Serial Changes of Neointimal Hyperplasia and Coverage on the Drug Eluting Stent Struts Crossing the Side-branch Vessels Evaluated by Optical Coherence Tomography Imaging.


Toyohashi Heart Center, Japan
Presenter Disclosure Information

Nothing to disclose related to this presentation.
Late stent thrombosis

Although DES has reduced rates of restenosis, late thrombosis, a life-threatening complication of this technology has emerged as a major concern.

Lancet 2004; 364: 1519-21
Late thrombosis in drug-eluting coronary stents after discontinuation of antiplatelet therapy

J Am Coll Cardiol 2005;45:2088-92
Late thrombosis: 0.35% ( 7 / 2,006 patients)  
8 late thromboses / 7 patients  
Aspirin (+) : 5 late thromboses  
No aspirin or clopidogrel : 3 late thromboses
A Bifurcation Lesion is the one of the most important Predictors of Late Stent Thrombosis

Interventional Cardiology

Correlates and Long-Term Outcomes of Angiographically Proven Stent Thrombosis With Sirolimus- and Paclitaxel-Eluting Stents

Pramod K. Kuchulakanti, MD; William W. Chu, MD, PhD; Rebecca Torguson, BS; Patrick Ohlmann, MD; Seung-Woon Rha, MD; Leonardo C. Clavijo, MD, PhD; Sang-Wook Kim, MD; Ahn Bui, MD; Natalie Gevorkian, MD; Zhenyi Xue, MS; Kimberly Smith, BS; Jana Fournadjieva, PhD; William O. Suddath, MD; Lowell F. Satler, MD; Augusto D. Pichard, MD; Kenneth M. Kent, MD; Ron Waksman, MD

There were more bifurcation lesions, type C lesion, and a trend for smaller diameter stents.
Pathology of Drug-Eluting Stents in Humans: Delayed Healing and Late Thrombotic Risk


The cause of LST might be delayed arterial healing in combination with other clinical and procedural risk factors.
Struts that crossed side branches were excluded from grading because they all showed grade 0 coverage.

Really?
Neointimal Coverage of SES struts Crossing a Side-branch@ 9 months follow-up

M. Terashima, et al. in AHA 2008
Backgrounds

- When DES implantation is performed to cross over the side-branch vessel (SBV) for the treatment of the bifurcation lesion, the lack of attachment of the stent struts to the vessel wall might not allow the enough neointimal coverage on the stent struts.

- The serial situational changes of neointimal hyperplasia (NIH) and coverage on DES struts which are placed across the SBV were not well evaluated.
Purpose

- The purpose of this study was to evaluate the serial changes of neointimal hyperplasia and coverage on the DES struts with cross over the SBV using Optical Coherence Tomography (OCT) imaging.
**Subjects**

- Thirty three patients who were treated bifurcation lesion with single DES implantation with cross over the SBV and serial OCT follow up were enrolled in this study.

*Patients with In-stnet restenosis, chronic kidney disease and kissing balloon technique were excluded.*
# Patients Characteristics

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Patients, n</td>
<td>33</td>
</tr>
<tr>
<td>Age, y</td>
<td>67 ± 8</td>
</tr>
<tr>
<td>Male Gender, %</td>
<td>88%</td>
</tr>
</tbody>
</table>

## Medical History

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyslipidemia</td>
<td>30%</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>33%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>48%</td>
</tr>
<tr>
<td>Current Smoking</td>
<td>24%</td>
</tr>
<tr>
<td>Obesity</td>
<td>30%</td>
</tr>
</tbody>
</table>

Values are means ± SD or percentage
OCT Analysis

Region of interest

They were imaged with motorized OCT pull back system (1mm/s) analyzed at 0.3 mm interval.
## Lesion and Stent Demographics

- Number of drug eluting Stents, n: 33
  - Sirolimus eluting stent: 27
  - Paclitaxel eluting stent: 6
- Vessels (LAD/LCX/RCA): 19 / 6 / 8
- Stent diameter, mm: $2.9 \pm 0.4$
- Stent length, mm: $27.7 \pm 11.4$

## OCT analysis of stent strut

<table>
<thead>
<tr>
<th></th>
<th>First OCT</th>
<th>Second OCT</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jailed struts analysis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total no. of stent strut</td>
<td>362</td>
<td>328</td>
<td></td>
</tr>
<tr>
<td>Mean no. of stent strut</td>
<td>$11 \pm 8$</td>
<td>$10 \pm 7$</td>
<td>P=0.53</td>
</tr>
<tr>
<td><strong>Main vessel stent struts analysis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total no. of stent strut</td>
<td>1214</td>
<td>1151</td>
<td></td>
</tr>
<tr>
<td>Mean no. of stent strut</td>
<td>$37 \pm 26$</td>
<td>$35 \pm 28$</td>
<td>P=0.81</td>
</tr>
</tbody>
</table>

Values are means ± SD, percentage or number
Representative cases

Serial changes of neointimal thickness and coverage

Before PCI

After PCI

Cranial view

Drug eluting stent
Representative cases

Serial changes of neointimal thickness and coverage

9 months later
RAO cranial view

20 months later
Cranial view
Representative cases

Serial changes of neointimal thickness and coverage

9 months later

20 months later
Representative cases
Serial changes of neointimal thickness and coverage

9 months later

20 months later
Average neointimal hyperplasia

Jailed stent strut analysis

Main vessel stent strut analysis

P = 0.94

P < 0.01
Percentage of uncovered stent strut

Jailed stent strut analysis

Main vessel stent strut analysis

- 9 months
- 21 months

P<0.01

P=0.63
Summary

- Average NIH of MV strut at the second follow up was similar to that at the first follow up.
- Average NIH of jailed strut at the second follow up was significantly increased compared to that in the first follow up.
- The percentage of uncovered MV strut at the second follow up was not decreased compared to that at the first follow up.
- The percentage of uncovered jailed strut at the second follow up was significantly decreased compared to that at the first follow up.
Limitations

- Sample size was small. Larger studies are required to confirm the current observations.
- The analyzed side branches were relatively small because large side branches (≥2.5mm) are usually dilated with kissing balloon technique.
- There are few pathological reports directly confirming our in vivo results.
Conclusion

In this follow up study, delayed endothelialization of jailed struts was observed at more than 20 months follow up.