

Assessment of Coronary Vessel Tone in Vasospastic
Angina by Multi-detector Computed Tomography
Coronary Angiography - MDCTA-Spasm Study

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Presenter Disclosure Information

Presenter: Cai De Jin

Title: Assessment of Coronary Vessel Tone in Vasospastic Angina
by Multi-detector Computed Tomography Coronary Angiography

No relationships to disclose

No industry sponsorship

Background

- Coronary angiography (CAG) with ergonovine provocation test has been widely used for the management of vasospastic angina (VSA).

Coronary Spastic Angina (JCS 2008): Circulation Journal 2010;74:1745-62.

- IVUS or OCT is useful to characterize coronary artery and plaque pattern at the spasm site in patients with VSA.

Tsujita K, et al. International Journal of Cardiology 2013;168:2411-5.

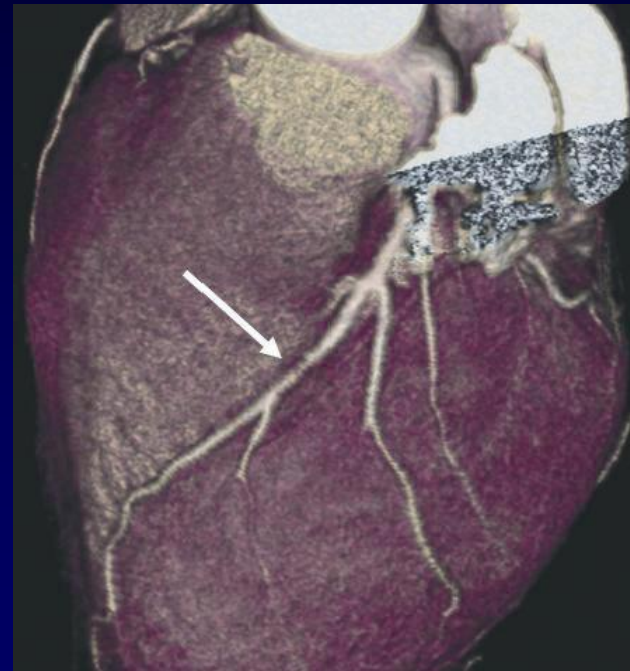
Hong YJ, et al. International Journal of Cardiology 2010;144:367-72.

Morikawa Y, et al. International Journal of Cardiology 2011;146:334-40.

Background

- Multi-detector CT angiography (MDCTA) is a promising noninvasive detection of VSA.

The diagnostic accuracy	
Sensitivity	48%
Specificity	100%
Positive predictive value	100%
Negative predictive value	68%



Study Aims

- * We investigate whether the extent of coronary vessel tone (CVT) assessed by MDCTA at the spasm site could be useful to predict VSA without a angiography provocation test.

Study Design

24 suspected variant angina patients (Oct. 2013 ~ Aug. 2014)

CAG with spasm test

Positive

Negative

3 patients excluded

21 VSA patients underwent MDCTA (Baseline + IV NTG)

Angiography matched spasm segment

MDCTA

IV NTG CT Protocol

To inject intravenous NTG (isosorbied dinitrate 2 mg/hr)



Blood pressure check (per every 2 minutes)



SBP/DBP decrease 10 mmHg



CT Scan

Exclusion Criteria

- Patients with significant stenosis ($\geq 50\%$ lumen diameter)
- Previous myocardial infarction, heart failure
- Previous PCI or CABG
- A history of cardiomyopathy, valvular heart disease
- Stroke
- Renal disease (creatinine > 2.0 mg/dl or eGFR < 45 ml/min)

Methods - Definition

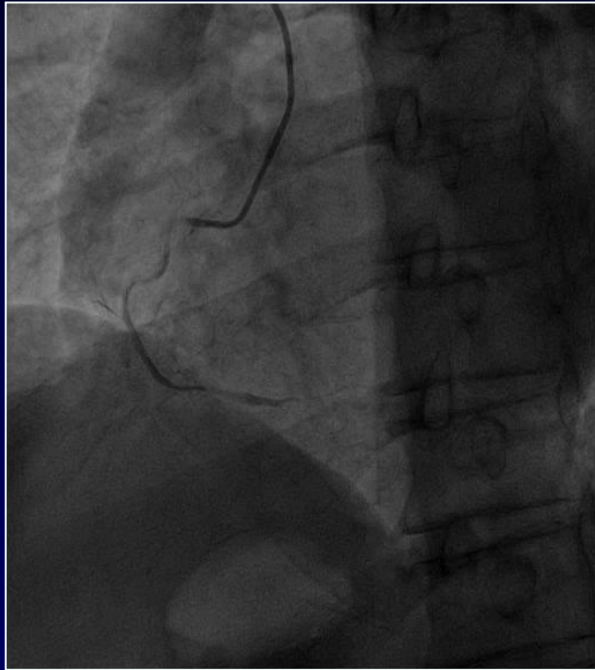
- Reference segment was defined as most normal looking site, which immediately (within 10 mm) close to spasm segment.
- Remodeling Index (RI)

$$[CSA_{\text{spasm}} / CSA_{(\text{proximal} + \text{distal reference}) / 2}] \times 100\%$$

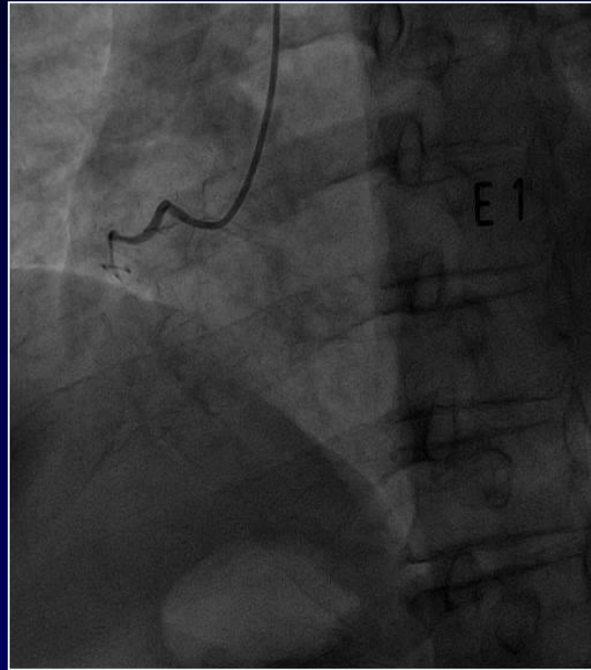
- Coronary vessel tone index (CVTI) at spasm segment

$$[(CSA^{IV\ NTG} - CSA^{\text{baseline}}) / CSA^{IV\ NTG}] \times 100\%$$

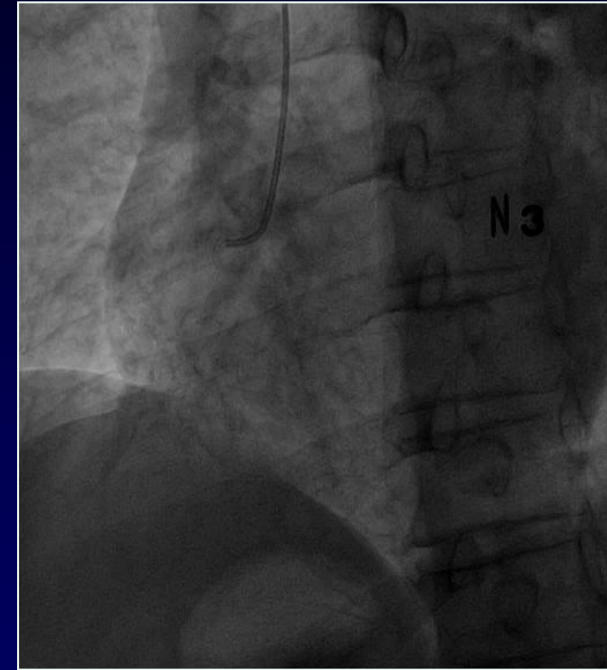
CAG with Spasm Test



Baseline



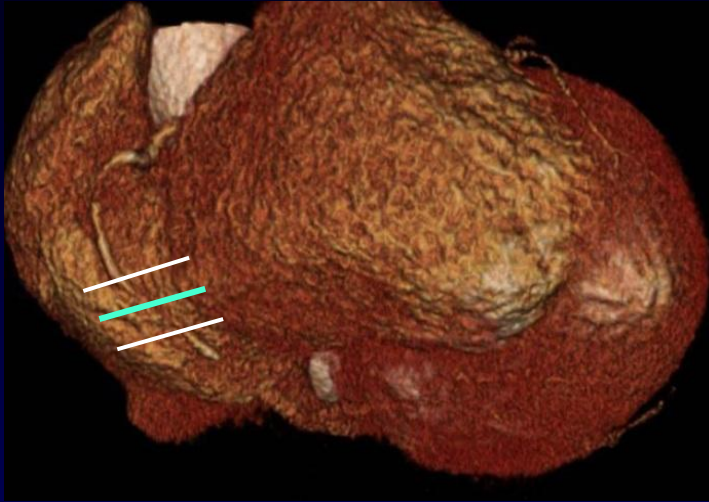
Ergonovine



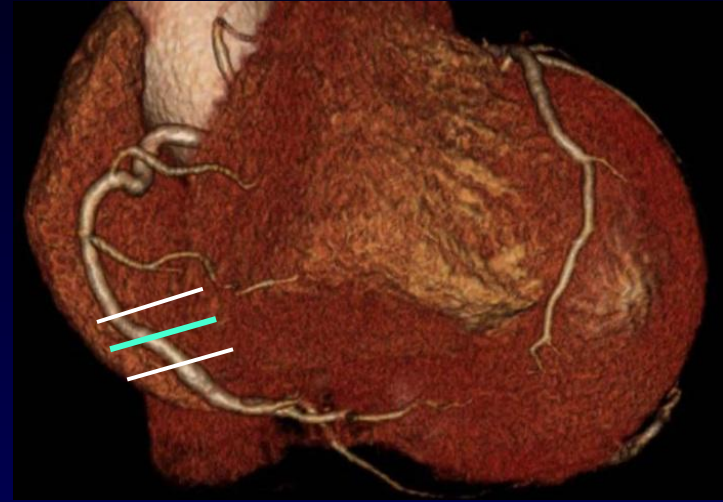
NTG

MDCTA matching CAG

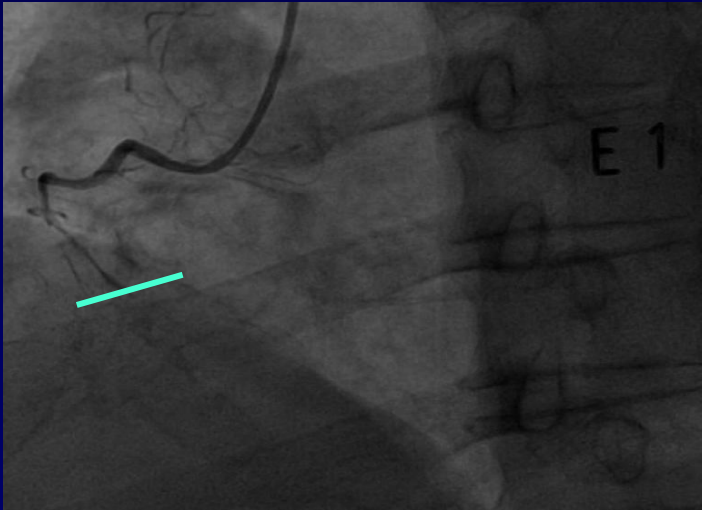
- 320-detector row CT scanner (Aquilion ONE, Toshiba medical systems, Inc., Tochigi, Japan).



Baseline

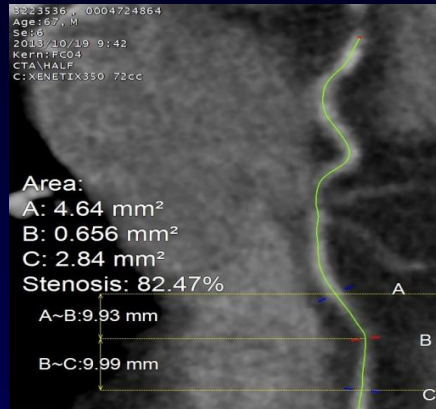


IV NTG

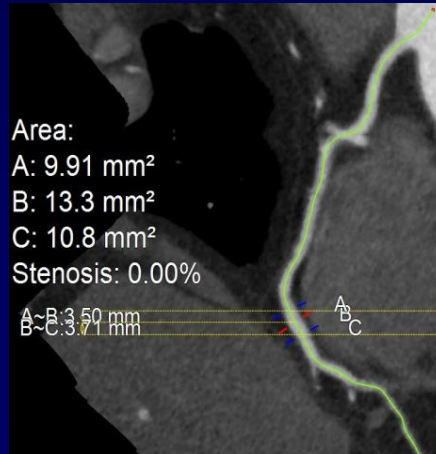
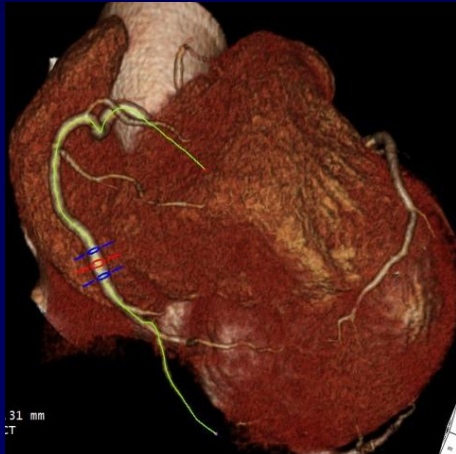


MDCTA

➤ 3D Software Aquarius intuition viewer (Version 1.1.11.39, TeraRecon, Foster city, CA, USA).



Baseline CT



IV NTG

➤ Remodeling index (RI)

$CSA_{spasm} / CSA_{(proximal + distal reference) / 2}$

1) Baseline RI: **0.18**

2) IV NTG RI: 1.28

➤ Coronary vessel tone index (CVTI)

$[(CSA_{IV\ NTG} - CSA_{baseline}) / CSA_{IV\ NTG}] \times 100\%$

1) CVTI (spasm segment): **95%**

2) CVTI (reference segment): 52%

Statistical Analysis

- SPSS v. 18.0 (SPSS Inc., Chicago, IL, USA)
 - Continuous variables
 - : paired-samples *t*-test.
 - Categorical variables
 - : Chi-square or Fisher exact test.
 - The receiver operating characteristic (ROC) curve.

Demographics and treatments of VSA patients (n = 21)

Age (yrs)	60 ± 9
Male gender	16 (76)
BMI (kg/m ²)	23.6 ± 3.0
LVEF (%)	61 ± 4
Coronary risk factors	
Smoking	12 (57)
Alcohol habit	8 (38)
Hypertension	10 (48)
Dyslipidemia	3 (14)
Diabetes mellitus	1 (5)
Medication	
Calcium channel blocker	17 (81)
Nitrate	17 (81)
β-Blocker	2 (10)
Statin	6 (29)

CAG & MDCTA Results

Spasm segments (n =28)

Spasm vessel	
LAD	4 (14.3%)
LCX	3 (10.7%)
RCA	21 (75%)
Diffuse spasm	12 (57%)
Calcification lesion	2 (7%)
Coronary calcium score	66.3 ± 165.5
Total radiation dose (mSv)	8.3 ± 3.3
Total contrast volume (ml)	134 ± 18

MDCTA Findings

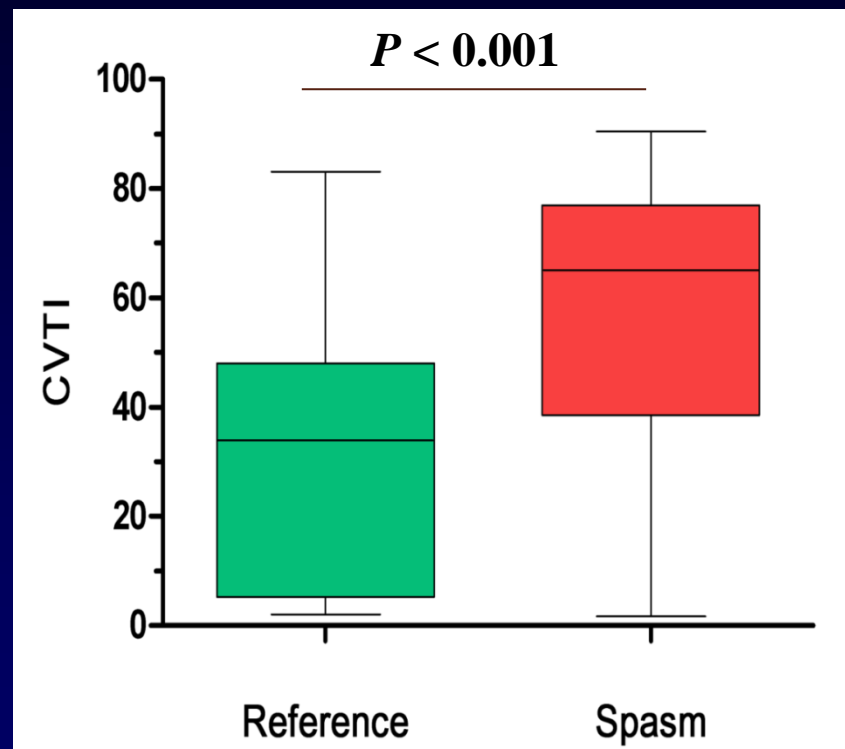
Variable	Baseline-CT	IV NTG-CT	P-value
Diameter-spasm (mm)	1.94 ± 0.72	2.67 ± 0.54	<0.001
CSA-spasm (mm ²)	3.41 ± 2.34	5.87 ± 2.32	<0.001
Remodeling index *	0.78 ± 0.20	0.96 ± 0.25	0.001
Negative remodeling [△] n (%)	24 (85.7)	13 (46.4)	0.002

* Remodeling index (RI) = $CSA_{spasm} / CSA_{(proximal + distal\ reference) / 2}$

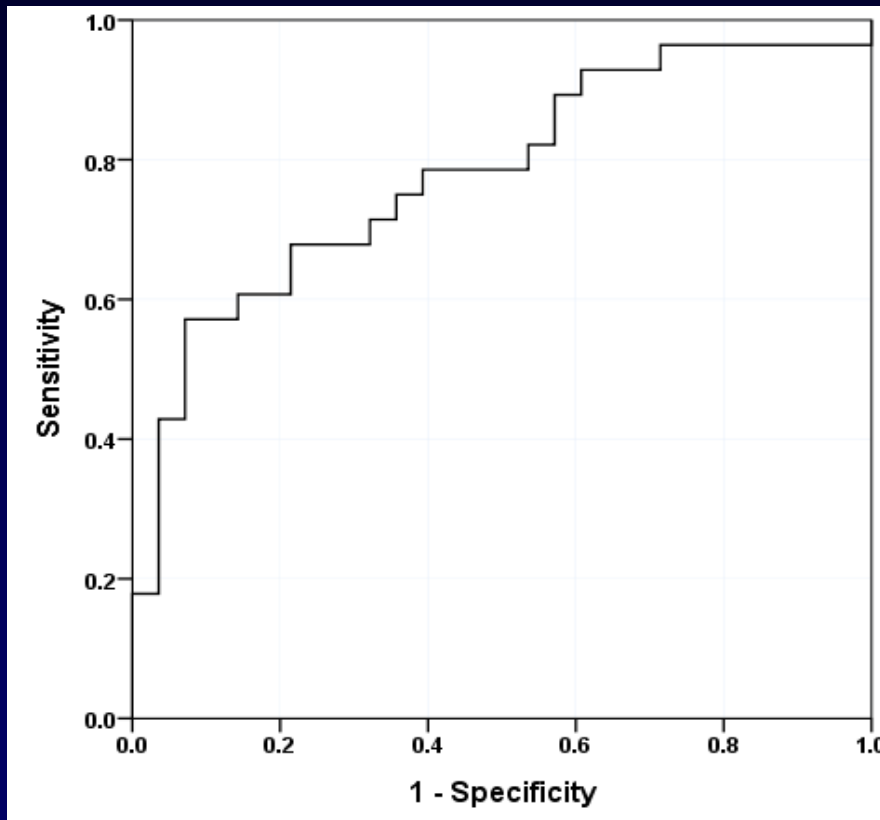
△ Negative remodeling (RI <0.95)

Coronary vessel tone index (CVTI)

$$\text{CVT index} = [(CSA^{\text{IV NTG}} - CSA^{\text{baseline}}) / CSA^{\text{IV NTG}}] \times 100\%$$



ROC curve for predicting VSA



1. CVT index

Cutoff value: **62.5%**.

2. AUC: **0.779**, 95%CI,
0.657-0.902; $P < 0.001$.

3. Sensitivity : 42.9%;

Specificity : 92.9%.

Summary

- Diffuse spasm with negative remodeling is characteristic findings of MDCTA in patient with vasospastic angina.
- We find cutoff value of coronary vessel tone index 62.5% at the spasm site could be helpful to predict vasospastic angina.

Limitation

- An observation, single-center, pilot study.
- Small number population (without control group).
- Selection bias of spasm coronary artery.
- Hard to exactly evaluate coronary plaque.
(calcified and lipid-rich plaques)
- Concern of radiation exposure

Conclusion

- The extent of coronary vessel tone characterized by MDCTA may be helpful to predict VSA without CAG provocation test.

Thank you for your attention.