

Relation of Aortic Wall Thickness, Aortic Calcification and Aortic Distensibility to Severity of Coronary Artery Disease

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Introduction

• Atherosclerotic cardiovascular disease : Diffuse condition involving the coronary arteries, carotid arteries, aorta and peripheral arteries.

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• There are 3 known factors of aorta, which can predict the severity of coronary artery disease.

1. Aortic Wall Thickness (AWT)

Jeltsch et al. showed a significant correlation between maximal wall thickness of descending aorta and coronary atherosclerosis.

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2. Aortic Calcification (AC)

Takasu et al. demonstrated that the aortic wall calcification distribution and associated risk factors parallel coronary atherosclerosis.

Am Heart J. 2008;155:765-771

3. Aortic Distensibility (AD)

Okuyama et al. showed that atherosclerosis and sclerosis of desc. thoracic aorta are associated with CAD.

Circ J 2008;72:2021-2027

Purpose

• To our knowledge, no study has evaluated the relationship between coronary artery disease (CAD) and all 3 factors of aorta.

- ✓ aortic wall thickness (AWT),
- ✓ aortic calcification (AC),
- ✓ aortic distensibility (AD).

• This study was conducted to determine the relation of AWT, AC, and AD to severity of CAD.

Materials

• From July 2008 until June 2009

• Among the consecutive patients who underwent cardiac CT angiography (CCTA) to rule out CAD

→ Among patients with CCTA finding of significant luminal stenosis or discordant image finding with symptom, **116 patients** underwent invasive coronary angiography.

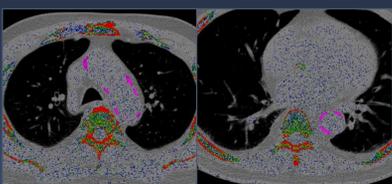
Methods-I

1. Aortic wall thickness measurement



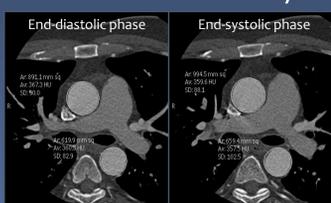
- ① at the thickest portion of descending thoracic aorta
- ② assessed max. wall thickness and not intima-media thickness or isolated plaque thickness
- ③ impossible to delineate each layers of aortic wall in MDCT

2. Aortic calcification quantification



- ① included both ascending and descending thoracic aorta
- ② ranged from upper edge of aortic arch to cardiac apex
- ③ using coronary calcium score software (Agatston score)

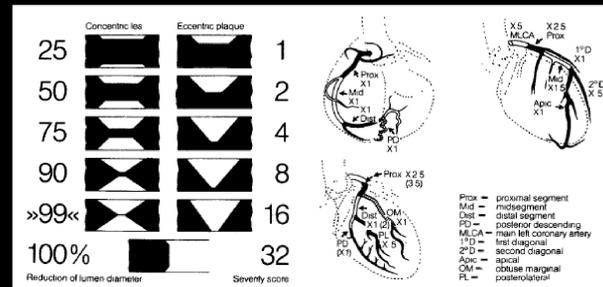
3. Aortic distensibility



- ① calculated by difference of max. ~ min. area of aorta and pulse pressure which measured during CT scan
- ② pulmonary bifurcation level
- ③ Distensibility (D) = $\Delta \text{AoArea} / \text{AoAD} \times \Delta \text{BP}$

Methods-II

1. Gensini score



2. Multi-vessel disease

- ① clinical 0- to 3- vessel disease score
- ② number of obstructed epicardial coronary arteries

3. Segment stenosis score (SSS)

- ① an estimate of the diameter of stenosis per segment
- ② scoring as very mild < 30% (0), mild 30-49% (1), moderate 50-69% (2), or severe 70% (3) using the worst score in the segment
- ③ SSS: sum of individual segment stenosis scores

4. Segment involvement score (SIS)

- ① amount of plaque for each segment
- ② scoring as absent (1) or as present (2)
- ③ SIS: sum of individual segment involvement scores

Results

Demographic Data	
Age (y) ^a	61.97 ± 10.42
Sex (male) ^b	68.1%
Hypertension ^b	51.3%
Diabetes ^b	33.9%
Dyslipidemia ^b	11.1%
Smoking ^b	30.9%
Medication ^b	61.4%
Total cholesterol (mg/dL) ^a	175.93 ± 38.82
Triglyceride (mg/dL) ^a	136.75 ± 78.66
HDL cholesterol (mg/dL) ^a	46.70 ± 15.50
LDL cholesterol (mg/dL) ^a	117.22 ± 48.54
hsCRP (mg/dL) ^a	14.65 ± 32.50
HbA1C (%) ^a	6.46 ± 1.34
FBS (mg/dL) ^a	118.62 ± 42.18

	Gensini	MVD	SSS	SIS
Total cholesterol	0.006	0.066	-0.027	-0.043
Triglyceride	0.035	0.075	-0.021	-0.064
HDL cholesterol	-0.196	-0.190	-0.224*	-0.228*
LDL cholesterol	-0.082	-0.044	-0.114	-0.120
hsCRP	0.133	0.113	0.081	0.050
HbA1C	0.130	0.254*	0.285**	0.292**
FBS	0.207	0.157	0.203	0.190

	Gensini	MVD	SSS	SIS
AWT	0.318**	0.297**	0.338**	0.288**
AC	0.270**	0.211*	0.330**	0.271**
AD Asc	-0.228*	-0.285**	-0.309**	-0.276**
AD Dsc	-0.200*	-0.226*	-0.248**	-0.218*

** p value < 0.05

* P value < 0.01

MVD: multi-vessel disease score

SSS: Segment Stenosis Score

SIS: Segment Involvement Score

^a Data are mean ± SD, ^b Data are % of patients

AWT: Aortic Wall Thickness

AC: Aortic Calcification

AD Asc: Aortic Distensibility of Ascending Aorta

AD Dsc : Aortic Distensibility of Descending Aorta

Conclusions

- Our study showed a significant relationship between the AWT, AC and AD with severity of CAD.
- AWT, AC and AD showed better correlation with severity of CAD than Lab. findings.
- Amongst the three factors, the **aortic wall thickness** was the most strongly associated factor relating to the severity of CAD.