How Bifurcation Angle Impact the Fate of Side Branch after Main Vessel Stenting

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Potential conflicts of interest

Speaker's name: Kefei Dou

☑ I do not have any potential conflict of interest
Coronary bifurcation angles:

- Important factors affecting coronary bifurcation intervention
## Conventional Wisdom

<table>
<thead>
<tr>
<th>Studies</th>
<th>Sample size</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gil et al in 2009</td>
<td>92</td>
<td>Bifurcation angle was not correlated with side branch compromise.</td>
</tr>
<tr>
<td>Kang et al in 2011</td>
<td>23</td>
<td>Greater percent reduction in lumen area of side branch was associated with small bifurcation angle ( (r=0.472, P=0.023) )</td>
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<tr>
<td>Gwon et al in 2012</td>
<td>44</td>
<td>Side branch compromise was not correlated with bifurcation angle ( (r=0.117; P=0.45) )</td>
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<tr>
<td>Goto et al in 2012</td>
<td>80</td>
<td>Bifurcation angle was not an independent predictor of side branch occlusion</td>
</tr>
<tr>
<td>Hahn et al in 2013</td>
<td>2227</td>
<td>Bifurcation angle was not an independent predictor of side branch occlusion</td>
</tr>
</tbody>
</table>
Conventional wisdom

◆ Side branch < 2.0mm were usually ignored
◆ Bifurcation located at RCA or LCX do not draw enough attention,
◆ Conventional wisdom is the production of 25% (>2.0mm LM/LAD/LCX) of all bifurcation lesions
Study Flowchart

Data base: 1171 consecutive patients with 1200 lesions

Data collection:
1. Baseline characteristics
2. Lesion characteristics of coronary angiography
3. Intervention procedural characteristics
4. Quantitative coronary angiography analysis data of baseline and procedure

Univariate analysis

Multivariate analysis

Independent predictors of SB occlusion
Angle Distribution

Bifurcation angle distribution

Quartile I: 40°
Quartile II: 52°
Quartile III: 69°
Incidence of SB Occlusion across Quartile of BA

Incidence of SB occlusion across quartile of BA

- BA ≤ 40°: 3.63%
- 40° < BA ≤ 52°: 4.71%
- 52° < BA ≤ 69°: 8.14%
- BA > 69°: 12.97%

Range of bifurcation angle (BA) (°)
### Predictors of SB Occlusion

<table>
<thead>
<tr>
<th>Independent predictors</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>High bifurcation angle (°)</td>
<td>1.026</td>
<td>1.014-1.037</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Plaque distribution at the same side of SB</td>
<td>1.988</td>
<td>1.237-3.194</td>
<td>0.0045</td>
</tr>
<tr>
<td>MV TIMI flow grade before stenting</td>
<td>4.204</td>
<td>2.099-8.420</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Pre-procedural diameter stenosis of bifurcation core (%)</td>
<td>1.013</td>
<td>1.004-1.021</td>
<td>0.0037</td>
</tr>
<tr>
<td>Diameter ratio between MV/SB</td>
<td>5.901</td>
<td>2.933-11.872</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Diameter stenosis of SB before MV stenting (%)</td>
<td>1.029</td>
<td>1.018-1.040</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

OR: odds ratio  
CI: confidence interval
State variable: SB occlusion after main vessel stenting

Test variable: bifurcation angle

Area under the curve: 0.655 (95% CI: 0.594-0.716, p<0.001).
Bifurcations with smaller angle was easier for flow diversion into SB.
Too large angle increases the pressure drop and flow resistance.

\[\theta_1, \theta_2\]

**Ostium length** \( \propto \left( \frac{\text{Reference Diameter}}{\sin \theta} \right) \) \(^1\)

\( \theta_1 \): bifurcation angle between distal MV and SB1;
\( \theta_2 \): bifurcation angle between distal MV and SB2;
RD of SB1 = RD of SB2; \( \theta_1 > \theta_2 \);
Ostium length of SB1 < Ostium length of SB2;
MV = main vessel; SB = side branch; RD = reference diameter

Wider angle, smaller ostium area.
Wider angle, heavier plaque burden.

- Wider angle decreased wall shear stress and increases oscillatory shear index significantly around the carina: induce plaque proliferation at the bifurcation region\(^1\), thus lead to heavier plaque burden.

- Wider angle was significantly associated with high-risk and noncalcified plaques in their proximal MV segments\(^2\), which is an independent predictors of SB occlusion\(^3\).

\(^1\)Rodriguez-Granillo GA et al. JACC. 2006;47:884-5.
\(^4\)Yunlong Huo et al. J Biomech. 2012 Apr 30;45(7):1273-9
High BA is Independent Risk factor of SBO
Final Results
Published Articles

How Bifurcation Angle Impacts the Fate of Side Branch After Main Vessel Stenting: A Retrospective Analysis of 1,200 Consecutive Bifurcation Lesions in a Single Center


Thank you for your attention!