Guidewire technologies

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## Guidewire lingo

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Torque control</td>
<td>Is an ability to apply rotational force at a proximal end of a guidewire and have that force transmitted efficiently to achieve proper control at the distal end</td>
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<tr>
<td>Trackability</td>
<td>Is an ability of a wire to follow the wire tip around curves and bends without bucking or kinking, to navigate anatomy of vasculature</td>
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<tr>
<td>Steerability</td>
<td>Is an ability of a guidewire tip to be delivered to the desired position in a vessel</td>
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<tr>
<td>Flexibility</td>
<td>Is an ability to bend with direct pressure</td>
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<tr>
<td>Prolapse tendency</td>
<td>Tendency of the body of a wire not to follow the tip around bends</td>
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<tr>
<td>Radiopacity/visibility</td>
<td>Is an ability to visualise a guidewire or guidewire tip under fluoroscopy.</td>
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<tr>
<td>Tactile feedback</td>
<td>Is tactile sensation on a proximal end of a guidewire that physician has that tells him what the distal end of the guidewire is doing</td>
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<tr>
<td>Crossing</td>
<td>Is an ability of a guidewire to cross lesion with little or no resistance</td>
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<tr>
<td>Support</td>
<td>Is an ability of a guidewire to support a passage of another device or system over it</td>
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</table>
Steerability and trackability
Steerability and trackability
Basic guidewire techniques for recanalization

- Sliding technique
- Drilling technique
- Balloon back-up
- Direct catheter passage
- Loop-based techniques
Sliding technique
‘Sliding’
‘Sliding’
‘Sliding’
Drilling
Balloon back-up
‘balloon back-up’
‘balloon back-up’
Direct balloon/support catheter advancement
‘Direct advancement’
J-loop technique

- Knuckle wire (lambda technique)
- Subintimal recanalization
Lambda technique
Lambda technique
J-loop technique

- Knuckle wire (lambda technique)
- Subintimal recanalization
Subintimal recanalization
Guide wire key components

The Building Blocks of All Guide Wires
Functional diameter

Guide Wire Stiffness – Diameter Differences

- .035"
- .018"
- .014"
The 6 guide wire core components

A balancing act of trade-offs between performance and clinical attributes; by changing the different “building blocks”, we change the characteristics!
The 6 guide wire core components

A balancing act of trade-offs between performance and clinical attributes; by changing the different “building blocks”, we change the characteristics!
1. Guide wire core materials

Core material affects flexibility, support, steering and tracking

Stainless Steel (SS)

Nitinol (NiTi)

Generation 1: Stainless Steel

Generation 2: High Tensile Strength SS

Generation 1: Nitinol

Generation 2: Stainless Steel+NiTi
The 6 guide wire core components

A balancing act of trade-offs between performance and clinical attributes; by changing the different “building blocks”, we change the characteristics!
2. Guide wire core diameter

Diameter affects flexibility
Support (stiffness) and torque response

Smaller diameter = More flexibility, enhanced trackability

Larger diameter = More support & torque, vessel straightening

Strength = Radius^4
Strength 0.018” = 2.73 \times \text{Strength of 0.014”}
The 6 guide wire core components

A balancing act of trade-offs between performance and clinical attributes; by changing the different “building blocks”, we change the characteristics!
3. Core tapers and grinds

**Core Taper** = The part of the wire where the diameter of the core changes over a set distance

**Core Grind** = The part of the core with constant diameter
3. Core tapers and 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
Guide wire support charts – how to read them
Differences in core and grind

3 Point Bend Test .018” Guide Wire

Hi-Torque Connect Flex (12g)  Hi-Torque Connect 250T (30g)  Hi-Torque Connect (30g)
A balancing act of trade-offs between performance and clinical attributes; by changing the different “building blocks”, we change the characteristics!
4. Guide wire tip design affects steering and durability

<table>
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<tr>
<th>Design Options</th>
<th>Core-to-tip</th>
<th>Shaping Ribbon</th>
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<tr>
<td>✓ Force transmission</td>
<td>✓ Ideal for peripheral vessels</td>
<td>✓ Ability to prolapse</td>
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<tr>
<td>✓ Better steerability</td>
<td>✓ More durable</td>
<td>✓ More delicate</td>
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<tr>
<td>✓ Tactile feedback</td>
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<td></td>
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<tr>
<td>✓ Easy tip shapeability</td>
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<td></td>
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<tr>
<td>✓ Flexibility, softness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓ Ability to prolapse</td>
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- Ribbon options:
  - Force transmission
  - Better steerability
  - Tactile feedback
  - Easy tip shapeability
  - Flexibility, softness
  - Ability to prolapse

- Core-to-tip options:
  - Ideal for peripheral vessels
  - More durable

- Shaping Ribbon options:
  - More delicate
Guide wire penetration power

• Understanding tip diameter and stiffness

**Tip Stiffness = 4.0g**

**Tip Diameter**

0.012”

**Area of Guide Wire Tip**

Penetration Power: 

\[
\text{Tip Stiffness} / \text{Area of Guide Wire Tip}: \quad 0.004 \text{kg}/(\pi \times 0.006”)^2
\]

Penetration Power = 40 Kg/in²
Penetration power scale

Penetration Power

HT Winn® 80
(9.7 g, ø .012” tip)

HT Winn® 40
(4.8 g, ø .012” tip)

HT Winn® 200T*
(13 g, ø .009” tip)

50 100 150 200

* “T” = Tapered
Step-up approach

Data on file at Abbott Vascular
The 6 guide wire core components

A balancing act of trade-offs between performance and clinical attributes; by changing the different “building blocks”, we change the characteristics!
5. Guide wire tip coils

- Affect support, steering, tracking and visibility (radiopacity)
- Impact dimension of wire
- Affect tactile feedback
Hi torque supra core™ construction

Dual coil construction is designed to provide support and flexibility
5. Guide wire covers

- Polymer or plastic
- Provide lubricity
- Smooth tracking through tortuosity
- Not to be confused with hydrophilic coating
5. Guide wire tip coils and covers - combinations

- Tip coils plus:
  - Intermediate coils
  - Bare core
  - Plastic cover
  - Polymer

- Polymer over tip coils

Polymer Cover + Tip Coils

Hi-torque Winn tip: exposed coils for better tactile response
The 6 guide wire core components

A balancing act of trade-offs between performance and clinical attributes; by changing the different “building blocks”, we change the characteristics!

- Repel water to create a smooth, “wax-like” surface
- No actuation with water required
- Reduces friction & provides improved device trackability

- Minimizes friction & provides better device trackability
- Attracts water to create a slippery “gel-like” surface
6. Guide wire coatings: lubricity vs. tactile feedback

Guide wire tip with:

- Polymer Cover With Hydrophilic Coating
- Hydrophilic Coating
- Hydrophobic Coating
- No Coating
# Designing for performance characteristics

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<tr>
<th>Feature</th>
<th>Performance Characteristics</th>
<th>Clinical Relevance</th>
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<tr>
<td>• Core diameter, material                                              • Torque transmission (steering)                                                           • Technique for advance/cross</td>
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<tr>
<td>• Inner tip diameter                                                   • Tip stiffness                                                                               • Lesion crossing-safety</td>
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<tr>
<td>• Coatings &amp; covers/sleeves                                            • Lubricity                                                                               • Lesion crossing ability</td>
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<tr>
<td>• Core diameter, taper length                                           • Support                                                                                 • Device delivery/pushability</td>
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<tr>
<td>• Material                                                             • Durability                                                                                • Wire durability/technique</td>
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<tr>
<td>• Tip design &amp; material                                                • Shaping and shape retention                                                               • Durability/push transmission</td>
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<tr>
<td>• Core tapers &amp; tip design                                             • Penetration/trackability                                                                   • Vessel access</td>
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<td>• Bare coils vs. polymer covers                                        • Tactile feedback                                                                          • Safety and positioning</td>
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<td>• Core tip dimensions, polymer covers &amp; coatings                       • Lubricity vs. safety                                                                        • Penetrating power and lesion crossing ability</td>
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- **Lubricity vs. safety**
- **Core diameter, material**
- **Inner tip diameter**
- **Coatings & covers/sleeves**
- **Core diameter, taper length**
- **Material**
- **Tip design & material**
- **Core tapers & tip design**
- **Bare coils vs. polymer covers**
- **Core tip dimensions, polymer covers & coatings**
- **Torque transmission (steering)**
- **Tip stiffness**
- **Lubricity**
- **Support**
- **Durability**
- **Shaping and shape retention**
- **Penetration/trackability**
- **Tactile feedback**
- **Lubricity vs. safety**
- **Clinical Relevance**
- **Technique for advance/cross**
- **Lesion crossing-safety**
- **Lesion crossing ability**
- **Device delivery/pushability**
- **Wire durability/technique**
- **Durability/push transmission**
- **Vessel access**
- **Safety and positioning**
- **Penetrating power and lesion crossing ability**
Designing for performance characteristics

**Performance Characteristics**
- Torque
- Tip Durability
- Tactile feedback
- Penetration
- Trackability
- Support

**Major Feature**
- Core diameter, core material
- Core material
- Polymer cover, Coatings
- Tip load, tip diameter
- Core diameter, Core tapers
- Core diameter, Core material

**Minor Feature**
- Core-to-tip, material bonds
- Coils, Core-to-tip
- Core tapers
Guidewire technologies

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