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).


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

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

The diagnostic accuracy

<p>| | |</p>
<table>
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<tbody>
<tr>
<td>Sensitivity</td>
<td>48%</td>
</tr>
<tr>
<td>Specificity</td>
<td>100%</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>100%</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>68%</td>
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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.
24 suspected variant angina patients (Oct. 2013 ~ Aug. 2014)

CAG with spasm test

Positive

21 VSA patients underwent MDCTA (Baseline + IV NTG)

Negative → 3 patients excluded

Angiography matched spasm segment

MDCTA
IV NTG CT Protocol

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

Blood pressure check (per every 2 minutes)

SBP/DBP decrease 10 mmHg

CT Scan
Exclusion Criteria

- Patients with significant stenosis (≥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)
- Reference segment was defined as most normal looking site, which immediately (within 10 mm) close to spasm segment.

- Remodeling Index ($RI$)

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

- Coronary vessel tone index ($CVTI$) at spasm segment

$$\left[\frac{(CSA_{\text{IV NTG}} - CSA_{\text{baseline}})}{CSA_{\text{IV NTG}}}\right] \times 100\%$$
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 Aquarlius intuition viewer (Version 1.1.11.39, TeraRecon, Foster city, CA, USA).

- Remodeling index (RI)
  
  \[ \text{CSA}_{\text{spasm}} / \text{CSA} \text{ (proximal + distal reference)} / 2 \]

  1) Baseline RI: 0.18
  2) IV NTG RI: 1.28

- Coronary vessel tone index (CVTI)
  
  \[ \left[ (\text{CSA}^{\text{IV NTG}} - \text{CSA}^{\text{baseline}}) / \text{CSA}^{\text{IV NTG}} \right] \times 100\% \]

  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.
<table>
<thead>
<tr>
<th>Demographic/Treatment</th>
<th>Value</th>
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<tbody>
<tr>
<td>Age (yrs)</td>
<td>60 ± 9</td>
</tr>
<tr>
<td>Male gender</td>
<td>16 (76)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>23.6 ± 3.0</td>
</tr>
<tr>
<td>LVEF (%)</td>
<td>61 ± 4</td>
</tr>
<tr>
<td>Coronary risk factors</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>12 (57)</td>
</tr>
<tr>
<td>Alcohol habit</td>
<td>8 (38)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>10 (48)</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>3 (14)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Medication</td>
<td></td>
</tr>
<tr>
<td>Calcium channel blocker</td>
<td>17 (81)</td>
</tr>
<tr>
<td>Nitrate</td>
<td>17 (81)</td>
</tr>
<tr>
<td>β-Blocker</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Statin</td>
<td>6 (29)</td>
</tr>
</tbody>
</table>
## CAG & MDCTA Results

<table>
<thead>
<tr>
<th>Spasm segments (n =28)</th>
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<tbody>
<tr>
<td><strong>Spasm vessel</strong></td>
<td></td>
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<tr>
<td>LAD</td>
<td>4 (14.3%)</td>
</tr>
<tr>
<td>LCX</td>
<td>3 (10.7%)</td>
</tr>
<tr>
<td>RCA</td>
<td>21 (75%)</td>
</tr>
<tr>
<td><strong>Diffuse spasm</strong></td>
<td>12 (57%)</td>
</tr>
<tr>
<td><strong>Calcification lesion</strong></td>
<td>2 (7%)</td>
</tr>
<tr>
<td><strong>Coronary calcium score</strong></td>
<td>66.3 ± 165.5</td>
</tr>
<tr>
<td><strong>Total radiation dose (mSv)</strong></td>
<td>8.3 ± 3.3</td>
</tr>
<tr>
<td><strong>Total contrast volume (ml)</strong></td>
<td>134 ± 18</td>
</tr>
</tbody>
</table>
## MDCTA Findings

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline-CT</th>
<th>IV NTG-CT</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter_{spasm} (mm)</td>
<td>1.94 ± 0.72</td>
<td>2.67 ± 0.54</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CSA_{spasm} (mm²)</td>
<td>3.41 ± 2.34</td>
<td>5.87 ± 2.32</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Remodeling index *</td>
<td>0.78 ± 0.20</td>
<td>0.96 ± 0.25</td>
<td>0.001</td>
</tr>
<tr>
<td>Negative remodeling △n (%)</td>
<td>24 (85.7)</td>
<td>13 (46.4)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

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

△ Negative remodeling (RI <0.95)
Coronary vessel tone index (CVTI)

CVT index = \[\frac{(CSA^{IV\ NTG} - CSA^{baseline})}{CSA^{IV\ NTG}}\times 100\%\]
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
The extent of coronary vessel tone characterized by MDCTA may be helpful to predict VSA without CAG provocation test.
Thank you for your attention.