Guide Wires
design and selection
“the cardiac catheter was...the key in the lock”

Courmand AF, Nobel lecture December 11, 1956;

“nowadays, the coronary guidewire is the master key to all locks”

Colombo et al. Interventional cardiology 2007;9-19;
Coronary guidewires are designed with the following functions in mind:

- to track through the vessel,
- to access the lesion,
- to cross it atraumatically,
- to steer into or away from side branches
- to provide device delivery support
Guidewires Selection

Wire performance characteristics influence choice

- Flexibility
- Support
- Steering
- Lubricity
- Tracking
- Prolapse tendency
- Visibility
- Tactile Feedback

Performance characteristics affect suitability in varying clinical situations

Wire choice should be based on performance requirements for each procedure
Design Variation

Performance Variation

- WorkhorseFrontline
- Extra support
- Severe stenoses
- Tortuosity
Guide Wire Construction: basics

**Shaft**
- Length: 145 cm
- Material: Stainless steel
- Stainless Steel: more => (Push)
- Coating: PTFE (Teflon)

**Distal Tip**
- Length: 40 cm
- Core Wire: Stainless steel or Nitinol
- Outer Material: Spring coil / Polymer Sleeve
- Lubricious Coating: Silicone / Hydrophilic

**Extension**
- 0.014”
- Compatible with AddWire™ Extension Wire
Guide Wire Construction: basics

Core Wire (length 40cm)
Central core wire usually stainless steel or nitinol (Nickel/Titanium Alloy)

Features
- Nitinol
- Stainless steel

Benefits
- Resilient, Durable, flexibility
- Inflexible, Better push, Better Rail Support
Core Diameter

Diameter affects flexibility, support and torque

Smaller Diameter = More Flexibility

Larger Diameter = More Support & Torque
Core Material

Affects flexibility, support, steering and tracking

Stainless Steel

Nitinol

High Tensile Strength Stainless Steel
Core Material

Stainless steel

Original core material technology
Good support, push force and torque
Less flexible than newer core materials
Core Material

Nitinol

Super-elastic alloy designed for kink resistance
Excellent flexibility and steering
Durable nature may facilitate treatment of multiple lesions and/or tortuous vessels
Core Material - Nitinol

DURABILITY:
Stainless Steel vs. Nitinol

Both wires shown after passing through tortuosity.

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Core Material

High Tensile Strength Stainless Steel

More durable than regular stainless steel
Retains shape
Good flexibility
Excellent steering and tracking
Core Wire: Stainless steel/Nitinol

Nitinol = Flexibility Durability & resiliency
Stainless Steel = Push & Rail support

Super Support
- Vessel Straightening

Extra Support
- Stent Delivery

Moderate Support
- Stent Delivery

Light Support
- POBA

Least Supportive
- Floppy

Most Supportive
- Tip Stiffness

STANDARD LESIONS

COMPLEX LESIONS

CTO

Nitinol = Flexibility Durability & resiliency
Stainless Steel = Push & Rail support

Nitinol = Flexibility Durability & resiliency
Stainless Steel = Push & Rail support
Tip Style

Affects steering

Design options

Core-to-tip

Shaping ribbon
Tip Style: Core-to-Tip

Precise steering and tip control

Soft

Stiffness for crossing resistant lesions
Tip Style - Shaping Ribbon

Flexible

Softer tip

Allows shape retention
Coils

Affect support, steering, tracking and visibility

Impact dimension of wire

Affect tactile feedback
Guide Wire Construction: basics

Outer material

1. **Spring (coil) Tip**
   Stainless steel with inner platinium coil for Radiopacity
   MP 35N Alloy

**Polymer Tip**
Polymer sleeve loaded with Tungsten for Radiopacity

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring Tip</td>
<td>Control</td>
</tr>
<tr>
<td>Polymer Tip</td>
<td>Crossing</td>
</tr>
</tbody>
</table>
Guide Wire Construction: basics

Lubricious Coating

Silicone

Hydrophilic (Stainless steel is a very difficult surface to coat due to its poor adherence => polymer sleeve)

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicone</td>
<td>30 g to push force</td>
</tr>
<tr>
<td>Hydrophilic</td>
<td>10 g to push force</td>
</tr>
</tbody>
</table>
## Coatings

- Affect lubricity and tracking
- Facilitate smooth movement
- Distal 30-35 cm

<table>
<thead>
<tr>
<th><strong>Hydrophilic</strong></th>
<th><strong>Hydrophobic</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Attracts water</td>
<td>Repels water</td>
</tr>
<tr>
<td>Applied over polymer and stainless steel, including tip coils</td>
<td>Silicone on working area of wire, excluding tip</td>
</tr>
<tr>
<td>Thin, non-slippery solid when dry</td>
<td>No activation required</td>
</tr>
<tr>
<td>Becomes gel when wet</td>
<td>Reduces friction</td>
</tr>
<tr>
<td>Reduces friction</td>
<td>Increases trackability</td>
</tr>
<tr>
<td>Increases trackability</td>
<td></td>
</tr>
</tbody>
</table>
Distal Core: Spring tip/Polymer Tip

**Hydrophilic Coated Wires:**
Provides a lower friction, lubricious tactile feel that enhances tracking and crossing
Requires only 10 grams of push force to navigate coronary vessels

**Silicone Coated Wires:**
Provides a higher friction, more anchorable tactile feel
Requires 28-30 grams of push force to navigate through the coronary vessels

- **Spring Tip Polymer Tip**
- **Polymer Tip Hydrophilic coating**
- **Polymer Tip**
- **Spring Tip Silicone coating**

- **Least Support**
  - Floppy
- **Rail Support**
  - Spring Tip/Polymer Tip
- **Most Supportive**
  - Stiff

- **Super Support**
  - Vessel Straightening
- **Extra support**
  - Stent Delivery
- **Moderate Support**
  - Stent Delivery
- **Light Support**
  - POBA

- **STANDARD LESIONS**
- **COMPLEX LESIONS**
- **CTO**
Guide Wire Shaping
## Wire Selection

By varying size and length of the core wire, it is possible to create different wire flexibility & rail support

**Distal tip** = designed to allow the guide wire to cross the lesion

<table>
<thead>
<tr>
<th>Clinical Situation (Lesion Type)</th>
<th>Distal Tip Stiffness Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple to Complex PTCA</td>
<td>Floppy</td>
</tr>
<tr>
<td>Complex PTCA</td>
<td>Intermediate</td>
</tr>
<tr>
<td>CTO</td>
<td>Standard</td>
</tr>
</tbody>
</table>

**Rail Support** = designed to allow the devices to cross the lesion

<table>
<thead>
<tr>
<th>Clinical application</th>
<th>Rail Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least rail support: POBA</td>
<td>Light Support</td>
</tr>
<tr>
<td>Stent delivery</td>
<td>Moderate Support</td>
</tr>
<tr>
<td>Added support for Stent delivery (Designed for the first generation of stents)</td>
<td>Extra Support</td>
</tr>
<tr>
<td>Vessel Straightening</td>
<td>Super Support</td>
</tr>
</tbody>
</table>
# Categories of Guidewires

<table>
<thead>
<tr>
<th>Standard Cases/AMI</th>
<th>Tortuous Cases-Hydrophilic</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMW</td>
<td>Whisper</td>
</tr>
<tr>
<td>BMW Universal</td>
<td>Traverse</td>
</tr>
<tr>
<td>Cougar XT</td>
<td>Cougar LS</td>
</tr>
<tr>
<td>Zinger Medium</td>
<td>Zinger Light</td>
</tr>
<tr>
<td>Floppy II</td>
<td>Zinger Marker</td>
</tr>
<tr>
<td>Choice</td>
<td></td>
</tr>
<tr>
<td>IQ/PT2</td>
<td>Miracle wires</td>
</tr>
<tr>
<td>ATW</td>
<td>Choice PT</td>
</tr>
<tr>
<td>Prowater</td>
<td>Cross-It wires</td>
</tr>
<tr>
<td></td>
<td>Pilot wires</td>
</tr>
<tr>
<td></td>
<td>Persuader 3-6-9</td>
</tr>
<tr>
<td>Extra Support Cases</td>
<td></td>
</tr>
<tr>
<td>BHW</td>
<td></td>
</tr>
<tr>
<td>Extra S’Port</td>
<td></td>
</tr>
<tr>
<td>Thunder</td>
<td></td>
</tr>
<tr>
<td>Zinger Support</td>
<td></td>
</tr>
<tr>
<td>Trooper</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Tough Crossing Cases-CTO</td>
<td></td>
</tr>
</tbody>
</table>

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Guidewires Selection

Select a guide wire that traverses the coronary anatomy

- safely
- independently
- without vessel trauma

Take into account:

- access to lesion
- crossing support
- platform for device manipulation

Guide wire selection is influenced by:

- Vessel anatomy
- Lesion location
- Lesion morphology
- Device selection
- Operators preference

- Tortuosity
- Stenosis severity
- Proximal
- Distal
- Bifurcation
- Concentric vs eccentric
- Focal vs diffuse
- Soft vs calcified
- Length
**Tips and tricks**

- Avoid excessive rotation
- Maintain free movement of wire tip
- Withdraw or reposition if needed
- Avoid undue force

**What can go wrong?**

- Plaque embolization
- Arterial perforation
- Acute vessel closure
- Sub-intimal wire placement
- Wire fracture
- Wire tip entrapment
“The guide is passed across the atheromatous block without going through the wall more by the application of judgement than force”

Charles Dotter an Melvin Judkins, Circulation 1964; 30:654-670
Quick Self Assessment …
“They love pericardium” is statement for:

1. Floppy wires
2. Extra support wires
3. Hydrophylic wires
4. Hydrophobic wires
“They love pericardium” is statement for:

1. Floppy wires
2. Extra support wires
3. Hydrophylic wires
4. Hydrophobic wires
Excellent flexibility and steering are characteristics for:

1. Stainless steel wires
2. Nitinol wires
3. High tensile strength stainless steel wires
4. Stainless steel and nitinol wires
Excellent flexibility and steering are characteristics for:

1. Stainless steel wires
2. Nitinol wires
3. High tensile strength stainless steel wires
4. Stainless steel and nitinol wires
Hydrophilic guidewires have all these characteristics EXCEPT:

1. Attract water
2. Becomes gel when wet
3. Difficult to cross the lesion
4. Reduces friction
Hydrophilic guidewires have all these characteristics EXCEPT:

1. Attract water
2. Becomes gel when wet
3. Difficult to cross the lesion
4. Reduces friction
Which guidewire doesn’t belong to the group:

1. BMW
2. Floppy II
3. Pilot
4. Prowater
Which guidewire doesn’t belong to the group:

1. BMW
2. Floppy II
3. Pilot
4. Prowater
Which guidewire doesn’t belong to the group:

1. Whisper
2. Traverse
3. Zinger
4. Choice PT
Which guidewire doesn’t belong to the group:

1. Whisper
2. Traverse
3. Zinger
4. Choice PT
Which guidewire doesn’t belong to the group:

1. Miracle
2. Cross It
3. Pilot
4. BMW Universal
Which guidewire doesn’t belong to the group:

1. Miracle
2. Cross It
3. Pilot
4. BMW Universal
Core diameter - which statement is true:

1. Smaller diameter = less flexibility
2. Larger diameter = more support & torque
3. Larger diameter = more flexibility
4. Smaller diameter = more support & torque
Core diameter - which statement is true:

1. Smaller diameter = less flexibility
2. Larger diameter = more support & torque
3. Larger diameter = more flexibility
4. Smaller diameter = more support & torque
Match the following guidewires with appropriate cases:

1. Standard cases/AMI
2. Tortuous cases
3. CTO-Tough crossing cases
   a. Shinobi
   b. BMW
   c. Wiggle
Match the following guidewires with appropriate cases:

1. Standard cases/AMI   b.
2. Tortuous cases        c.
3. CTO-Tough crossing cases a.

a. Shinobi
b. BMW
 c. Wiggle
Cases Review
CASE 1

- K. J.
- Age: 60 years
- Gender: male
- Risk factors:
  - prior IM
  - hiperlipidemia
Location, approach, type of stent

- ost LAD
- Approach
- Guidewire 0.014”
- Guidewire 0.014”
- Guidewire 0.014”
- Balloon pre dilatation
- Balloon pre dilatation
- Stent to LAD

- 100%+CTO+collateral
- trans radial
- Hydrophilic
- Hydrophilic
- Floppy Extra Support
- 1,5/20mmx12atm
- 1,5/20mmx16atm
- 3,5/24mm x 14atm
Ostial LAD  100%
Multi wires approach

Hydrophilic 0.014" (LAD), Floppy Extra support 0.014" (Cx)
Multi wires approach

Hydrophilic 0.014”(LAD), Floppy Extra support 0.014”(Cx)
Balloon catheter pre dilatation  1,5/20mm x 18atm
Result after post dilatation
BMS deployment (3,5/24mmx14atm)
Final result
CASE 2

- A. V.
- Age: 66 years
- Gender: female
- Risk factors:
  - hypertension
  - hiperlipidemia
Location, approach, type of stent

- p RCA
- m RCA
- p LAD
- m LAD
- p LCx

Approach
- Stent to p RCA
- Stent to m RCA

- 99%+TIMI flow=2
- 90%+TIMI flow=2
- 80%+TIMI flow=3
- 85%+TIMI flow=3
- 90%+TIMI flow=3
- trans radial
- BMS 3.0/38x15atm
- BMS 3.0/20x22atm
- BMS 2.5/28x12atm
Left coronary artery
Multi wires approach: BMW, Hydrophilic wires
Balloon catheter 2.0/20mm x 15atm pre-dilatation
Balloon catheter 2.0/20mm x 15atm pre-dilatation
Removing balloon catheter
Result
BMS implantation 2.5/28mm x 12atm
Post-stenting result
BMS implantation 3.0/38mm
BMS implantation 3.0/38mm x 15atm
Post-stenting result
Balloon catheter 2.5/20mm x 15atm post-dilatation
Balloon catheter 3.0/10mm x 15atm post-dilatation
Result post balloon dilatation
BMS implantation 3.0/20mm x 22atm
Final result
CASE 3

- T. G.
- Age: 68 years
- Gender: male
- Risk factors:
  - hypertension
  - positive family history
  - prior IM
  - prior PCI/stenting to LAD et LCx
Location, approach, type of stent

- m RCA
- m LCX
- OM
- Approach
- Guidewires
- Balloon pre dilatation
- Stent to m LCx
- Balloon post dilatation

- intermediate
- 95-99% TIMI flow=3
- 95% TIMI 3 flow
- trans radial
- BMW 0.014” x 2
- 2.0/15x12atm
- BMS 2.75/28x16atm
- 3.0/15x12atm
Left coronary artery
Result after balloon dilatation (OM)
BMS 2.75/28mm x 16atm
Result after stenting
Balloon catheter post dilatation 3.0/15 x 12atm