The Difficult Reverse CART

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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**
- Grant/Research Support
- Consulting Fees/Honoraria
- Major Stock Shareholder/Equity
- Royalty Income
- Ownership/Founder
- Intellectual Property Rights
- Other Financial Benefit

**Company**
- Company Names
- Company Names
- Company Names
- Company Names
- Company Names
- Company Names
- Company Names
## Potential CTO PCI Market

- **600,000-1,800,000**
  - Americans with Refractory Angina (RA) \(^1\)
- **>500,000** \(^1\)
  - Canadians with RA
- **30%**
  - Patients under primary care in Australia with daily or weekly angina \(^2\)

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1. Can J Cardiol 2012;28:S20-41  
Refractory Angina

- A persistent, painful condition characterized by the presence of angina caused by coronary insufficiency in the presence of coronary artery disease which cannot be controlled by a combination of medical therapy, angioplasty, and CABG. *McGillion et al. Can J Cardiol 2012;28:S20-41*

<table>
<thead>
<tr>
<th>Reason for no revascularization</th>
<th>Number</th>
<th>% (n = 33)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic total occlusion</td>
<td>23</td>
<td>69.7%</td>
</tr>
<tr>
<td>Diffuse disease</td>
<td>15</td>
<td>45.5%</td>
</tr>
<tr>
<td>Collateral dependent perfusion</td>
<td>14</td>
<td>42.2%</td>
</tr>
<tr>
<td>Comorbidities</td>
<td>4</td>
<td>12.1%</td>
</tr>
<tr>
<td>Multiple restenoses</td>
<td>2</td>
<td>6.1%</td>
</tr>
<tr>
<td>Poor distal targets</td>
<td>1</td>
<td>3.0%</td>
</tr>
</tbody>
</table>

*Patients could have more than one reason precluding revascularization.*
Chronic Total Occlusion

- Complete coronary occlusion > 3 months duration

Fefer et al J Am Coll Cardiol 2012;59:991–7
Barriers to CTO-PCI

- Long Procedures
- Technically difficult
- Poorly reimbursed
- Poorly taught
- Safety concerns
A Percutaneous Treatment Algorithm for Crossing Coronary Chronic Total Occlusions

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The Hybrid Algorithm for CTO PCI

Dual Catheter Angiography

1. Clear proximal cap
2. Good Distal Target

Antegrade

- Wire escalation
- yes
- 3. Length < 20mm

Dissection Reentry (crossboss-stingray)

Retrograde

- Wire escalation
- yes
- 3. Length < 20mm

Dissection Reentry (reverse CART)

Switch
The Hybrid Approach to CTO-PCI

Preliminary data courtesy of EM Brilakis
Reverse CART
Coronary Laser

- Ultraviolet 308nm wavelength laser.
- Works by the use of photoablation:
  - Photoablation - light to vaporize and break down matter
- Three distinct mechanisms
  1. Photochemical
  2. Photothermal
  3. Photomechanical
New Laser Technology

Improved Catheter Design

- ↑fibers, optimally spaced
- Improved flexibility
- Hydrophilic Coating
- Improved tracking and pushability
- 0.9 mm smaller catheter

Spectranetics, Inc
Use of Laser in CTO-PCI

- Originally used in standard methods
  - Device resistant lesions
  - In-stent re-stenosis.
- Used in more novel methods specific to CTO
  - Resistant proximal caps
  - Completing the reverse CART
Laser Reverse CART
Completing the rev CART

- 56 year old male
- CCS II despite OMT
- HTN and Chol
- Inferior isch on DSE
- Found to have CTO RCA
- Hybrid algorithm:
  - Ambiguous proximal cap
  - Occlusion > 20 mm
  - Landing zone bifurcation
  - Good interventional collaterals

Retrograde as initial strategy with ADR bail out
Septal Surfing
Retrograde Knuckle Wire
0.9 mm Laser
XCART ballooning
After Ballooning
**Conclusion**

- Large population of patients with unmet need for angina relief
- Variability in use of PCI suggesting underutilization
- Technical barriers to efficient CTO PCI
- Laser debulking may improve reproducibility, efficiency, teachability of CTO-PCI
- Safety studied in OPEN CTO
## OPEN CTO

**Outcomes, Patient health status, and Efficiency in Chronic Total Occlusion hybrid procedures**

| Primary Investigators | J. Aaron Grantham (PI)  
| William L. Lombardi (Co-PI) |
|-----------------------|--------------------------|
| Overview              | 10 US sites  
|                       | 1000 patients  
|                       | Multi-center, prospective, single arm observational registry |
| Aims                  | Safety, success, efficiency of hybrid approach  
|                       | Health status effects of CTO-PCI  
|                       | Indications and appropriateness of CTO-PCI  
|                       | Economic analysis |
| Status                | Enrolling 2014 |
| Sponsors              | Boston Scientific  
|                       | Saint Luke’s Mid-America Heart Institute |

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**Angiographic core lab, Events adjudication, NCDR auditing**