Histology Is a Big Key to Success in CTO-PCI

Satoru Sumitsuji MD. FACC.
Osaka University / Tokushukai (Nozaki, Nagoya)
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:

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<tr>
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Why should we consider histology?

- CTO-PCI = Operator x Equipment x CTO lesion
  - Operator’s Skill, and Strategy
    - Antegrade approach, retrograde approach
    - Single wire, Parallel wire
    - Retrograde wire cross, Kissing wire cross, CART, reverse CART
  - Equipment
    - Guiding catheter, micro catheter, wire, balloon, stent, etc.
  - CTO lesion itself
    - All CTO lesions are not same.
    - How serious to understand CTO lesion?
Key points in Histology

- Intimal plaque / subintimal space
  - Intimal plaque tracking, subintimal tracking
    » Key to success of wire cross

- Micro-channel / Loose tissue
  - Loose tissue tracking
    » Wire selection handling
Feature of Subintima
Subintimal tracking in antegrade
Subintimal tracking in antegrade
CT for intimal plaque tracking
Typical young and aged CTO

1.5 yrs

5 yrs

Sumitsuji et al. JACC Intv 2011; 9:941–51
Loose Tissue / Micro-channel

0.014 inch : 360μm
0.009 inch : 230μm
Loose Tissue / Micro-channel

Intravascular and Extravascular Microvessel Formation in Chronic Total Occlusions
A Micro-CT Imaging Study

Nigel R. Muirce, PhD,* Bradley H. Strauss, MD, PhD,†† Xiuqing Qi, PhD,†
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Graham A. Wright, PhD†

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J Am Coll Cardiol Img 2010;3:797–805
Loose Tissue / Micro-channel

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Concept of “Loose Tissue Tracking”

1. wire-tip force
2. resistance in loose tissue
3. resistance in plaque

If we can control $2 < 1 < 3$, wire might easily pass CTO.
Histopathological features of CTO

Histopathological features of CTO

<table>
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<tr>
<th>Number of cases</th>
<th>Small recanalization</th>
<th>Configuration of loose fibrous tissue</th>
<th>Length of the occluded segment</th>
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Progression of CTO

Sumitsuji et al. JACC Intv 2011; 9:941–51

Figure 1
Histopathologic features of CTO

Progression of CTO

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Case: occluded LAD (2008/6/14)
Heart CT (2008/6/25)
Loose Tissue Tracking

Wire looks like tracking soft part (loose tissue) in occlusion.
Wire cross for easy total occlusion
Wire cross for easy total occlusion
PCI CTO wire selection & handling
antegrade approach

- Normal work-horse wire
- Intermediate wire
  - Stiff wire
  - Intermediate wire
  - Stiff wire
- Normal work-horse wire

Careful wire control to get dimple of CTO entry

Drill or Controlled drill

Controlled wire manipulation (needs controllable wire)
Subintimal tracking in retrograde
Subintima: histopathology vs. IVUS
Subintimal tracking in retrograde
PCI CTO wire selection & handling retrograde approach

- Externalization wire
- Stiff wire
- Intermediate wire / soft wire
- Stiff wire
- Normal work-horse wire

Intentional wire cross
- Polymer Jacket wire
- Intermediate wire with Drilling or Knuckle technique
- Careful wire control not to perforate
Diagnostic Angio & Stage 1 PCI
Stage 2 RETRO CTO PCI
Stage 2 RETRO CTO PCI
IVUS in reverse CART
RETRO wire cross to prox. true lumen
IVUS after little advancing RETRO wire
IVUS after little advancing RETRO wire
Procedure & Final Result
Fundamental Wire Technique and Current Standard Strategy of Percutaneous Intervention for Chronic Total Occlusion With Histopathological Insights

Satoru Sumitsuji, MD,* Katsumi Inoue, MD,† Masahiko Ochiai, MD,‡ Etsuo Tsuchikane, MD,§ Fumiaki Ikeno, MD‖

Osaka, Kitakyushu, Yokobama, and Toyohashi, Japan; and Palo Alto, California

Currently, successful treatment of chronic total occlusion (CTO) seems markedly improved, due to several new techniques and dedicated device developments. However, this improved success rate is often limited to procedures performed by skilled, highly experienced operators. To improve the overall success rate of percutaneous coronary intervention of CTO from a worldwide perspective, a deeper understanding of CTO histopathology might offer insights into the development of new techniques and procedural strategies. In this review, CTO histopathology and wire techniques are discussed on the basis of the fundamental concepts of antegrade and retrograde approaches. Although details pertaining to wire manipulation are very difficult to explain objectively, we tried to describe this as best as possible in this article. Finally, a systematic review of the current standard CTO strategy is provided. Hopefully, this article will enhance the understanding of this complex procedure and, consequently, promote safe and effective CTO-percutaneous coronary intervention for patients who present with this challenging lesion subset.

(J Am Coll Cardiol Intv 2011;4:941–51) © 2011 by the American College of Cardiology Foundation
Summary

- Because CTO-PCI consist of physician, equipment, and lesion, we must know CTO lesion with histologic aspect.
- In CTO histology, “intimal plaque vs. subintimal space” and “loose tissue including micro-channels” are most important for CTO-PCI.
- With understanding of those, CTO-PCI can be more logic, reproducible, and successful.