Retrograde Approach Step by Step

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Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

**Affiliation/Financial Relationship**

- Consulting Fees/Honoraria

**Company**

- Ashai Intec, Teleflex, Cordis, Abbott, Biotronik, Terumo, AstraZeneca,
  Daiichi Sankyo, Medtronic
Introduction

- Analyzing Collaterals
- Retrograde MC passage
- Revers CART
- Externalization
Analyzing Collaterals
Selection of the best collateral connection

![Comparison of different vessels](image)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Bypass graft</th>
<th>Septal</th>
<th>Epicardial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tortuosity</td>
<td>+</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>Perforation risk</td>
<td>+</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>Wiring difficulty</td>
<td>+</td>
<td>++/+++</td>
<td>+++</td>
</tr>
<tr>
<td>Able to dilate</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Fig. 1. Comparison of the different vessels that can be used for retrograde CTO interventions.

Brilakis ES et al. Cath Cardiovasc Interv 2011, published online
Predictors for collateral failure?

Ching-Chang Huang et al. Circ Cardiovasc Interv. 2018

Table 3. Univariable and Multivariable Analyses for Predictors of Successful CC Tracking

<table>
<thead>
<tr>
<th>Variable</th>
<th>Univariable</th>
<th>Multivariable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>P Value</td>
</tr>
<tr>
<td>Large size</td>
<td>4.14 (2.05–8.38)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lack of tortuosity</td>
<td>9.93 (4.32–22.83)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>AoA &lt;45°</td>
<td>1.82 (0.9–3.69)</td>
<td>0.096</td>
</tr>
<tr>
<td>LEP &gt;5 mm</td>
<td>0.66 (0.2–2.12)</td>
<td>0.48</td>
</tr>
<tr>
<td>AVG</td>
<td>1.27 (0.46–3.49)</td>
<td>0.65</td>
</tr>
<tr>
<td>Epicardial</td>
<td>1.13 (0.55–2.32)</td>
<td>0.75</td>
</tr>
<tr>
<td>Septal</td>
<td>0.80 (0.41–1.59)</td>
<td>0.53</td>
</tr>
<tr>
<td>J-CTO score</td>
<td>0.75 (0.47–1.2)</td>
<td>0.23</td>
</tr>
<tr>
<td>First CC attempted</td>
<td>2.03 (0.79–5.21)</td>
<td>0.14</td>
</tr>
</tbody>
</table>

AoA indicates angle of attack; AVG, atrioventricular groove; CC, collateral channel; CI, confidence interval; J-CTO, Multicenter CTO Registry of Japan; LEP, length to emerging point; and OR, odd ratio.
Relationship between new retrograde collateral channel (CC) scores and procedural outcomes

Large Collaterals (CC 2): 1 point
No tortuosity: 2 point

Area under ROC curve = 0.800
Area under ROC curve = 0.752
J-channel score for predicting successful wiring in collateral channels

### J-Channel Score

**A. CC Vessel Size**
- Large (CC2)
- Small (CC0 or CC1)

**B. Reverse Bend**
- None: \(<90^\circ\)
- Yes: \(\geq 90^\circ\)

**C. Continuous Bends**
- None: \(\leq 2\)
- Yes: \(\geq 3\)

**D. Corkscrew**
- None
- Yes: Continuous bends \(\geq 3\) with AD ratio \(\leq 2\)

<table>
<thead>
<tr>
<th>Collateral Channel Score</th>
<th>Septal</th>
<th>Non septal</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC Vessel Size: Small</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Reverse Bend: Yes</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Continuous Bends: Yes</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Corkscrew: Yes</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total Score**

**Category of Difficulty (Total Score)**
- Easy: 0
- Intermediate: 1-2
- Difficult: \(\geq 3\)

**How to use:**
1st Classify CC into type of CC.
2nd Sum up numbers on vertical frame as type of CC.
3rd Estimate difficulty.
J-channel score for predicting successful wiring in collateral channels

**Septal CC**

<table>
<thead>
<tr>
<th>Difficulty grade</th>
<th>J-Channel score</th>
<th>CC number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy</td>
<td>0</td>
<td>407</td>
</tr>
<tr>
<td>Intermediate</td>
<td>1-2</td>
<td>112</td>
</tr>
<tr>
<td>Difficult</td>
<td>&gt;=3</td>
<td>203</td>
</tr>
</tbody>
</table>

**Non-Septal CC**

<table>
<thead>
<tr>
<th>Difficulty grade</th>
<th>J-Channel score</th>
<th>CC number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy</td>
<td>0</td>
<td>184</td>
</tr>
<tr>
<td>Intermediate</td>
<td>1-2</td>
<td>63</td>
</tr>
<tr>
<td>Difficult</td>
<td>&gt;=3</td>
<td>92</td>
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</table>
Selection of the best collateral connection: Septal first

J-channel score: 0

Huang – Score: 3

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<tr>
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<td>1</td>
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<tr>
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<td>Yes</td>
<td>0</td>
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<td><strong>Total Score</strong></td>
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Category of Difficulty (Total Score)
- Easy: 0
- Intermediate: 1-2
- Difficult: ≥3

Large Collaterals (CC 2): 1 point
No tortuosity: 2 point

A CC tracking success by new CC score

- 44.4%
- 77.8%
- 93.8%
- 95.0%

p<0.001
Selection of the best collateral connection

- **I) Proximal Septal:**
  - Proximal: often to PLA-System and partial epicardial

- **II) Mid Septal:**
  - Generally to the PDA
  - Often very tortious before entry to the PDA common

- **III) Distal Septal:**
  - Attention regarding sheer stress
Septal passage
Passing Epicardials
STEP 1: Analyze the angiogram
STEP 1: Analyze the angiogram

Higher flow, more contrast
(5/sec. 18ml)
STEP 1: Choose the right collateral

NO!

X
STEP 2: Superselective injection

**J-channel score:** 1  
**Huang – Score:** 1

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**Category of Difficulty (Total Score):**  
- Easy: 0  
- Intermediate: 1-2  
- Difficult: ≥3

- Large Collaterals (CC 2): 1 point  
- No tortuosity: 2 point

**A. CC tracking success by new CC score**  
- Success rate: 44.4%  
- 77.8%  
- 93.8%  
- 95.0%

- **Success rate:**  
  - 54.3%  
  - 77.8%
STEP 3: How to pass epicardial collaterals >1,5mm

Wire of choice:
Sion black

Technique:
Fast rotation
Stop when there is resistance
Epicardial Crossing of small Epicardials
Retrograde Microcatheter Passage
Septal crossing with channel dilatator

Thanks to Nicolas Boudou for the great organization and invitation of the JIF CTO in Toulouse 2016
Most common Microcatheters for retrograde CTO approach

- **Septal Crossing**
  - >1,5mm
    - Rotatable MC
      - Corsair
      - Turnpike
  - < 1,5mm
    - Epicardial Crossing
      - Low profile MC
        - Finecross
        - Turnpike LP
        - Caravel
Complications in collaterals – Over-rotating the MC

Do not force an over-rotation of the MC in tortuosity
Complications in collaterals – Pushing MC in tortuosity

1) Do not use a MC which you have to push in tiny collaterals and severe angulations
2) A rotatable MC may be safer (Turnpike LP, Corsair)
Revers CART
Controlled Antegrade and Retrograde Tracking

New concept for CTO recanalization using controlled antegrade and retrograde subintimal tracking: the CART technique
Conventional Revers CART Technique
IVUS guidance in revers CART

Alternative Externalization Techniques
Wire Externalization Techniques for Retrograde Percutaneous Coronary Interventions of Chronic Total Occlusions, K. Mashayekhi et al. 2017 accepted, EuroIntervention
Externalization Process

Wire Externalization Techniques for Retrograde Percutaneous Coronary Interventions of Chronic Total Occlusions, K. Mashayekhi et al. 2017 accepted, EuroIntervention
Snaring in ostial RCA – CTO (2x6F unlar/radial)
Snaring: “KAM-Snare”

Wire Externalization Techniques for Retrograde Percutaneous Coronary Interventions of Chronic Total Occlusions, K. Mashayekhi et al. 2017; accepted in EuroIntervention
Snaring: “KAM-Snare”
Alternative externalization after ante,- and retrograde uncrossability
Why do we need Tip In and Rendezvous?

1. Retrograde MC can not pass the lesion
2. Save Contrast
3. Avoid collateral sheer stress
4. Alternative externalization after ante,- and retrograde uncrossability
5. Avoid conventional externalization in Kissing wire position
Retrograde CTO PCI

- Septal first! Try to avoid epicardial CCs!
- Understand to handle a rotable MC for retrograde septal passage
- Use IVUS to understand the failure mode of Revers CART
- Mastering alternative extranalisation techniques gives you more option and higher success rates
Retrograde CTO PCI

• Septal first! Try to avoid epicardial CCs!
• Understand to handle a rotatable MC for retrograde septal passage
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