NOBORI - Bifurcation Substudy

Dr. Bernard Chevalier
on behalf of NOBORI II investigators
Nobori DES 3.5mm dilated with 4 mm balloon

Optimal Side Branch Access

Biodegradable Polymer Abluminal Coating

Enhanced deliverability thanks to hydrophilic coating

Biolimus A9
Left main bifurcation bench: 4.0/3.5/3.2 mm
Angle 70°
Nobori 3.5 x 24 at 12 ATM
Proximal vessel 4.5 mm, distal 3.5 mm
Nobori 3.5 x 24 at 12 ATM
Proximal vessel 4.5 mm, distal 3.5 mm
POT technique using Hiryu 4.5 x 10
Nobori 3.5 x 24 at 12 ATM
Proximal vessel 4.5 mm, distal 3.5 mm
After POT and after side branch opening
Nobori 3.5 x 24 at 12 ATM
Proximal vessel 4.5 mm, distal 3.5 mm
Final double balloon kissing
Nobori 3.5 x 24 at 12 ATM
Proximal vessel 4.5 mm, distal 3.5 mm
Final result after kissing
1 Nobori 3.5 x 24
1 Nobori 3.0 x 24
Proximal vessel 4.5 mm, distal 3.5 mm
Final result after kissing
Patients Population

- All patients eligible for PCI using DES
- Sizes of the vessel matches available Nobori DES diameters
- No restriction on number of vessels or lesions treated

Exclusion:
- Allergy to aspirin colpidogrel, contrast media, stainless steel, sirolimus or biolimus
- Not signed informed consent
Study limitations

- NOBORI Bifurcation is a substudy of NOBORI 2 study
- Design of the study and CRF not adapted for bifurcation stenting
- No specific information about stenting technique are collected
- Most of the procedure related data originate from QCA analysis
695 patients were treated for bifurcation lesions

**Primary endpoint:**

**Target Lesion Failure (TLF) at 12 months:**

composite of cardiac death, myocardial infarction (MI) target vessel related and target lesion revascularisation (TLR)
**PI:**
Dr. G.B. Danzi

**Executive Operational Committee:**
- B. Chevalier
- P. Urban
- W. Wijns
- M. Wiemer
- J. Goicolea
- A. Serra

**Monitoring**
- 100% monitoring on-line, 30% on-site

**Study management**
- Terumo Europe

**Data management**
- Electronic data collection KIKA
- In-house and outsourced statistics

**Steering Committee:**
- E. Stabile
- K. E. Hauptmann
- P. Kala
- J. Koolen
- R. Koning
- F. Fath-Ordoubadi
- D. Carrie

**CEC – all events adjudicated**
- C. Hanet
- G. Stankovic
- J. Vos
- M.A. Vogt
- B. Rensing
- C. Royaards

**Angiographic Corelab:**
- MCR – Milan
- CorExperts - Belgrade

**Sponsor**
- Terumo
## NOBORI - Bifurcation Study
### Baseline Demographics

<table>
<thead>
<tr>
<th></th>
<th>Bifurcation n=695</th>
<th>No-bifurcation n=2130</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years±SD</td>
<td>65 ±11</td>
<td>64 ±11</td>
<td>0.73</td>
</tr>
<tr>
<td>Male</td>
<td>83</td>
<td>76</td>
<td>0.0003</td>
</tr>
<tr>
<td>Previous MI</td>
<td>31.8</td>
<td>34.3</td>
<td>0.24</td>
</tr>
<tr>
<td>Prior PCI</td>
<td>30.4</td>
<td>32.5</td>
<td>0.30</td>
</tr>
<tr>
<td>Prior CABG</td>
<td>6.4</td>
<td>9.3</td>
<td>0.02</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>27.1</td>
<td>29.9</td>
<td>0.17</td>
</tr>
<tr>
<td>Insulin-dependent</td>
<td>7.2</td>
<td>6.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>69.7</td>
<td>72.0</td>
<td>0.28</td>
</tr>
<tr>
<td>Hypertension</td>
<td>68.3</td>
<td>69.3</td>
<td>0.60</td>
</tr>
<tr>
<td>Current smoker</td>
<td>24.1</td>
<td>25.4</td>
<td>0.52</td>
</tr>
<tr>
<td>Charlson Comorbidity</td>
<td>3.1 ±1.7</td>
<td>3.2±1.8</td>
<td>0.44</td>
</tr>
</tbody>
</table>

NOBORI - Bifurcation Study
Baseline Demographics
## NOBORI - Bifurcation Study Clinical Presentation

<table>
<thead>
<tr>
<th>Angina status before PCI, %</th>
<th>Bifurcation (n=695)</th>
<th>No-bifurcation (n=2130)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silent ischemia</td>
<td>16.3</td>
<td>14.8</td>
<td>0.33</td>
</tr>
<tr>
<td>Stable angina</td>
<td>43.7</td>
<td>46.2</td>
<td>0.27</td>
</tr>
<tr>
<td>Unstable angina</td>
<td>40.0</td>
<td>39.0</td>
<td>0.65</td>
</tr>
<tr>
<td>Acute coronary syndrome</td>
<td>51.5</td>
<td>54.1</td>
<td>0.25</td>
</tr>
</tbody>
</table>
**NOBORI - Bifurcation Study**  
**Lesion Location**

<table>
<thead>
<tr>
<th>%</th>
<th>Bifurcation lesions</th>
<th>No bifurcation lesions</th>
<th>Total</th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Graft</strong></td>
<td>0.3</td>
<td>1.0</td>
<td>0.4</td>
<td>2.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>LAD</strong></td>
<td>56.8</td>
<td>33.6</td>
<td>48.4</td>
<td>37.8</td>
<td></td>
</tr>
<tr>
<td><strong>RCA</strong></td>
<td>13.1</td>
<td>36.6</td>
<td>21.1</td>
<td>33.9</td>
<td></td>
</tr>
<tr>
<td><strong>LCX</strong></td>
<td>26.2</td>
<td>27.0</td>
<td>27.0</td>
<td>25.2</td>
<td></td>
</tr>
<tr>
<td><strong>LM</strong></td>
<td>3.7</td>
<td>1.8</td>
<td>3.0</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bifurcation lesions</td>
<td>No bifurcation lesions</td>
<td>Total</td>
<td>Total</td>
<td>p-value</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Lesion length, mm</td>
<td>16.25±9.85</td>
<td>15.68±10.74</td>
<td>16.09±10.10</td>
<td>15.38±9.36</td>
<td>0.10</td>
</tr>
<tr>
<td>RVD -pre, mm</td>
<td>2.62±0.58</td>
<td>2.63±0.60</td>
<td>2.62±0.59</td>
<td>2.61±0.58</td>
<td>0.52</td>
</tr>
<tr>
<td>MLD - pre, mm</td>
<td>0.83±0.46</td>
<td>0.93±0.49</td>
<td>0.86±0.47</td>
<td>0.82±0.51</td>
<td>0.02</td>
</tr>
<tr>
<td>Diameter stenosis - pre, %</td>
<td>68.0±16.6</td>
<td>65.0±15.4</td>
<td>67.12±16.35</td>
<td>68.59±17.91</td>
<td>0.03</td>
</tr>
<tr>
<td>RVD -post, mm</td>
<td>2.87±0.50</td>
<td>2.85±0.55</td>
<td>2.87±0.51</td>
<td>2.89±0.50</td>
<td>0.12</td>
</tr>
<tr>
<td>MLD - post, mm</td>
<td>2.46±0.46</td>
<td>2.49±0.50</td>
<td>2.47±0.47</td>
<td>2.52±0.47</td>
<td>0.002</td>
</tr>
<tr>
<td>Diameter stenosis - post, %</td>
<td>14.2±7.8</td>
<td>12.8±6.6</td>
<td>13.83±7.53</td>
<td>12.78±6.79</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Acute gain in-stent, mm</td>
<td>1.64±0.54</td>
<td>1.55±0.58</td>
<td>1.61±0.55</td>
<td>1.70±0.59</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
NOBORI - Bifurcation Study
Medina Classification

1,1,1 21.0%
1,1,0 41.0%
1,0,1 3.0%
0,1,1 3.0%
1,0,0 8%
0,1,0 16.0%
0,0,1 8.0%
<table>
<thead>
<tr>
<th></th>
<th>Bifurcation n=695</th>
<th>No-bifurcation n=2130</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diseased vessels per patient</td>
<td>1.83 ± 0.76</td>
<td>1.70 ± 0.77</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lesions per patient</td>
<td>2.22 ± 1.16</td>
<td>1.96 ± 1.11</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lesions treated per patient</td>
<td>1.61 ± 0.81</td>
<td>1.33 ± 0.62</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Stents per patient</td>
<td>2.00 ± 1.25</td>
<td>1.66 ± 1.00</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
NOBORI - Bifurcation Study
Lesions treatment

**Bifurcation Lesions**  
*n=705*

- **True Bifurcation**  
  *n=190*
  - 2 Wires Technique 121
    - 3 Stents: 3
    - 2 Stents: 55
    - 1 Stent: 63
    - 1 Stent+Balloon: 7
  - 1 Wire Technique 69
    - Kissing balloon 39
    - Kissing Balloon 24

- **Partial Bifurcation**  
  *n=515*
  - 2 Wires Technique 195
    - 2 stents: 6
    - 1 stent: 182
    - 1 stent+Balloon: 7
    - Balloon only: 4
  - 1 Wire Technique 320
    - 1 Stent: 309
    - 1 Stent+Balloon: 7
    - Balloon only: 4

Kissing balloon for True Bifurcation: 39
Kissing Balloon for Partial Bifurcation: 24

**True bifurcation** = Medina 1.1.1 + 0.1.1. + 1.0.1
**Partial bifurcation** = Medina 1.1.0 + 0.1.0 + 1.0.0 + 0.0.1
<table>
<thead>
<tr>
<th>Event</th>
<th>Bifurcation (n=695)</th>
<th>No-Bifurcation (n=2130)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Death</td>
<td>0.6</td>
<td>1.3</td>
<td>0.15</td>
</tr>
<tr>
<td>MI</td>
<td>2.3</td>
<td>1.3</td>
<td>0.08</td>
</tr>
<tr>
<td>TL-CABG</td>
<td>0.6</td>
<td>0.4</td>
<td>0.50</td>
</tr>
<tr>
<td>TL-Re-PCI</td>
<td>2.0</td>
<td>1.6</td>
<td>0.50</td>
</tr>
<tr>
<td>TV-Re-PCI, non TL</td>
<td>1.2</td>
<td>1.1</td>
<td>0.84</td>
</tr>
<tr>
<td>TLF</td>
<td>4.5</td>
<td>3.4</td>
<td>0.20</td>
</tr>
<tr>
<td>MACE</td>
<td>5.3</td>
<td>4.5</td>
<td>0.35</td>
</tr>
</tbody>
</table>

TLF = Cardiac death, MI-TV related, clinically driven TLR; MACE = cardiac death, any MI, TVR
NOBORI - Bifurcation Study
1 Year Clinical Outcomes

Kaplan-Meier survival curves - TLF

Days after index procedure

% patients

Patients with bifurcation
Patients without bifurcation
NOBORI - Bifurcation Study
1 Year Clinical Outcomes

Kaplan-Meier survival curves - Cardiac Death

- Patients with bifurcation
- Patients without bifurcation

Days after index procedure
NOBORI - Bifurcation Study
1 Year Clinical Outcomes

Kaplan-Meier survival curves - Any MI

- Patients with bifurcation
- Patients without bifurcation

Days after index procedure
NOBORI - Bifurcation Study
1 Year Clinical Outcomes
NOBORI - Bifurcation Study
1 Year Stent Thrombosis

ST = Definite/Probable according to ARC
Despite the inherent limitations related to study design, it is possible to conclude that NOBORI Bifurcation substudy showed good procedural success and low rates of death, MI, TLR and TVR at 1 year FUP.

Particularly appealing is absence of late stent thrombosis in bifurcation group.

Wide cell opening of Nobori stent, biodegradable polymer and abluminal coating, might have contributed to those encouraging findings.

Planned long term follow-up will give further valuable information about durability of treatment with this new stent.