The Basics of Coronary PCI: Angiographic Views and Material Selection

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Material for Angioplasty

- **Sheath**: remember LONG SHEATH for tortuous iliac vessels (braided 24 cm) – aorta (65-90)

- **Guiding Catheter**

- **Guide Wire**

- **Balloon**
Guiding Catheter

Functions of Guide Catheter

- Conduit for injecting contrast and transporting guide wire & devices
- Device for measuring aortic & arterial pressures (side holes)
- System for back up support during intervention:
  - Balance between support and vessel damage from aggressive intubation.
Guiding Catheter

How to Handle It?

- Guiding catheters have thinner walls than diagnostic catheters: repeated spinning kinks, weakens, ruins them

- Rotate it while withdrawing or advancing it

- Maintaining wire within the catheter, deep inspiration may help

- If you have no torque control think of a sheath long enough to straighten the most tortuous arterial segments
Selection of guiding catheter

- Size
- Shape/Curve
- Length
<table>
<thead>
<tr>
<th>Guide/ Manufacturer</th>
<th>Inner lumen size</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tr>
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<td>0.091</td>
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Selection of guiding catheter

■ 6 F (2.00 mm) is the standard
  - Permits radial access
  - Allows active engagement
  - 2 modern monorails balloons fit (any size), 1.50 Rotablator
  - Less contrast

■ 7 F (2.33 mm)
  - Bifurcation techniques requiring Double stenting approach: Crush, V stenting
  - CTO (2 OTW catheters for parallel wire approach)
  - 1.75 Rotablator

■ 8 F (2.66 mm)
  - Atherectomy Flexicut
  - Rotablator (≥ 2.0)
  - IVUS + OTW catheter for guided recanalisation
Selection of Guiding Catheter: Left

- Judkins Left (JL)
- Amplatz Left (AL)
- Extra Back Up (EBU)
Example of guiding catheter’s curve

Left System

CLS™
Kiesz Left
Q-Curve™
Voda Left™
Selection of Radial guiding catheter

Radial Approach

Kimny™ Curve
- RCA & LCA Intervention
- Contralateral Support

Radial curve™
- RCA & LCA Intervention
- Contralateral Support

1 size fits all
How to select the curve?

LCA Length Variations

- Smaller Guides will Selectively Engage LAD
- Larger Guides will Selectively Engage and give better support LCx
- Amplatz tip selectively engages LCx
## Guiding catheter’s size in practice

**Left System**

<table>
<thead>
<tr>
<th></th>
<th>AL Curve Amplatz curve</th>
<th>XB Curve</th>
<th>JL Curve Judkins left</th>
<th>Q Curve</th>
<th>VL Curve Voda Left</th>
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<td><strong>Normal</strong></td>
<td>AL1</td>
<td>XB 4.0 or 3.5</td>
<td>JL4</td>
<td>Q 4</td>
<td>VL 4</td>
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<td><strong>Dilated</strong></td>
<td>AL2</td>
<td>XB 4.0 or 4.5</td>
<td>JL 4.5</td>
<td>Q 4.5</td>
<td>VL 5</td>
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<td><strong>Narrow</strong></td>
<td>AL 0.75</td>
<td>XB 3.0 or 3.5</td>
<td>JL 3.5</td>
<td>Q 3.5</td>
<td>VL 3</td>
</tr>
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</table>
Changes in the Practice of Angiography

**CABG Oriented**
- Standard multiple views focused on detection of “significant” stenoses and status of distal vessels (run-off, site anastomosis)
- No limitations to contrast use (only diagnostic angiogram performed)
- Angiogram and clinical data reviewed in a cardiological-surgical session for a final decision

**PCI Oriented**
- Selected views focused on culprit stenotic segment, showing status of adjacent vessel segments and involvement of sidebranches
- More careful use of contrast (angioplasty follows in most cases)
- A decision on the best treatment option must be taken after angiography

Di Mario, Sutaria Heart 2005
Standard Views LCA

50° LAO with 30° cranial
(Left main, LAD, diagonal, proximal Cx, distal RCA by collaterals)

40° RAO
(LAD, Circumflex)

30° RAO with 35° cranial
(Left main, LAD, diagonals)

30° RAO with 25° caudal
(LAD, circumflex, intermediate, distal left main)

60° LAO
(Circumflex, distal RCA by collaterals)

Left Lateral
(LAD, circumflex)
Visualisation of LAD Anatomy: 2\textsuperscript{nd} Segment

Spider (LAO Caudal) AP Cranial Left Cranial
Selection of guiding catheter
Right system

Judkins Right (RL)  Amplatz Right (AR)
Take-Off Right Coronary Artery

Transverse

Superior

Inferior

Judykins Right

JR, Hockey-Stick, EBU R, Amplatz Right or Left

JR, Multipurpose, SLS
Example of guiding catheter’s curve

RCA: Superior Take-Off

- allRight (Art curve)
- Right coronary Shepherd’s crook
- Kiesz Right Superior
- Hockey Stick
- Amplatz Left ™
Vertical Take-Off Combined with High and Posterior Origin

Aortogram
Standard Views RCA

50° LAO
(proximal RCA, crux, posterolateral)

30° LAO, 20° cranial
(proximal RCA, crux, posterolateral)

RAO 40°
(proximal RCA, posterior descending)

PA, 30° cranial
(posterior descending, crux, posterolateral)
Right Coronary Artery: Lesion Second Segment + Distal Branch for Posterior Wall
Selection of guiding catheter

- Length:
  - Standard length:
    - 100cm.
  - Shorter length for distal lesions (LIMA, sequential SVGs, retrograde approach to CTO):
    - 85 cm, 90 cm
  - Longer length (Tall patients, tortuous aortoiliac vessels):
    - 110-115 cm
Choice of a guiding catheter

**Take Home message**

- Diagnostic curve selection
- Size of the Aortic root
- Origin and take-off of target artery
- Location & severity of lesion
- Device to be utilized during intervention
Choice of the guide wire

**Workhorse**
- High Torque Floppy ACS
- BMW Universal Guidant/Abbott
- Runthrough Terumo
- Prowater (Renato) Asahi/Abbott
- ATW Cordis
- Galeo Flex Biotronik

**Dedicated**
- Tortuous/calcific vessels (polymer coated, Faβdasher)
- Tortuous (High Support)
- CTO (Cross-It, Persuader, Miracle,
  Confianza, CrossWire, Shinobi)
- Active Steer (Steer-It)
- RotaWire (0.09”, uncoated)
Guidewire Construction

3 basic components

- Central Core
  - (stainless steel, or nitinol)
- Outer Covering:
  - Polymer sleeve
  - or
  - Coil-Spring
    - (Platinum, Tungsten, Stainless Steel)
- Lubricious Coating
  - (silicone - hydrophobic, hydrophilic)

145 cm

40 cm

Extension: DOC, Cynch, AddWire
Rail Support Examples

Moderate support

Super support
Guidewires
Mechanical Properties

**SUPPORT**
- Faβdasher (0.010”)
- Choice PT
- ATW Cordis
- Pilot
- Prowater (Renato)
- Runthrough
- BMW Universal
- BMW
- Choice PT Support
- Ironman
- Mailman
- Platinum Plus

**TIP STIFFNESS**
- Soft
- Intermediate
- Standard
- Pilot 50
- Crossit/Pilot 100
- Crossit/Pilot 200
- Crossit 400
- Miracle 3
- Miracle 4.5
- Miracle 6.0
- Miracle 12
Core Material
Nitinol

More Flexible, Reshapable, Kink Resistant, Durable (3V angioplasty)
Less Tensile Strength
Different Polymer Coated Wires

Guidant Pilot 50: Coil for better shape and visibility, polymer for lubricity

BSC P2: Lubricious, poor tactile feed-back while advancing, limited support and radiopacity, difficult to shape

BSC Choice PT Plus, lubricious Tip to advance into the vessel, Excellent Support
Guidewires

How to Handle It?

- Get familiar with one workhorse wire and use it for most cases

- DON’T USE ROUTINELY A POLYMER COATED WIRE AS YOUR WORKHORSE (easier to slide down but more dissections and distal perforations!!!)

- Learn how to shape it

- Never push when the wire bends: WITHDRAW and ROTATE

- Learn how to change a wire using OTW balloon/catheters

- Expand your range of wires when you start dealing with more complex lesions
1. Spring (coil) Tip
   - Stainless steel with inner platinium coil for Radiopacity
   - MP 35N Alloy

2. Polymer Tip
   - Polymer sleeve loaded with Tungsten for Radiopacity
Guide Wire Shaping

PreShaped: possible advantage for polymer-coated wires but ....

Heated tip becomes stiffer;

curve never matches real anatomy;

no secondary curve
Primary Curve Matches Most Angulated Vessel Bend

Secondary Curve Matches the Vessel Size

Secondary Primary

Secondary Primary

Secondary Primary

Secondary Primary
IQ™ Guide Wire with Markers

5, 15, 20, 25, 35, & 40mm measurements possible
Tortuosity

- Steerability
- Tracking
- Tip control
- Support

Examples:
- BMW
- Whisper MS

Alternatives: Double Wire; supersoft lubricious wire to start:
Change OTW to a stiffer wire
Extremely tortuous vessel
Pre-procedure
Extremely tortuous vessel

Pre-dilatation

1.5mm balloon  Crescendo 2.0x12 (Cordis)  2.5x12 BA
Extremely tortuous vessel

After dilatation with 2.5mm BA

RAO Caudal

Spider
Extremely tortuous vessel

Final Result after PostDilatation 3.0 x 18 Atm

Stent Positioning    RAO Caudal    Spider
Extremely tortuous vessel

Final Results after 3.0 mm balloon at 18 Atm

RAO Caudal  Spider
75 yo gentleman

- Two sets of CABG, most recent Nov 2004 with a pedicle RIMA to LAD and SVG to OM2
- Widespread peripheral artery disease
- Increasing angina
- Angiography Sep 2006 – access from left radial artery

- Cardiac risk factors:
  - Diabetes, Ex-smoker, HT, Dyslipidaemia
Severe LM-LAD stenosis
Unable to cross LM-LAD with Whisper (Asahi), Pilot 50, FaβDasher
Cordis STEER-IT™ Deflecting Tip Guidewire

- **Guidewire**
  - Length: 300 cm / 180 cm
  - OD compatible with 0.014” interventional devices
  - Torque response: 1:1

- **Deflection Tip**
  - 7 mm & 3 mm
  - Elastomer coated to ensure longevity
  - Minimum 45° bi-directional deflection

- **Handle**
  - Removable & re-attachable
  - Center, straight tip indicator
Steer-IT across, Predilatation, 3.5 x 13 mm Cypher Select, Postdilated to 4.0 mm
Balloon Catheters

Basic Terminology

Hub ——— Proximal Shaft ——— Dist. Shaft ——— Balloon ——— Tip

RX

Guide-wire

GW Exit Port

May be coated

Transition

Transition Angle

Inner Body

Outer Body

Distal Segment

May be coated
Catheter Design

Rapid Exchange - RX

Over the Wire - OTW

Workhorse

CTO, wire exchange
Selection of Balloon Catheter

- Balloon Diameter
- Balloon Length
- Balloon Compliance
- Shaft Diameter
- Shaft Length
- Crossing Profile
Example What is “Crossing Profile”

<table>
<thead>
<tr>
<th>Balloon Junction (prox. seal OD)</th>
<th>Proximal Shoulder (2/3)</th>
<th>Distal Profile (1mm)</th>
<th>Tip seal (Xing profile)</th>
<th>Tip Entry Profile</th>
<th>Tip I.D.</th>
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<tbody>
<tr>
<td>0.037&quot;</td>
<td>0.031&quot;</td>
<td>0.031&quot;</td>
<td>0.024&quot;</td>
<td>0.019&quot;</td>
<td>0.0155&quot;</td>
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**BALLOON PROFILE**
Selection of Balloon Diameter

- Vessel Size (Tapering? Long Lesions)
- PreDilatation/PostDilatation
- Remember Quarter Sizes
- Remember Balloon Compliance

Selection of Balloon Length

- Lesion Length
- PreDilatation: shorter than final stent
- PostDilatation: short for resistant lesions
Balloon Sizing

- **Reference vessel**
- **0.9 to 1.1 ratio**
- **QCA**
- **IVUS**
PTCA Balloon Catheters
Relationship between pressure and diameter

- **Compliant balloon**
  - CrossSail, OpenSail
    - 8ATM: 3.0mm Nom
    - 14ATM: 3.25mm RBP
    - (18ATM: 3.54mm)

- **Semi-Compliant**
  - PowerSail
    - 10ATM: 3.0mm Nom
    - 18ATM: 3.18mm RBP
    - (22ATM: 3.25mm)
## Balloon Compliance 3.0mm

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<tr>
<th>3.0mm</th>
<th>ATM</th>
<th>Maverick</th>
<th>Quantum Maverick</th>
<th>Powersail</th>
<th>Taxus Lib.</th>
<th>Cypher Sel.</th>
<th>CoStar</th>
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<td>9</td>
<td>3.14</td>
<td>2.89</td>
<td>2.95</td>
<td>3.02</td>
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<tr>
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<td>10</td>
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<td>2.93</td>
<td>3.00(N)</td>
<td>3.08</td>
<td>3.00(N)</td>
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<td>3.02</td>
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<td>3.31</td>
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Withdrawal
Needs to be easy and safe

- **Rewrap:**
  - the ability of the balloon to regain its wrapped state upon deflation
  - Winging refers to the tendency of certain balloons to form planes impeding safe removal from the vessel and withdrawal into the catheter

- **Number of lobes**
  - Bifold vs Tri-fold

- **Manufacturing with lobes vs. without lobes**
  - Effect on wrap and re-wrap
Balloon Compliance
Clinical Importance

- Prevent damage to healthy vessel
- More compliant = limited pressure range
- Non-compliant = limited diameter range
- Semi-compliant = multipurpose use
- Clinical data
Coatings

- **Hydro-phobic**
  - Water “fearing”
  - Reasonably slippery
  - Silicon base
  - Example: SLX

- **Hydro-phylic**
  - Water “loving”
  - Only “Slippery when Wet”
  - when wet Extremely Slippery
  - Example: HydroCoat
Catheter Tip Examples
Requirements of PTCA Balloon Catheters
Pressure Terminology:

- **Nominal:**
  - The pressure at which the balloon reaches its nominal diameter (diameter on the label)

- **Rated Burst Pressure:**
  - The pressure at which and below which in vitro testing has shown that, with 95% confidence, 99.9% of the balloons will not burst

- **Mean Burst Pressure:**
  - The mathematical mean pressure at which a balloon bursts. The “average”
Balloon Characteristics

- Material
- Compliance
- Sizing
- Catheter platform