Introduction

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


• 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.


  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 of descending thoracic aorta is 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 (Agaston 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)=∆AaArea/ AoAD x ∆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 (0) or present (2)
  ③ SIS: sum of individual segment involvement scores

Results

Table: Demographic Data

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>Sex (male)</th>
<th>Hypertension</th>
<th>Diabetes</th>
<th>Dyslipidemia</th>
<th>Smoking</th>
<th>Medication</th>
<th>Total cholesterol (mg/dL)</th>
<th>Triglyceride (mg/dL)</th>
<th>HDL cholesterol (mg/dL)</th>
<th>LDL cholesterol (mg/dL)</th>
<th>hsCRP (mg/dL)</th>
<th>HbA1C (%)</th>
<th>FBS (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>175.93 ± 38.82</td>
<td>136.75 ± 78.66</td>
<td>46.70 ± 15.50</td>
<td>117.22 ± 48.54</td>
<td>14.65 ± 32.50</td>
<td>6.46 ± 1.34</td>
<td>118.62 ± 42.18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gensini</th>
<th>MVD</th>
<th>SSS</th>
<th>SIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol</td>
<td>0.006</td>
<td>0.066</td>
<td>-0.027</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>0.035</td>
<td>0.075</td>
<td>-0.021</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>-0.196</td>
<td>-0.190</td>
<td>-0.224**</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>-0.082</td>
<td>-0.044</td>
<td>-0.114</td>
</tr>
<tr>
<td>hsCRP</td>
<td>0.133</td>
<td>0.113</td>
<td>0.081</td>
</tr>
<tr>
<td>HbA1C (%)</td>
<td>0.130</td>
<td>0.254*</td>
<td>0.285**</td>
</tr>
<tr>
<td>FBS</td>
<td>0.207</td>
<td>0.157</td>
<td>0.203</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Gensini</th>
<th>MVD</th>
<th>SSS</th>
<th>SIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWT</td>
<td>0.318**</td>
<td>0.297**</td>
<td>0.338**</td>
</tr>
<tr>
<td>AC</td>
<td>0.270</td>
<td>0.211</td>
<td>0.330**</td>
</tr>
<tr>
<td>AD Asc</td>
<td>-0.218</td>
<td>-0.285**</td>
<td>-0.309**</td>
</tr>
<tr>
<td>AD Dsc</td>
<td>0.200*</td>
<td>-0.226</td>
<td>-0.248*</td>
</tr>
</tbody>
</table>

** P value < 0.05
* P value < 0.01
† Data are mean ± SD, ‡ Data are † of patients

 methodologies:
AWT: Aortic Wall Thickness
AC: Aortic Calcification
SSS: Segment Stenosis Score
SIS: Segment Involvement Score
AD: 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.