CTO PCI in 2015: How to Achieve Success Rates of 95% with new Technologies and Aggressive Techniques

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Disclosures

- As a faculty member for this program, I disclose the following relationships with industry:

- Speakers Bureau for Abbott Vascular, MDT vascular and Boston Scientific

Current Perspectives on Coronary Chronic Total Occlusions

The Canadian Multicenter Chronic Total Occlusions Registry

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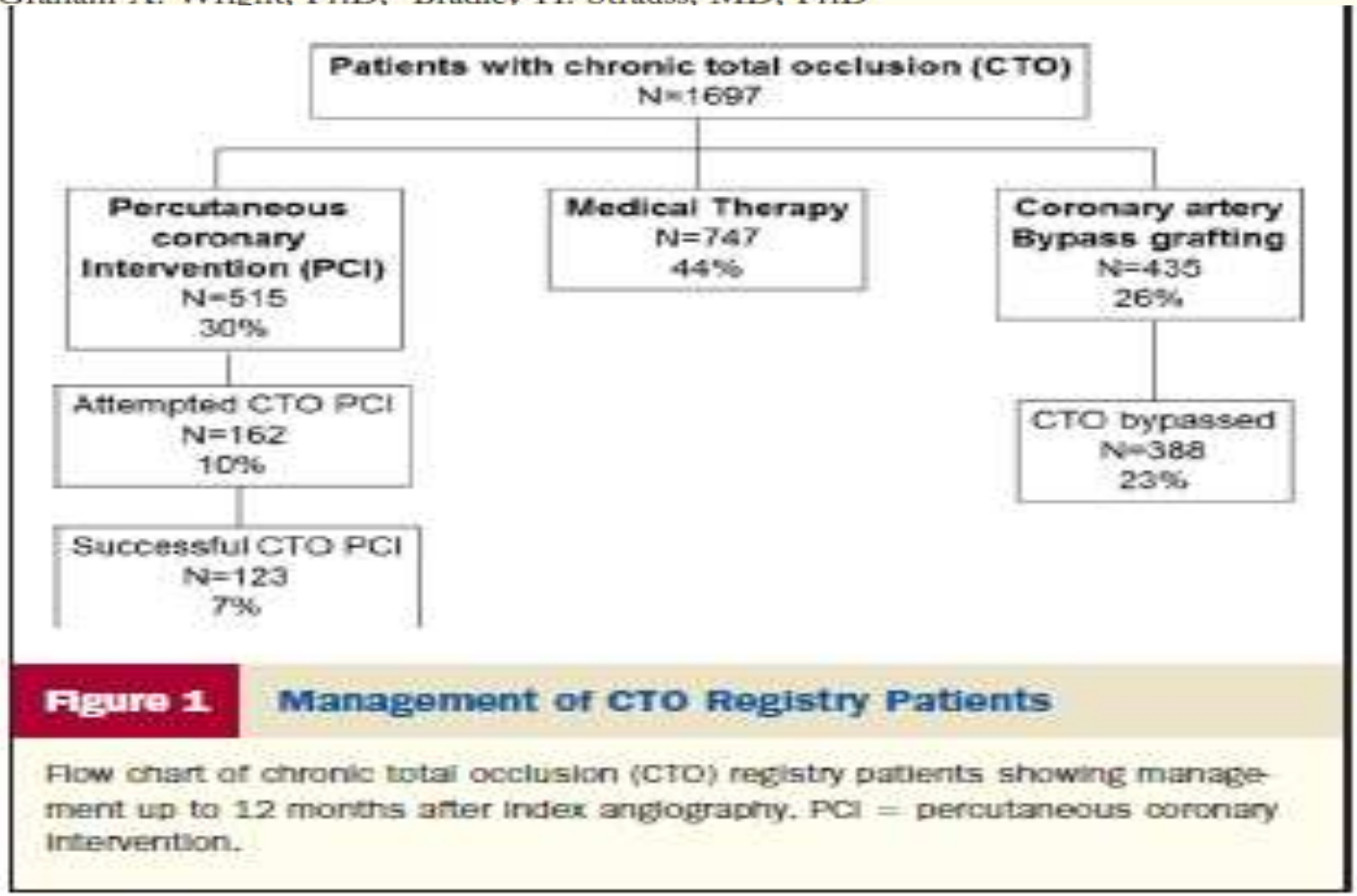


Figure 1 **Management of CTO Registry Patients**

Flow chart of chronic total occlusion (CTO) registry patients showing management up to 12 months after index angiography. PCI = percutaneous coronary intervention.

Conclusions Chronic total occlusions are common in contemporary catheterization laboratory practice. Prospective studies are needed to ascertain the benefits of treatment strategies of these complex patients. (J Am Coll Cardiol 2012;59:991–7) © 2012 by the American College of Cardiology Foundation

False Assumptions about Coronary Chronic Total Occlusions (1)

- The CTO is well collateralized and therefore there is minimal impact on quality of life and prognosis
- CTO is a closed vessel and therefore not at risk for/or during ACS/AMI
- CTO outcomes are more benign than non CTO coronary disease

False Assumptions about Coronary Chronic Total Occlusions (2)

- CTO PCI is associated with unacceptably high complication rate
- CTO PCI is too complex and cannot be performed in the current U.S medical environment
- CTO PCI is for Japanese Masters only and cannot be taught to a more broad population of Interventionalists
- CTO PCI is an economic disincentive for hospitals because of increased cost

Contemporary CTO Revascularization Achievement of Procedural Success Through Advanced Technique

145 Patients, 160 CTO Lesions
Piedmont Hospital, 10/2009-12/2010

- Indications
  - Angina, 60%
  - Heart failure/arrhythmia, 18%
  - Provocative ischemia on non-invasive testing, 13%
- Procedural Characteristics
  - Right coronary artery, 54%
  - In-stent occlusion, 10%
  - Retrograde wire placement, 38%
  - Average stent length, 64.7±30.7 mm
- Procedural and In-Hospital Outcomes
  - Procedural success, 85.6%
  - Death, 0.6%
  - Emergency bypass surgery, 0.6%
  - Myocardial infarction, 1.9%, Tamponade 0.6%

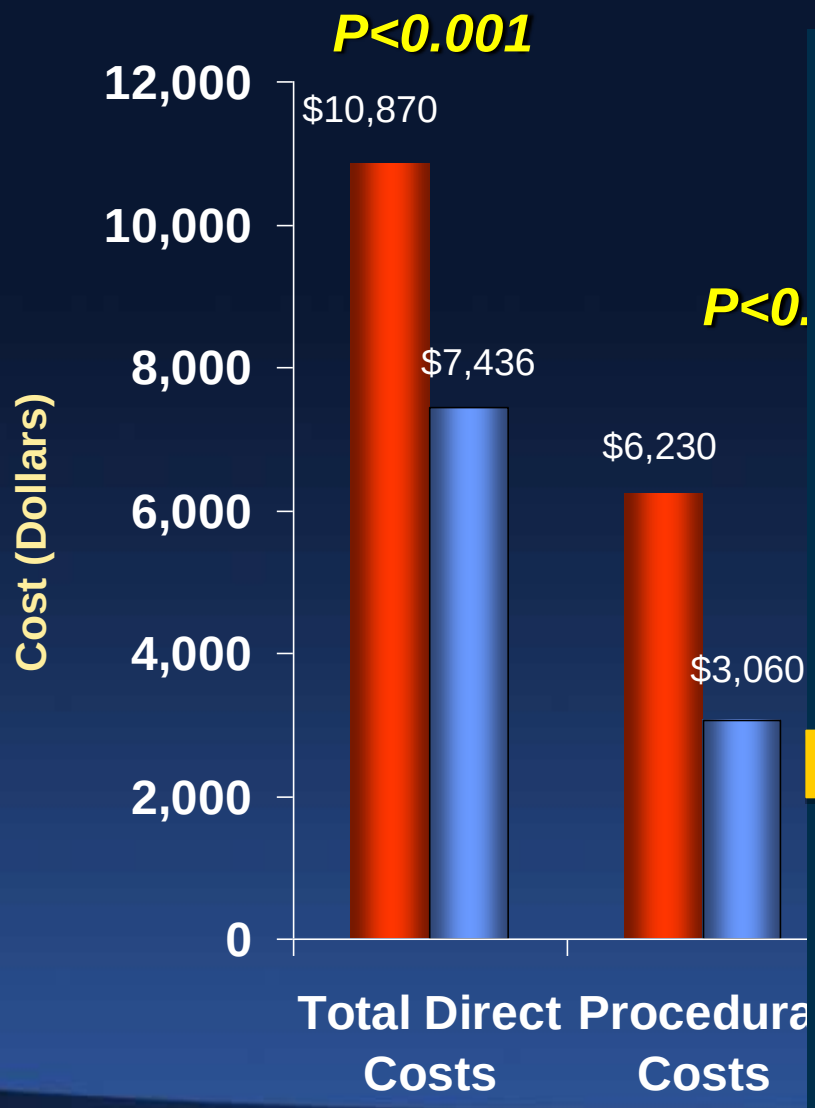
CTO Revascularization: Economic Outcomes

O, N=154

n-CTO, N=1,847

Karm

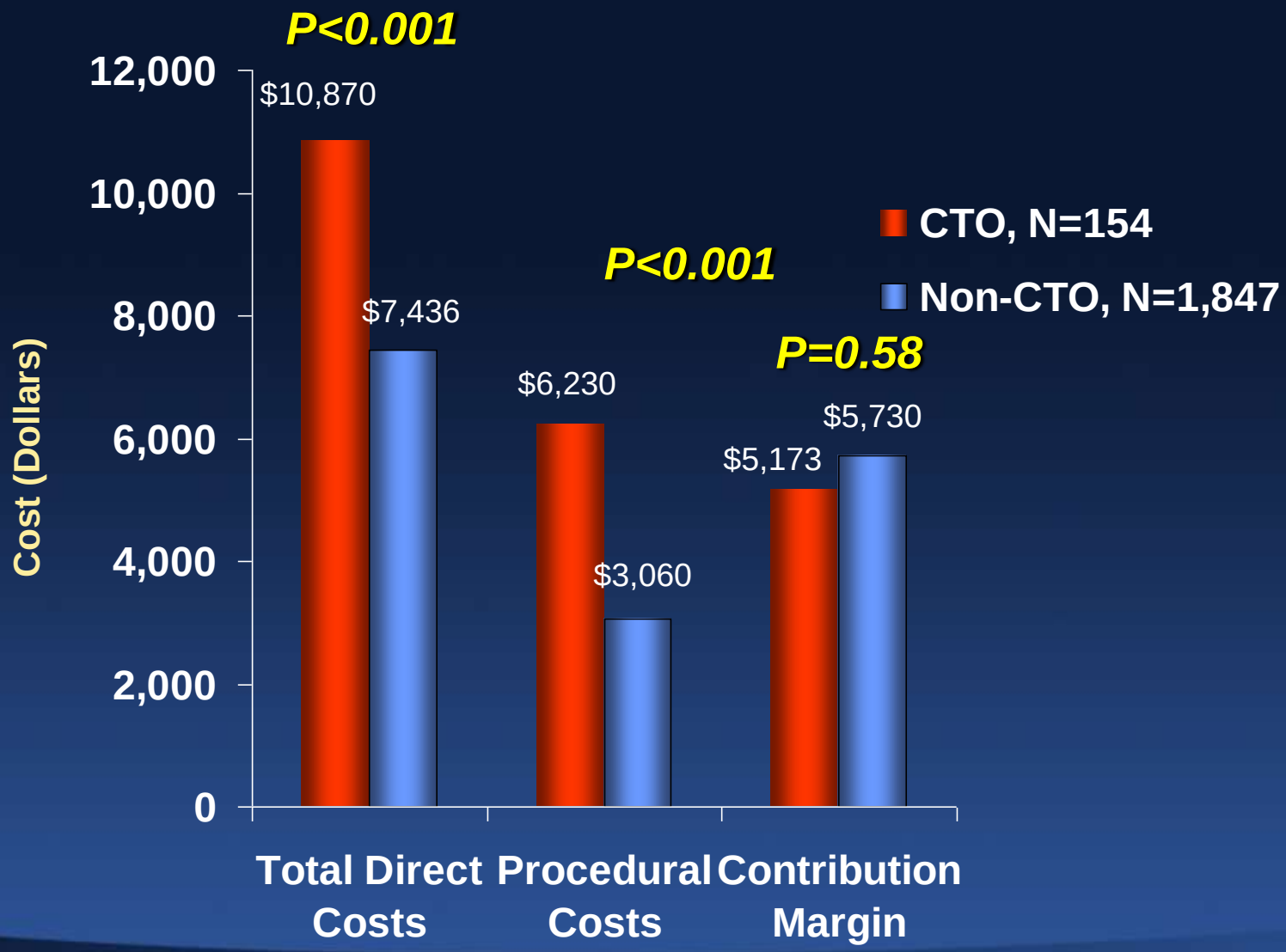
CTO Revascularization: Economic Outcomes



- Balloon angioplasty catheters
  - $600 vs $304
- Guidewires
  - $715 vs $174
- Stents
  - $3,590 vs $2,036

Karmpaliotis et al. CCI 2

CTO Revascularization: Economic Outcomes



Karmpaliotis et al. CCI 2012 *In press*

Summary of Large Contemporary Registry Publications of Percutaneous Coronary Interventions of Chronic Total Occlusions

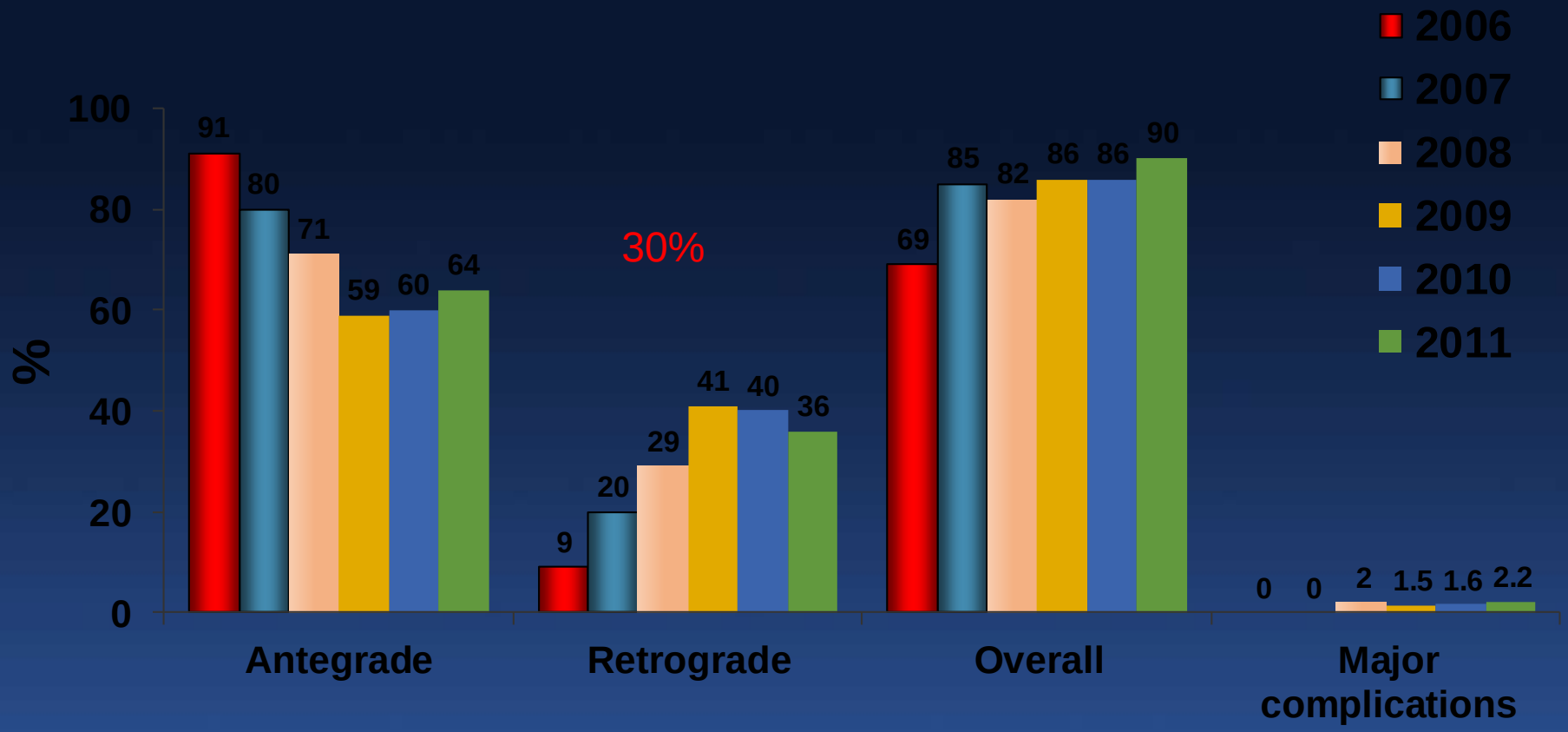
Author	Year	N (CTO lesions)	Prior CABG	Diabetes	Retrograde	Technical Success	Major complications	Death	Tamponade	Fluoroscopy time (minutes)	Contrast use, (ml)
Rathore	2009	904	12.6	40.0	17	87.5	1.9	0.6	0.6	NR	NR
Morino	2010	528	9.6	43.3	26	86.6	NR	0.4	0.4	45 (1-301)*	293 (53-1,097)*
Galassi	2011	1983	14.6	28.8	14	82.9	1.8	0.3	0.5	42.3±47.4	313 ±184
U.S Registry*	2013	1361	37.0	40.0	34	85.5	1.8	0.22	0.6	42±29	294 ±158

* Median (range)

* Tesfaldet, Karmpaliotis, Brilakis, Lembo, Lombardi, Kandzari. *Am J Cardiol* 2013

CTO PCI: success and complications

N=1,363
3 US sites

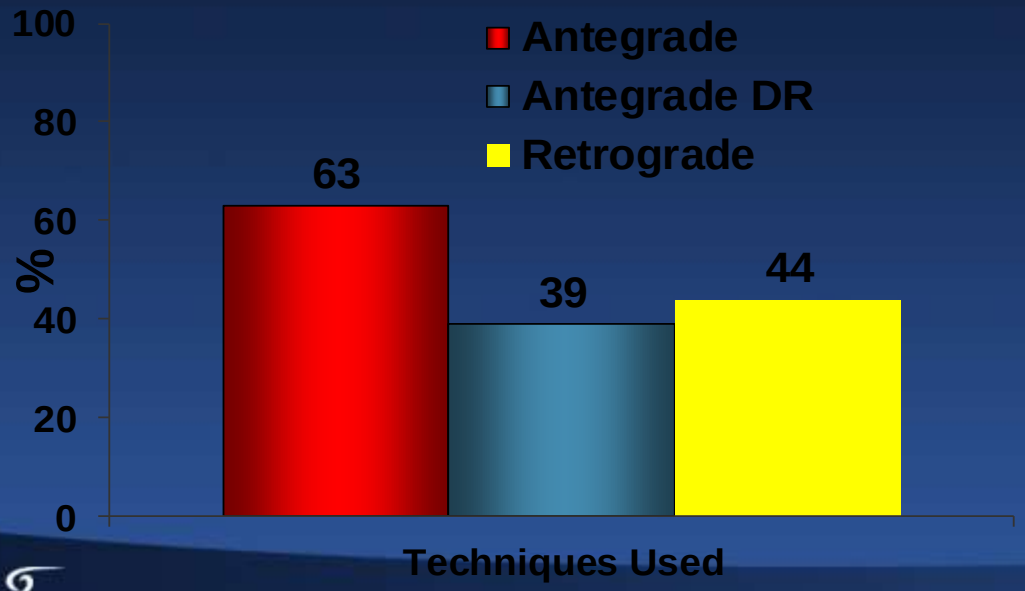


Michael, Karmpaliotis, Brilakis, Lombardi, Kandzari et al. Am J Cardiol 2013;112:488-492

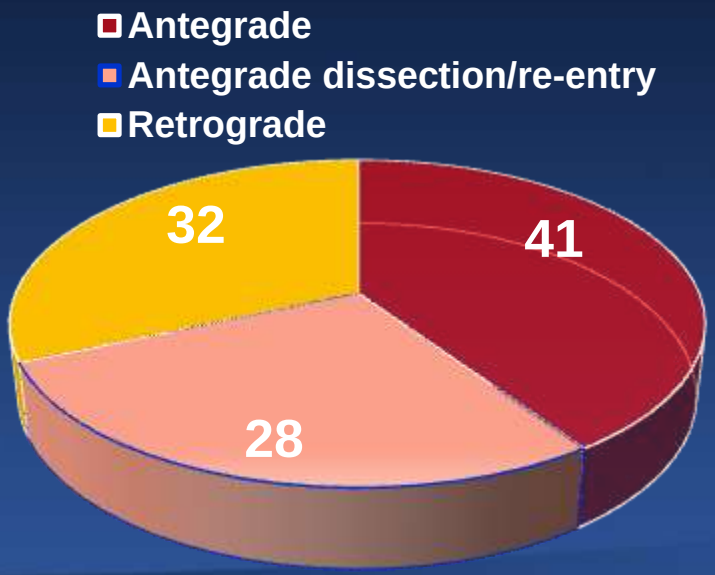
Multicenter CTO registry

- Appleton Cardiology, WI
- Dallas VAMC/UTSW
- Peaceheath Bellingham, WA
- Piedmont Heart Institute, GA
- St Luke's Mid America Heart Institute, MO

1/2012 to 8/2013
n=489
Technical success: 91.6%
Major complications: 1.6%

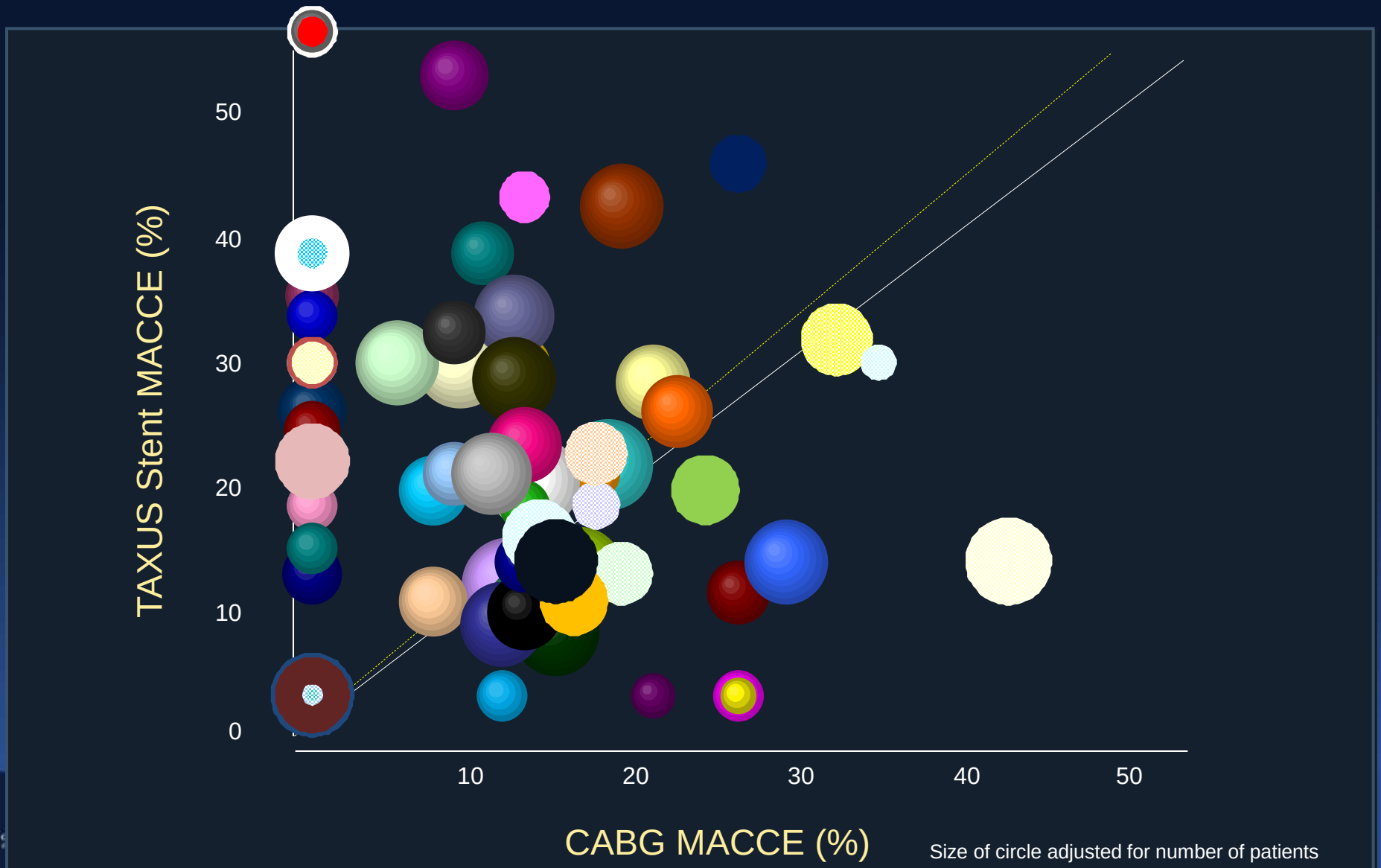


Successful technique

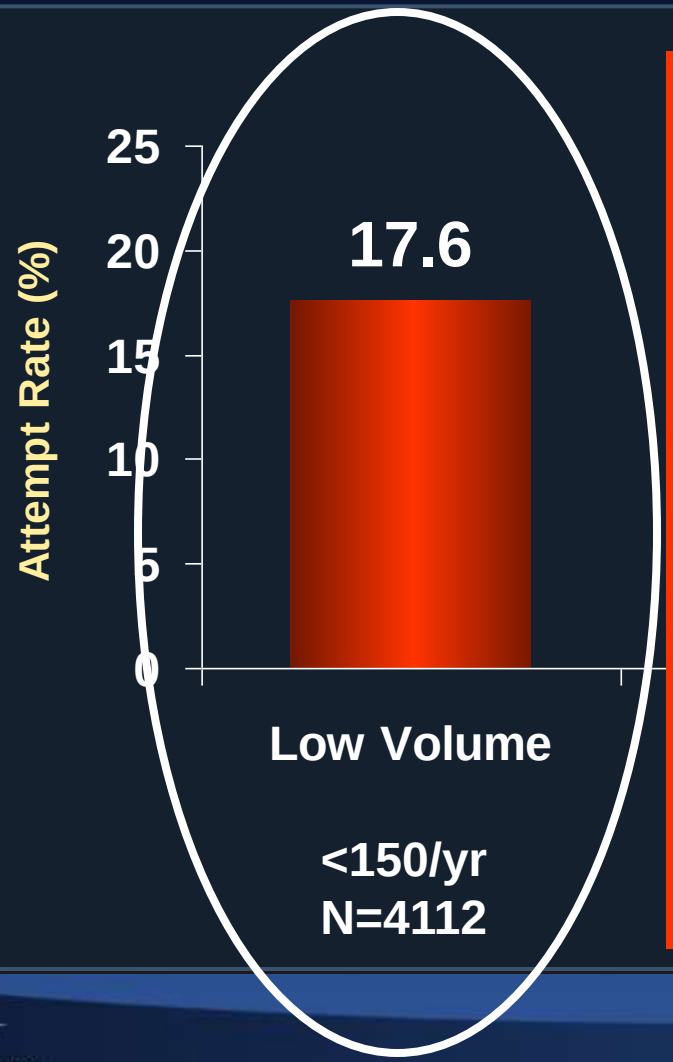


Menon, Karmpaliotis, Alaswad, Lombardi, Grantham, Thompson, Brilakis et al, JIC 2014

SYNTAX: One-year MACCE rates per site
CABG vs. TAXUS Express Stent:



Who Is Performing my CTO PCI?
ACC/NCDR Database: 45,826 CTO Patients



89% of CTO PCI is done by Low Volume Operators!!!

Grantham et al, I2 Summit 2007

There is PCI and there is CTO PCI

CTO PCI Vocabulary

Antegrade

Retrograde

Hybrid

Wire Escalation

Dissection Re-Entry

CART

Reverse CART/Confluent Balloons

Dancing

Surfing/Tip Injection

Trap/Retrograde Trap

Anchor

Western Prep

Power Knuckle/Knuckle Management

Knuckle Re-Direct/Pilot Re-Direct

Swiss Cheese

There is PCI and there is CTO PCI

Base of Operations

STAR/Mini STAR

LAST

Guideliner Assisted Reverse CART/Contemproary R-CART/Laser Assisted R-CART/Stent Assisted R-CART

Stick and Swap

Scratch and Go

Bob Sled

Straw/Modified Straw

Tip In

Carlino/Retrograde Carlino

Cloud

Rendez Vous

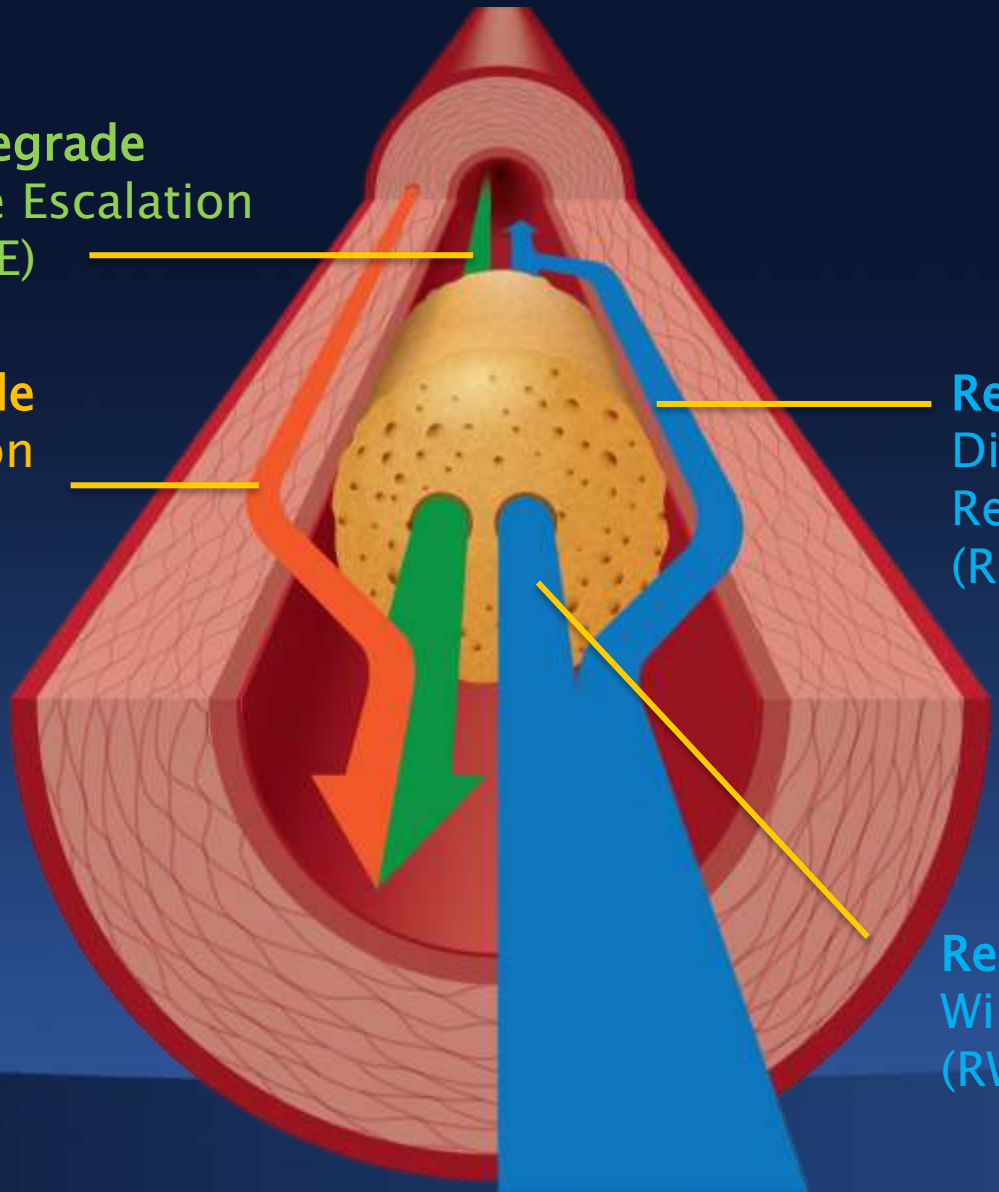
Grenedoplasty/BAM

VDAR

SKRAT

Landing Zone/Management of the Landing Zone

4 options to crossing CTOs



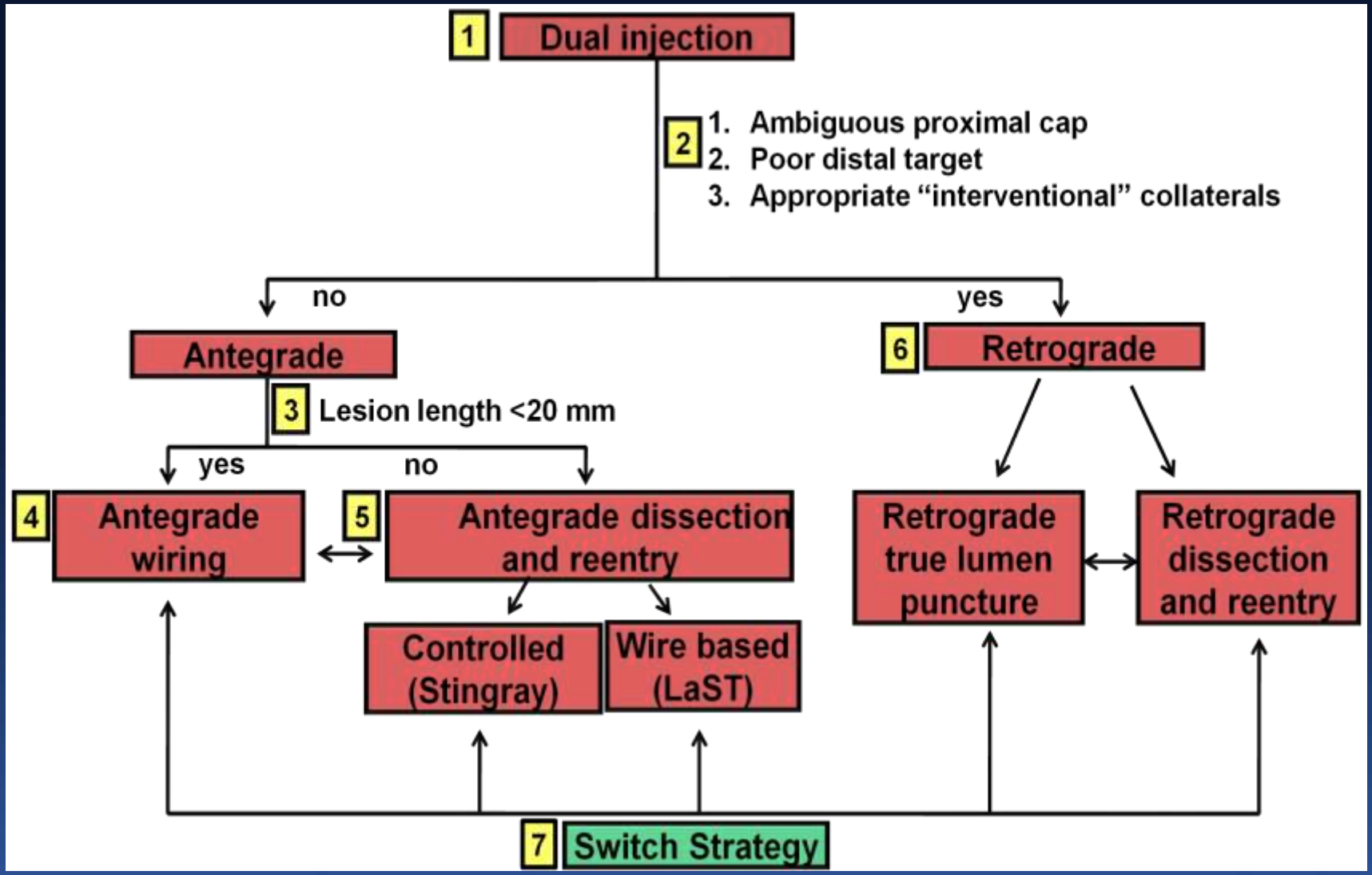
Antegrade
Wire Escalation
(AWE)

Antegrade
Dissection
Re-entry
(ADR)

Retrograde
Dissection
Re-entry
(RDR)

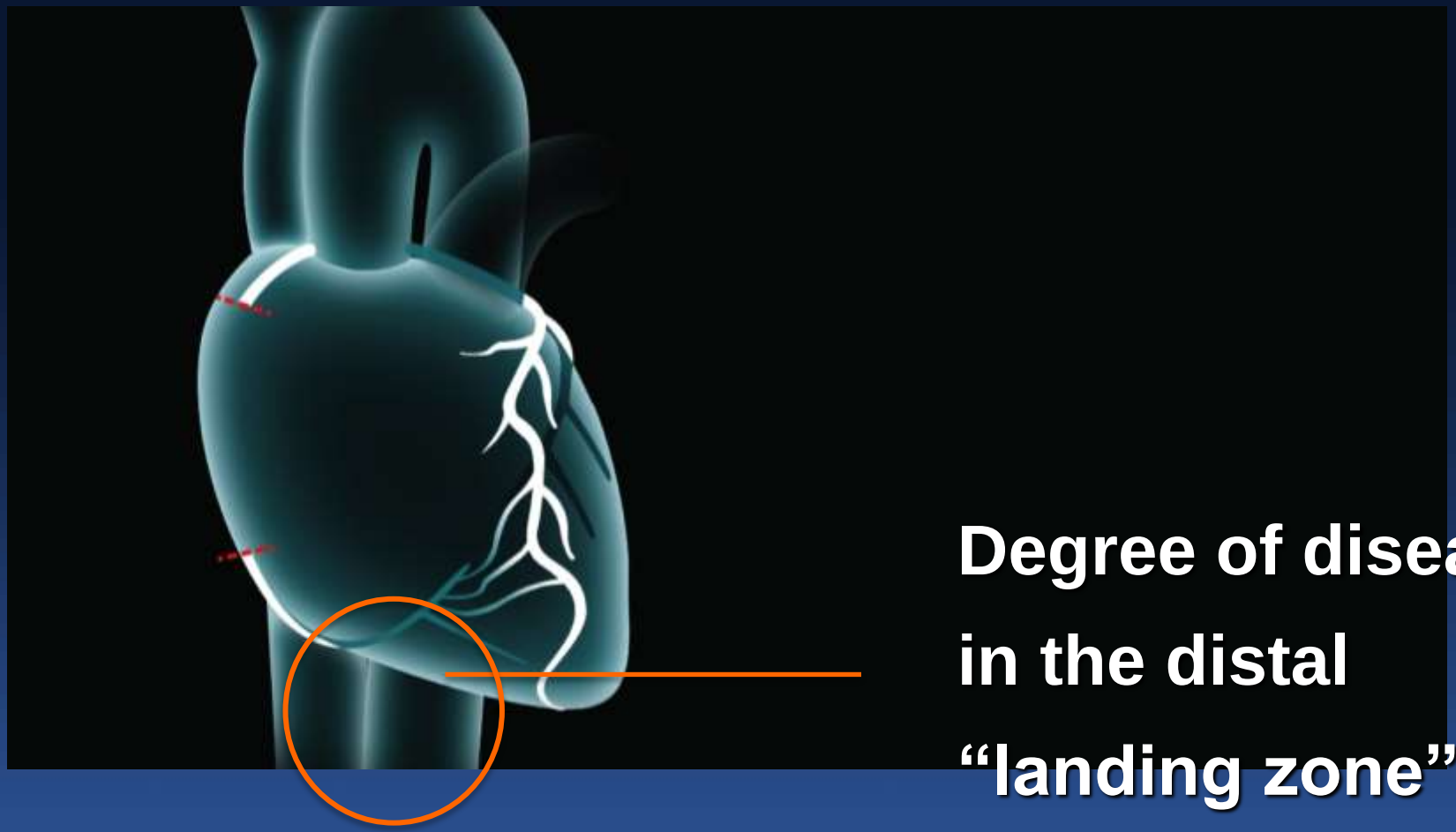
Retrograde
Wire Escalation
(RWE)

Hybrid Strategy Treatment Algorithm



Brilakis et al.

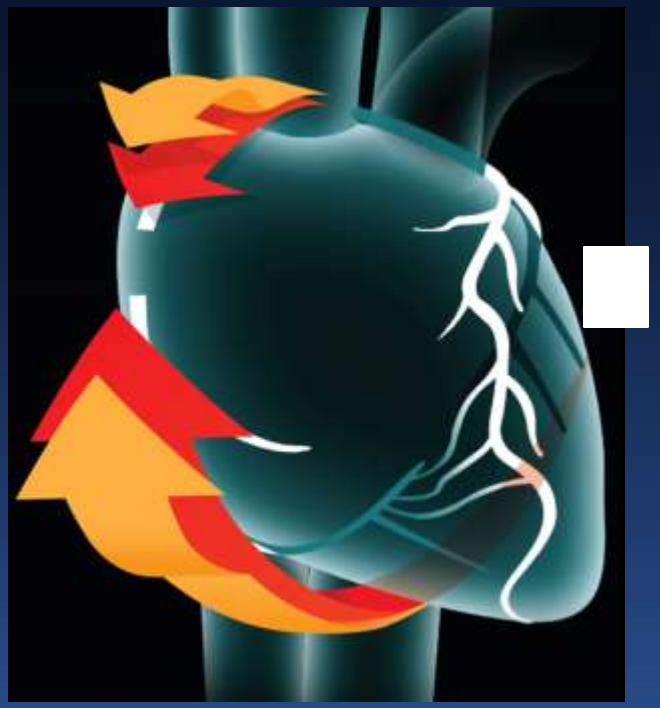
JACC: CARDIOVASCULAR INTERVENTIONS, VOL. 5, NO. 4, 2012
APRIL 2012:389–92



Degree of disease in the distal “landing zone”

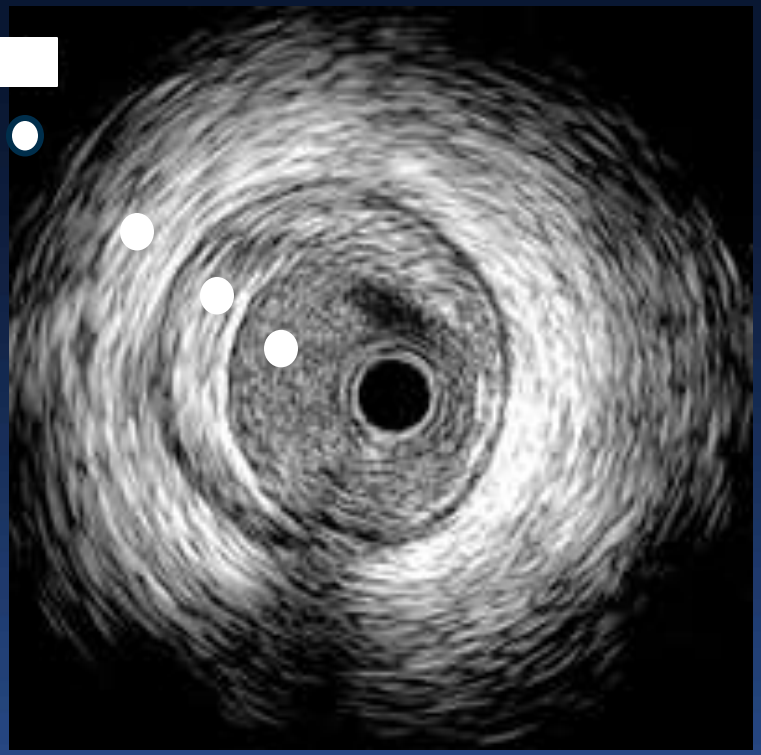
Base of Operation

- Term describing the location in the vessel at which the operator is trying to employ techniques to cross the CTO or utilize re-entry strategies to enter the true lumen



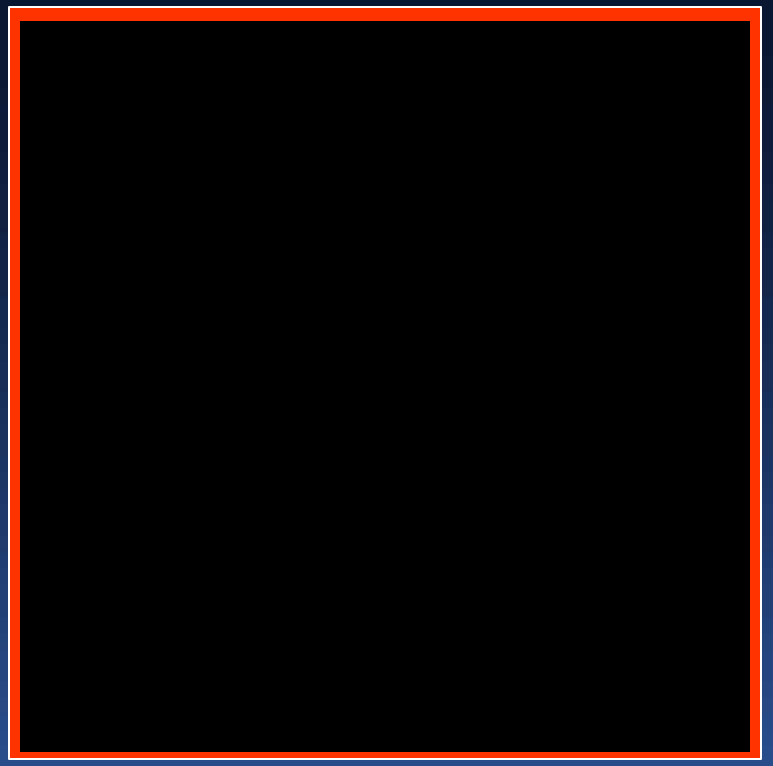
Vessel Architecture

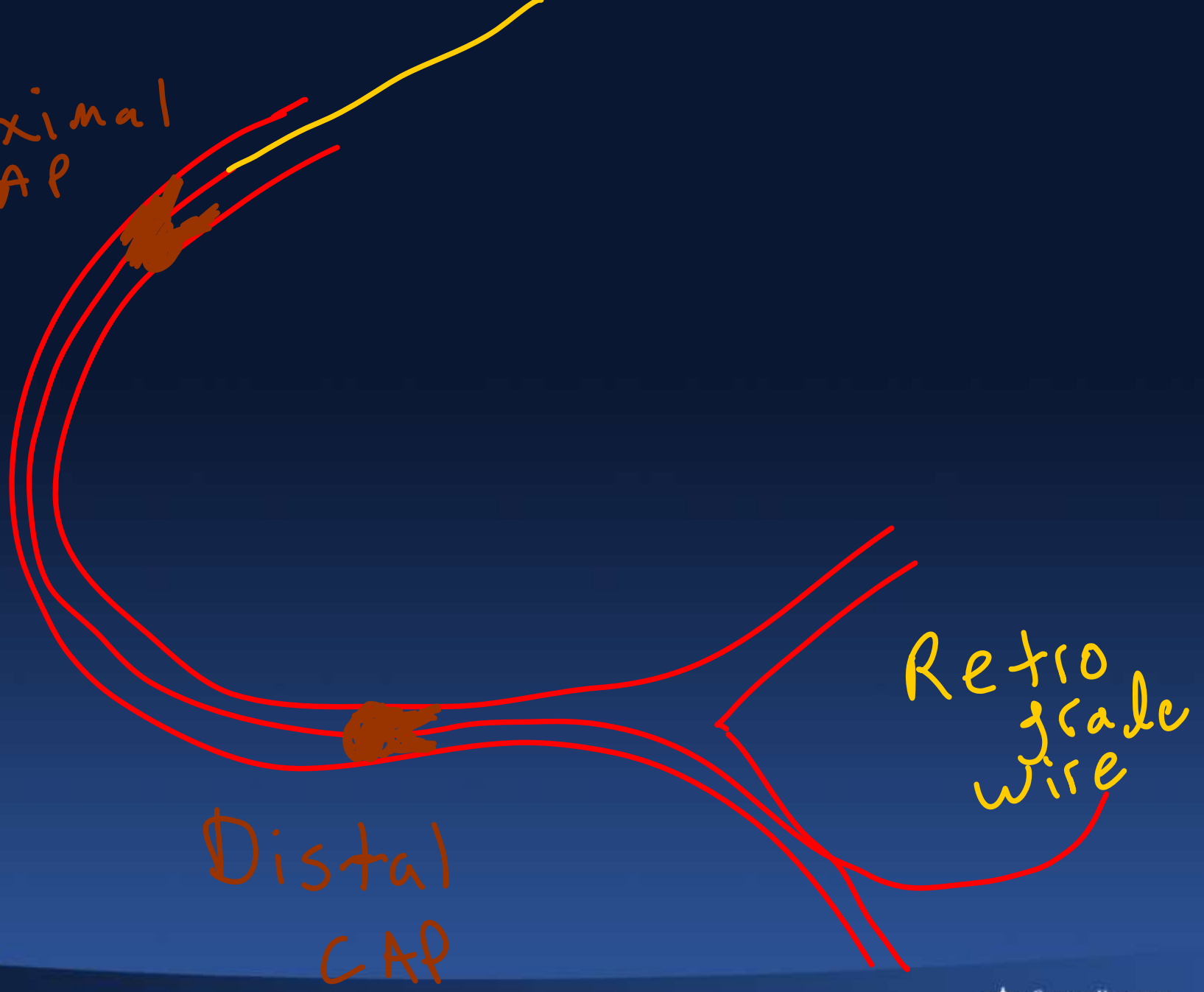
- Term used in reference to the location of a guidewire in an effort to distinguish its binary location of either outside of the vessel (i.e. in the pericardial space) or anywhere within the three layers of the target vessel

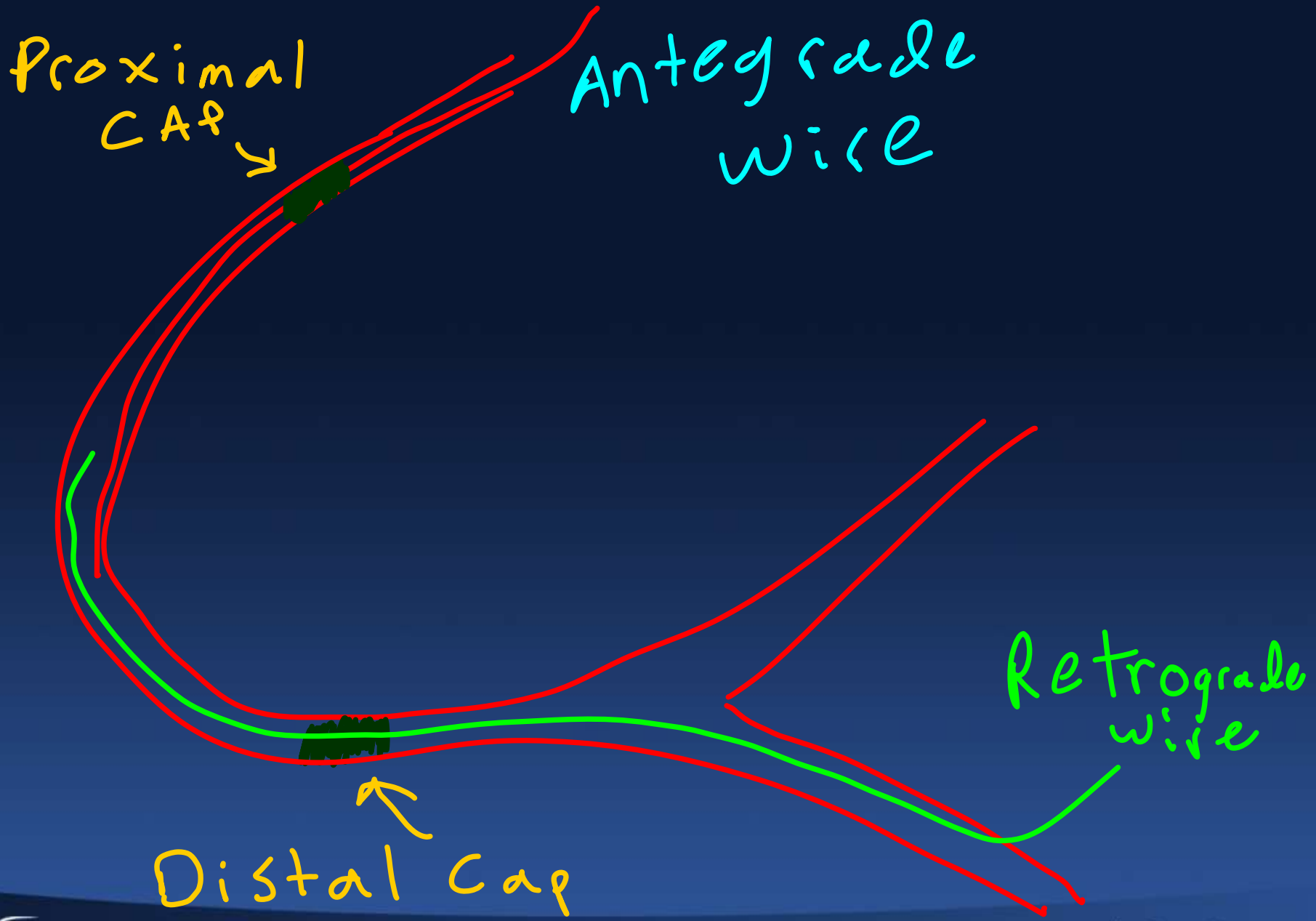


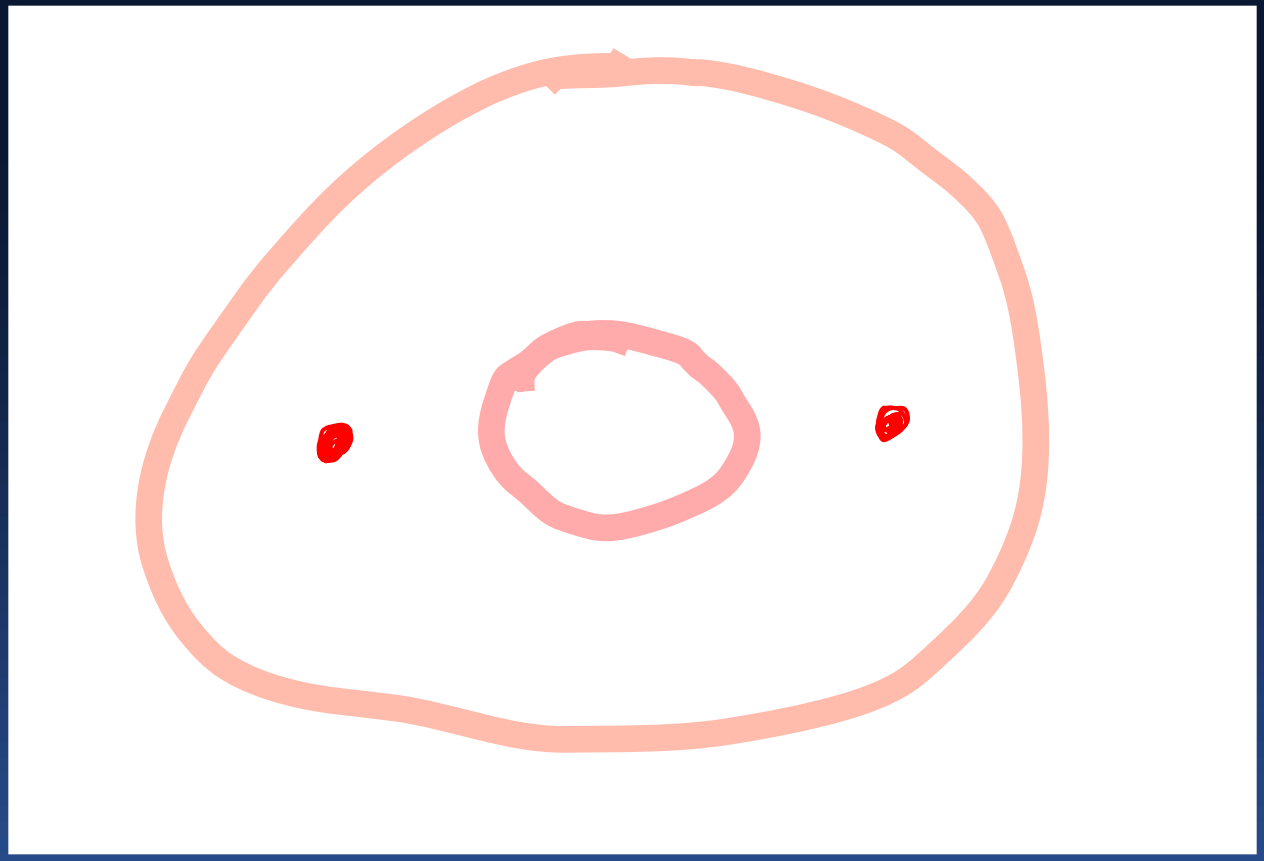
Knuckle Wire

- Creating a blunt dissection tool by forward advancing a polymer-jacketed guidewire (Fielder XT or Pilot 200) until it prolapses on itself to form a tight loop which can be advanced past the occlusion in the suboptimal space



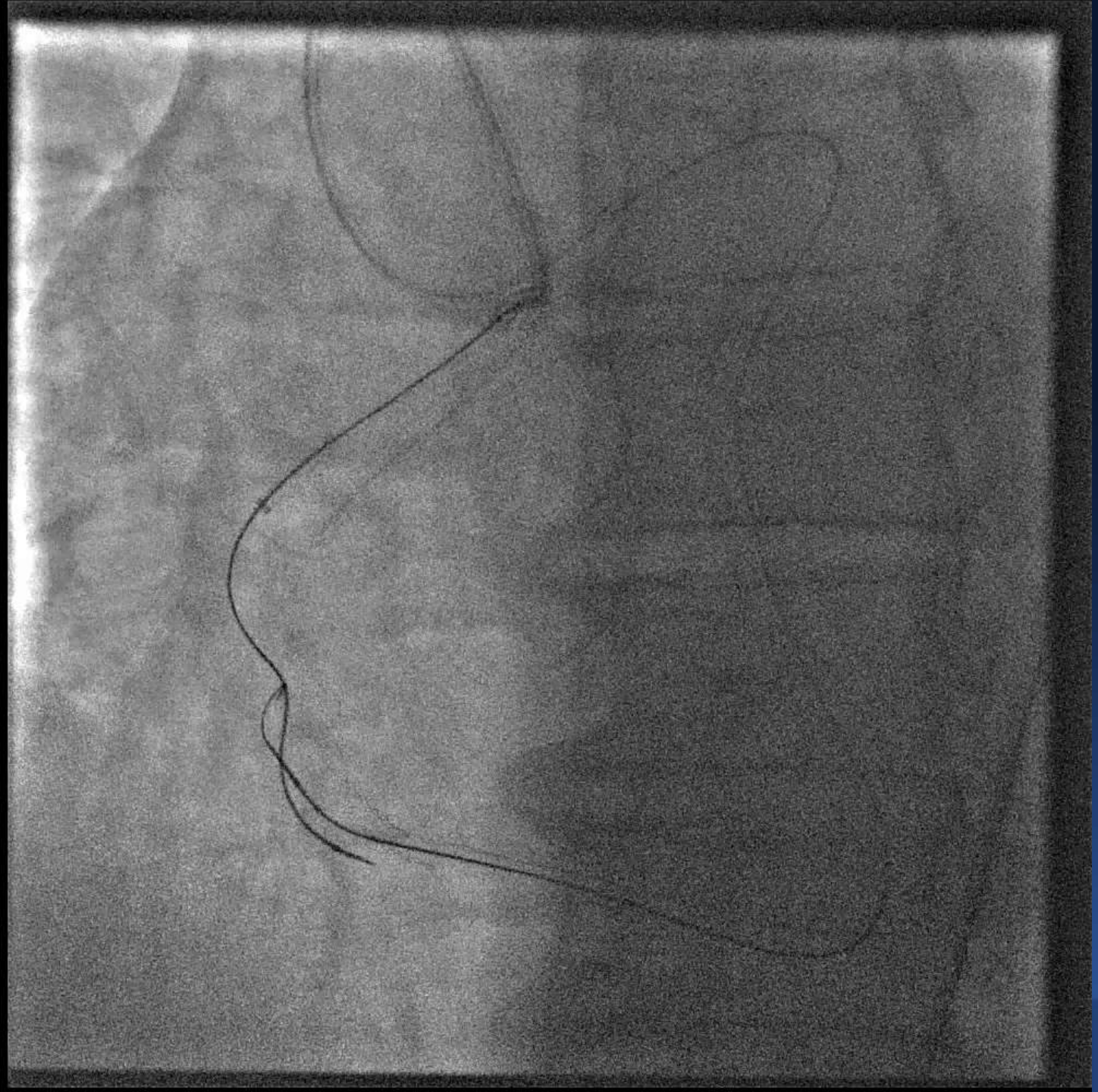






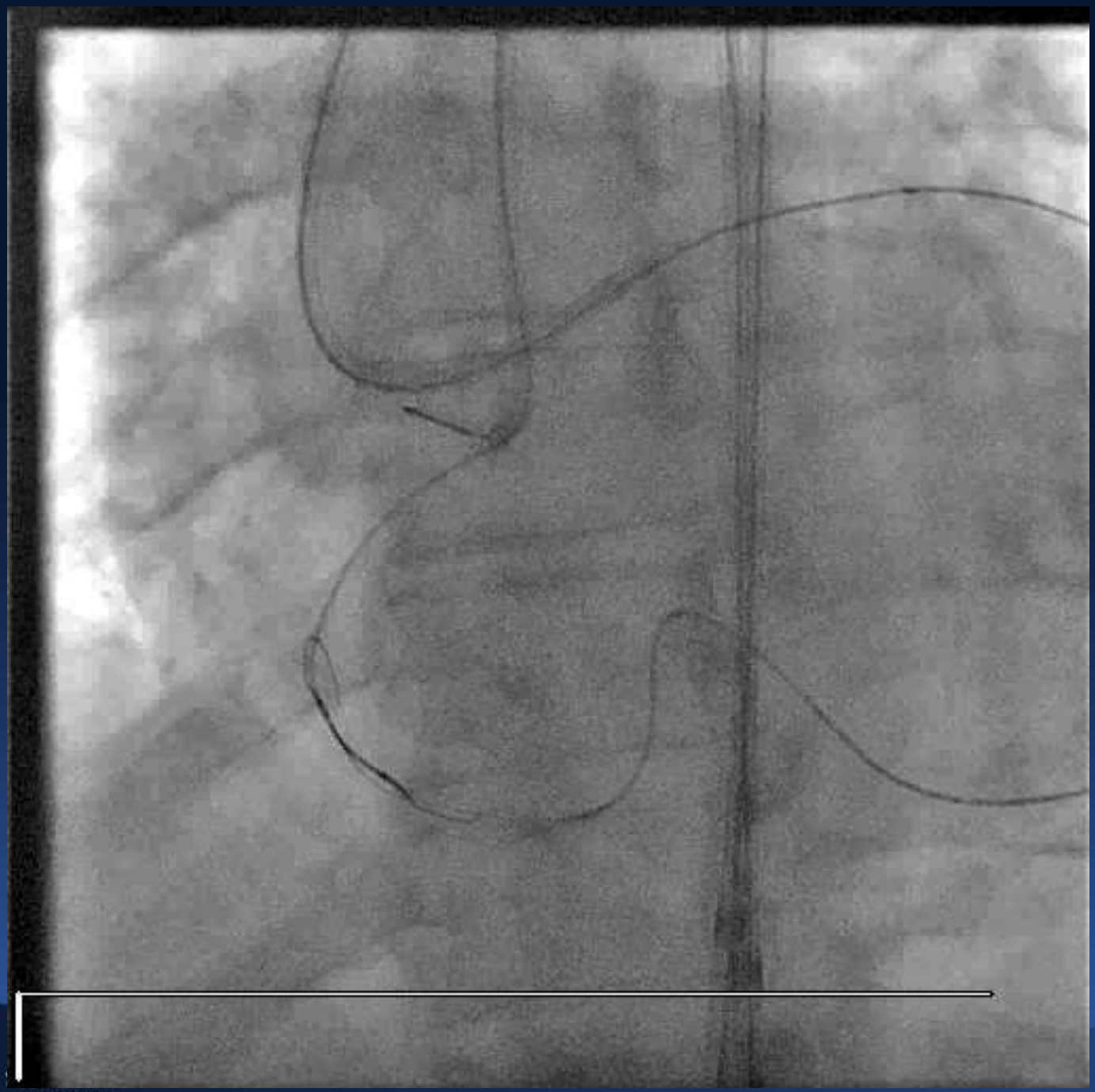
Unable to obtain R radial access

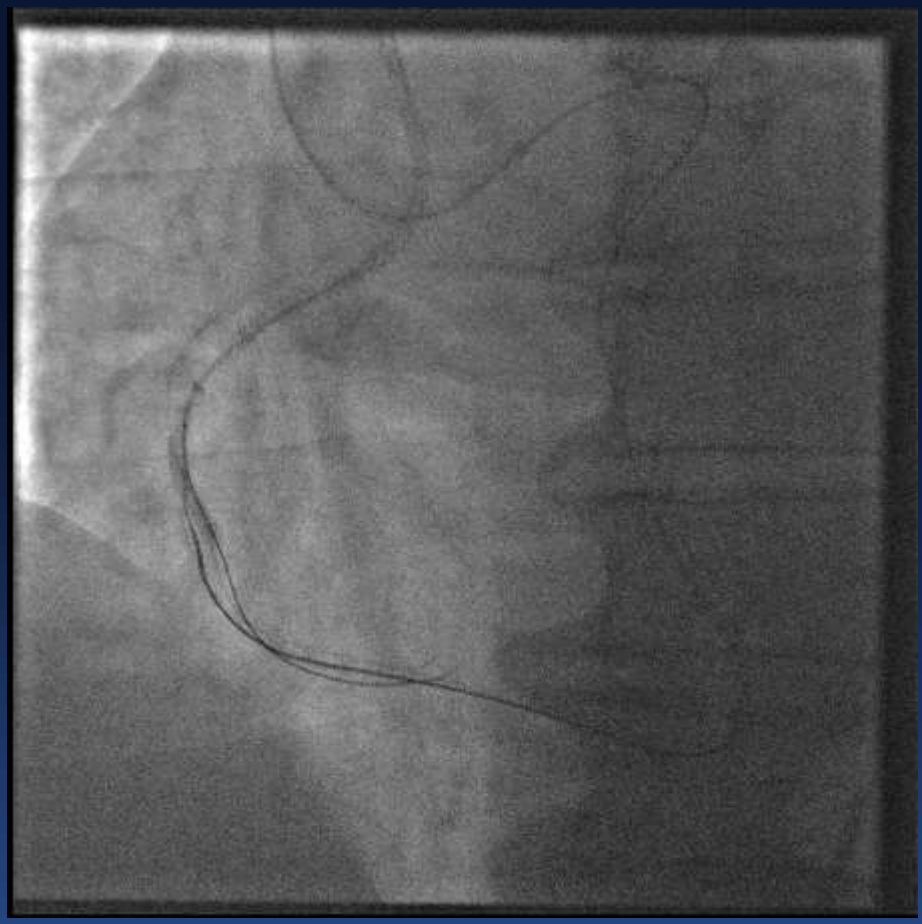
L radial access obtained

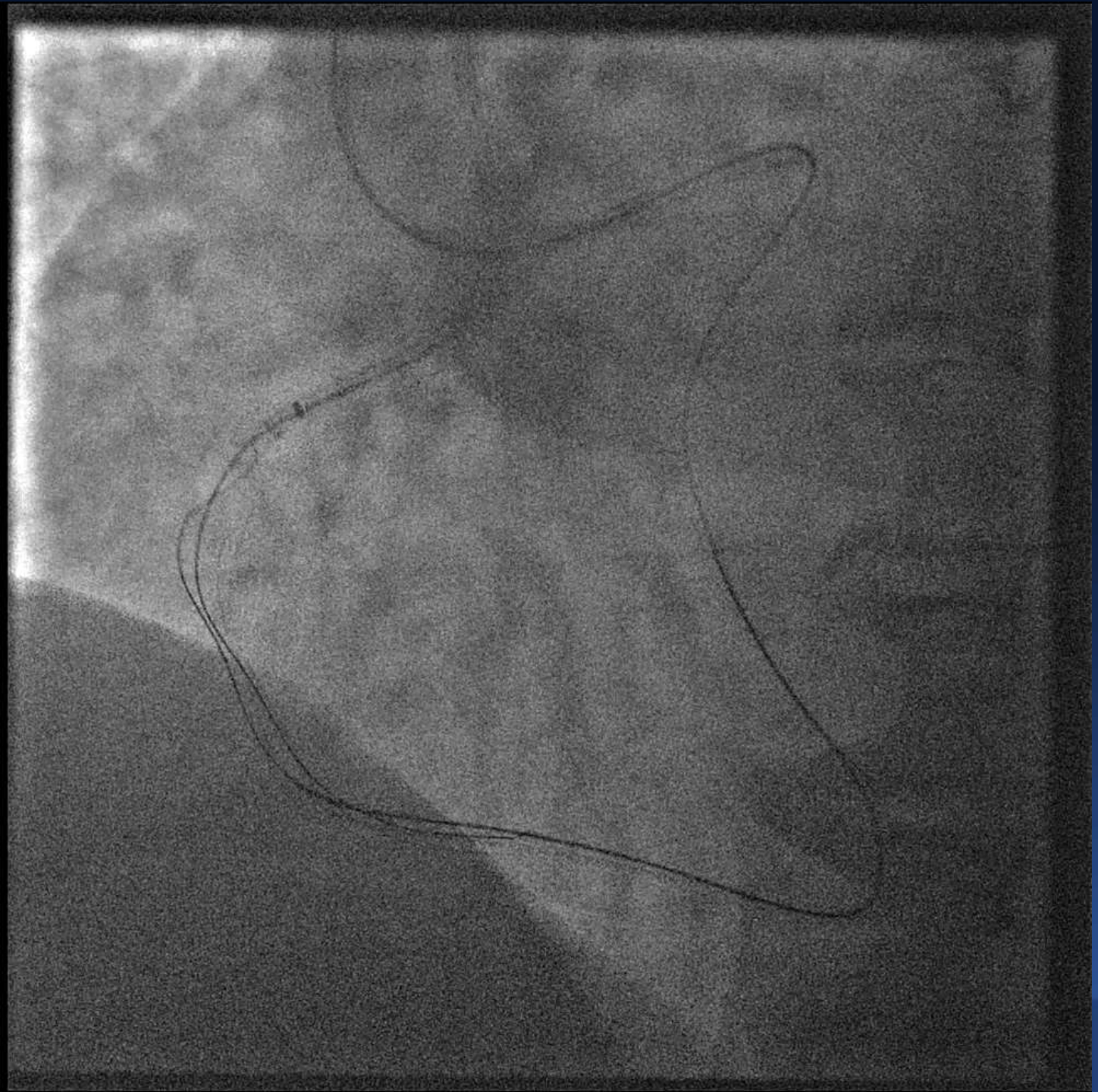


Antegrade:
BMW
Pilot 200
Miracle 6
Guideliner

Retrograde:
Corsair (long)
Miracle 6

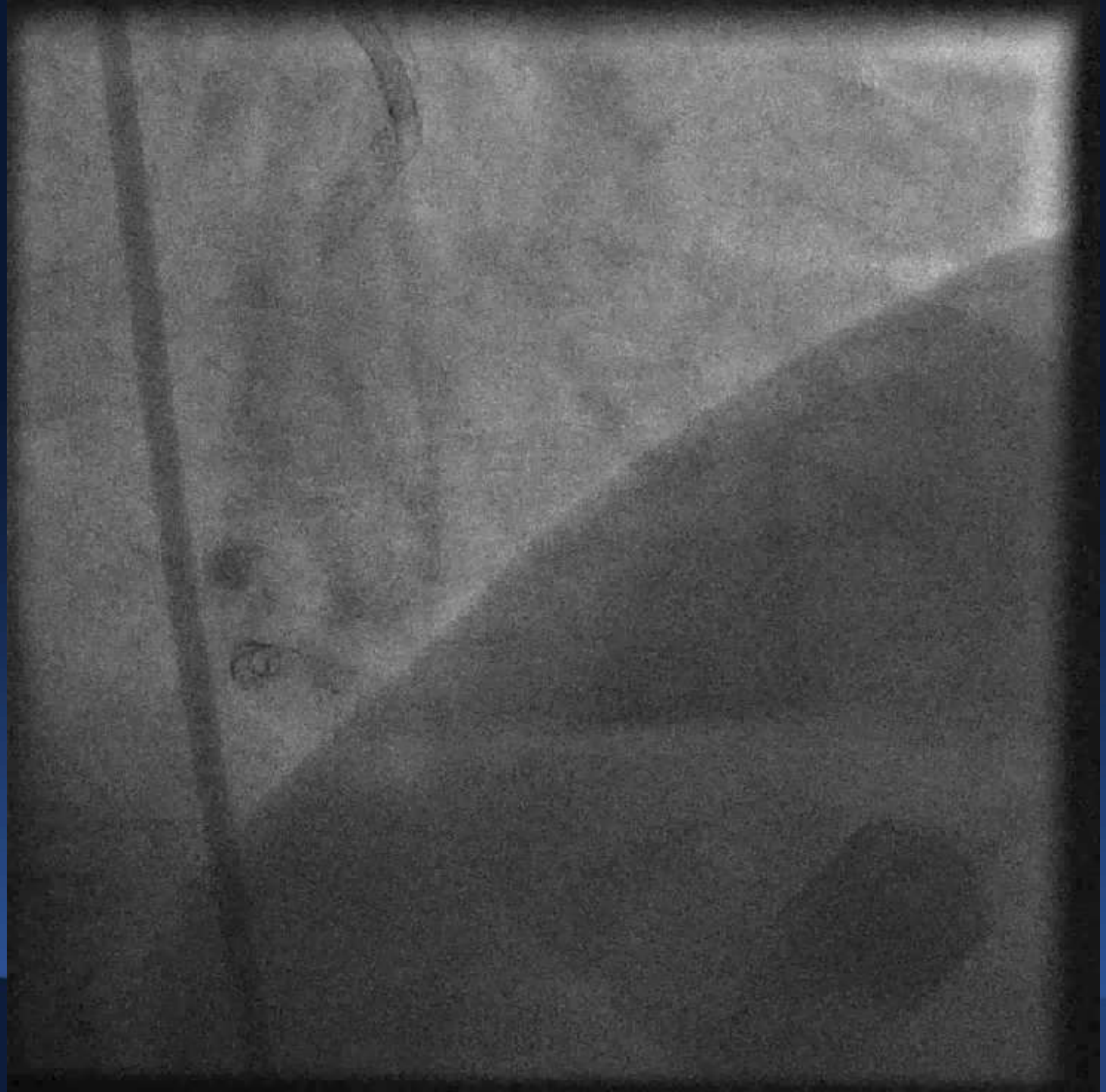




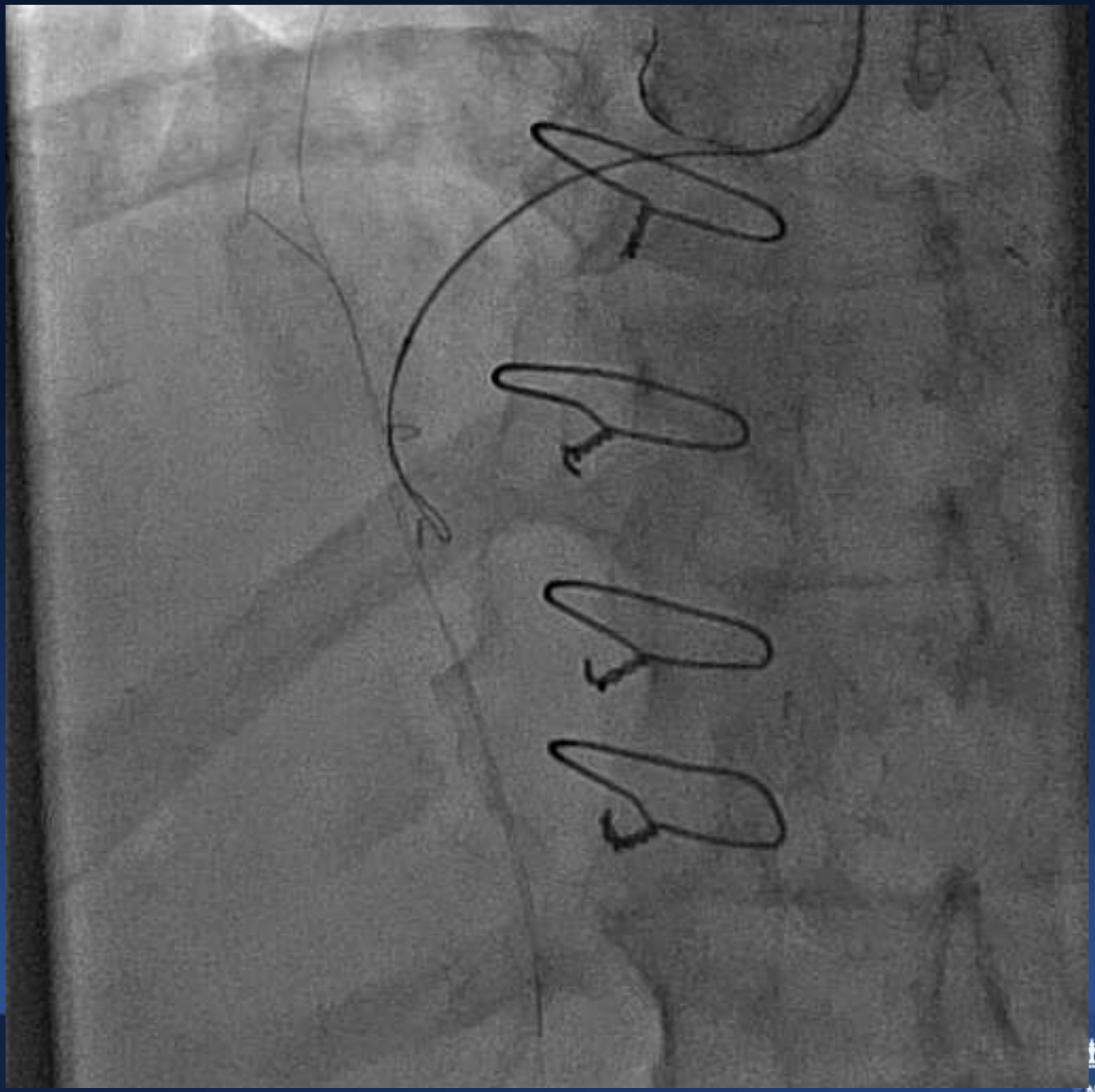


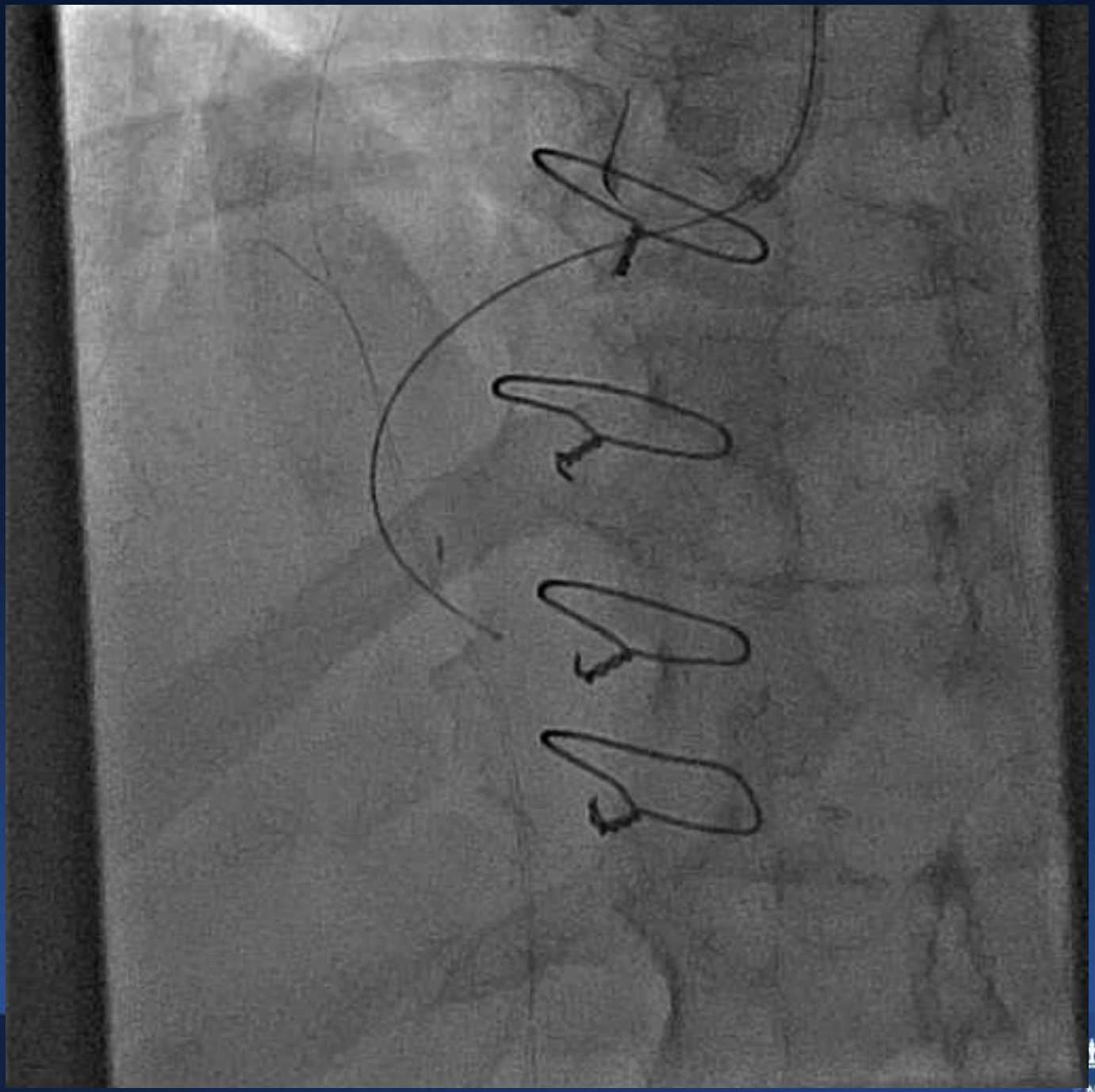
Retrograde:
Corsair (long)
Miracle 6
Confianza Pro 12

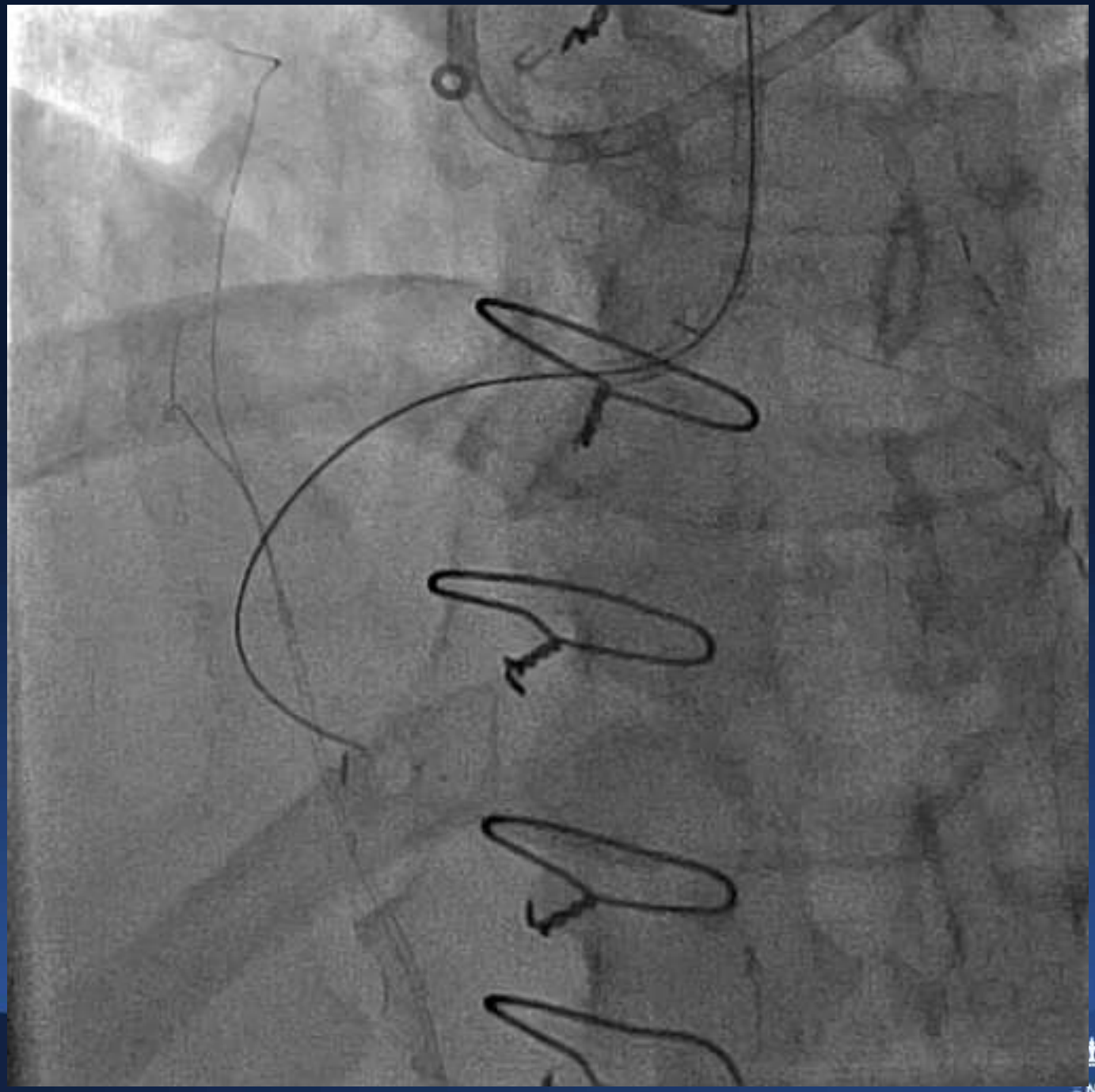
Confianza Pro 12 crossed lesion

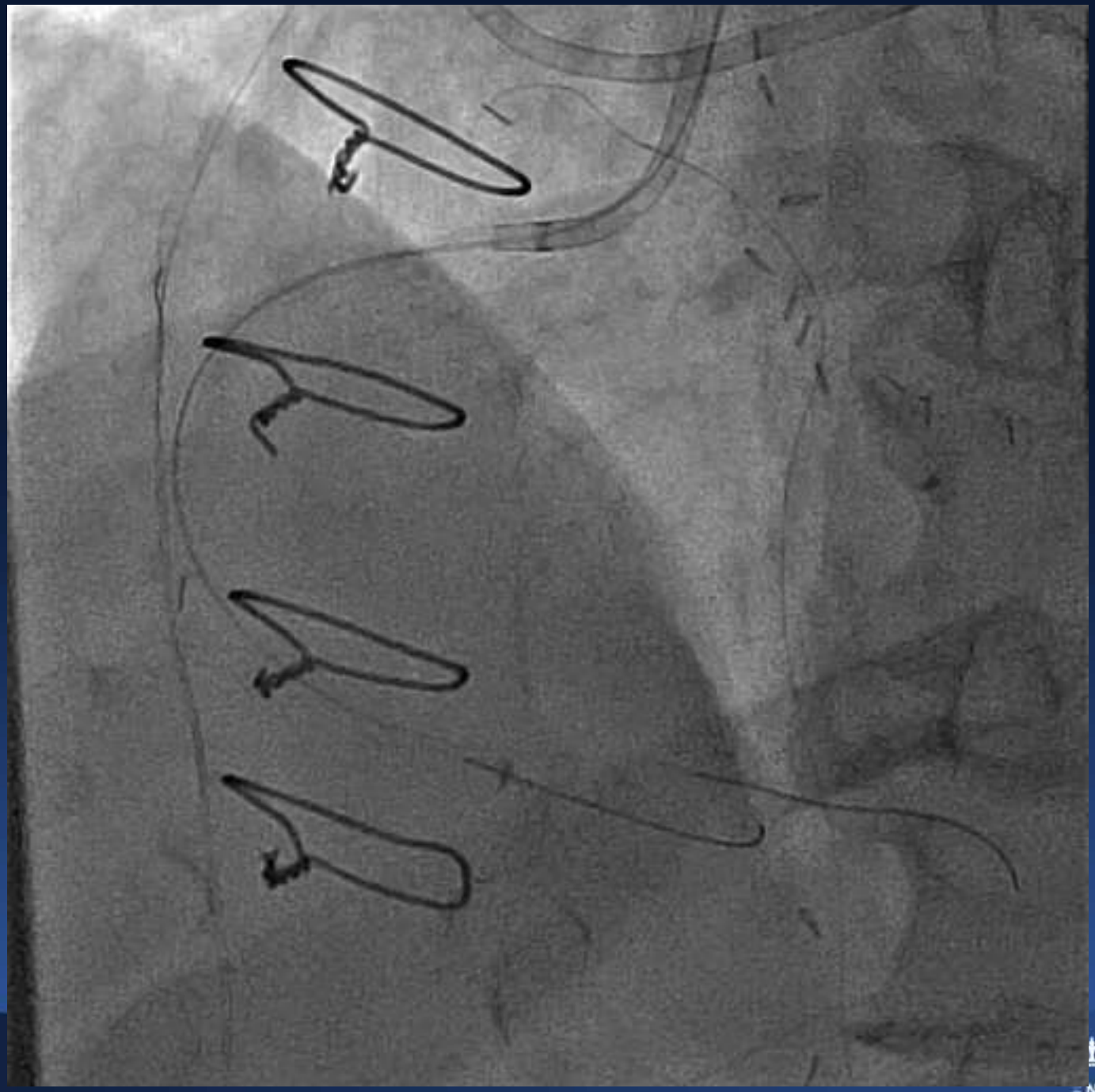


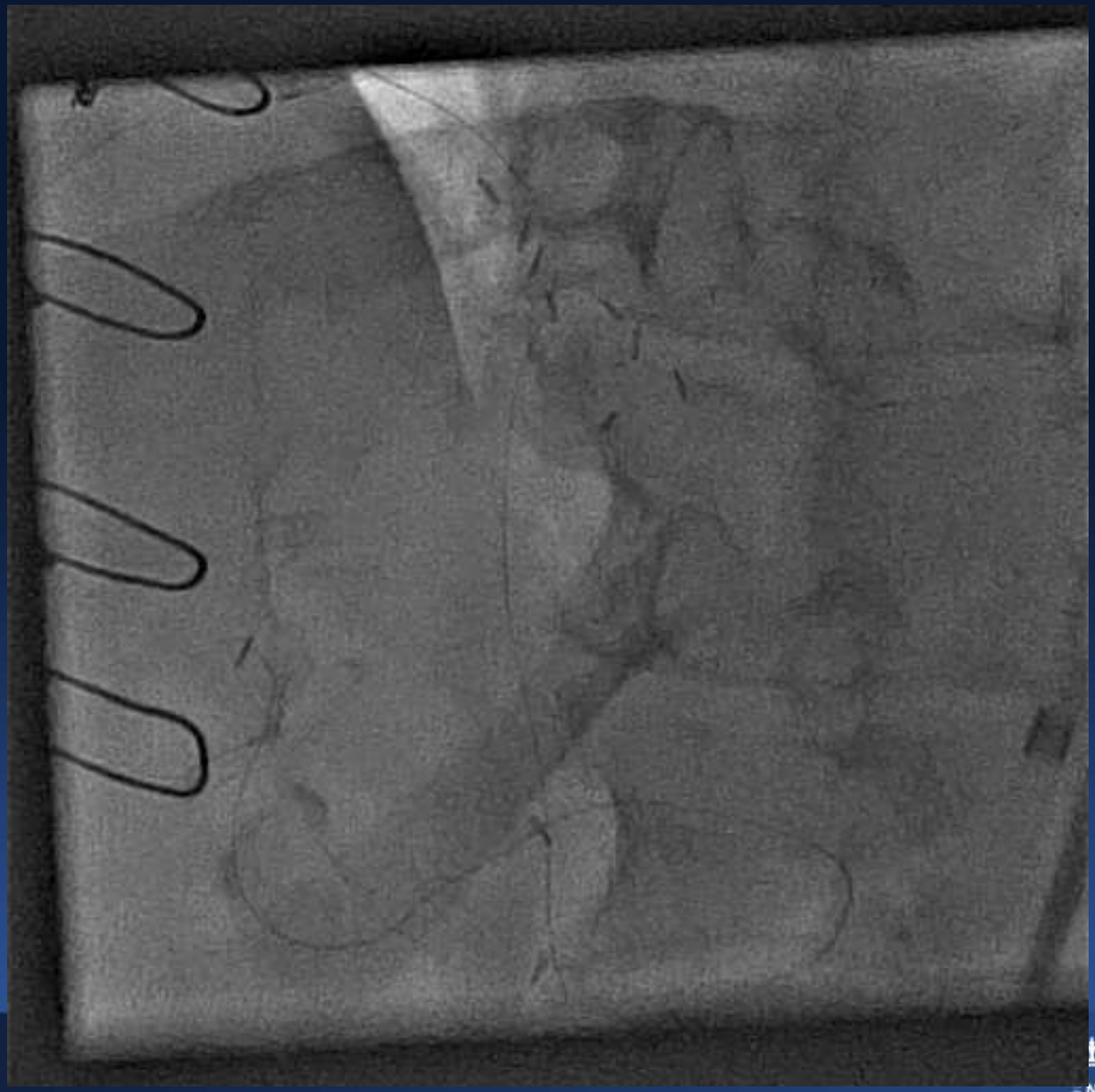
Antegrade Dissection Re-Entry (ADR)





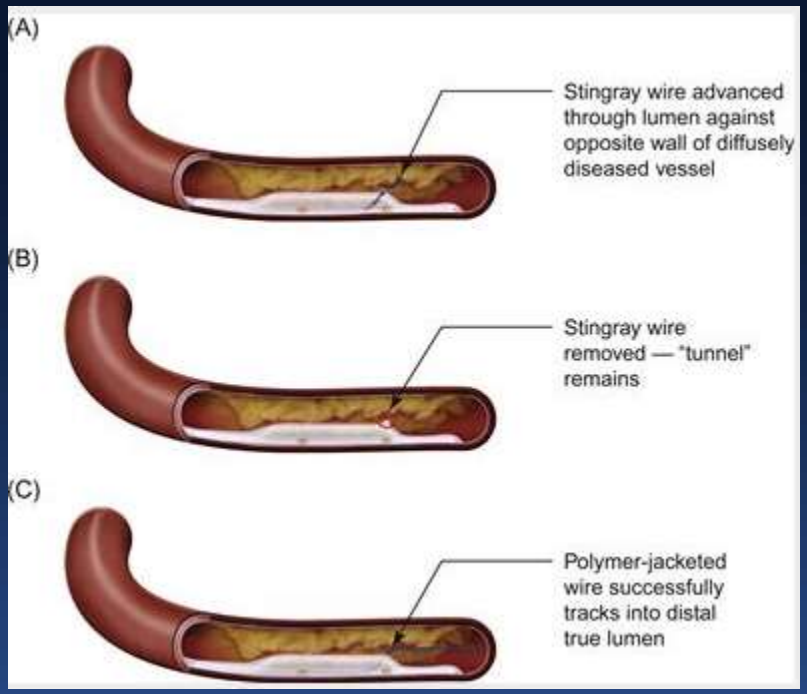


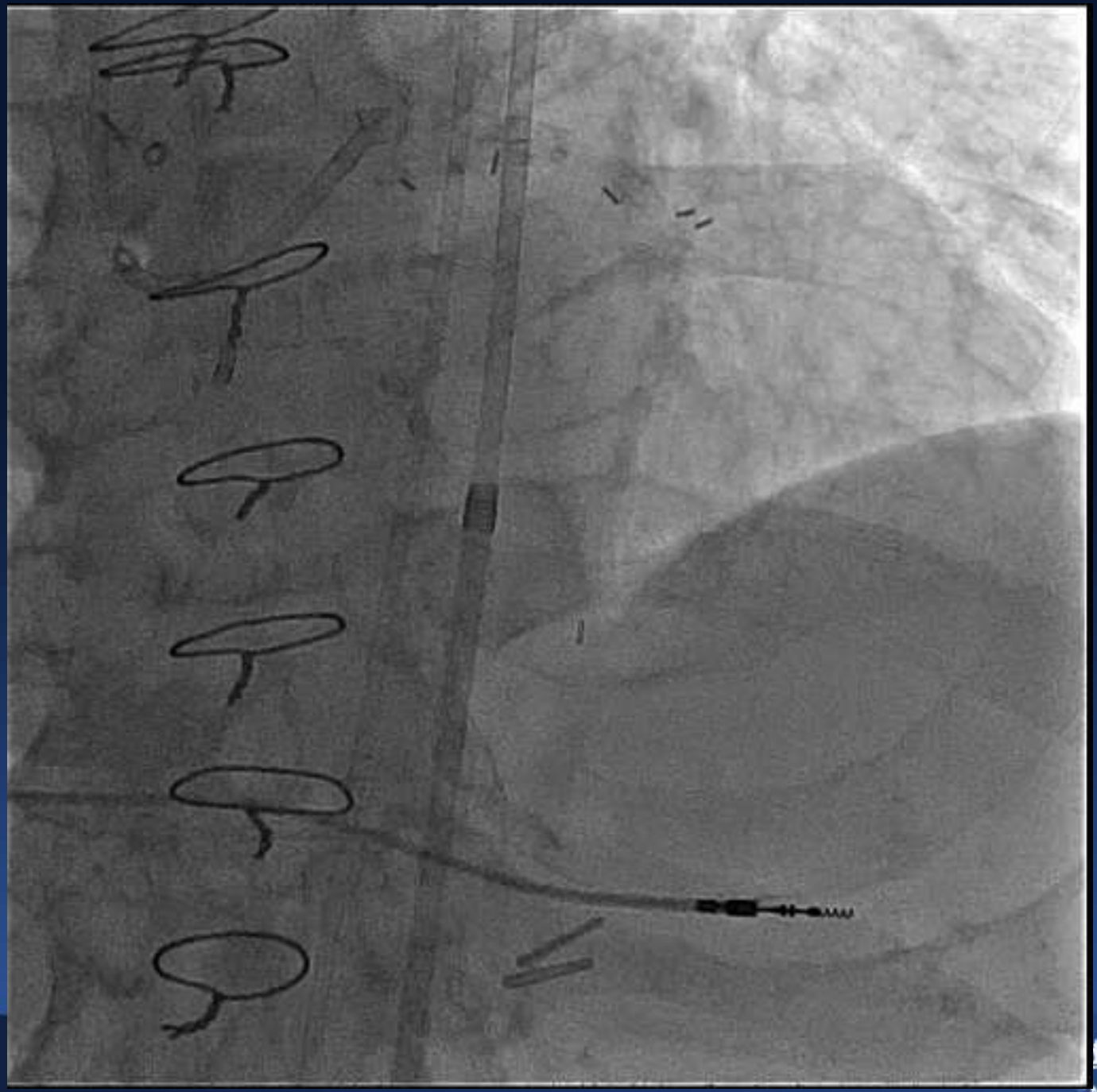


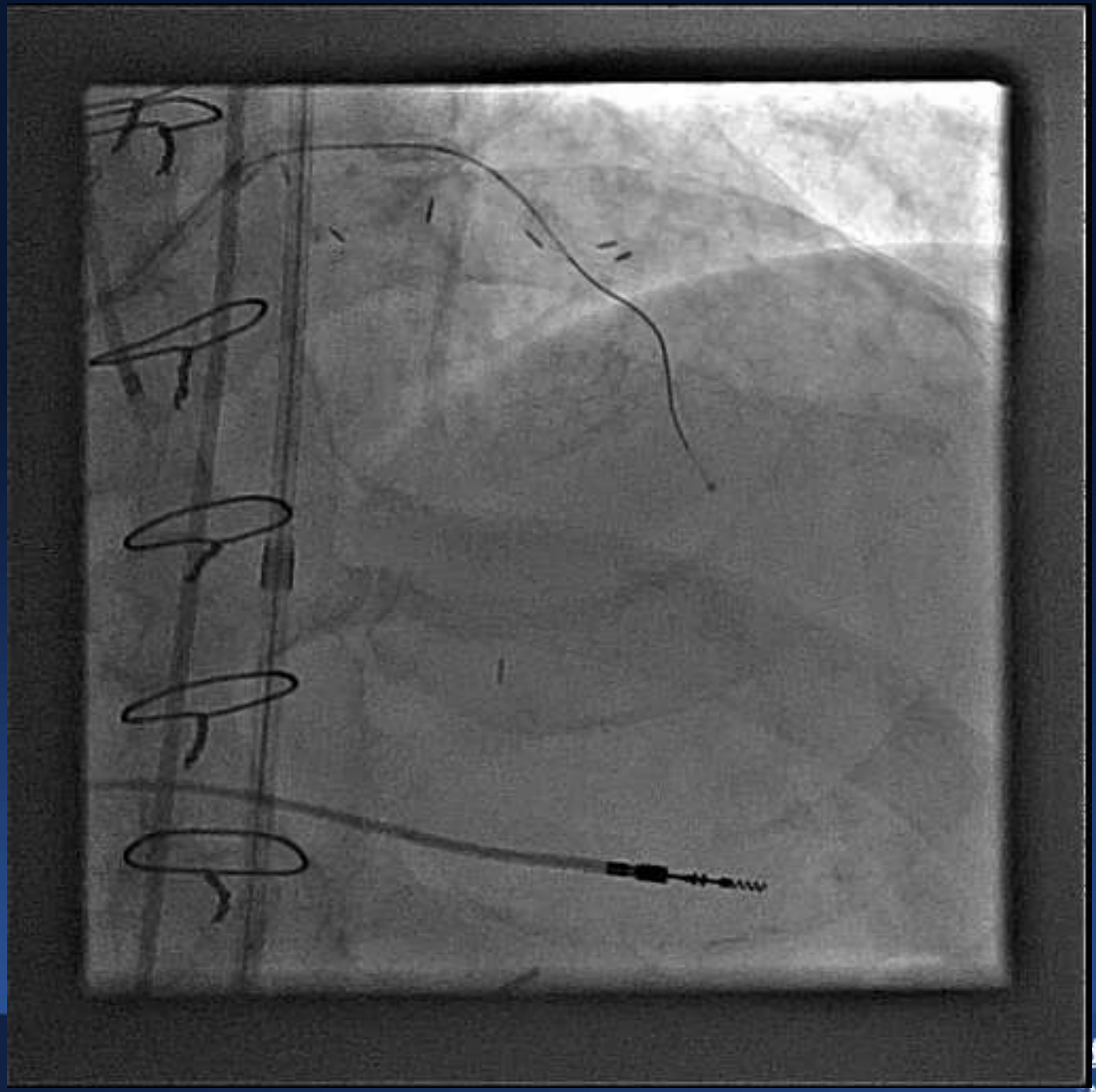


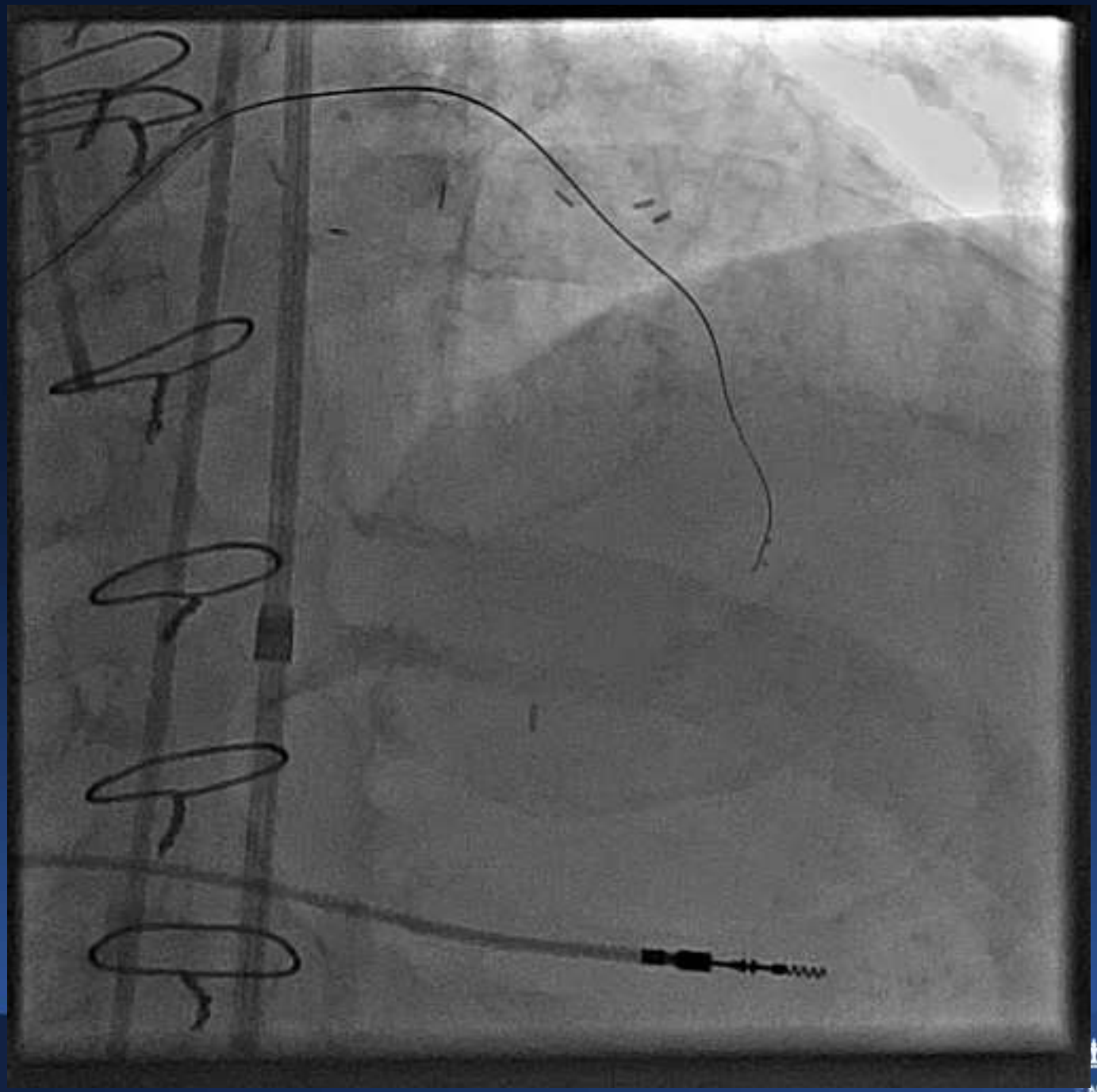
Stick and Swap

- Method of reentry in which an initial puncture into the true lumen from the Stingray balloon side-port is performed with the Stingray wire. This wire is removed and a Pilot 200 guidewire is advanced through the same tunnel created by the Stingray wire into the distal true lumen.

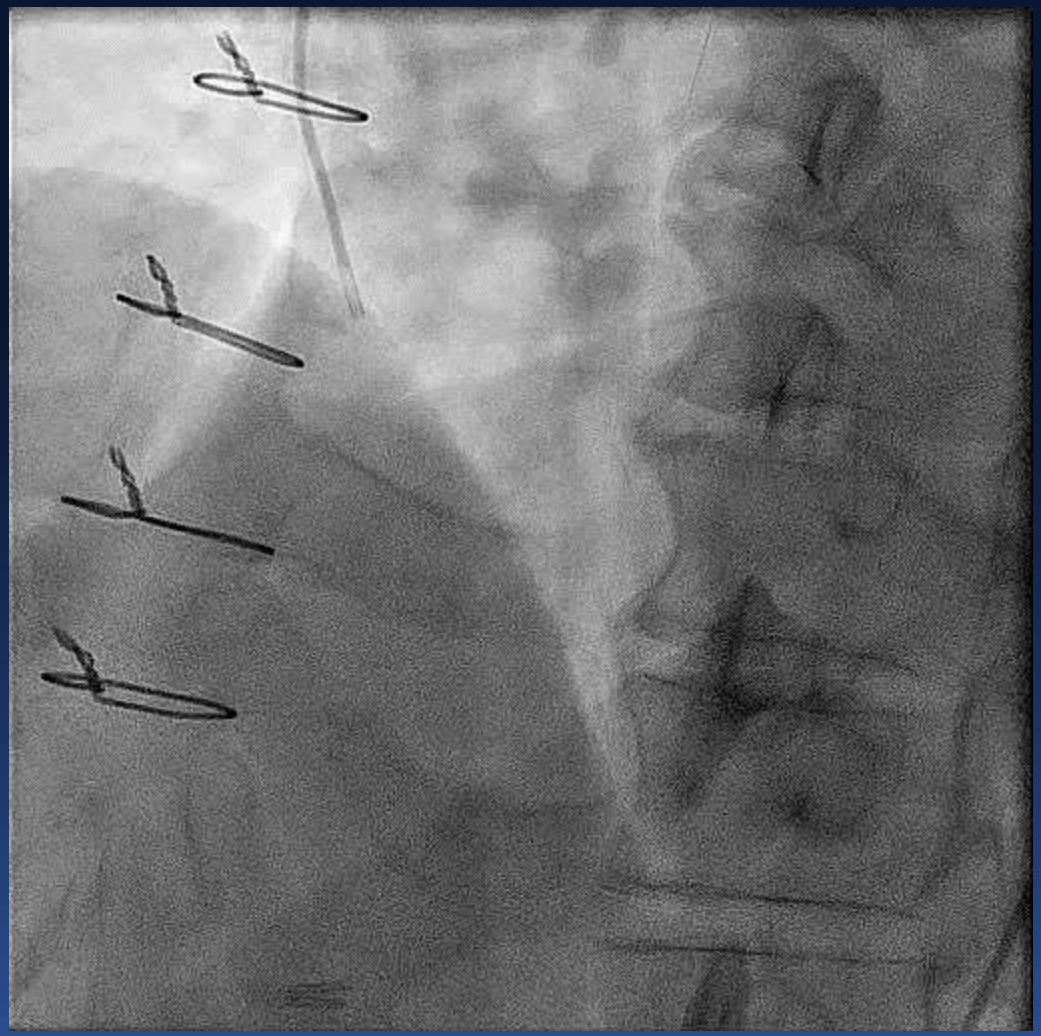


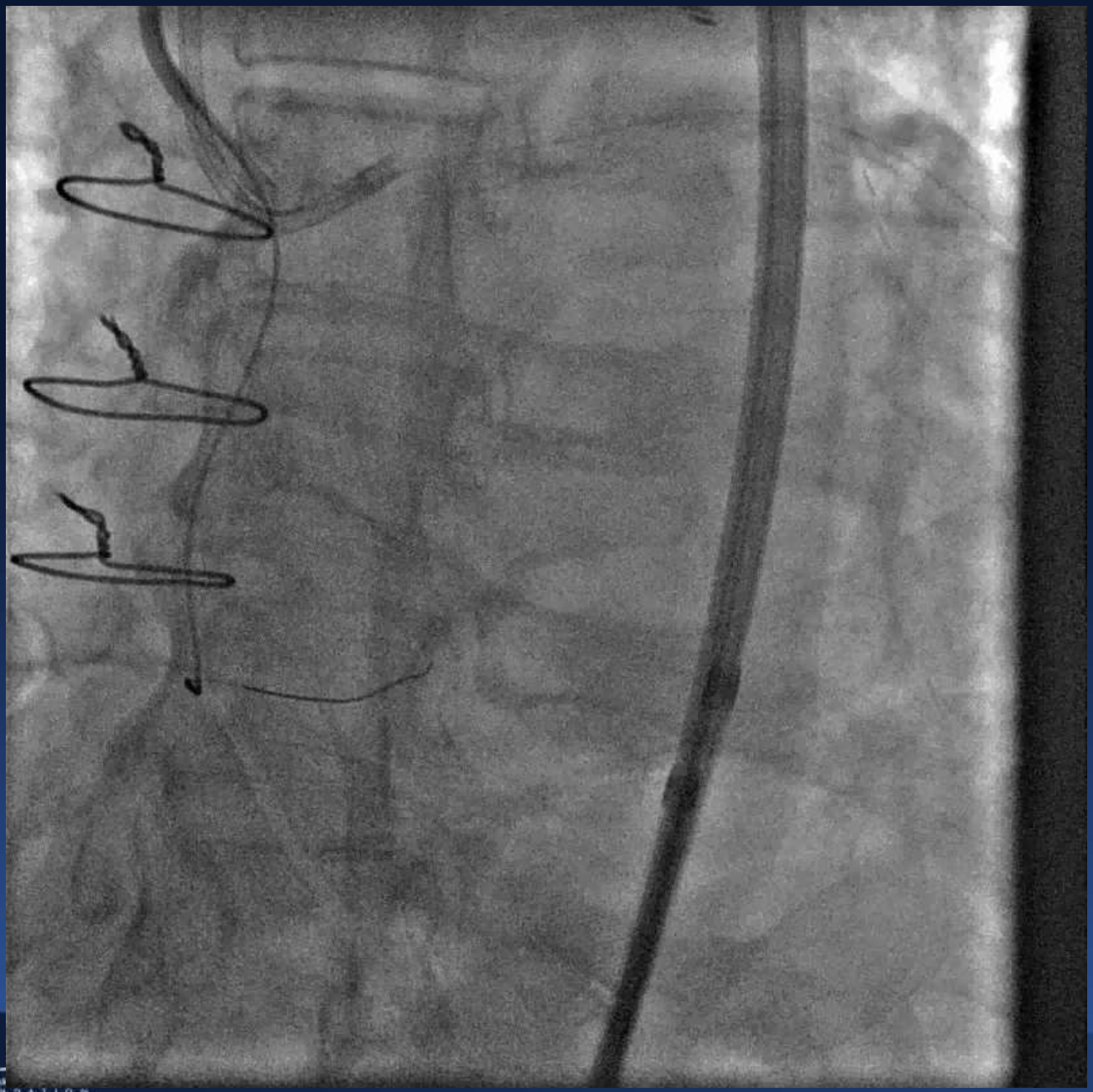




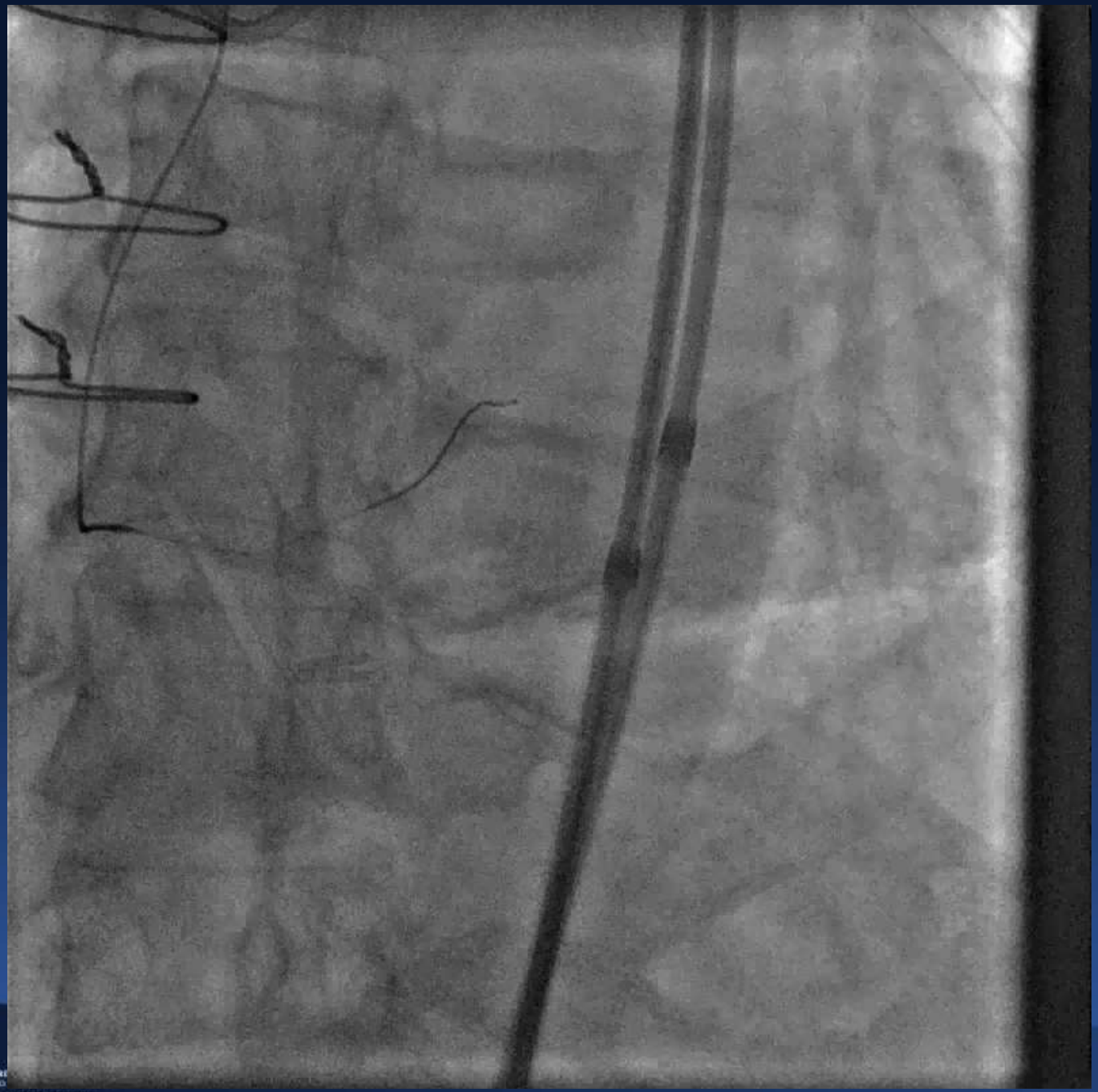


Skills/Skillsets

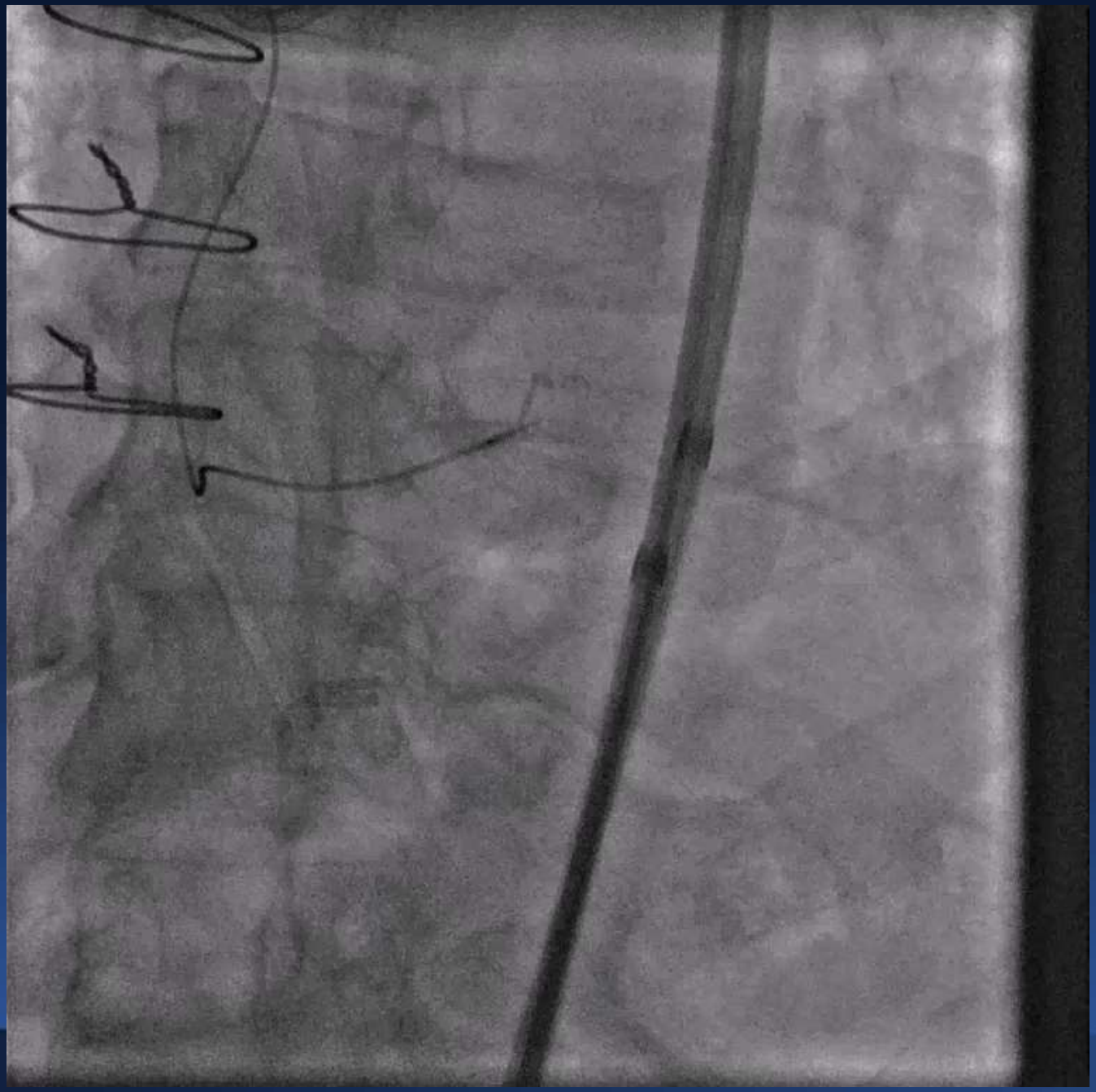


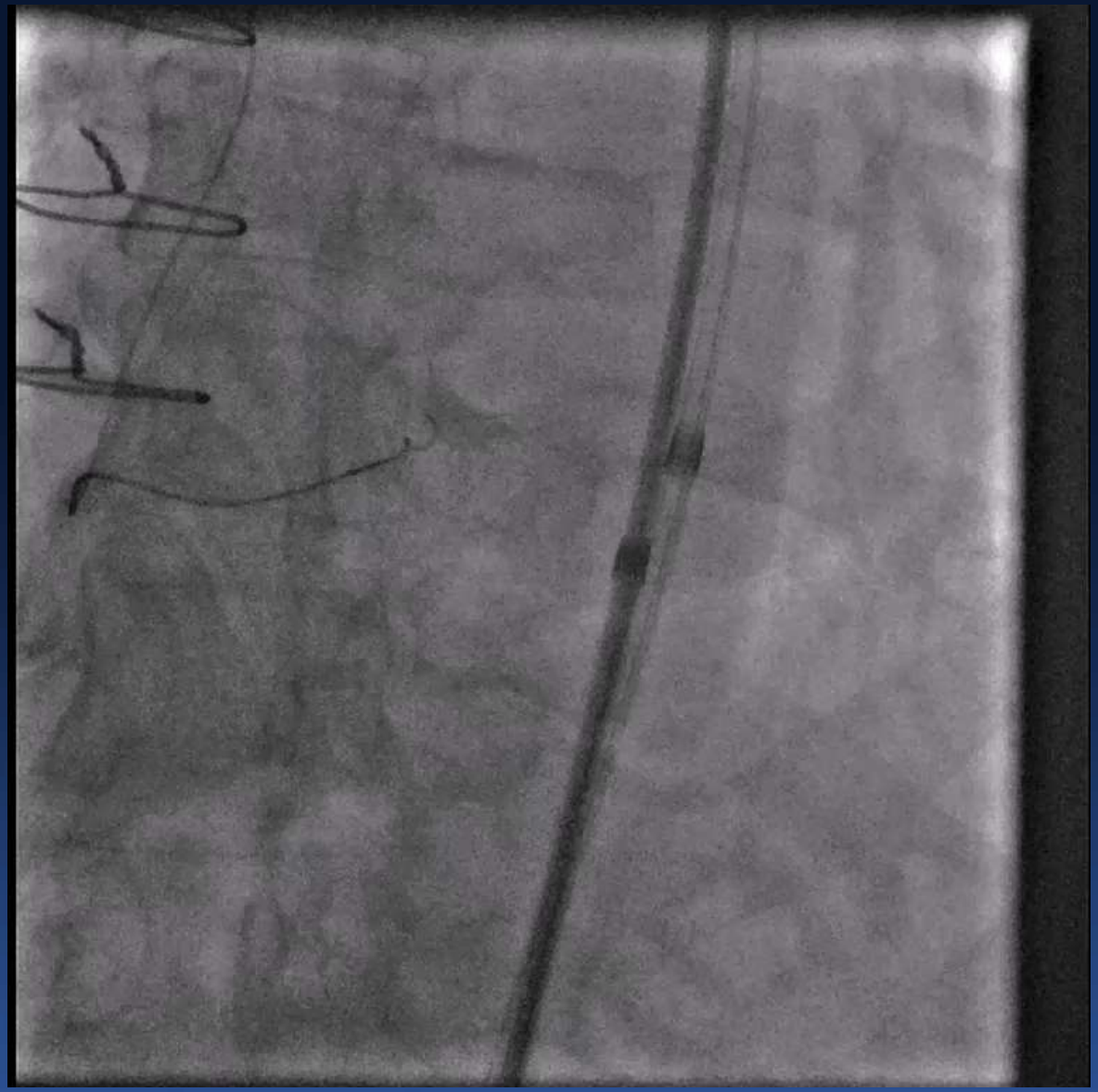


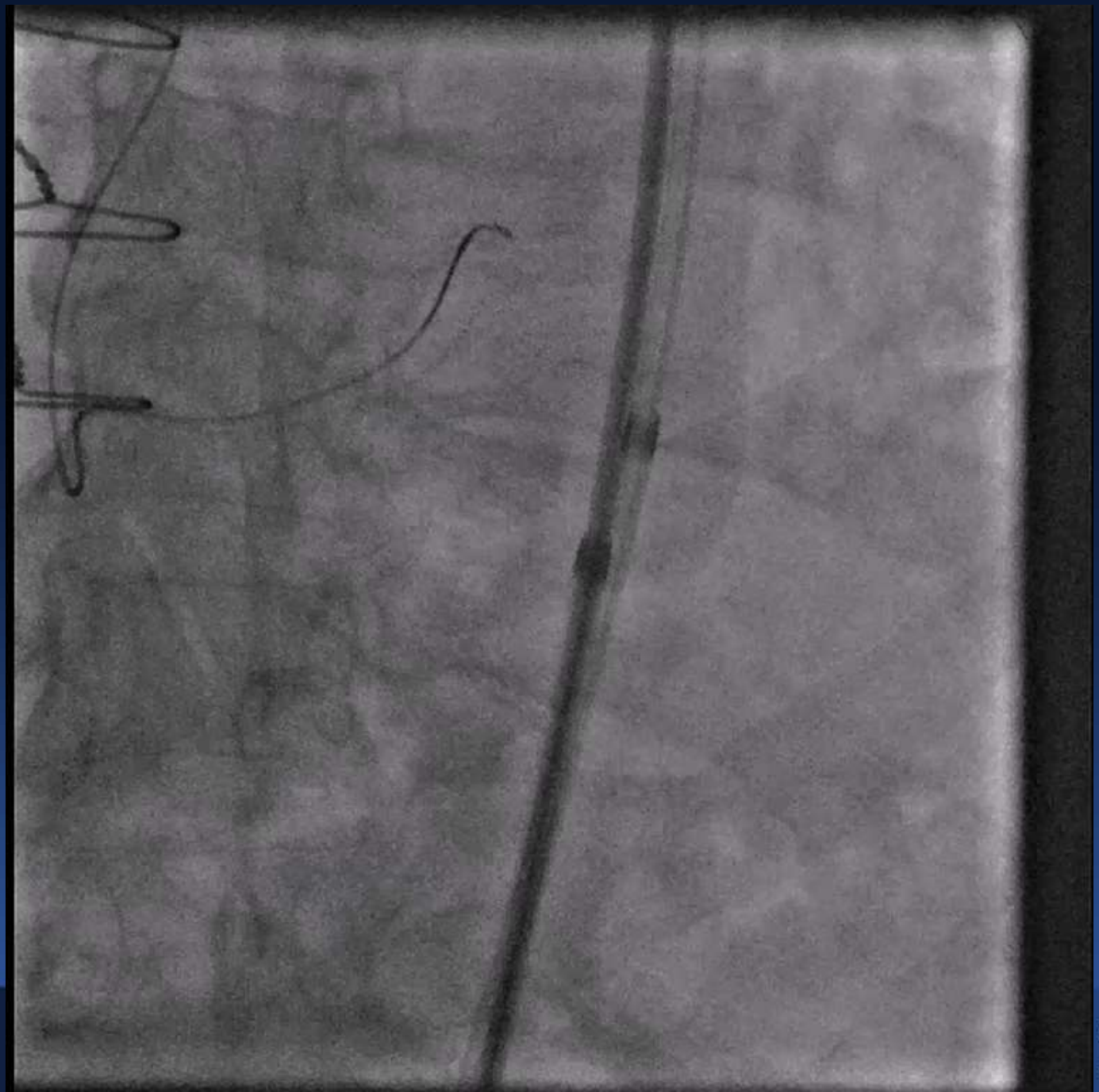
Corsair (long)
Prowater
Sion

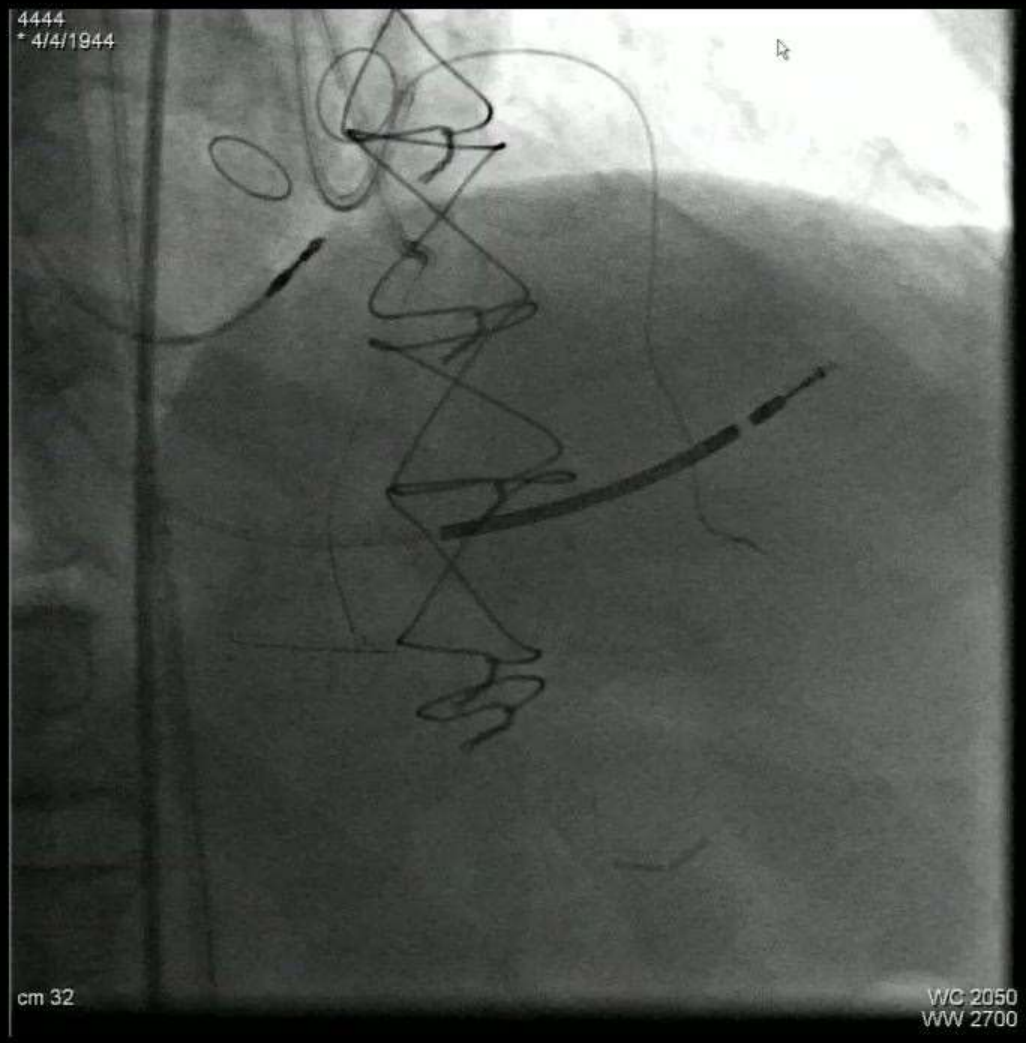


Corsair (long)
Sion





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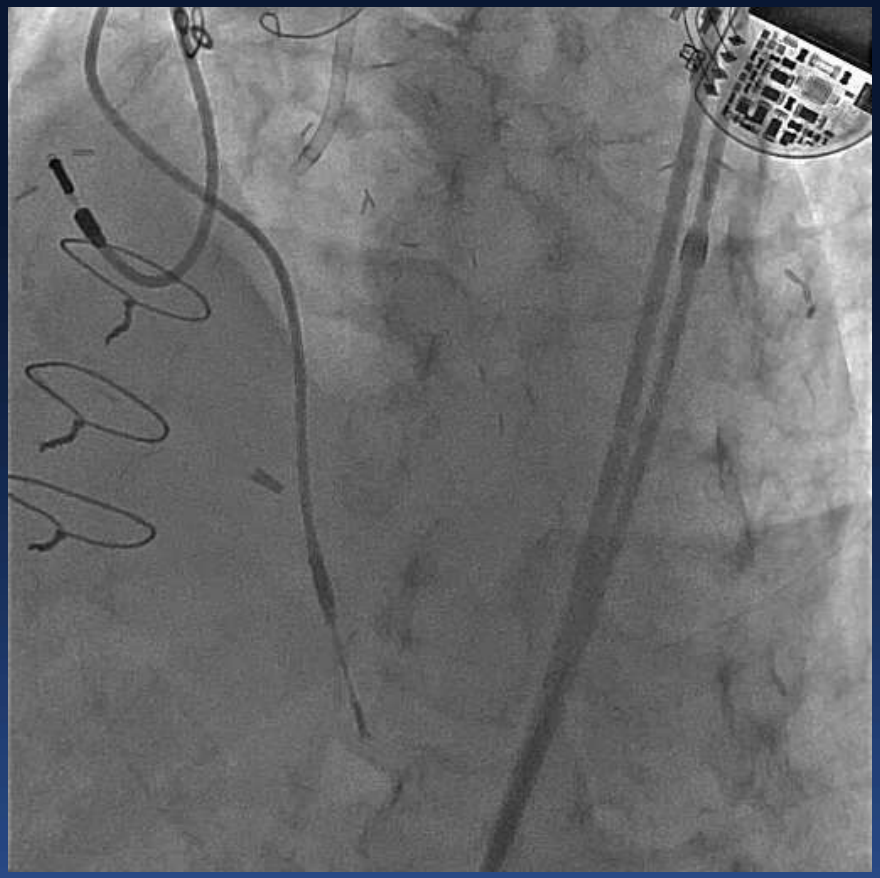
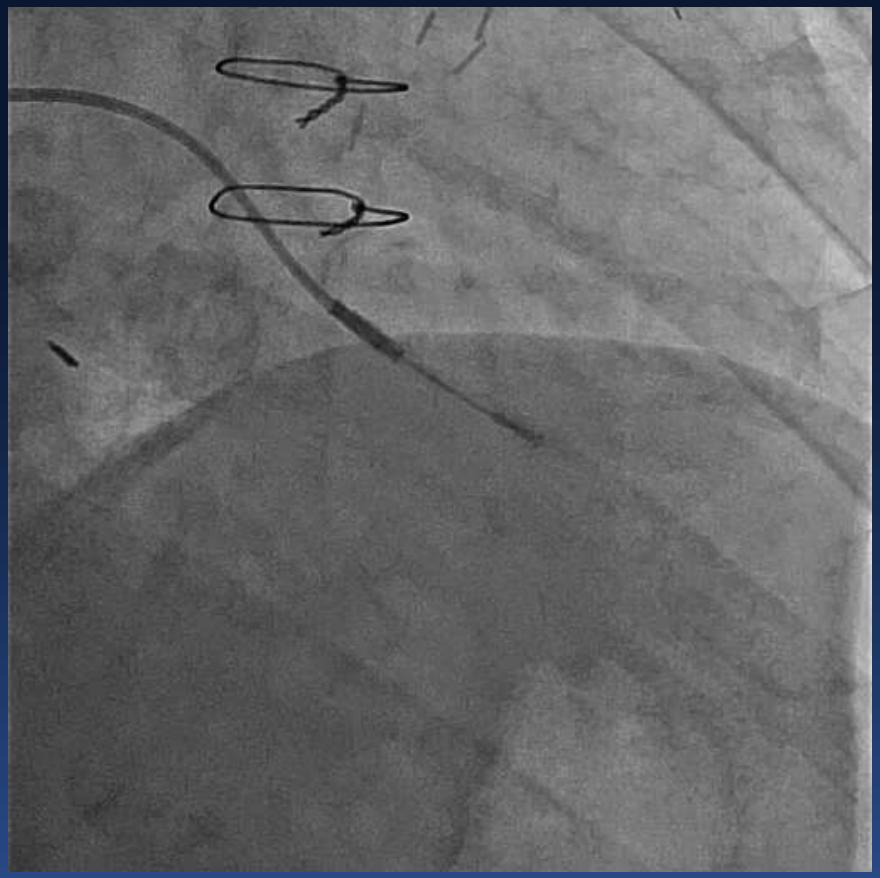
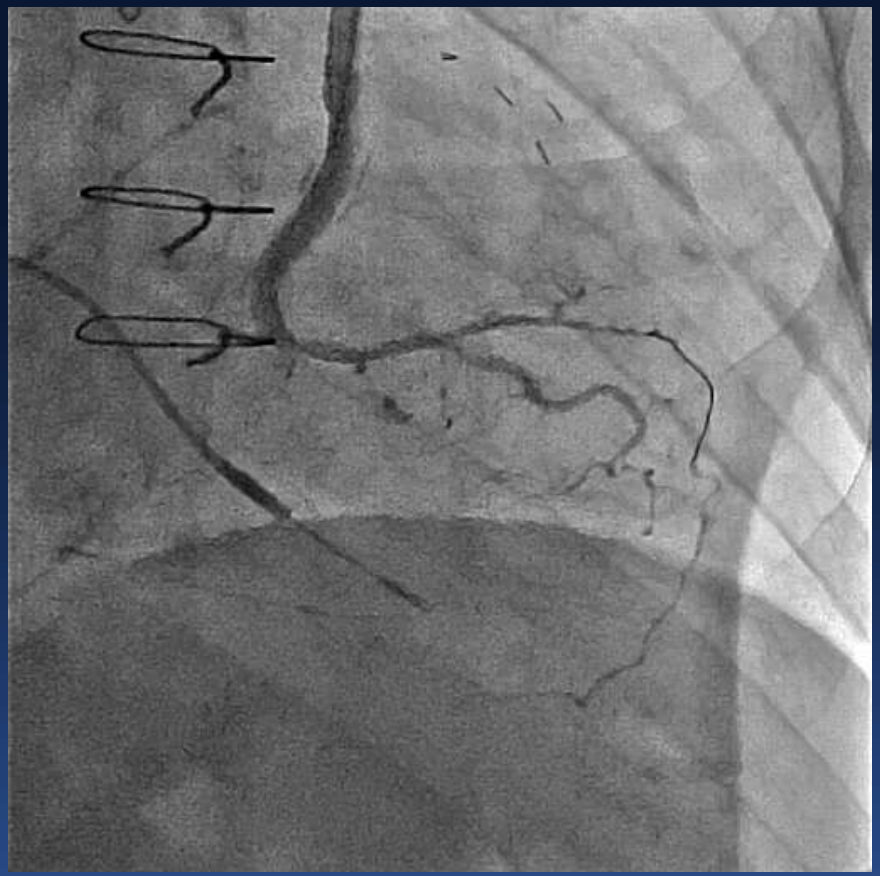
* 4/4/1944
cm 32
WC 2050
WW 2700

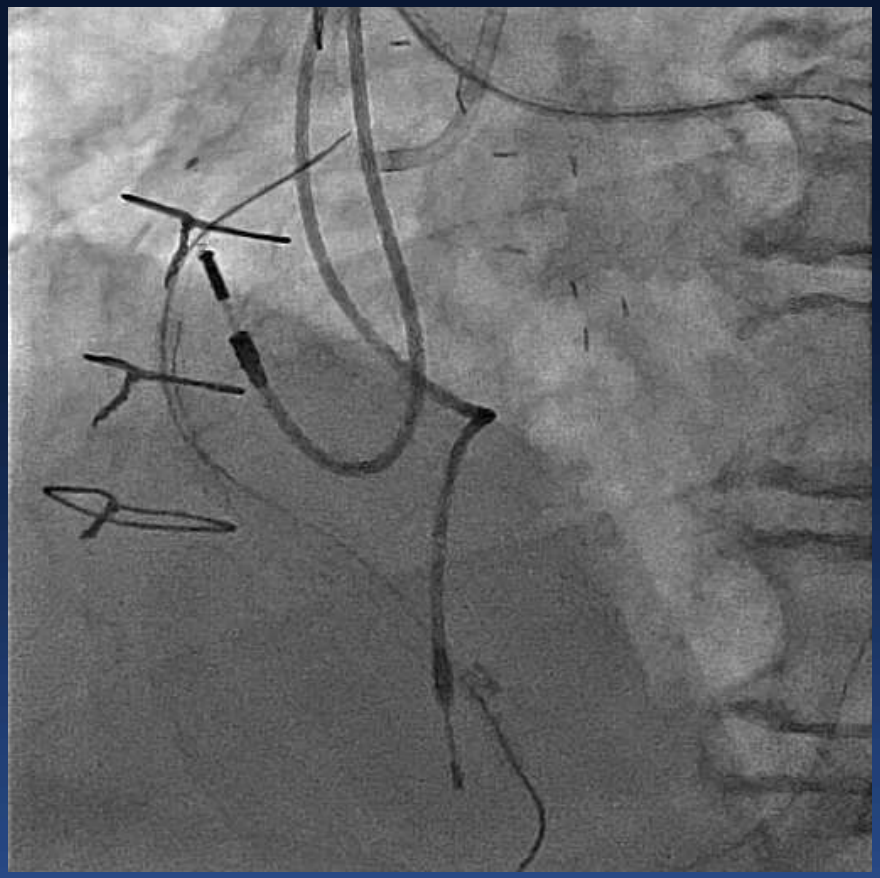

AO
AO
103/48/71
103/56/75

Case Review 1

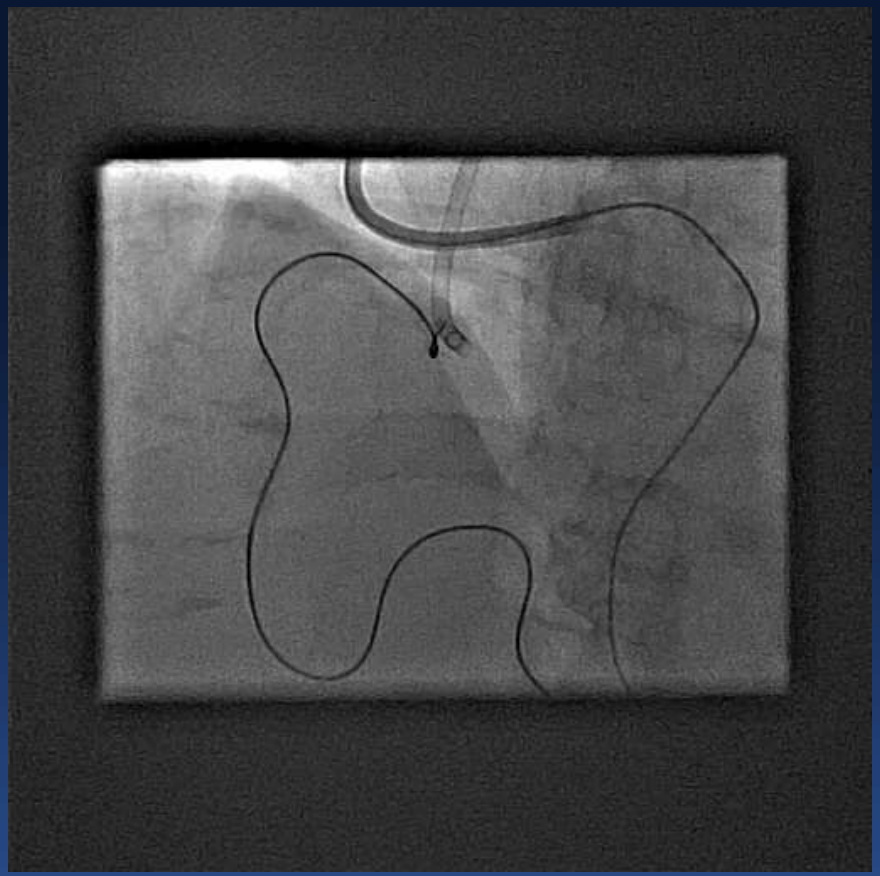


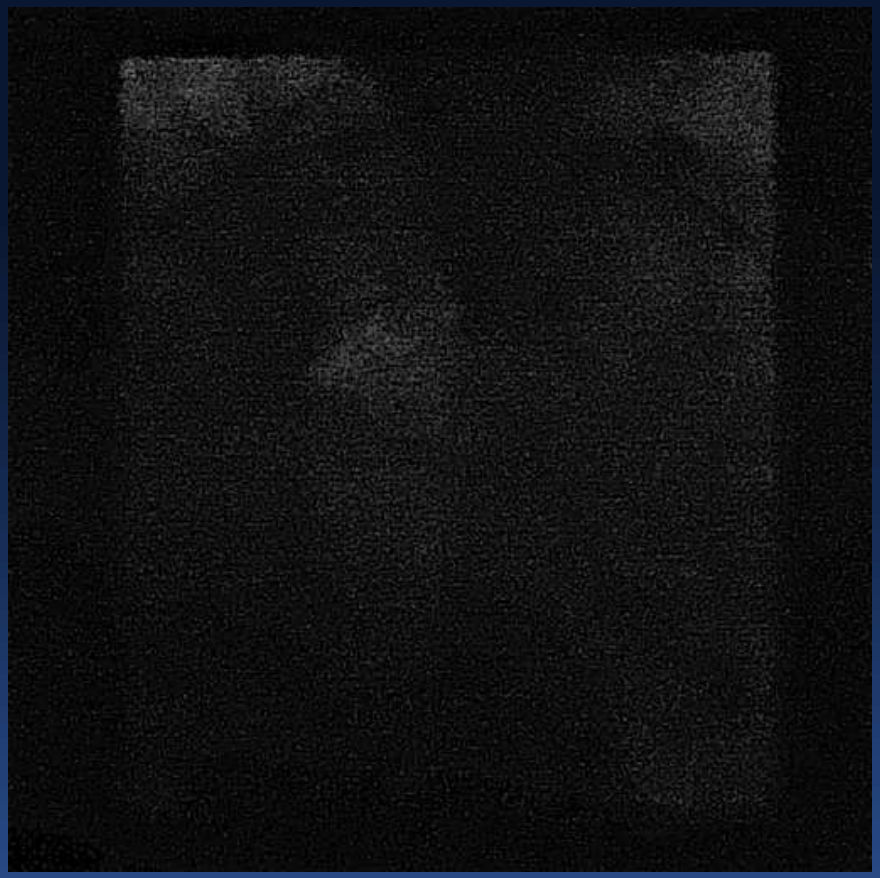


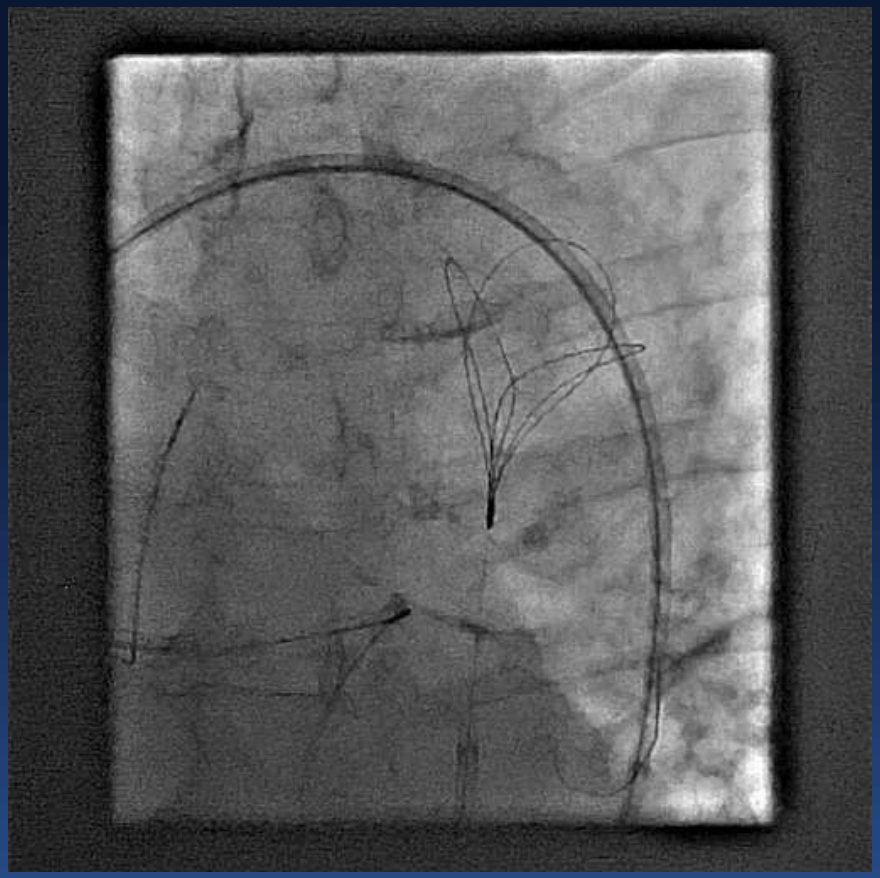


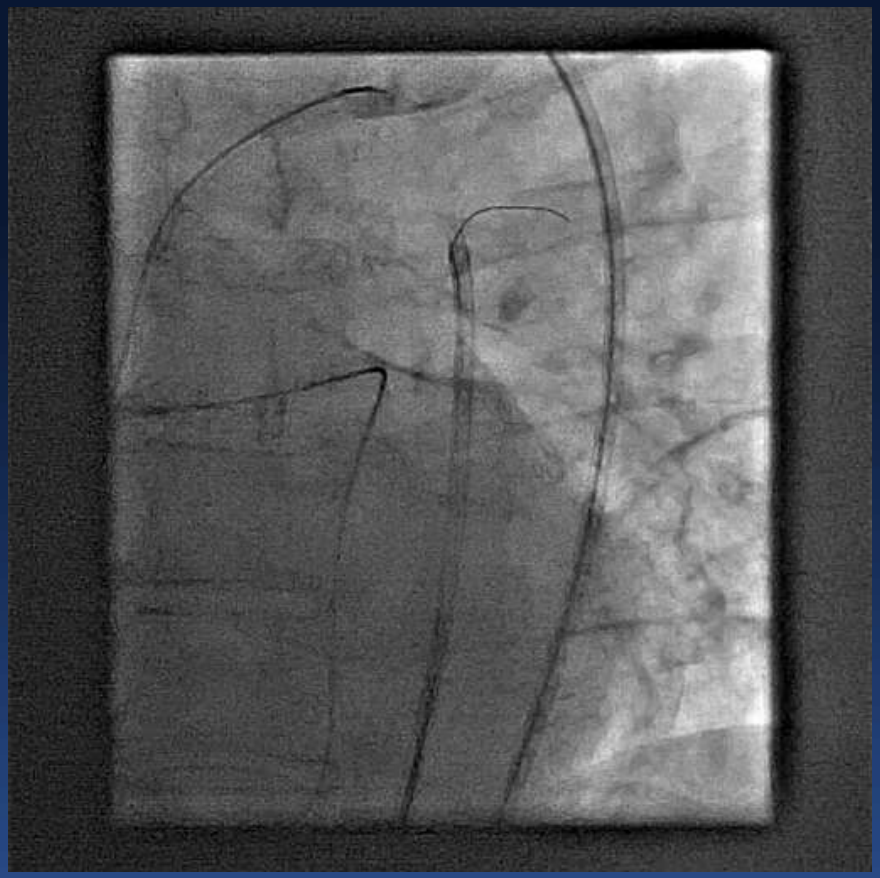


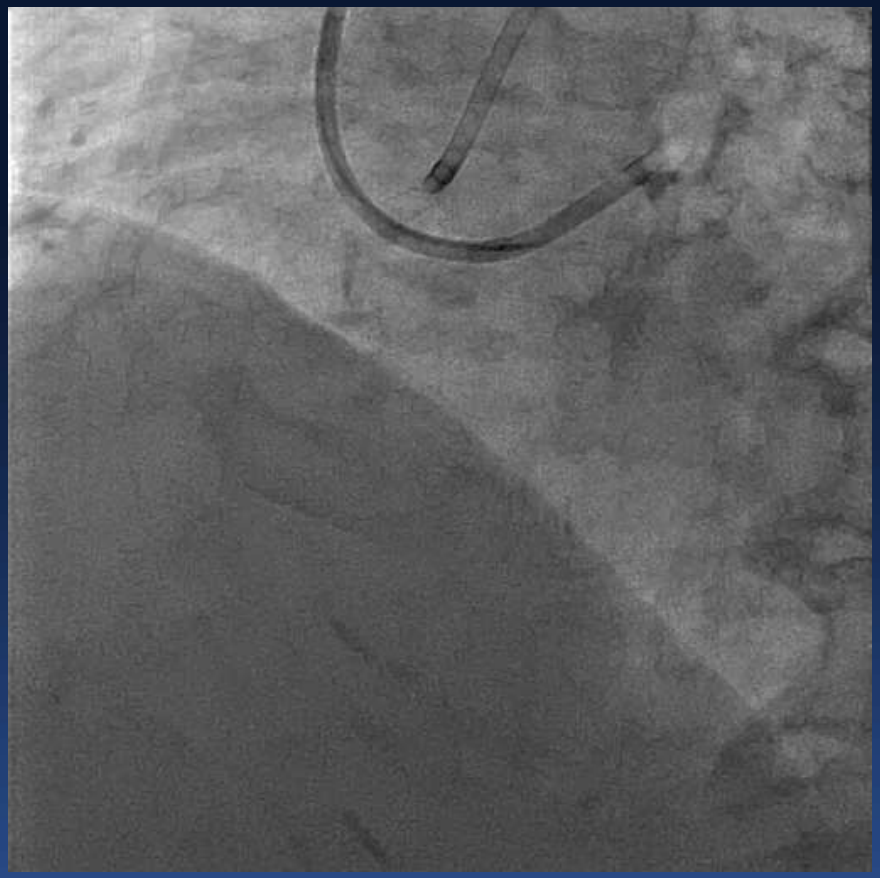
Case Review 2



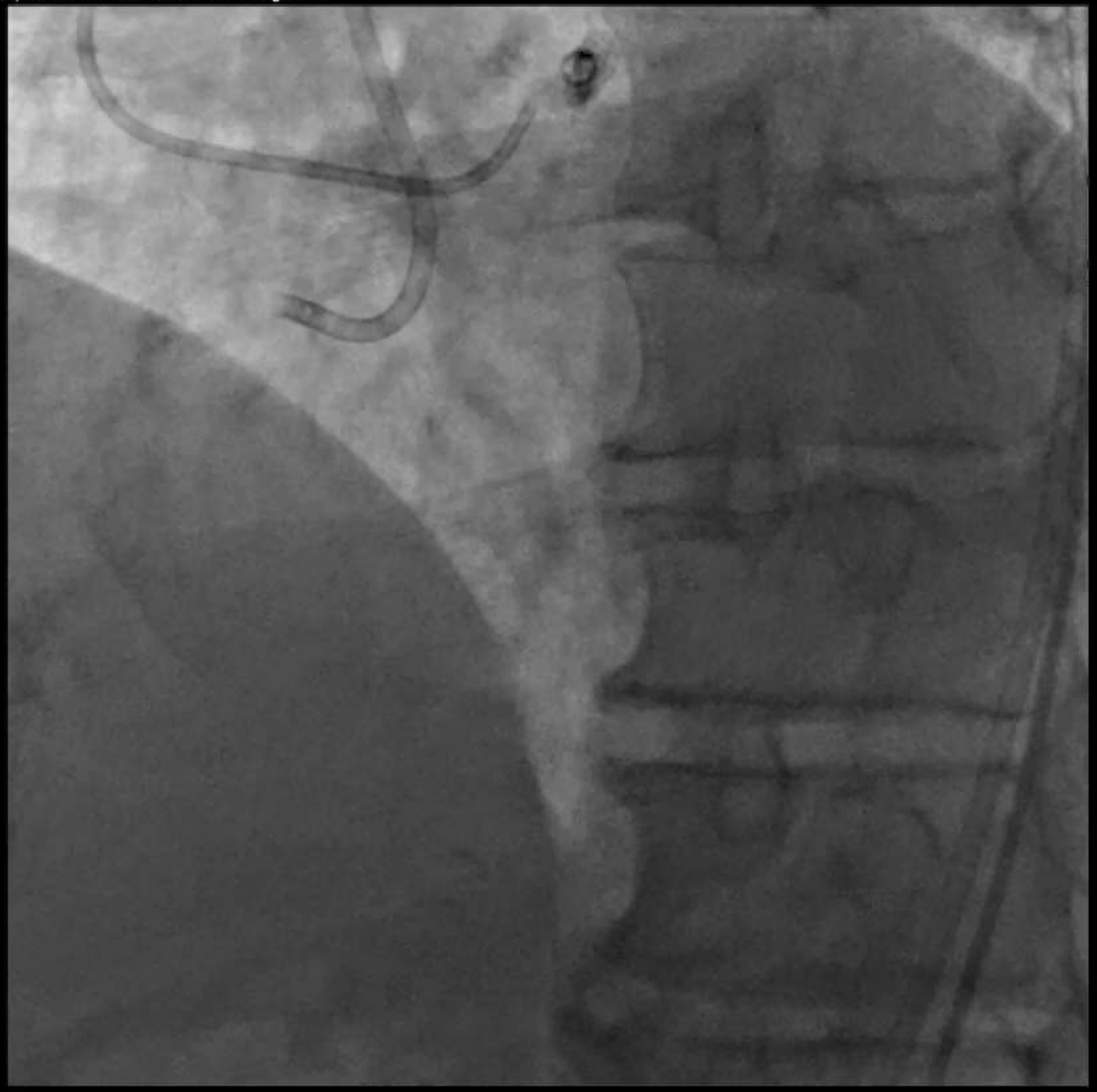




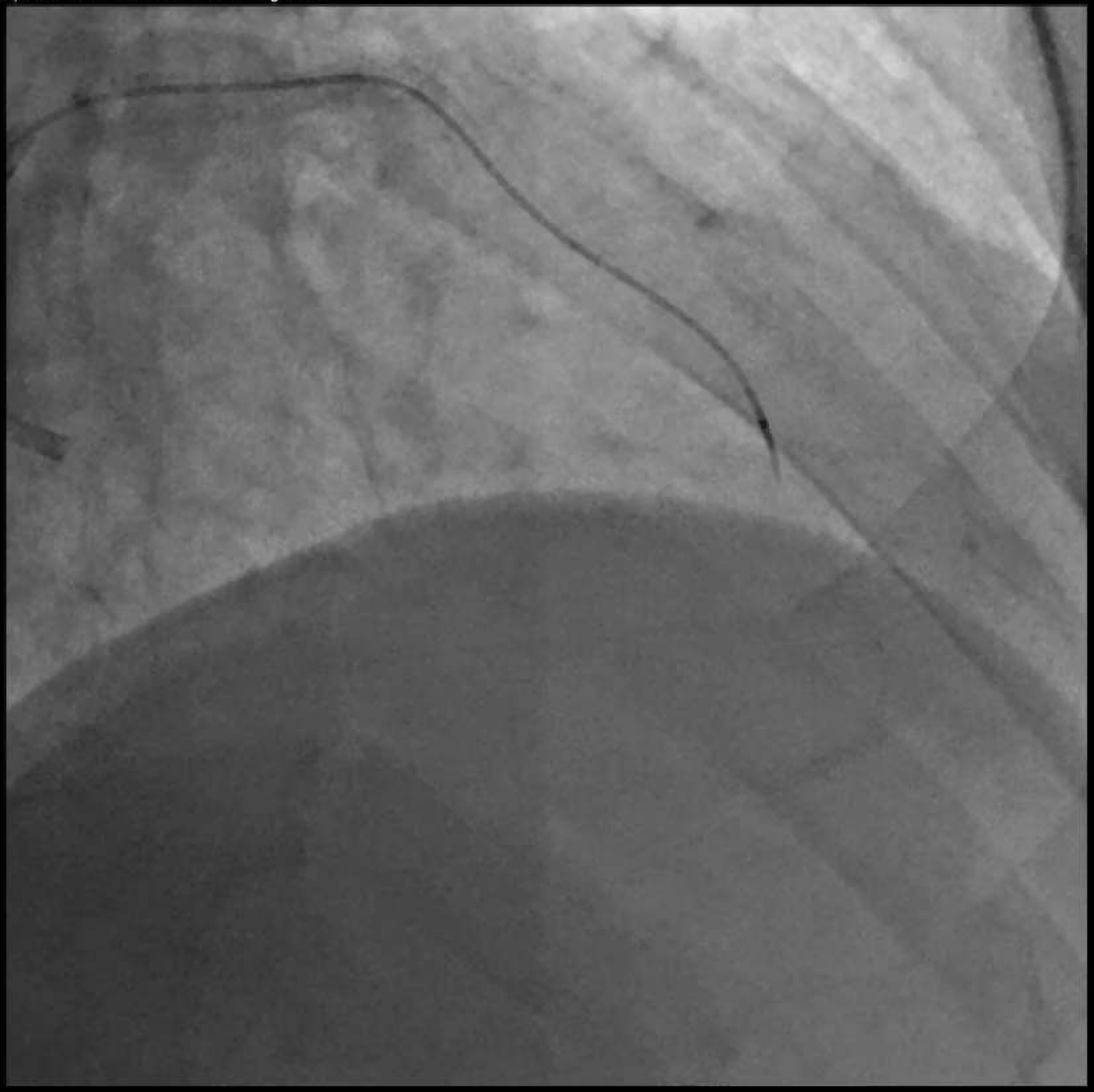


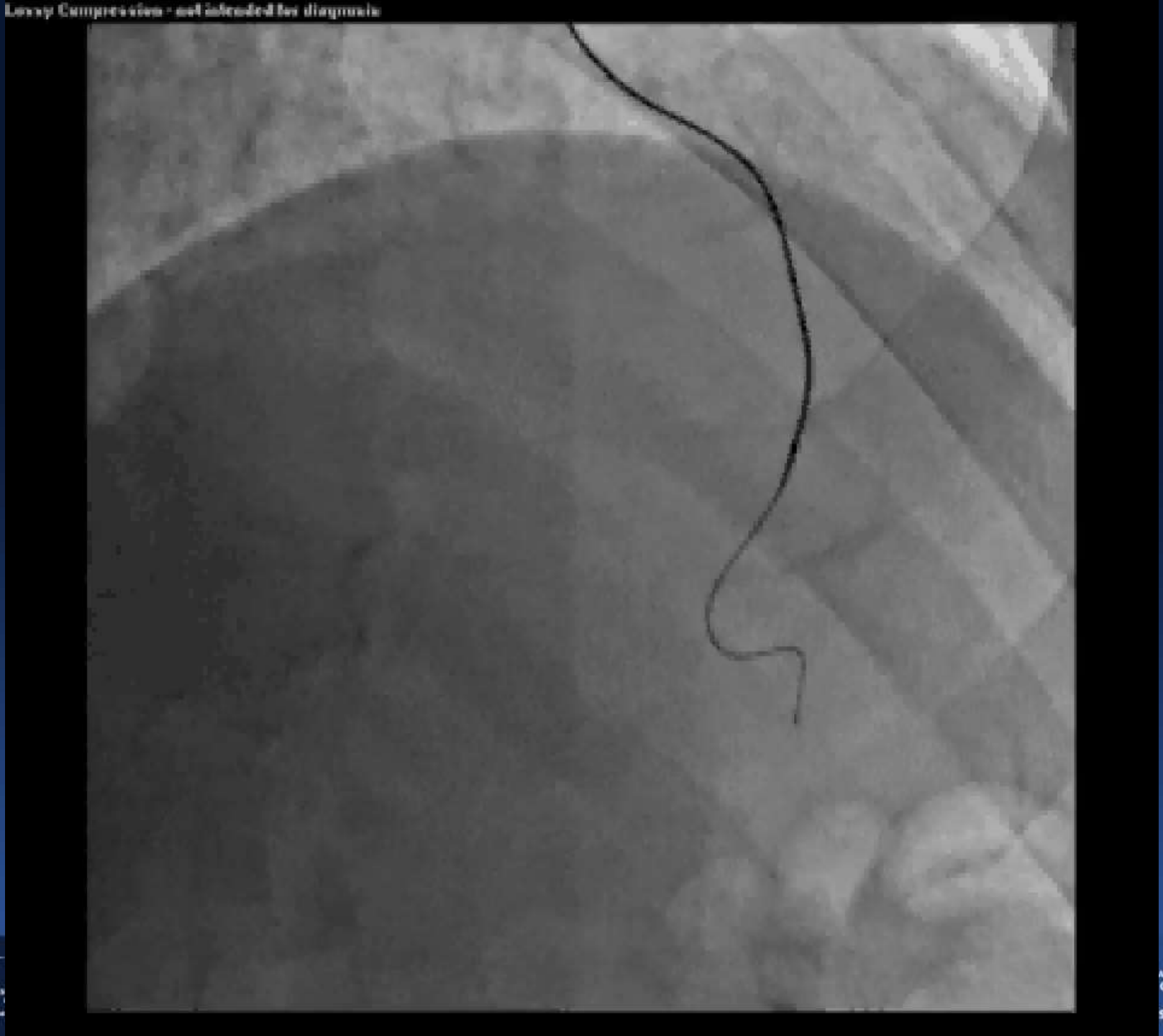


Putting it all together

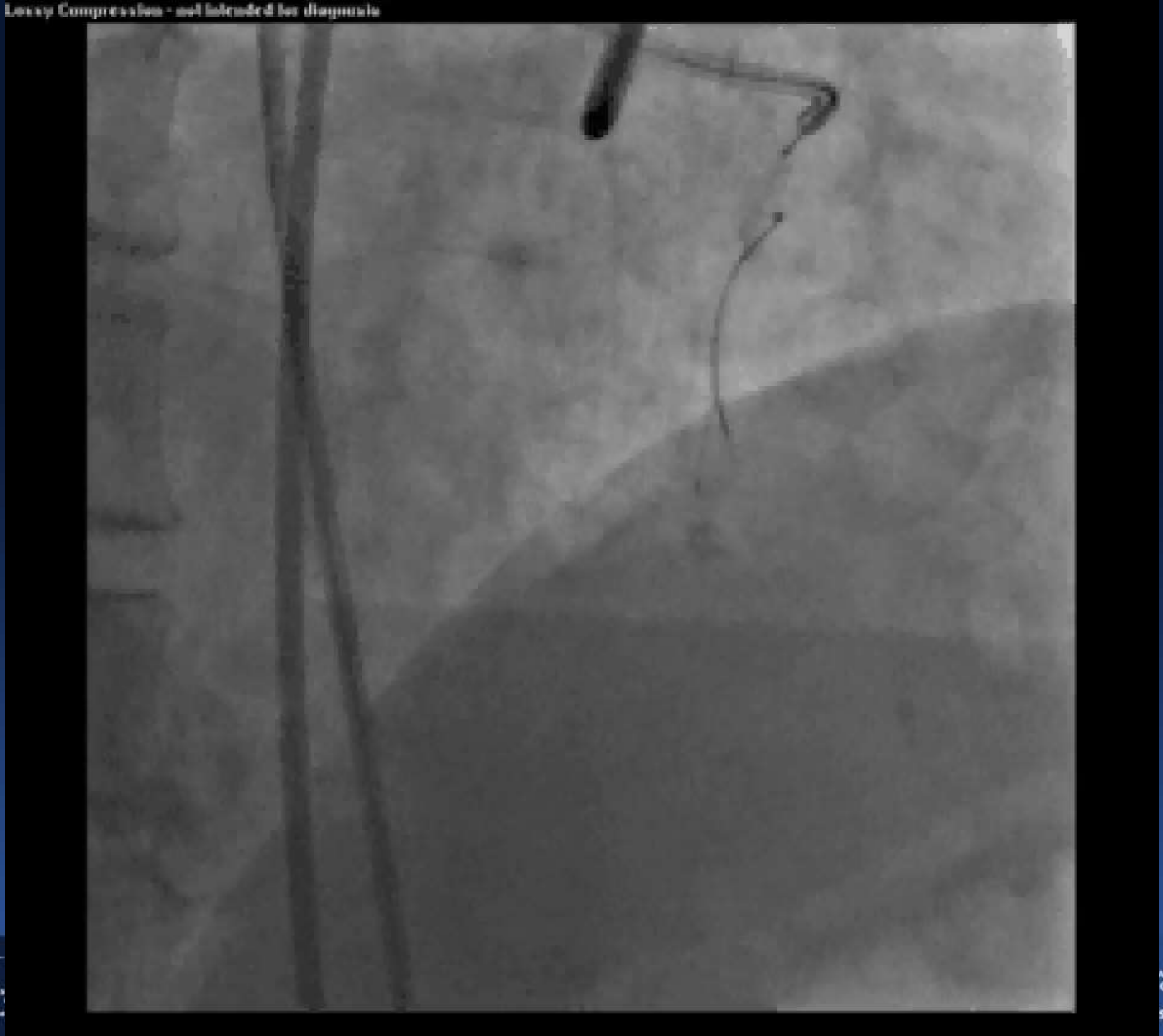


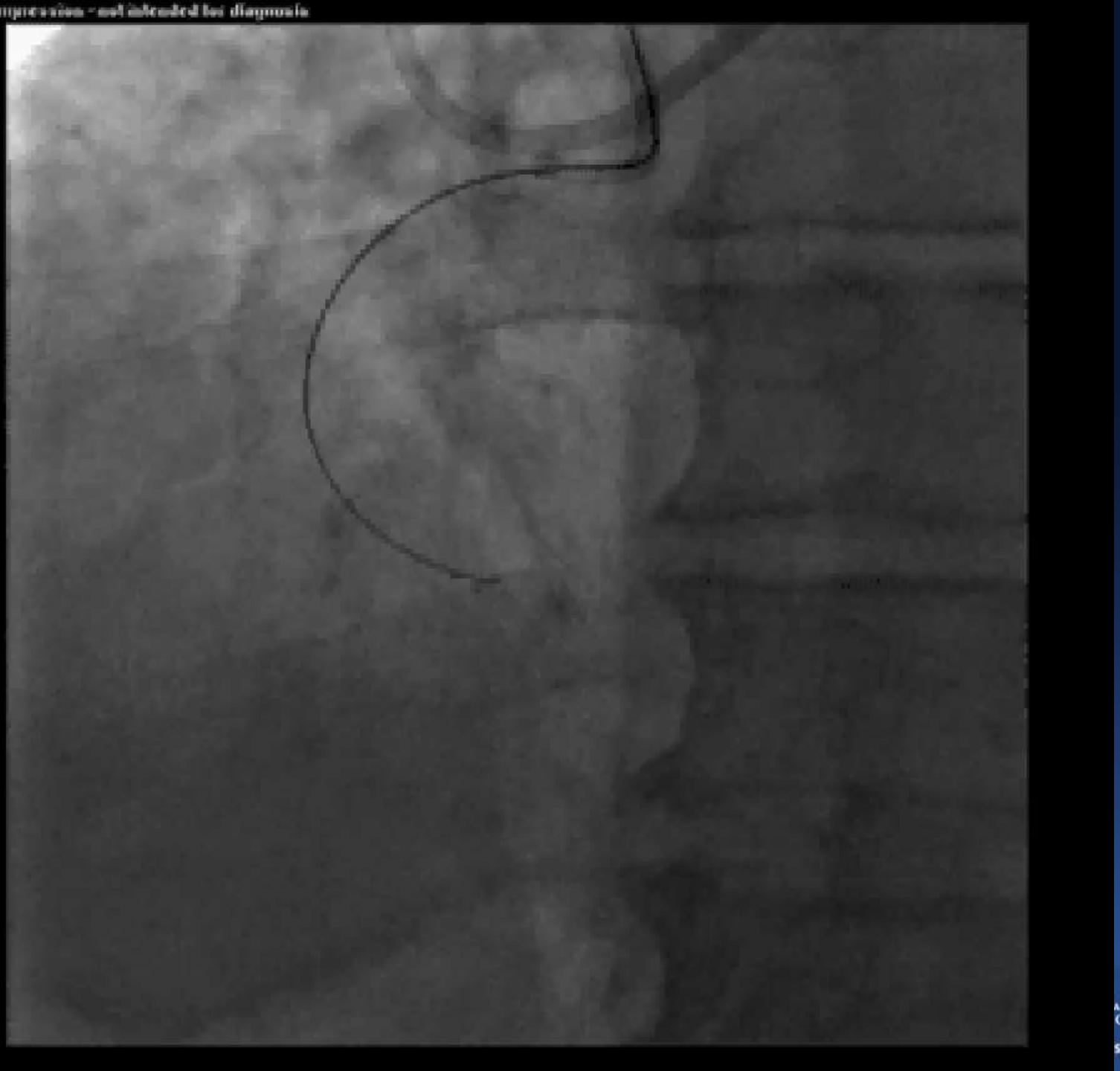

Lumen Compression - not intended for diagnosis




Lumpy Compression - not intended for diagnosis


Lossy Compression - not intended for diagnosis


Lossy Compression - not intended for diagnosis


Lossy Compression - not intended for diagnosis


Lossy Compression - not intended for diagnosis


Lossy Compression - not intended for diagnosis

The CTO “Toolbox”: Review of Hardware Design and Purpose

Basic Principles

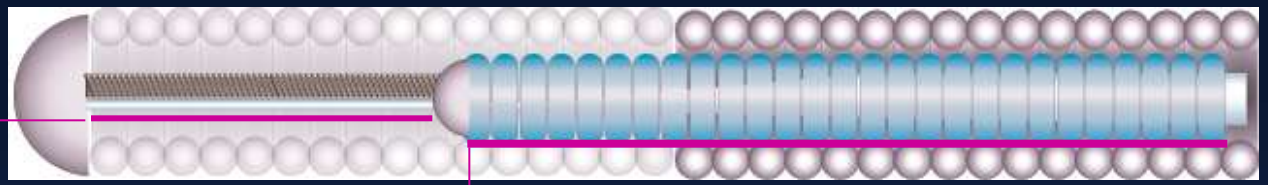
1. Deep Understanding of Equipment
2. Efficiency
3. Safety
4. Simplicity
5. Reproducibility
6. Reasonable Budget

- Sheaths
- Guides
- Support Catheters
- Wires
- Crossing Catheters
- Guide Support Systems
- Snares

Wires

- Fielder XT
- Fielder FC/Pilot 50
- Confienza Pro 12
- Pilot 200
- Sion
- Gaia
- Miracle Bro 12
- Externalization Wires

Composite Core



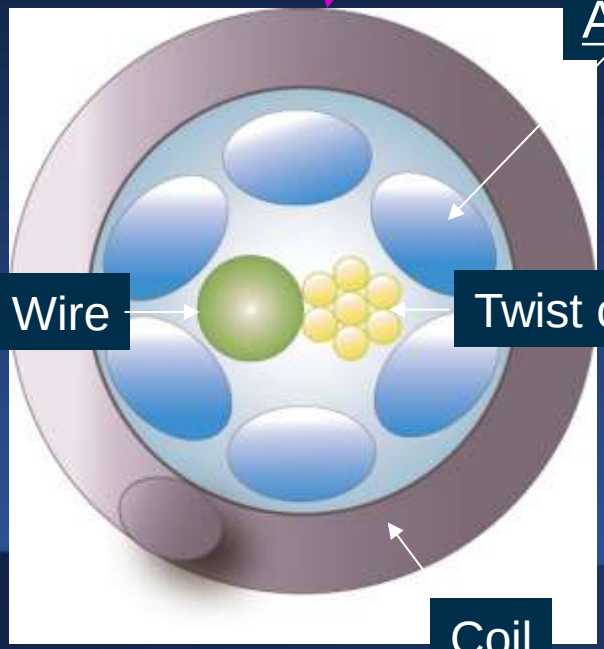
ACT ONE benefits

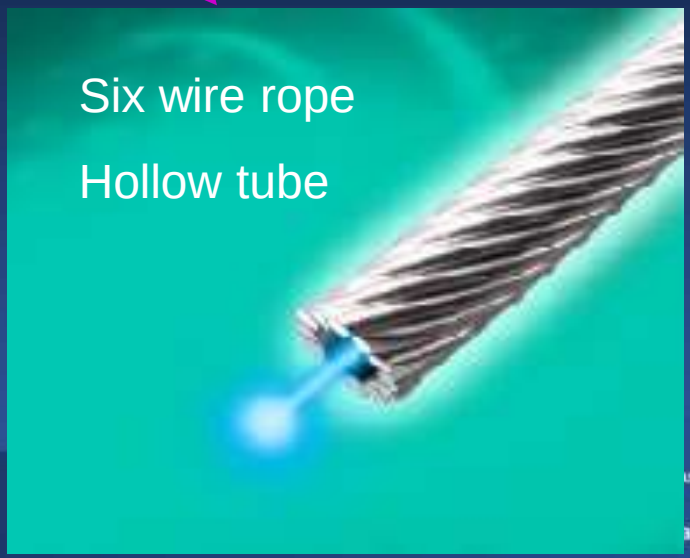
1. Shape protection
2. Torque transmission

Twist core benefits

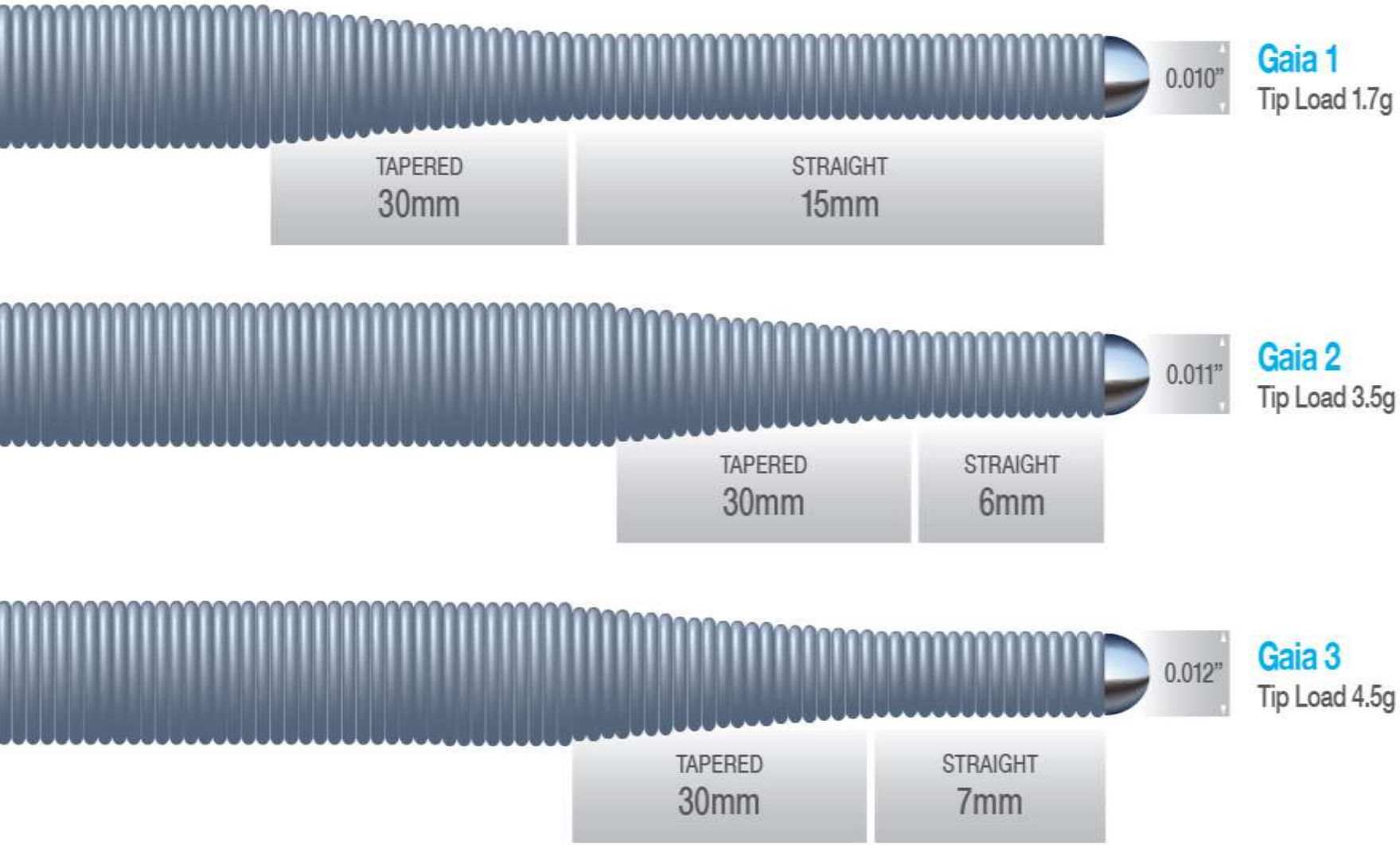
1. Stronger tip
2. Eliminates“ whipping”
3. Composite Core allows for a smaller core wire diameter

Composite Core



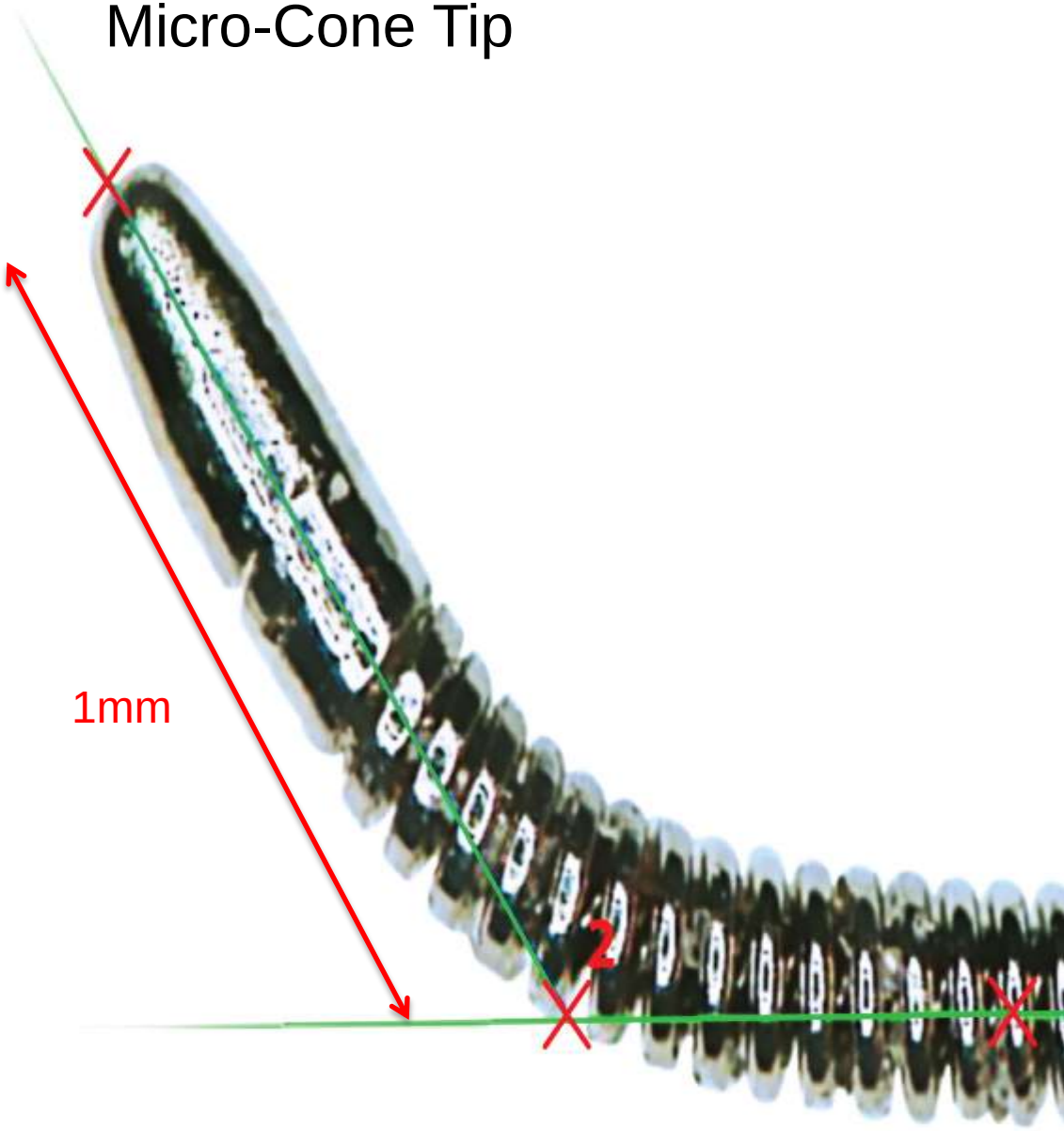


Gaia First / Second / Third

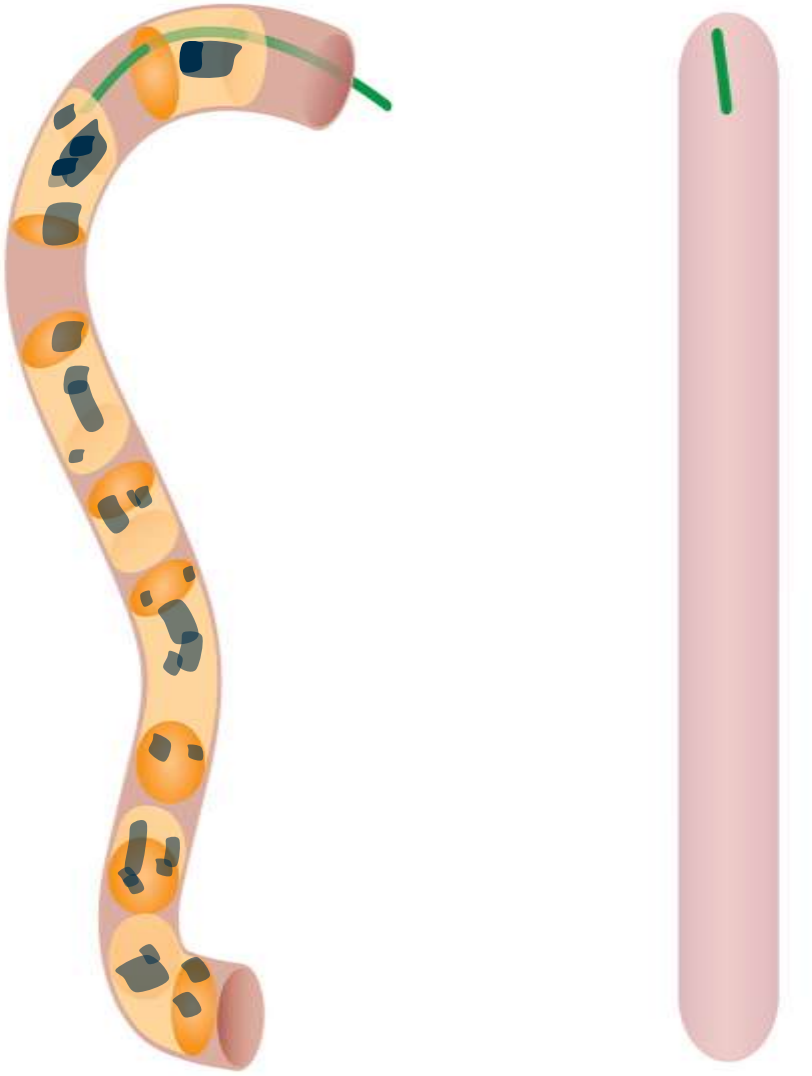


Conventional Guide Wire Tip

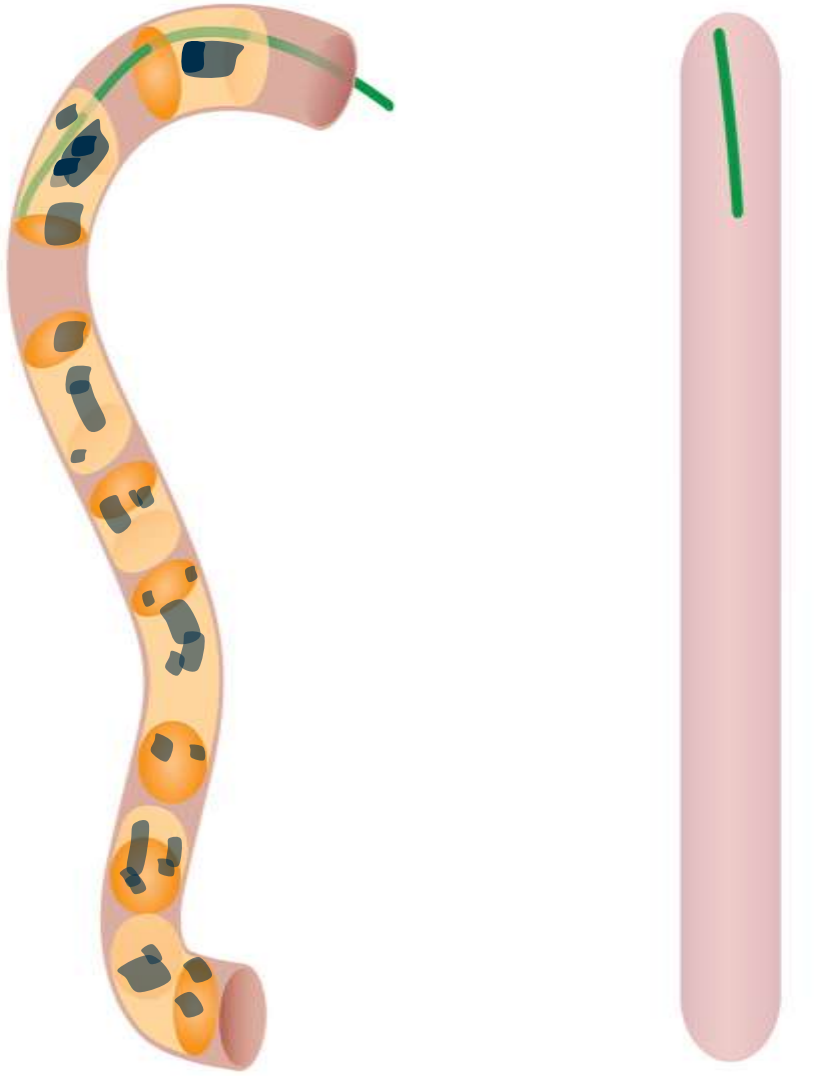
Gaia Wire: Micro-Cone Tip



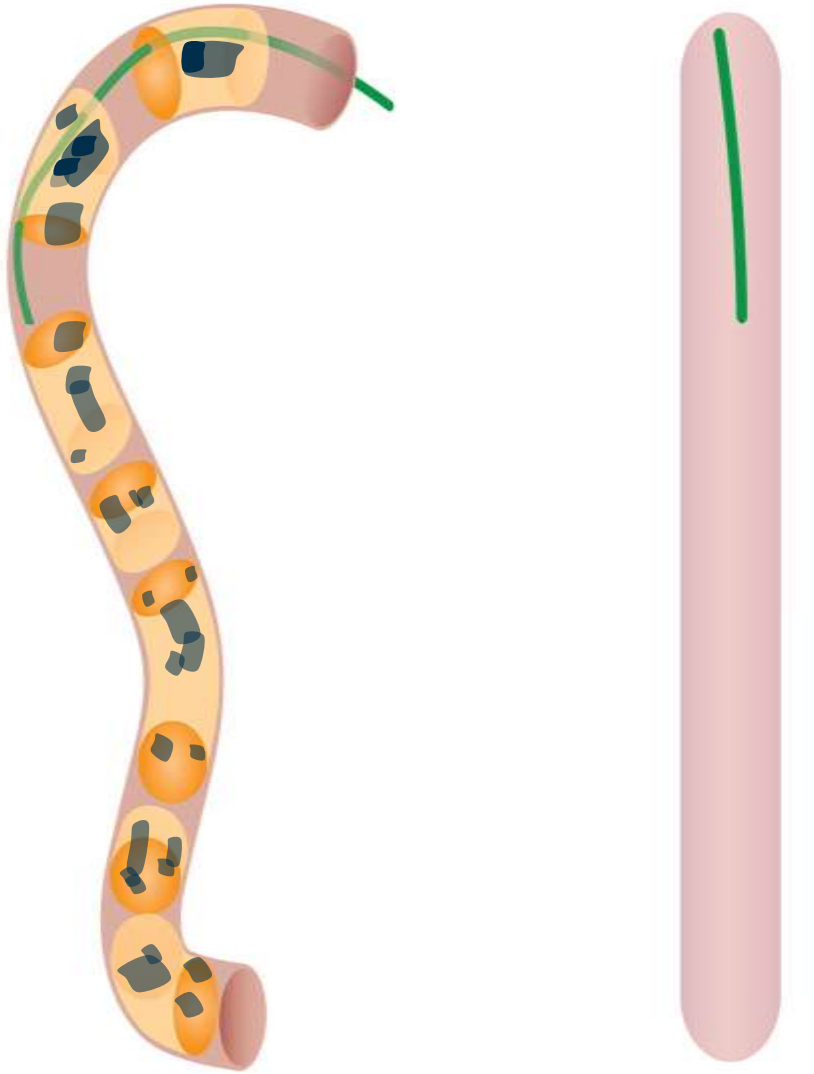
Angiographic views:



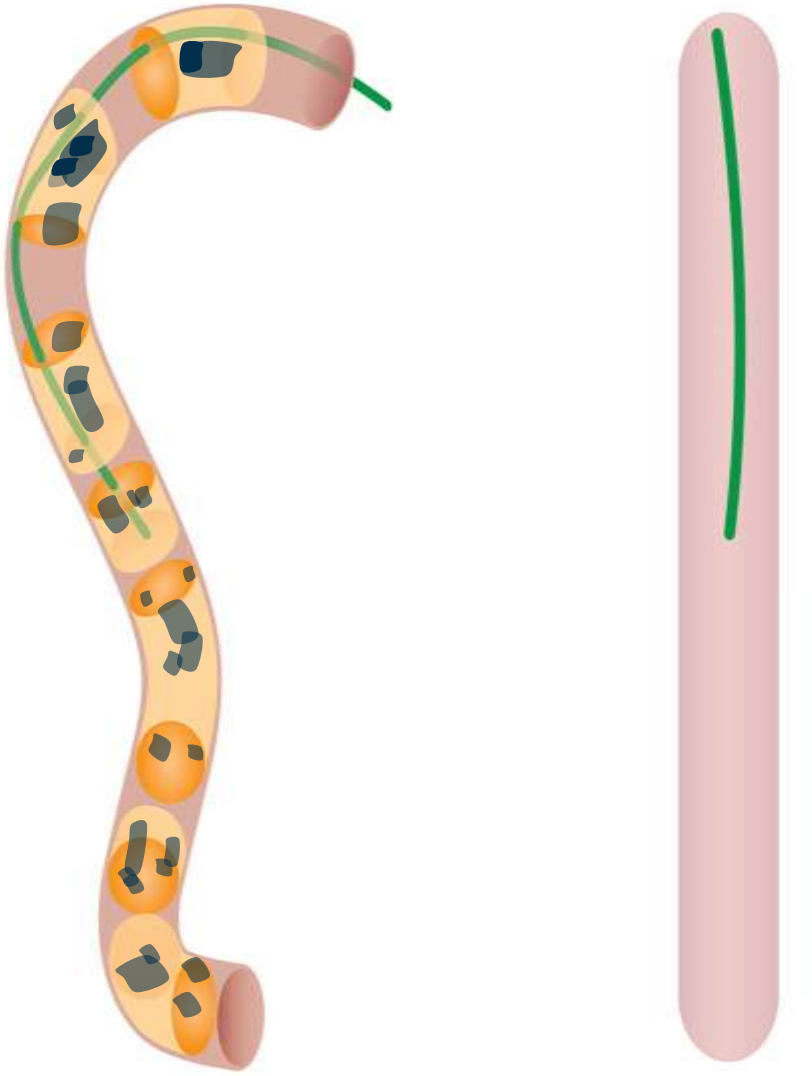
Negotiating intra-intimal plaque resistance



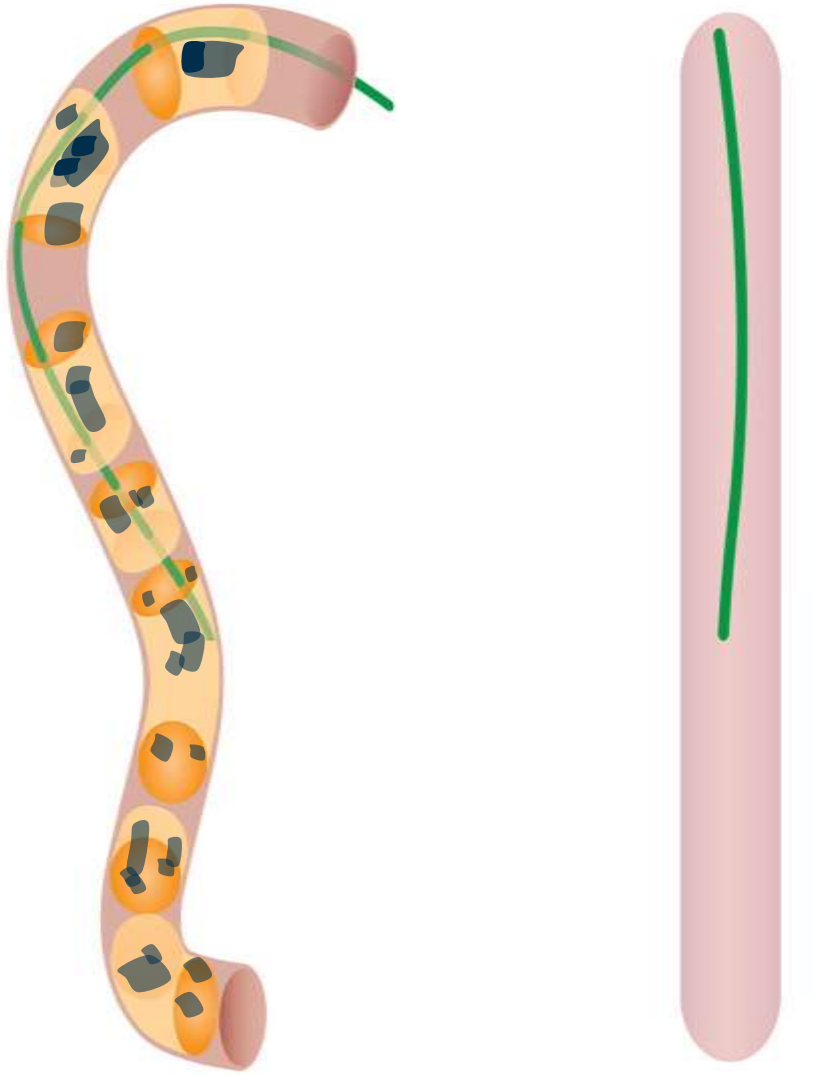
Negotiating intra-intimal plaque resistance



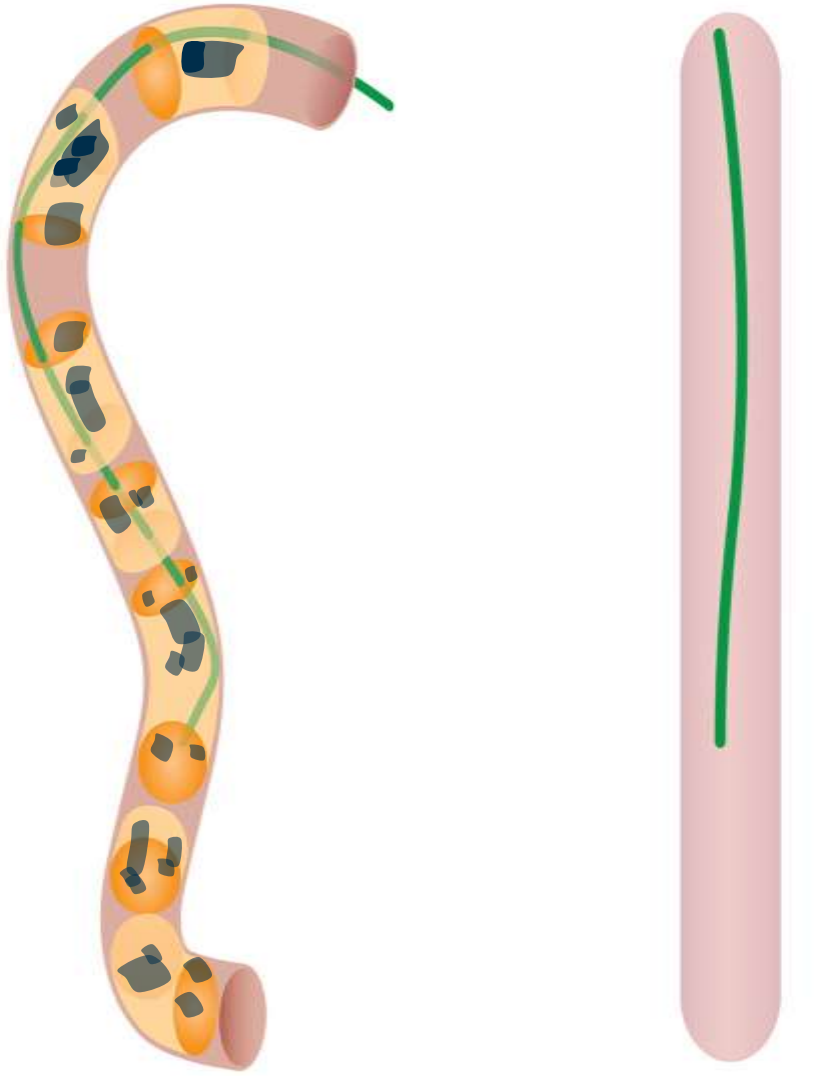
Negotiating intra-intimal plaque resistance



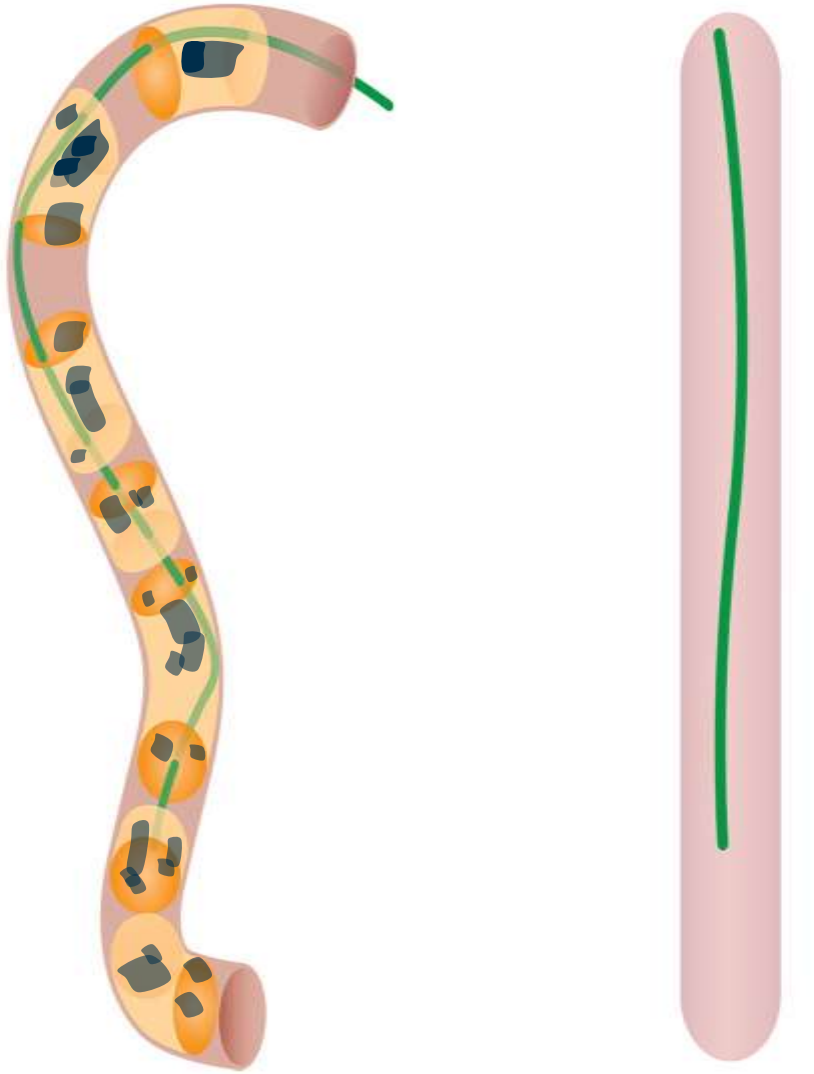
Negotiating intra-intimal plaque resistance



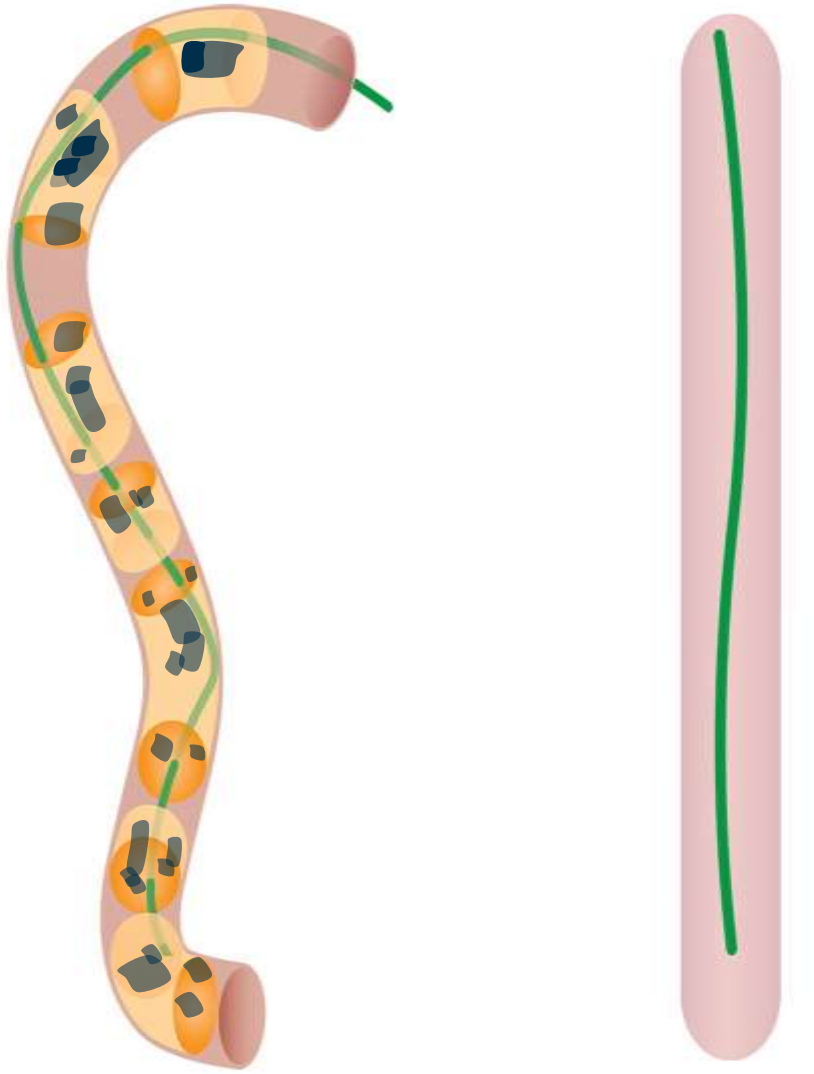
Negotiating intra-intimal plaque resistance



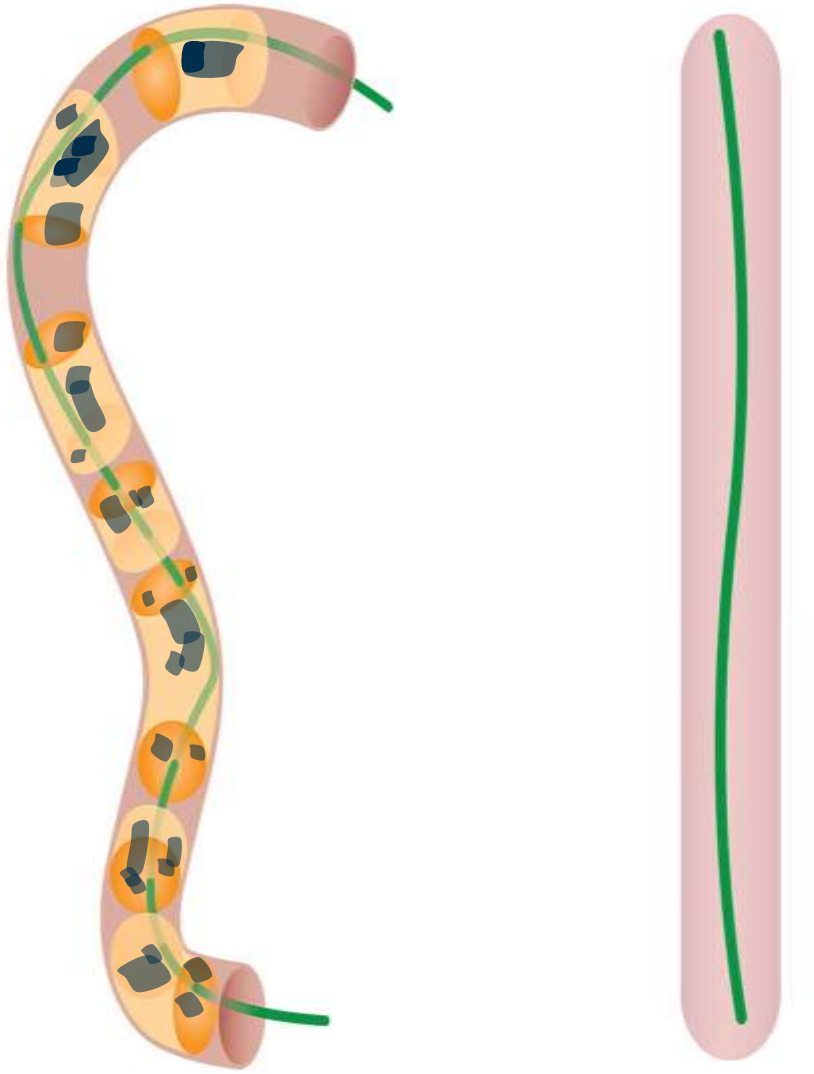
Negotiating intra-intimal plaque resistance



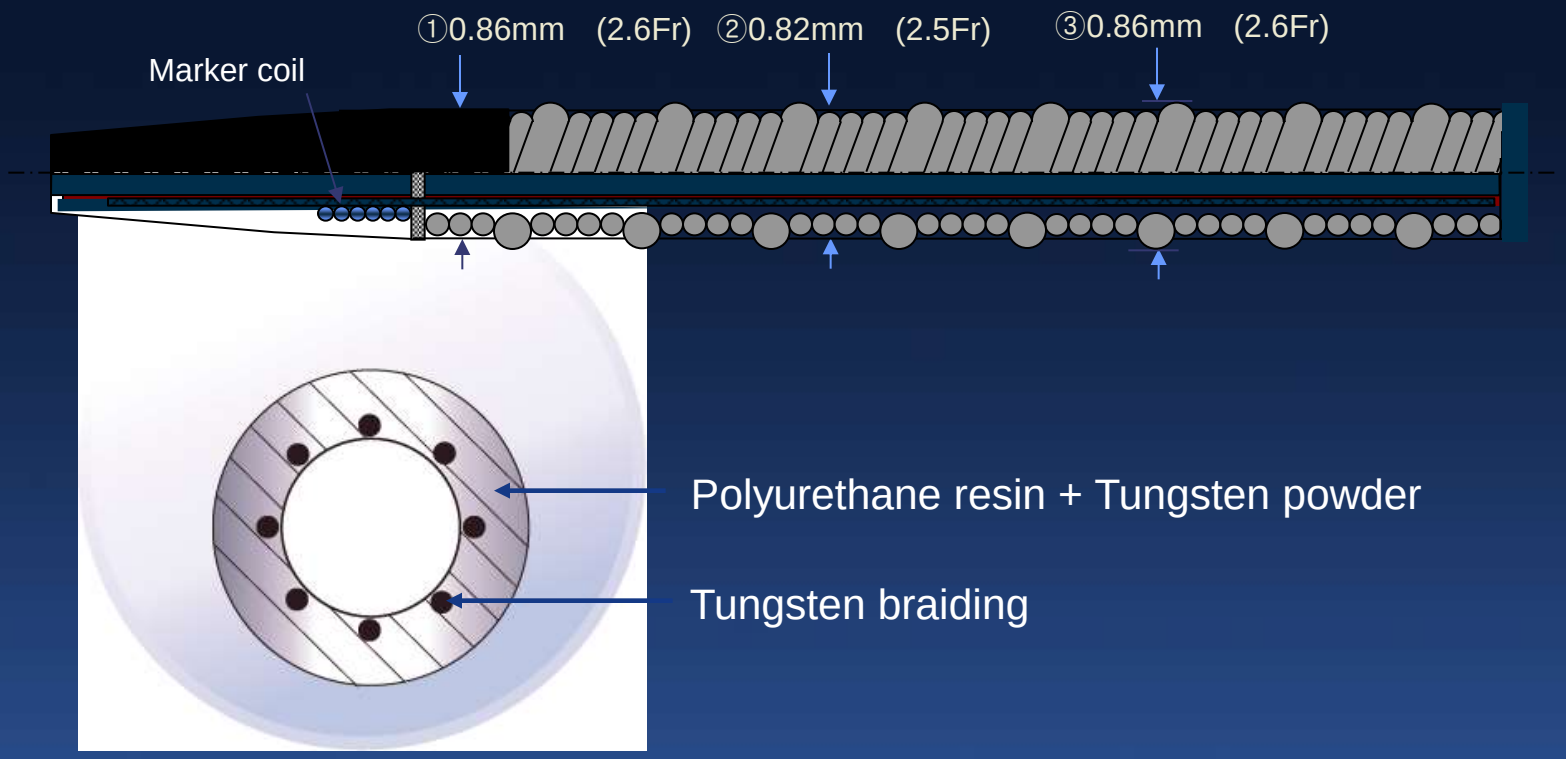
Negotiating intra-intimal plaque resistance



Negotiating intra-intimal plaque resistance



Corsair



Available in 135 mm (antegrade) and 150mm (retrograde) lengths.

ASAHI Caravel

Complex PCI

Caravel is easy to advance, just push

Caravel has an excellent **crossing profile** 1.9Fr

Braided wires maintain lumen diameter and guidewire performance

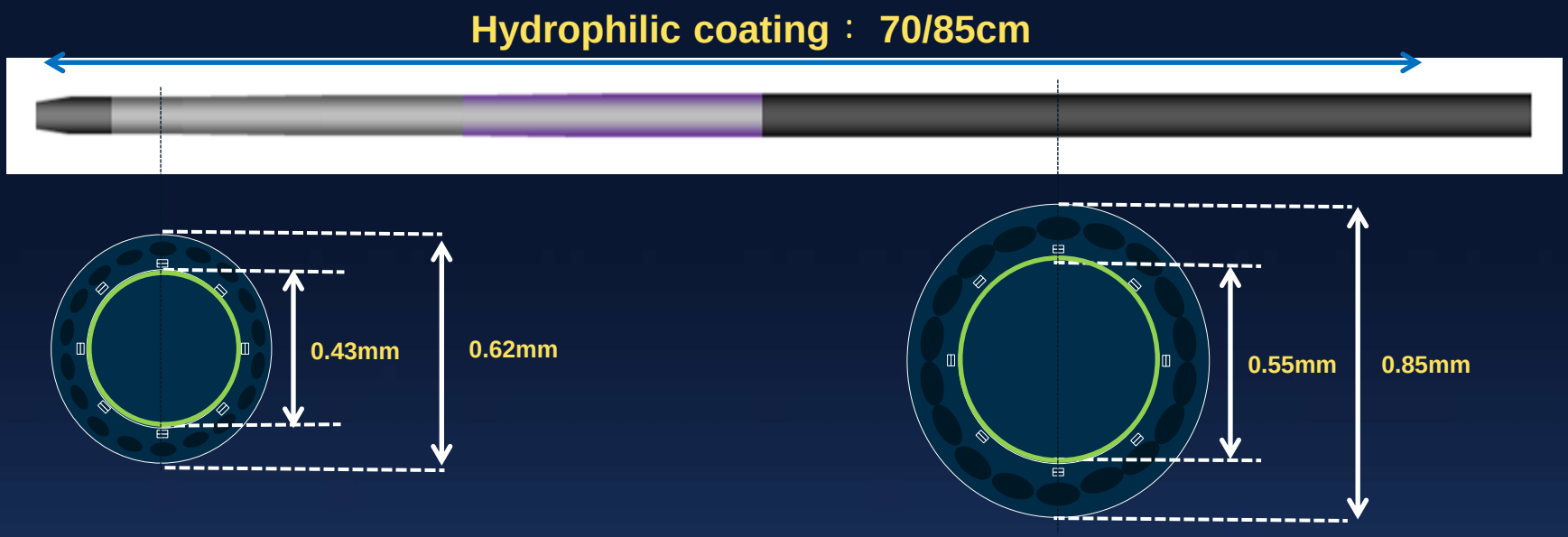
Antegrade Cases

When a lower profile support catheter is needed

Retrograde Cases

When you need to navigate very tortuous anatomy

Product structure



Products	O.D.			I.D.			Length	Coating Length
	Entry	Distal	Proximal	Entry	Distal	Proximal		
ASAHI Caravel 135cm	0.48 mm (1.4 Fr)	0.62 mm (1.9 Fr)	0.85 mm (2.6 Fr)	0.40 mm (0.016inch)	0.43 mm (0.017inch)	0.55 mm (0.022inch)	135cm	70cm
ASAHI Caravel 150cm	0.48 mm (1.4 Fr)	0.62 mm (1.9 Fr)	0.85 mm (2.6 Fr)	0.40 mm (0.016inch)	0.43 mm (0.017inch)	0.55 mm (0.022inch)	150cm	85cm

Low Profile

Tip tapers to 0.019”/ 1.4Fr
Excellent – 1.9Fr
Less Limitations on Device Selection

Excellent Tip Flexibility

Improves Tracking

ACT ONE® Precision Braided Shaft

Unique Braiding Delivers Flexibility Without Compromising Inner Lumen
Maintains Optimal Guidewire Performance

Turnpike catheters

Components

Unique dual-layer, bidirectional coil over braid provides the ultimate combination of flexibility with torque response

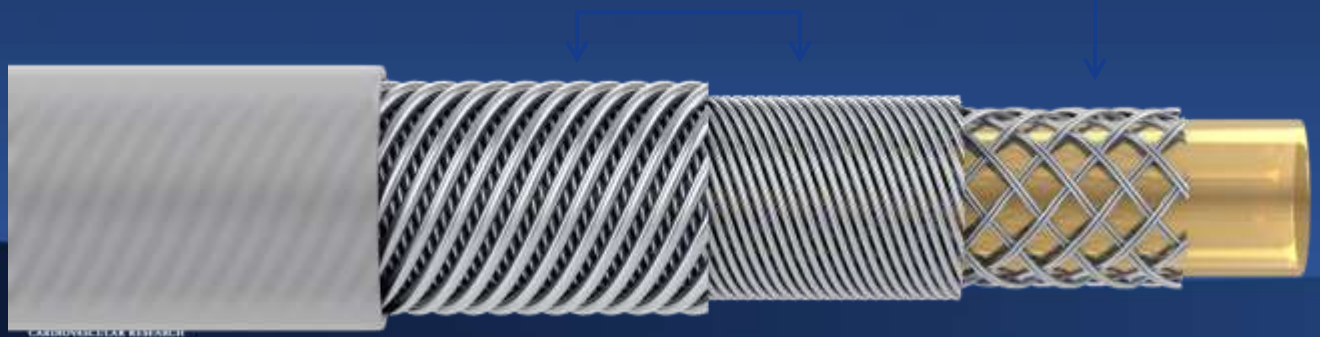
Turnpike
Turnpike Spiral
Turnpike Gold

Polymer outer layer for smooth outer surface

Dual-layer, bidirectional coil for kink-resistance with torque

Braid for longitudinal strength

PTFE liner for excellent guidewire movement

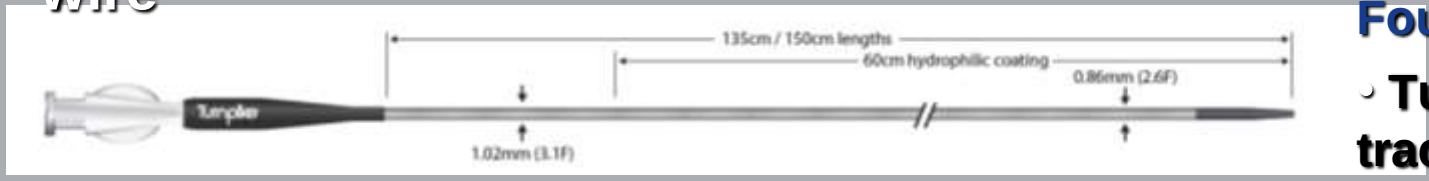


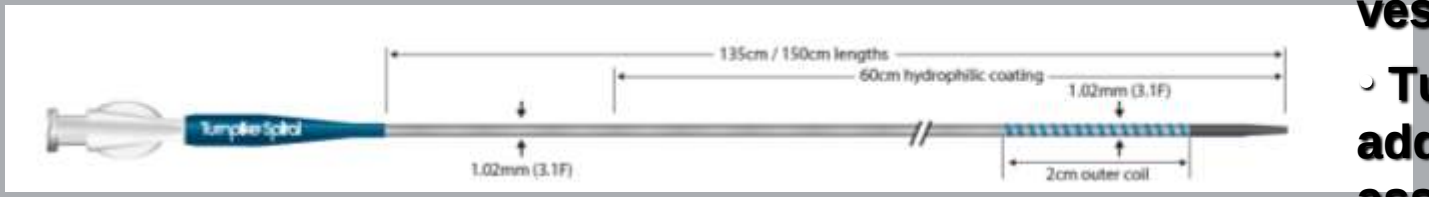
Turnpike LP

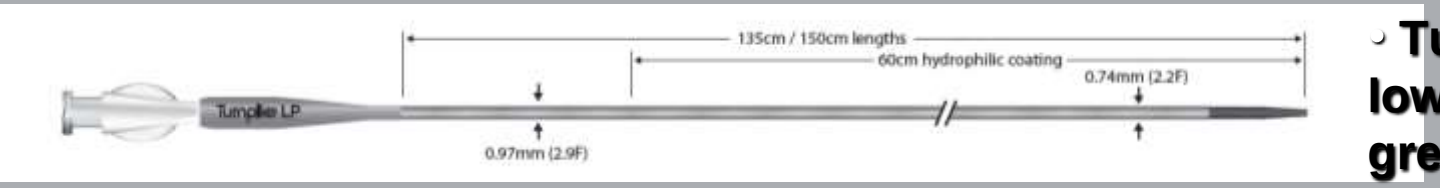
Columbia University Medical Center
NewYork-Presbyterian

Overview

OTW catheters with dual-layer coil + braid shaft design for superior flexibility and torque for delivery over a 0.014" wire





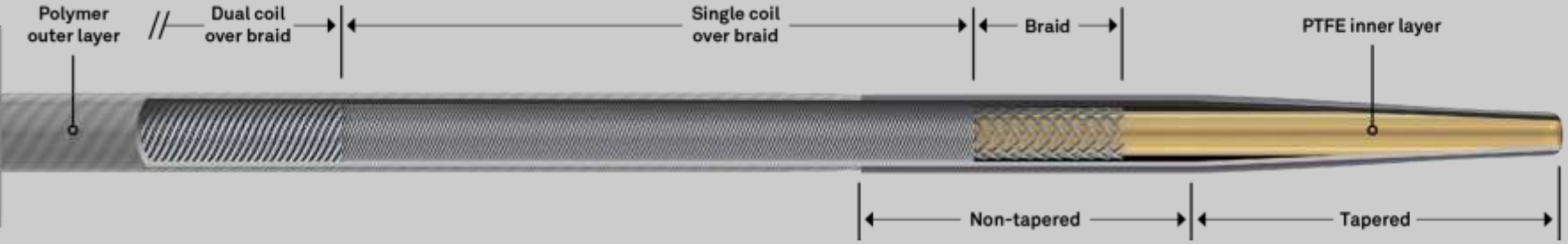


Four versions:

- **Turnpike for superior tracking in tortuous vessels**
- **Turnpike Spiral for additional rotational assistance**
- **Turnpike Gold for enhanced advancement through lesions**
- **Turnpike LP for lower profile with greater tip and distal shaft flexibility**

Turnpike LP

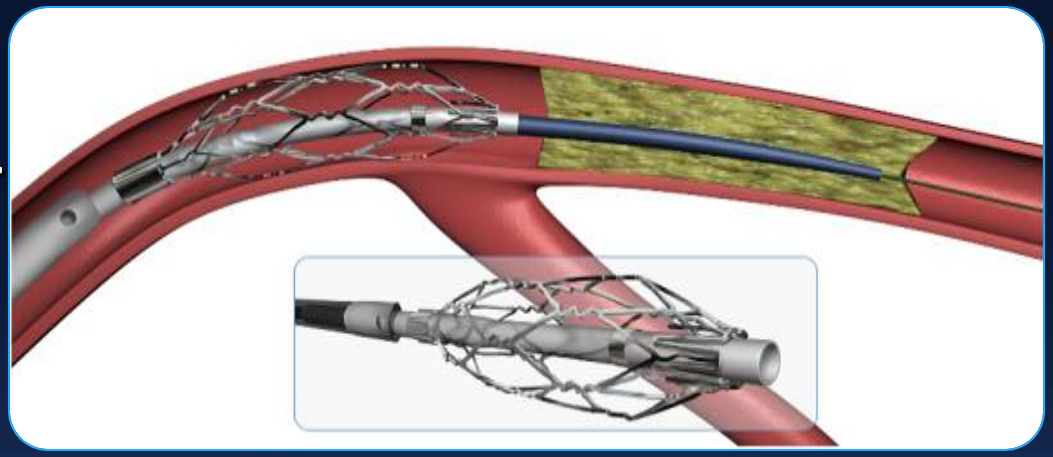
- Low-profile version provides greater tip and distal shaft flexibility for advancement through extreme tortuosity

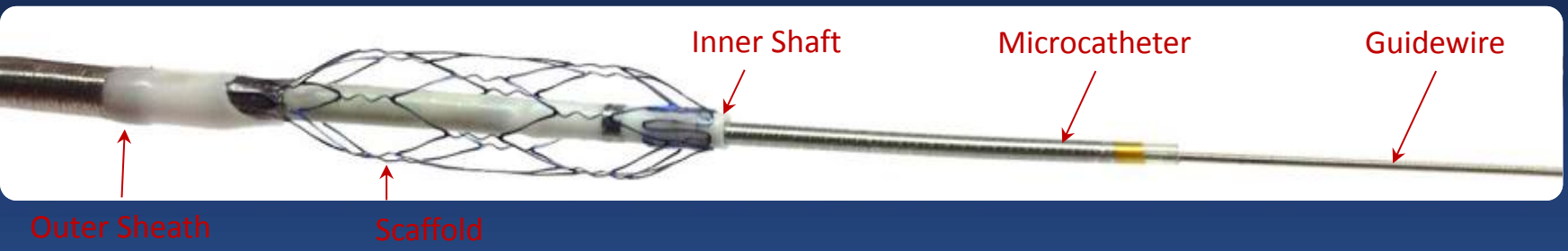


Dual coil tapers down to single coil 21cm proximal to distal tip for increased flexibility

Amplified Support – Anchoring and Centering

- CenterCross™
  - Self-expanding anchor
  - Coaxial alignment
  - Central 3F lumen



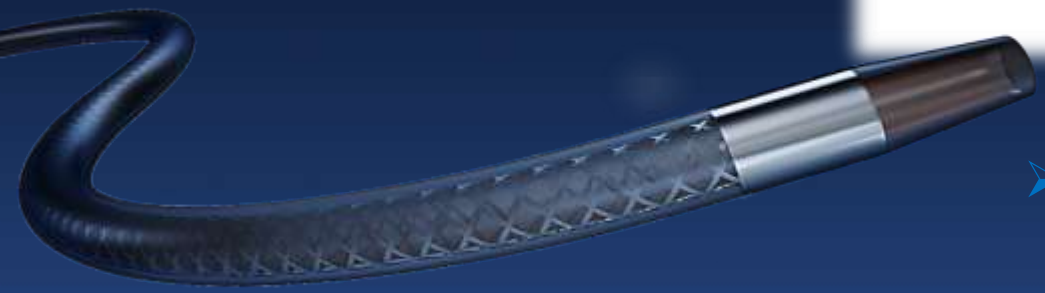


Simplified Luminal Crossing

Roxwood Medical – Micro 14/18

Micro14

- **1.6F tip, 2.5F body**
- **155cm**, 0.014” GW compatible
- Variable-pitch braided shaft
- Low profile + Torque



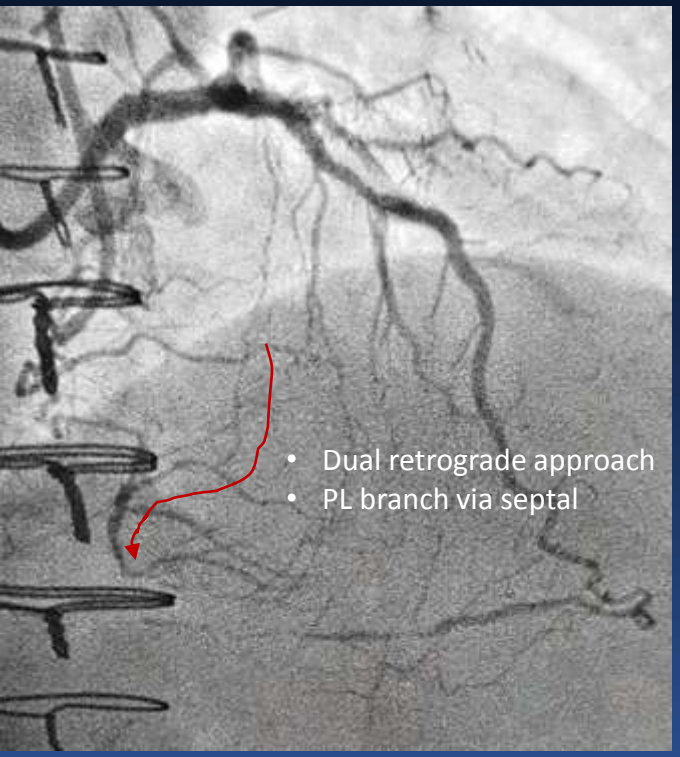
Micro18

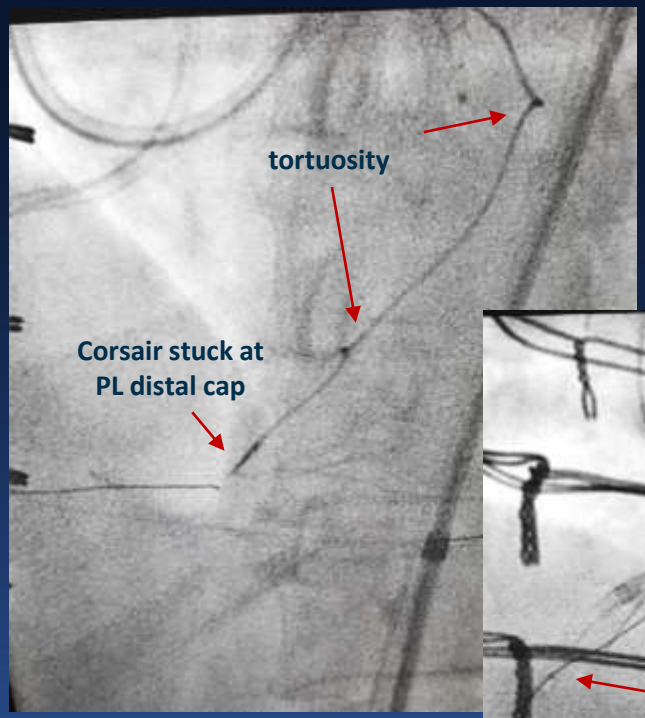
- **1.9F tip, 2.8F body**
- **155cm** , 0.018” GW compatible
- Variable-pitch braided shaft
- Low Profile + Torque

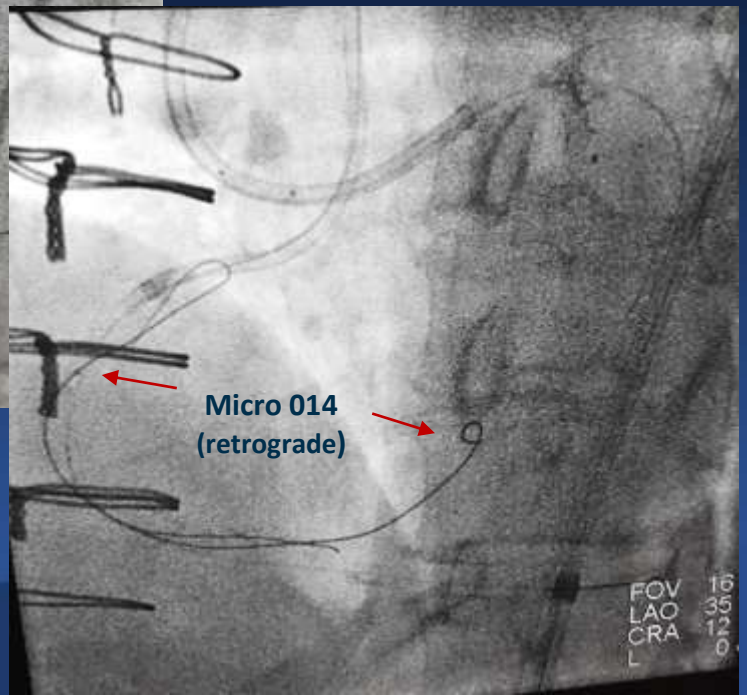
❖ *Ultra low-profile* ❖ *State-of-the-art Serene™ coating* ❖ *Ultimate trackability*

Micro14 – Trans-septal Retrograde

Target	Stenosis	Occlusion
RCA via PL (Retrograde)	**Flush RCA Occlusion**	**80+mm**







CARDIOVASCULAR RESEARCH FOUNDATION
A Passion for Innovation

Twin-Pass
dual access catheters

Dual Access Catheters

Two lumens for distal access with rapid exchange convenience

Rx ONLY

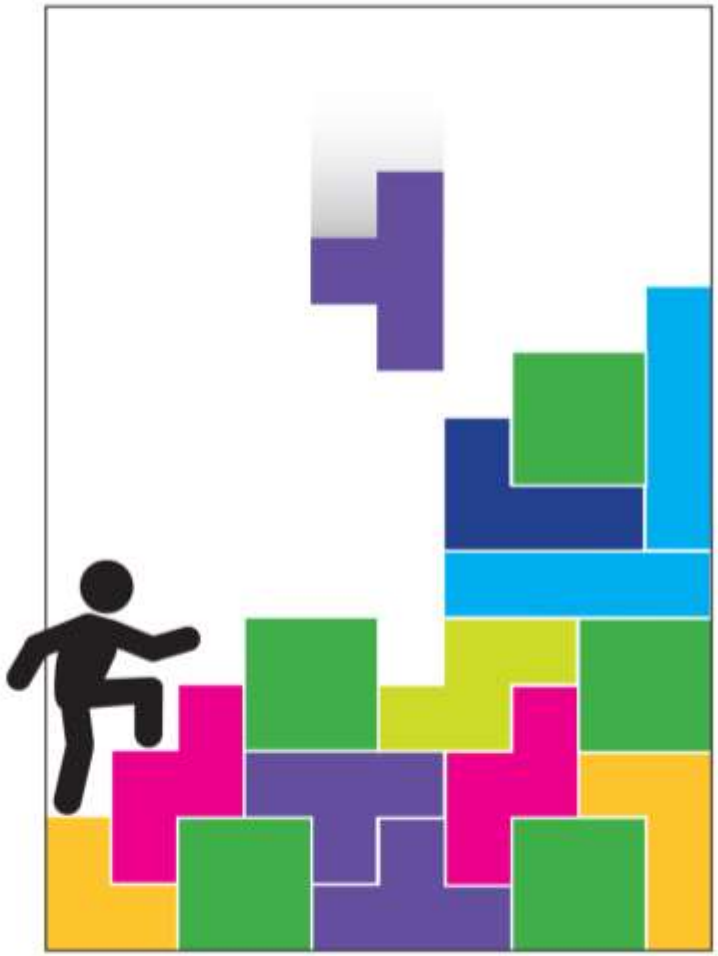
Columbia University Medical Center
NewYork-Presbyterian

Be Prepared for BADNESS

- Coils
- Covered Stents
- Beads/Microspheres
- Thrombin
- Circulatory Support

REMEMBER

- The BEST GEAR is YOUR BRAIN
- Always Show your Superior Judgment
- So that You DON'T HAVE TO SHOW YOUR SUPERIOR SKILLS
- Know WHEN TO QUIT and Return Another Day



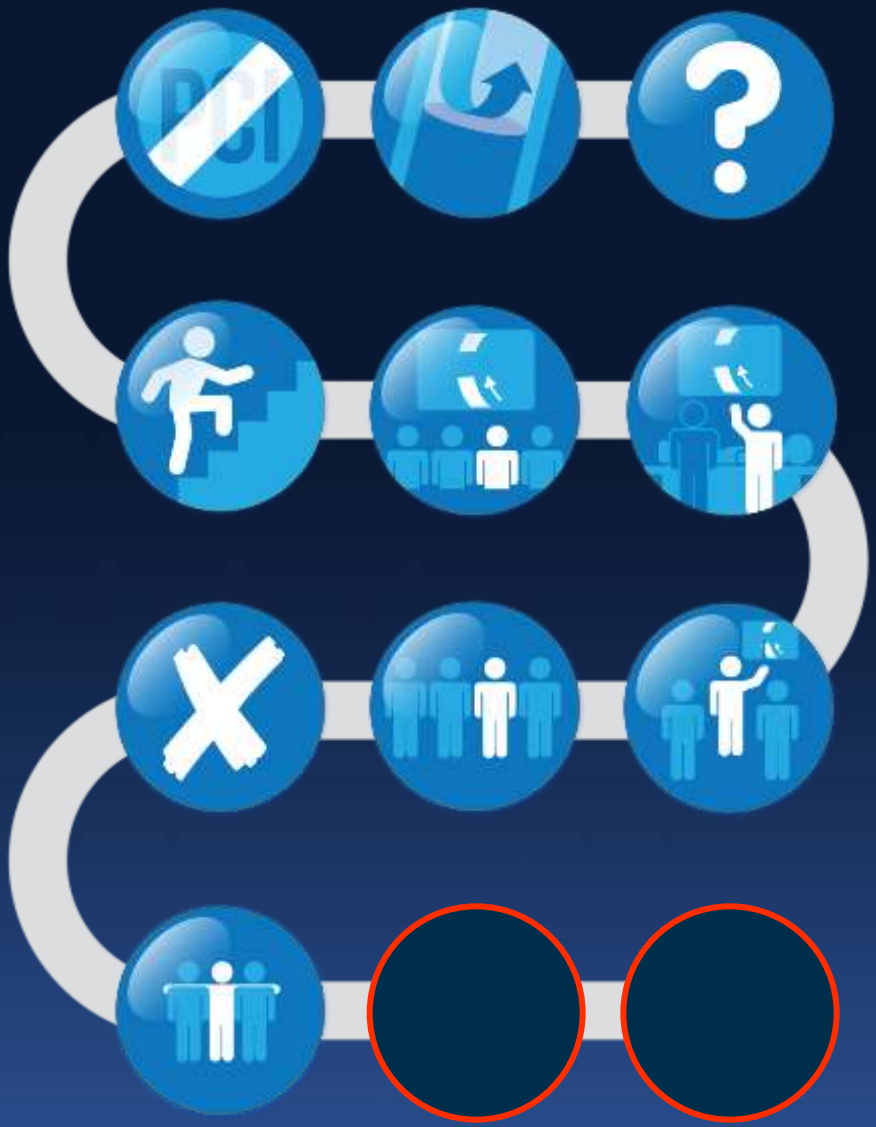
Meetings

Proctoring

Online Education

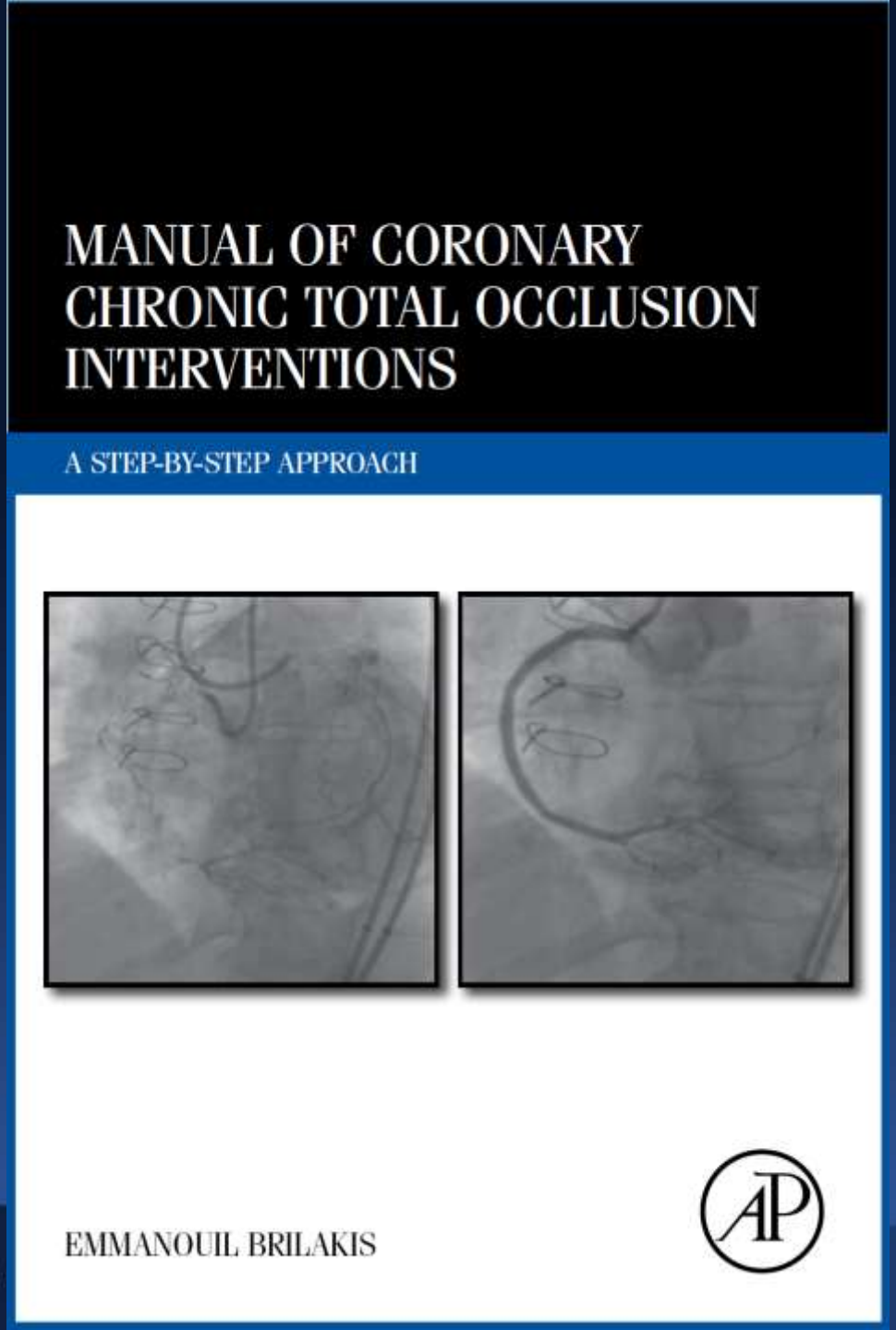
Workshops

iBooks`



CTO

CTOFUNDAMENTALS.ORG



Release: TCT 2013

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NewYork-Presbyterian