

Comparison between Vascular Calcification on Plain Radiograph and Lesions on Coronary Angiography in Dialysis Patients

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Introduction & Aims

- Cardiovascular disease (CVD) plays an important role in morbidity and mortality of dialysis patients and the incidence of CVD is increasing each year.
- However, It is difficult to decide coronary angiographic procedure because patients often do not show classical symptoms such as chest discomfort.
- Previous studies have shown that vascular calcification (VC) of L-spine, pelvis and hands, feet, and chest on plain radiography is associated with CVD in chronic kidney disease (CKD) patients
- The aim of this study is to compare between VC scores on plain radiographs of chest, hands, pelvis, feet, lateral lumbar spine and severity of lesions on coronary artery angiography (CAG) in dialysis patients

Methods

- Study design**
 - Retrospective study, single Dong-A University Dialysis Center
 - From Sep. 2004 to Aug. 2013
- Subjects**
 - Patients who were checked with plain radiographs within 1 year before or after CAG and were to receive hemodialysis or peritoneal dialysis
- Measurements**
 - VC through the plain radiographs of the feet, hands, pelvis and lateral lumbar spine
 - Significant VC was any one finding among the following findings on plain radiographs: score of abdominal aortic calcification ≥ 5 ; score of the hands and pelvis ≥ 3 ; score of aortic arch calcification ≥ 4 ; presence of medial artery calcification on the feet
 - Number or location of coronary artery disease, number of luminal stenosis $>70\%$ in diameter, number of chronic total occlusion, number, length, or diameter of inserted stent, severity or type of calcification, and SYNTAX score on CAG
 - Severity of calcification was classified into three groups: mild, presence of density after injection of a radiocontrast agent (Figure 1A); moderate, presence of density in accordance with heart movement before injection of a radiocontrast agent (Figure 1B); severe, presence of radio-opaque lesion before injection of a radiocontrast agent regardless of the heart movement (Figure 1C)
 - Type of stenosis was categorized into diffuse, tubular, or discrete type
 - We retrospectively analyzed 55 patients' medical records

Results

- Of 55 patients, 41 patients (74.5%) had significant VC on plain radiographs. Patients with significant VC had higher incidence of stent insertion, but there was no significant association (43.9% vs.35.7%, $p = 0.592$). Stent length in patients with significant VC was longer (34.1 ± 19.1 mm vs. 16.6 ± 15.2 mm, $p = 0.029$). Similar result was observed in SYNTAX score (14.5 ± 15.6 vs. 5.1 ± 5.5 , $p = 0.002$). Patients with significant VC had significantly higher prevalence rate of severe coronary artery calcification (56.1% vs. 14.3%, $p = 0.007$) and diffuse/tubular type of stenosis (73.2% vs. 35.7%, $p = 0.012$) on CAG than those without significant VC.
- The rate of VC scores of the L-spine ≥ 5 (68.0% vs. 40.0%, $p = 0.038$), pelvis and hands ≥ 3 (64.0% vs. 30.0%, $p = 0.012$), feet ≥ 1 (72.0% vs. 33.3%, $p = 0.004$), and chest ≥ 4 (60.0% vs.36.7%, $p = 0.084$) were significantly higher in patients with severe calcification than in those with mild to moderate calcification.
- The rate of the L-spine VC score ≥ 5 (68.6% vs. 25.0%, $p = 0.002$) and significant VC (85.7% vs.55.0%, $p = 0.012$) were significantly higher in patients with diffuse/tubular type of stenosis than in those with discrete type.

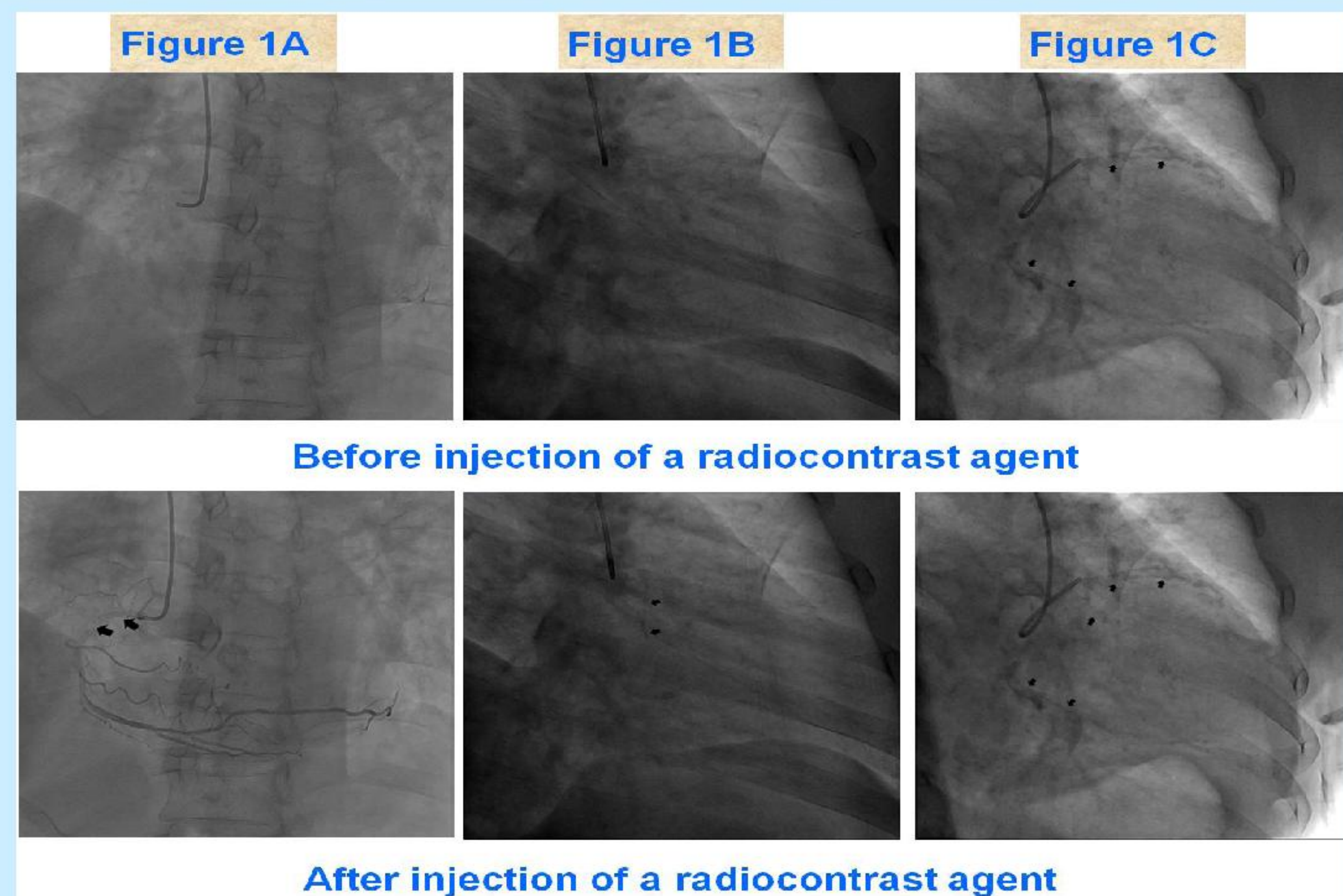


Table 1. Comparison of clinical characteristics in accordance with absence or presence of significant vascular calcification

Characteristics	Total (n = 55)	Significant vascular calcification on plain radiographs		p-value
		Negative (n = 14)	Positive (n = 41)	
Stent diameter on CAG	1.4±1.4	1.3±1.6	1.4±1.4	0.800
Stent length on CAG	29.6±19.8	16.6±15.2	34.1±19.5	0.029
Inserted stent on CAG, n (%)	23 (41.8%)	5 (35.7%)	18 (43.9%)	0.592
CTO on CAG, n (%)	4 (7.3%)	1 (7.1%)	3 (7.3%)	0.983
> 70% stenosis lesion on CAG, n (%)	16 (29.1%)	2 (14.3%)	14 (34.1%)	0.158
Syntax score on CAG	12.1±14.3	5.1±5.5	14.5±15.6	0.002
Severe Calcification on CAG, n (%)	25 (45.4%)	2 (14.3%)	23 (56.1%)	0.007
Diffuse/tubular stenosis on CAG, n (%)	35 (63.3%)	5 (35.7%)	30 (73.2%)	0.012

Table 2. Comparison of clinical characteristics between patients with mild to moderate and severe calcification on CAG

Characteristics	Mild to moderate calcification on CAG (n = 30)	Severe calcification on CAG (n = 25)	p-value
Framingham risk score	10.5±5.4	10.7±4.8	0.878
Stent diameter on CAG (mm)	1.3±1.5	1.4±1.4	0.797
Stent length on CAG (mm)	21.7±17.2	38.1±19.4	0.019
Inserted stent on CAG, n (%)	11 (36.7%)	12 (48.0%)	0.396
CTO on CAG, n (%)	0 (0%)	4 (16.0%)	0.023
> 70% stenosis lesion on CAG, n (%)	5 (16.7%)	11 (44.0%)	0.026
Syntax score on CAG	6.6±7.9	18.6±17.3	0.003
Diffuse/tubular stenosis on CAG, n (%)	13 (43.3%)	22 (88.0%)	0.001
Calcification scores on plain radiograph, n (%)			
L-spine ≥ 5	12 (40.0%)	17 (68.0%)	0.038
Hands/pelvis ≥ 3	9 (30.0%)	16 (64.0%)	0.012
Feet ≥ 1	10 (33.3%)	18 (72.0%)	0.004
Chest ≥ 4	11 (36.7%)	15 (60.0%)	0.084
Significant vascular calcification	18 (60.0%)	23 (92.0%)	0.007

Table 3. Comparison of clinical characteristics according to type of stenosis on CAG

Characteristics	Discrete lesion (n = 20)	Diffuse /Tubular lesion (n = 35)	p-value
Framingham risk score	10.2±6.0	10.8±4.6	0.652
Stent diameter on CAG (mm)	0.9±1.4	1.7±1.4	0.050
Stent length on CAG (mm)	11.8±7.9	35.8±19.0	<0.001
Inserted stent on CAG, n (%)	5 (25.0%)	18 (51.4%)	0.056
CTO on CAG, n (%)	0 (0%)	4 (11.4%)	0.285
> 70% stenosis lesion on CAG, n (%)	3 (15.0%)	13 (37.1%)	0.082
Syntax score on CAG	2.7±4.8	17.4±15.2	<0.001
Severe calcification on CAG, n (%)	3 (15.0%)	22 (62.9%)	0.001
Calcification scores on plain radiographs, n (%)			
L-spine ≥ 5	5 (25.0%)	24 (68.6%)	0.002
Hands/pelvis ≥ 3	6 (30.0%)	19 (54.3%)	0.082
Feet ≥ 1	10 (50.0%)	18 (51.4%)	0.919
Chest ≥ 4	8 (40.0%)	18 (51.4%)	0.414
Significant vascular calcification	11 (55.0%)	30 (85.7%)	0.012

Table 4. Independent factors associated with calcification or type of stenosis on CAG

Characteristics	Calcification on CAG		Diffuse/Tubular stenosis on CAG	
	HR* (95% CI)	p-value	HR* (95% CI)	p-value
Age (years)	0.95 (0.87-1.03)	0.180	1.05 (0.96-1.13)	0.285
Framingham risk score	1.07 (0.2-1.24)	0.403	0.97 (0.82-1.16)	0.754
SYNTAX score	1.07 (1.01-1.13)	0.020	1.25 (1.01-1.46)	0.004
Calcification scores, n (%)				
L-spine ≥ 5	2.77 (0.71 - 10.73)**	0.142	5.54 (0.99 - 31.14)**	0.052
Hands/pelvis ≥ 3	3.36 (0.96 - 11.80)**	0.059	2.01 (0.45 - 9.02)**	0.361
Feet ≥ 1	5.39 (1.39 - 20.87)**	0.015	0.75 (0.17 - 3.39)**	0.710
Chest ≥ 4	2.29 (0.67 - 7.84)**	0.187	1.66 (0.36 - 7.64)**	0.513
Significant vascular calcification	6.00 (1.08 - 33.41)**	0.041	2.97 (0.61 - 14.56)**	0.180

*Clinical parameters (Age, Framingham risk score, syntax score) were examined with significant vascular calcification.

**The effects of calcification scores were examined separately.

Conclusions

- Significant VC scores on plain radiographs are useful predictor of SYNTAX score, severity and type of calcification on coronary artery angiography in dialysis patients. Especially, calcification on feet was associated with degree of calcification on CAG, and L-spine calcification was related with severity of stenosis on CAG.