Culotte Technique in Left Main Disease

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• No Disclosures
# Culotte technique for LM Bifurcation

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be used as a provisional bifurcation strategy</td>
<td>Access to LAD/LCX lost during stent implantation with potential not to be able to re-enter with the wire, balloon or 2nd stent</td>
</tr>
<tr>
<td>Is adaptable to varying angles between LAD and LCx, even retrovert origin</td>
<td>Left main often too large for the current drug-eluting stent diameters</td>
</tr>
<tr>
<td>Ensures complete lesion coverage (with some exceptions .......!!)</td>
<td>Relatively few DES with proven low restenosis (e.g. Cypher, Taxus, Promus/Xience) with struts that can be opened &gt; 3.5mm (Promus/Xience ~ 4mm)</td>
</tr>
</tbody>
</table>
Side branch access

Cypher

Taxus Express

Courtesy of Dr. Ormiston
LAD/LCx ANGLE

• At the Royal Brompton, we will tend to use culotte when there is a narrow angle or a retrovert origin

• We tend to use T-stenting when there is a 90 degree right angle
# Bifurcational Lesion Treatment and Bifurcation Angles

Bifurcation Angle Measured in 209 Consecutive Patients from 64 MSCT Volume Rendering Images

<table>
<thead>
<tr>
<th>Angle Type</th>
<th>LM-LCx</th>
<th>LAD-Diag</th>
<th>LCx-OM</th>
<th>RCA-PD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>121°</td>
<td>138°</td>
<td>134°</td>
<td>137°</td>
</tr>
<tr>
<td>Maximum</td>
<td>168°</td>
<td>170°</td>
<td>176°</td>
<td>168°</td>
</tr>
<tr>
<td>Minimum</td>
<td>63°</td>
<td>62°</td>
<td>63°</td>
<td>82°</td>
</tr>
<tr>
<td>&lt;110°</td>
<td>26%</td>
<td>8%</td>
<td>15%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Courtesy of T. KAWASAKI, Shin-Koga Hospital, Japan
45 Culotte, 35 T-Stenting
52% Cypher, 48% Taxus; 88% Final Kissing

**Bifurcation Angle**

<table>
<thead>
<tr>
<th></th>
<th>Culotte</th>
<th>T-stenting</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-procedure</td>
<td>53.6±20.8°</td>
<td>60.4±22.5°</td>
<td>0.16</td>
</tr>
<tr>
<td>Post-procedure</td>
<td>48.9±12.5°</td>
<td>62.5±23.5°</td>
<td>0.0014</td>
</tr>
</tbody>
</table>

Kaplan S, Barlis P, Di Mario C. Am. Heart J 2007,
45 Culotte, 35 T-Stenting
52% Cypher, 48% Taxus; 88% Final Kissing

Kaplan S, Barlis P, Di Mario C. Am Heart J in press
Kaplan S, Barlis P, Di Mario C. Am Heart J 2007, in press
Culotte as a provisional LM strategy

- Male aged 57 y
- Risk factors:
  - Positive Family History
  - Hypertension
  - Dyslipidaemia
- No significant comorbidities
- Social history – former wrestling instructor
- New onset angina December 2005
- Physical examination normal
  - Normal ECG and echocardiography
- Diagnostic angiography – Left Main stem + 3 vessel disease (occluded RCA)
Baseline angiogram

Collateralised RCA
Promus (Everolimus) stent implanted

Pre-Intervention

Single 4.0 mm everolimus stent
Postdilatation 4.0 x 24 atm into LM/LAD and final kissing into LAD and Cx with 4.0 and 3.5 mm at 14 atm
79 yr, diabetic, multiple co-morbidities
LCx stent balloon retracted and
• Kissing dilatation
left main OCT pullback – non-occlusive technique
Culotte stenting using DES

- Multi-centre registry
- 127 consecutive patients treated using the culotte strategy as the primary/intended strategy (61%) or as part of a provisional strategy (39%)
- Implantation of either SES or PES

Unpublished data
Participating Centres

• Royal Brompton Hospital, London (n=74)
• Thoraxcenter, Erasmus MC, Rotterdam (n=26)
• National University Hospital, Singapore (n=12)
• St Thomas’ Hospital, London (n=15)
N=127

Barlis et al, In preparation
### Baseline characteristics

<table>
<thead>
<tr>
<th></th>
<th>ALL n=127</th>
<th>SES n=52</th>
<th>PES n=75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (yrs)</td>
<td>64.3±10.7</td>
<td>62.9±9.6</td>
<td>65.3±11.4</td>
</tr>
<tr>
<td>Male</td>
<td>97 (76.4)</td>
<td>42 (80.8)</td>
<td>55 (73.3)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>82 (64.6)</td>
<td>34 (65.4)</td>
<td>48 (64.0)</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>96 (75.6)</td>
<td>42 (80.8)</td>
<td>54 (72.0)</td>
</tr>
<tr>
<td>Family History</td>
<td>52 (41.0)</td>
<td>19 (36.6)</td>
<td>33 (44.0)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>24 (18.9)</td>
<td>9 (17.3)</td>
<td>15 (20.0)</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>35 (27.6)</td>
<td>16 (30.8)</td>
<td>19 (25.3)</td>
</tr>
<tr>
<td>Prior MI</td>
<td>65 (51.6)</td>
<td>28 (53.8)</td>
<td>37 (49.3)</td>
</tr>
<tr>
<td>Prior PCI</td>
<td>44 (34.6)</td>
<td>18 (34.6)</td>
<td>26 (34.7)</td>
</tr>
<tr>
<td>Prior CABG</td>
<td>8 (6.2)</td>
<td>4 (7.7)</td>
<td>4 (5.3)</td>
</tr>
<tr>
<td>Multi-vessel disease</td>
<td>56 (75.7)</td>
<td>31 (72.1)</td>
<td>25 (80.6)</td>
</tr>
<tr>
<td>Ejection fraction</td>
<td>50.3±19.3</td>
<td>52.3±17.9</td>
<td>48.9±20.2</td>
</tr>
<tr>
<td>Stable angina presentation</td>
<td>86 (68.3)</td>
<td>36 (70.6)</td>
<td>50 (66.7)</td>
</tr>
<tr>
<td>Unstable angina presentation</td>
<td>41 (32.3)</td>
<td>15 (29.4)</td>
<td>25 (33.3)</td>
</tr>
<tr>
<td>Glycoprotein IIb/IIa Inhibitor</td>
<td>76 (59.9)</td>
<td>32 (61.5)</td>
<td>44 (58.7)</td>
</tr>
</tbody>
</table>

89% kissing inflation
Mean duration of follow-up 18 months

Only 1 event in the LM group - TLR at distal stent edge of LCX, no cases of thrombosis
Culotte Stenting - Complete lesion coverage??

- 77 yr old, prior CABG, LIMA-LAD, SVG-RCA
- Worsening angina, inducible ischaemia lateral wall
Right caudal view
Balloon to open struts in direction of main branch
Pinched ostium
Further kissing, initially 30 atm to each branch
Technical pitfalls
New wire crosses LAD and 2.5mm balloon used to pre-dilate
3.5x28mm Cypher Select+ positioned in the LAD
Kissing inflation 3.5mm balloon in LAD, 2.5mm balloon to diagonal

LAD – 22Atm
Diagonal-14atm
Why so many unapposed struts at the carina?
Summary

• The culotte technique is more technically demanding compared to other bifurcation strategies.

• It is not routinely applied in LM given the relative large size of the LM compared to the available DES diameters.

• It is adaptable as a truly provisional strategy, with the second stent being implanted only if required.

• It can be applied to varying angles, particularly retrovert origin.