

بِسْمِ اللَّهِ  
الرَّحْمَنِ  
الرَّحِيمِ



# Transradial Access and intervention: Step-by-step

**Gamal Fahim, MD, FSCAI**

**Cardiology Department Mansura  
university**

**31 December 2015**

**[ggomaa.blogspot.com](http://ggomaa.blogspot.com)**



# Case scenario



# Clinical data

- Male, E M
- 52 Years
- DM
- New-onset severe prolonged typical chest pain
- New Resting ST T wave changes in chest leads; Wellen`s syndrome

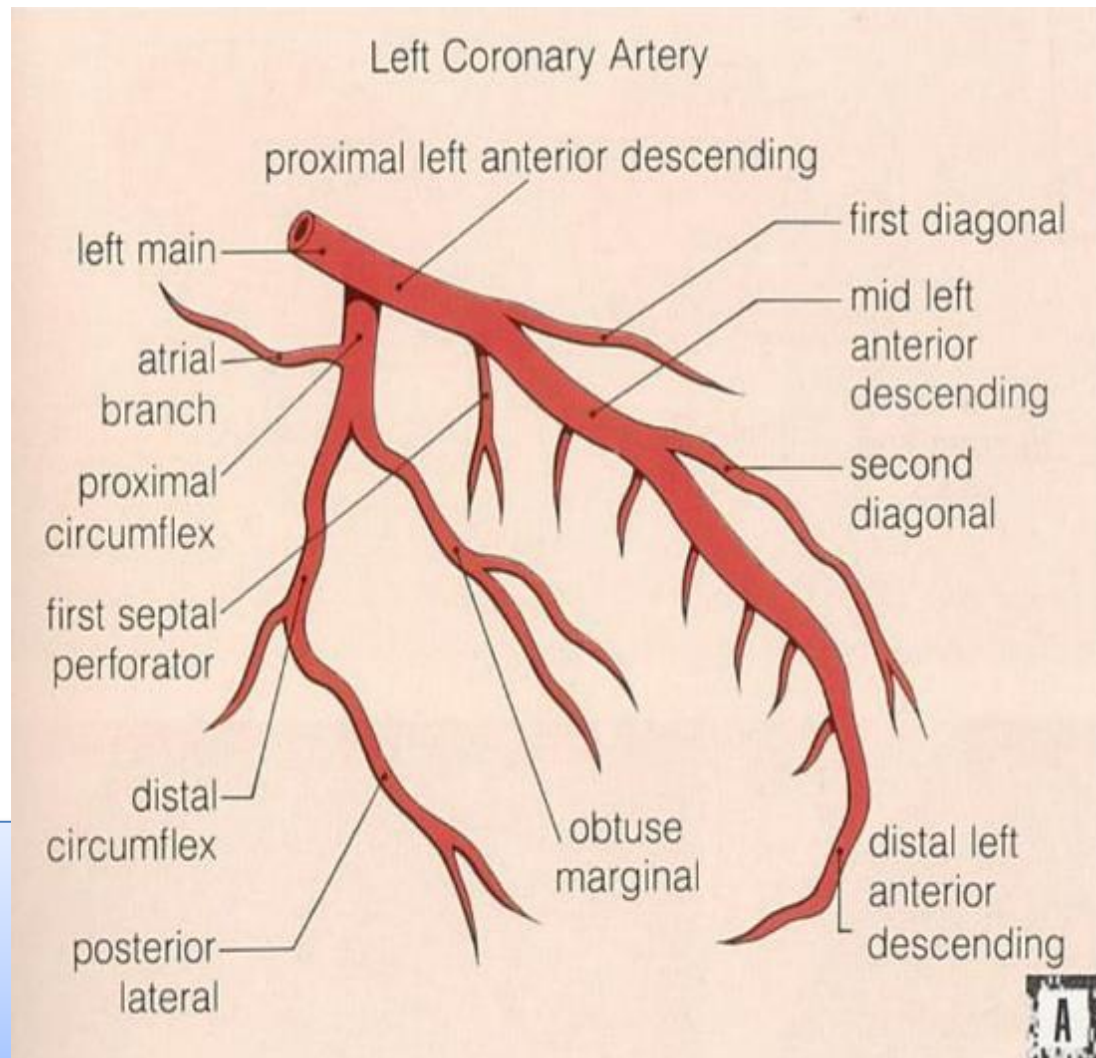
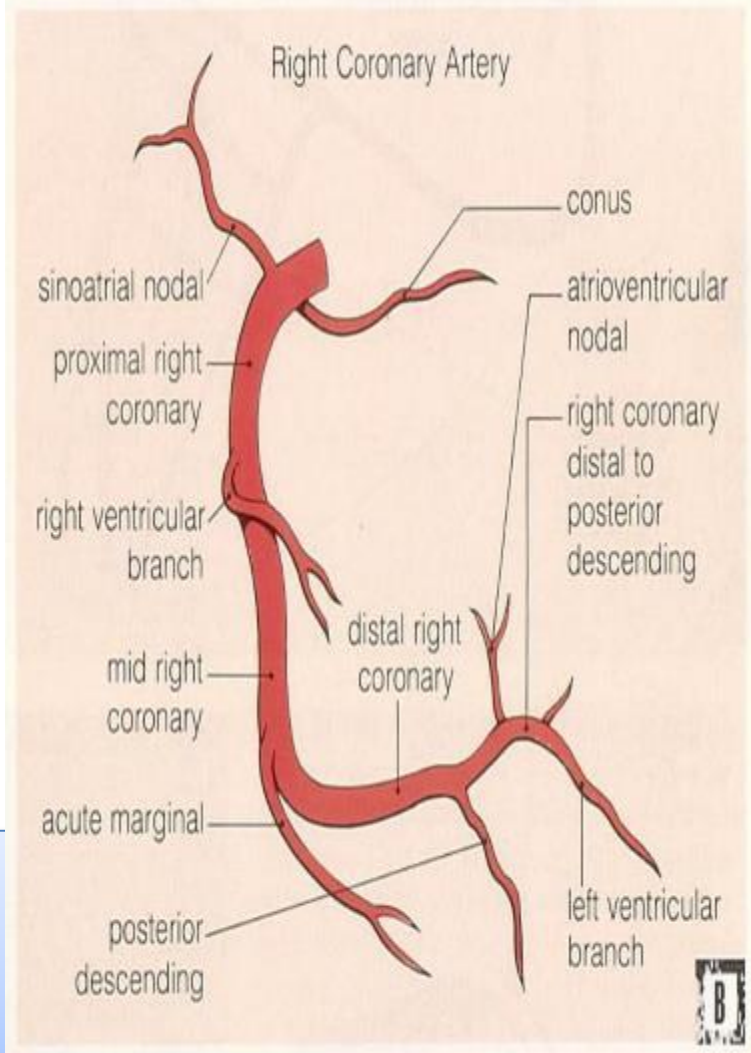


# Clinical data

- **Echo: no RSWMA, normal EF**
- **Coronary angio**
  - Right radial
  - Trumo set
  - JR 3.5, JL 3.5 6F

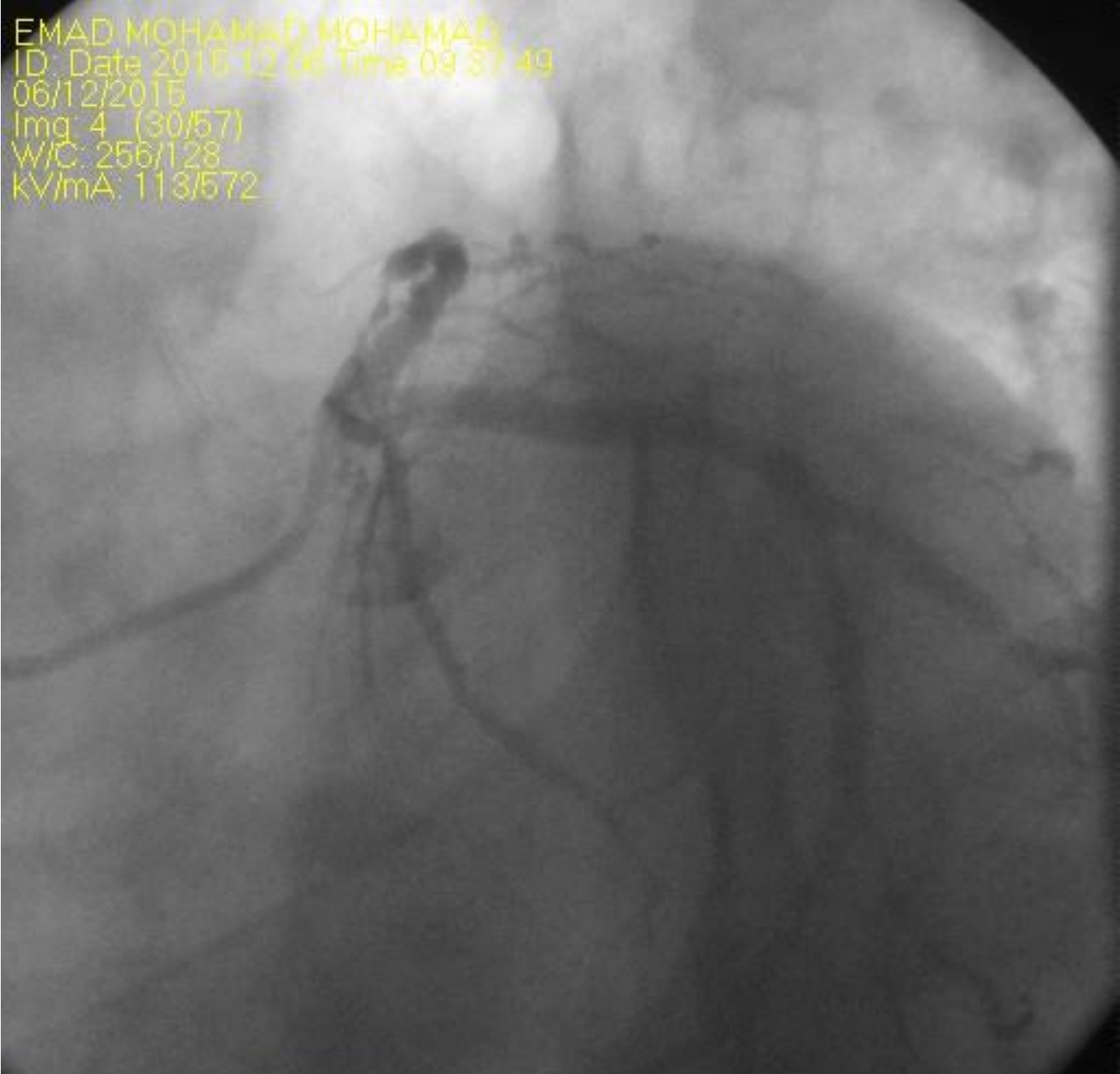


# Anatomy of major epicardial coronaries



EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 2 (16/34)  
W/C: 256/128  
kV/mA: 73/695

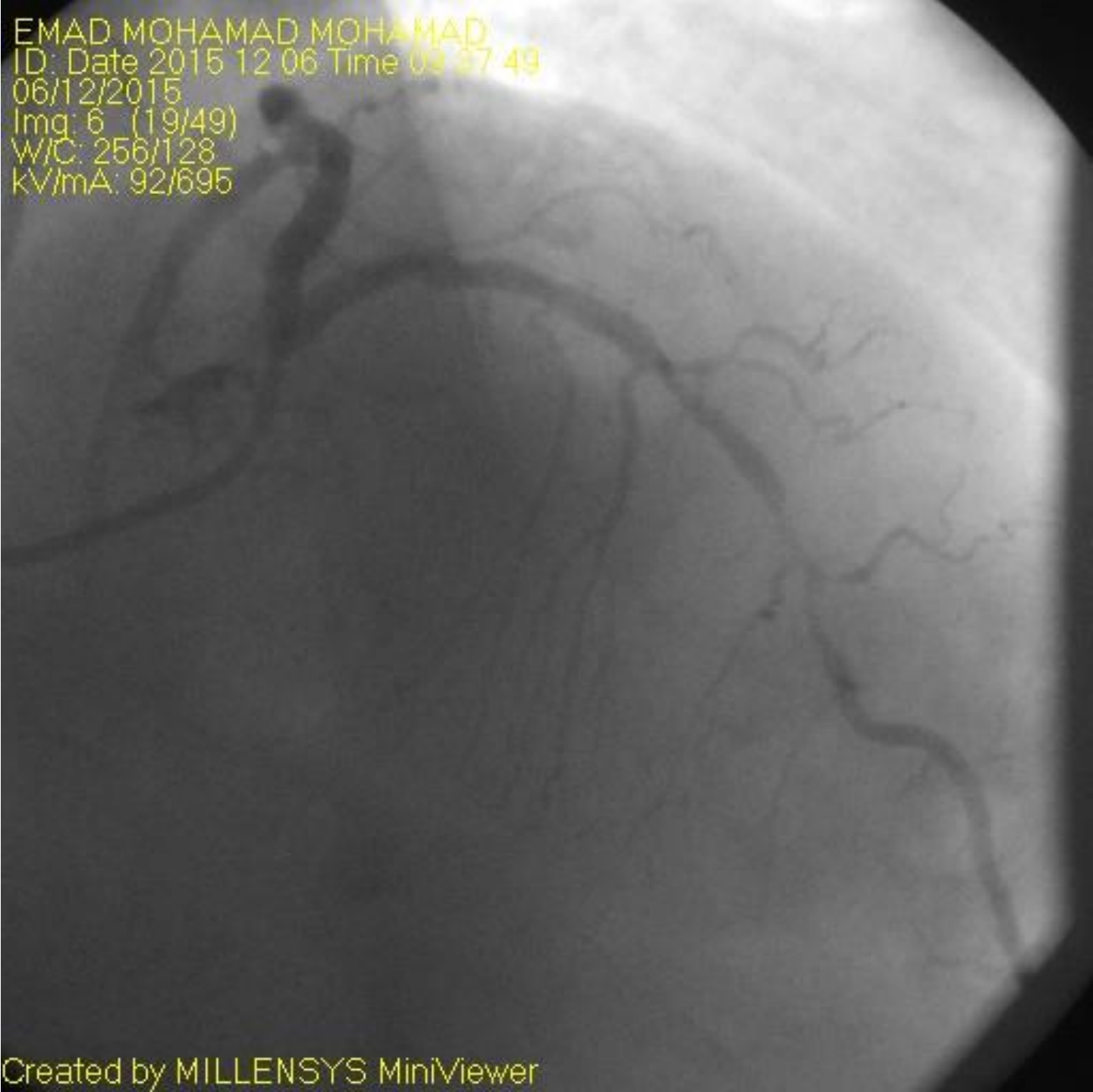
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ID: Date 2015-12-06 Time 09:37:49  
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Img: 4 (30/57)  
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kV/mA: 113/572





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06/12/2015  
Img: 5 (31/58)  
W/C: 256/128  
kV/mA: 80/788

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ID: Date 2015 12 06 Time 09 27 49  
06/12/2015  
Img: 6 (19/49)  
W/C: 256/128  
kV/mA: 92/695



EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 7 (30/57)  
W/C: 256/128  
kV/mA: 90/721

EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 8 (33/63)  
W/C: 256/128  
kV/mA: 115/562

EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 9 (26/60)  
W/C: 256/128  
kV/mA: 80/760

EMAD MOHAMMAD MOHAMMAD  
ID: Date 2015-12-06 Time 09:37:49  
06/12/2015  
Img 10 (40/65)  
W/C 256/128  
kV/mA 106/607



# Diagnosis

**52 y, M, Diabetic**

**High-risk ACS**

**Normal LV systolic function**

**Angiography:**

- Tight long subtotal mid LAD
- LCX: Dominant, small vessel disease
- RCA: non dominant, small diffuse disease



# Decision

## PCI and stenting of LAD:

**Approach: Right radial**

**Guiding: EBU 3.5 6 F**

**PTCA Wire: Runthrough Floppy**

**STENT: DES promus element 3 38**

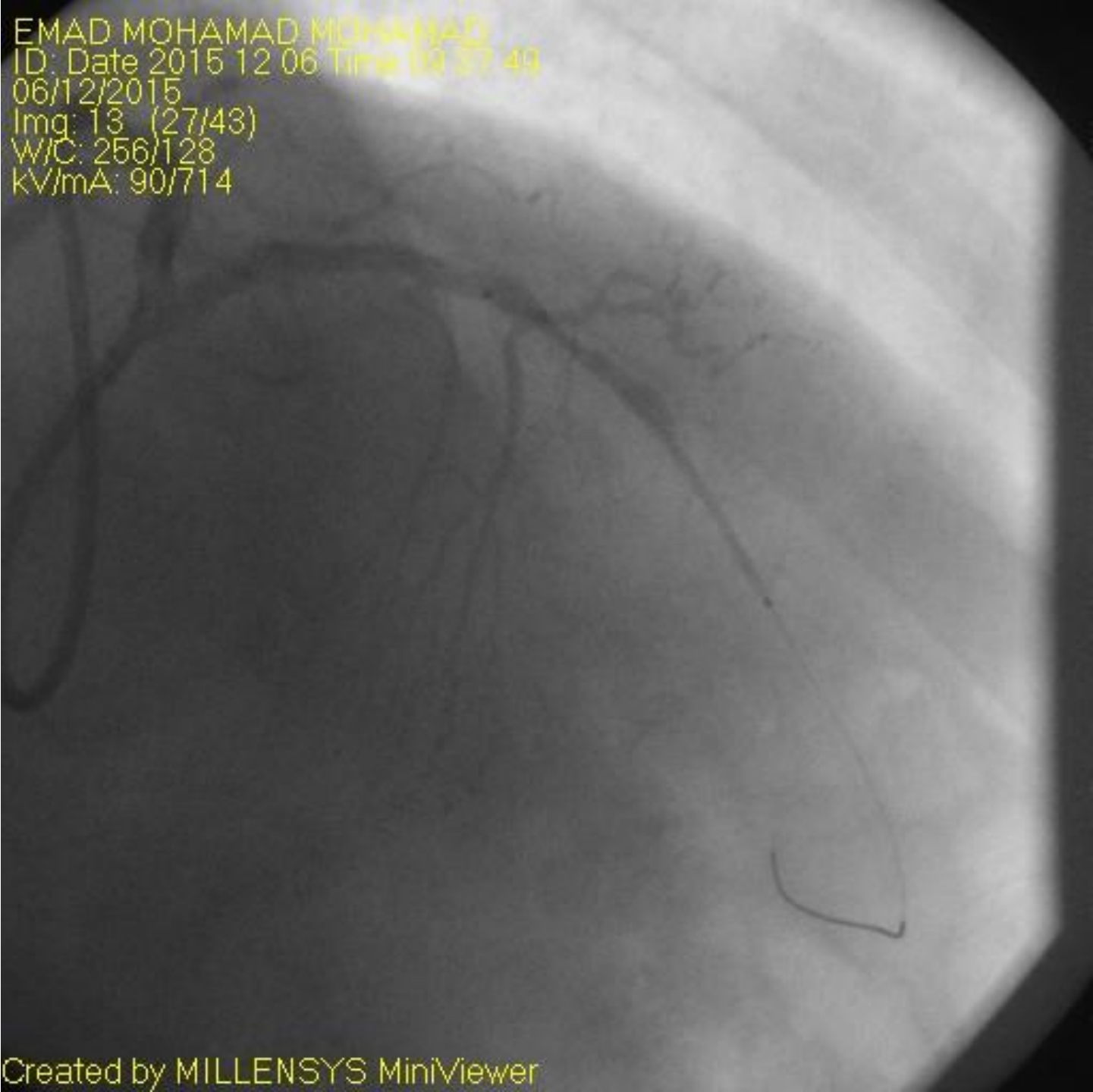
**Post tenting optimization: NC 3.5 15**





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06/12/2015  
Img: 12 (32/54)  
W/C: 256/128  
kV/mA: 86/750

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ID: Date 2015 12 06 Time 09 27 49  
06/12/2015  
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kV/mA: 90/714



EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 14 (17/36)  
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kV/mA: 88/728

EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 27 43  
06/12/2015  
Img: 15 (14/23)  
W/C: 256/128  
kV/mA: 88/731

**DES 3 38**



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06/12/2015  
Img: 17 (30/44)  
W/C: 256/128  
kV/mA: 95/674

EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 18 (31/40)  
W/C: 256/128  
kV/mA: 87/738

EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 19 (31/31)  
W/C: 256/128  
kV/mA: 89/718

**NC 3.5 15**



EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 20 (14/20)  
W/C: 256/128  
kV/mA: 88/730

**NC 3.5 15**





EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 21 (15/21)  
W/C: 256/128  
kV/mA: 85/756

EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 22 (26/42)  
W/C: 256/128  
kV/mA: 95/671

EMAD MOHAMAD MOHAMAD  
ID: Date 2015 12 06 Time 09 37 49  
06/12/2015  
Img: 23 (21/38)  
W/C: 256/128  
kV/mA: 98/654

# Final result

## Baseline



## Final result



# CLINICAL COURSE

- **Angiographic success**
- **TR band and removal of sheath on table**
- **Pain free**
- **Stable hemodynamics**
- **Electrically stable**
- **Discharged at 6 hours**



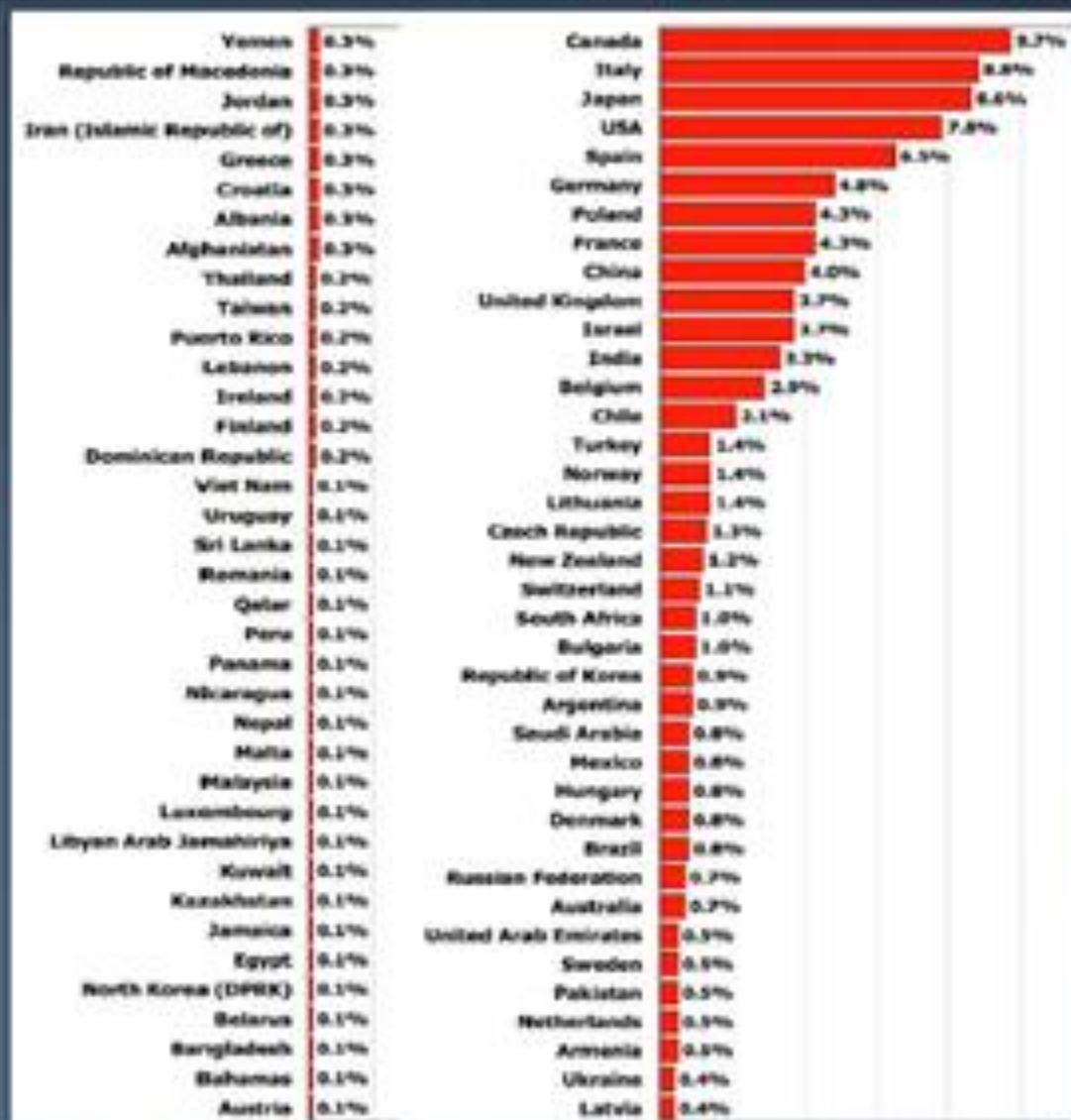
# TRI: Step by Step

- 1. Introduction & Positioning the patient**
- 2. Right vs. left radial access**
- 3. Choice of equipment**
- 4. Arterial puncture technique**
- 5. Understanding and navigating the upper extremity vasculature**
- 6. Coronary engagement – Catheter selection for diagnostic angiography and PCI**
- 7. Hemostasis**

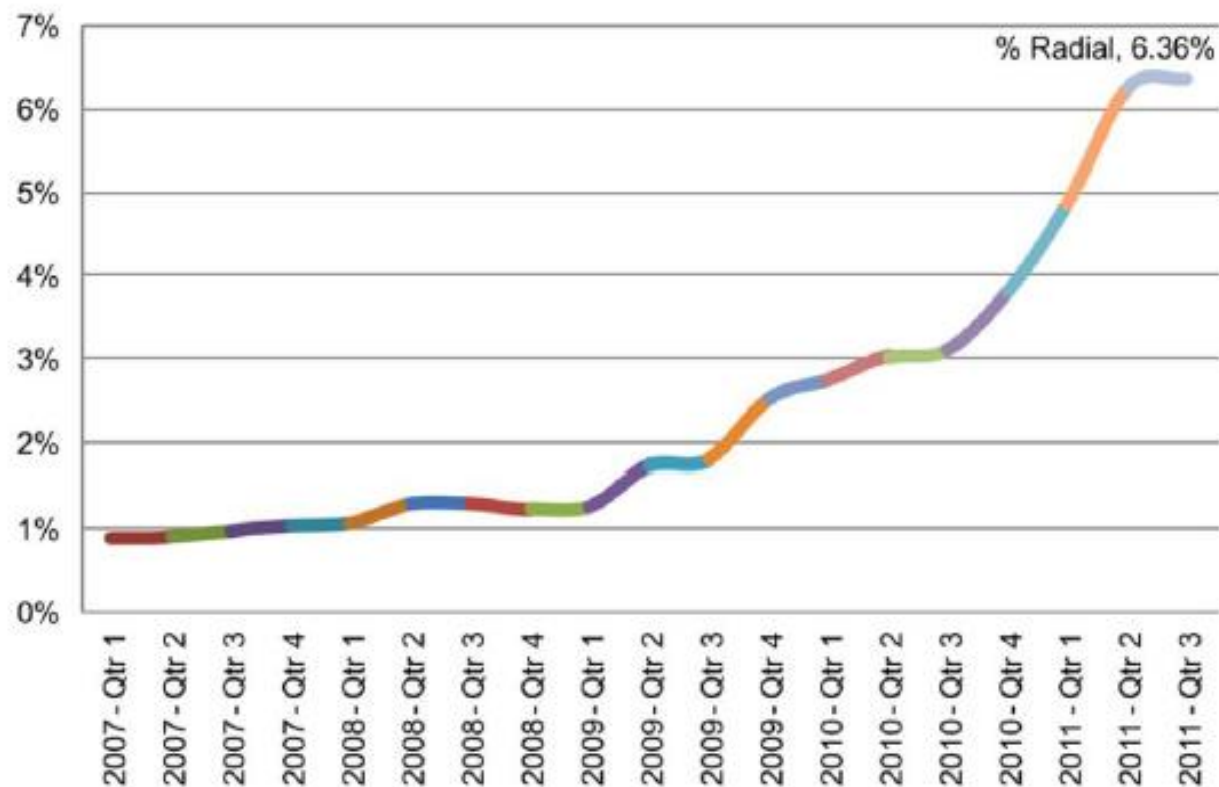


# Prevalence of TRA By Country

N = 1107  
Physicians  
Surveyed in  
75 Countries



# Transradial Use for STEMI in the US



**Figure 3** Temporal Trend in Use of TRI for STEMI PCI from 2007 to 2011



# When not to consider radial access

## ■ Can be done by experienced operators:

- Bilateral IMA grafts<sup>1</sup>
- Devices requiring large-bore guide catheters<sup>1</sup>

## ■ Just don't do it:

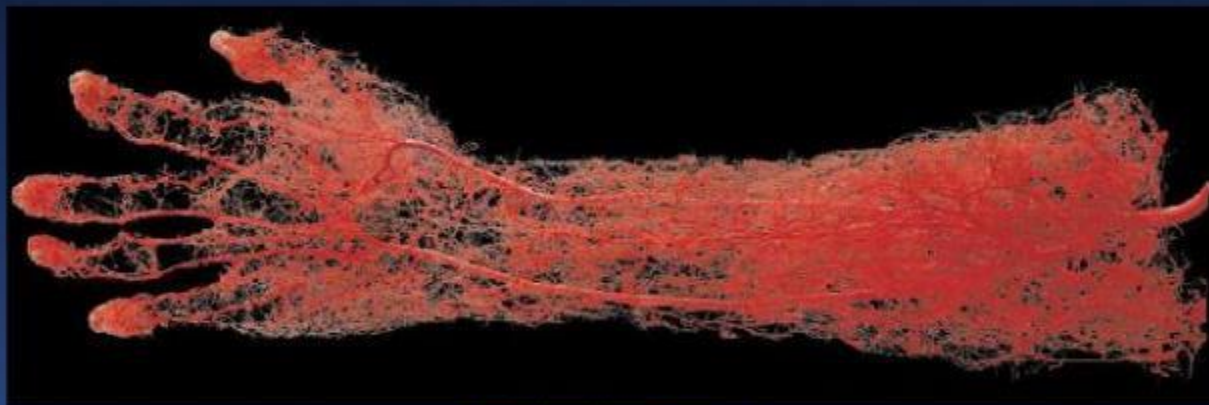
- Patient refuses
- Dialysis grafts<sup>2</sup>
- Raynaud's, Buerger's disease, Scleroderma, Ipsilateral mastectomy
- If you are an untrained operator!!

<sup>1</sup>Can be done by experienced radialists

<sup>2</sup>Some data suggesting this is safe

# Arm is very well collateralized

- *No correlation to hand ischemia & arterial lines*<sup>1</sup>
- Extensive radial CABG experience without ischemia
- Radial harvest with abnormal Allen's Test is possible<sup>2</sup>



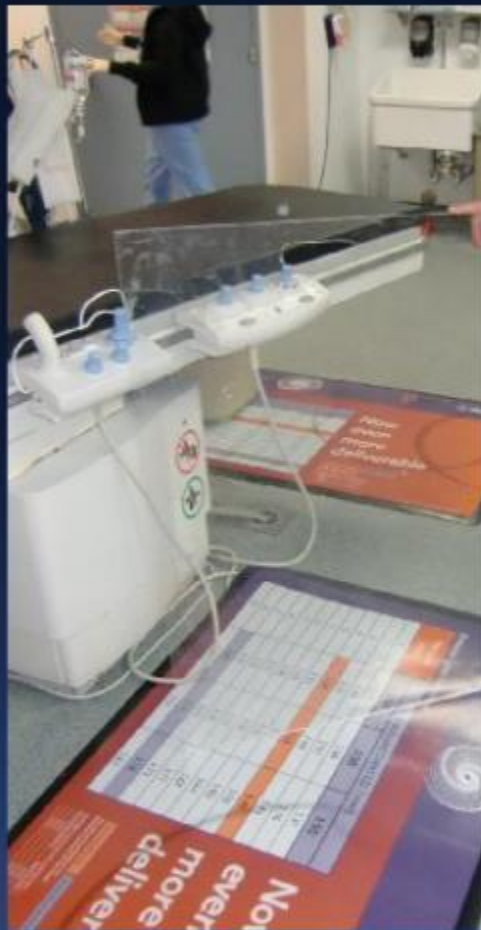
[www.bodyworlds.com](http://www.bodyworlds.com)

***Theoretical fears from an abnormal Allen's Test is a poor excuse for a real risk of groin complications***

# Basic Rules

## Radial is Different than Femoral

- **Precise puncture & never push (finesse over muscle)**
- **Prophylactic antispasm medication is needed**
  - Verapamil 3 mg / NTG
- **Anticoagulate to prevent (reduce) thrombosis**
  - Heparin 5000 U (~50 U/Kg in lighter patients)
- **Hold on to hard won territory (exchange wire or jet-catheter exchange technique)**
- **Find a catheter series that works for you (practice makes perfect)**
- **Remove the sheath at the end of the case**





**The pulse oxymeter is placed on the thumb and the wrist is hyper extended using a towel**





# TRI: Step by Step

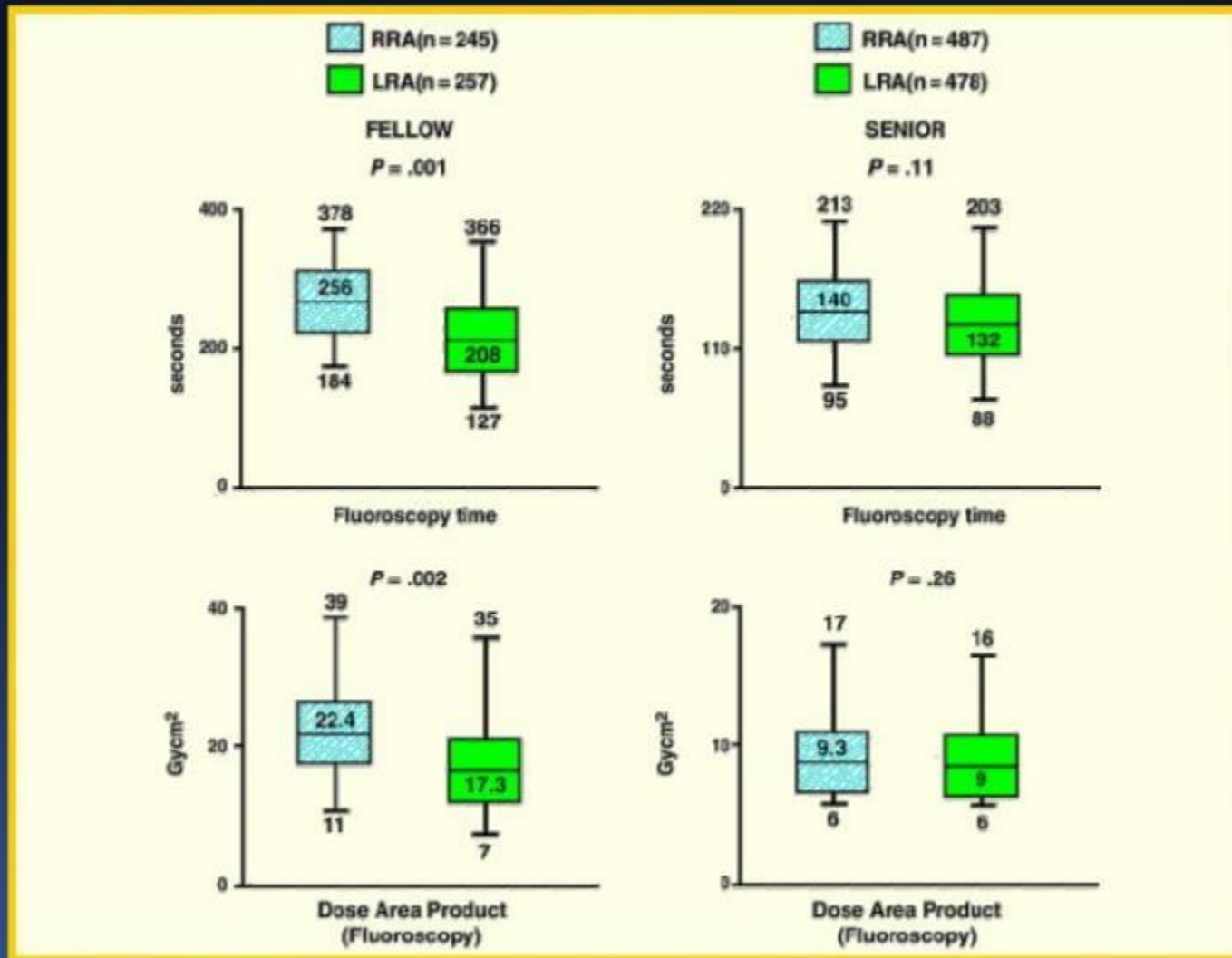
1. Introduction & Positioning the patient
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# TALENT TRIAL: Right vs. Left Radial

*Operator's experience matters*



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# Sheath Selection

Pts Undergoing Cath or PCI  
via the Radial Artery

2x2 Factorial Randomization

R

R

Long (23 cm)  
n=396

Short (13 cm)  
n=394

Coated  
n=397

Uncoated  
n=393

Operator  
RAS

110 (27.9%)

120 (30.8%)\*

75 (19.0%)

155 (39.9%)^

Patient  
discomfort

85 (21.5%)

87 (22.2%)\*

60 (15.1%)

112 (28.5%)^

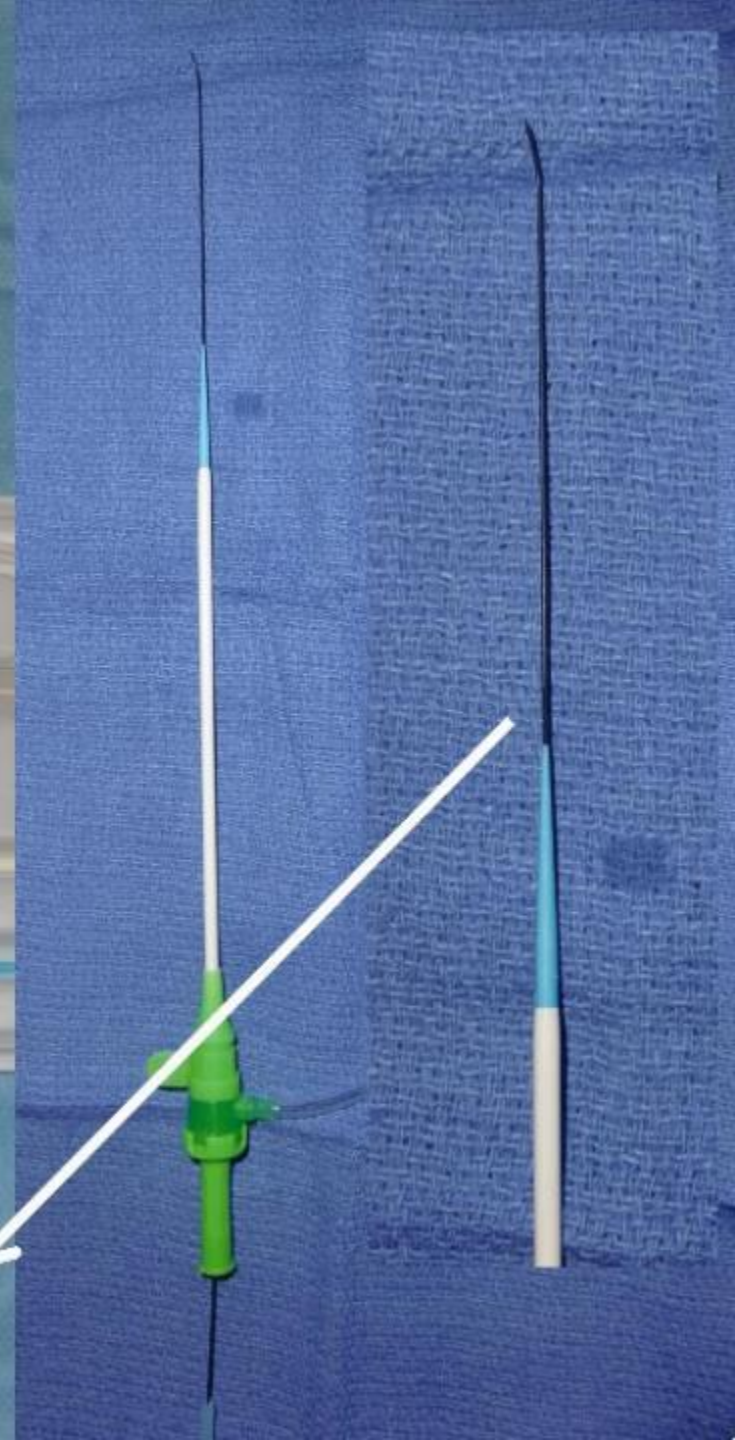
\*p=NS

^p<0.001

Young age, female sex, diabetes, and low BMI to  
be independent predictors of RAS



Tapered transition between sheath and wire makes skin nick unnecessary



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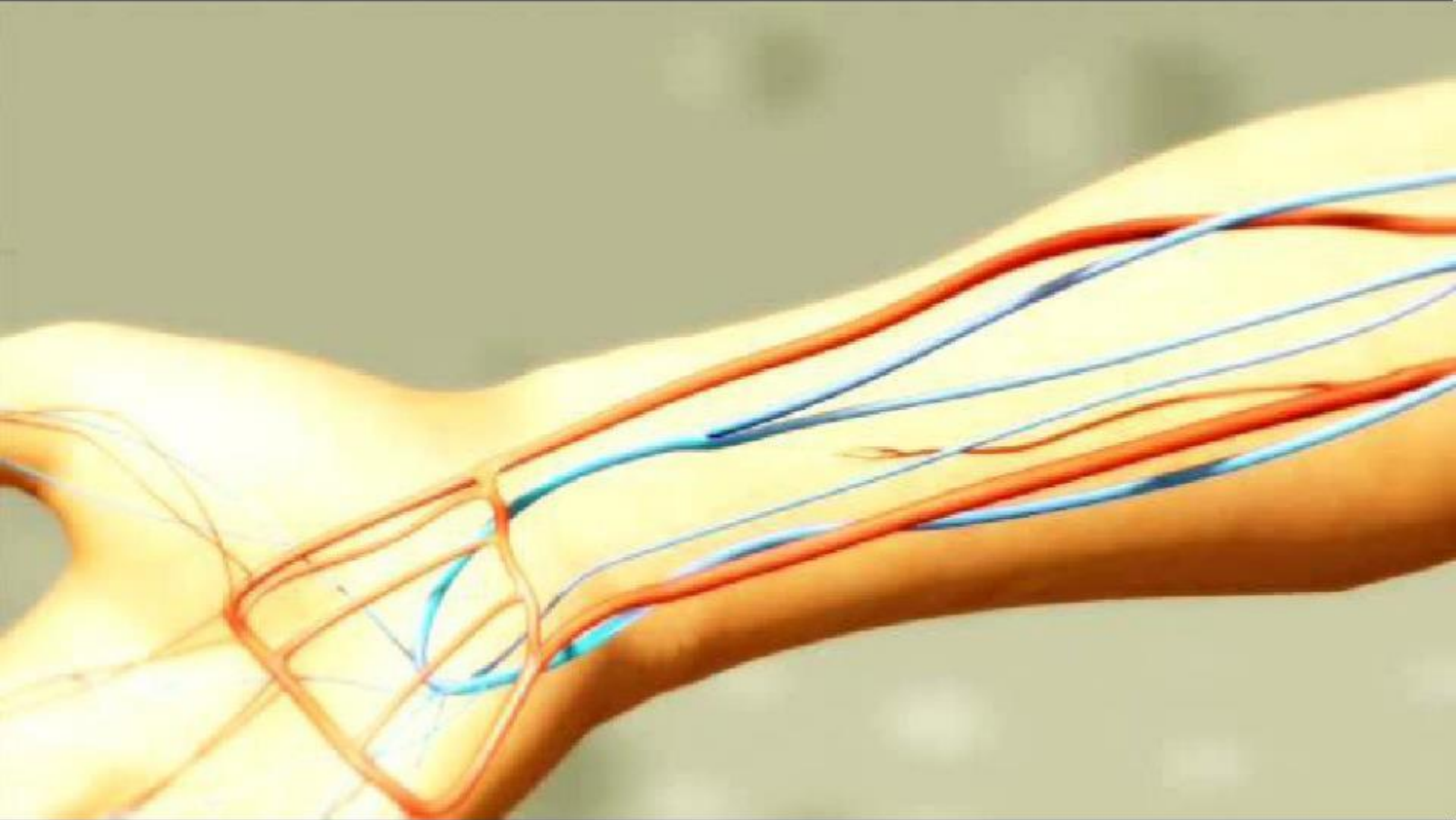


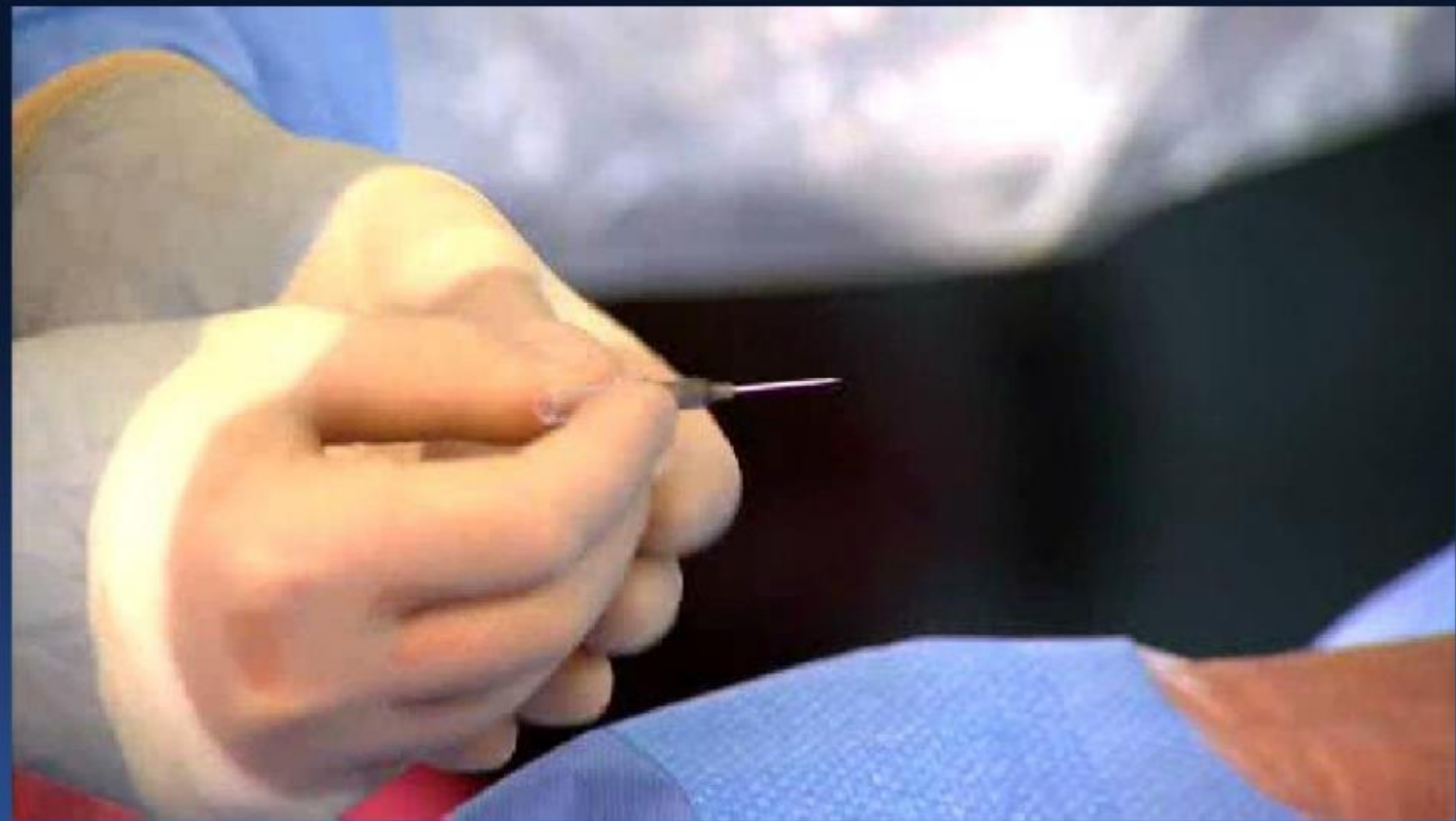
# Access Techniques

- Right or left?
- Access the radial artery  $\geq 2$  cm proximal to the radial styloid process
- Avoid access over the flexor retinaculum
- **Back-wall puncture technique**
  - Seldinger method
  - Micropuncture IV catheter (fine metal needle and a 22G Teflon catheter)  $\rightarrow$  "Angiocath"
- **Single wall technique**
  - Short 2.5 cm stainless steel 21G needle
- **Both allow the passage of a 0.018"-0.021" guidewire**









# Radial Artery Access Technique Evaluation Trial

## Radial Catheterization

R

**Seldinger**  
(n=210)

**Modified Seldinger**  
(n=202)

**Procedural Characteristics**  
**Complications**

Two operators

5F hydrophilic-coated sheaths

Vasodilators: Diltiazem 5 mg + NTG 200 mcg

Anticoagulation: 50 U/Kg UFH

Hemostasis: TR Band applied for 2 hs

# Results: Procedure Characteristics

	<b>Seldinger Technique (n=210)</b>	<b>Modified Seldinger Technique (n=202)</b>	<b>P-value</b>
<b>Access Time (min)</b>	78.3±37.7	134.2±87.5	<0.001
<b>Procedure time (min)</b>	17.1±6.4	19.3±7.1	<0.01
<b>Number of attempts</b>	1.7±0.8	2.2±0.8	<0.001
<b>First Attempt Access</b>	53%	16%	<0.001
<b>Crossover</b>	0	10.8%	<0.0001

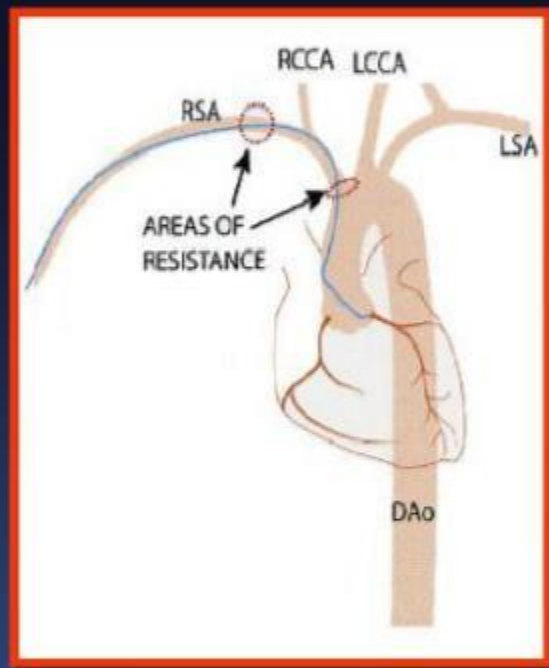
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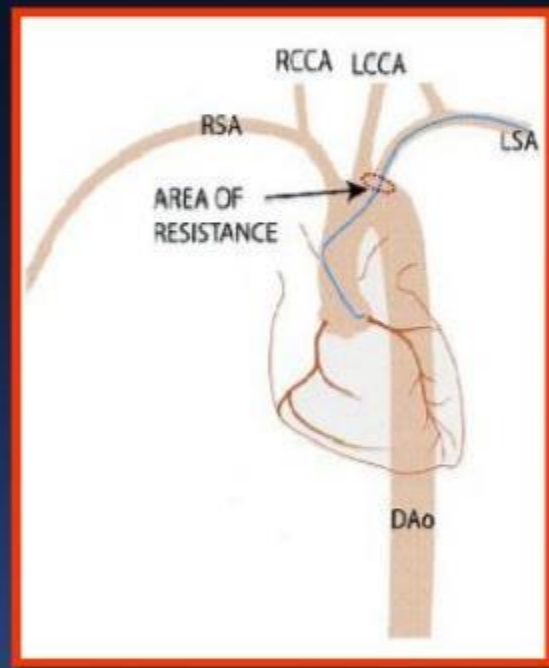
# Understanding the Catheter's Course

## Right Radial



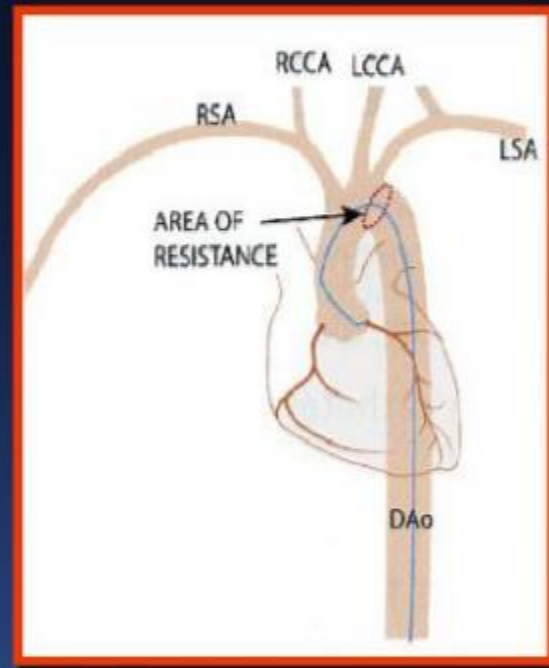
2 points of resistance

## Left Radial



1 point of resistance

## Femoral



1 point of resistance

# TRA: Mechanisms of Failure

Total number of Failures

98/2100 (4.6%)

---

## Failure of arterial access

Inadequate arterial puncture

13%

---

## Failure to advance catheter to ascending aorta

Radial artery

**HYDROPHYLIC SHEATHS NOT USED**

34%

Radial artery dissection

10%

Radial artery loop/tortuosity

6%

Radial artery stenosis

1%

---

## Failure to complete PCI due to lack of guide support

Subclavian tortuosity

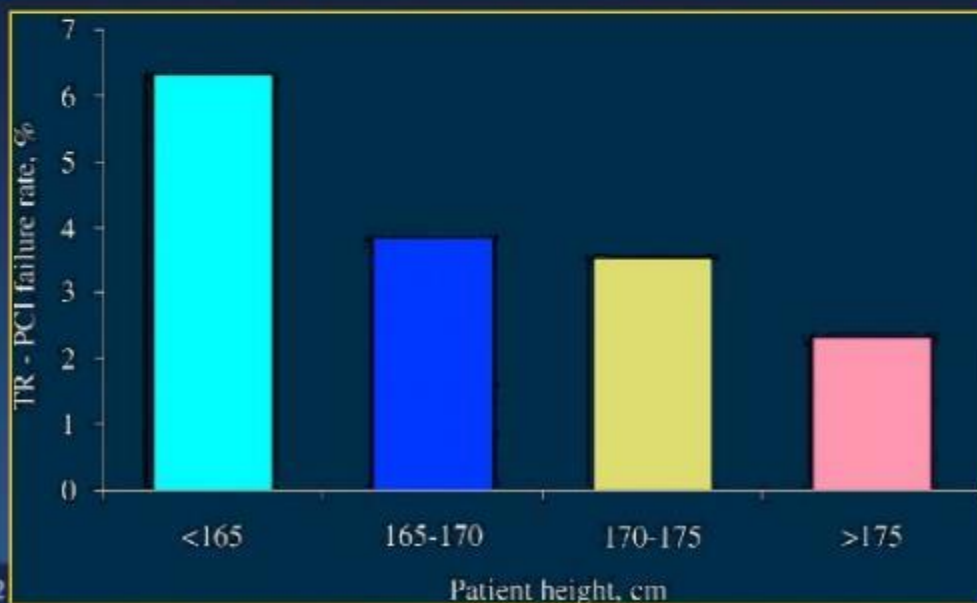
18%

Inadequate guide backup support

17%

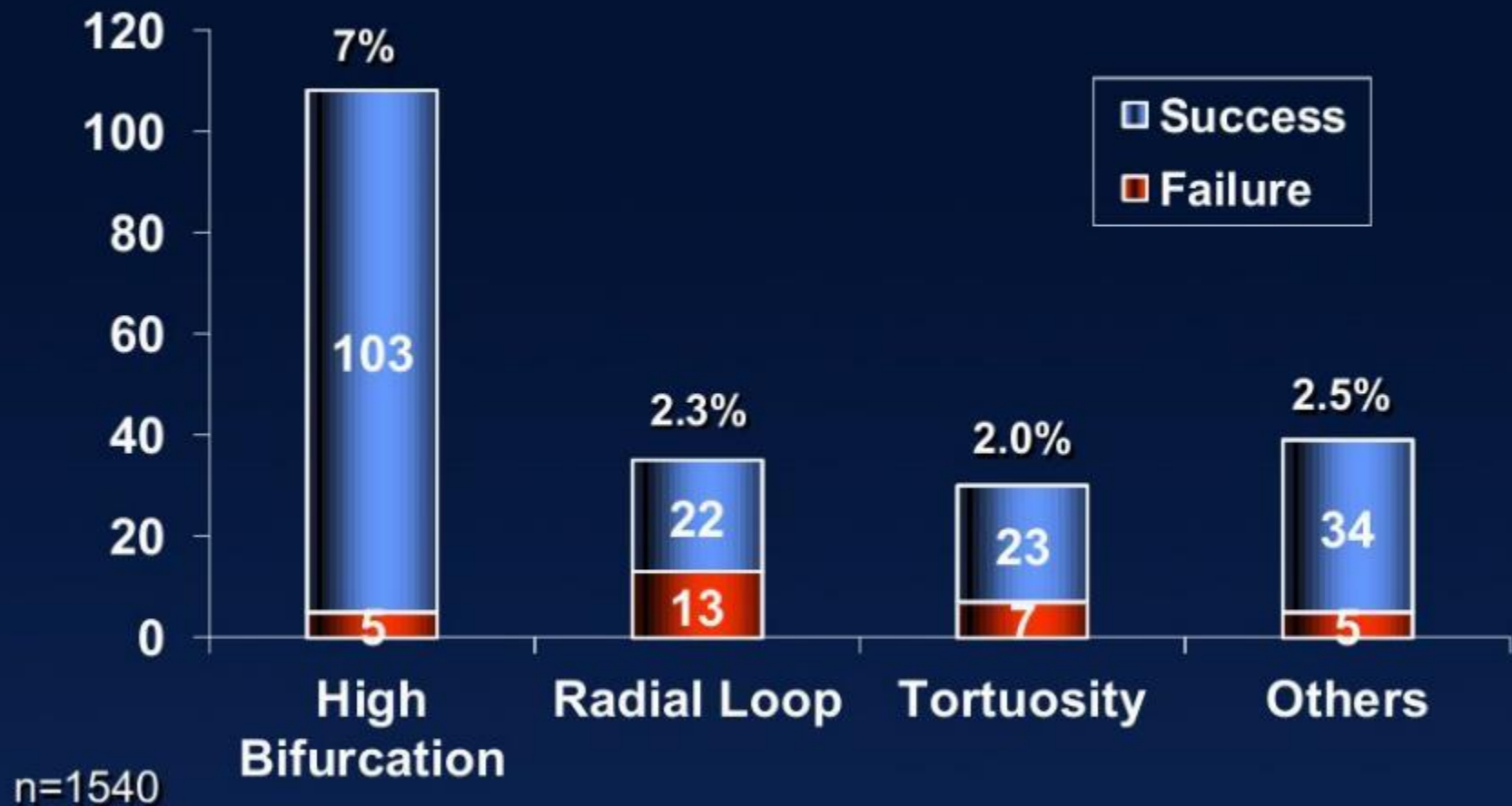
n=2,100

# TRA: Predictors of Failure





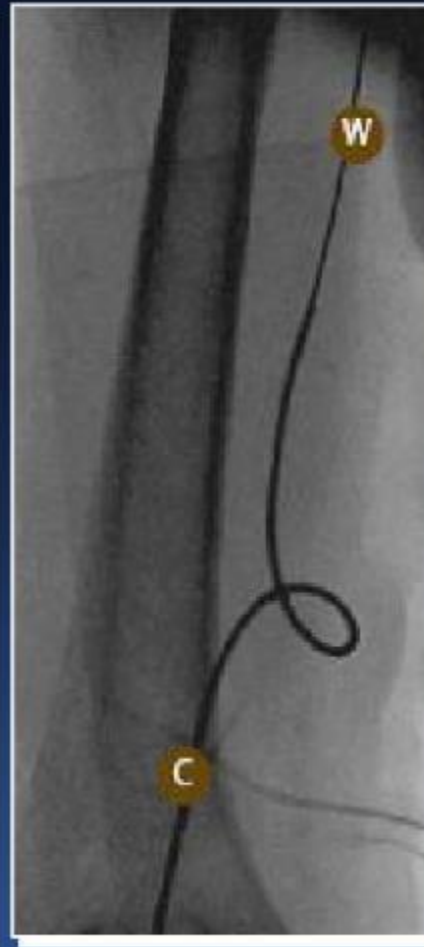
# Radial Anomalies and Procedural Failure



# Radial Loop

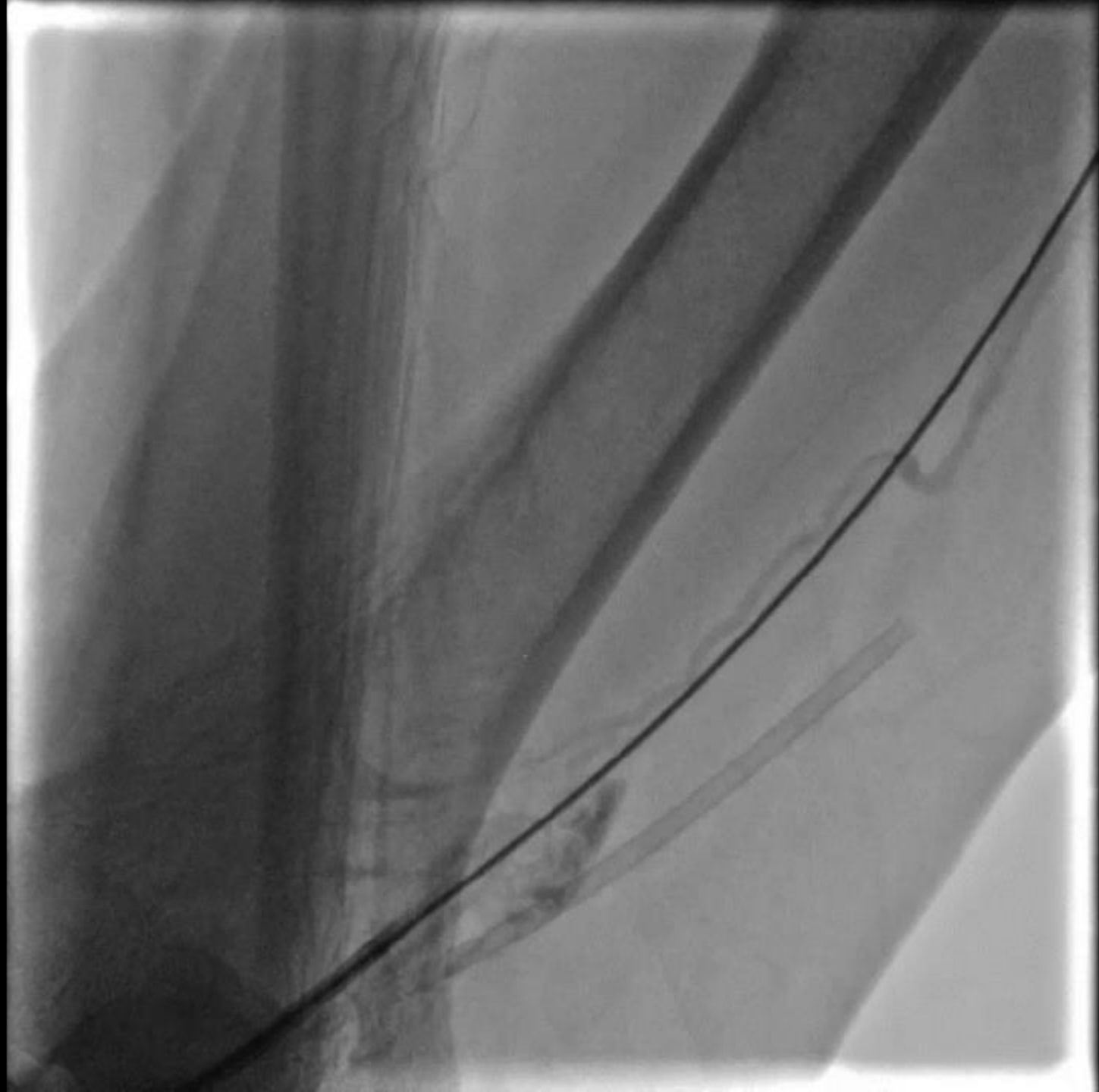


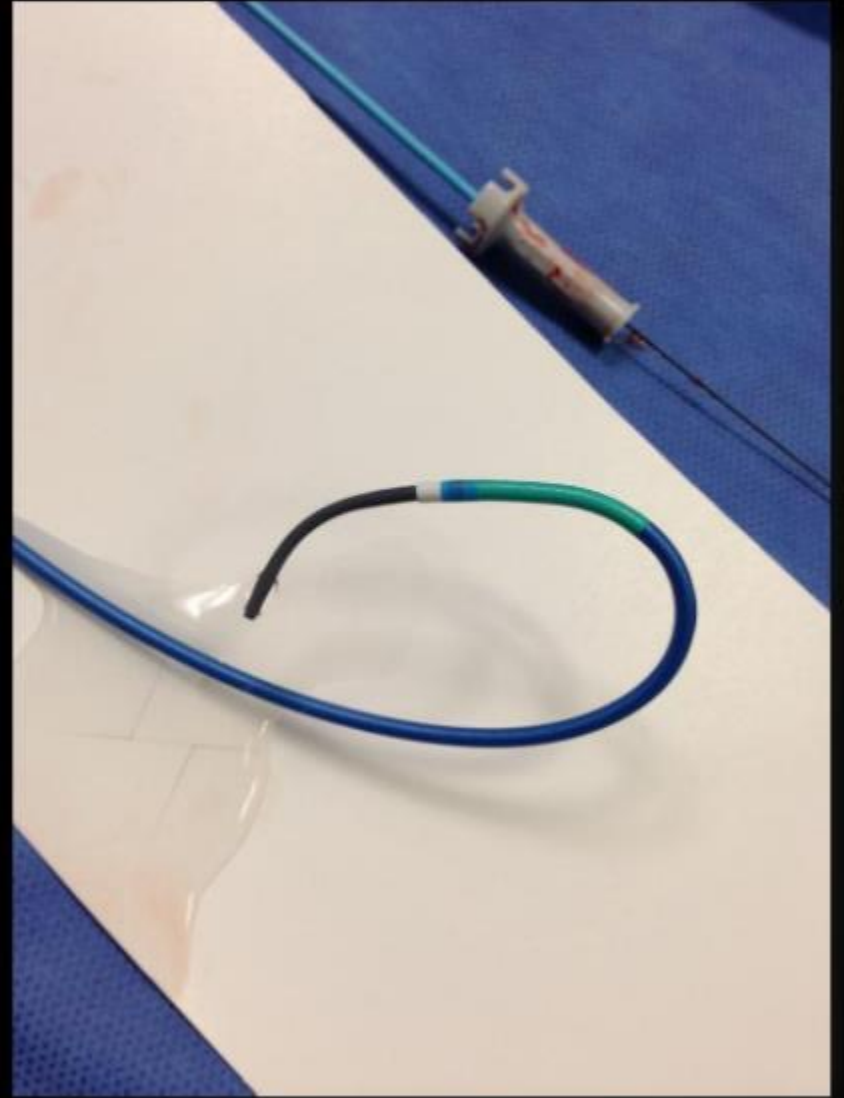
# Traversing a radial loop

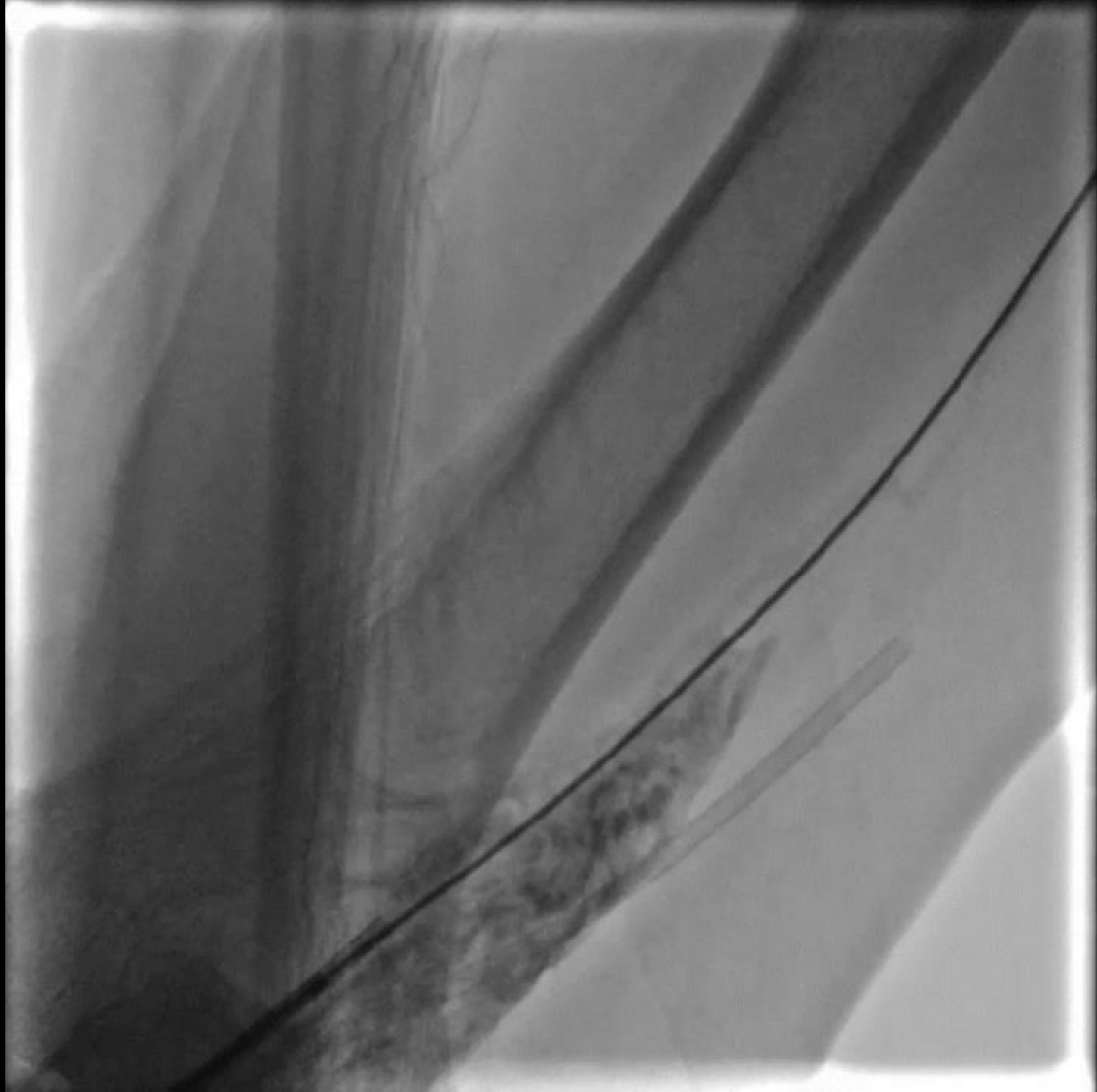




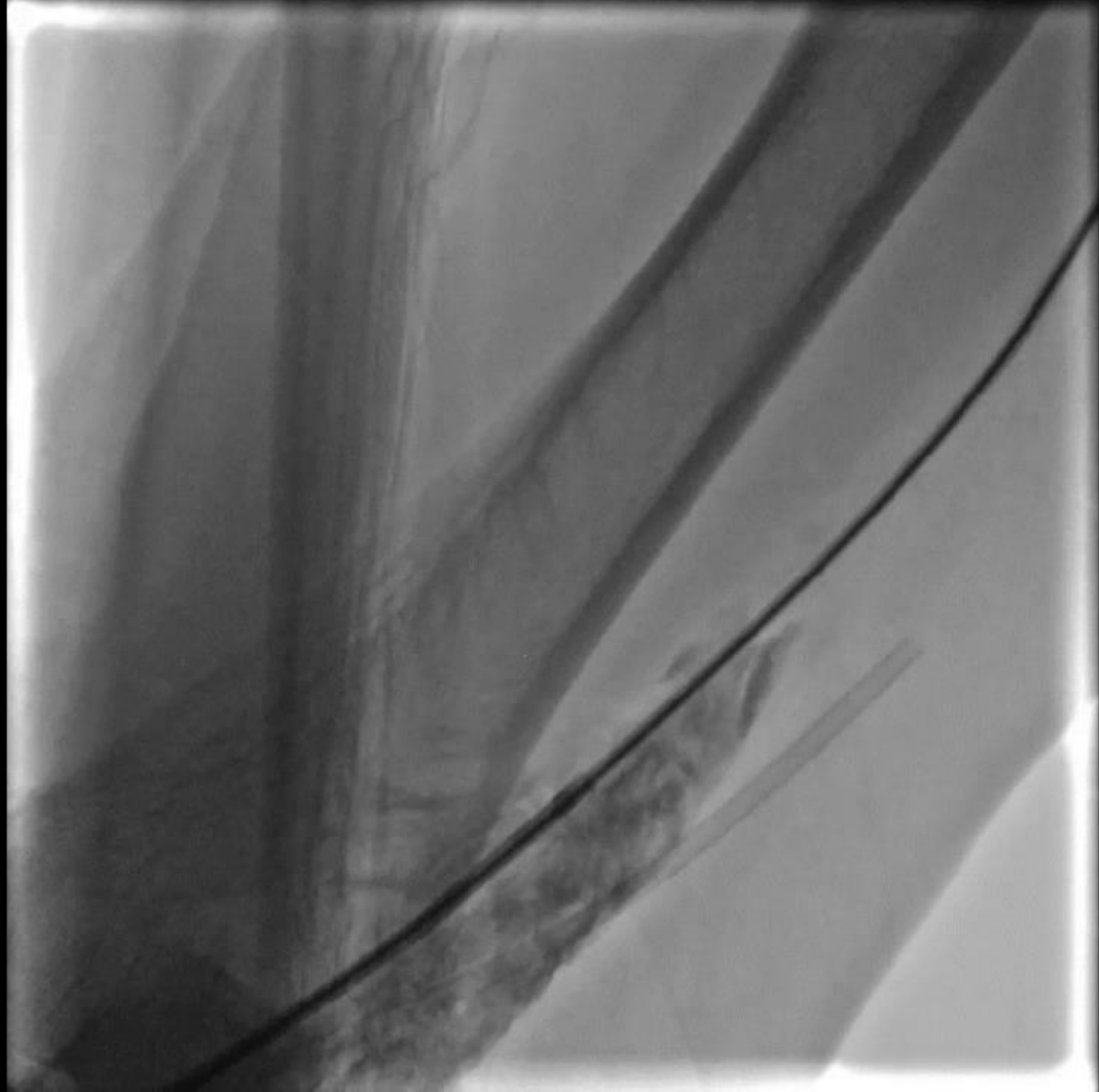












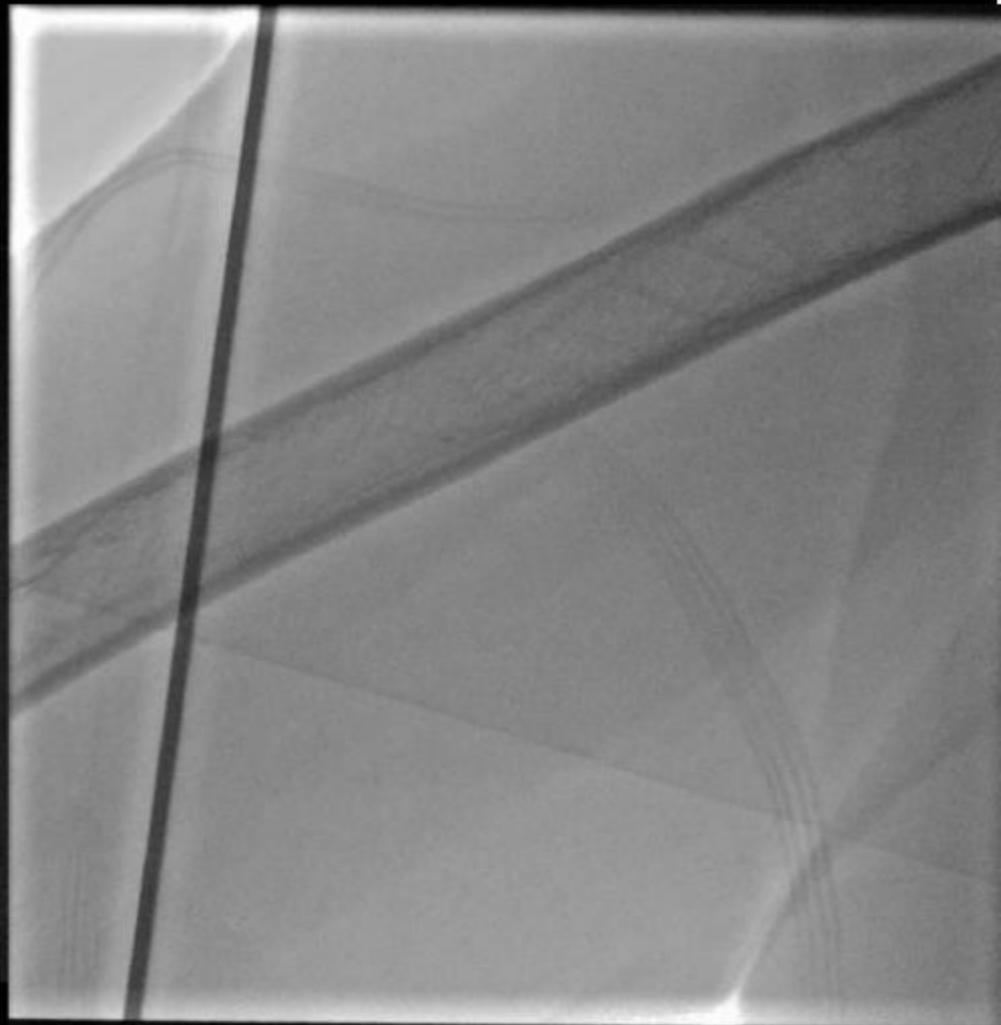








# High Bifurcating Radial Artery



# Brachial Tortuosity



# Brachial Tortuosity

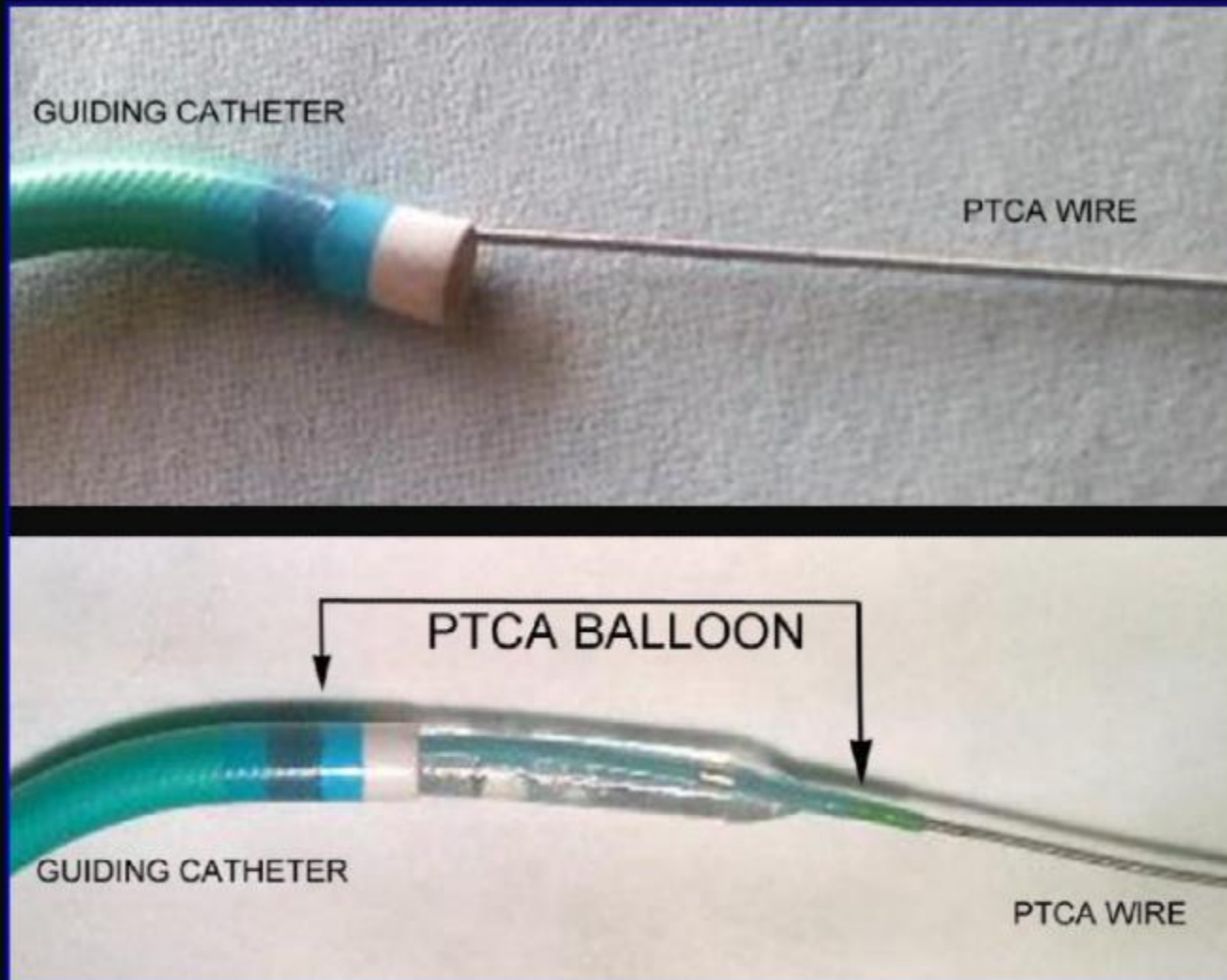




# Brachial Tortuosity

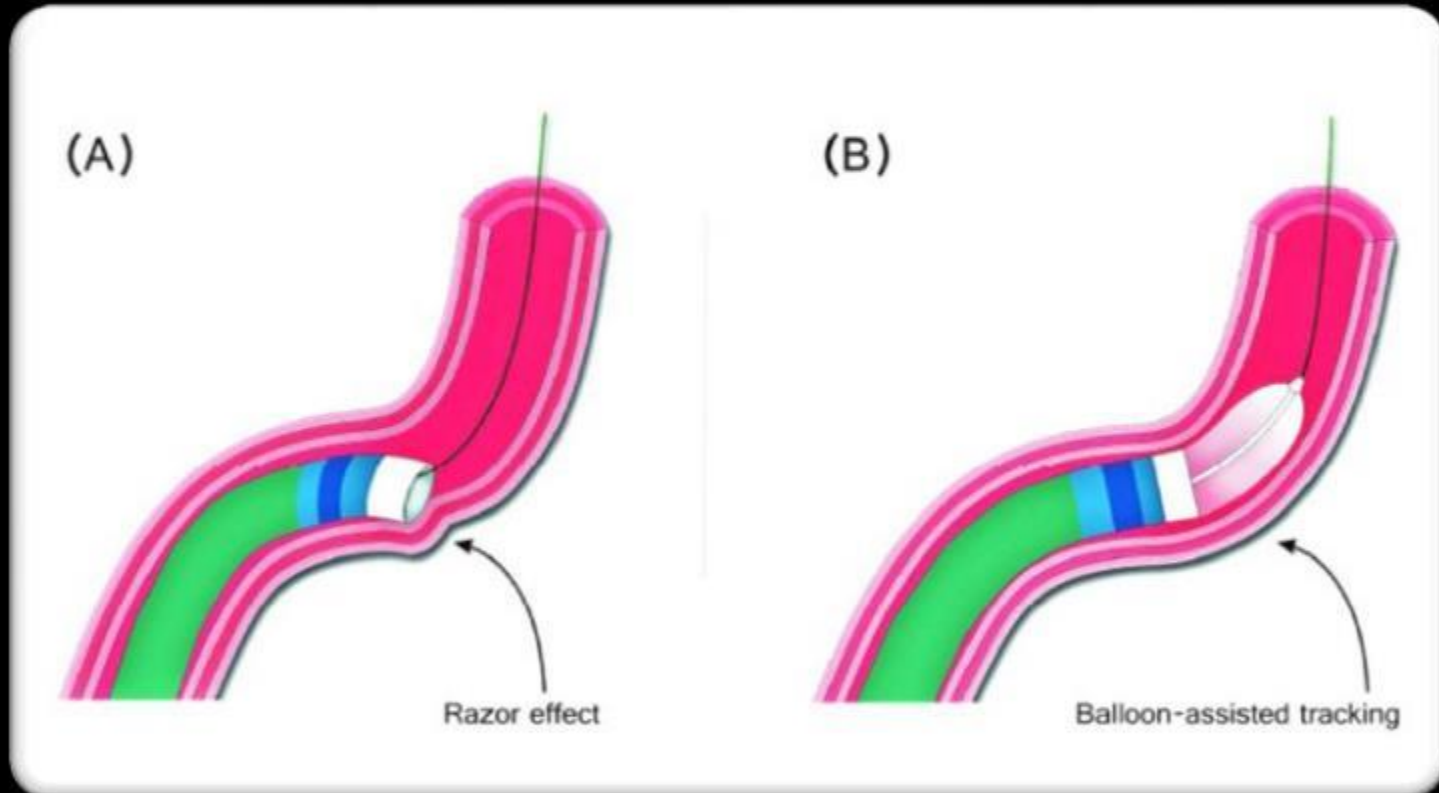


# Balloon Assisted Tracking



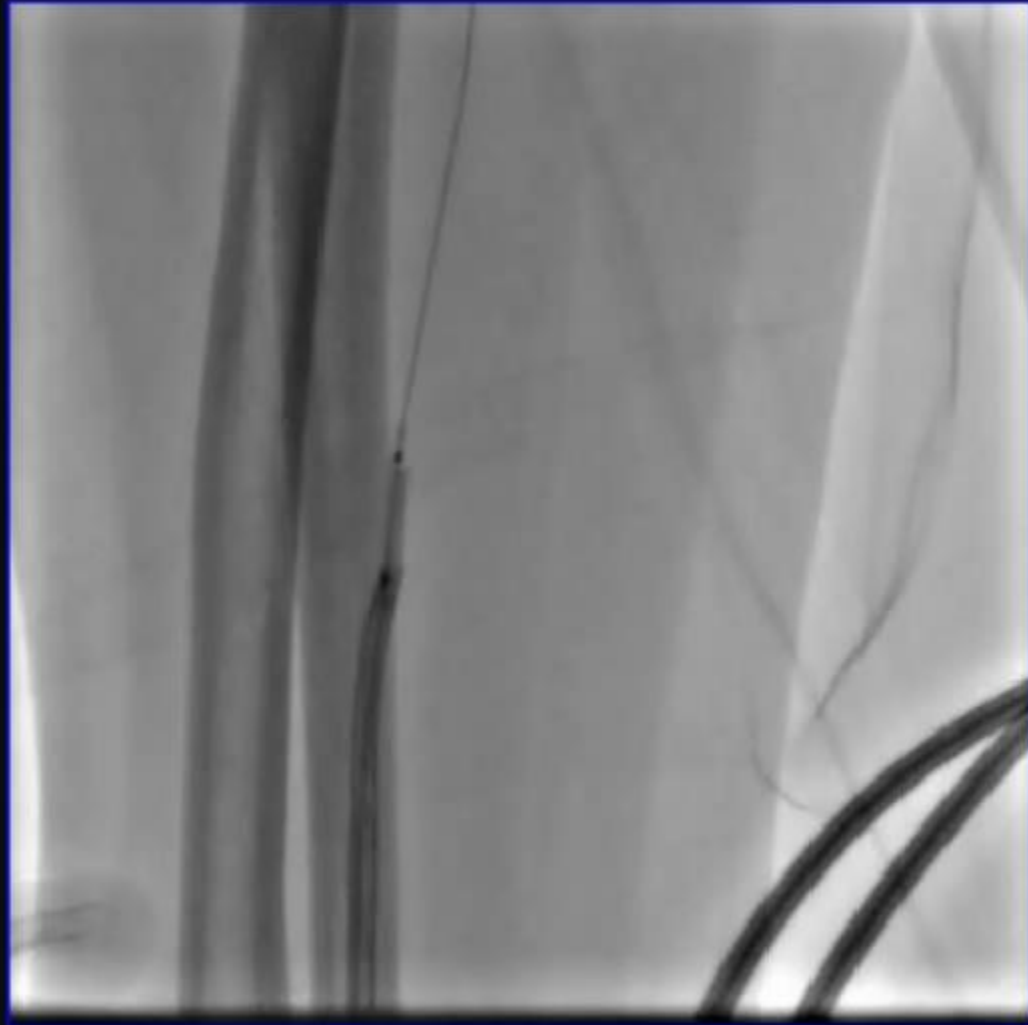
# Razor Effect

## Balloon Assisted Tracking



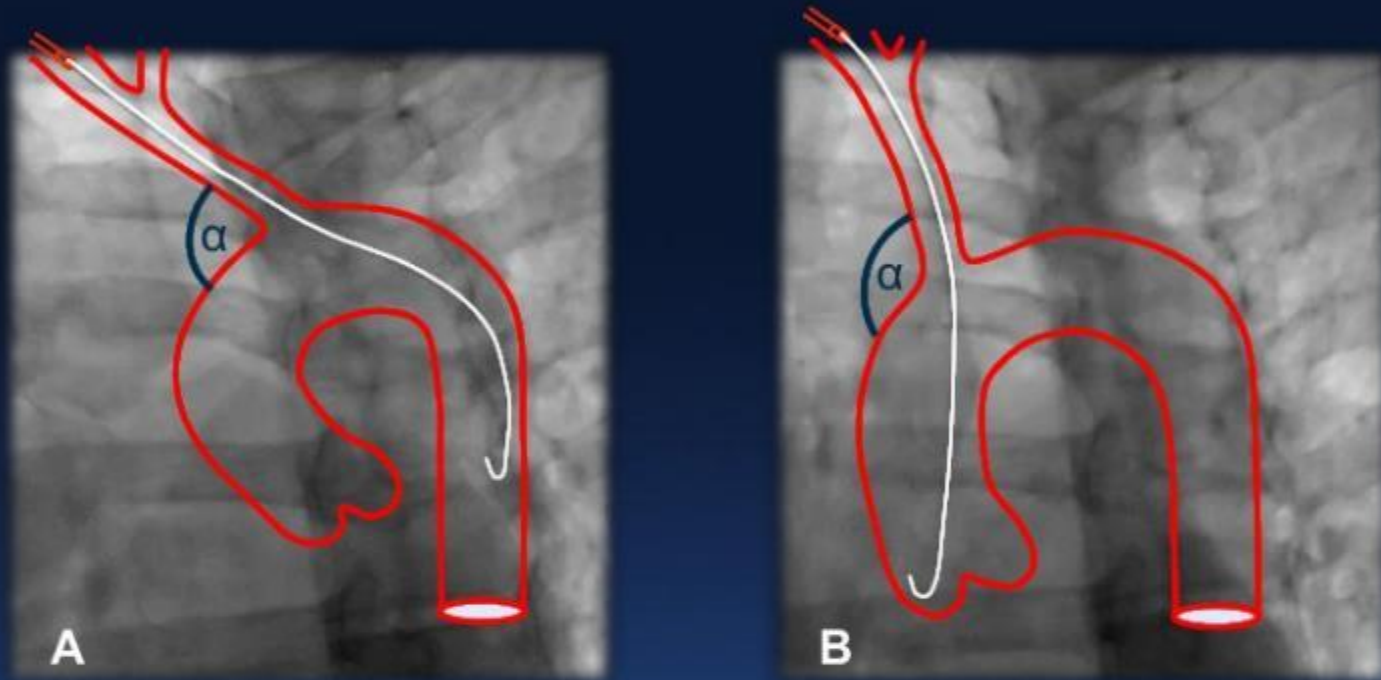


Courtesy – Tejas Patel



Courtesy – Tejas Patel

# Effect of Inspiration



Panel A: During expiration there is a more acute angle ( $\alpha$ ) between the brachiocephalic trunk and the ascending aorta, therefore the wire takes a more horizontal direction towards the descending aorta. Panel B: During deep inspiration, the diaphragm lowers the heart and straightens the angle ( $\alpha$ ) between the brachiocephalic trunk and the ascending aorta. The wire takes a more vertical direction towards the ascending aorta.

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## Most frequently used diagnostic coronary catheter shapes



Tiger



Jacky



Amplatz Left



LCB



RCB



Judkins Left



Judins Right



Multipurpose A2



IM



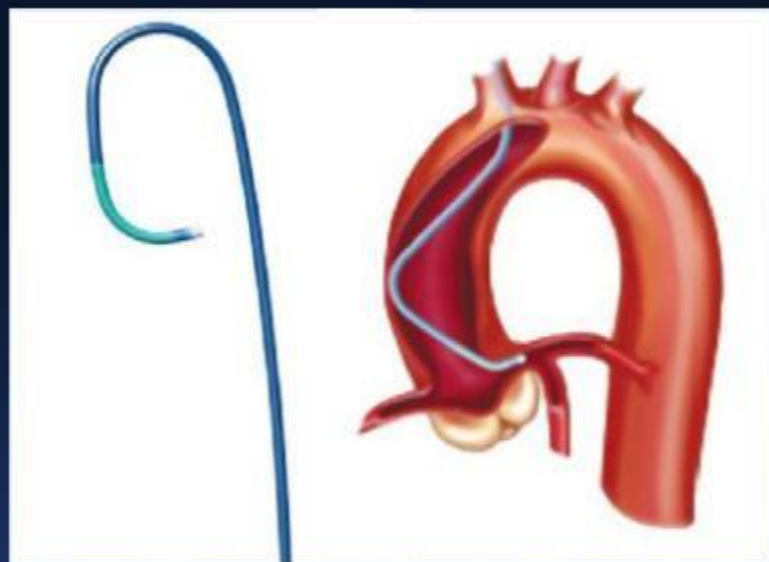
3D LIMA



IM VB-1



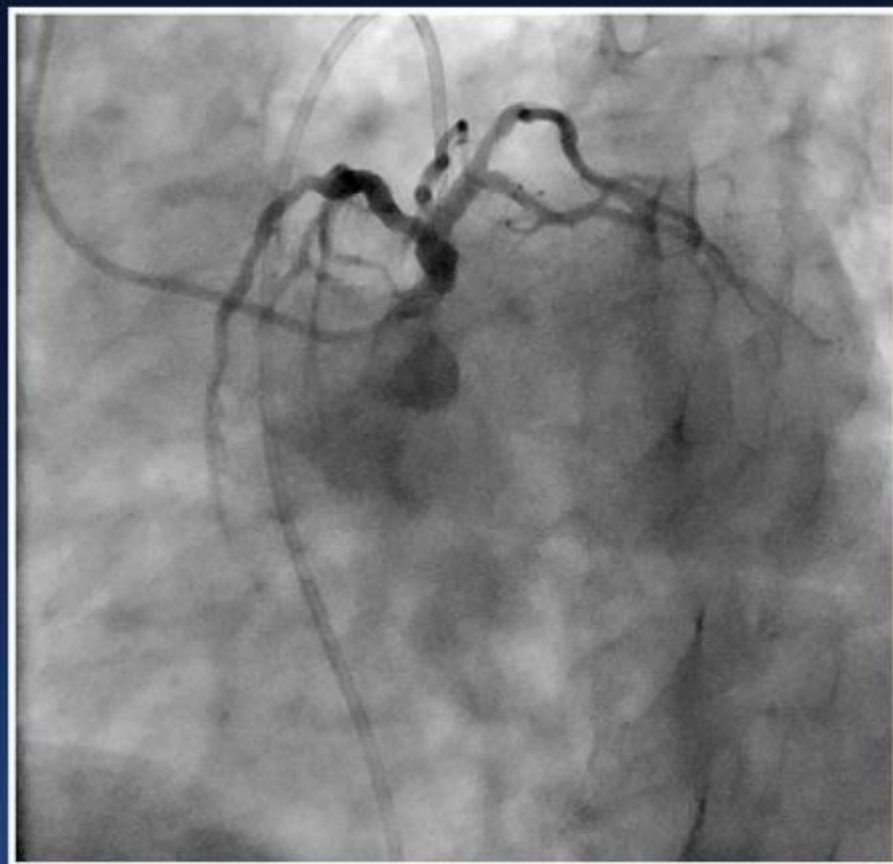
# Transradial Curves for Left Coronary – Judkins Left



Standard curve for the left coronary artery  
(may be particularly useful for short left  
coronary arteries)

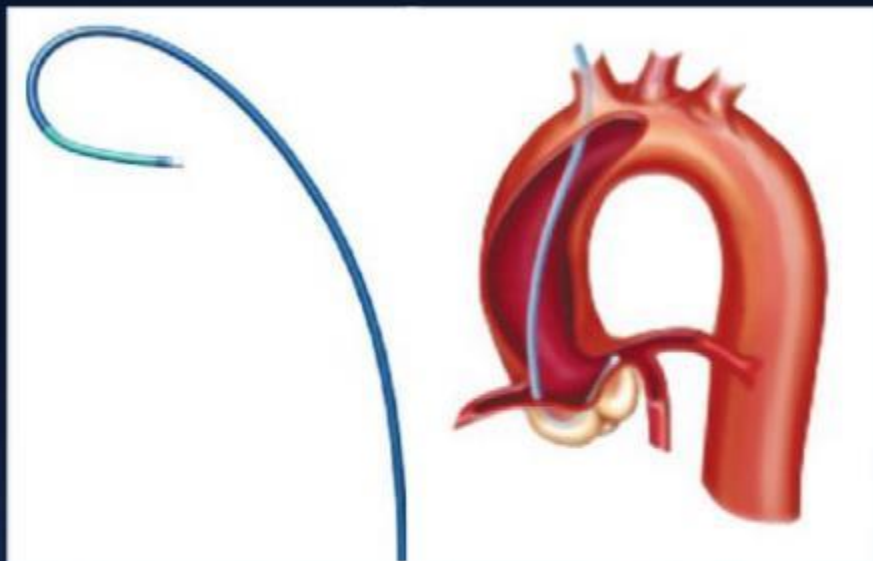
Sizing suggestions:

Downsize the curve by 0.5 from what is used  
for a femoral approach



Judkins engagement technique, similar to  
femoral approach. Very fine torquing  
movements may be required to direct the  
catheter toward the left coronary artery

# Transradial Curves for Left Coronary – Extra Backup



Workhorse curve for left coronary artery

Sizing suggestions:

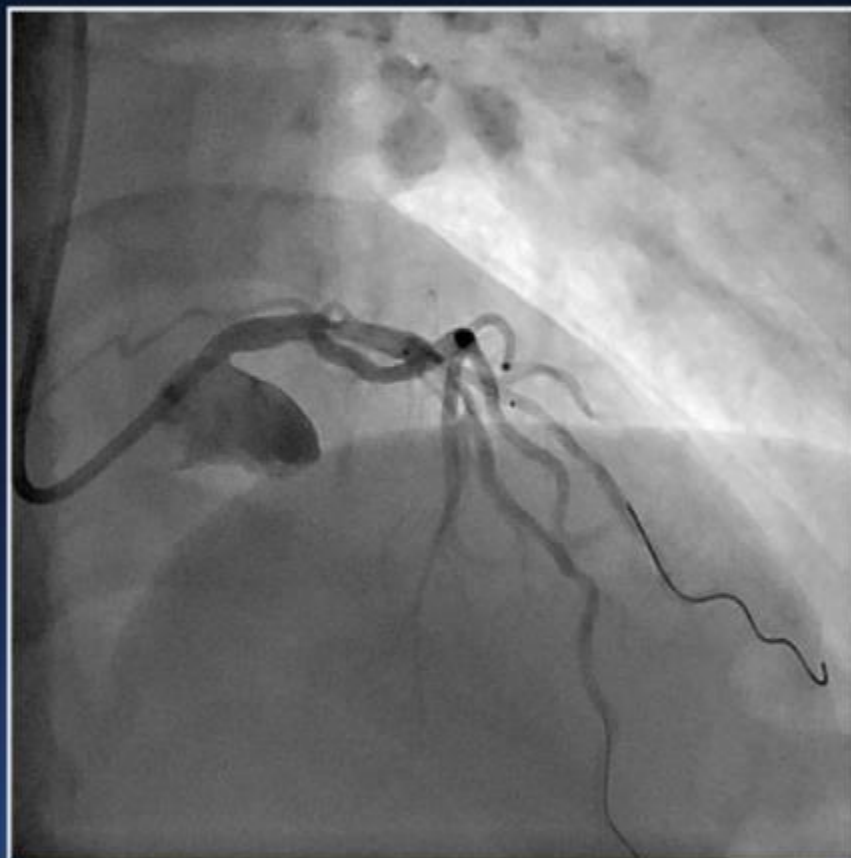
JL3.5 = EBU3.5

JL4.0 = EBU3.75

Comparable to:

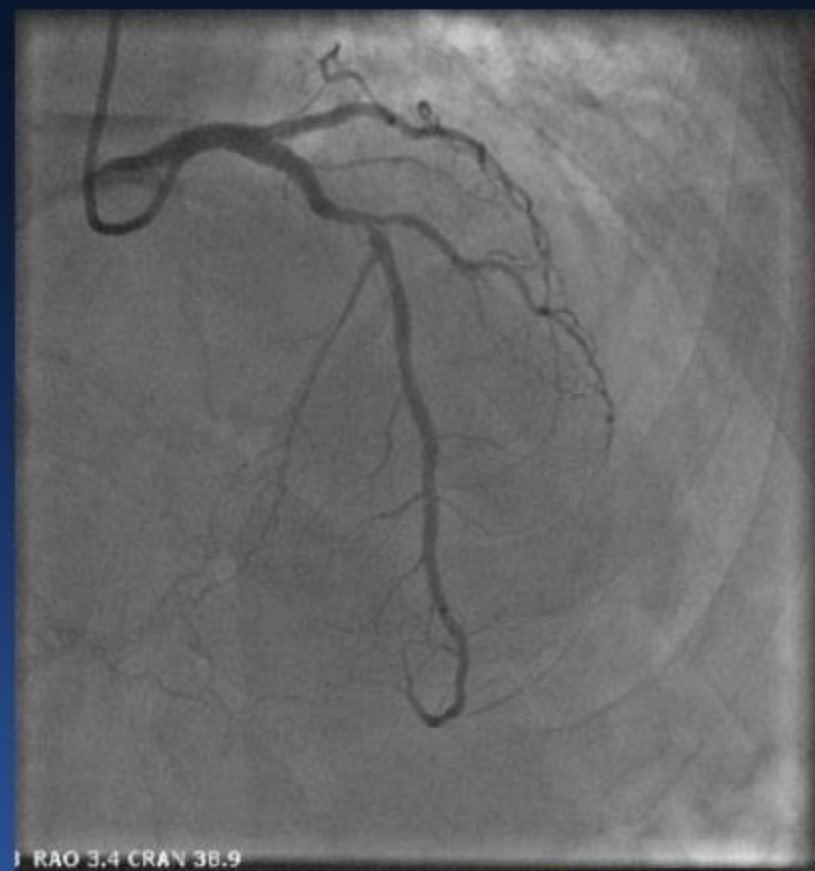
Cordis: XB, XBLAD

BSC: Muta Left, Radial Curve, Brachial Curve

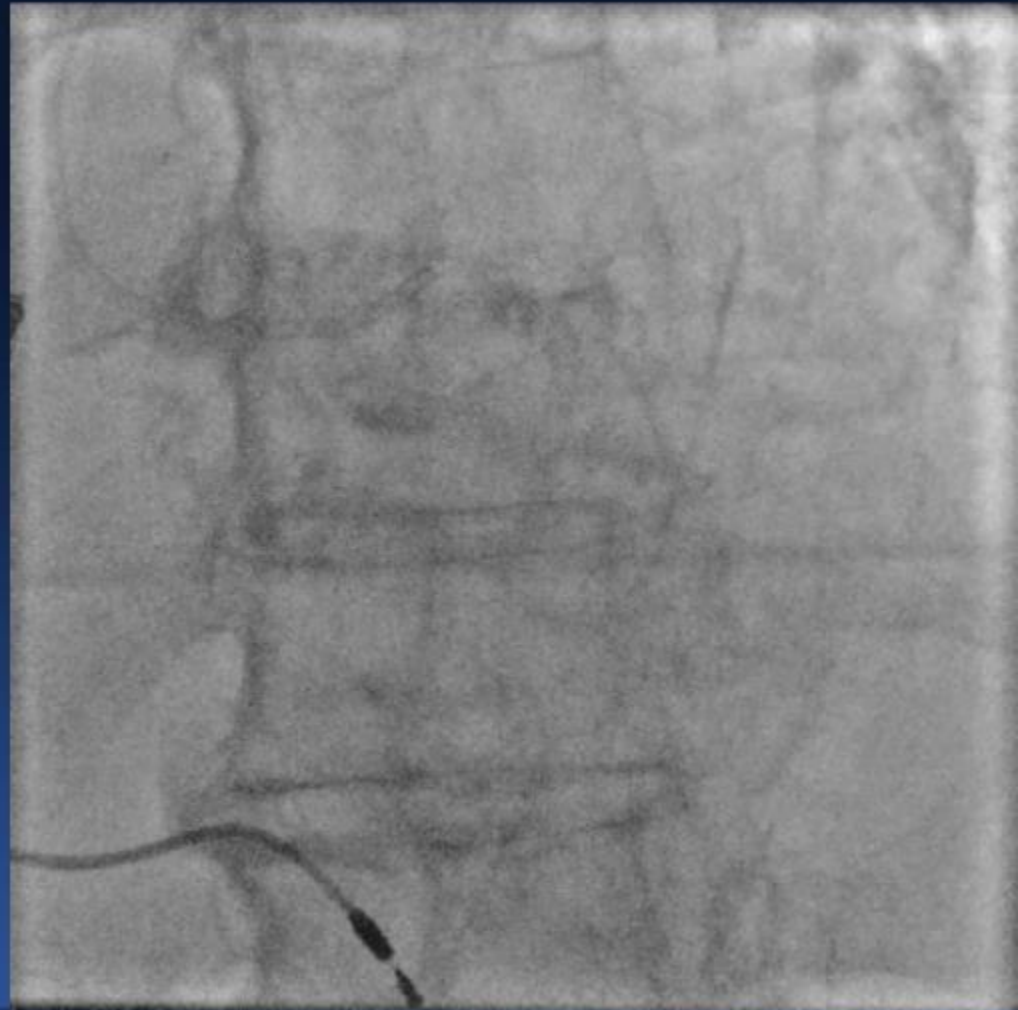
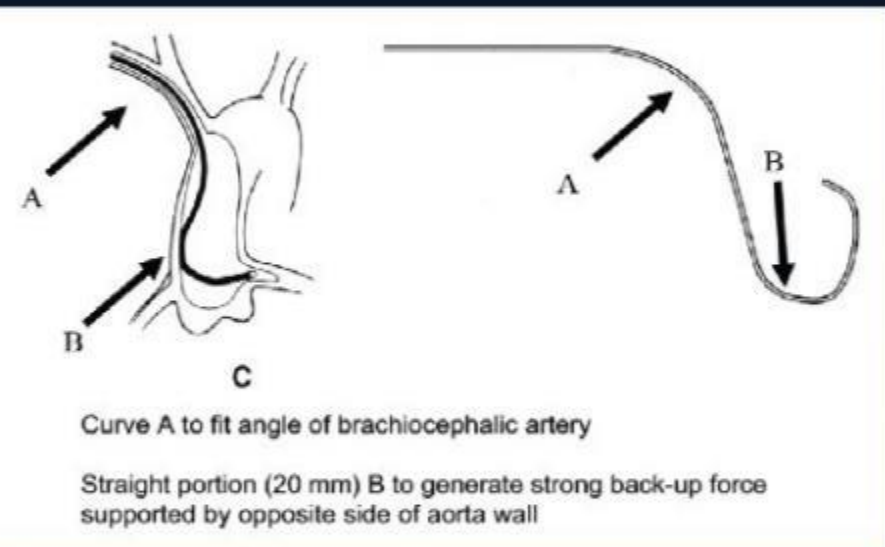


Apply torque to point the tip to the left coronary cusp and turn catheter. Pull wire back and the catheter will engage the left coronary artery. Backup support from the sinus of valsalva

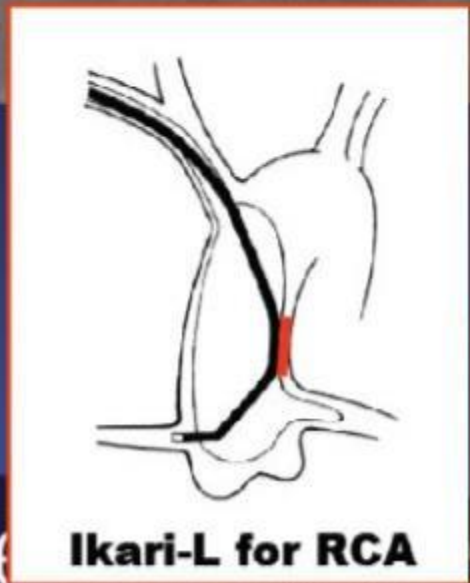
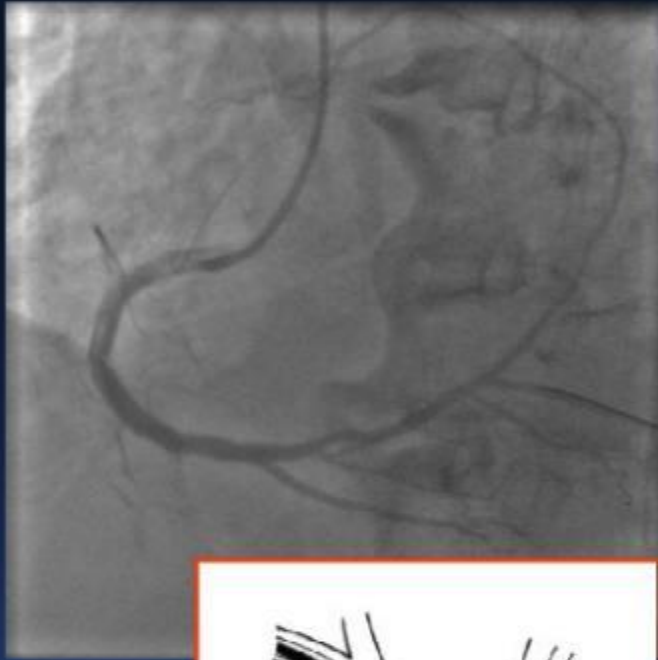
# Jacky Catheter: Selective Engagement of RCA and LM



# IKARI Left Catheter

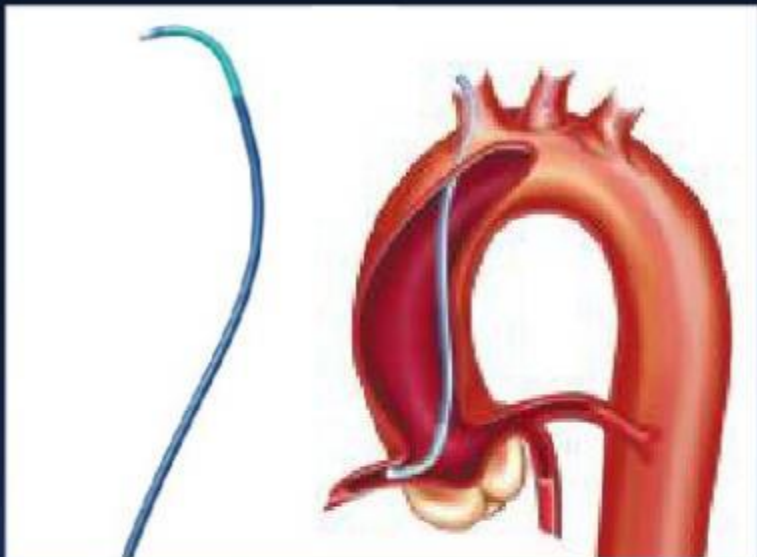


# IKARI Left Catheter: Multivessel Intervention



**Ikari-L for RCA**

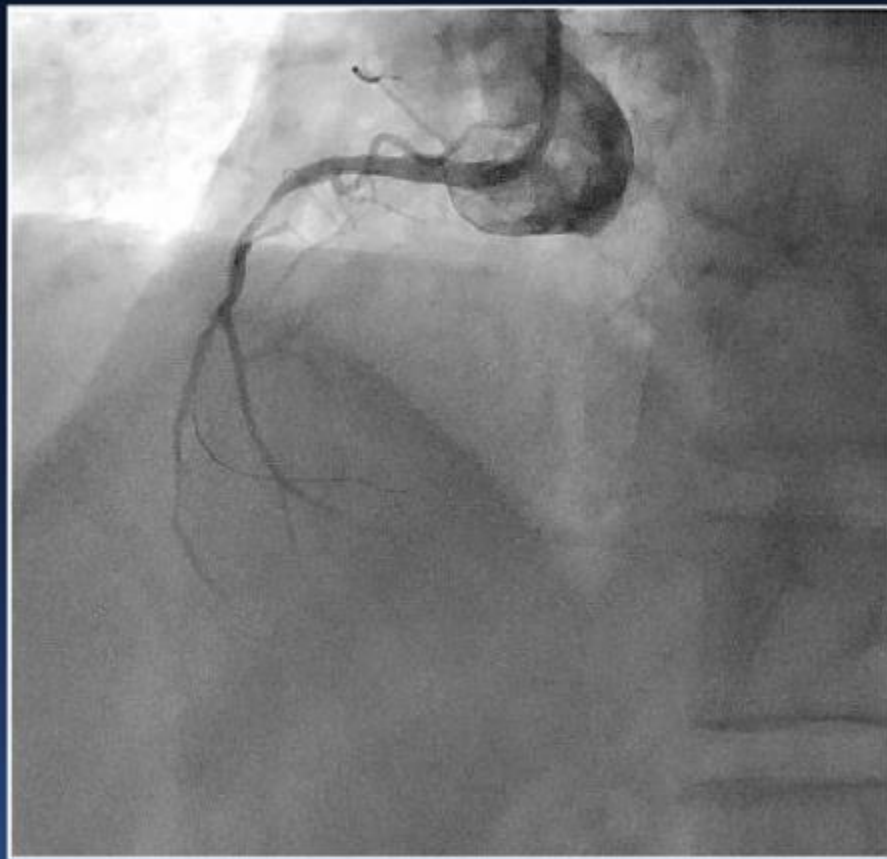
# Transradial Curves for Right Coronary – Judkins Right



Standard curve for right coronary artery (may be particularly useful for inferior takeoffs)

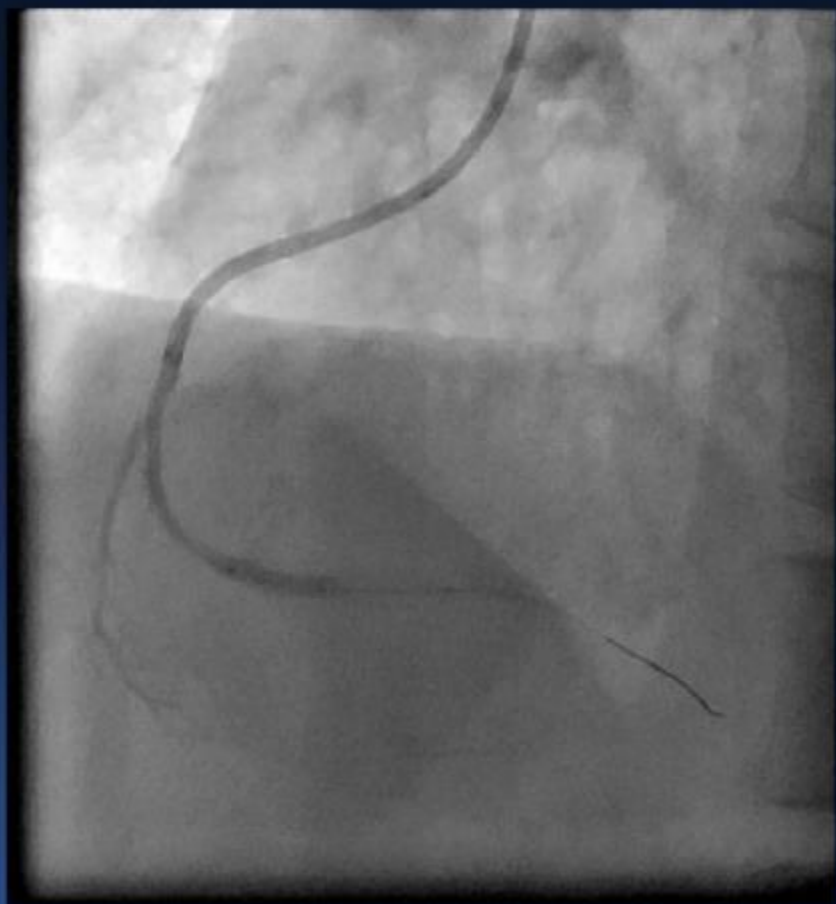
Sizing suggestions:  
Same as femoral approach

Comparable to:  
Cordis: Judkins Right  
BSC: Judkins Right



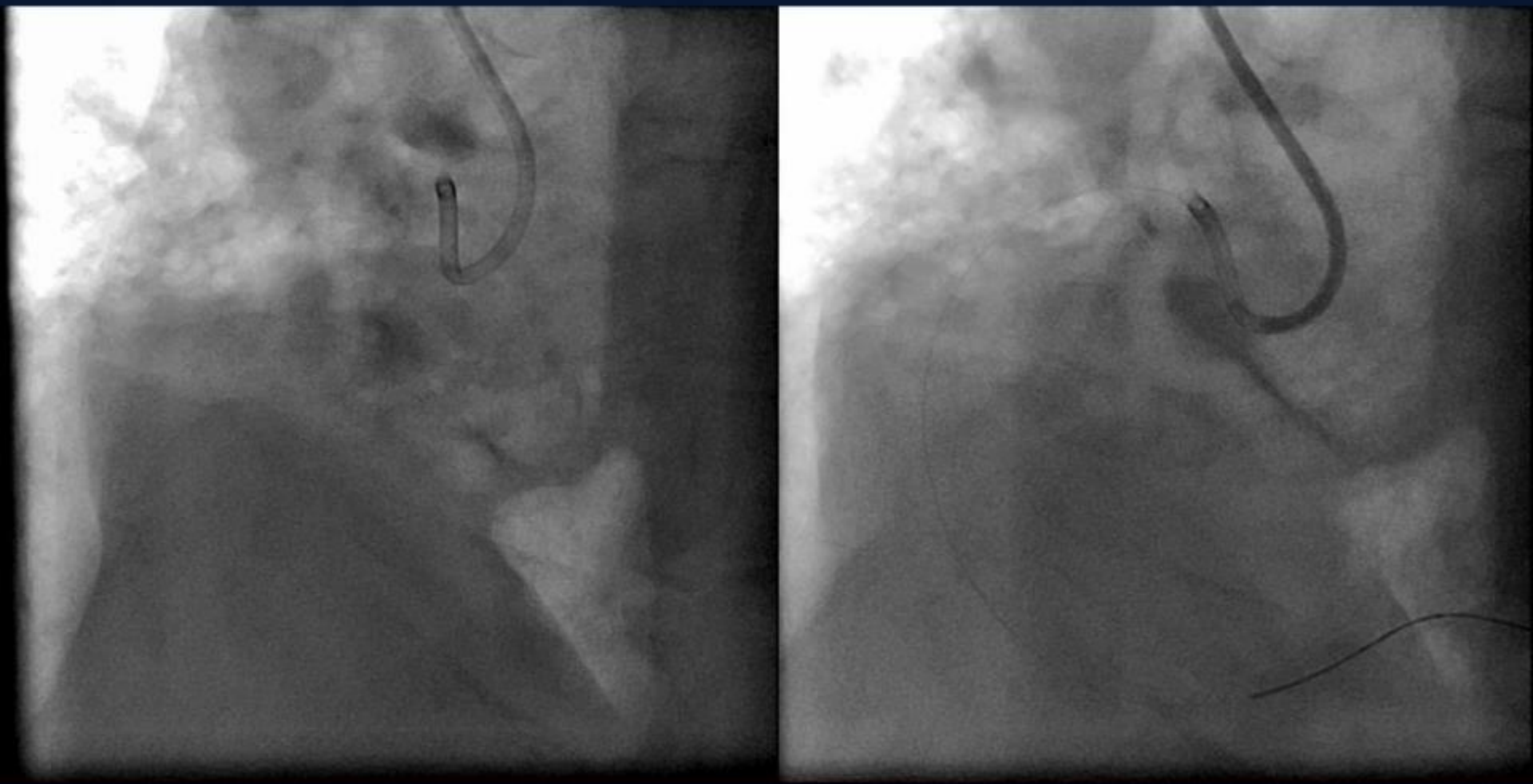
Judkins engagement technique, similar to femoral approach. Apply a clockwise rotation to engage right coronary artery

# Transradial Curves for Right Coronary – Judkins Right



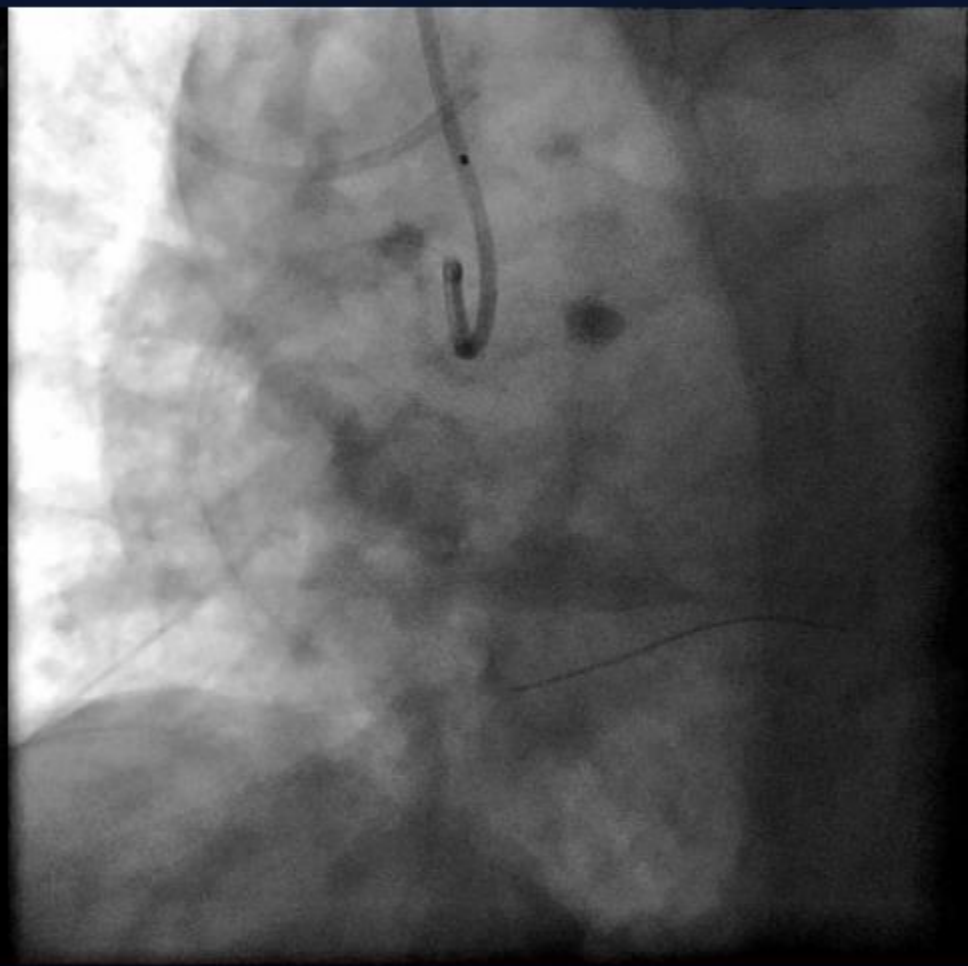
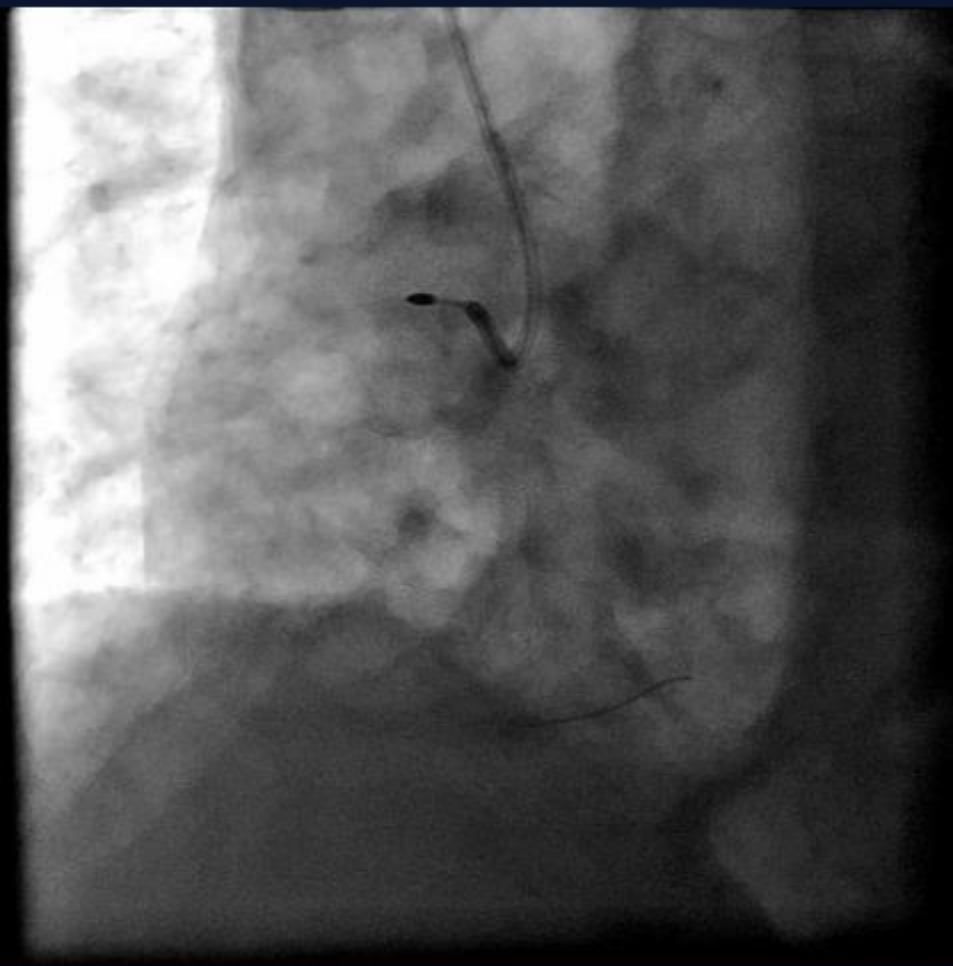
Deep intubation of RCA with JR4

# AMPLATZ for Complex PCI





# AMPLATZ for Complex PCI



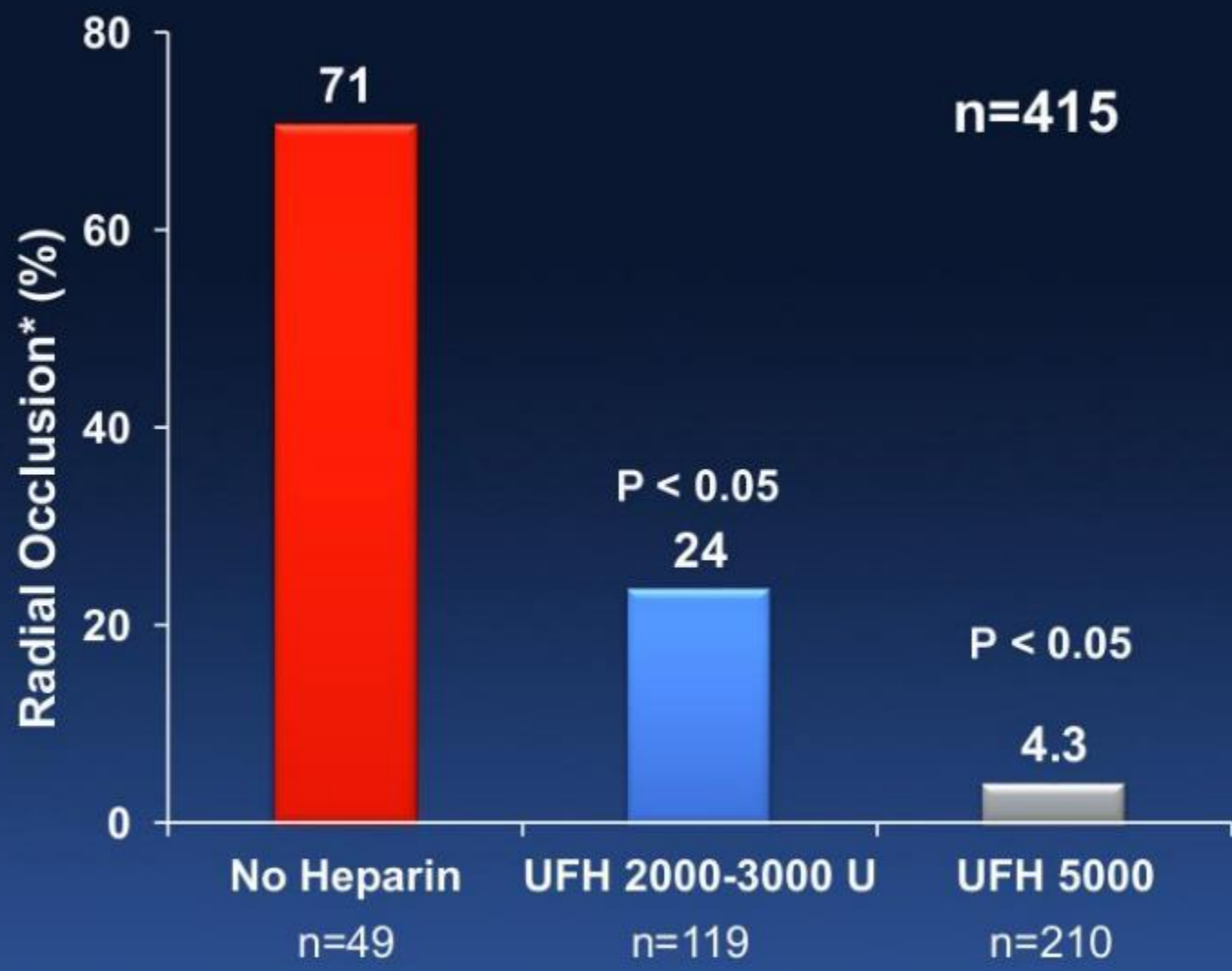
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4. Arterial puncture technique
5. Understanding and navigating the upper extremity vasculature
6. Coronary engagement – Catheter selection for diagnostic angiography and PCI
7. Hemostasis





# Anticoagulation and Radial Artery Patency



\*Assessed by Doppler examination

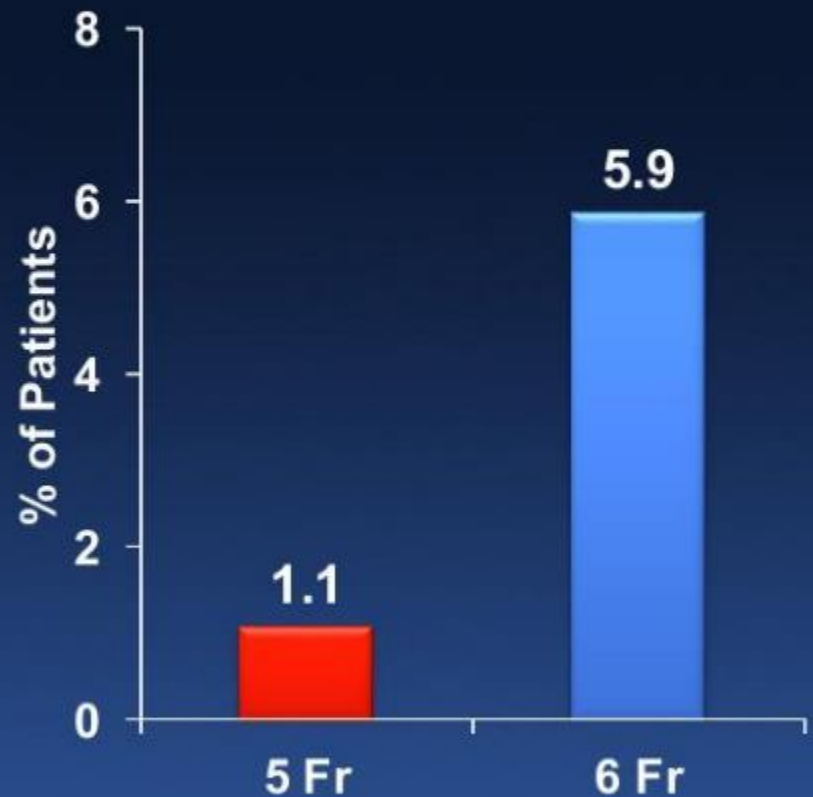


# Catheter Size and Radial Artery Occlusion

## Randomized Study

- **N=171**
- **Procedural Success:**
  - 95.4% of 5 Fr
  - 92.9% of 6 Fr

## Radial Artery Occlusion



# Reverse Allen's test to determine post-procedural radial patency



# Prevention of Radial Occlusion

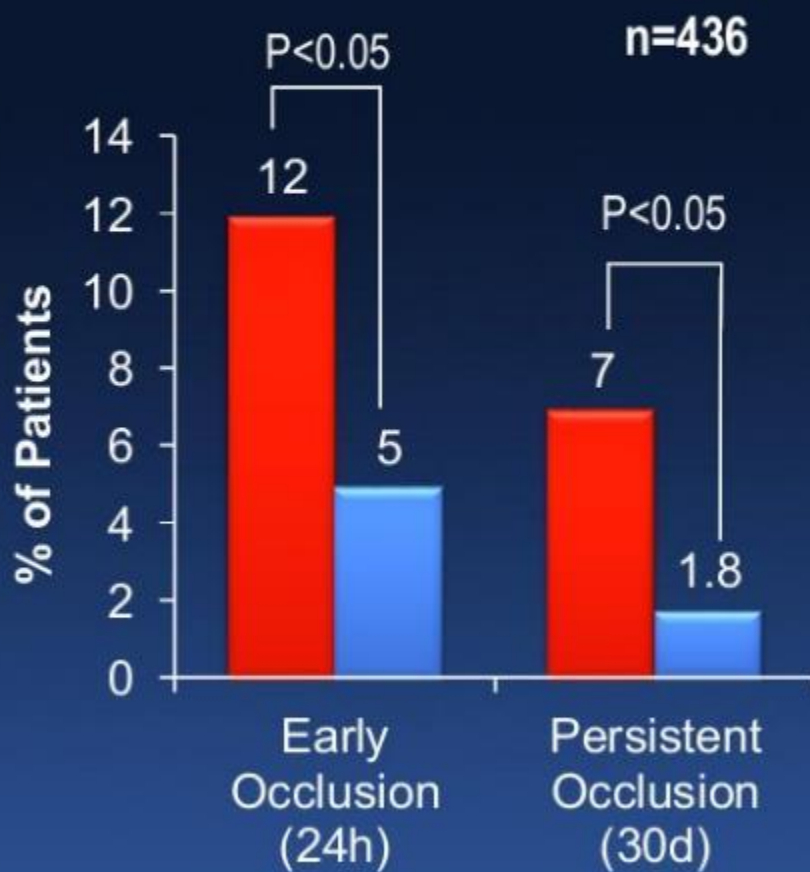
## Patent Hemostasis

### ■ Conventional Hemostasis

- Band left in place for 2 hours

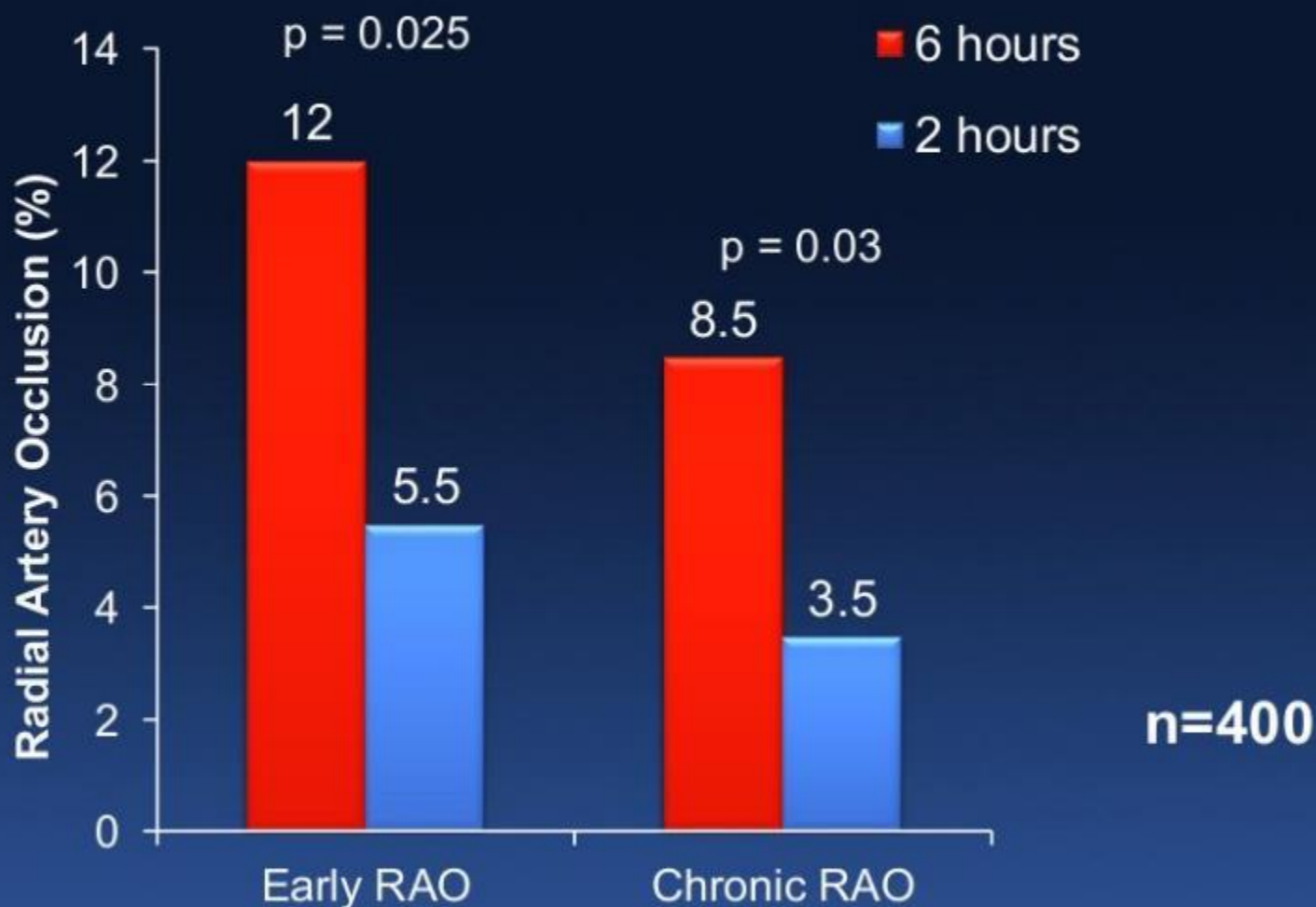
### ■ Patent Hemostasis

- Loosen the pressure on the radial artery while compressing the ulnar artery until return of plethymographic signal





# Compression time and RAO



# Hematoma or Swelling in Holding?



# Hematoma or Swelling in Holding? your best friends

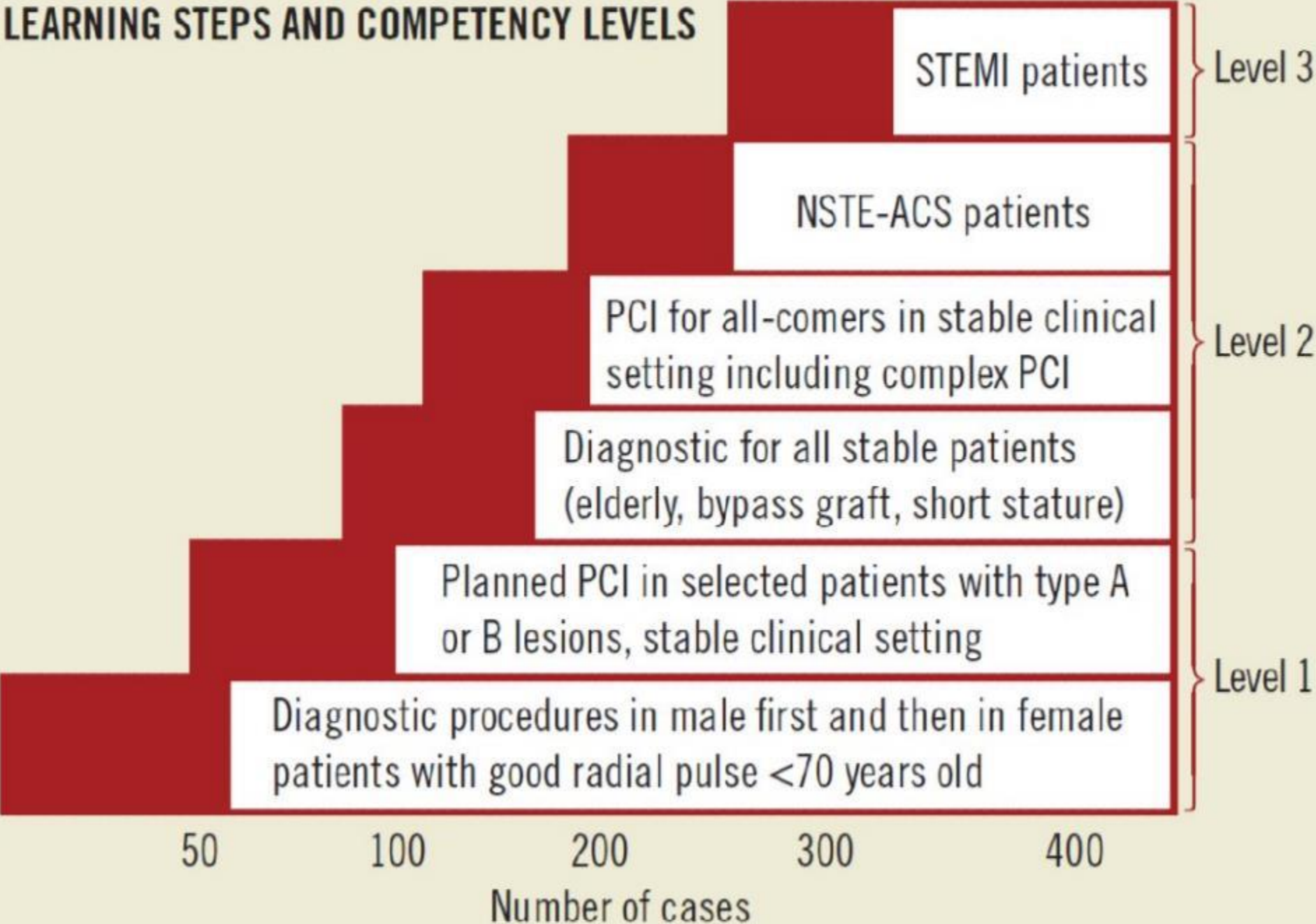


# Managing a Perforation

- **Early recognition**
- **Wrap potential bleeding site**
  - If seen on angiogram
  - If wire pushed too hard
- **Okay to wrap and finish case**
- **Forearm swelling not related to hemostasis device at any time, consider wrap with elastic bandage**



# LEARNING STEPS AND COMPETENCY LEVELS



**Transradial Arterial Access for Coronary and Peripheral Procedures:** Executive Summary by the Transradial Committee of the SCAI

- Level 1 competency
  - Simple diagnostic cases on patients with favorable upper limb anatomy (large men).
- Level 2 competency
  - Simple diagnostic and interventional procedures on patients with more challenging upper limb anatomy (elective single vessel PCI; bypass grafts, small women, radial and subclavian loops).
- Level 3 competency
  - Complex interventional procedures even with challenging limb anatomy (CTOs, multivessel, AMI).

# Implement a Radial Program

- **SAFETY – SAFETY – SAFETY!!**
- **Learning curve of 50-100 cases**
- **Radial angiography requires awareness of anatomical variations and specific catheter manipulation**
- **Retrograde limited radial angiography helps in planning a strategy to save time and avoid vascular complications**
- **Consider left radial access as a first step for inexperienced operators during their learning curve**
- **Commit to radials – Create a policy and involve the staff**
- **Develop a same-day discharge PCI program**
- **Hospital administration delighted with cost-savings**

# References

**Transradial Access and Intervention:  
A Step-by-Step Approach**

**Mauricio G. Cohen, MD Associate  
Professor of Medicine Director, Cardiac  
Cath Lab**

***21 fellow course 2015***



An aerial photograph of a university campus. The scene is dominated by lush greenery, including numerous tall palm trees and various shrubs. A paved road curves through the landscape, with a red car visible on the left. In the center, there is a large, circular green lawn area. A prominent feature is a large, triangular stone monument or structure. A string of flags, including the national flag of the United Arab Emirates, is strung across the middle of the image. The overall atmosphere is bright and sunny.

# THANK YOU

مركز تقنية الاتصالات والمعلومات - جامعة المنصورة