Coronary Artery Aneurysm After DES Implantation

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Coronary artery aneurysm after coronary intervention

Coronary aneurysms are rare findings after coronary intervention, with an incidence of 0.3% to 6%, depending on the definition used for vessel expansion.

Pseudoaneurysms are the most common form of trauma-induced coronary aneurysms, because of abnormal healing of an intimal dissection that occurs at the time of intervention.

True aneurysms involving all 3 layers are uncommon after coronary intervention.

Etiology of coronary artery aneurysm after coronary intervention

1. Deep artery injury (injury or resection of media)
   - Oversized balloon or stent
   - High pressure inflation
   - Atherectomy
   - Laser angioplasty
2. Residual dissection
3. Systemic anti-inflammation agents
   - Glucocorticoids
   - Colchicine
4. Kawasaki disease
5. Connective tissue disorder
   - Marfan’s disease
   - Ehlers-Danlos syndrome
Incidence of coronary artery aneurysm after coronary stenting

The STRESS trial

Coronary artery aneurysms were defined as areas of localized coronary artery dilatation ≥1.5 times the diameter of the adjacent normal reference segment.

Slata PA et al. *Am J Cardiol.* 1997;79:1104-1106
Does the incidence of coronary artery aneurysm increase after DES implantation?

1. The antiproliferative action which may delay the healing process.

2. The antimetabolite effect which may induce necrosis or apoptosis.

3. The antimigratory and antiproliferative action which may prevent myoblasts from colonizing and proliferating in an organized thrombus.

4. Hypersensitivity toward drug and polymer.
Does the incidence of coronary aneurysm increase after DES implantation?

Angiographic and IVUS pictures of the right coronary artery after Cypher implantation

Incidence of coronary artery aneurysm after CYPHER implantation

The SIRIUS trial

Definition of coronary aneurysm was minimum lumen diameter within treatment zone that was 1.2 times larger than the average reference diameter of vessel.

## Incidence of coronary artery aneurysm after TAXUS implantation

<table>
<thead>
<tr>
<th>Phase</th>
<th>Study Details</th>
<th>SR</th>
<th>BMS</th>
<th>SR-control (BMS)</th>
<th>BMS-control (BMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TAXUS II</strong></td>
<td>Colombo A, et al. Circulation. 2003;108:788-794</td>
<td>2.3%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.7%</td>
</tr>
<tr>
<td><strong>TAXUS IV</strong></td>
<td>Stone GW, et al. NEJM. 2004;350:221-231</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.7%</td>
</tr>
<tr>
<td><strong>TAXUS V</strong></td>
<td>Stone GW, et al. JAMA. 2005;294:1215-1223</td>
<td>1.4%</td>
<td>0.2%</td>
<td>0.7%</td>
<td>0.7%</td>
</tr>
<tr>
<td><strong>TAXUS VI</strong></td>
<td>Dauwkins KD, et al. Circulation. 2005;112:3306-3313</td>
<td>1.4%</td>
<td>0.5%</td>
<td>0.7%</td>
<td>0.7%</td>
</tr>
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</table>
Odds ratio of coronary artery aneurysm associated with DES vs. BMS

<table>
<thead>
<tr>
<th>Study</th>
<th>DES n/N</th>
<th>BMS n/N</th>
<th>Odds ratio</th>
<th>Odds ratio (95% CI)</th>
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<tbody>
<tr>
<td>SIRIUS</td>
<td>2/350</td>
<td>4/351</td>
<td>0.499</td>
<td>(0.091, 2.740)</td>
</tr>
<tr>
<td>TAXUS II SR</td>
<td>3/131</td>
<td>1/136</td>
<td>3.164</td>
<td>(0.325, 30.812)</td>
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<tr>
<td>TAXUS II MR</td>
<td>1/135</td>
<td>3/134</td>
<td>0.326</td>
<td>(0.033, 3.173)</td>
</tr>
<tr>
<td>TAXUS IV</td>
<td>2/292</td>
<td>2/267</td>
<td>0.914</td>
<td>(0.128, 6.533)</td>
</tr>
<tr>
<td>TAXUS V</td>
<td>7/498</td>
<td>1/492</td>
<td>7.000</td>
<td>(0.858, 57.107)</td>
</tr>
<tr>
<td>TAXUS VI</td>
<td>3/209</td>
<td>1/207</td>
<td>3.000</td>
<td>(0.310, 29.079)</td>
</tr>
<tr>
<td>Total</td>
<td>18/1615</td>
<td>12/1587</td>
<td></td>
<td>1.326 (0.571, 3.078)</td>
</tr>
</tbody>
</table>

Test for heterogeneity
X² = 6.335 (d.f. = 5), P = 0.275

Test for overall effect
Z = 0.656, P = 0.512
Incidence of coronary aneurysm after DES implantation in the daily practice

From India,
Coronary aneurysm was observed in 0.4% (4/2408) of DES.
  2 (SES) within 2 weeks; pericarditis (+)
  1 (SES) at 6 months; large aneurysm, restenosis (+)
  1 (PES) at 18 months; multiple small aneurysms, restenosis (+)


From Korea,
Routine angiography at 6 months were performed and 1.7% (5/296) of patients were diagnosed as coronary aneurysm.
  2 (SES); single small aneurysm, asymptomatic, restenosis (-)
  2 (SES); multiple small aneurysms, asymptomatic, restenosis (-)
  1 (PES); single small aneurysm, asymptomatic, restenosis (-)

Rha SW et al. Am J Cardiol. 2005;96(supple 7A):170H
Coronary aneurysm developed from incomplete stent apposition in the RAVEL

Coronary aneurysm developed from incomplete stent apposition in the RAVEL
## Published case reports of coronary aneurysm after DES implantation

<table>
<thead>
<tr>
<th>Author</th>
<th>Age</th>
<th>Gender</th>
<th>Presentation</th>
<th>DES</th>
<th>Vessel</th>
<th>Timing</th>
<th>Symptom</th>
<th>Reste</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Gupta</td>
<td>32</td>
<td>Male</td>
<td>AP</td>
<td>SES</td>
<td>LAD</td>
<td>3 days</td>
<td>ACS</td>
<td>-</td>
<td>CABG REPAIR</td>
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<tr>
<td>Gupta</td>
<td>55</td>
<td>Male</td>
<td>OMI</td>
<td>SES</td>
<td>LAD</td>
<td>2 weeks</td>
<td>ACS</td>
<td>-</td>
<td>CABG REPAIR</td>
</tr>
<tr>
<td>Singh</td>
<td>56</td>
<td>Male</td>
<td>AP</td>
<td>SES</td>
<td>LAD</td>
<td>2 weeks</td>
<td>MI</td>
<td>+</td>
<td>CABG</td>
</tr>
<tr>
<td>Panja</td>
<td>58</td>
<td>Male</td>
<td>ACS</td>
<td>SES</td>
<td>LAD</td>
<td>6 weeks</td>
<td>ACS</td>
<td>+</td>
<td>CABG REPAIR</td>
</tr>
<tr>
<td>Nislen</td>
<td>55</td>
<td>Female</td>
<td>AP</td>
<td>PES</td>
<td>LAD</td>
<td>2 months</td>
<td>-</td>
<td>-</td>
<td>Observe</td>
</tr>
<tr>
<td>Kaul</td>
<td>75</td>
<td>Female</td>
<td>ACS</td>
<td>SES</td>
<td>LAD</td>
<td>6 months</td>
<td>NYHA III</td>
<td>+</td>
<td>CABG REPAIR</td>
</tr>
<tr>
<td>Anandaraja</td>
<td>45</td>
<td>Female</td>
<td>NYHA III</td>
<td>PES</td>
<td>LAD</td>
<td>6 months</td>
<td>ACS</td>
<td>+</td>
<td>?</td>
</tr>
<tr>
<td>Vik-Mo</td>
<td>43</td>
<td>Male</td>
<td>?</td>
<td>PES</td>
<td>RCA</td>
<td>6 months</td>
<td>-</td>
<td>-</td>
<td>Graft stent</td>
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<tr>
<td>Kim</td>
<td>54</td>
<td>Male</td>
<td>AP</td>
<td>PES</td>
<td>LAD</td>
<td>6 months</td>
<td>-</td>
<td>-</td>
<td>Observe</td>
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<tr>
<td>Kim</td>
<td>63</td>
<td>Female</td>
<td>Exertional AP</td>
<td>PES</td>
<td>LCX</td>
<td>6 months</td>
<td>-</td>
<td>-</td>
<td>Observe</td>
</tr>
<tr>
<td>Bavry</td>
<td>45</td>
<td>Male</td>
<td>?</td>
<td>PES</td>
<td>RCA</td>
<td>6 months</td>
<td>?</td>
<td>?</td>
<td>Observe</td>
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<tr>
<td>Le</td>
<td>73</td>
<td>Male</td>
<td>ACS</td>
<td>PES</td>
<td>LMT</td>
<td>7 months</td>
<td>CHF</td>
<td>-</td>
<td>CABG REPAIR</td>
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<tr>
<td>Stabile</td>
<td>52</td>
<td>Female</td>
<td>ACS</td>
<td>SES</td>
<td>LAD/RCA</td>
<td>7 months</td>
<td>AP</td>
<td>+</td>
<td>BMS</td>
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<tr>
<td>Bavry</td>
<td>49</td>
<td>Female</td>
<td>?</td>
<td>SES</td>
<td>LMT</td>
<td>10 months</td>
<td>?</td>
<td>?</td>
<td>Observe</td>
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<tr>
<td>Li</td>
<td>12</td>
<td>Female</td>
<td>AP</td>
<td>SES</td>
<td>RCA</td>
<td>1 year</td>
<td>-</td>
<td>-</td>
<td>Observe</td>
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<tr>
<td>Abreu</td>
<td>52</td>
<td>Male</td>
<td>ACS</td>
<td>SES</td>
<td>LCX</td>
<td>15 months</td>
<td>AP</td>
<td>-</td>
<td>Observe</td>
</tr>
<tr>
<td>Bavry</td>
<td>49</td>
<td>Female</td>
<td>?</td>
<td>SES</td>
<td>LCX</td>
<td>19 months</td>
<td>?</td>
<td>?</td>
<td>CABG</td>
</tr>
<tr>
<td>Bavry</td>
<td>44</td>
<td>Male</td>
<td>?</td>
<td>PES</td>
<td>LCX</td>
<td>21 months</td>
<td>?</td>
<td>?</td>
<td>Coiling</td>
</tr>
</tbody>
</table>
Algorithm for the treatment of coronary aneurysm after DES implantation

- Infectious etiology
  - Infectious aneurysm (+)
  - Infectious aneurysm (-)

- Antibiotic therapy
- Surgical treatment
- Excision of the aneurysm
- CABG

- IVUS
- Pseudoaneurysm
- Symptom (+)
- Symptom (-)

- Large* or symptom (+)
- Small** or symptom (-)

- Percutaneous treatment
  - Stent graft
  - Bare metal stent
  - Coil (true aneurysm)
  - Surgical treatment

- True aneurysm
  - Follow up angiography at 3-6 months
  - No change/smaller without symptom
  - Larger
  - Careful observation (considering follow-up angiography or coronary CT)
  - Double antiplatelet therapy

- Large *
- Small **
Coronary artery aneurysms after DES implantation are rare, with an incidence of 0.2% to 2.3% in the DES and BMS pivotal randomized trials.

The clinical course of coronary artery aneurysms after DES implantation is variable. Some aneurysms naturally resolve, but some aneurysms can lead to life-threatening complications.

Although the best treatment for coronary aneurysms after DES is controversial, we propose that a combination of aneurysm size, expansion history, pathophysiology, and symptoms be used to decide on treatment.

Expanding pseudoaneurysms, infected aneurysms, and large, chronic (and expanding) aneurysms with symptoms should be treated.

Further investigation is necessary to determine the pathophysiology, natural history, and best therapies for DES-associated aneurysms.
Incidence of coronary artery aneurysm after TAXUS implantation

TAXUS II, IV, V and VI

P = 0.11

TAXUS
16/1265

BMS
8/1236
Predictors for late acquired incomplete stent apposition after DES implantation

In the IVUS data from TAXUS II trial,
Significant predictors for late acquired incomplete stent apposition were
1) Lesion length
2) Unstable angina
3) Absence of diabetes


In the IVUS data from the Asan medical center,
Significant predictors for late stent malapposition were
1) Total stent length
2) Acute myocardial infarction
3) Chronic total occlusion

SIRIUS - Angio Aneurysms @
The Two Worst SIRIUS Cases with Aneurysms at 8 mos Angio FU

Both in control bare metal stents!
Aneurysm A-1

Baseline

Stent

Final
Aneurysm A-2

8 month follow-up
Aneurysm B-1

Baseline

After stenting
Aneurysm B-2

8 month follow-up
Aneurysm C-1
Baseline
Aneurysm C-2

8 month follow-up
Sirolimus Associated Aneurysm

Baseline

After pre-dilatation
Sirolimus Associated Aneurysm
- 2

After stents implantation
Sirolimus Associated Aneurysm

8 month follow-up
Brazil

Micotic

Aneurysms
kawasaki

waksman
Fig. 3. Giant aneurysm proximal to stent and progression of lesion in proximal left anterior descending artery and circumflex.