Hydrophilic vs. Non-coated Guidewires for CTO

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Introduction

- All guidewires (as well as balloons) are coated to allow easier passage down coronary arteries.
- Hydrophilic wires are coated with a coating that becomes slicker when exposed to water (or blood).
- As compared to conventional coatings, hydrophilic coatings do not deteriorate during prolonged use.
- Hydrophilic wires are many times more slippery than conventionally coated wires.
- This extreme lubricity represents both their forte and their failing.
  - They will go anywhere without resistance, even down minute branches and false channels.
Conventional wire technique - I

- Conventional approach to CTO is with non-coated wires introduced through transit or small over the wire balloon catheters.
- Conventional wires are more controllable and provide better tactile feel.
  - This is especially important when trying to penetrate the distal fibrous cap.
- Technique with conventional wires is to drill through the distal cap with a to and fro rotation over several minutes.
- Using this technique with conventional wires one can actually feel the fibrous cap when the wire is properly engaged.
Conventional wire technique - II

- If the wire runs askew of the cap or enters a false channel, the tactile feel is lost.
- If the wire enters a false channel, there is resistance to further passage.
- Recognizing this resistance and not forcing the wire will allow a better opportunity to probe for the true route.
- Forcing a guidewire in the false channel serves to widen the channel, risks possible perforation and make it impossible to finish the case successfully.
Hydrophilic Wires - Shortcomings

- Hydrophilic wires have the disadvantage that once in a false passage, the wire can continue for long distances without encountering resistance.
- This leads to a greater tendency to create large false channels that preclude success.
- Similarly, hydrophilic wires frequently seek tiny branches.
  - Once in small branches the wires can travel distally without resistance, eventually penetrating the branch and entering the pericardial cavity.
Hydrophilic Wires in Small Distal Branches

- Small stain indicates guidewire perforation
- Type II perforation
Hydrophilic Wires Shortcomings - II

• This can lead to cardiac tamponade, especially in the presence of group IIb/IIIa inhibitors.

• If an operator fails to recognize that a hydrophilic wire has entered a false passage or tiny branch and a balloon is subsequently inflated, massive perforation, cardiac tamponade and death can ensue.

• Although proper technique can prevent these disasters, there have been many such complications with hydrophilic wires - causing them to fall into disfavor in the management of CTO’s.
The Problem with Hydrophilic Wires
So Why Do I Use Hydrophilic Wires?

• Despite these shortcomings, hydrophilic wires are my wires of choice for CTO.
• The reason I use them routinely is that they work.
• With careful technique I am able to do CTO cases more quickly, with a higher success rate and as safely as with conventional wires.
The Beauty of Hydrophilic Wires
CTO of RCA > One Year
Twenty Minutes Later
Caveat

• To safely use hydrophilic wires for coronary CTO, it is absolutely imperative to assure that the wire is in the true lumen of the distal vessel.
  – The safest and most reliable way to do this is with contralateral injections in at least two orthogonal views.
  – If this is not possible, a less desirable alternative is distal injection through a transit catheter or 1.5 mm coronary balloon catheter.

• A balloon should never be inflated distally unless the operator is 100% certain that the balloon and wire are in the true lumen.
Try to find Baptist CD of consequences of inflating balloon in false channel.

James R. Margolis, 2005-01-25
The Problem with Hydrophilic Wires
My Personal Technique
(Gaijin Technique)

• I almost always begin with bare wire technique.
• I normally start by probing the CTO with a PT Graphix™ or Cougar™ intermediate wire.
• On some occasions, this wire will cross – sometimes without difficulty.
• This is the case when the occlusion is less chronic than originally thought or there is evidence for partial recanalization.
• Occasionally, an apparently impossible CTO is crossed in seconds with a PT Graphix™ or Cougar™ intermediate wire.
RCA Flush Occlusion

Left to Right Collaterals
Lesion was easily crossed with PT Graphix Intermediate wire and 2.0 mm balloon

After 2.0 Balloon
PT Graphix Wire

• More frequently, the PT Graphix™ will penetrate the proximal fibrous cap and proceed one or more centimeters beyond, then buckle as it encounters the distal fibrous cap.
• I do not try to force the PT Graphix™ wire in such cases. If it does not cross with careful probing, I immediately switch to a stronger wire.
• Even when the PT Graphix™ fails, it usually provides some information regarding the correct route through the occlusion.
PT Graphix™ Intermediate Wire in CTO
Gaijin Technique - II

• My second choice of wires is usually a 300 cm SHINBOI Plus™.
• This is both the most useful and the most dangerous of the CTO wires.
• Features:
  – Exquisite torque control that transmits to the tip, even in long and tortuous CTO lesions.
  – Retains tip shape reasonably well.
  – Stiff enough to penetrate most distal fibrous caps.
• Initial approach with this wire is also with bare wire technique.
SHINOBI Plus™ Wire Technique

• SHINOBI Plus™ invariably passes the proximal cap without difficulty, but can stray into tiny branches or subintimally while negotiating the portion between the proximal and distal caps.

• This is where knowledge obtained from initial probing with the PT Graphix™ wire can be useful.

• The SHINOBI Plus™ wire can be directed along the correct path originally followed by the PT Graphix™.
SHINOBI Plus™ Wire Technique

- At the distal fibrous cap, SHINOBI Plus™ wire technique differs from that with conventional wires.
- Instead of trying to drill through the distal cap, I try to spear the cap with the relatively sharp tip of the SHINOBI™.
- Although this maneuver invariably involves some element of drilling, the focus is in keeping the wire tip pointed in the direction of the distal vessel.
  - Perpendicular to the tangent of the fibrous cap.
- This must be constantly checked in orthogonal views using frequent contralateral injections.
- The stiffness of the SHINOBI Plus™ tip allows for some tactile feel.
- This feel combined with visual input makes it clear when the wire tip and fibrous cap are engaged.
Penetrating Distal Fibrous Cap

Tip too inferior

Tip too superior

Tip in position to penetrate distal cap
SHINOBI Plus™ Wire Technique

- As with conventional wires, the SHINOBI Plus™ not infrequently slides off the fibrous cap and/or courses subintimally.
- When this occurs, the management is similar to that with conventional wires.
- The most important first step is to immediately recognize the aberrant course, pull back the wire and attempt to redirect it.
- It is equally important to avoid forcing the wire in a subintimal course thus enlarging the false channel.
- If the wire continually re-enters the false channel, it is best to leave the wire in place and introduce a second wire – again, a technique identical to that used with conventional wires.
SHINOBI Plus™ wire in false lumen
SHINOBI Plus™ enters false lumen, but second SHINOBI Plus™ finds true lumen

Wire tip entering false lumen

1st wire in false lumen

2nd wire in true lumen
SHINOBI Plus™ Wire Technique

• When a CTO is successfully crossed with the SHINOBI Plus™ wire, it is important to immediately exchange for a conventional wire (A 300 cm wire is used for this reason).

• If the wire is left in place during proximal ballooning and stenting the extreme stiffness and lubricity of the SHINOBI Plus™ makes it prone to distal migration and perforation.

• Wire exchange is usually performed through a 1.5 mm over-the-wire balloon catheter which can then be used for initial dilatation.

• Prior to wire exchange position is again verified by contralateral injections and/or injection through the distal balloon catheter tip.
Consequences of Not Exchanging
SHINOBI Plus™ Wire

Small stain indicates guidewire perforation

Type II perforation
Excimer Laser

• The Excimer laser has been useful in crossing CTO lesions that have been crossed by a wire, but cannot be crossed with a balloon.

• The X-80 high 0.9 mm catheter is particularly useful in this regard.
Excimer Laser Crosses “Uncrossable Lesions”

Wire in distal lumen, balloon will not cross

After 0.9 mm Excimer laser
Footnote

• I have had positive experiences with other hydrophilic wires in CTO
  – Sometimes when I have failed with the PT Graphix intermediate and SHINOBI Plus.

• There are many wires that are not marketed in the US, and are thus unavailable to me.

• It is important for each operator to familiarize himself with as many different wires as possible, but to choose a few workhorse wires with which he has a substantial experience. This is true whether one primarily uses conventional or hydrophilic wires.
Summary

• In the approach to CTO, hydrophilic wires are a reasonable alternative to conventional wires.
• The very characteristics that make hydrophilic wires easier to use also make them more dangerous.
• Meticulous adherence to technique, especially verification of position, is mandatory.
• Not all hydrophilic wires are the same.
• As with conventional wires, in order to properly deal with CTO, one must have access to a family of hydrophilic wires with varying degrees of stiffness and tip characteristics.
• Whether one chooses to use conventional or hydrophilic wires, experience, technique and patience are essential to solving the problem of CTO.
But It’s Worth It