Disclosure

I have nothing to disclose
Mechanisms of Angiographic SB Jailing

Carina Shift

Initial After Cross-Over

LCX FFR 0.91
Post-stenting
Carina Shift
After cross-over

Area Change

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>ΔLumen</td>
<td>-3.4 mm$^2$</td>
</tr>
<tr>
<td>ΔVessel</td>
<td>-3.5 mm$^2$</td>
</tr>
<tr>
<td>ΔPlaque</td>
<td>-0.1 mm$^2$</td>
</tr>
</tbody>
</table>

LCX MLA 7.2 mm$^2$
EEM area 9.3 mm$^2$
P+M area 2.1 mm$^2$

LCX MLA 3.8 mm$^2$
EEM area 5.8 mm$^2$
P+M area 2.0 mm$^2$
Mechanisms of Angiographic SB Jailing

Plaque Shift

Pre-procedural

Post-stenting

After cross-over

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<thead>
<tr>
<th>Area Change</th>
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<tbody>
<tr>
<td>Lumen</td>
<td>-1.9mm²</td>
</tr>
<tr>
<td>Vessel</td>
<td>-0.4mm²</td>
</tr>
<tr>
<td>Plaque</td>
<td>+1.5mm²</td>
</tr>
</tbody>
</table>

LCX MLA 6.9mm²
EEM area 9.1mm²
P+M 2.2 mm²

LCX MLA 5.0mm²
EEM area 8.7mm²
P+M 3.7 mm²
Plaque Shift vs. Carina Shift

- Mechanisms of SB Compromise
- Impact on SB Luminal Loss
- Impact on Functional Significance
### Anatomic and Functional Evaluation of Bifurcation Lesions Undergoing Percutaneous Coronary Intervention

Bon-Kwon Koo, MD, PhD; Katsuhisa Waseda, MD, PhD; Hyun-Jae Kang, MD, PhD; Hyo-Soo Kim, MD, PhD; Chang-Wook Nam, MD, PhD; Seung-Ho Hur, MD, PhD; Jung-Sun Kim, MD, PhD; Donghoon Choi, MD, PhD; Yangsoo Jang, MD, PhD; Joo-Yong Hahn, MD, PhD; Hyeon-Cheol Gwon, MD, PhD; Myeong-Ho Yoon, MD, PhD; Seung-Jea Tahk, MD, PhD; Woo-Young Chung, MD, PhD; Young-Seok Cho, MD, PhD; Dong-Ju Choi, MD, PhD; Takao Hasegawa, MD; Toru Kataoka, MD; Sung Jin Oh, MD; Yasuhiro Honda, MD; Peter J. Fitzgerald, MD, PhD; William F. Fearon, MD

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
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<tbody>
<tr>
<td><strong>Lumen VI</strong></td>
<td>3.5±1.5</td>
<td>6.1±2.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Plaque VI</strong></td>
<td>5.4±1.8</td>
<td>5.3±1.7</td>
<td>0.227</td>
</tr>
<tr>
<td><strong>Vessel VI</strong></td>
<td>9.0±2.5</td>
<td>11.3±3.1</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Luminal gain is not caused by plaque shift but by EEM expansion, leading to carina shift and SB compromise.

*Koo et al. Circ Cardiovasc Interv 2010;3:113-9*
Changes in Left Main Bifurcation Geometry After a Single-Stent Crossover Technique

An Intravascular Ultrasound Study Using Direct Imaging of Both the Left Anterior Descending and the Left Circumflex Coronary Arteries Before and After Intervention (n=23 LM bifurcation lesions)

**MLA within LCX ostium**

5.4mm\(^2\) → 4.0mm\(^2\)

*p=0.009*

**EEM area at MLA**

11.8mm\(^2\) → 9.6mm\(^2\)

*p=0.048*

**EEM eccentricity**

1.22 → 1.47

*p<0.001*

78% showed a >10% reduction of MLA within LCX ostium after cross-over stenting

Carina Shift
Primary Mechanism of SB Compromise

%Δ MLA, LCX os (%) vs %Δ EEM area at MLA site (%)

Change in EEM eccentricity

Kang et al. Circ Cardiovasc Interv 2011 Accepted
Plaque Redistribution
Second Mechanism of SB Compromise

In 39%, plaque redistribution may be superimposed on carina shift to contribute to further lumen loss

Kang et al. Circ Cardiovasc Interv 2011 Accepted
A narrow distal carina angle predicts a greater reduction in MLA and EEM area at the LCX ostium.
Plaque Shift vs. Carina Shift

- Mechanisms of SB Compromise
- Impact on SB Luminal Loss
- Impact on Functional Significance
In 90 non-LM bifurcation lesions with SB DS <75%, post-stenting SB FFR <0.80: 18%
SB FFR <0.75: 9%

**SB MLA 2.4mm²**

- Sensitivity 94%
- Specificity 68%
- PPV 40%
- NPV 98%

**Plaque burden 50%**

- Sensitivity 75%
- Specificity 71%
- PPV 36%
- NPV 93%

Kang et al. Am J Cardiol 2011;107:1787-93
Only 52% FFR < 0.80

94% FFR ≥ 0.80

No suggestion for role of mechanisms of SB change lack of post-stenting SB IVUS

Kang et al. Am J Cardiol 2011;107:1787-93
**Impact of Changes in SB Geometry**

After MB Stenting in 40 Non-LM Bifurcations

*A decrease in SB MLA >10% was found in 78% (31/40)*

<table>
<thead>
<tr>
<th>SB MLA (mm²)</th>
<th>EEM (mm²)</th>
<th>Eccentricity</th>
<th>P+M (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5±1.3→2.8±1.2</td>
<td>6.3±1.9→5.5±1.7</td>
<td>1.1±1.1→1.4±0.2</td>
<td>2.8±1.5→2.7±1.3</td>
</tr>
</tbody>
</table>

**AMC Preliminary**
Variable degree of carina shift characterized by Eccentricity↑EEM↓ was associated in almost all lesions

AMC Preliminary
Plaque Shift + Carina Shift

\[ \Delta P + M \]

Isolated Carina Shift

\[ \Delta V / \Delta L \]

45%

55%

AMC Preliminary
Impact of Mechanisms on FFR

After MB Stenting

Post-stenting SB MLA poorly predicts functional significance of SB SB FFR measurement

MLA 1.9mm²

FFR 0.83
Relationship Between MLA–FFR

Overall, 15% (6/40) showed FFR<0.80

Post-PCI MLA of SB (mm²)
Impact of Mechanisms on FFR

28% in the presence of Plaque Shift

5% in Isolated Carina Shift

\[ \Delta P + M \]

\[ \Delta V / \Delta L \]

\[ p = 0.041 \]

FFR \( \geq 0.80 \)

FFR < 0.80

AMC Preliminary
Predictor for Plaque Shift

<table>
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<tbody>
<tr>
<td>Lumen area, MB carina</td>
<td>-0.137</td>
<td>0.399</td>
</tr>
<tr>
<td><strong>Plaque burden, MB carina</strong></td>
<td><strong>0.341</strong></td>
<td><strong>0.031</strong></td>
</tr>
<tr>
<td>Plaque burden, distal MB</td>
<td>0.299</td>
<td>0.061</td>
</tr>
<tr>
<td>Plaque burden, proximal MB</td>
<td>-0.039</td>
<td>0.813</td>
</tr>
<tr>
<td>Plaque burden, SB ostium</td>
<td>-0.218</td>
<td>0.176</td>
</tr>
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MB Cross-over

Pre-procedural

SB carina

SB MLA 2.3 mm²
EEM area 5.0 mm²
P+M 2.7 mm²

MB distal to carina
Functional SB compromise was mainly due to plaque shift which is predicted by huge PB at the MB carina.

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<th>Post-stenting</th>
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<td>1.0 mm$^2$</td>
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SB MLA 2.3 mm$^2$
EEM area 5.0 mm$^2$
P+M 2.7 mm$^2$

SB MLA 1.4 mm$^2$
EEM area 4.7 mm$^2$
P+M 3.3 mm$^2$
Summary

- Anatomical SB jail is more common than functional compromise

- Considering the frequent mismatch between MLA and FFR, functional compromise should be confirmed by post-stenting FFR

- Carina shift with variable degree is a general mechanism of SB jailing, occurs in almost all lesions

- Plaque shift is less frequent, but more aggressive mechanism for functional SB compromise