CTO PCI via Bi-radial access

Специфика и возможности выполнения реканализации хронических окклюзий коронарных артерий бирадиальным доступом

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Brisbane, Australia
Among the topics

• Why radial access?
• Why biradial access: obese patients, severe PVD, etc
• Anatomy dictates the strategy (once indications sorted)
• Distal biradial access
• No dogma in CTO PCI
• 7F is enough and 6F will do the most
• ...
CTO: Rational?

"God gave us 3 patent coronary arteries, and all has to be done to keep them patent"

A. Gruentzig, 1977
Femoral vs Radial

- Local haematomas
- Psudoaneurysm
- Arteriovenous fistula
- Retroperitoneal haematoma
- Late ambulation
CORSAIR
300 cm GW prox
300 cm GW distal
Catheterization of the coronary arteries was unsuccessful in two. Manipulation of catheters presented no problem, and arterial spasm was rarely observed, only before the use of a 23-cm-long sheath. Only two complications without symptoms were observed: arterial dissection of the brachial artery in one patient and occlusion of the radial artery in another. With experience, this approach may become as effective and possibly safer than the transbrachial entry.

Key words: percutaneous radial catheterization, brachial artery catheterization, "inverse" Allen test, complications of arterial catheterization, coronaryography

INTRODUCTION

The percutaneous transbrachial artery approach for left heart catheterization and coronary angiography has recently been described as a safe alternative to the standard cut-down arteriotomy brachial artery and the percutaneous axillary and femoral artery techniques [1–7]. All these procedures are associated with rare vascular complications, frequently requiring surgery, such as arterial occlusion, false aneurysm, arteriovenous fistula, or nerve injury [5–14]. We postulate that the radial artery approach can be free of significant complications because blood supply to the hand is provided, in the majority of patients, after opening the closed hand and release of the pressure over the ulnar artery; and absence of significant reactive hyperemia upon release of the pressure over the radial artery [17]. The remaining 70 were consecutive patients of both genders referred to the author for coronaryography who had a normal Allen test and a palpable ulnar artery. Seventeen patients (20%) were omitted because of an unsatisfactory Allen test response; half of these had no palpable ulnar artery pulse. Subjects who required studies other than coronary angiography and left ventriculography were also excluded from study. There were no patients with vascular disease of the upper extremities,
Transradial CTO Program in Québec

- Québec had almost 20 years of TR PCI experience by 2010 when CTO program started by Stéphane Rinfret
- High expectations from transradial colleagues
- As many TR (biradial) as possible
- Our program encouraged many CTO operators to start using radial access
- Typically 6F guides: with many trade-offs
<table>
<thead>
<tr>
<th>Variables</th>
<th>Total (n=470)</th>
<th>Post-CABG (n=175)</th>
<th>No Previous CABG (n=295)</th>
<th>P Value</th>
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<tbody>
<tr>
<td>Dual radial</td>
<td>269 (57)</td>
<td>83 (47)</td>
<td>186 (63)</td>
<td>…</td>
</tr>
<tr>
<td>Dual femoral</td>
<td>21 (4)</td>
<td>16 (9)</td>
<td>5 (2)</td>
<td>…</td>
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<tr>
<td>Radial and femoral</td>
<td>124 (26)</td>
<td>59 (34)</td>
<td>65 (22)</td>
<td>…</td>
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<tr>
<td>Dominant collateral</td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Septal</td>
<td>190 (41)</td>
<td>41 (24)</td>
<td>149 (51)</td>
<td>…</td>
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<tr>
<td>Epicardial</td>
<td>249 (54)</td>
<td>106 (62)</td>
<td>143 (49)</td>
<td>…</td>
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<tr>
<td>SVG</td>
<td>23 (5)</td>
<td>23 (14)</td>
<td>0 (0)</td>
<td>…</td>
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<tr>
<td>Rentrop score</td>
<td>2.6±0.6</td>
<td>2.5±0.6</td>
<td>2.7±0.5</td>
<td>0.01</td>
</tr>
<tr>
<td>ADR</td>
<td>100 (21)</td>
<td>37 (21)</td>
<td>63 (21)</td>
<td>0.96</td>
</tr>
<tr>
<td>Retrograde approach</td>
<td>241 (51)</td>
<td>99 (57)</td>
<td>142 (48)</td>
<td>0.08</td>
</tr>
<tr>
<td>Dissection reentry</td>
<td>222 (50)</td>
<td>102 (62)</td>
<td>120 (43)</td>
<td>0.0001</td>
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<td>Recanalization technique</td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.0001</td>
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<td>AWE</td>
<td>160 (36)</td>
<td>45 (27)</td>
<td>115 (41)</td>
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<td>100 (22)</td>
<td>37 (22)</td>
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<td>RWE</td>
<td>63 (14)</td>
<td>18 (11)</td>
<td>45 (16)</td>
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<td>RDR</td>
<td>122 (27)</td>
<td>65 (39)</td>
<td>57 (20)</td>
<td>…</td>
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<tr>
<td>DES length in CTO artery, mm</td>
<td>71±38</td>
<td>78±39</td>
<td>67±37</td>
<td>0.002</td>
</tr>
<tr>
<td>Radiation dose area product, μGy/m²</td>
<td>22 202±14 481</td>
<td>24 871±14 207</td>
<td>20 613±14 433</td>
<td>0.002</td>
</tr>
<tr>
<td>Fluoroscopic time, min</td>
<td>61±36</td>
<td>73±37</td>
<td>53±34</td>
<td>&lt;0.0001</td>
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<tr>
<td>Contrast, cc</td>
<td>321±142</td>
<td>346±153</td>
<td>306±133</td>
<td>0.004</td>
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<tr>
<td>Procedure duration, min</td>
<td>145±72</td>
<td>172±76</td>
<td>129±65</td>
<td>&lt;0.0001</td>
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<tr>
<td>Final technical success</td>
<td>432 (92)</td>
<td>158 (90)</td>
<td>274 (93)</td>
<td>0.32</td>
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Table 1. Patient characteristics and procedural data for the retrograde approach: septals vs. all other retrograde pathways.

<table>
<thead>
<tr>
<th>Variables</th>
<th>All retrograde cases (n=260)</th>
<th>Septal channels (n=152)</th>
<th>All other retrograde pathways (n=108)</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Age, years</td>
<td>64±11</td>
<td>65±9</td>
<td>64±11</td>
<td>0.901</td>
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<tr>
<td>Male</td>
<td>190 (90)</td>
<td>119 (78)</td>
<td>71 (82)</td>
<td>0.54</td>
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<tr>
<td>Diabetes mellitus</td>
<td>95 (61)</td>
<td>61 (41)</td>
<td>34 (41)</td>
<td>0.96</td>
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<td>Hypertension</td>
<td>198 (66)</td>
<td>122 (81)</td>
<td>75 (80)</td>
<td>0.09</td>
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<tr>
<td>BMI</td>
<td>30±6</td>
<td>29±6</td>
<td>29±6</td>
<td>0.14</td>
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<tr>
<td>Current smoking</td>
<td>41 (20)</td>
<td>33 (25)</td>
<td>8 (11)</td>
<td>0.01</td>
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<td>LVEF %</td>
<td>55±9</td>
<td>53±13</td>
<td>52±18</td>
<td>0.22</td>
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<tr>
<td>Creatinine, mmol/L</td>
<td>92±31</td>
<td>95±26</td>
<td>79±50</td>
<td>0.41</td>
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<td>Indication for CTO PCI</td>
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<td>0.08</td>
</tr>
<tr>
<td>CCSI I-II angina</td>
<td>90 (31)</td>
<td>23 (15)</td>
<td>7 (9)</td>
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<tr>
<td>CCSI III-IV angina</td>
<td>32 (22)</td>
<td>15 (10)</td>
<td>16 (17)</td>
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<tr>
<td>ULMR</td>
<td>129 (51)</td>
<td>78 (59)</td>
<td>51 (55)</td>
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<tr>
<td>Other</td>
<td>34 (14)</td>
<td>17 (13)</td>
<td>17 (20)</td>
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<tr>
<td>Previous PCI</td>
<td>168 (70)</td>
<td>107 (70)</td>
<td>61 (69)</td>
<td>0.86</td>
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<tr>
<td>Previous CAGB</td>
<td>99 (61)</td>
<td>29 (19)</td>
<td>70 (80)</td>
<td>&lt;0.0001</td>
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<tr>
<td>Previous MI</td>
<td>125 (55)</td>
<td>73 (50)</td>
<td>52 (64)</td>
<td>0.04</td>
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<tr>
<td>Target CTO vessel</td>
<td></td>
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<td>0.004</td>
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<tr>
<td>LM</td>
<td>36 (%)</td>
<td>1 (1)</td>
<td>6 (7)</td>
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<tr>
<td>LAD</td>
<td>35 (15)</td>
<td>9 (6)</td>
<td>26 (27)</td>
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<tr>
<td>LAD/LCX</td>
<td>91 (35)</td>
<td>2 (1)</td>
<td>29 (33)</td>
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<tr>
<td>LCA</td>
<td>161 (66)</td>
<td>121 (81)</td>
<td>40 (46)</td>
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<td>Diagnoses</td>
<td>3 (1)</td>
<td>0 (0)</td>
<td>3 (3)</td>
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<tr>
<td>Number of diseased vessels</td>
<td>1.6±0.8</td>
<td>2.6±0.8</td>
<td>&lt;0.0001</td>
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<tr>
<td>Pressure spikes</td>
<td>73 (90)</td>
<td>59 (38)</td>
<td>15 (17)</td>
<td>0.001</td>
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<tr>
<td>Lesion length &gt;20 mm</td>
<td>146 (61)</td>
<td>96 (63)</td>
<td>50 (57)</td>
<td>0.33</td>
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<tr>
<td>Lesion length &gt;40 mm</td>
<td>64 (27)</td>
<td>42 (28)</td>
<td>22 (25)</td>
<td>0.66</td>
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<tr>
<td>Bending &gt;90 degrees</td>
<td>147 (61)</td>
<td>83 (55)</td>
<td>64 (73)</td>
<td>0.005</td>
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<tr>
<td>Blunt proximal cap</td>
<td>176 (74)</td>
<td>103 (68)</td>
<td>73 (83)</td>
<td>0.01</td>
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<tr>
<td>Calcifications</td>
<td>193 (74)</td>
<td>177 (11)</td>
<td>16 (18)</td>
<td>0.09</td>
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<tr>
<td>Bridging collaterals</td>
<td>81 (64)</td>
<td>56 (37)</td>
<td>25 (28)</td>
<td>0.18</td>
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<tr>
<td>Branch at proximal entry</td>
<td>145 (61)</td>
<td>91 (63)</td>
<td>50 (57)</td>
<td>0.44</td>
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<tr>
<td>Distal location</td>
<td>33 (22)</td>
<td>24 (16)</td>
<td>9 (11)</td>
<td>0.002</td>
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<tr>
<td>In-situ CTO</td>
<td>23 (10)</td>
<td>12 (8)</td>
<td>11 (13)</td>
<td>0.24</td>
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<tr>
<td>Proximal cap ambiguity</td>
<td>145 (60)</td>
<td>81 (53)</td>
<td>64 (73)</td>
<td>0.053</td>
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<tr>
<td>Bifurcation at distal cap</td>
<td>156 (60)</td>
<td>73 (48)</td>
<td>43 (49)</td>
<td>0.90</td>
</tr>
<tr>
<td>Good distal landing zone</td>
<td>137 (77)</td>
<td>91 (60)</td>
<td>46 (52)</td>
<td>0.25</td>
</tr>
<tr>
<td>Interventional collaterals</td>
<td>275 (94)</td>
<td>146 (94)</td>
<td>79 (90)</td>
<td>0.09</td>
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<tr>
<td>L-CTO score, mean</td>
<td>2.6±1.06</td>
<td>2.4±1.0</td>
<td>2.8±1.0</td>
<td>0.18</td>
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<tr>
<td>L-CTO score 5</td>
<td>145 (60)</td>
<td>85 (56)</td>
<td>60 (64)</td>
<td>0.06</td>
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<tr>
<td>Vessel access</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Single radial</td>
<td>3 (1)</td>
<td>3 (2)</td>
<td>0 (0)</td>
<td>0.22</td>
</tr>
<tr>
<td>Single femoral</td>
<td>1 (0.5)</td>
<td>1 (1)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Dual radial</td>
<td>147 (61)</td>
<td>102 (67)</td>
<td>45 (51)</td>
<td></td>
</tr>
<tr>
<td>Dual femoral</td>
<td>10 (4)</td>
<td>6 (4)</td>
<td>4 (5)</td>
<td></td>
</tr>
<tr>
<td>Radial and femoral</td>
<td>74 (29)</td>
<td>43 (28)</td>
<td>31 (35)</td>
<td></td>
</tr>
<tr>
<td>5± in catheter retrograde</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Dominant collateral</td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>SVS</td>
<td>17 (7)</td>
<td>10 (6)</td>
<td>7 (7)</td>
<td></td>
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<tr>
<td>e-CTO score</td>
<td>145 (60)</td>
<td>85 (56)</td>
<td>60 (64)</td>
<td>0.08</td>
</tr>
</tbody>
</table>
• Need good transradial non-CTO PCI experience
• Right radial for left guide, and left radial for right guide (no matter where is the CTO)
  • Better support from the right radial in a LM
• Keep it simple: XB 3.5 for LM, AL 0.75 or JR for RCA
• 6F retrograde is usually fine (90cm if long retrograde course)
  • Rotating devices need less support
• 7F antegrade (with Slender sheath) or 8F sheathless (better in LM than in RCA)
• Never use 5F (limiting options+++)
8F vs 6F guides

• x3 times more guide support
• Simultaneous use of microcatheters, IVUS
• Stingray required 8F to allow trapping
Home-made 8F sheathless technique

Dautov R et al, Am J Cardiol 2016;118:785-789
Regular guide
Dilator
0.035” wire

5,6,7F
e.g. 7F guide can replace
5F diagnostic catheter with sheath
Without increasing radial hole
8F TR - Method of Kal Alaswad, Henry Ford Hospital, Detroit
New innovations for complex TR PCI

• Slender 7F in 6 (Terumo Slender® or Merit Ideal®) introducers with thin-wall sheath

• TrapLiner (Teleflex)
• Trapper (Boston Scientific)

• 8F sheathless technique?

became obsolete because of miniaturization of CTO devices (all compatible with 7F)

Dautov R et al, Am J Cardiol 2016;118:785-789
Sheathless Eaucath guides issues in CTO

• Prone in-and-out movements in the coronary ostia with heart beats and breathing: risk for coronary dissection

• Clearly not as efficient as standard guides re: support. Often they slip out of ostium spontaneously or with minimal push to advance coronary gear

• 7.5F provides inner diameter of 2.06mm, vs regular 7F - 2.00mm
  8F sheathless technique has larger inner diametre
[Peculiarities of arterial access in endovascular surgery in elderly patients].

[Article in Russian]
Kaledin AL, Kochanov IN, Seletskii SS, Arkharov IV, Burak Tla, Kozlov KL.

Abstract
In elderly patients, when performing endovascular cathlabs manipulation the radial and cubital accesses is preferable. We propose a new arterial access on the back surface of the hand in the anatomical snuffbox. Artery catheterization of the hand in the anatomical snuffbox preserves intact the radial artery in the forearm for subsequent potential surgical interventions.

PMID: 25051767
[Index for MEDLINE]
Left distal transradial access in the anatomical snuffbox for coronary angiography (IdTRA) and interventions (IdTRI)

Published on 20 September 2017

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Department of Cardiology, Tergooi Blaricum, Blaricum, the Netherlands

Abstract

Aims: The aim of this technical report is to demonstrate the feasibility of the left distal transradial approach for patients in whom left radial access is preferred over right radial access for coronary angiography and interventions. This procedure is more convenient for the operator. For the right-handed patient, the left radial access is more convenient because of the free use of the right hand after the procedure. In addition, this technique reduces the chance of radial artery occlusion at the site of the distal forearm.
Bilateral trans-ulnar vascular access

Different ways to fix Left arm
Biradial approach

Permits early sitting and ambulation: can be a huge advantage in some patients

Unavoidable in:
• Post-CABG cases with multiple sources of collateral channels requiring 2 retrograde catheters
• LV support (Impella) cases
• Very obese patients
• Severe peripheral disease with no femoral access
Fully TRA CTO percutaneous coronary intervention is a valid alternative to TFA with a high rate of success, low complication rates, and no decrease in procedural efficiency.
Same success

**1,253 CTO PCI, 17 European centers Recharge Registry**

<table>
<thead>
<tr>
<th></th>
<th>fTRA (single or biradial) N=306</th>
<th>TFA (single or bifem or combined rad + fem) N=947</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>J-CTO score</td>
<td>2.1±1.2</td>
<td>2.3±1.1</td>
<td>0.06</td>
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<tr>
<td>Technical success</td>
<td>85%</td>
<td>86%</td>
<td>0.51</td>
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<td>In-hosp MACE+CVA</td>
<td>2.0%</td>
<td>2.9%</td>
<td>0.40</td>
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<td>Major access site bleeding</td>
<td>0.3%</td>
<td>0.5%</td>
<td>0.66</td>
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<tr>
<td>Duration (min)</td>
<td>80 [54–120]</td>
<td>90 [60–121]</td>
<td>0.07</td>
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<tr>
<td>DAP (Gray×cm2)</td>
<td>89 [52–163]</td>
<td>101 [59–171]</td>
<td>0.06</td>
</tr>
<tr>
<td>Contrast (cc)</td>
<td>200 [150–310]</td>
<td>250 [200–350]</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

fTRA CTO percutaneous coronary intervention is a valid alternative to TFA with a high rate of success, low complication rates, and no decrease in procedural efficiency.

On biradial technique

• R radial for LM
• L radial for RCA
• Guide selection
• Biradial 6F?
• Sheaths, slender, sheathless, home-made
Bi-radial approach - R radial 8F EBU 4.0; L radial 6F AL, JR, LIMA
Positioning of 8F 4.0 EBU with DEFLECTOR instrument

R radial access with
Merit 8F 4 cm sheath
Breathing effect on radial access vs femoral
Movement of AL guide with breathing

Need a landing zone for the guide catheter
Breathing and femoral access
Breathing and femoral access
Breathing and radial access
Ostial RCA CTO = femoral

Ostial RCA disease without an appropriate landing zone to seat the guide
Case

• 58/M, T2DM, MV repair 10 years ago
• Incidental finding of EF=40-45% on echo - referred for cath, while waiting – presented with chest pain on-off for 1 week at home
• Cath showed occluded LAD and RCA CTO
• LVEF 12-15%. Surgeons declined (LAD not viable)
• Referred for RCA CTO PCI
cath 2 days prior to CTO PCI
Bi-radial access with EBU 3.5 and JR 4 6F guides
Ipsilateral and bridging collaterals
2 days later:

- 8F 45cm intro via R femoral: JR4 8F guide

- R radial 7in6 intro and 7F EBU 3.5 guide

**PLAN:**
1. AWE
2. ADR
3. Retro via RV ipsilateral
Corsair with Pilot 200
Retro injection does not help: need antegrade injections!
Gaia 2\textsuperscript{nd} is still subintimal
Time for Stingray
Stingray balloon is inflated to wrap itself around the artery lumen beyond the distal cap of occlusion. Specially built Stingray wire punctures adventitia towards true lumen.
Stingray balloon is ‘under’ the vessel so we have to use the proximal port!
Stingray wire finds the true lumen (‘pop’ tactile feedback)

look how the Stingray wire is re-directed to the proximal port
Sting and swap technique (swap with Pilot 200)
Final result after 2 x DES 3.5 x 38; 4.0 NC
• Guide extension catheter with an integrated trapping balloon for maintaining GW position during catheter exchanges
• Same GuideLiner V3 functionality
• Offered in 6F, 7F & 8F
Advantages of TrapLiner

• You can trap all devices even in 6F
• Makes ADR possible and easier through 6F
• Can serve as an inflow occluder during ADR
• Readily available to increase support, including for power anchor of microcatheter
• Can be used retrograde to improve support and ease exchange of microcatheters
• Can be used to perform TrapLiner-X CART
When radial?

• Because you want to avoid bleeding complication and you can do it = *why not*

• When you need more than 2 access sites for post-CABG CTO PCI

• When you need one femoral access for CHIP
When radial?

• Because you want to avoid bleeding complication and you can do it = why not

• When you need more than 2 access sites for post-CABG CTO PCI

• When you need one femoral access for CHIP
Case

• 52/M
• Referred from Darwin with prox RCA CTO
• > 1 year of exertional dyspnea
• Normal LV on echo
RCA shot in Darwin and then in Brisbane
Pilot 200 is clearly not near the RCA
Preparation for BASE (balloon-assisted subintimal entry) technique (3.0 x 6 NC)
Knuckling Fielder XTR in subintimal space
Exchange of Corsair to Stingray balloon over Miracle 12 wire

Trapliner is now not only inflated intermittently but also wedged into RCA to avoid haematoma
Finding the right projection for Stingray balloon

RAO 40

LAO 30

AP 0

✓
Need to use the left sided port to STING
Sting and swap technique (Stingray wire to Pilot 200)
Before and after
Tips and Tricks

• Especially in obese patients: ‘Hacking technique”
Left radial “hacking” technique by Stéphane Rinfret

Terumo 25 cm sheath, 15 in, 10 out
Easy access
When radial?

• Because you want to avoid bleeding complication and you can do it = *why not*

• When you need more than 2 access sites for post-CABG CTO PCI

• When you need one femoral access for CHIP
Example of triple arterial access
I CTO vs. 2 CTOs?
1) LIMA 2) SVG D1 3) LM (post DES) Triple retro injection

1) XB via RR 2) AL1 via LR in SVG-D1 3) IMA via fem
Optimal visualization of crux
PL is a CTO...(RCA+PL)
Retro via SVG to DI
Distal tip injection
IM 8F in RCA from femoral retrograde contrast-induced dissection
Knuckled Pilot 200 for retrograde dissection
Close to proximal cap
After rCART, removal of retrograde system, Rota in PDA
When radial?

• Because you want to avoid bleeding complication and you can do it = why not
• When you need more than 2 access sites for post-CABG CTO PCI
• When you need one femoral access for CHIP
Biplane view: RCA CTO 7F x 2 through Slender
Critical LAD and LCx disease
Rotational atherectomy after failed balloon dilation
Retro through septal CC (failed antegrade attempt)
Wire into a GuideLiner
Post stenting of LAD
PCI of LCx-resistant lesion
Rota again...
Final
Conclusions

• Transradial access is an essential skill to master for complex PCI

• With current tools (slender sheaths, Trapper, TrapLiner, guide extensions) and miniaturization of devices (microcatheters, Stingray LP), 7F antegrade guides catheters are big enough and provide sufficient support

• Steady decrease in use of systematic bi-femoral approach in CTO PCI since 2010

• CTO through 6F is easier with new tools

• No need to be dogmatic: femoral access is safe and necessary in many patients
Conventional vascular access site approach versus fully trans-wrist approach for chronic total occlusion percutaneous coronary intervention: a multicenter registry

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Procedural success rates stratified by Japanese-CTO (J-CTO) score according to Conventional and Fully trans-wrist access (TWA) approaches.

Rates of primary safety endpoint and its individual components, according to Conventional versus Fully trans-wrist access (TWA) approach

Unadjusted rates of vascular complications according to Conventional versus Fully trans-wrist (TWA) approach
Radial or Femoral Approach for Chronic Total Occlusion Revascularization?
The Answer Is Both*

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