



First European Interventional Cardiology Fellows Course  
London, 16-18 November 2006



# The Basics of Coronary PCI: Angiographic Views and Material Selection

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# Material for Angioplasty

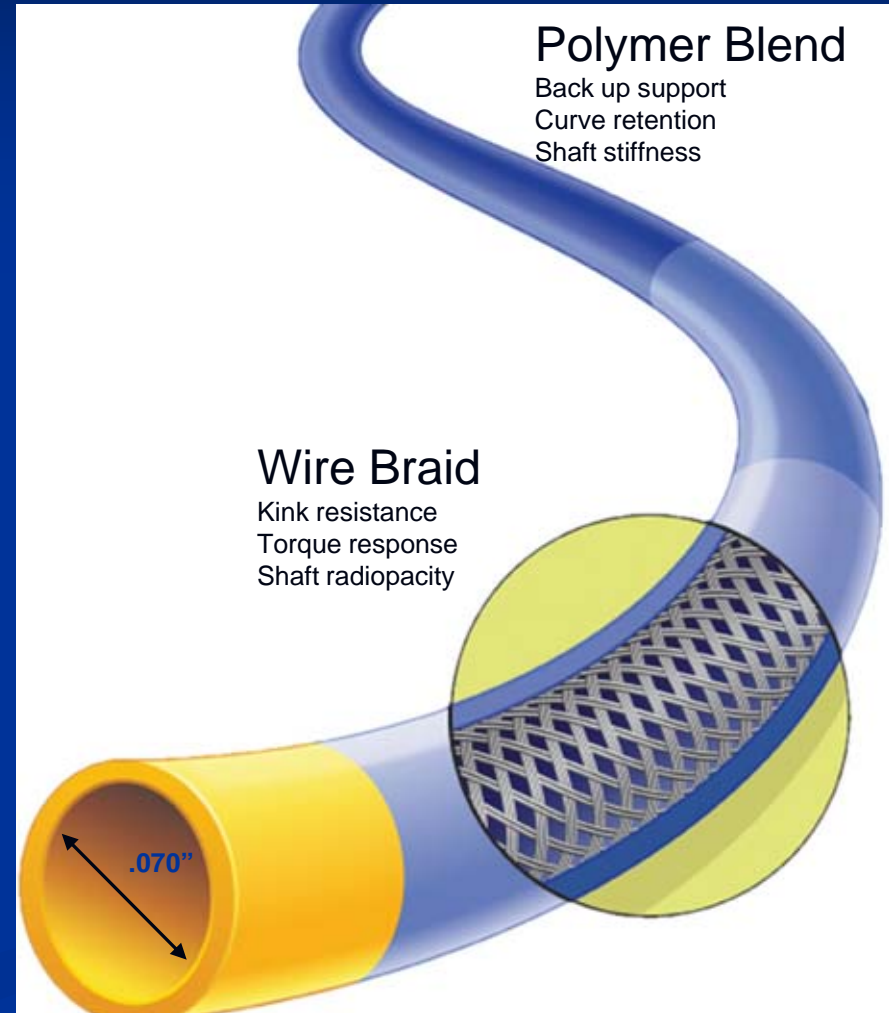
- **Sheath:** remember LONG SHEATH for tortuous iliac vessels (braided 24 cm) – aorta (65-90)
- **Guiding Catheter**
- **Guide Wire**
- **Balloon**

# 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.

Inner Lumen



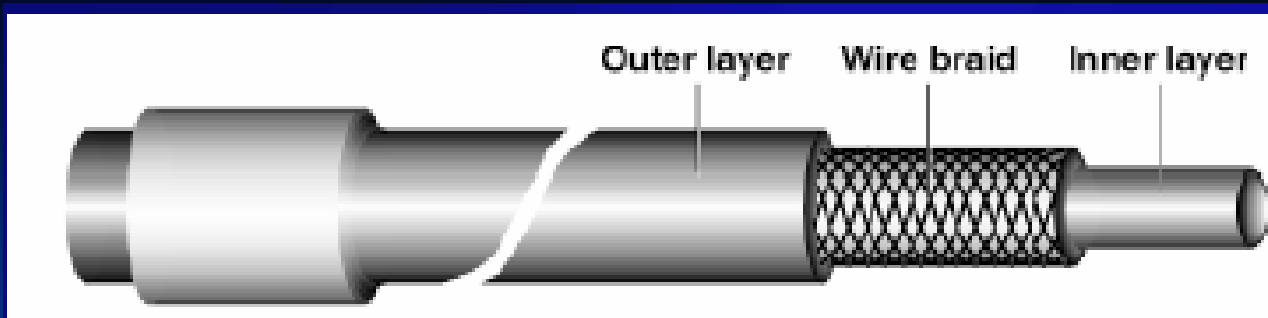
# Guiding Catheter

## 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



		Outer lumen size			
		5	6	7	8
Guide/ Manufacturer					
Launcher / Medtronic	Inner lumen size	NA	<b>0.071</b>	0.081	0.090
Vista Brite Tip / Cordis		0.056	<b>0.070</b>	0.078	0.088
Mach1 / BSC		NA	<b>0.070</b>	0.081	0.091
Viking / Guidant Abbott		NA	<b>0.068</b>	0.078	0.091
Wiseguide / BSC		NA	<b>0.066</b>	0.076	0.086

# 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 ( $\geq 2.0$ )
- ✓ IVUS + OTW catheter for guided recanalisation

# Selection of Guiding Catheter: Left

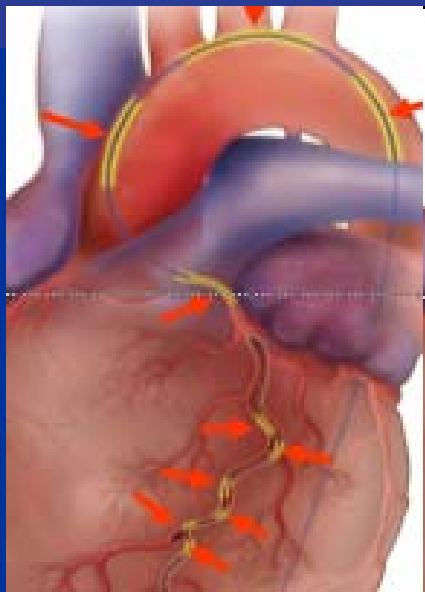
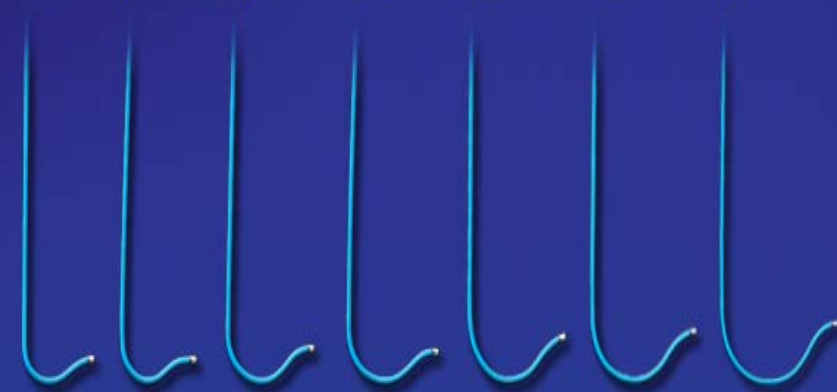
Judkins Left (JL)

Amplatz Left (AL)

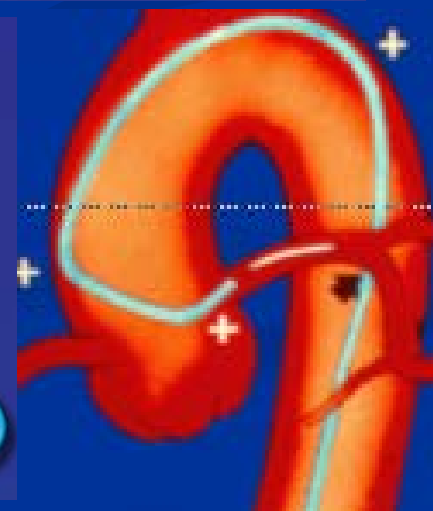
JL 3.0 JL 3.5 JL 4.0 JL 4.5 JL 5.0 JL 6.0



AL 0.75 AL 1.0 AL 1.5 AL 2.0 AL 2.5 AL 3.0 AL 4.0



EBU 3.0 EBU 3.5 EBU 3.75 EBU 4.0 EBU 4.5 EBU 5.0



Extra Back Up (EBU)



# Example of guiding catheter's curve

Left System



CLS™



Kiesz  
Left



Q-Curve™

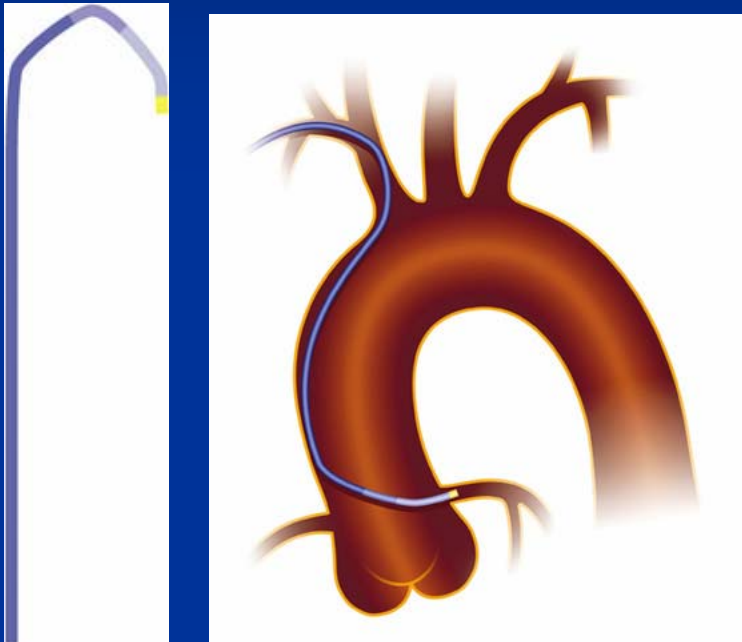


Voda  
Left™

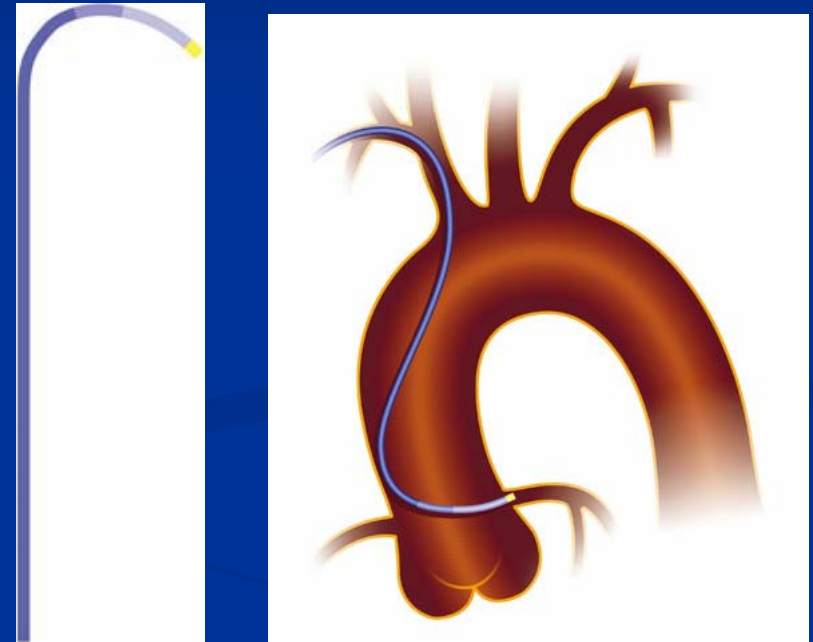
# Selection of Radial guiding catheter

## Radial Approach

Kimny™ Curve



Radial curve™



### Kimny Curve

- RCA & LCA Intervention
- Contralateral Support

1 size fits all

### Radial curve

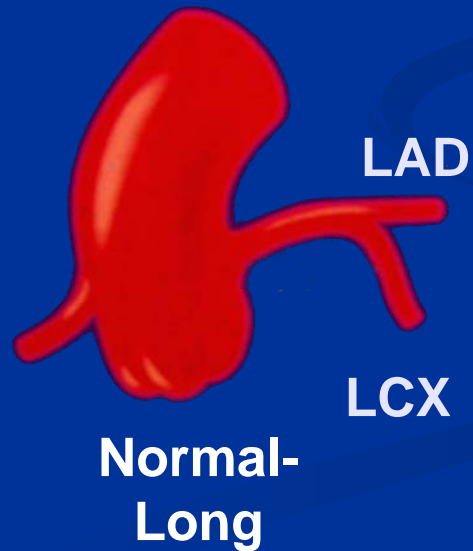
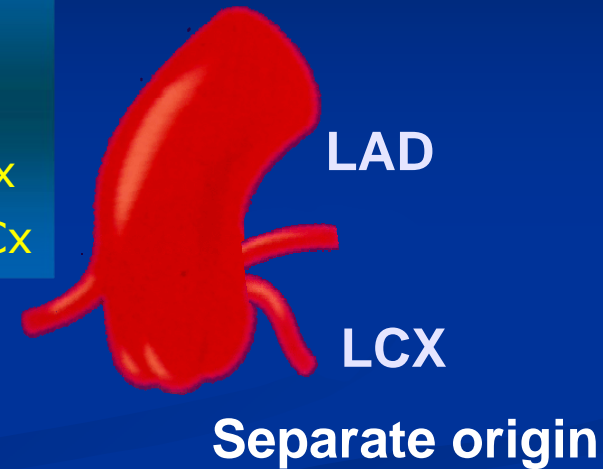
- RCA & LCA Intervention
- Contralateral Support

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

	AL Curve Amplatz curve	XB Curve	JL Curve Judkins left	Q Curve	VL Curve Voda Left
<b>Normal</b>	<b>AL1</b>	<b>XB 4.0 or 3.5</b>	<b>JL4</b>	<b>Q 4</b>	<b>VL 4</b>
<b>Dilated</b>	<b>AL2</b>	<b>XB 4.0 or 4.5</b>	<b>JL 4.5</b>	<b>Q 4.5</b>	<b>VL 5</b>
<b>Narrow</b>	<b>AL 0.75</b>	<b>XB 3.0 or 3.5</b>	<b>JL 3.5</b>	<b>Q 3.5</b>	<b>VL 3</b>

# Changes in the Practice of Angiography

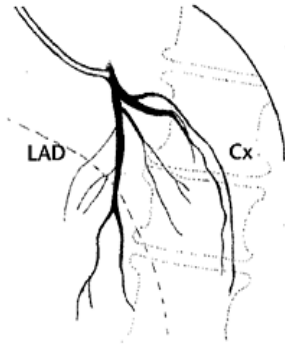
## CABG Oriented

- **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**

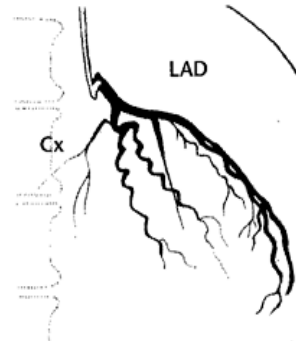
## PCI Oriented

- **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**

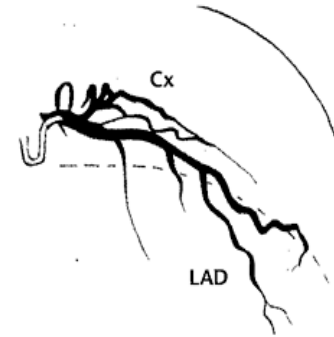
# Standard Views LCA



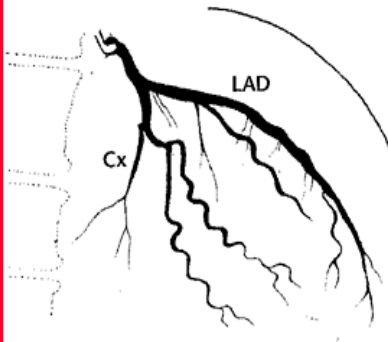
50° LAO with 30° cranial  
(Left main, LAD, diagonal,  
proximal Cx, distal RCA by  
collaterals)



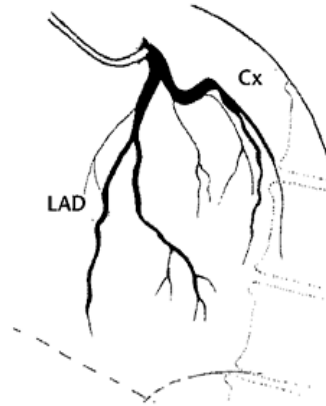
40° RAO  
(LAD, Circumflex)



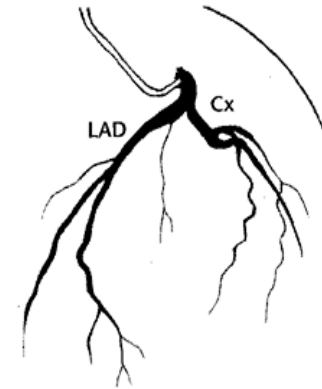
30° RAO with 35° cranial  
(Left main, LAD, diagonals)



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<sup>nd</sup> Segment



Spider (LAO Caudal)



AP Cranial



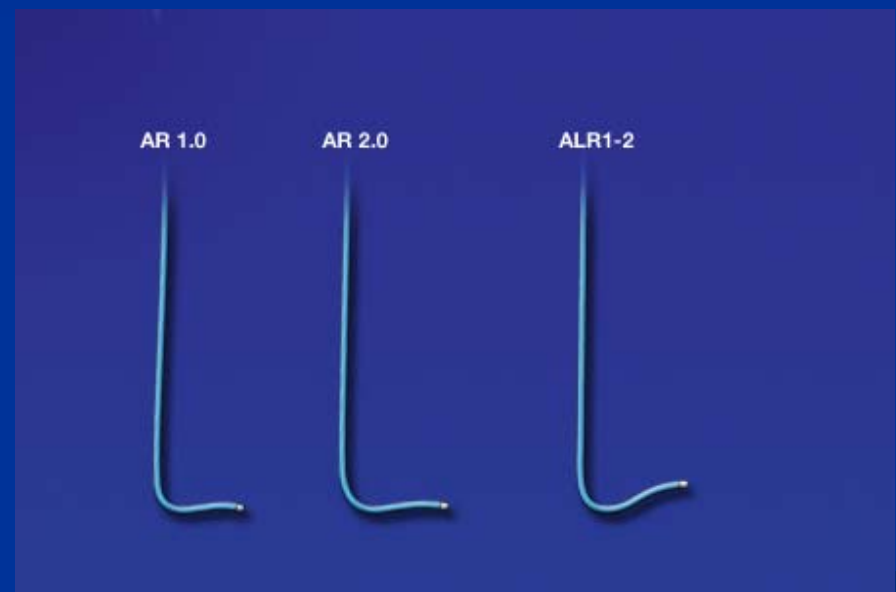
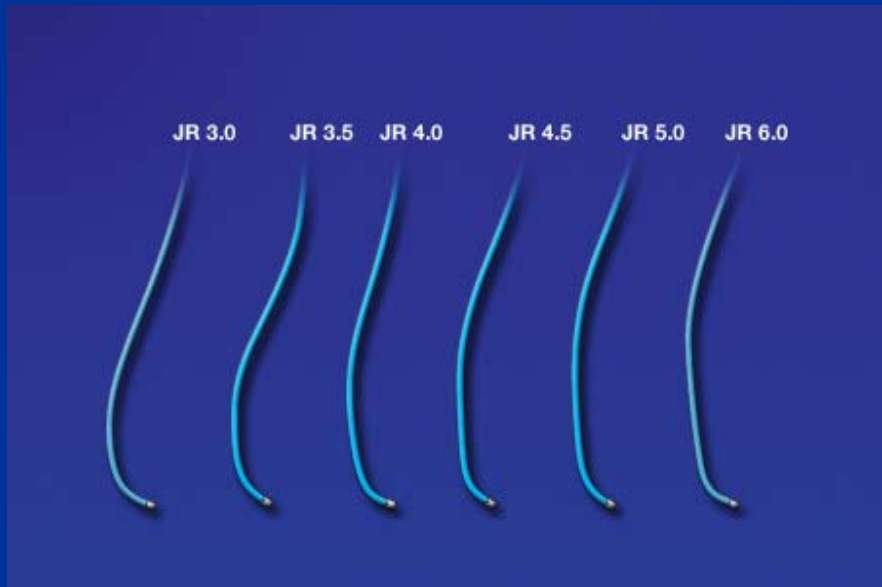
Left Cranial

# Selection of guiding catheter

## Right system

Judkins Right (RL)

Amplatz Right (AR)



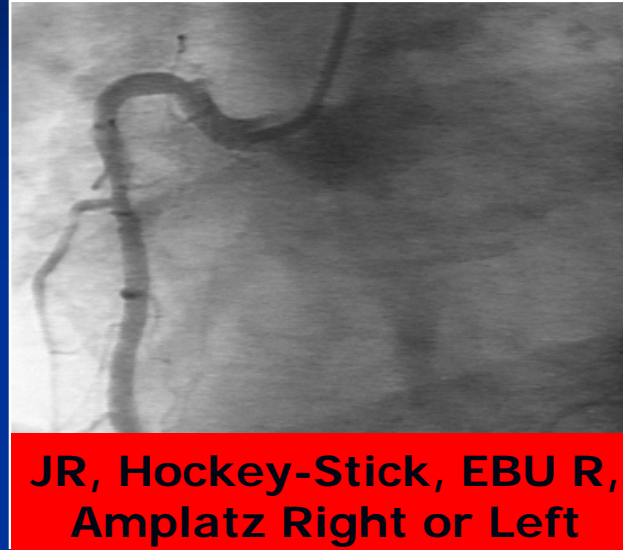
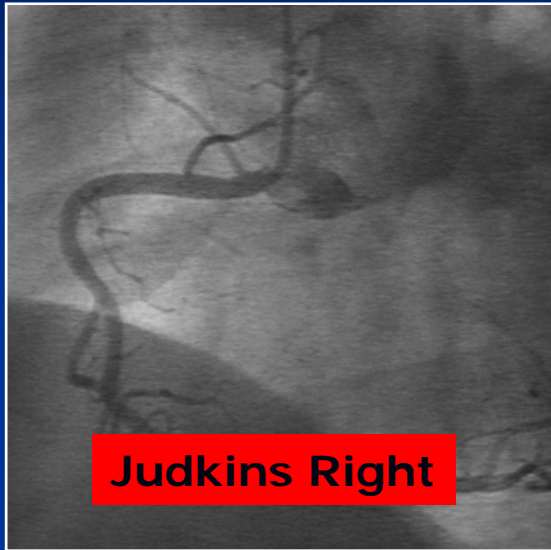


# Take-Off Right Coronary Artery

Transverse

Superior

Inferior



# Example of guiding catheter's curve

RCA: Superior Take-Off



allRight  
(Art curve)



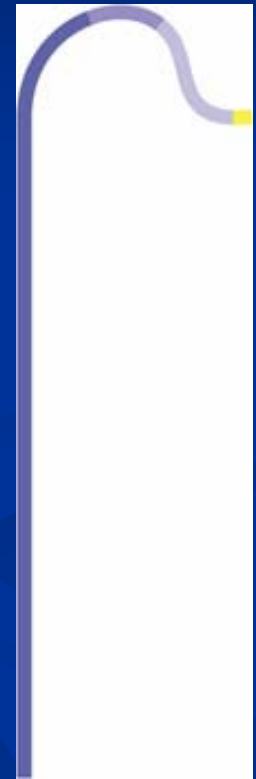
Right coronary  
Shepherd's crook



Kiesz  
Right Superior

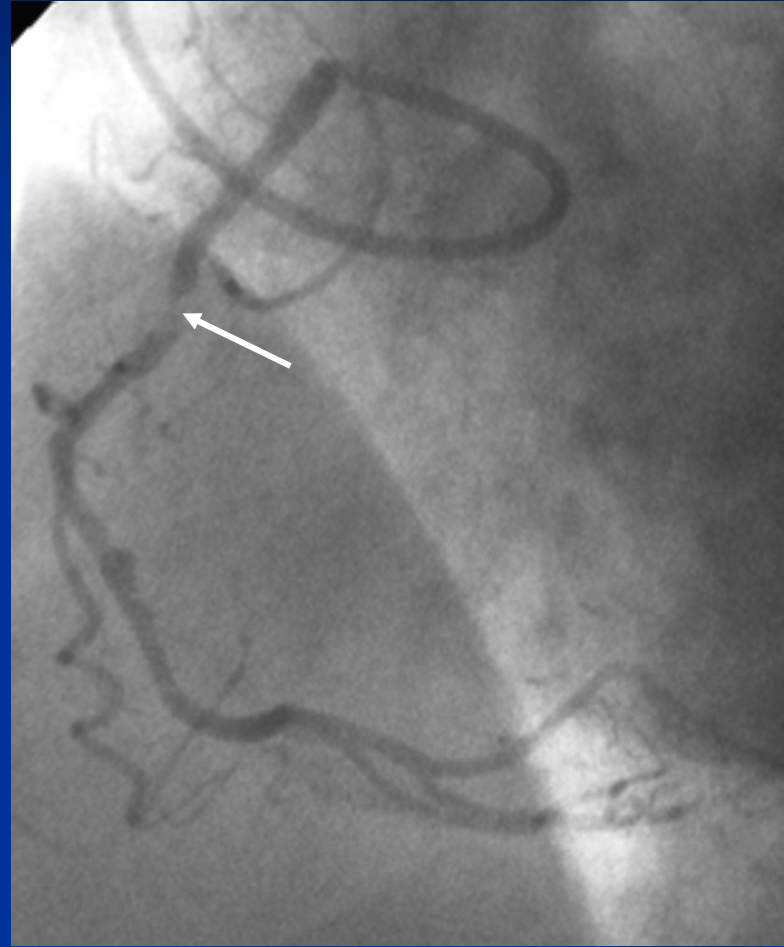
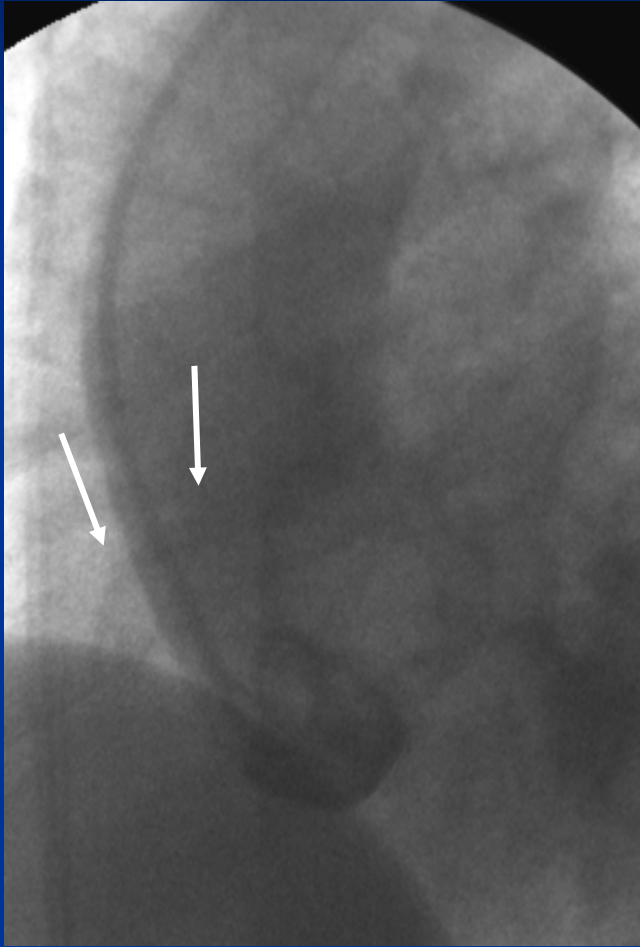


Hockey Stick



Amplatz Left <sup>TM</sup>

# Vertical Take-Off Combined with High and Posterior Origin

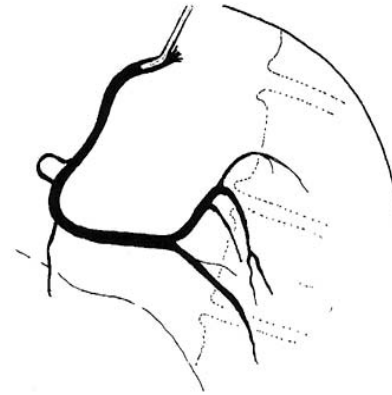


Aortogram

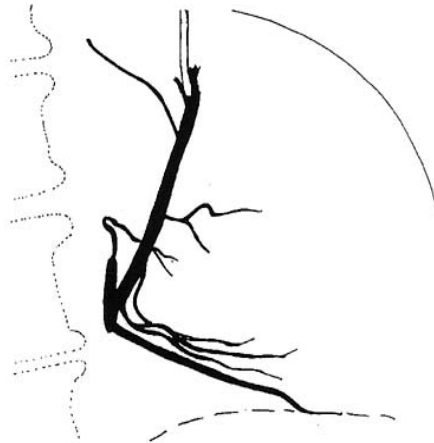
# Standard Views RCA



**50° LAO**  
(proximal RCA, crux,  
posterolateral)



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

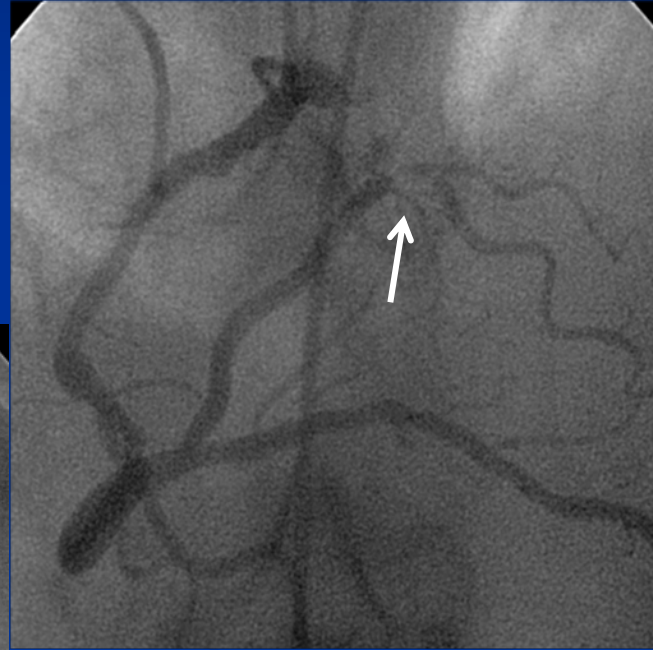
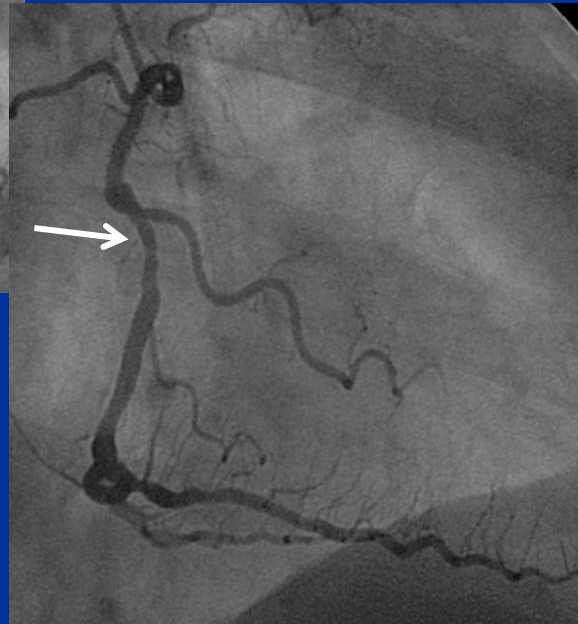
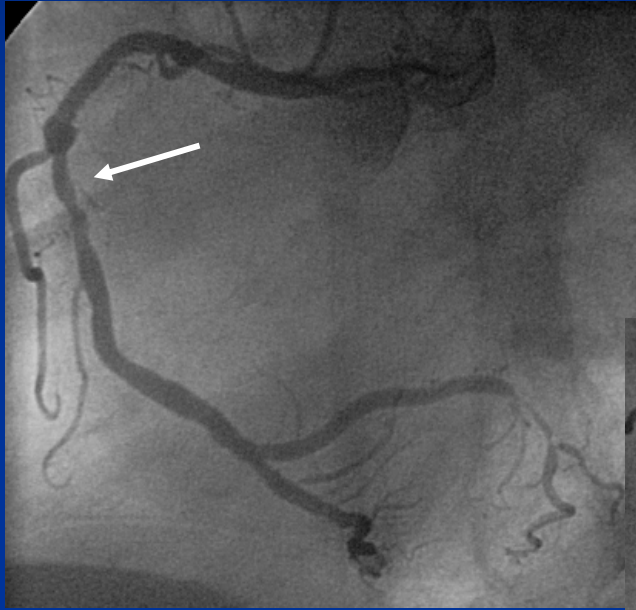


**RAO 40°**  
(proximal RCA, posterior  
descending)



**PA, 30° cranial**  
(posterior descending, crux,  
posterolateral)

# Right Coronary Artery: Lesion Second Segment + Distal Branch for Posterior Wall



# Selection of guiding catheter

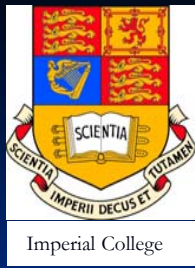
## ■ Length:

- Standard length:
  - 100cm.
- Shorter length for distal lesions (LIMA, sequential SVGs, retrograde approach to CTO):
  - 85 cm, 90 cm
- Longer length (Tall patients, tortuous aortailiac 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



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# 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

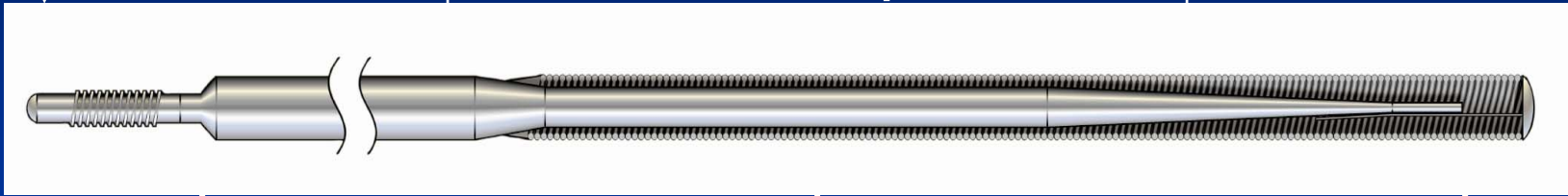
Tortuous/calcific vessels (polymer coated, Faßdasher)  
Tortuous (High Support)  
CTO (Cross-It, Persuader, Miracle,  
Confianza, CrossWire, Shinobi)  
Active Steer (Steer-It)  
RotaWire (0.09", uncoated)



Extension: DOC,  
Cynch, AddWire

# Guidewire Construction

3 basic components



**Central  
Core**

(stainless steel,  
or nitinol)

145 cm

**Outer Covering:  
Polymer sleeve**

or

**Coil-Spring**

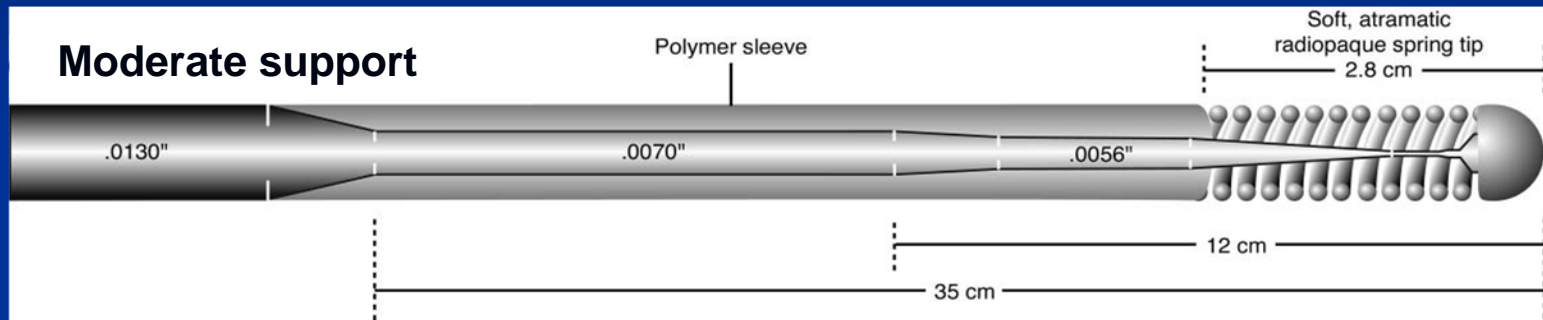
(Platinum, Tungsten,  
Stainless Steel)

40 cm

**Lubricious  
Coating**

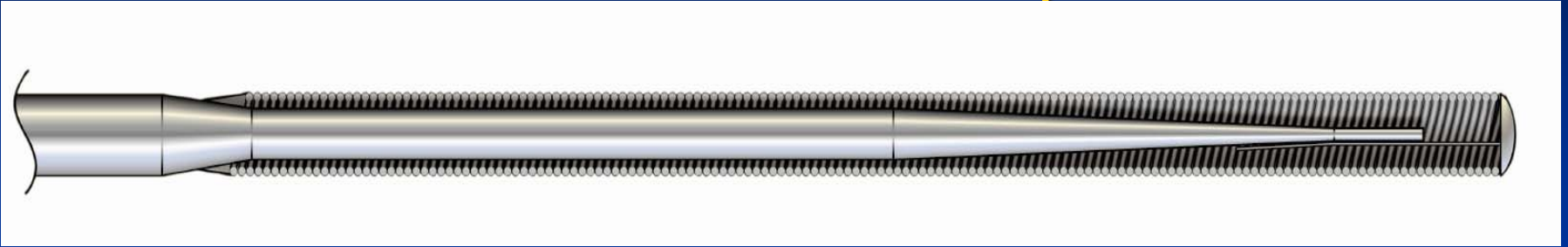
(silicone -  
hydrophobic,  
hydrophilic)

# Rail Support Examples



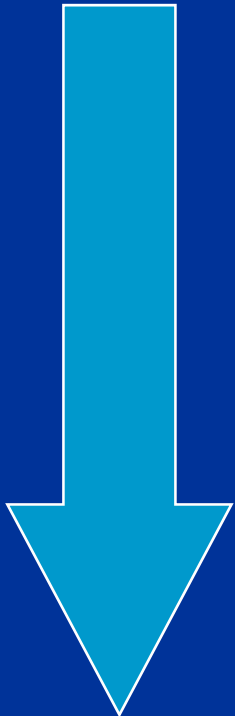
# Guidewires

## Mechanical Properties



### SUPPORT

Faßdasher (0.010")  
Choice PT  
ATW Cordis  
Pilot  
Prowater (Renato)  
Runthrough  
BMW Universal  
BMW  
Choice PT Support  
Ironman  
Mailman  
Platinum Plus



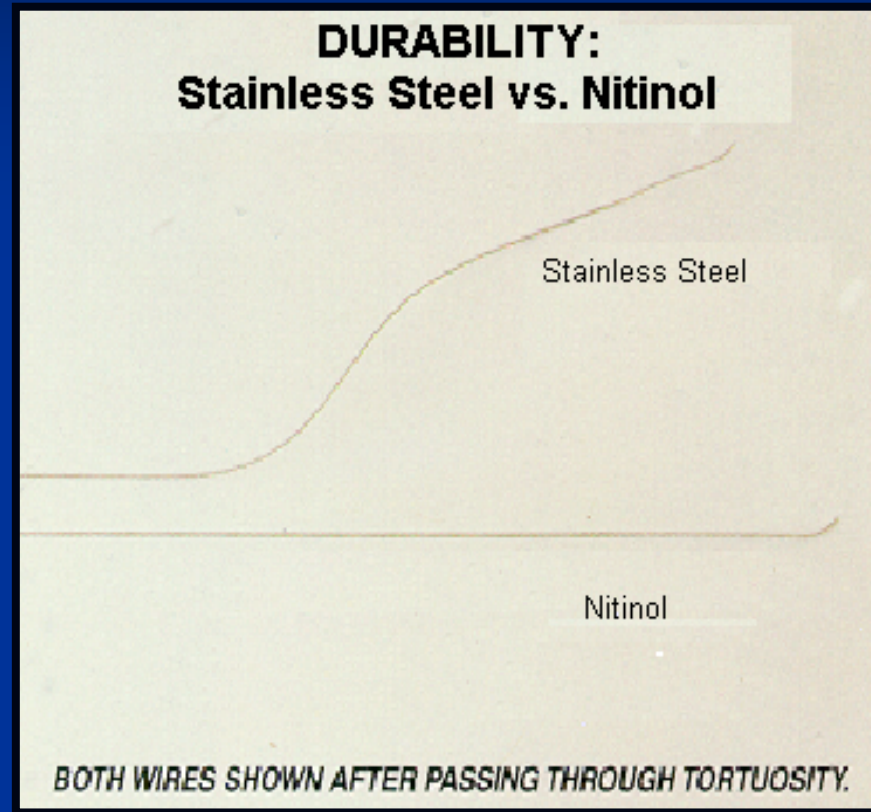
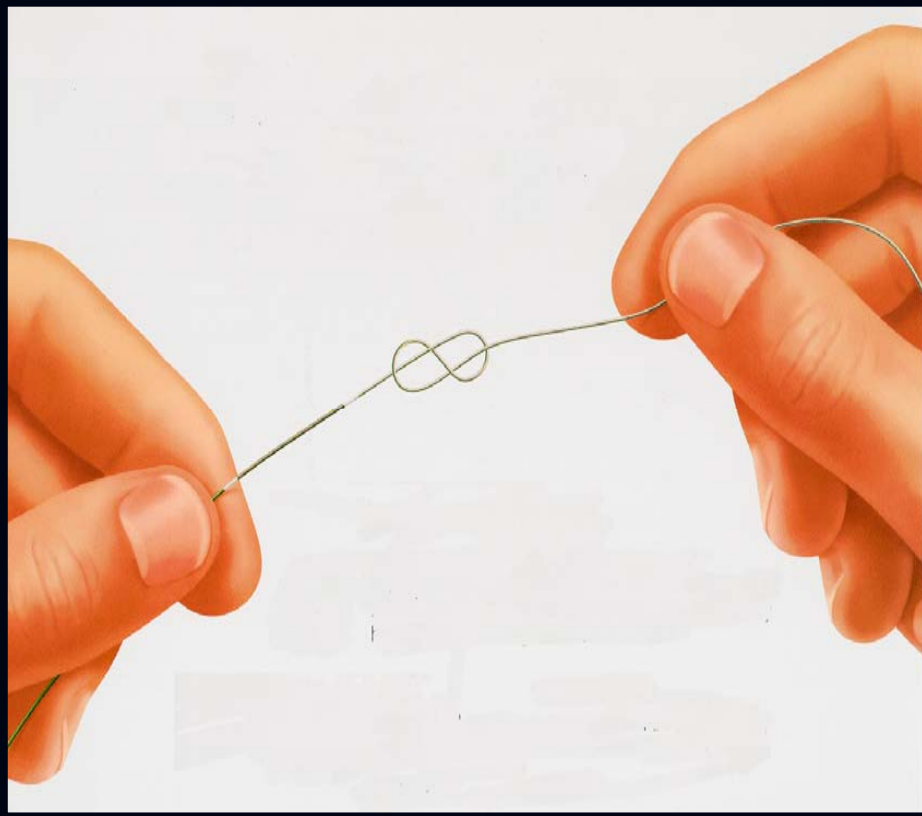
### TIP STIFFNESS

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

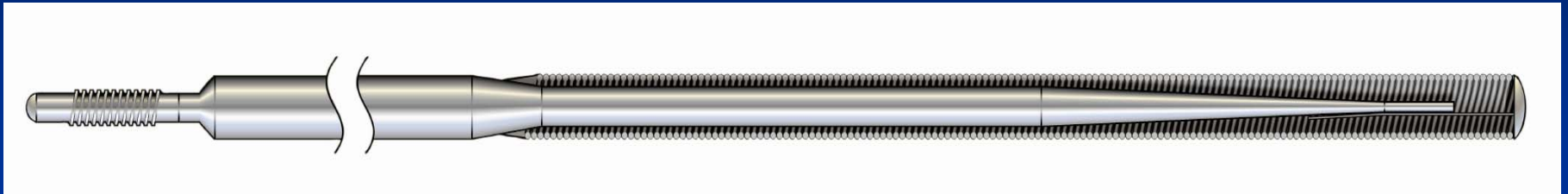


# Guidewires

## 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

# Outer material



## 1. Spring (coil) Tip

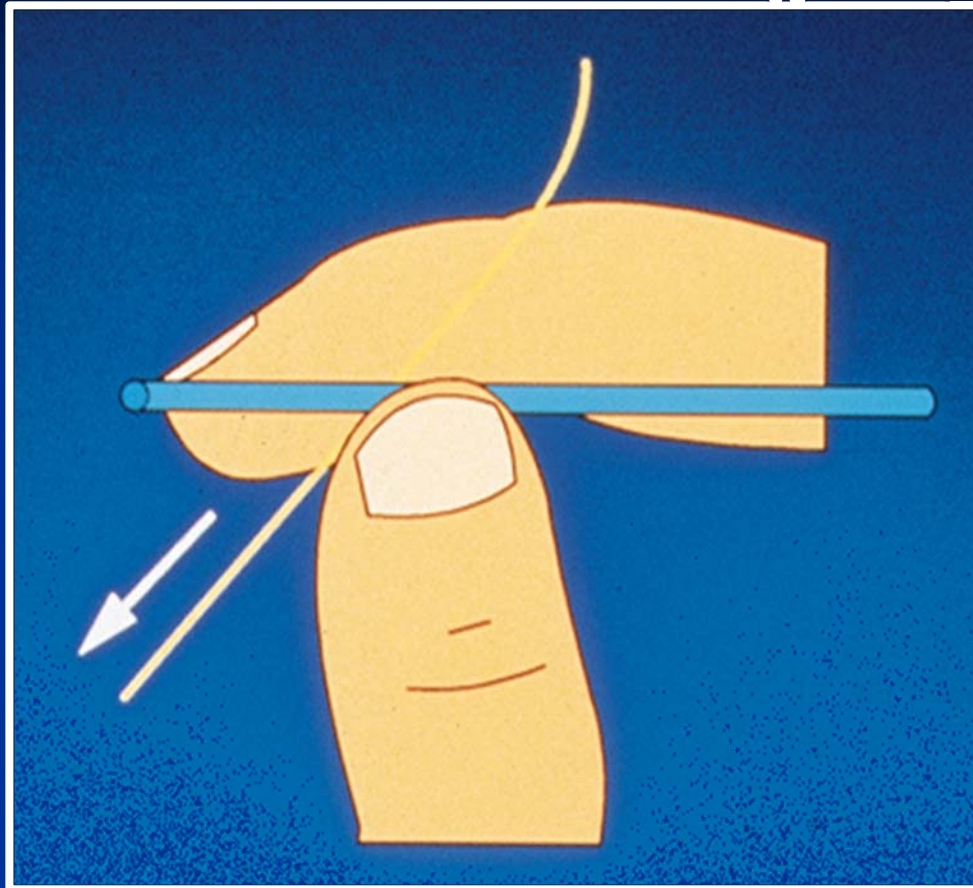
- Stainless steel with inner platinum coil for Radiopacity
- MP 35N Alloy



## 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;

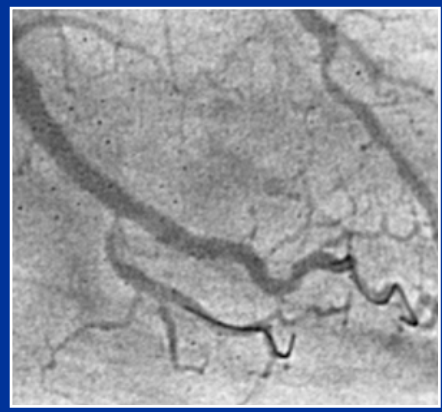
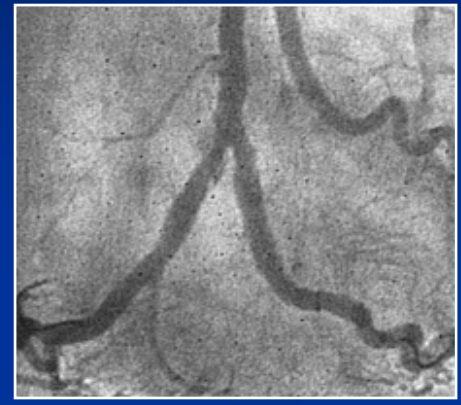
no secondary curve



# Primary Curve Matches Most Angulated Vessel Bend

Secondary Curve Matches the Vessel Size

  
Secondary Primary

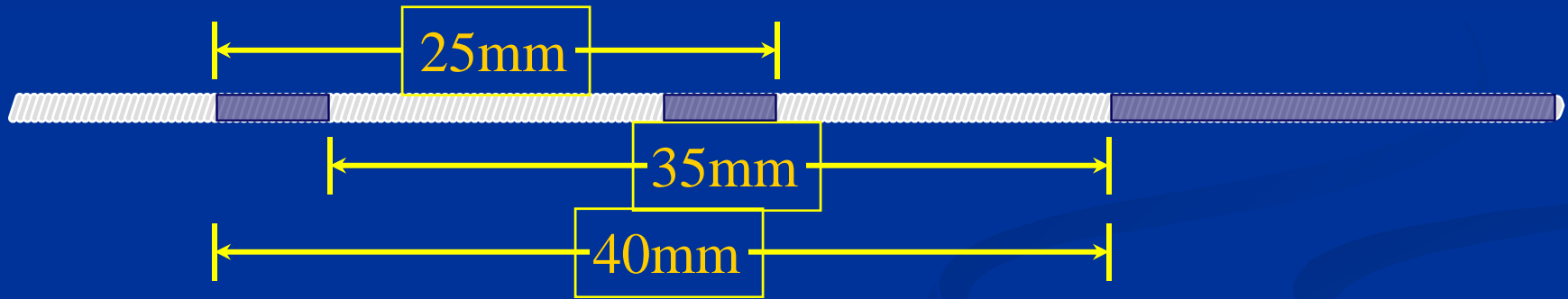


  
Secondary Primary



  
Secondary Primary

# IQ™ Guide Wire with Markers



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



# Tortuosity

- Steerability
- Tracking
- Tip control
- Support



Examples:

-BMW

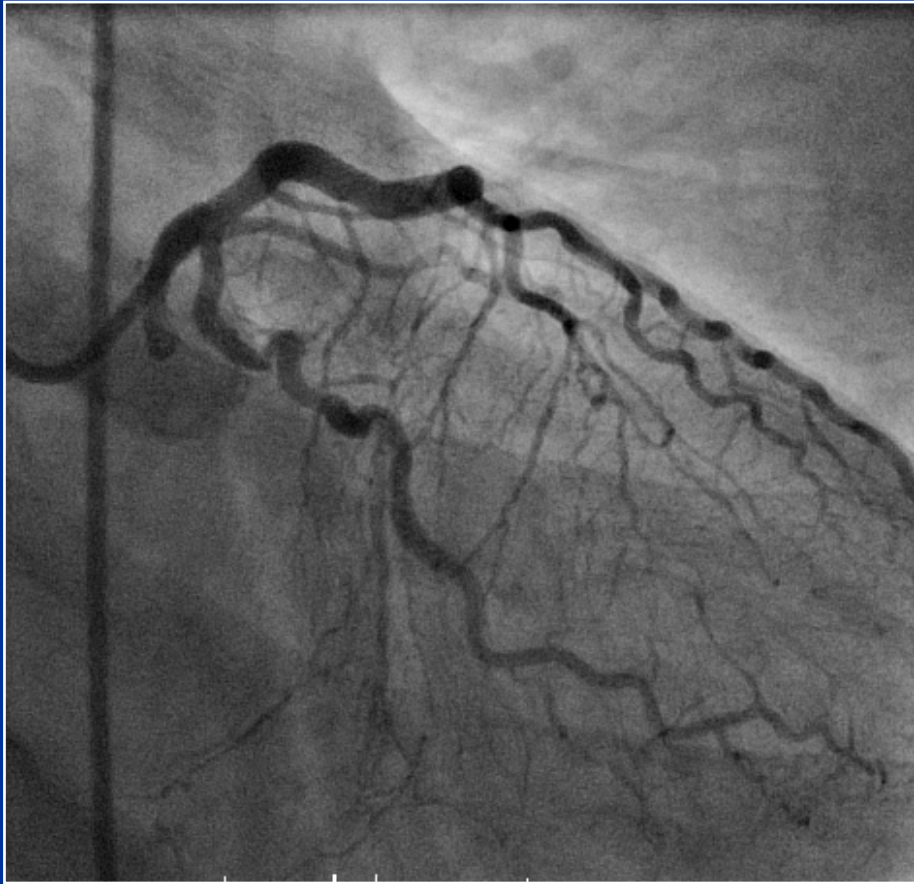
-Whisper MS

Alternatives: Double Wire; supersoft lubricious wire to start:

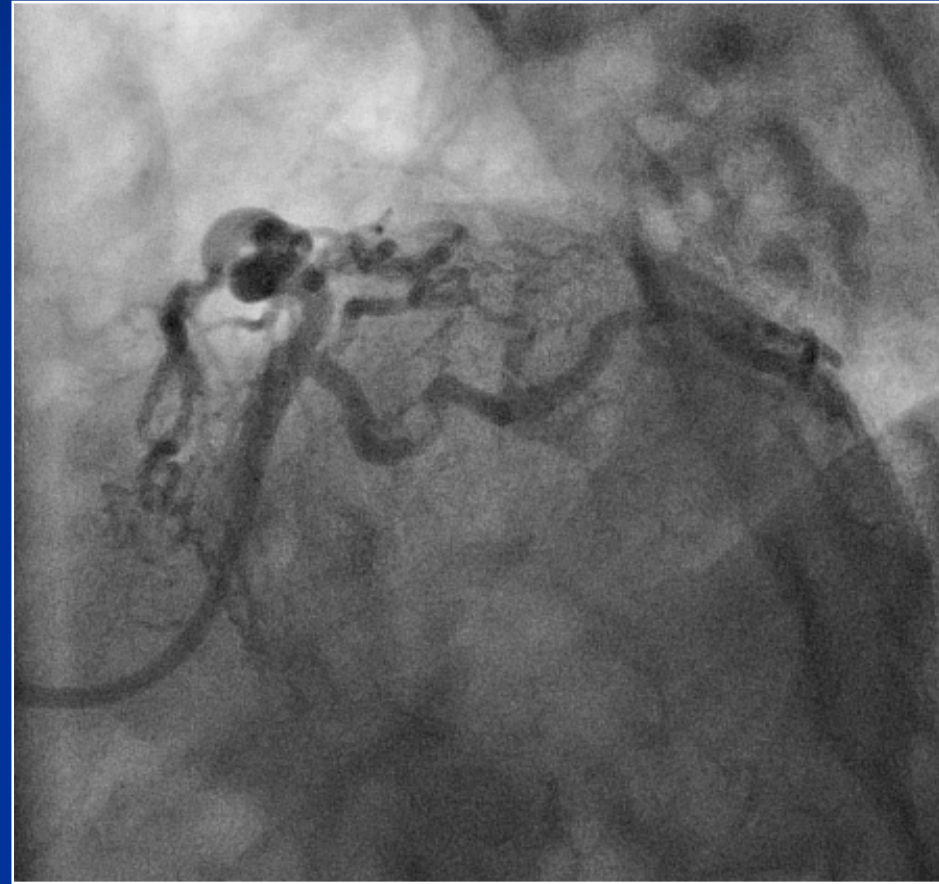
Change OTW to a stiffer wire

# Extremely tortuous vessel

Pre-procedure



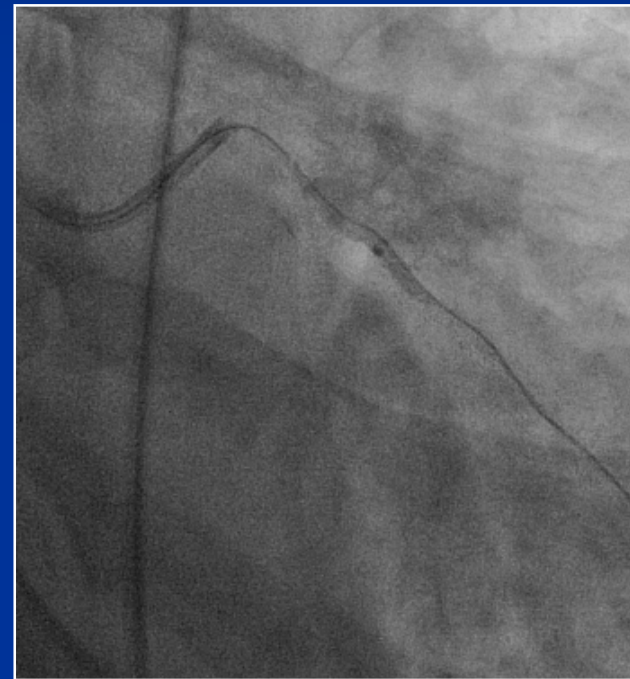
RAO Caudal



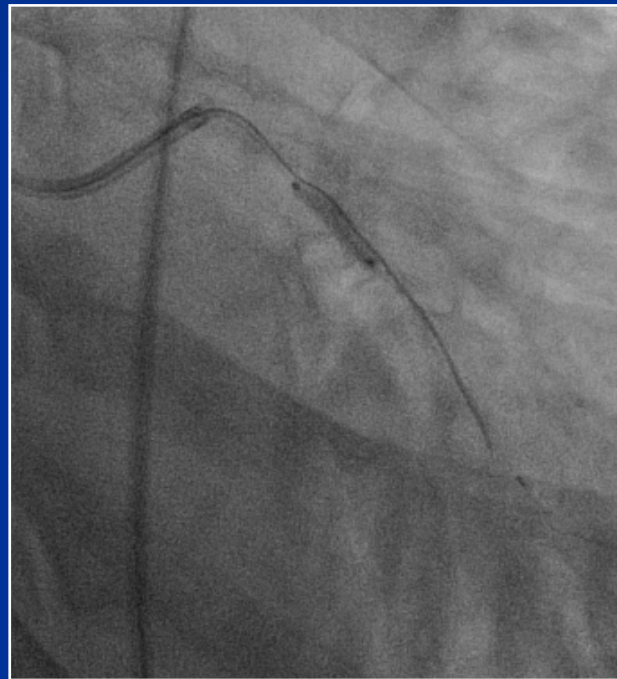
Spider

# Extremely tortuous vessel

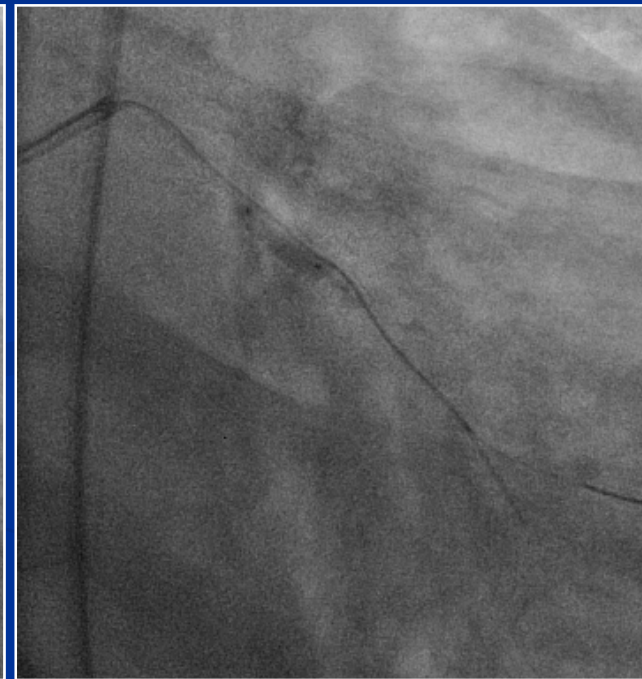
## Pre-dilatation



1.5mm balloon



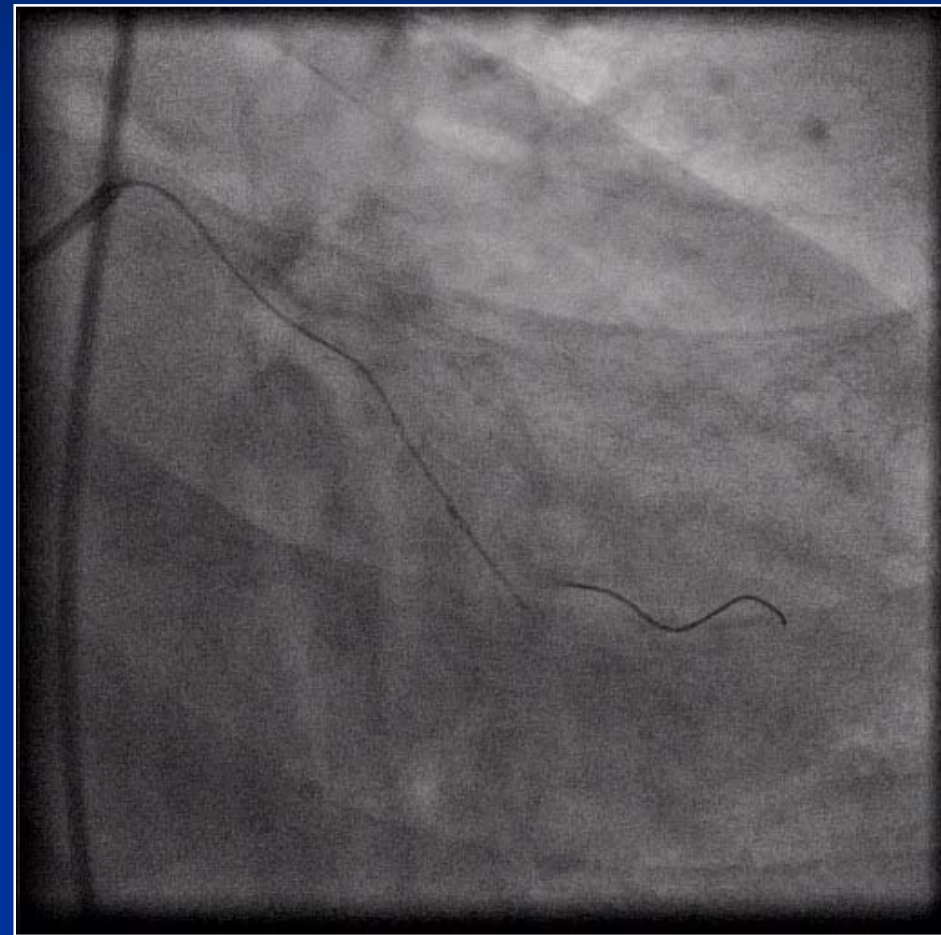
Crescendo 2.0x12 (Cordis)



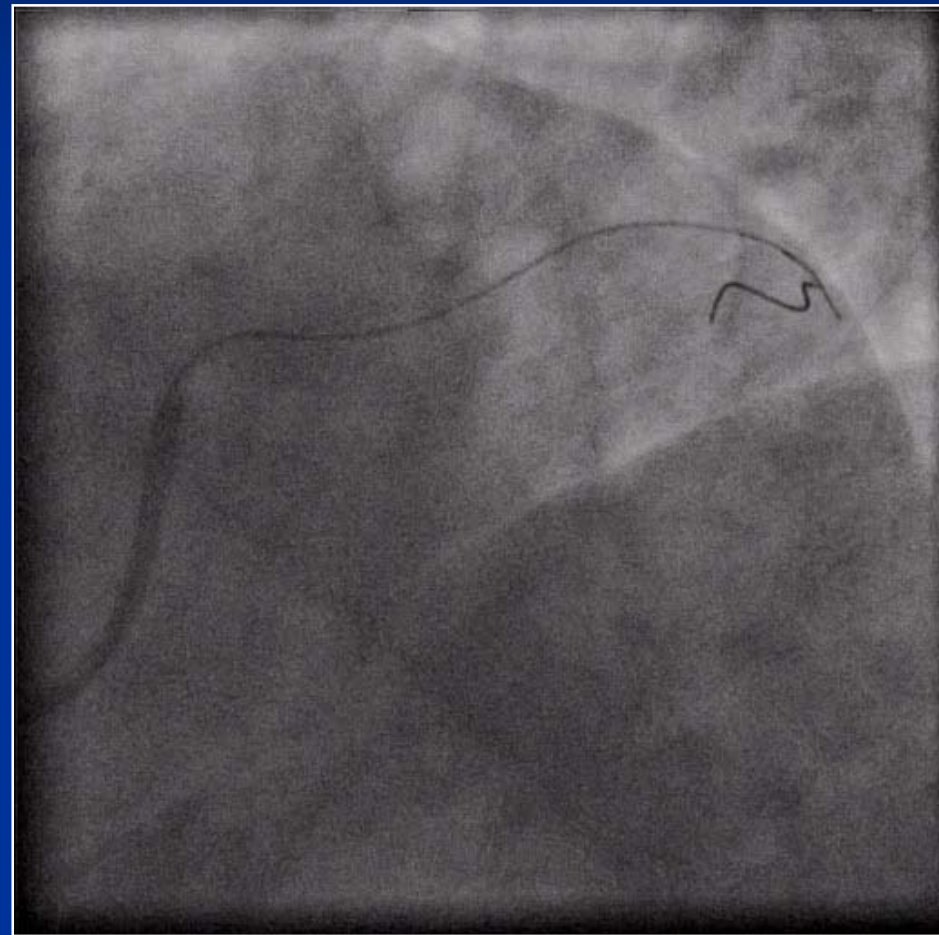
2.5x12 BA

# Extremely tortuous vessel

After dilatation with 2.5mm BA



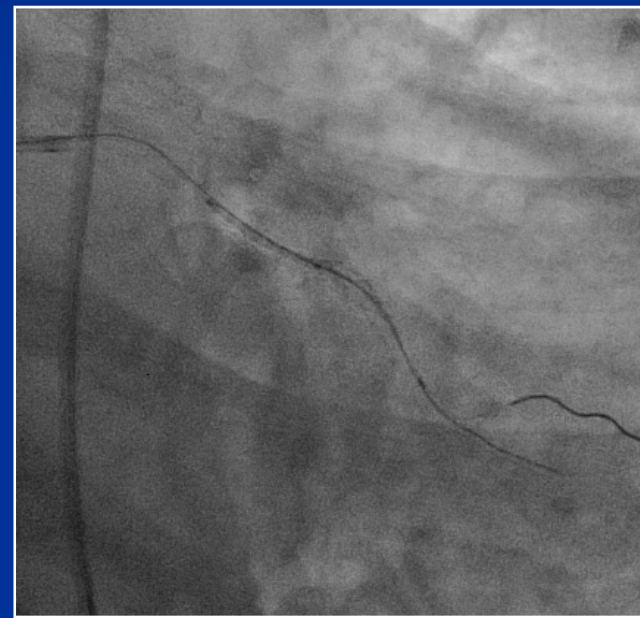
RAO Caudal



Spider

# Extremely tortuous vessel

Final Result after PostDilatation 3.0 x 18 Atm



Stent Positioning



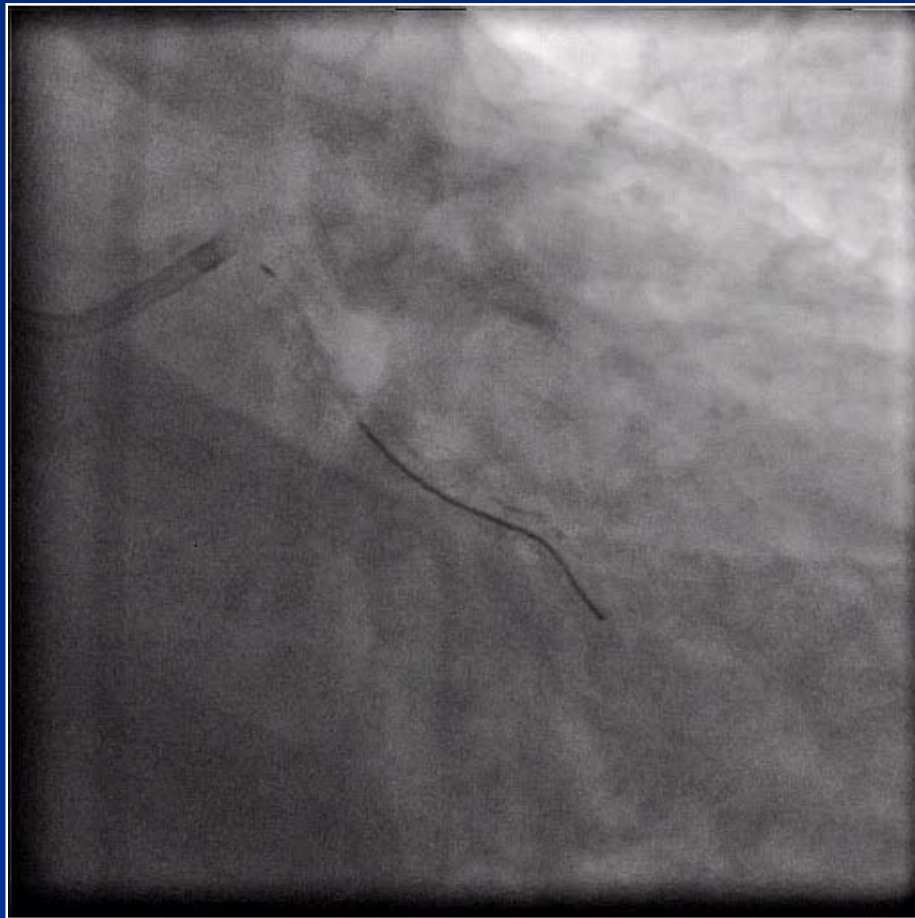
RAO Caudal



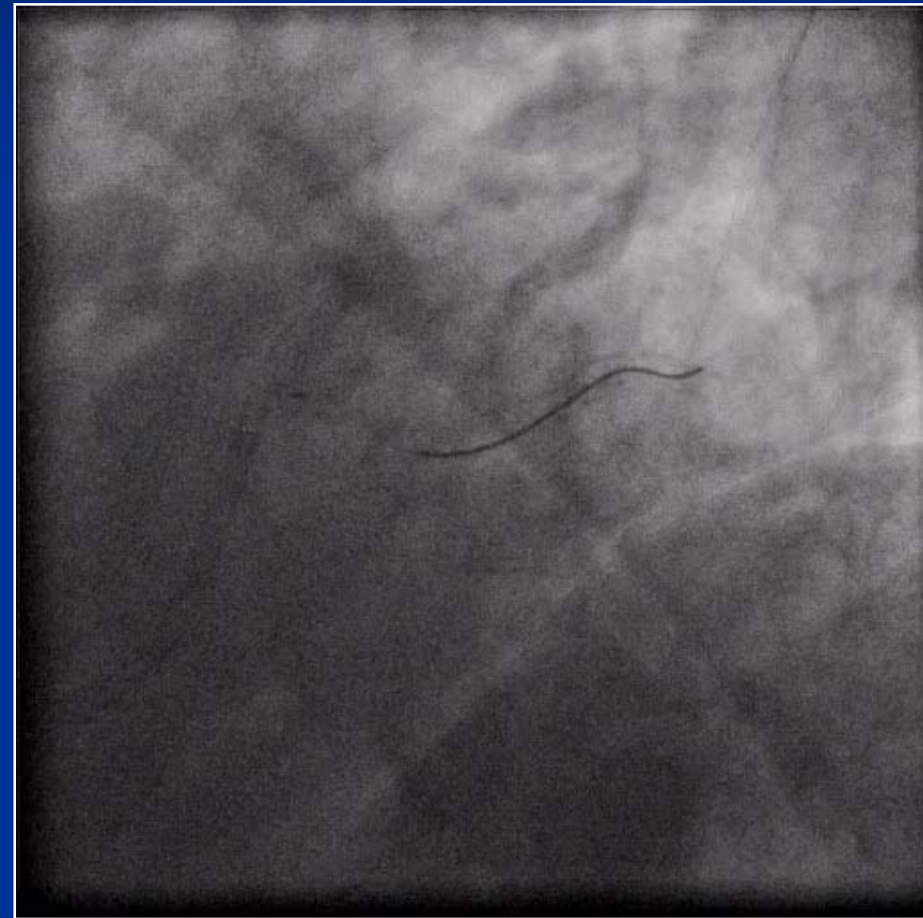
Spider

# Extremely tortuous vessel

Final Results after 3.0 mm balloon at 18 Atm



RAO Caudal



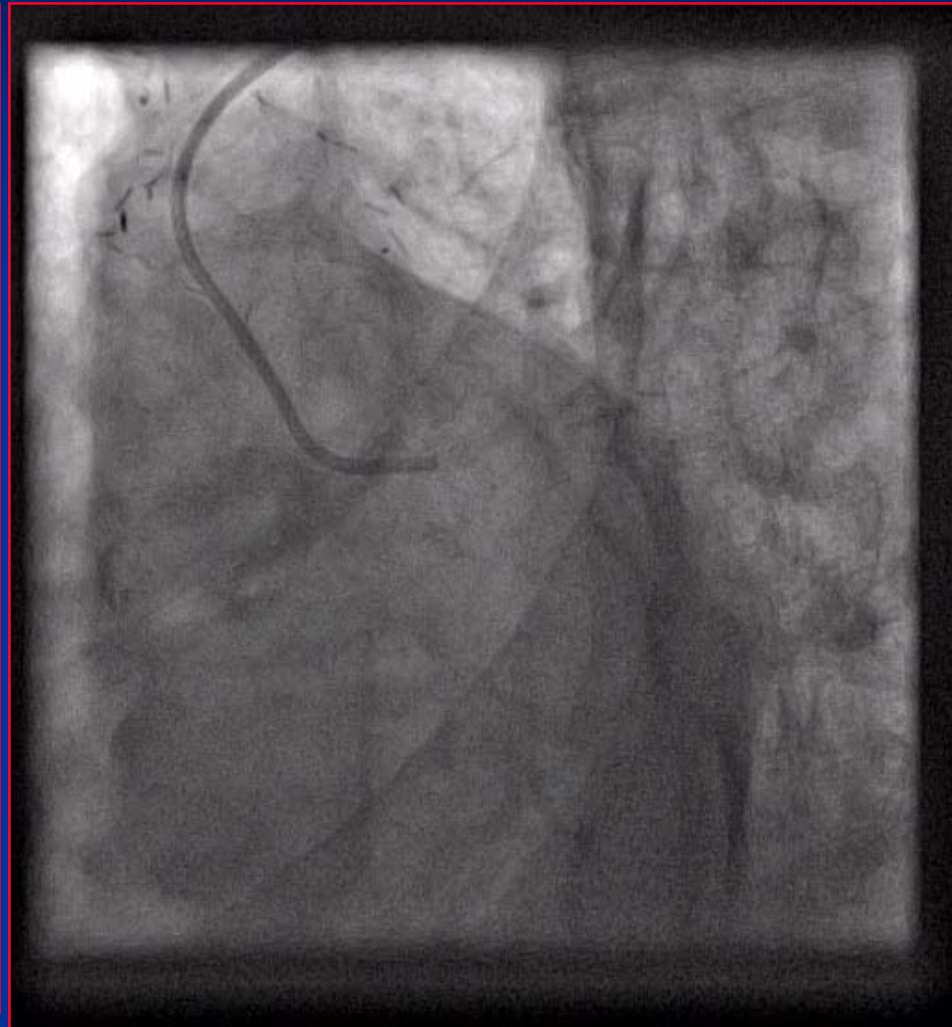
Spider



# 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, FaßDasher



# Cordis STEER-IT™ Deflecting Tip Guidewire

## ■ Guidewire

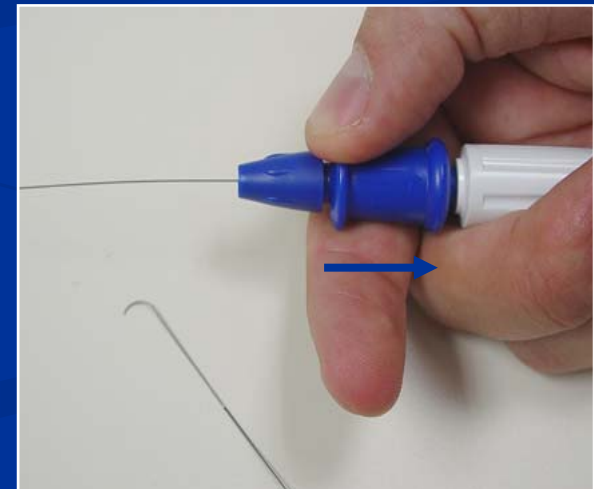
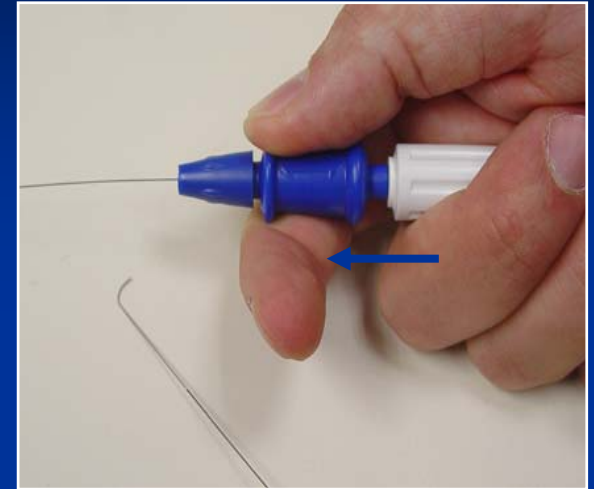
- Length: 300 cm / 180 cm
- OD compatible with 0.014" interventional devices
- Torque response: 1:1

## ■ Deflection Tip

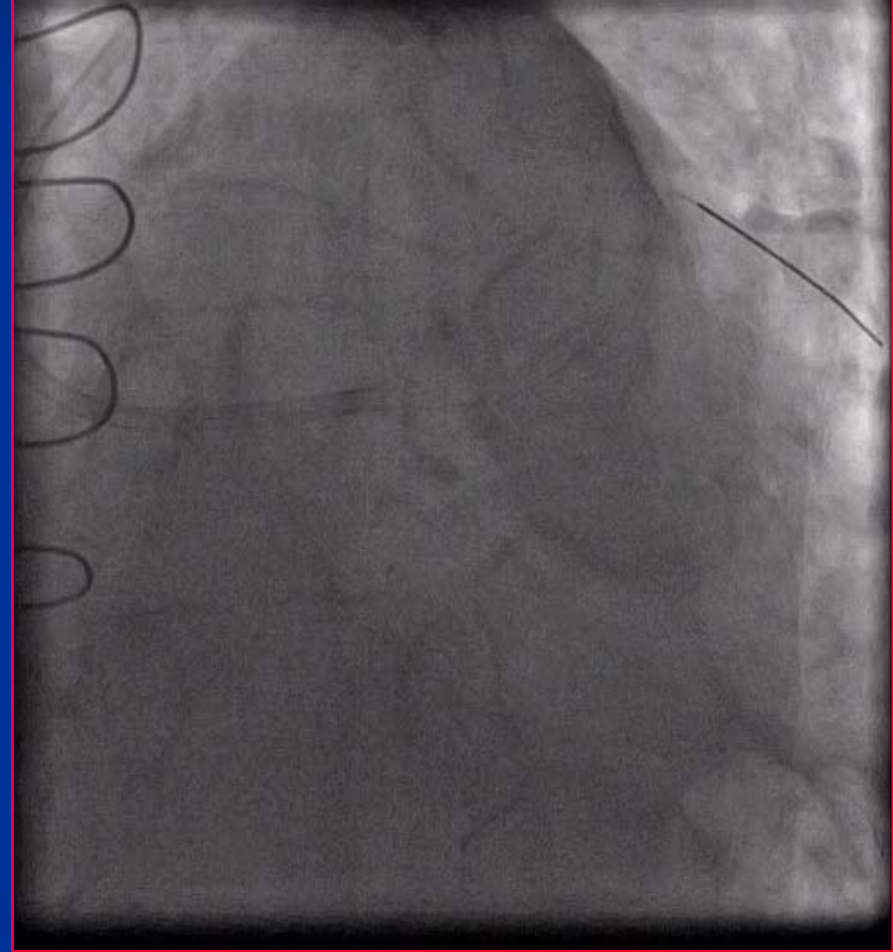
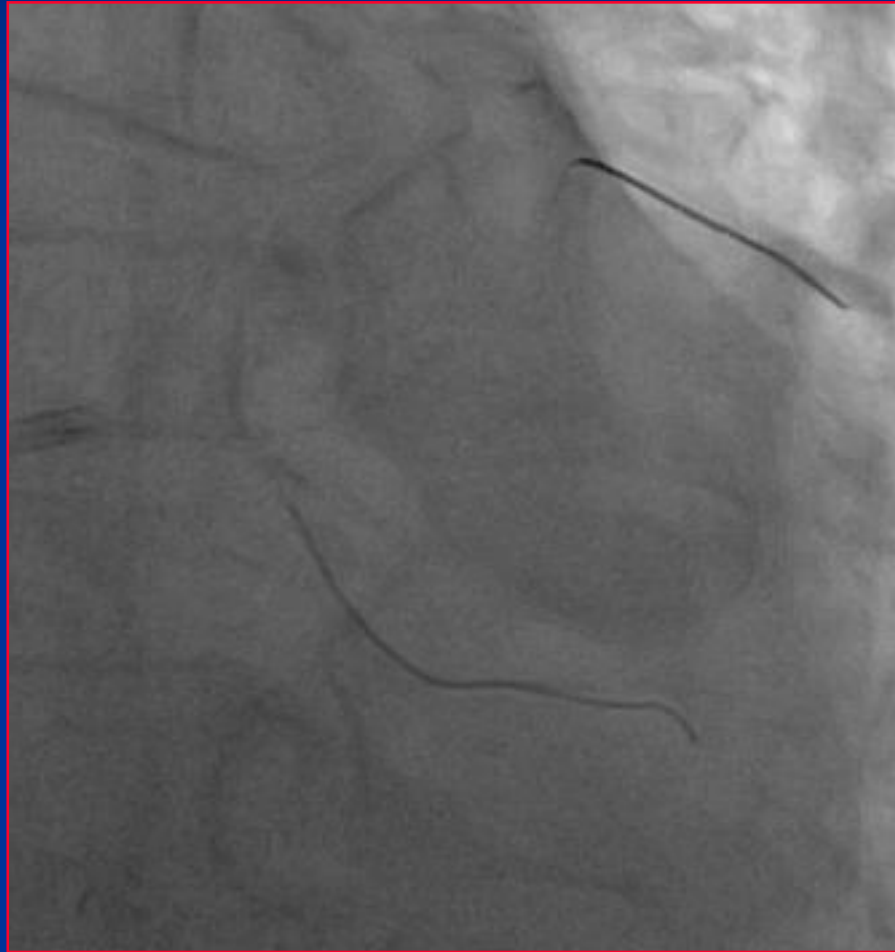
- 7 mm & 3 mm
- Elastomer coated to ensure longevity
- Minimum 45° bi-directional deflection

## ■ Handle

- Removable & re-attachable
- Center, straight tip indicator

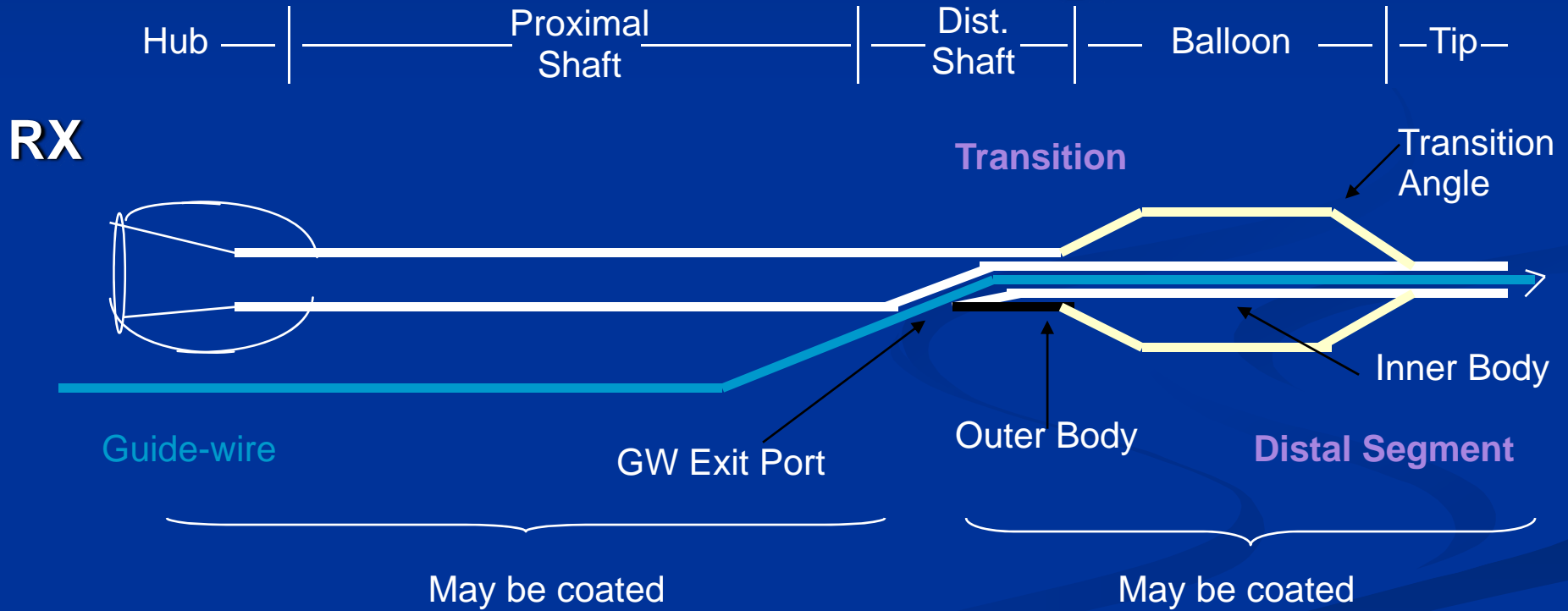


# Steer-IT across, Predilatation, 3.5 x 13 mm Cypher Select, Postdilated to 4.0 mm

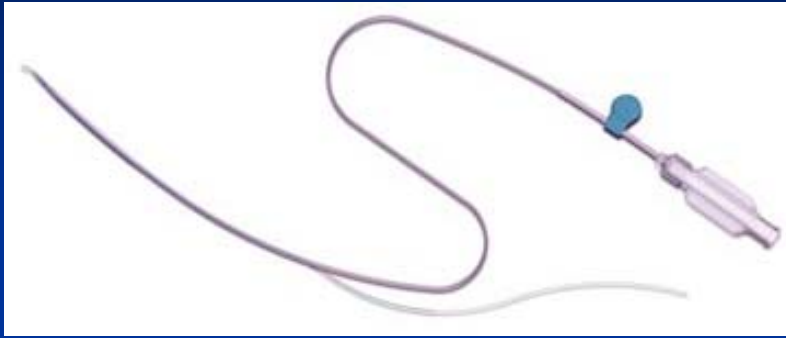


# Balloon Catheters

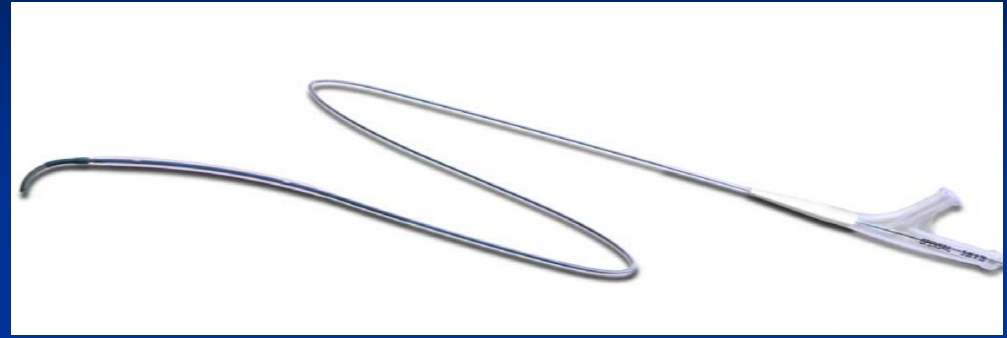
## Basic Terminology



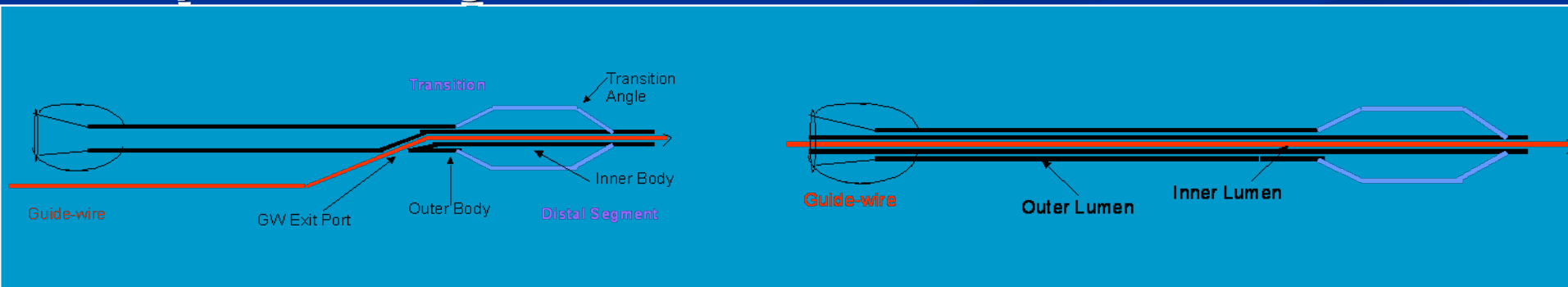
# Catheter Design



Rapid Exchange - RX



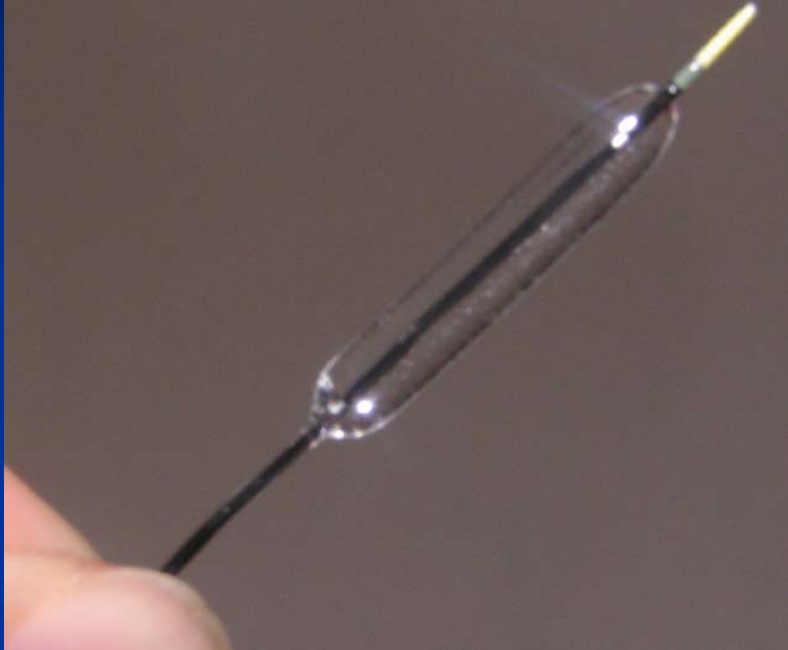
Over the Wire - OTW



Workhorse

CTO, wire exchange

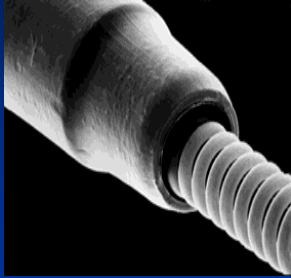
# Selection of Balloon Catheter



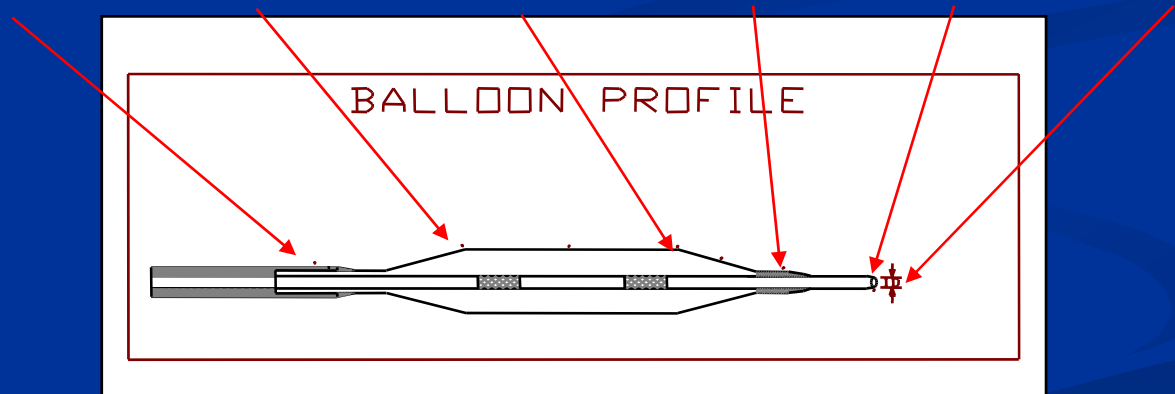
- Balloon Diameter
- Balloon Length
- Balloon Compliance
- Shaft Diameter
- Shaft Length
- Crossing Profile



# Example What is “Crossing Profile”



Balloon Junction (prox. seal OD)	Proximal Shoulder ( 2/3 )	Distal Profile ( 1mm )	Tip seal (Xing profile)	Tip Entry Profile	Tip I.D.
0.037"	0.031"	0.031"	0.024"	0.019"	0.0155"



# Selection of Balloon Diameter

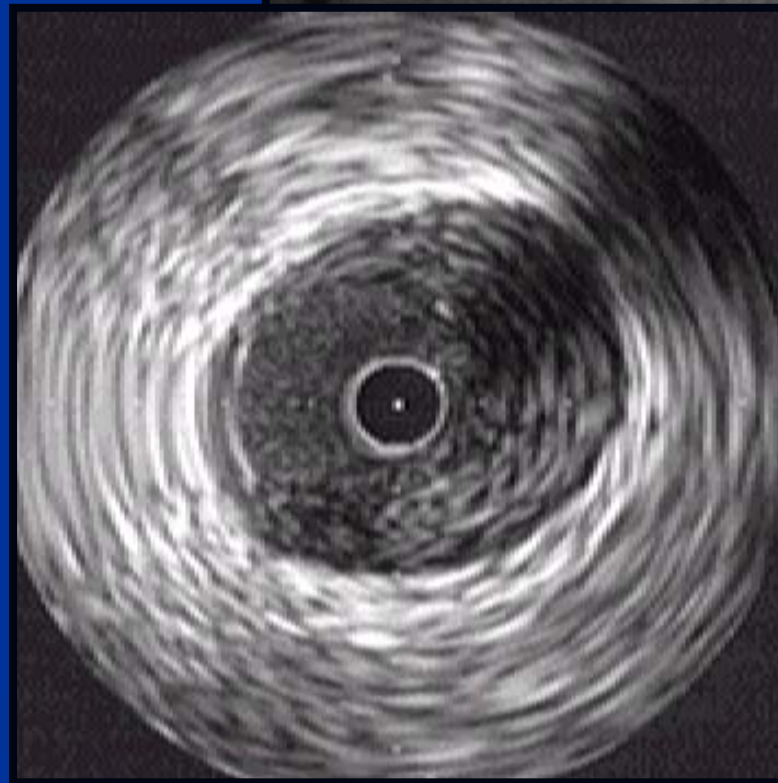
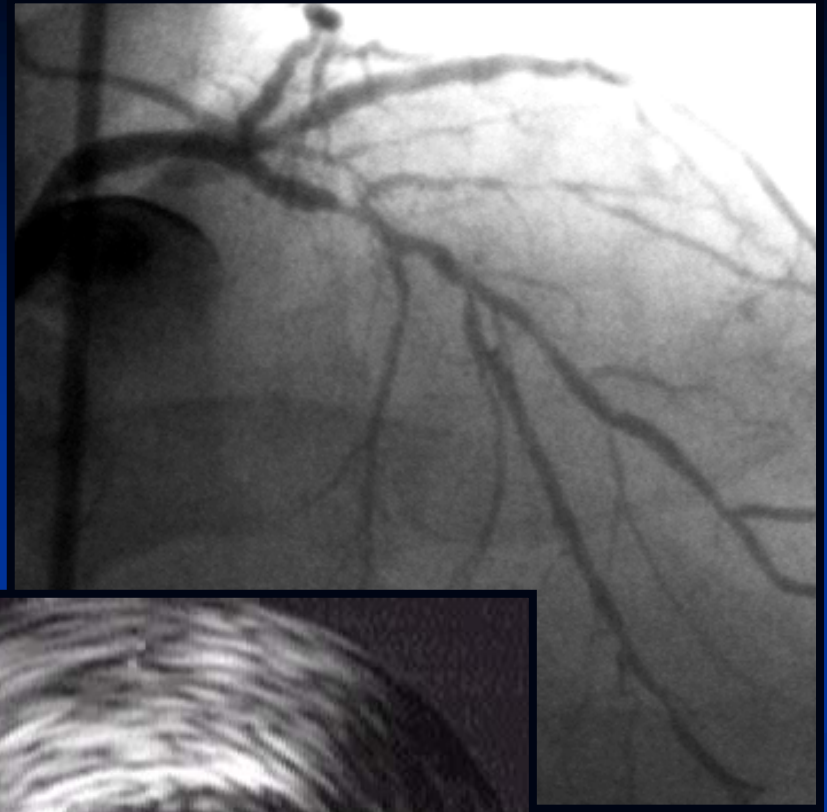
- Vessel Size (Tapering? Long Lesions)
- PreDilatation/PostDilatation
- Remember Quarter Sizes
- Remember Balloon Compliance

# Selection of Balloon Length

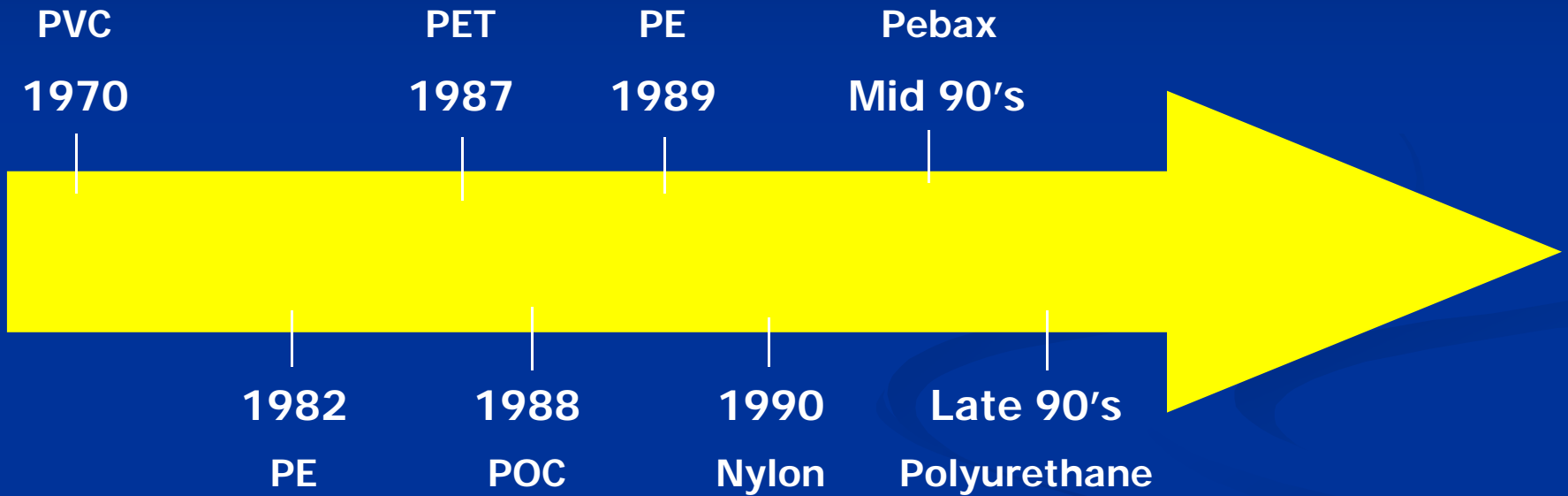
- Lesion Length
- PreDilatation: shorter than final stent
- PostDilatation: short for resistant lesions

# Balloon Sizing

- Reference vessel
- 0.9 to 1.1 ratio
- QCA
- IVUS



# Balloon Materials



# PTCA Balloon Catheters

## Relationship between pressure and diameter

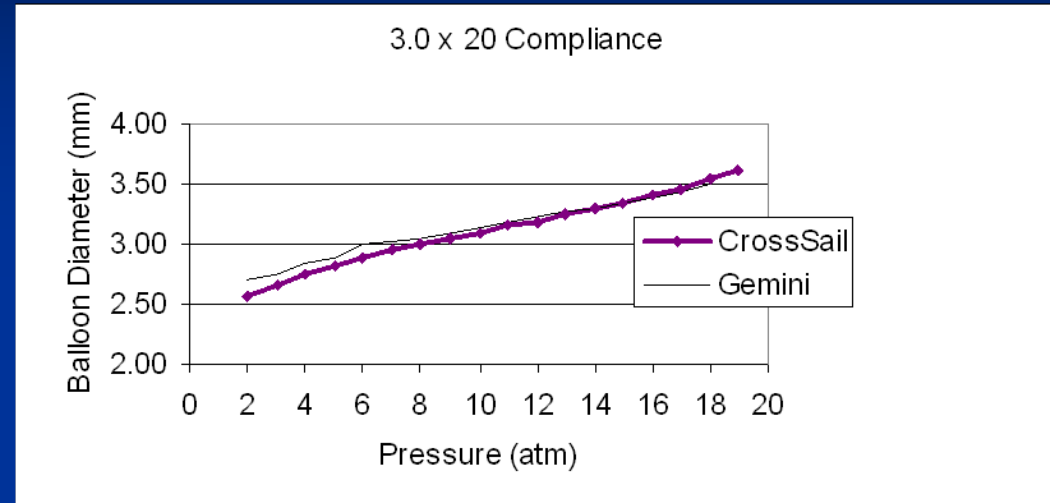
### ■ Compliant balloon

#### ➤ CrossSail, OpenSail

**8ATM: 3.0mm Nom**

**14ATM: 3.25mm RBP**

*(18ATM: 3.54mm)*



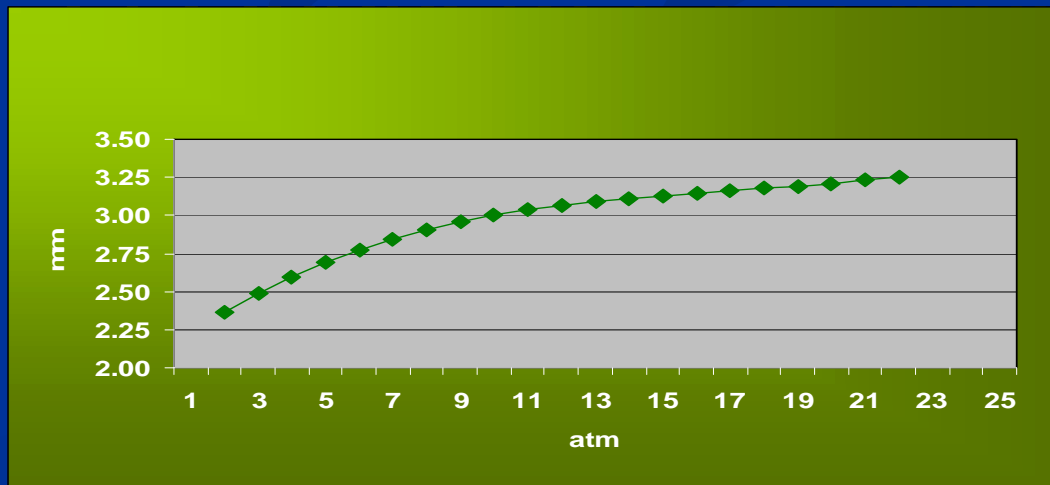
### ■ Semi-Compliant

#### ➤ PowerSail

**10ATM: 3.0mm Nom**

**18ATM: 3.18mm RBP**

*(22ATM: 3.25mm)*



# Balloon Compliance 3.0mm

		ATM	Maverick	Quantum Maverick	Powersail	Taxus Lib.	Cypher Sel.	CoStar	Endeavour
3.0mm	9	3.14	2.89	2.95	3.02	2.94	3.00	3.0(N)	
	10	3.18	2.93	3.00(N)	3.08	3.00(N)	3.10	3.02	
	11	3.23	2.96	3.04	3.14	3.05	3.17	3.05	
	12	3.28	3.00(N)	3.07	3.19	3.09	3.23	3.08	
	13	3.32	3.01	3.09	3.23	3.12	3.28	3.12	
	14	3.37(R)	3.03	3.11	3.27	3.15	3.33	3.15	
	15	3.41	3.05	3.13	3.31	3.18	3.37	3.19	
	16	3.46	3.07	3.15	3.34	3.21(R)	3.41	3.22(R)	
	17	3.5	3.08	3.16	3.37	3.23	3.44	3.25	
	18	3.55	3.10	3.18(R)	3.39(R)	3.26	3.49	3.29	
	19		3.12	3.19		3.28			
	20		3.14(R)	3.21		3.31			

# 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

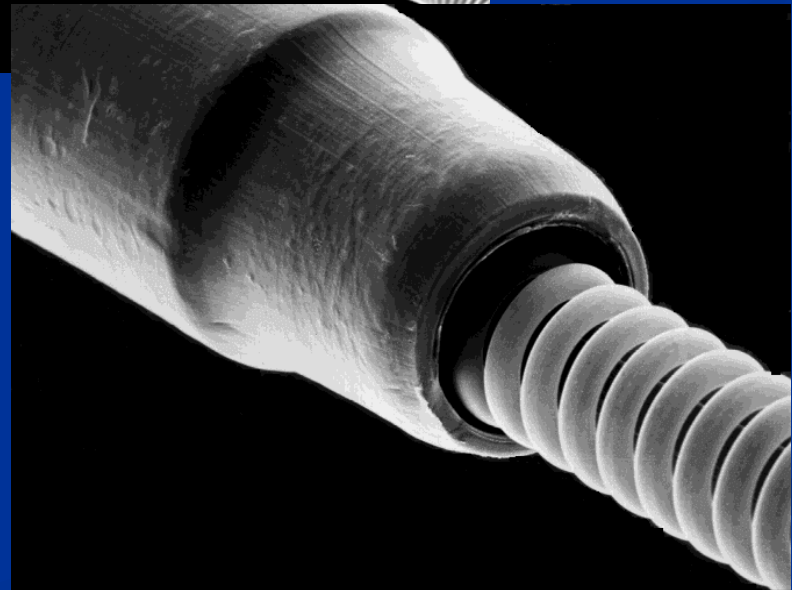
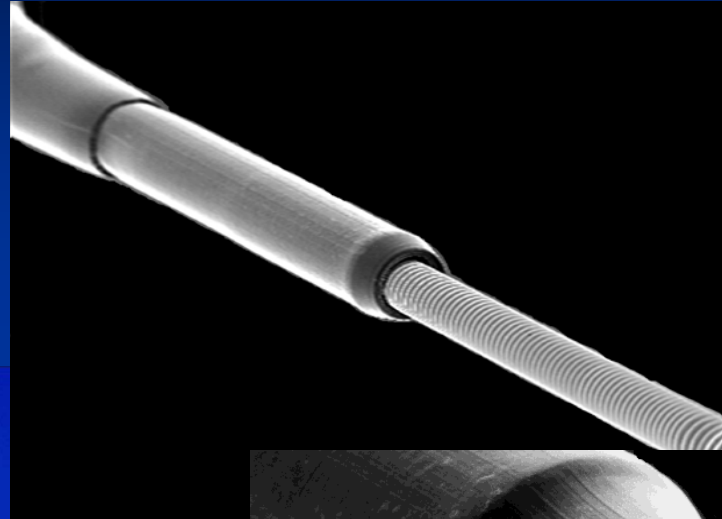
## ■ Hydro-phobic

- 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

