Guidewires

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Historical Perspective

• Grüntzig performed the first coronary angioplasty in 1977 using a short, non-independently movable guidewire. The balloon and the guidewire were advanced as a single unit with limited manoeuvrability.

• In 1982 Simpson reported the use of an independently movable, flexible-tipped guidewire within the over-the-wire balloon dilation catheter to facilitate the selection of the target vessel.

• Guidewire technology has since advanced significantly, with a wide selection for different lesion characteristics and vessel anatomies.
Guide Wire Selection Goals

- Traverse the coronary anatomy safely independently and without damaging the vessel
- Appropriate match for clinical setting
  - Workhorse/front-line use
  - Navigate tortuous anatomy
  - Provide extra support
  - Challenging lesions

Guide Wire Selection Strategic Goals

- Select a guide wire to specifically match a clinical/anatomical situation
- Appropriate guide wire selection can make it easier to overcome difficult clinical scenarios
Guidewire selection may be influenced by:

- Vessel Take-off
- Vessel Anatomy
- Lesion Location
- Lesion Morphology
- Device Strategy

![Vessel take-off / Bifurcation](image)

The Guidewire Building Blocks

1. Core material
2. Core diameter
3. Core taper
4. Tip style
5. Coils & covers
6. Coatings

A Balancing Act of Trade-offs Between Performance and Clinical Attributes. By changing the different “building blocks” we change the characteristics!
Central core

- Longest & stiffest portion of guidewire
- Tapers distally to a variable extent
  - 2-piece core- distal part of core does not reach distal tip of wire → shaping ribbon, extends to distal tip
  - 1-piece core- tapered core reaches distal tip weld
- 2-piece → easy shaping & durable shape memory
- 1-piece → better force transmission to tip & greater “tactile response” for operator

Central core

**Stainless steel**
- superior torque characteristics, can deliver more push, provides good shapeability of tip
- more susceptible to kinking

**Durasteel**
- better tip shape retention and durability

**Nitinol**
- pliable but supportive, less torquability than stainless steel
- generally considered kink resistant & have a tendency to return to their original shape, making them potentially less susceptible to deformation during prolonged use
Distal tip

- Flexible, radio-opaque part

- Consists of spring coil extending from distal untapered part of central core to distal tip weld

- Integrates tapered core barrel (as well as shaping ribbon in 2-piece wire)

- Spring coil-variable length (1-25cm) with a radio-opaque section located at its terminal end

- Distal tip weld- short (≤2mm) compact cap forming the true distal end of the wire - to ↓ trauma while the wire is traversing vessels

Core Taper & Grinds

- Broad, gradual, or long tapers
  Offers acute vessel access, improved tracking
  The wire follows itself well around bends

- Abrupt or short tapers
  Creates support in shorter distance
  Greater tendency to prolapse
Tip Styles

- Better steerability
- Force transmission
- Tactile feedback
- Tip stiffness/Tip-load
- More durable
- Ideal for peripheral (distal) vessels
- Easy tip shapability
- Flexibility, softness
- Ability to prolapse
- More delicate

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Tip Styles

**Tapered**
- Narrow tip profile with torque and tip control
- Easier crossing of tight lesions
- Might access micro-channels or existing lumen in a functional occlusion

**Straight**
How Do Each Component Translate to Performance?

Each component affects a technical attribute and each attribute in turn has an impact in performance characteristics of the wire.

SHAPING THE WIRE TIP

• A bend at the tip of the guidewire allows it to be manipulated.

• The most common way of shaping the guidewire is to draw it over the thumb and index finger, a guidewire introducer or a needle.

• It is important to minimize the amount of force applied to the wire to avoid damaging the structure and solidity of the wire.

• The shape of the distal tip can mimic the take-off of the vessel or the curve of the artery. (Usually a simple J-curve with a distal bend that approximates the vessel diameter).
Wire Coating
(hydrophilic/hydrophobic)

Hydrophobic:

- Repels water - requires no wetting
- ↓friction, ↑trackability
- Preserves tactile feel, allows easier anchor ability / parking specially in CTO
- Silicone, Teflon
Hydrophilic:

- Attracts water - needs lubrication
- Thin, slippery, non-solid when dry → becomes a gel when wet
- ↓ friction → glide through tortuousities
- ↑ trackability
- ↓ Thrombogenicity
  ➢ ↓ tactile feel- ↑ risk of perforation
  ➢ Tendency to stick to angioplasty cath

- Useful in negotiating tortuous lesions and in “finding microchannels” in total occlusions
- Lubricity is highest with hydrophilic wires, less with Silicone coating and least with PTFE or Teflon coating

Coating
Wire Categorization

• Workhorse.

• Tortuous Anatomy.

• Extra Support.

• Highly Stenosed Lesion - CTO

Workhorse:

• Physician’s first wire for up to 90% of cases.

• “All around” wire

Example:

• Abbott HT BMW Family
• Choice Floppy
  • PT series
  • Galeo
• Terumo Runthrough Floppy
Wire Categorization

**Tortuous Anatomy:**
* To access lesions in extremely difficult anatomy
* Distal
* Tortuous
* Acute angles before lesion

**Example:**
* Abbott Whisper Family
* PT2 series
* Abbott Pilot-50
* Asahi FielderFC

Wire Categorization

**Extra Support:**
* Delivering stiffer, bulkier devices
* Delivering stents in tortuous anatomy
  * “Bigger rail”
  * Straighten vessel

**Example:**
* Abbott BHW
* PT 2 MS
* Abbott Whisper ES
* Asahi Grandslam
Wire Categorization

Highly Stenosed Lesion – CTO:
• To cross very tight lesions
• Often swapped out after crossing

Example:
• Abbott HT Progress Family
• Asahi Conquest (Confianza) Family
• Asahi Miracle Bros Family
• Asahi FielderXT, XT-A, XT-R
• Asahi Gaia Series
• Terumo Runthrough Intermediate

Wire Categorization

• One operator’s “work horse” wire can be another operator’s “extra support” category wire operator’s experiences).

• Each patient’s lesion & anatomy will likely require all properties of guide wires at different degree (priority), and sometimes will require more than one wire.
Choice of CTO Guidewire

Considerations:
- Torque
- Stiffness
- Feel (tactile response)
- Tip shaping

Hydrophobic Wires:
- Better tactile response
- Good for older, fibro-calcific lesions
- Good for initial piercing of fibrous cap

Hydrophilic Wires:
- Good for less chronic total occlusion; softer
- May find microchannels easier (especially with tapered tip)
- Follow path of least resistance; easier to go extra-luminal

Control Drilling

The guide wire is advanced using gentle movements. Straight tip guide wires facilitate tactile feedback and steerability. Step up with stiffer guide wires.
Penetration

Penetrating the obstruction aiming at the target. The direction of the guide wire is more precisely controlled. Tapered tip guide wires permit higher penetrating forces.

Recommended Guide Wires
- Straight Tip Guide Wires
  - ASAHI MIRACLEBROS 12
- Tapered Tip Guide Wires
  - ASAHI CONFIANZA 8
  - ASAHI CONFIANZA PRO 9
  - ASAHI CONFIANZA PRO 12
  - HT CROSS-IT 489XT
- Abbott Progress 140T
- Abbott Progress 200T

Sliding & Microchannel tracking

Very lubricious polymer covered guide wires are used to slide through narrow lesions or functional occlusions.

Recommended Guide Wires
- Tapered Polymer Tip Guide Wire
  - ASAHI FIELDER XT
- Polymer Covered Guide Wires
  - HT PILOT 150
  - HT PILOT 280
- Asahi XT-A
Collateral tracking

When an antegrade approach to the CTO fails or is contraindicated, the CTO can sometimes be approached from the retrograde direction. Flexible polymer covered guide wires are recommended for navigation through septals.

SION, SION BLUE Structure

<table>
<thead>
<tr>
<th>Guidewire</th>
<th>SION</th>
<th>SION BLUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tip load</td>
<td>0.8 g</td>
<td>0.5 g</td>
</tr>
<tr>
<td>Tip style</td>
<td>Core to Tip</td>
<td>Core to Tip</td>
</tr>
<tr>
<td>Distal coating</td>
<td>Slip coat (hydrophilic)</td>
<td>Slip coat (hydrophilic) + 1.5 cm Silicone coated tip (hydrophobic)</td>
</tr>
<tr>
<td>Coil length</td>
<td>28 cm</td>
<td>20 cm</td>
</tr>
<tr>
<td>Core material</td>
<td>High tensile stainless steel</td>
<td>High tensile stainless steel</td>
</tr>
<tr>
<td>Differences</td>
<td>Higher tip load, Less support</td>
<td>Softer tip load, More support, Hydrophilic coat + 1.5 cm hydrophobic tip</td>
</tr>
</tbody>
</table>

Source: ASAHI Data
FIEDLER XT-R & FIEDLER XT-A

Tip load: 0.8gf

Tapered type Polymer jacket

XT-R Durability & Control XT-A Crossability
Tip load: 0.6gf Tip load: 1.0gf

Trackability

Gaia Tip Design

ASAHI Gaia micro-cone tip
The ball tip is designed with a thinner taper to keep tip both flexibility and penetration efficacy.

ASAHI Gaia micro-cone tip

Conventional GW ball tip
Active wire control in Gaia wire

Properties Of An Ideal Guidewire

- Push transmission/steerability
- Torque transmission/torquability
- Body support/ trackability
- Tip support/mobility
- Flexibility
- Tip durability/elasticity
- Tip visibility and markers
- Tactile feedback
- Prolapse tendency

Do not rotate the wire too much
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

Case scenarios for different wires
Which guidewire would you prefer?
A) BMW
B) Pilot 150
C) PT2
D) Conquest

Which guidewire would you prefer?
A) BMW
B) Galeo
C) PT2
D) Pilot 200
Which guidewire would you prefer to attack this tortuous anatomy?
A) Galeo
B) Choice floppy
C) PT2 MS
D) Pilot 150

Which guidewire would you prefer in the side branch?
A) BMW
B) Pilot 50
C) PT2
D) Pilot 150
E) A or C
Which guidewire would you prefer to start with in this CTO?
A) BMW
B) Galeo
C) PT2
D) Asahi intermediate
E) Any of the above.

Which guidewire would you prefer when doing this retrograde approach for CTO?
A) BMW
B) Galeo
C) Fielder series
D) Pilot 200
Which guidewire would you prefer to enter the true lumen in this dissection?

A) BMW  
B) Fielder  
C) PT2  
D) Pilot 200

Conclusion
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>
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</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>
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</tbody>
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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:

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

Concentric vs eccentric
Focal vs diffuse
Soft vs calcified
Length
Thank You