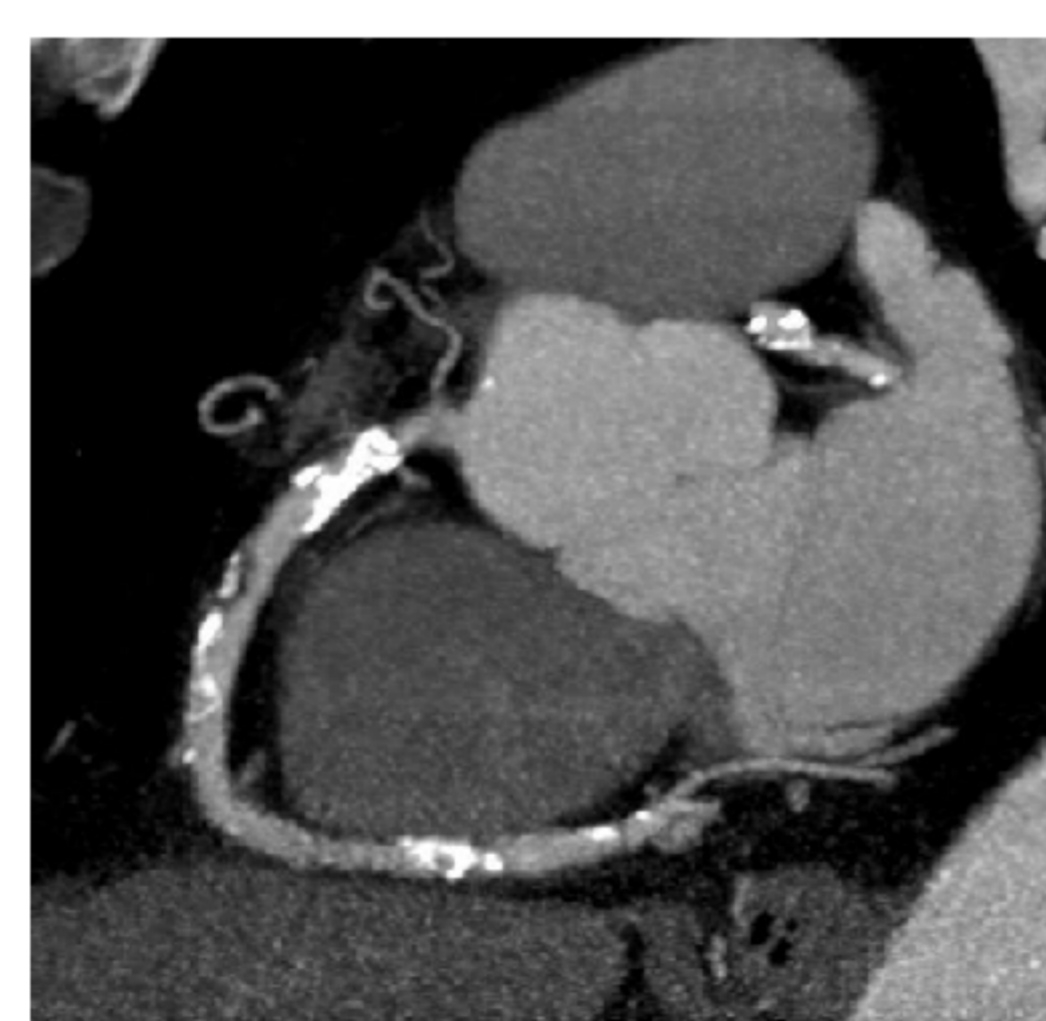
Fig. 3. Assessment of aortic calcifications segmentally from lateral lumbar radiograph, scoring 0 for aortic calcifications (both posterior and anterior) in front of L1 vertebra, 2 for calcification in the posterior wall, 1 for anterior wall in front of L2 vertebra and 3 for calcifications in front of L3 and L4 vertebrae.

Scoring System for Lumbar Aortic Calcification

	Posterior	Anterior	Sum A+P	Affected A+P	Affected A or P
L1	0	0	0	0	0
L2	2	1	3	2	1
L3	3	3	6	2	1
L4	3	3	6	2	1
			15	6	3
			24	8	4
					Maximum

Fig. 4. Scoring system for lumbar aortic calcifications. Scores based on findings in the 3.

Kaupilla LI et al. Atherosclerosis 132:245-250, 1997



High calcium score

CAC (coronary artery calcium) score

- Agatston score

0	none
1-99	mild
100-400	moderate
>400	severe

Results

- Mean CAC as determined by MDCT score was 410 (range 0-4,254) and mean AAC score was 3.6 (range 0-13) (Table 1).
- AAC and CAC scores were higher in patients with cardiovascular disease (CVD) than in patients without CVD (Table 2).
- CAC score was found to have significant positive correlations with AAC ($r = 0.34$; $P = 0.01$) (Figure 1).
- Multivariate analysis showed CAC scores were independent risk factor for CVD (OR=1.01, 95% CI 1.01-1.02, $P=0.02$, Table 3).
- Cut-off between AAC grades 0-6 and ≥ 7 had a sensitivity of 50.0%, specificity of 86.1%, PPV of 66.7 % and NPV of 75.6% for the correct identification of CAC scores greater than 100 (Table 4). ROC analyses revealed an area under the curve (AUC) of 0.79 (95 % CI 0.53-0.84).

Table 1. Clinical and laboratory characteristics of the patients

Variables	n=64
Age (years)	55.1±11.1
Female gender (%)	50.0%
Diabetes (%)	53.1%
Previous CVD (%)	32.8%
Dialysis vintage (years)	4.3±3.0
BMI (kg/m ²)	21.8±3.0
Hemoglobin (g/dL)	10.1±1.0
Albumin (g/dL)	4.0±0.7
Calcium (mg/dL)	8.5±0.7
Phosphorus (mg/dL)	4.9±1.5
intact-PTH (pg/mL)	148.2±97.1
Kt/V	1.59±0.29
25-hydroxyvitamin D level (ng/mL)	8.1±4.1
Aorta calcification score	3.6 (0-13)
CACS	410 (0-4254)

Table 2. Patients characteristics according to CVD

	CVD (-) (n=43)	CVD (+) (n=21)	P-value
Age (years)	55.3±11.9	54.5±9.6	0.7
Male gender (%)	48.8%	52.4%	0.9
Diabetes (%)	53.5%	52.4%	0.9
Dialysis vintage (years)	4.0±2.8	4.7±3.5	0.4
BMI (kg/m ²)	21.8±3.4	21.8±2.1	0.9
Albumin (g/dL)	3.9±0.7	4.0±0.6	0.5
Calcium (mg/dL)	8.6±0.7	8.4±0.7	0.5
Phosphorus (mg/dL)	4.6±1.6	5.3±1.2	0.09
Total cholesterol (mg/dL)	149.5±28.7	134.2±32.2	0.08
HDL-cholesterol (mg/dL)	39.6±12.7	38.6±12.6	0.7
LDL-cholesterol (mg/dL)	84.6±22.5	77.2±22.7	0.2
Intact-PTH (pg/mL)	131.0±90.1	180.1±103.7	0.06
hs-CRP (mg/L)	3.4±7.4	10.1±18.5	0.1
25-hydroxyvitamin D (ng/mL)	7.8±3.57	8.5±5.1	0.5
CACS	186.0±433.9	868.9±1233.2	0.02
Aorta calcification score	2.7±3.6	5.3±4.7	0.04

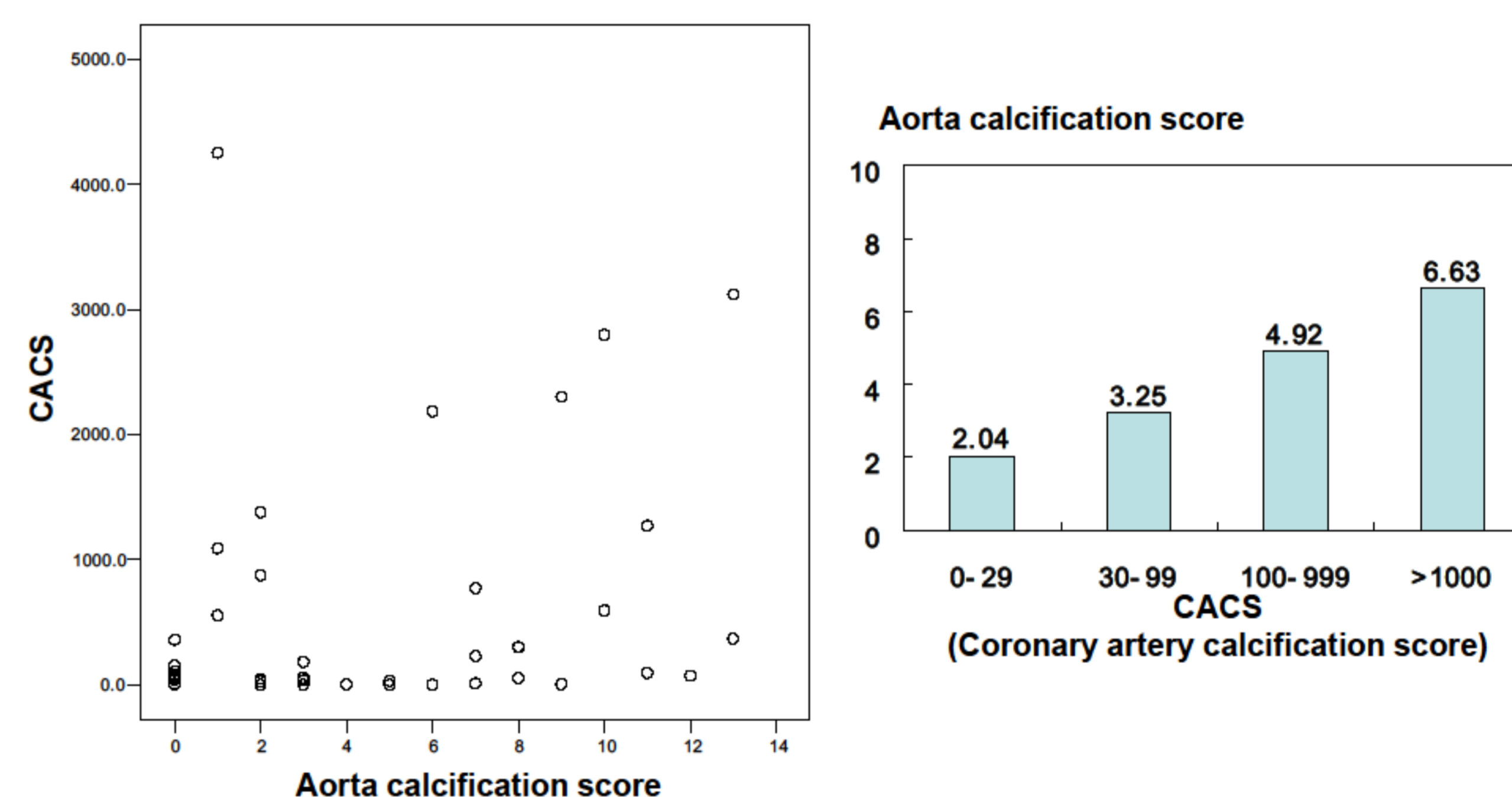


Fig. 1. Correlation of CAC and aorta calcification

Table 3. Multivariate analysis for risk factors of CVD

Variables	OR (95% CI)	P-value
Age (per 10 year)	0.86 (0.46-1.62)	0.6
Diabetes mellitus	2.26 (0.43-11.95)	0.3
CACS (per 10 point)	1.01 (1.01-1.02)	0.02
Aorta calcification	1.11 (0.92-1.34)	0.3
hs-CRP	1.05 (0.99-1.12)	0.1
Intact-PTH	1.00 (0.99-1.01)	0.5

Table 4. Prediction of CAC according to the aorta calcification score

	Sensitivity	Specificity	Negative predictive value
Score ≥ 7	50.0%	86.1%	75.6%
ROC curve: AUC 0.79 (95% CI 0.53-0.84, $P=0.02$)			

Conclusions

- This study demonstrated that semi-quantitative AAC grading on plain abdominal radiography appears reliable and positively associated with CAC scoring. AAC depicted on plain radiograph has a high specificity for ruling out CAC scores greater than 100.

