A Glossary of CTO PCI Techniques and Skills

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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

The CTO Conundrum…

- 55 y.o male with HTN, HLD
- 4 months of exertional angina
- Nuclear stress test positive for inferior wall ischemia with normal EF

c/o D. Karmpaliotis

A Different Patient… His identical twin

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- 4 months of exertional angina
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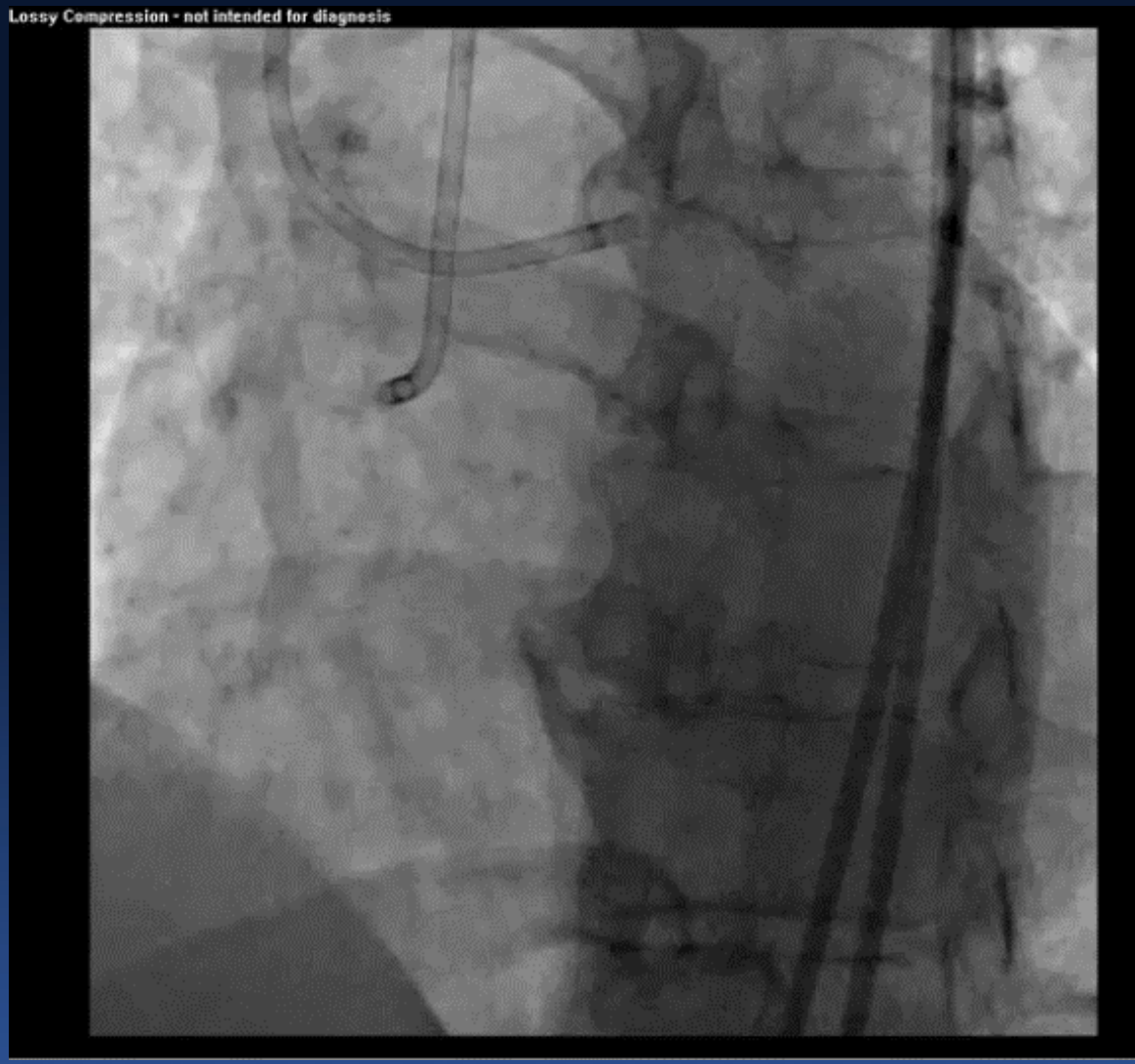


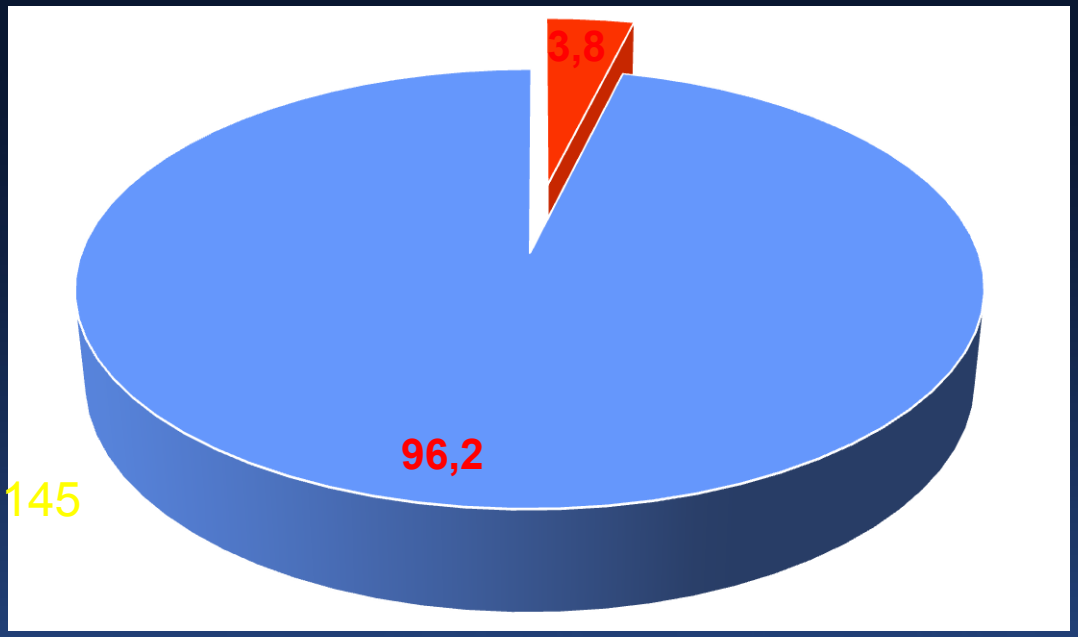
Why Do We Treat This So Differently?

c/o D. Karmpaliotis

NCDR®
NATIONAL CARDIOVASCULAR DATA REGISTRY

594,510 procedures

22,365



234 of 1,387 sites (17%) never performed CTO PCI
Operators % CTO PCI IQR: 0.3% to 4.9%

Brilakis et al, JACC Cardiovasc Intv 2014 – in press

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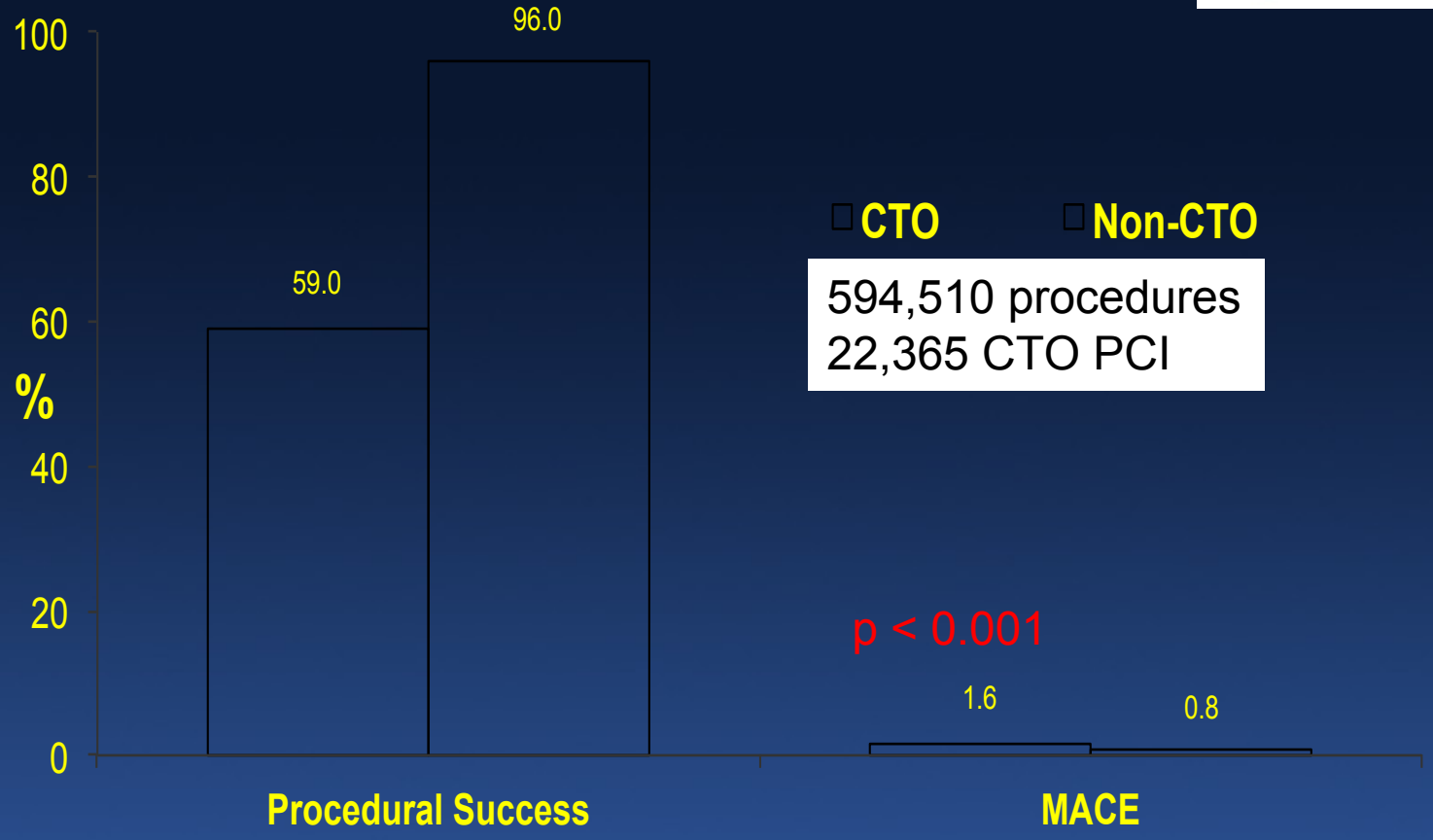
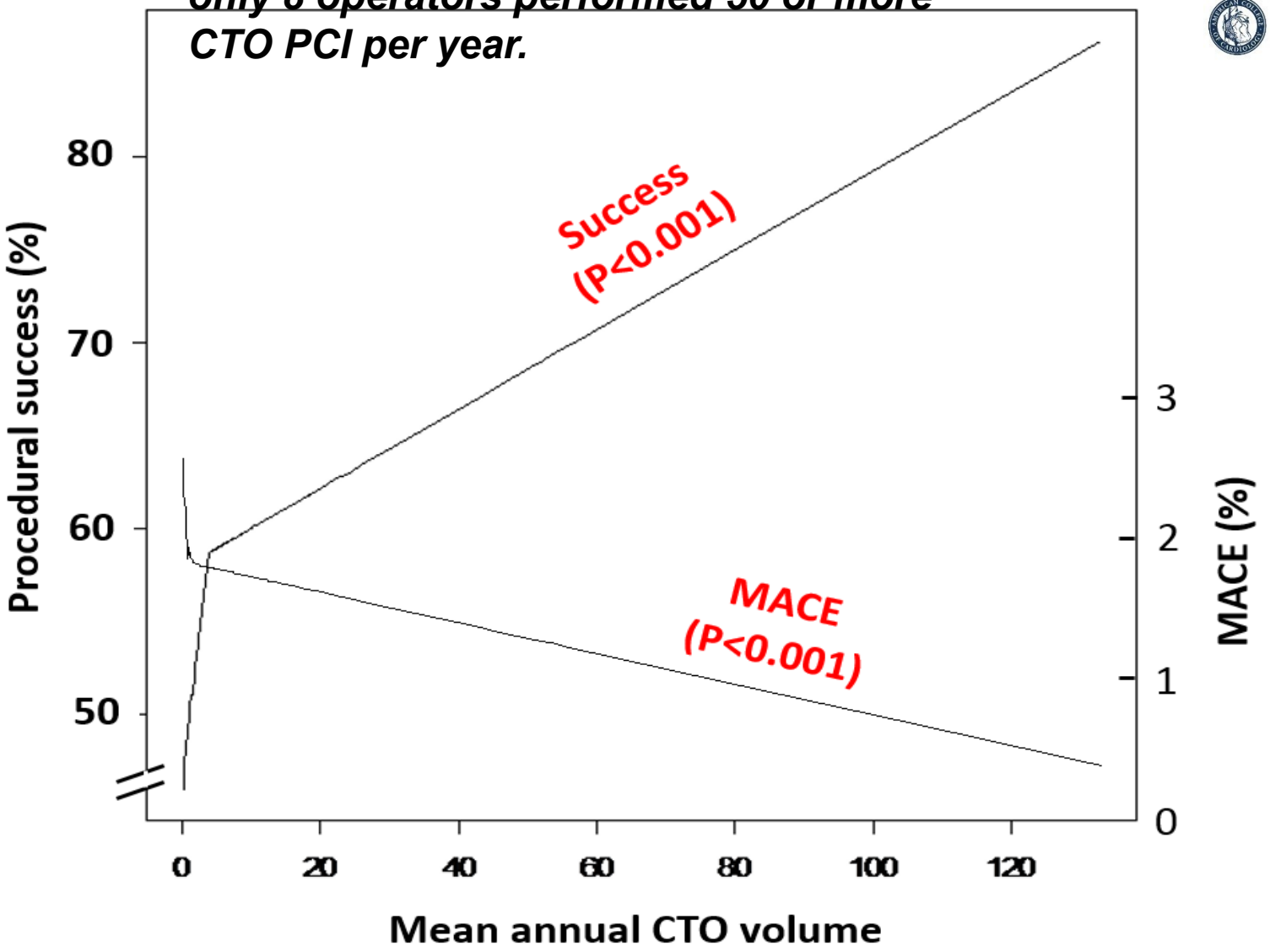
Procedural success and MACE



Brilakis et al, JACC Cardiovasc Intv 2014 – in press

only 8 operators performed 50 or more CTO PCI per year.



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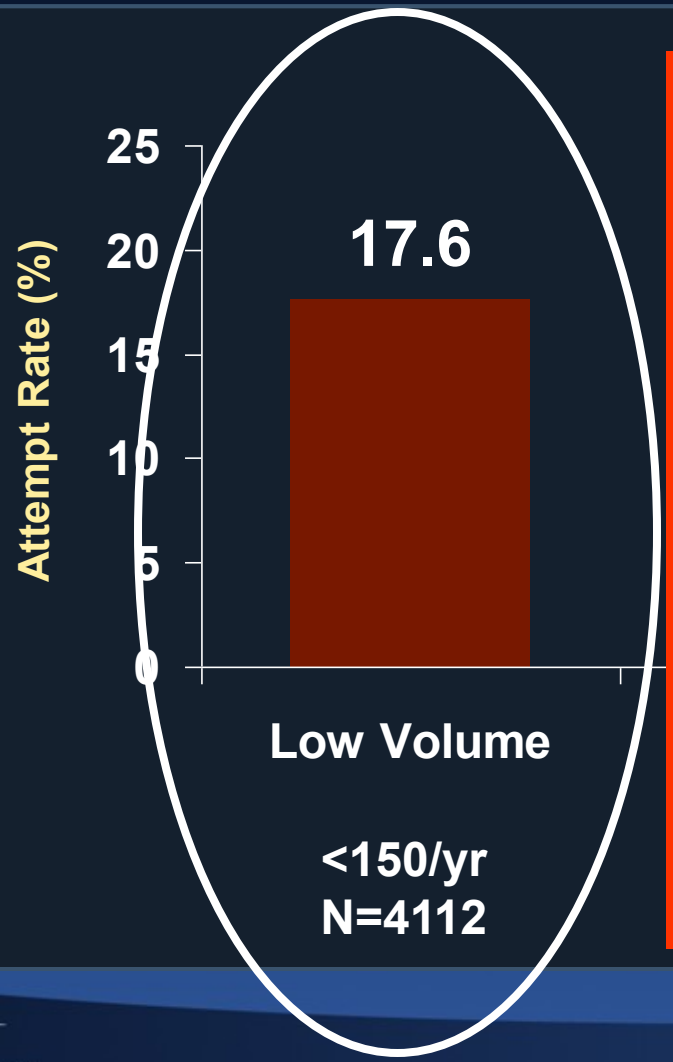
Who Is Performing my CTO PCI?
ACC/NCDR Database: 45,826 CTO Patients



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

Grantham et al, I2 Summit 2007

Reasons Interventionalists Do Less CTO PCI Than We Should

- Complexity is greater and training is less
- Success rates of CTO procedures are lower
- Risks of CTO procedures are potentially higher
- Time/Costs

Many operators shun CTOs because they feel that CTO PCI is inherently more risky (and less successful than standard PCI), and the benefits are less clearly intuitive

Fundamentals of CTO PCI in 2015

- The indications for the case do not change just because the lesion is "harder to treat"
  - The risk/benefit equation can be modified with CTO-specific training and techniques!

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

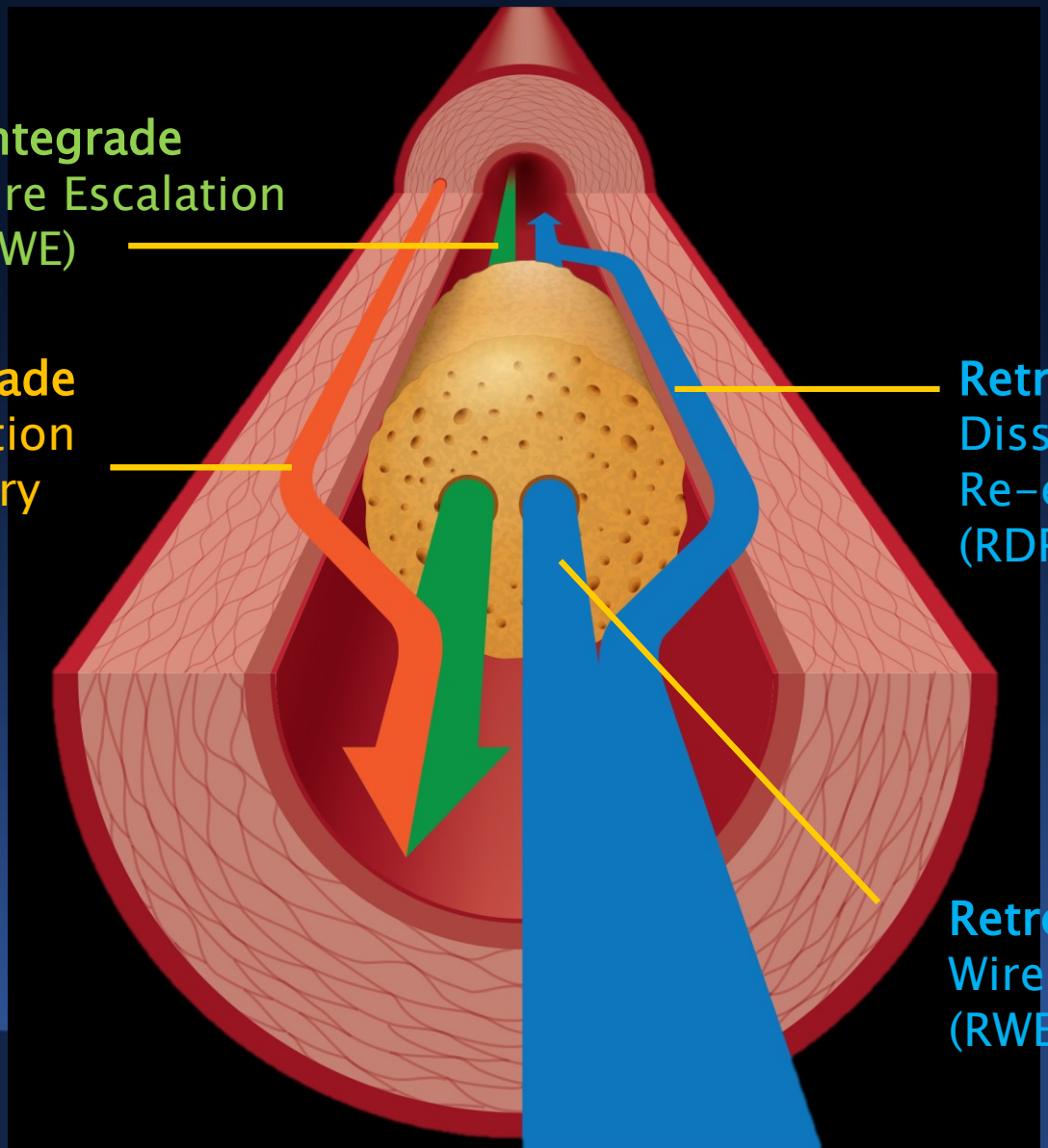
Grenedoplasty/BAM

VDAR

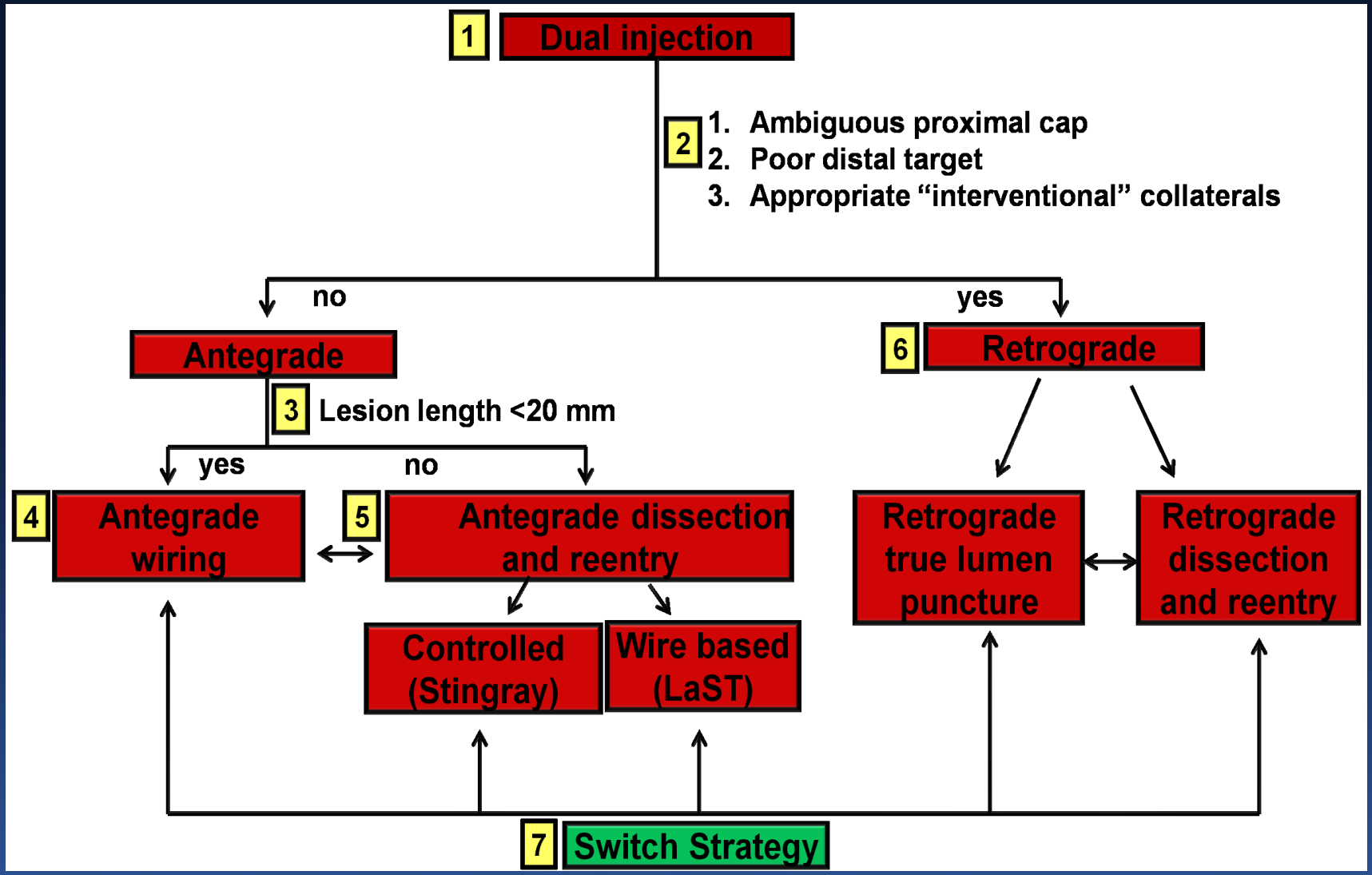
SKRAT

Landing Zone/Management of the Landing Zone

4 options to crossing CTOs

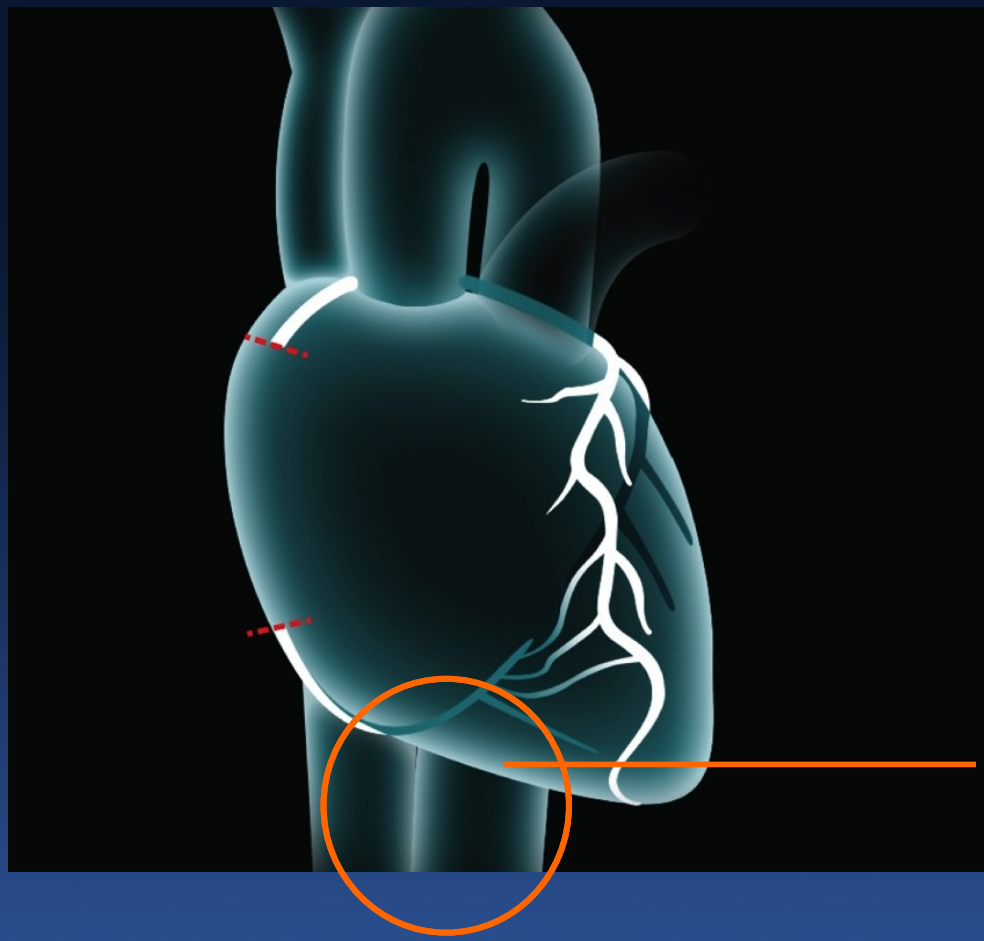


Hybrid Strategy Treatment Algorithm



Brilakis et al.

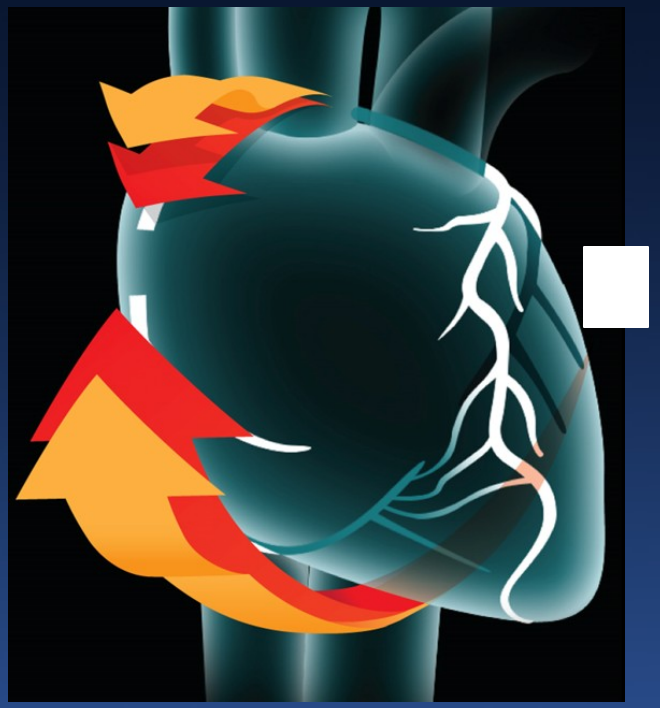
JACC: CARDIOVASCULAR INTERVENTIONS, VOL. 5, NO. 4, 2012
APRIL 2012:389–92



Degree of disease in the distal “landing zone”

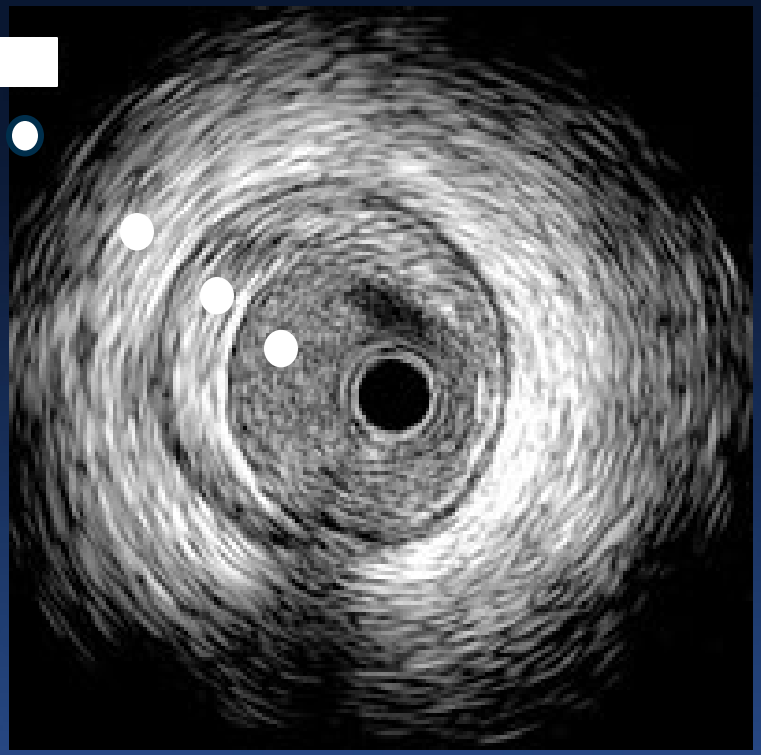
Base of Operation

- 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



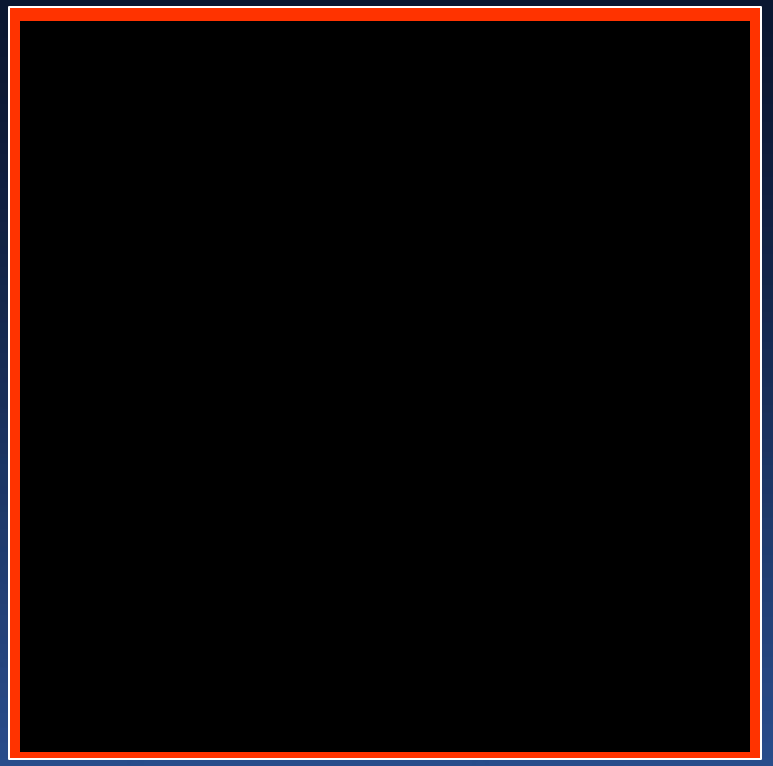
Vessel Architecture

- 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

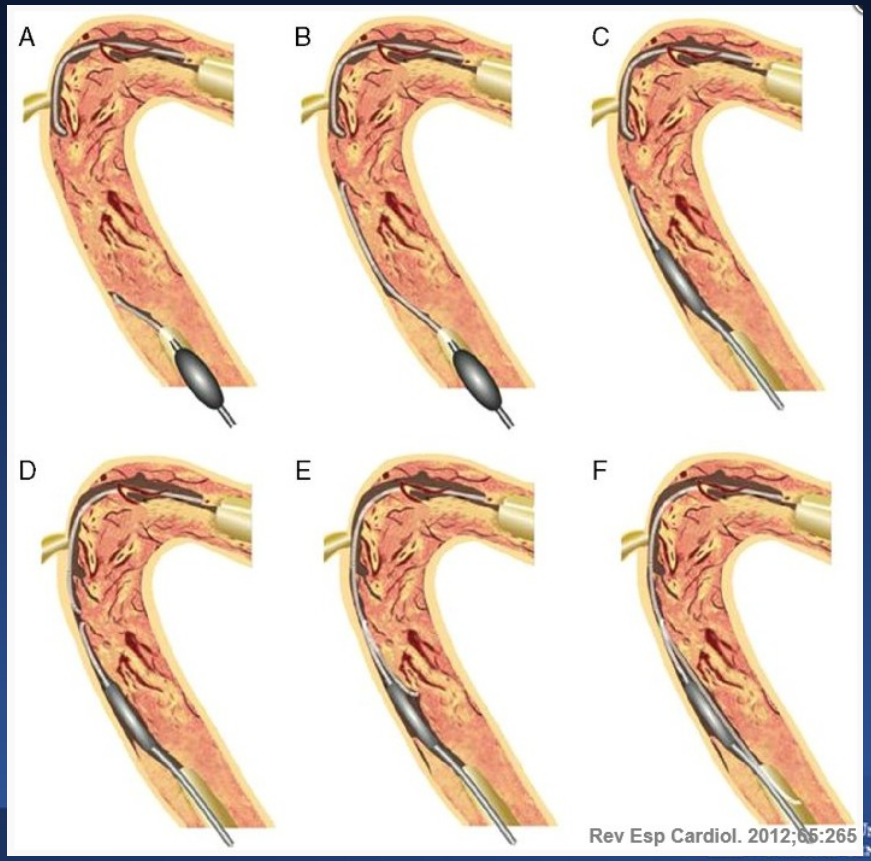
- Creating a blunt dissection tool by forward advancing a polymer-jacketed guidewire (Fielder XT or Pilot 200) until it prolapses on itself to form a tight loop which can be advanced past the occlusion in the suboptimal space



CART

Controlled Antegrade and Retrograde Tracking

- Technique to facilitate re-entry of the antegrade wire into the distal true lumen by balloon inflation over the retrograde guidewire creating a space for the antegrade guidewire to be advanced

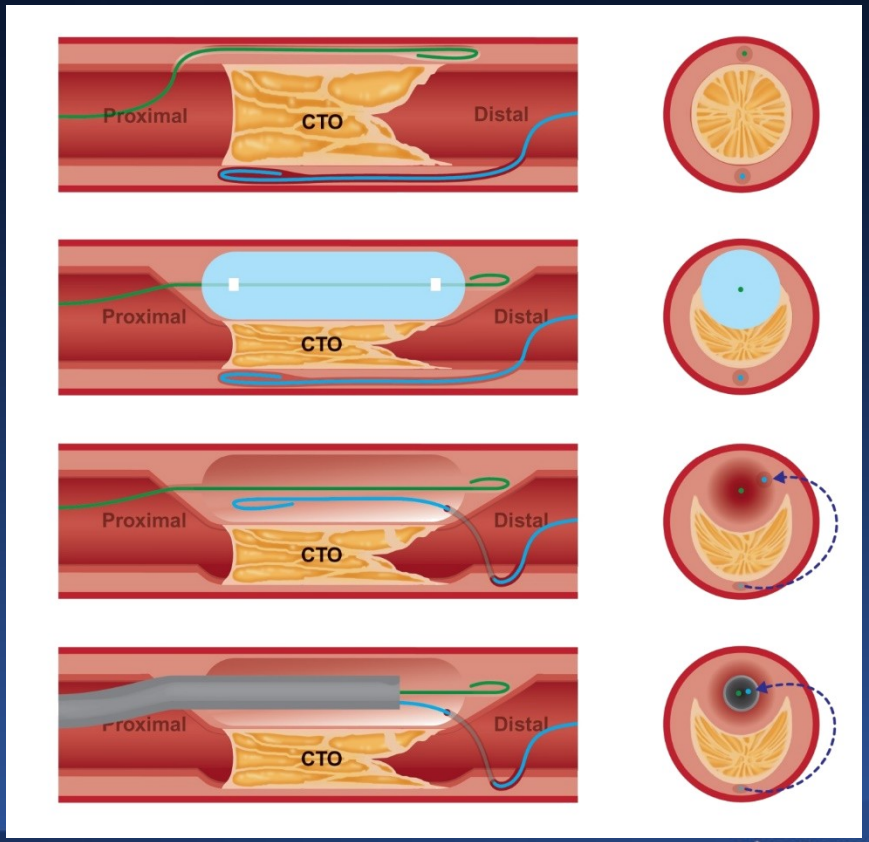


Rev Esp Cardiol. 2012;65:265

Reverse CART

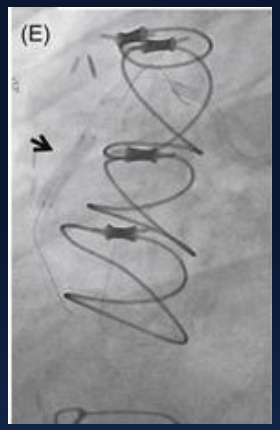
Reverse Controlled Antegrade and Retrograde Tracking

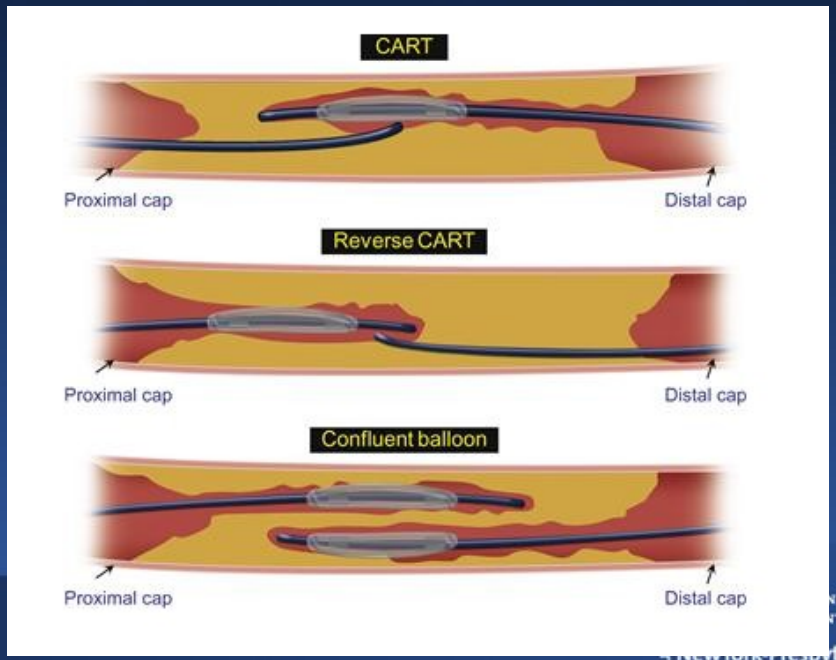
- Technique to facilitate re-entry of the retrograde wire into the antegrade true lumen by balloon inflation over the antegrade wire to create a potential space for the retrograde wire to be advanced
- Most common retrograde re-entry technique

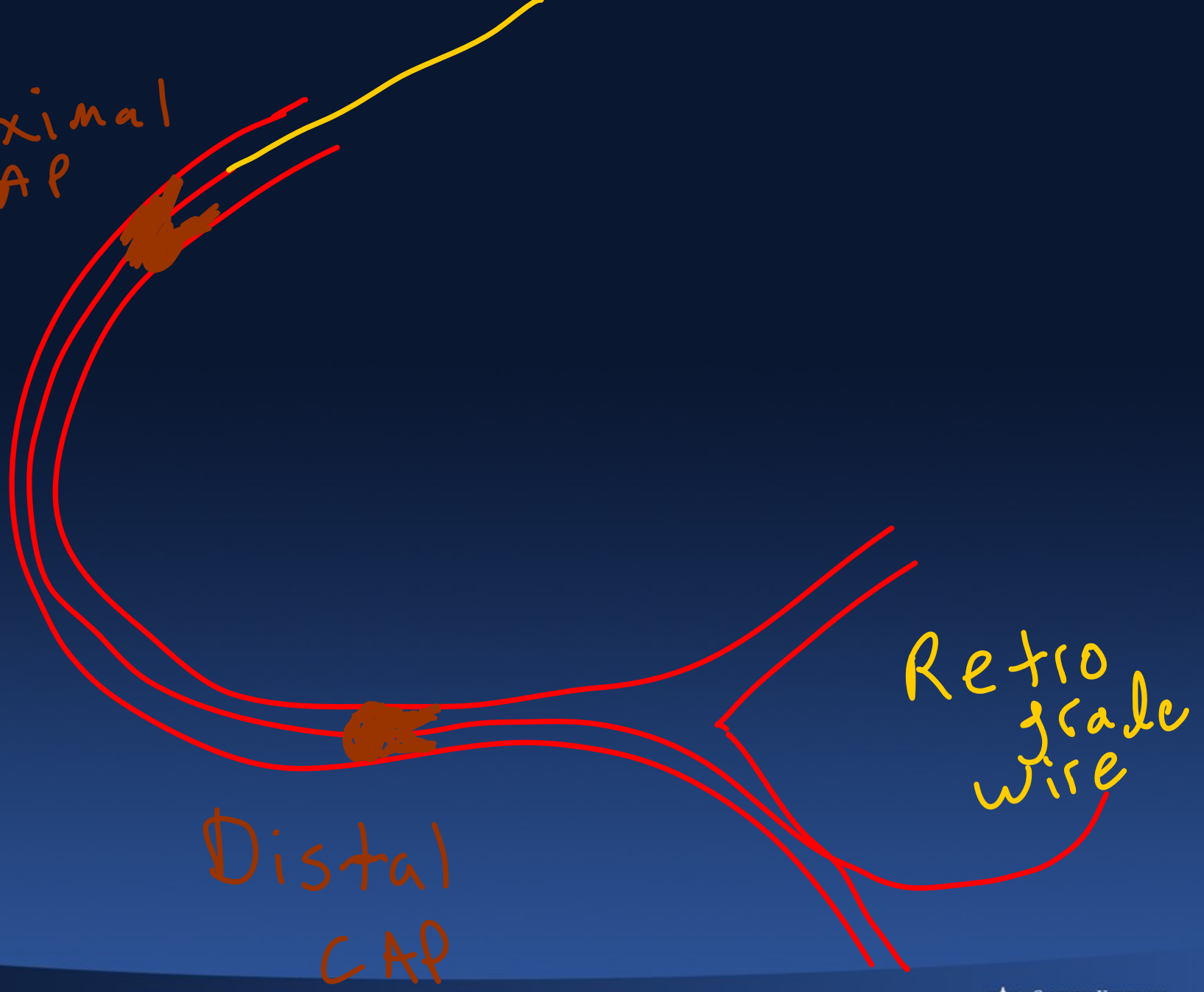


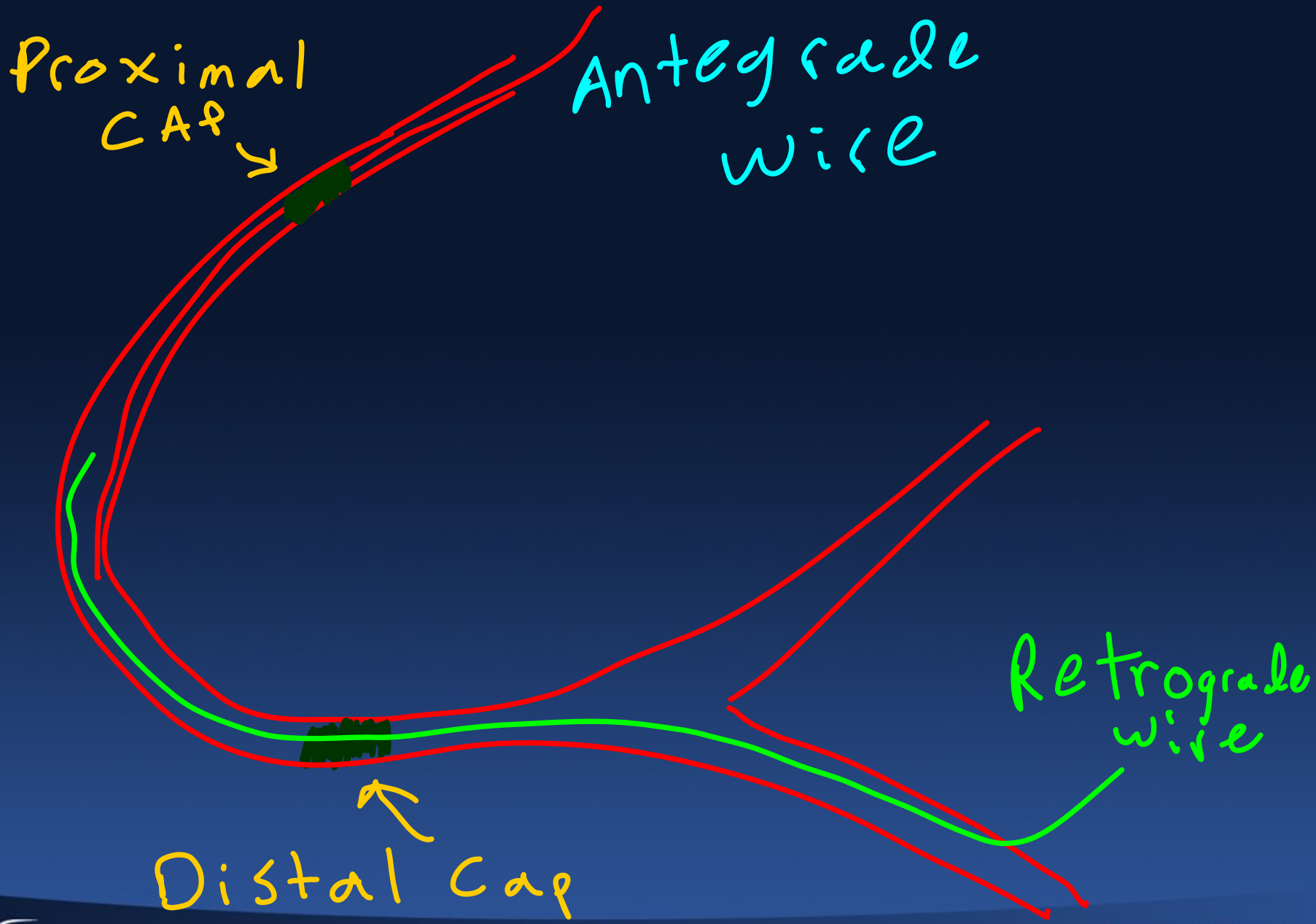
Confluent Balloon Technique

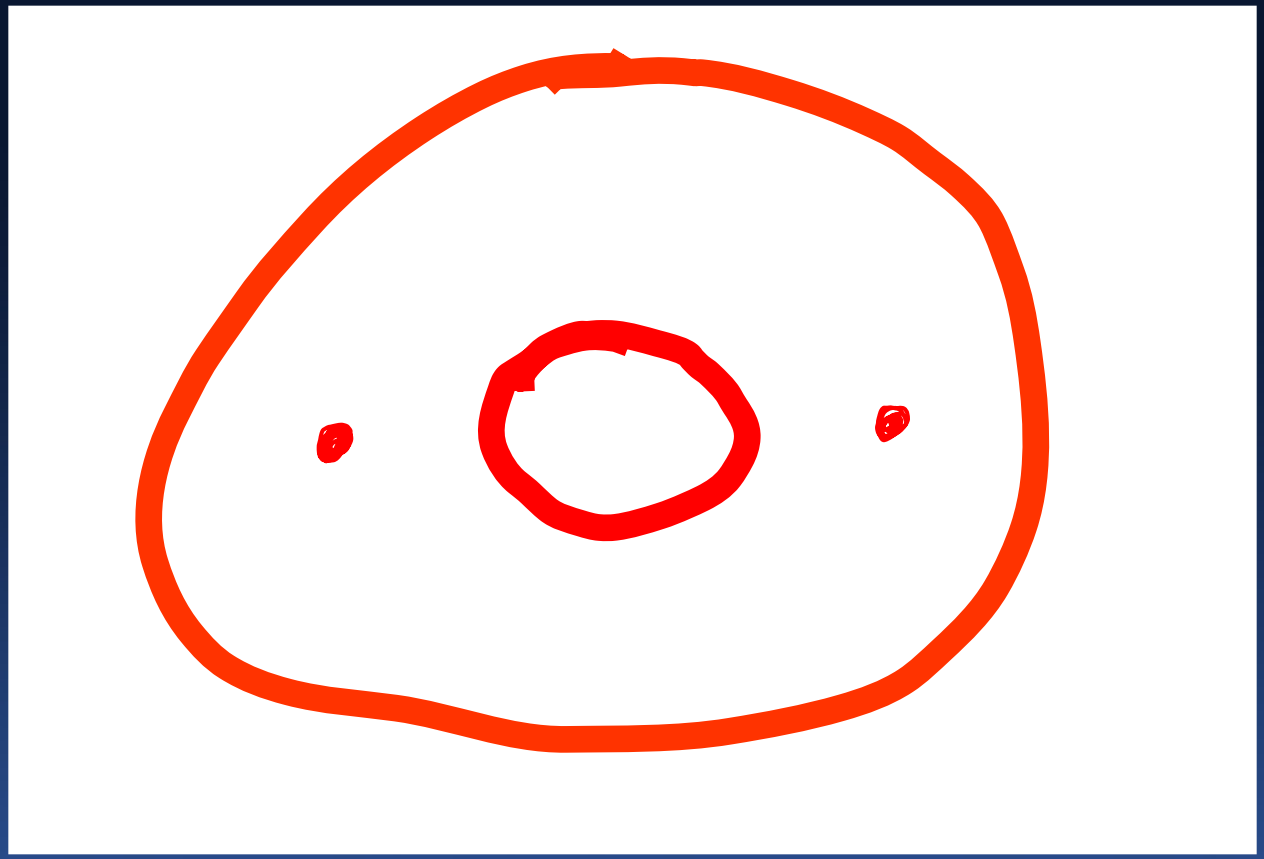
- Iteration of CART / Reverse CART in which a balloon is inflated on both the antegrade and retrograde wires in a kissing fashion to cause the subintimal space to become confluent, allowing wire advancement into the true lumen





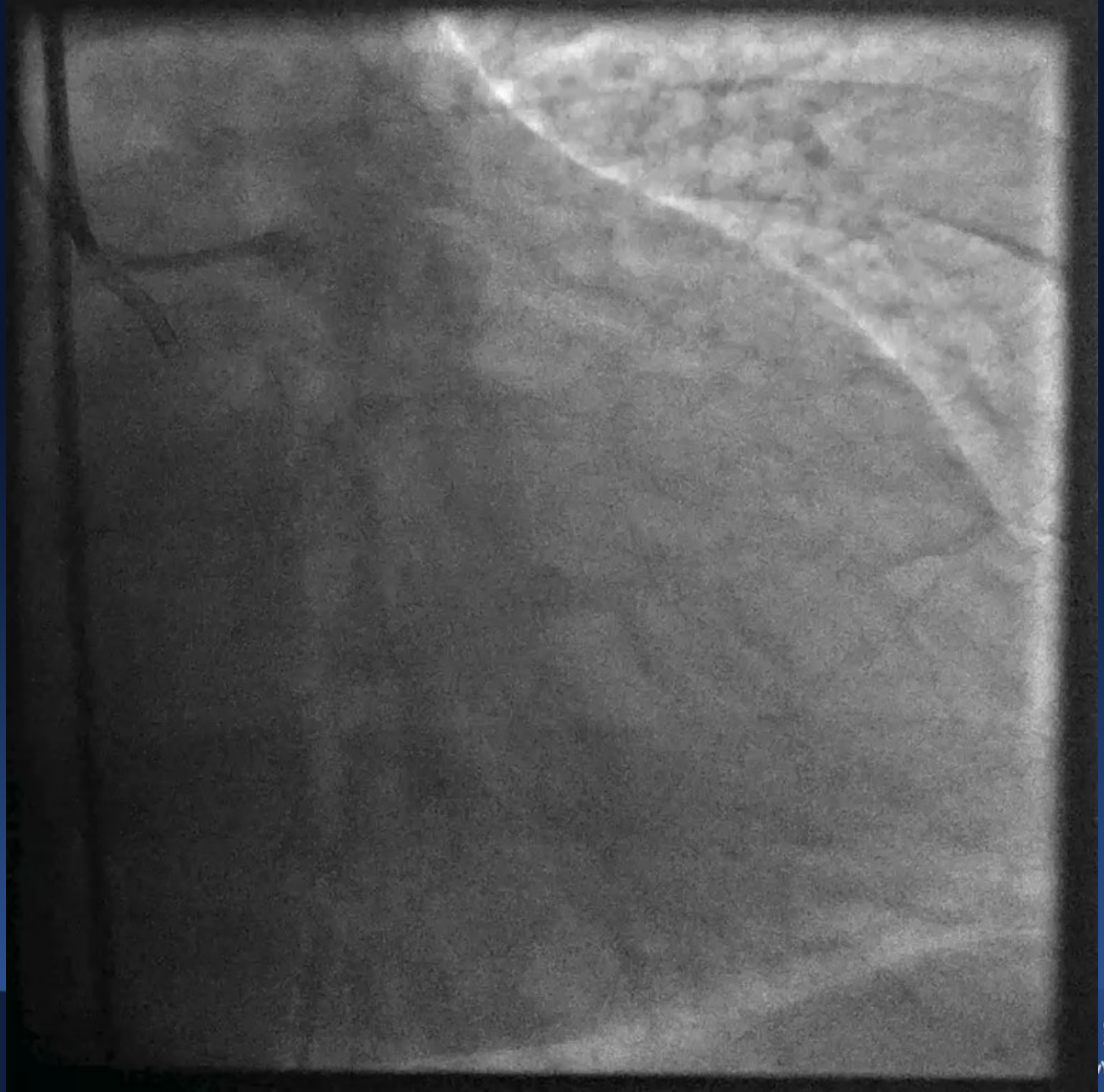


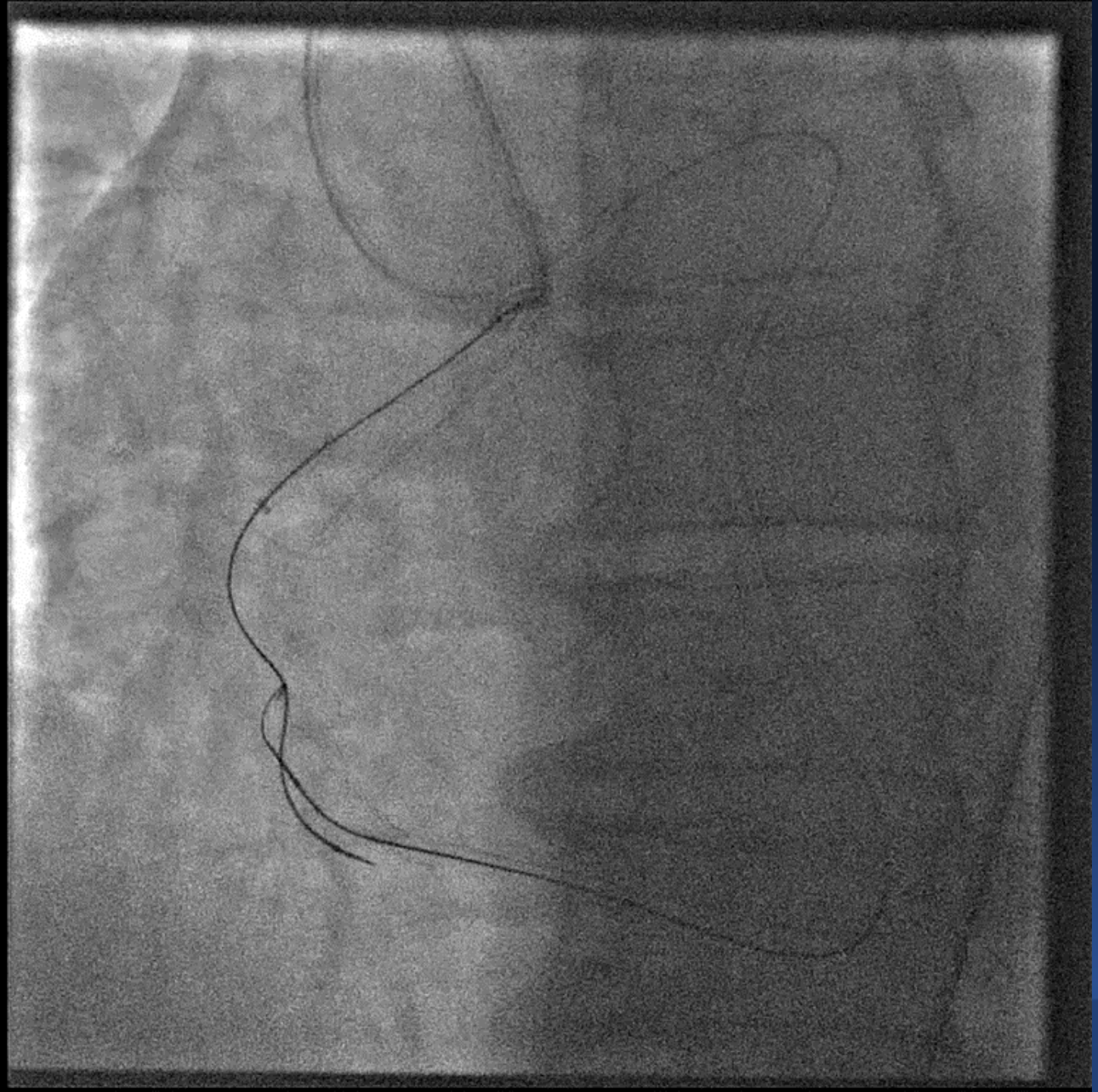




Unable to obtain R radial access

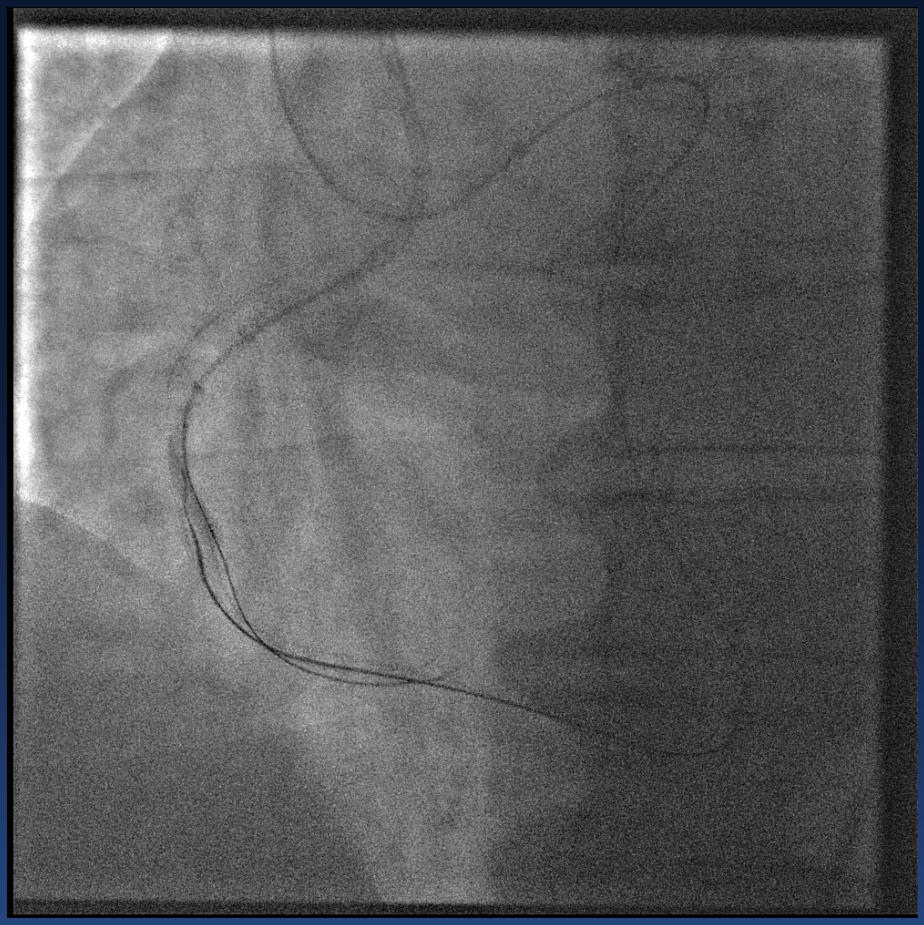
L radial access obtained



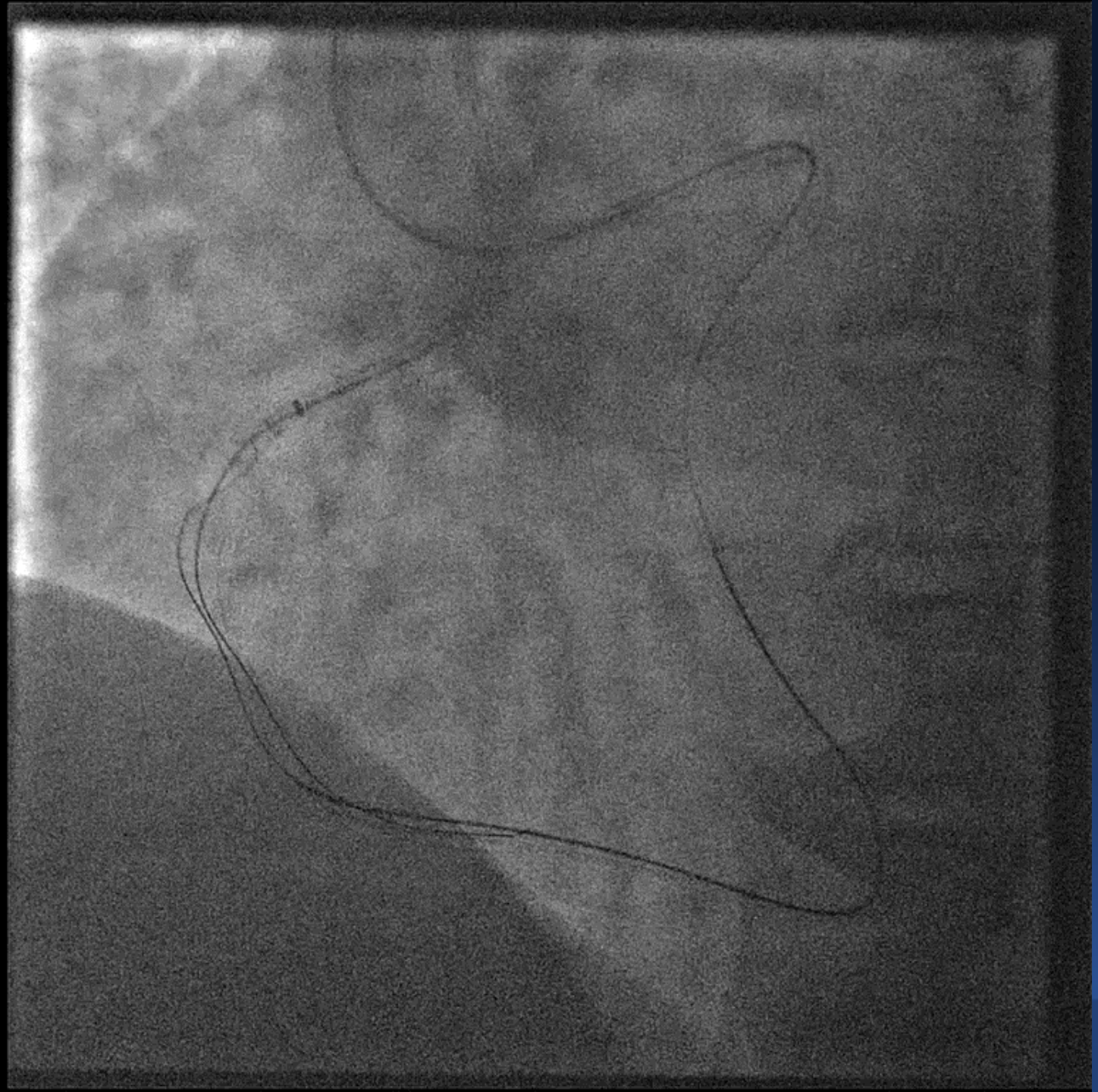


Antegrade:
BMW
Pilot 200
Miracle 6
Guideliner

Retrograde:
Corsair (long)
Miracle 6

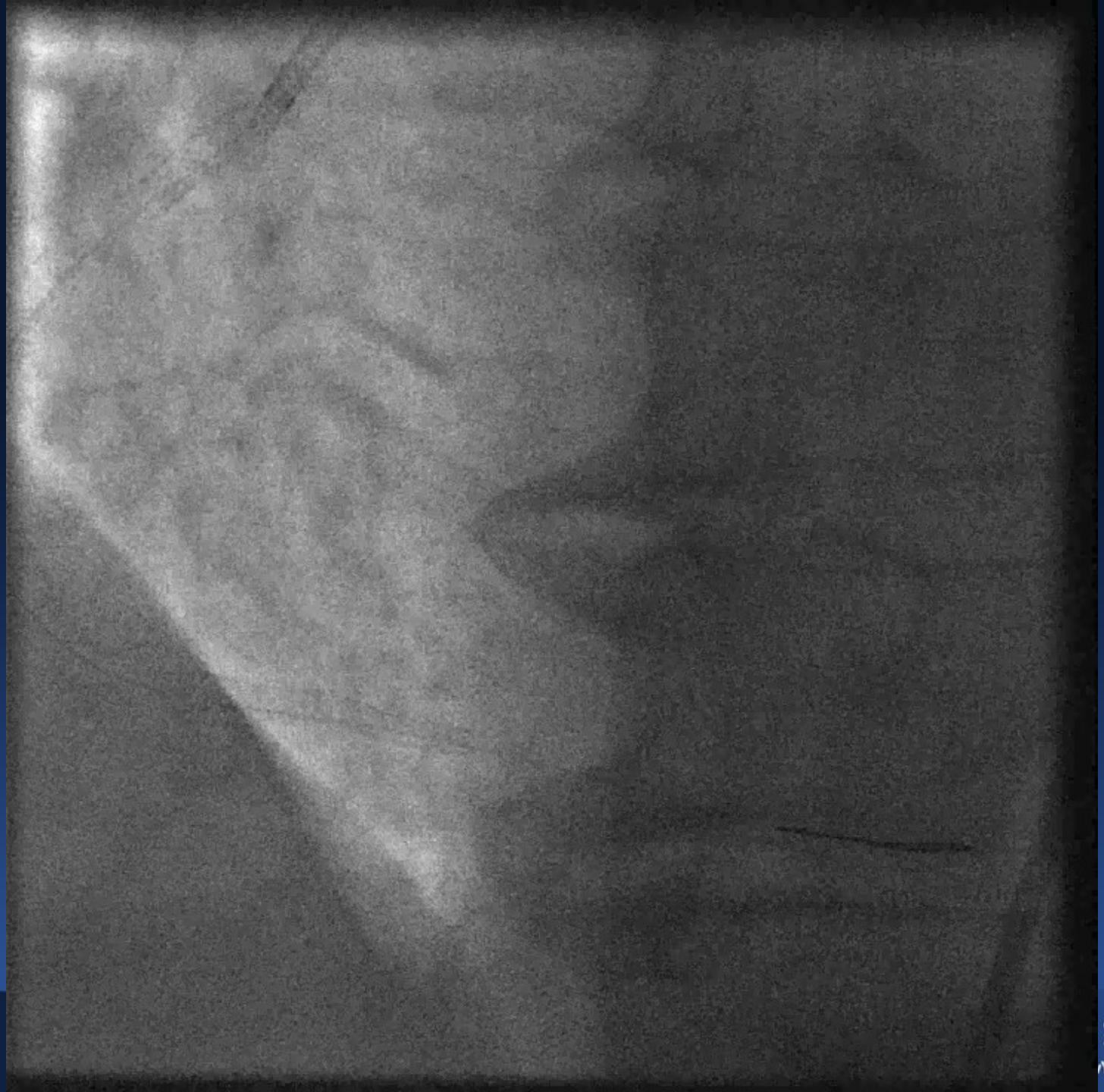


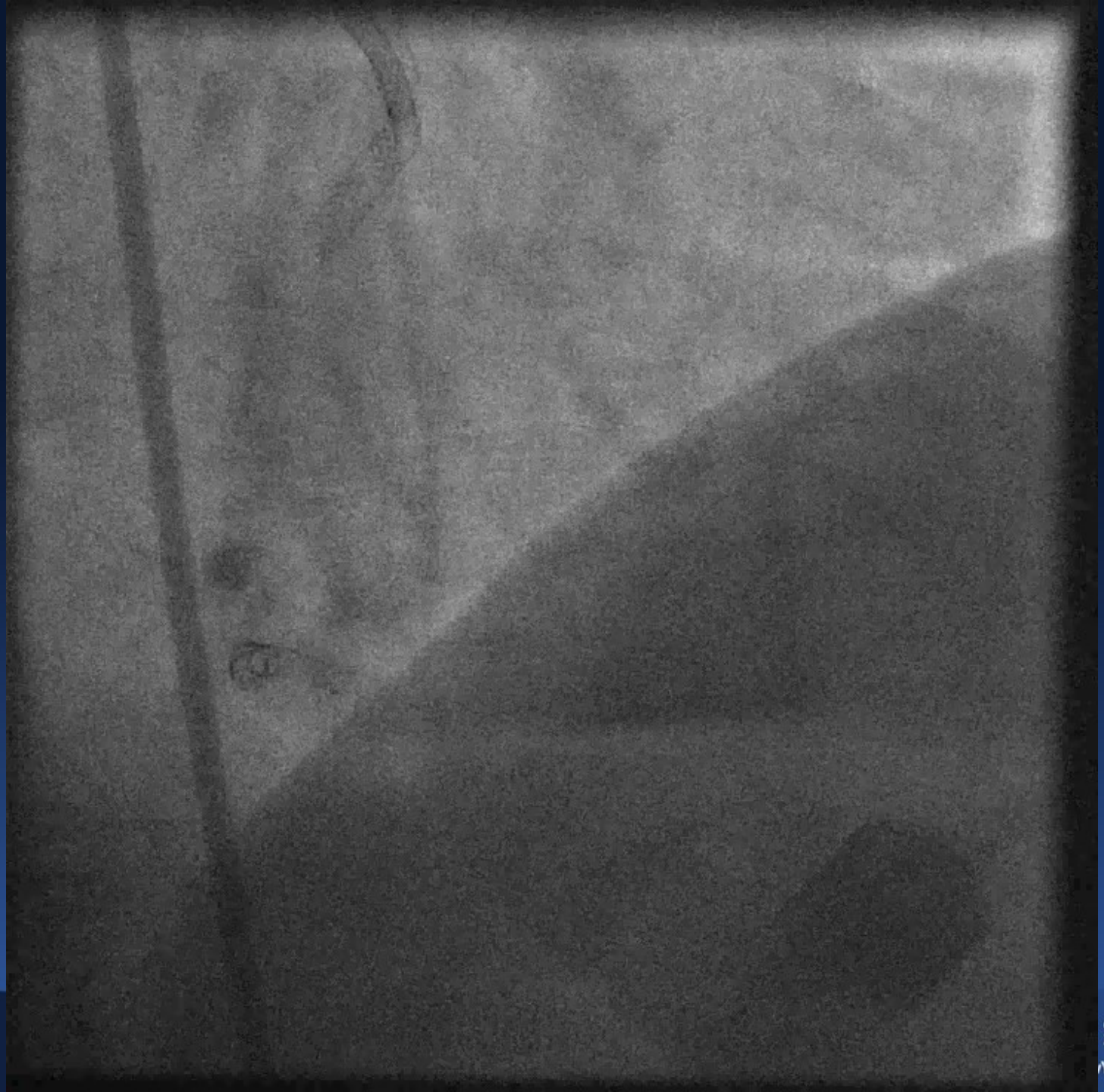
Emerge 3.0x20mm, 12atm



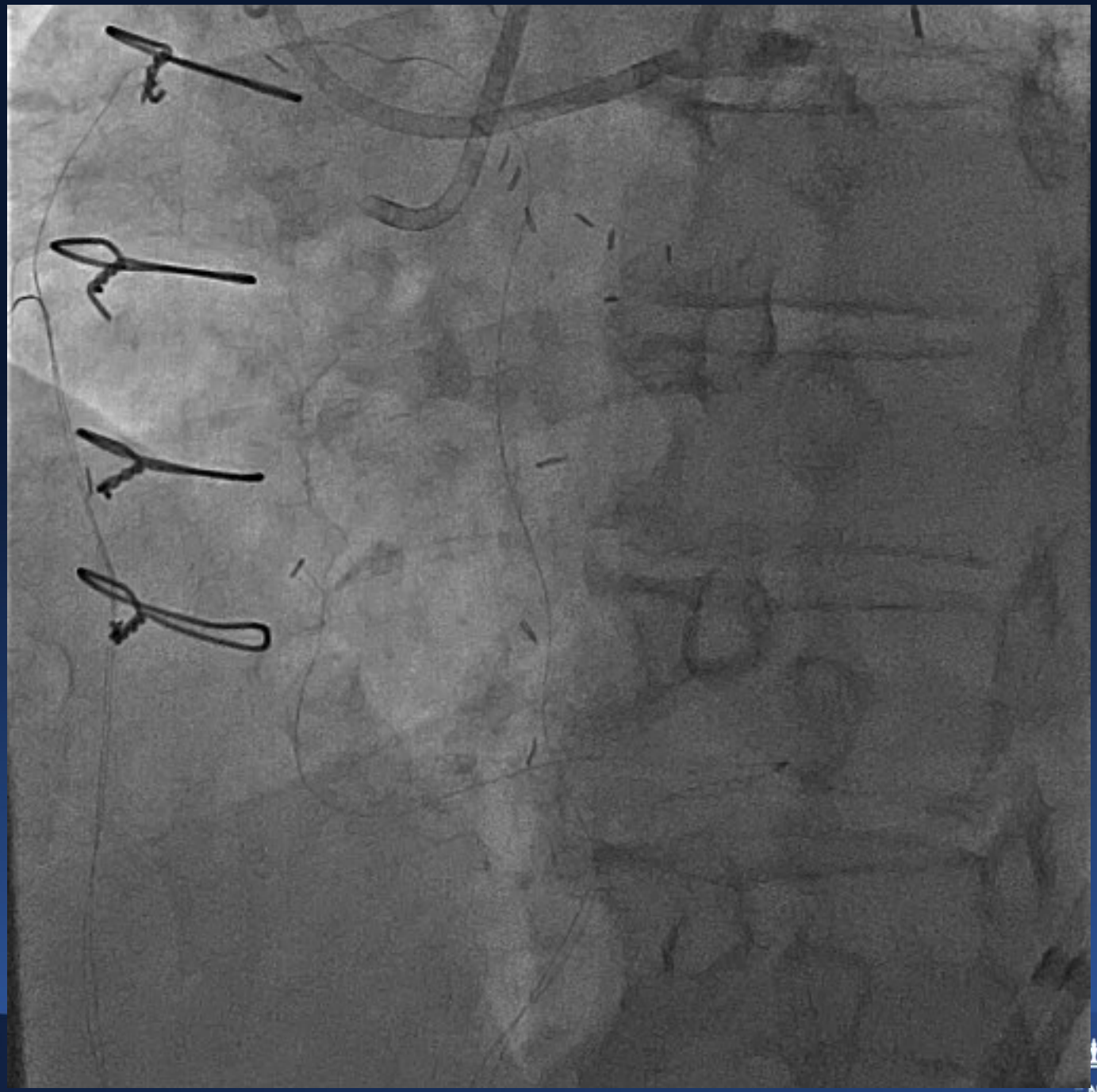
Retrograde:
Corsair (long)
Miracle 6
Confianza Pro 12

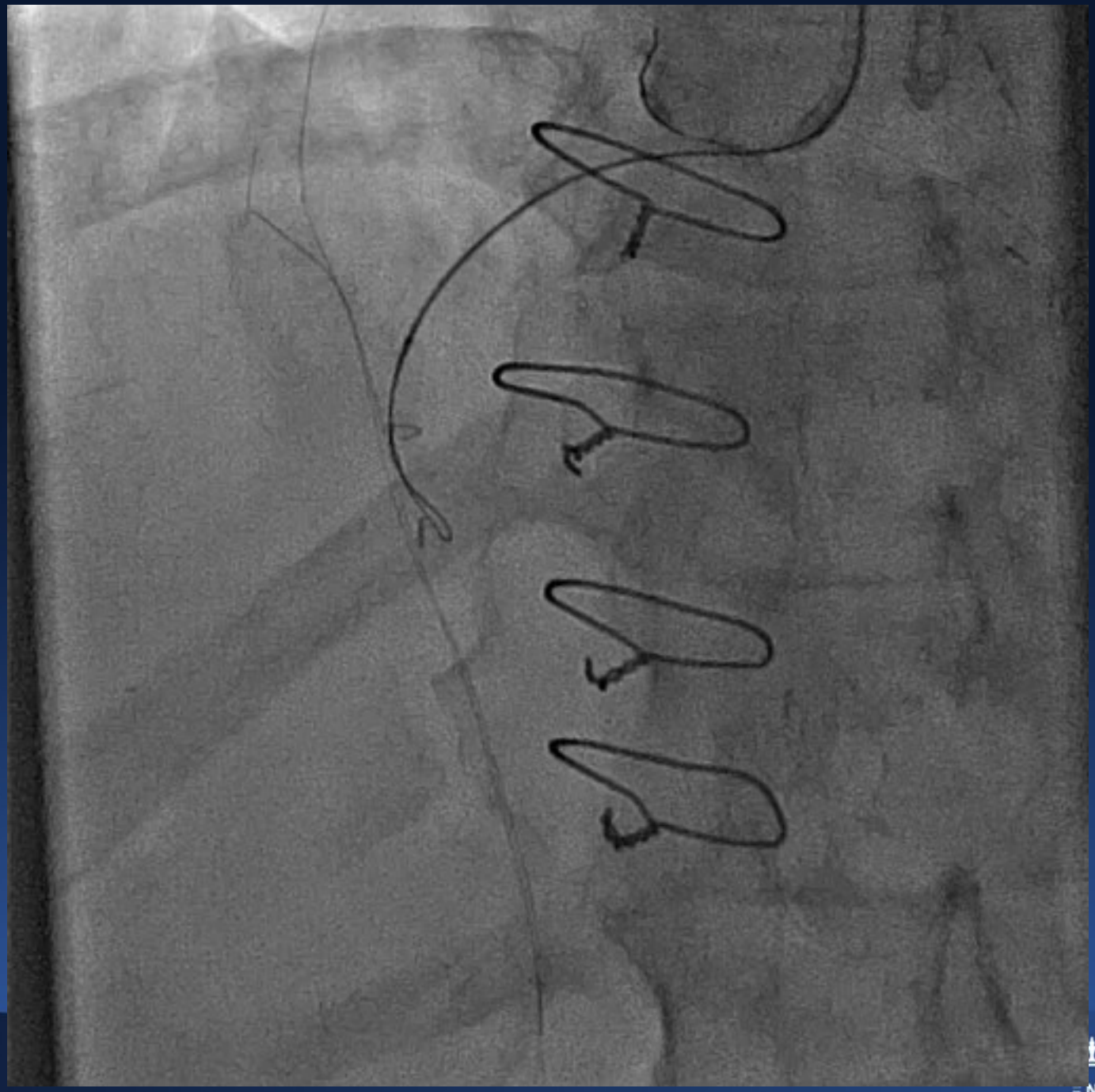
Confianza Pro 12 crossed lesion

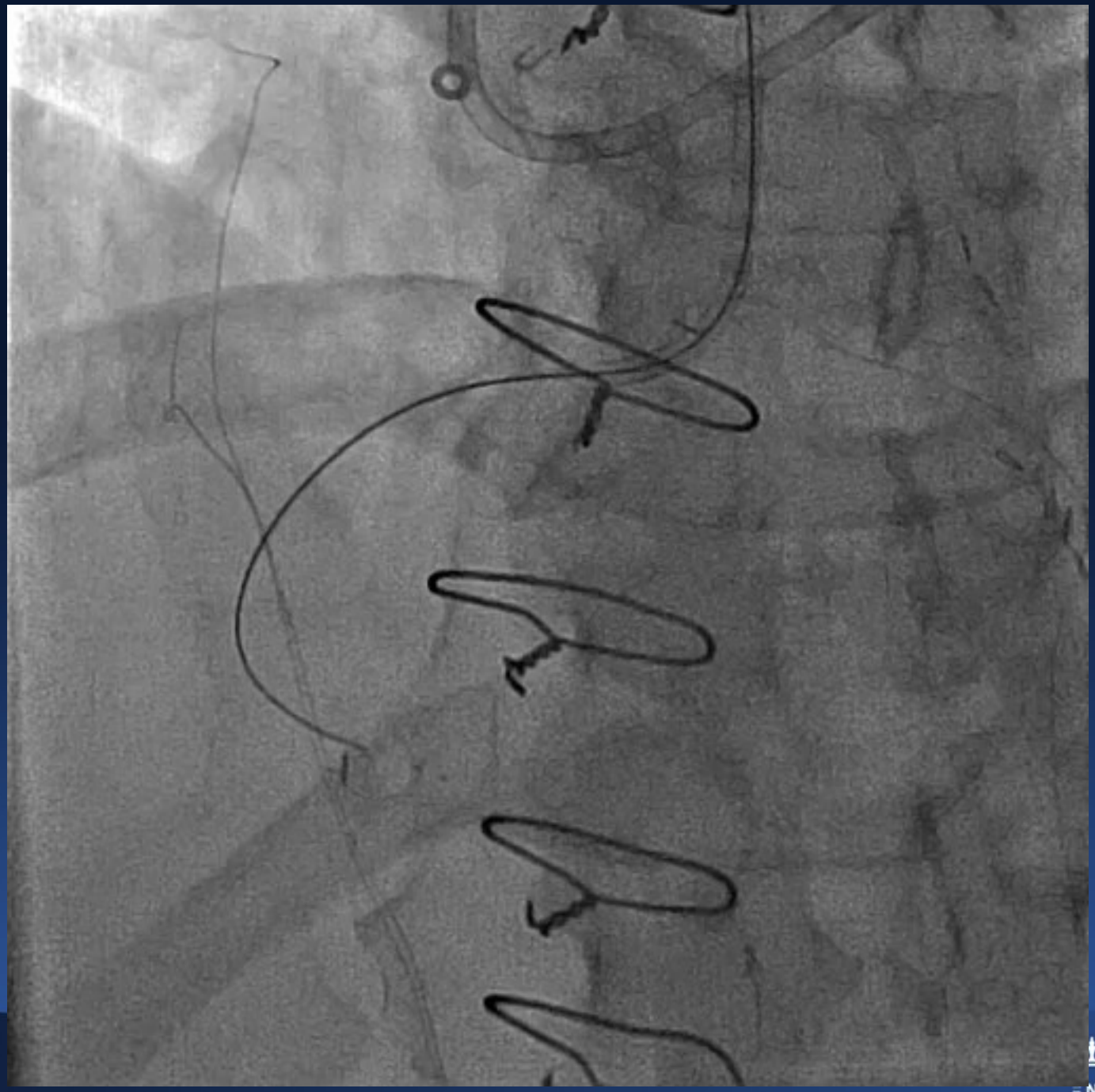


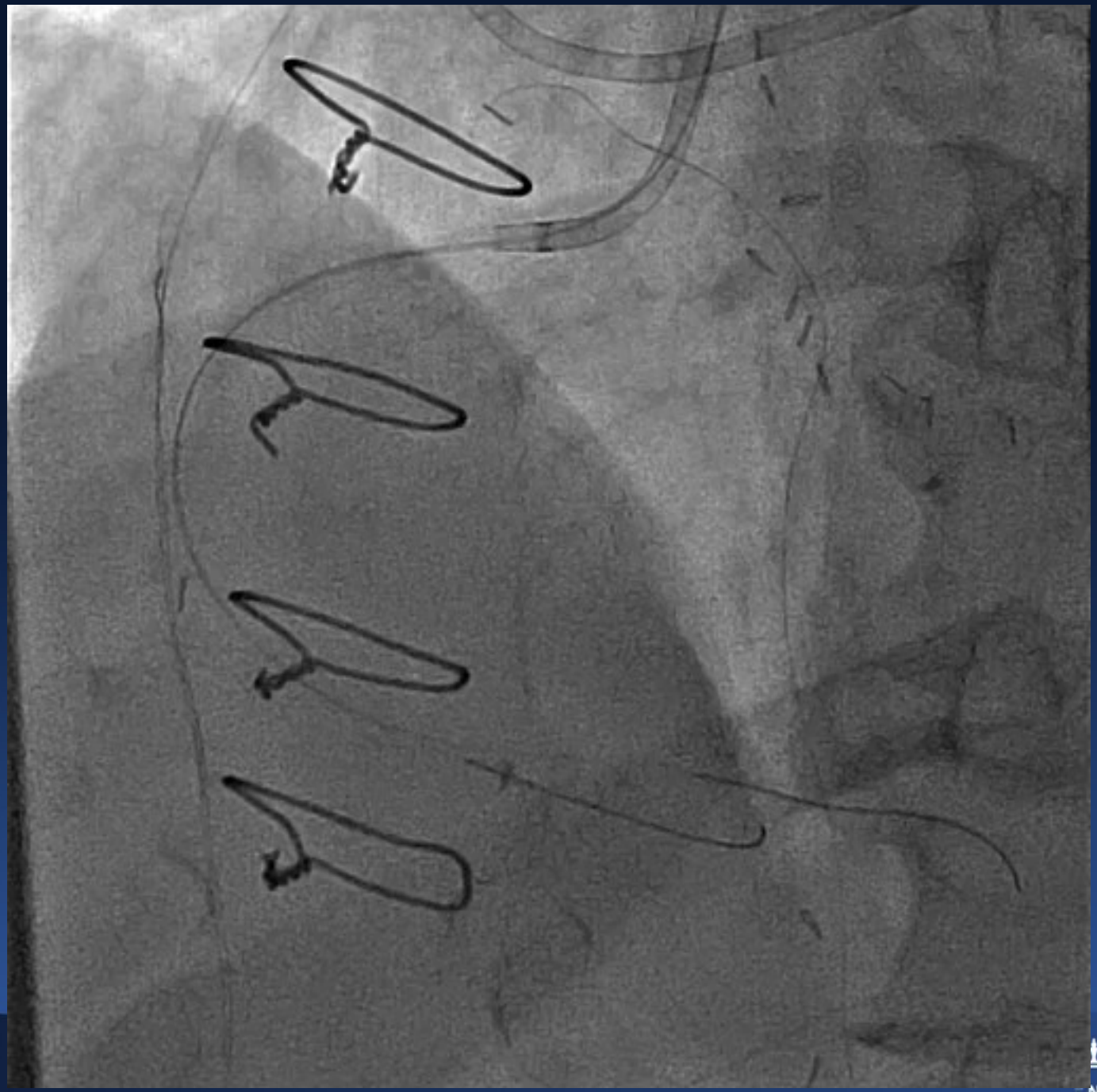


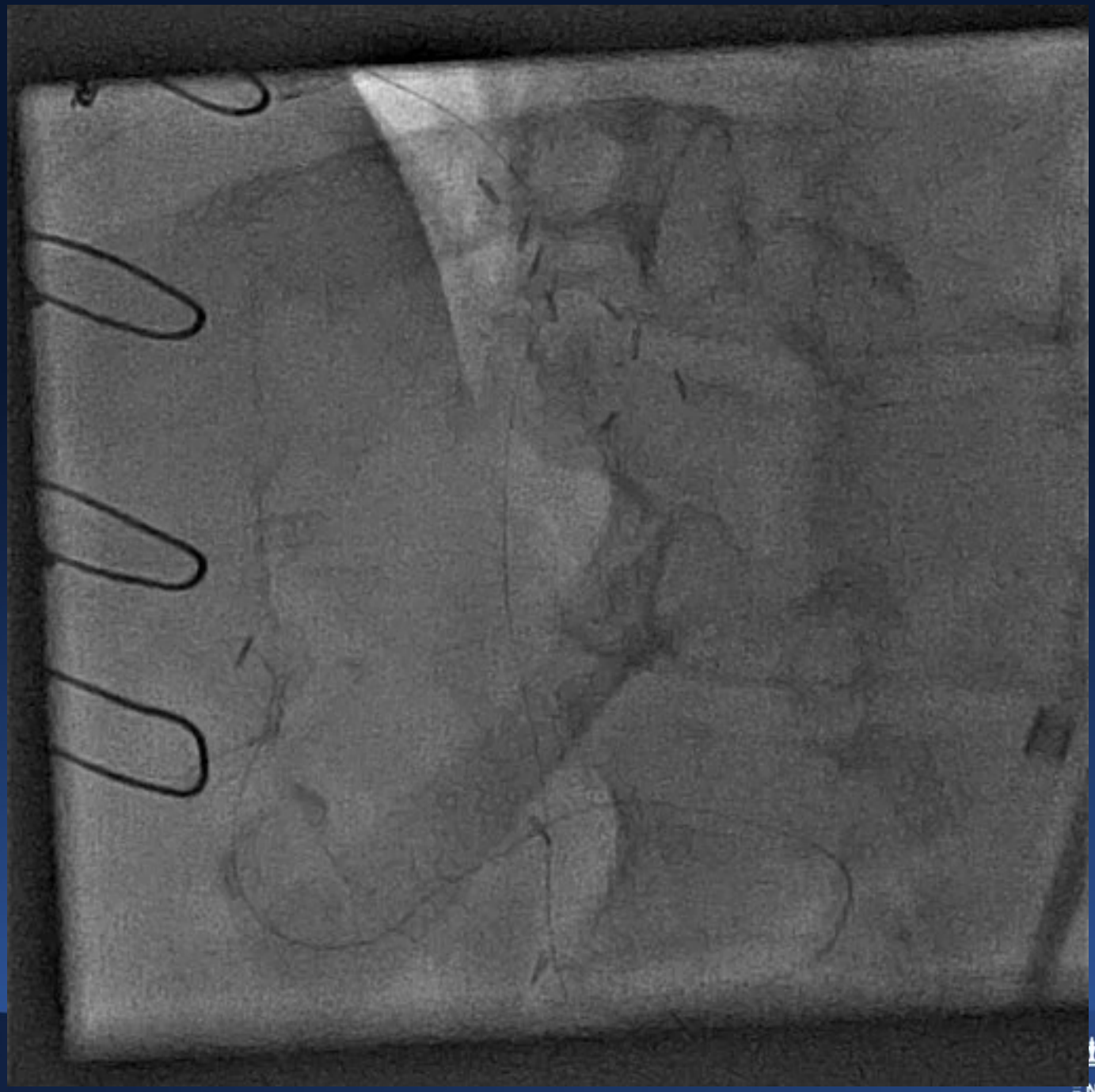
Antegrade Dissection Re-Entry (ADR)





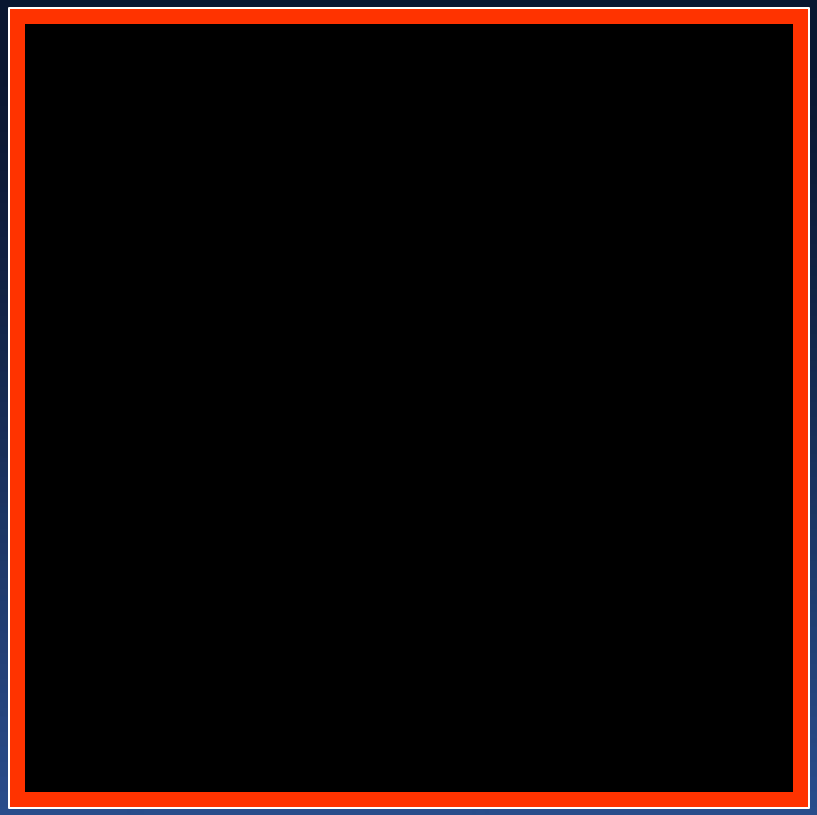






Bobsledding

- After unsuccessful StingRay re-entry, the balloon is deflated and pushed forward downstream in the subintimal space without a leading guidewire to allow for a fresh zone to attempt re-entry



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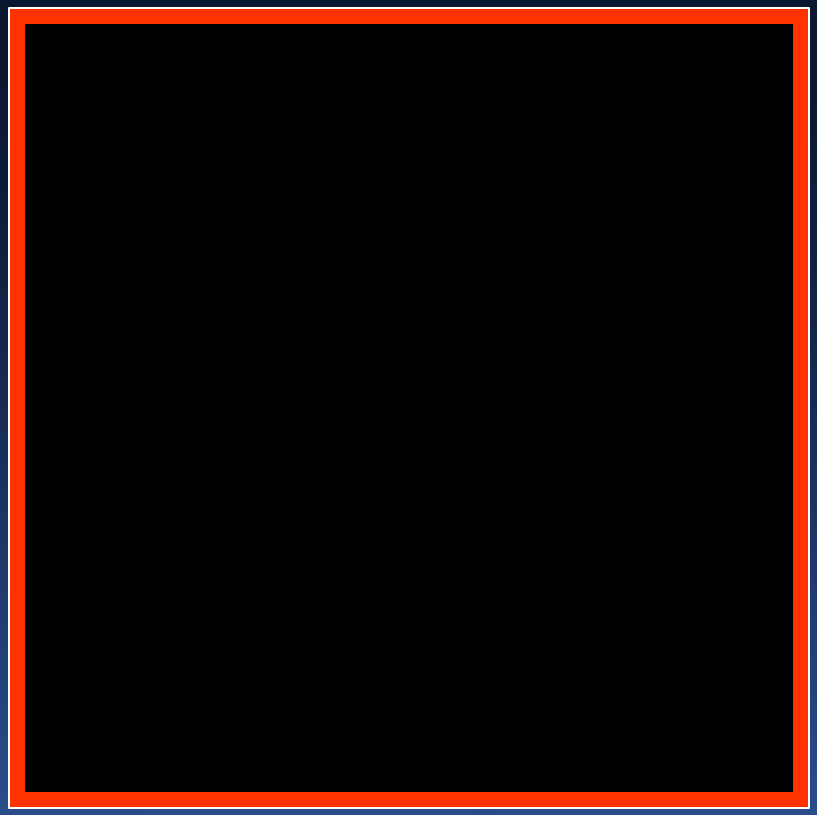
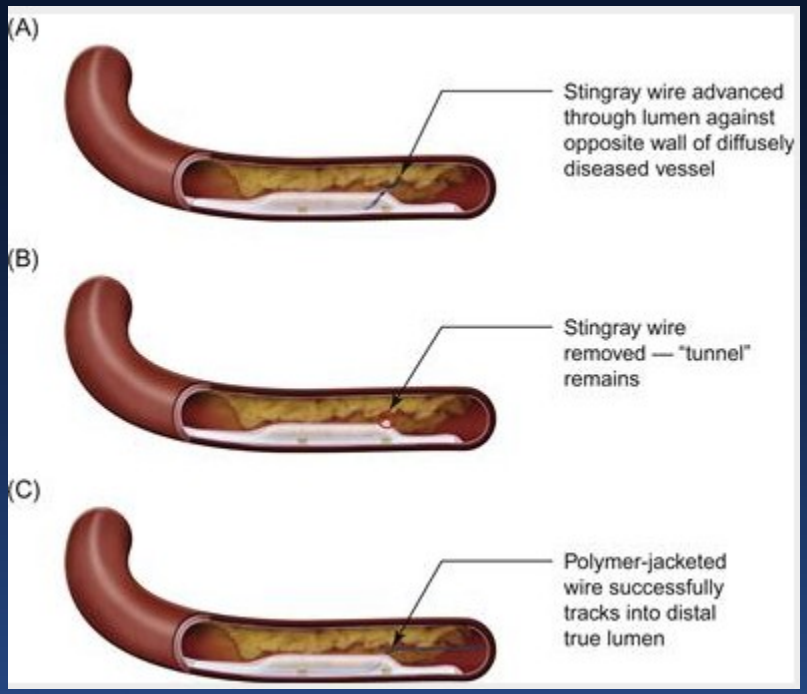
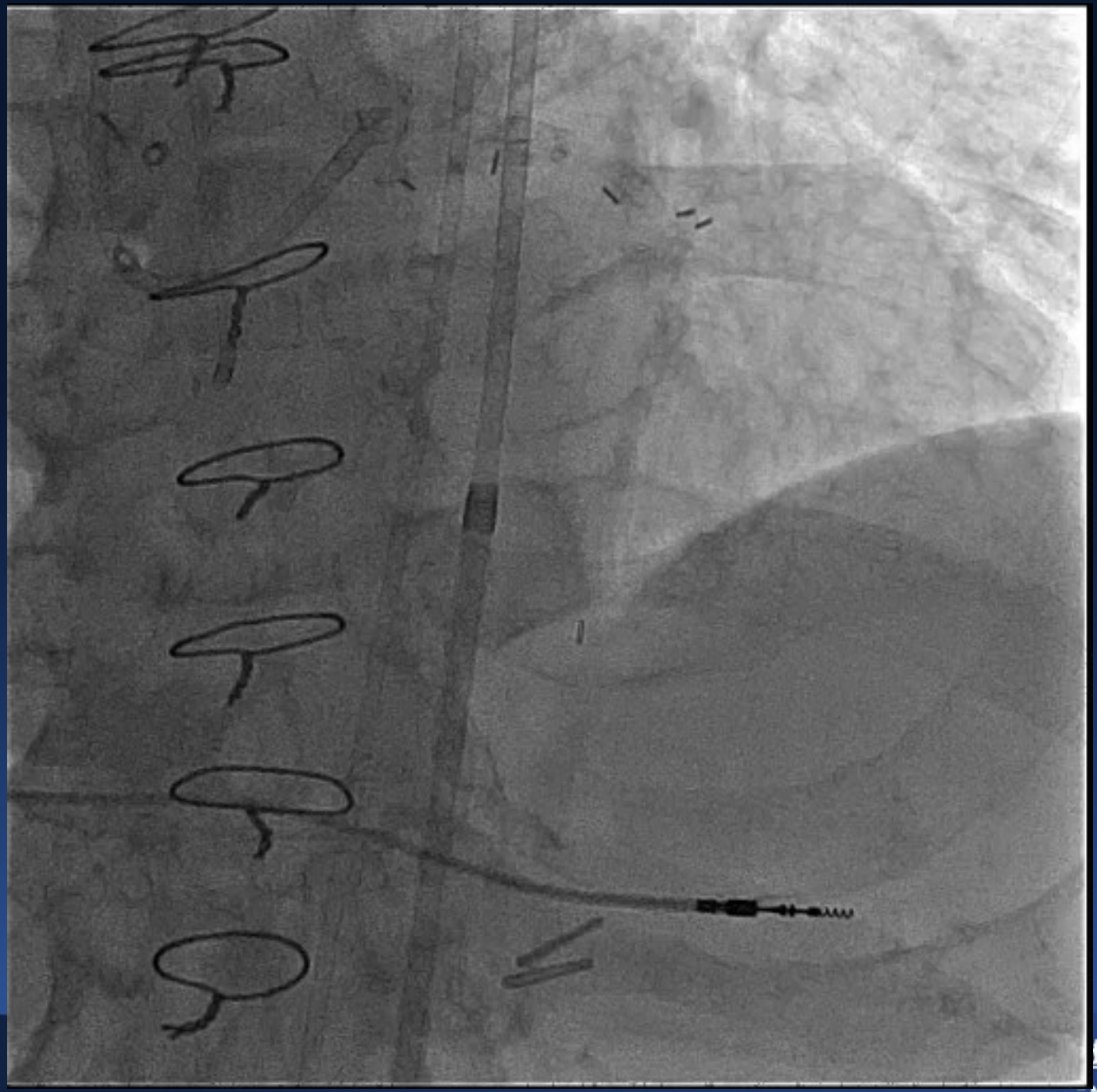
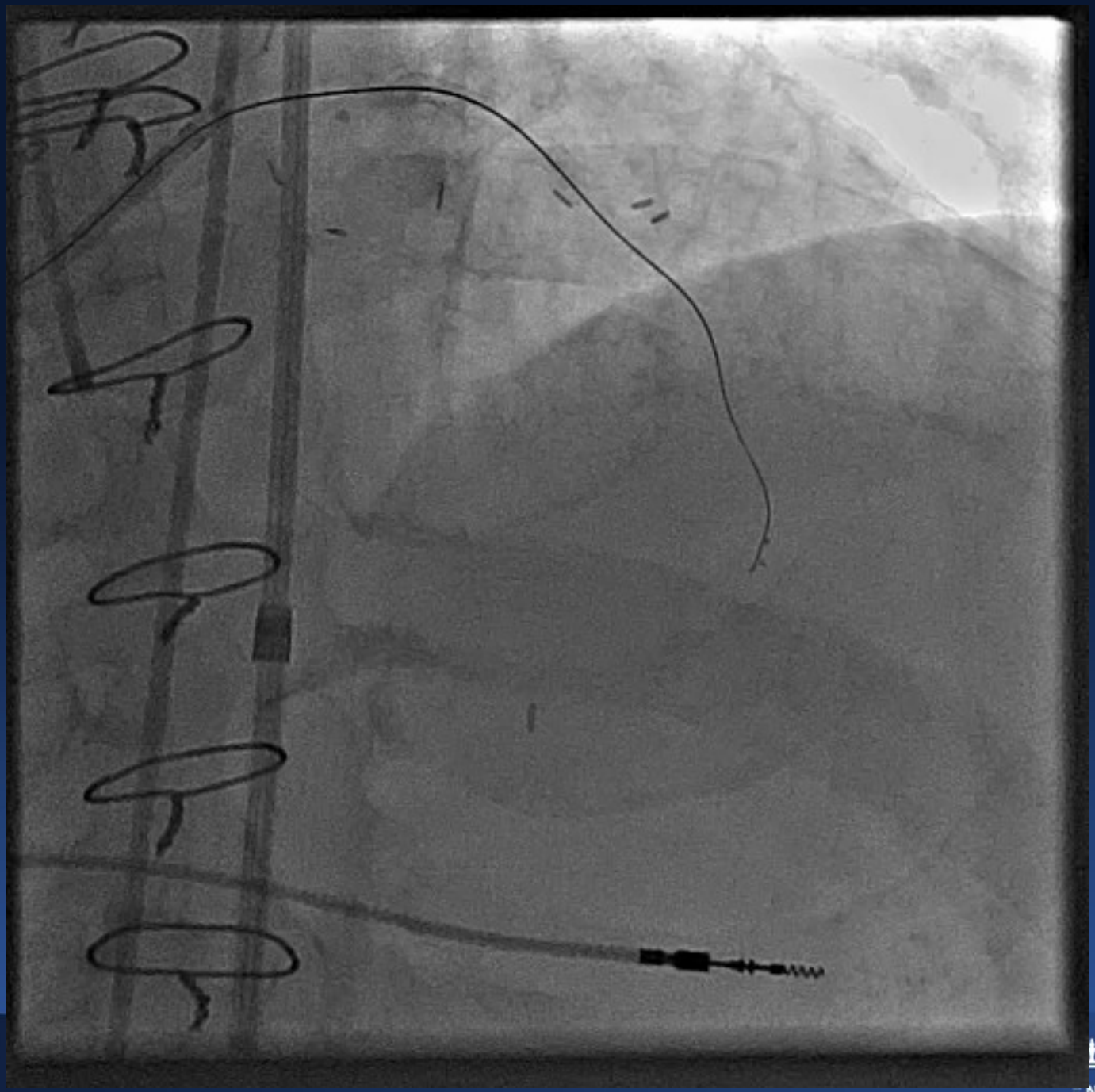


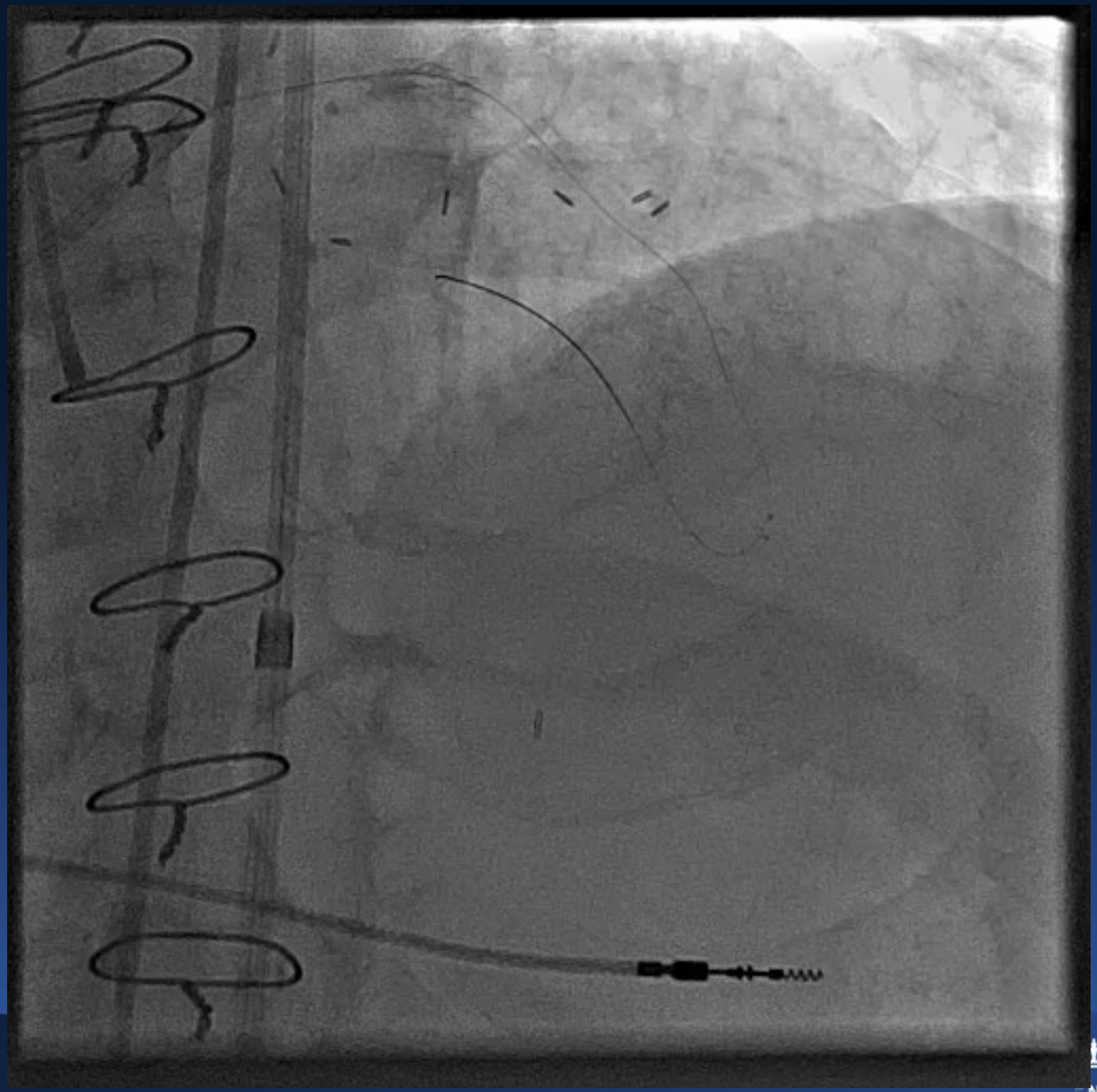
Stick and Swap

- 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.





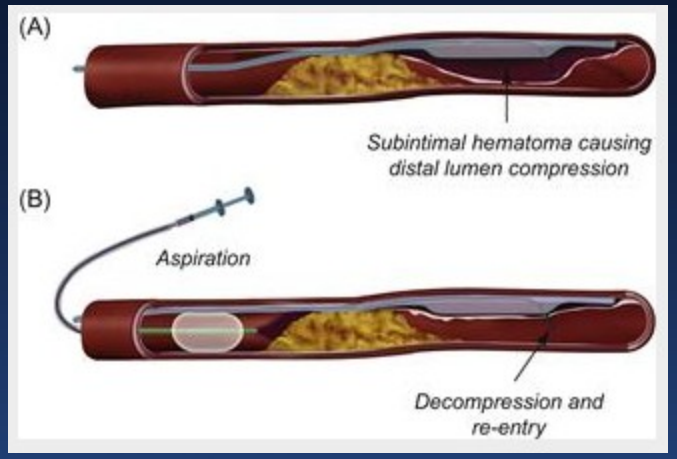




STRAW

Subintimal Transcatheter Withdrawal

- Method used to aspirate subintimal hematoma which may develop in the dissection plane by placing an over the wire balloon or microcatheter next to the Stingray balloon and aspirating.



LAST

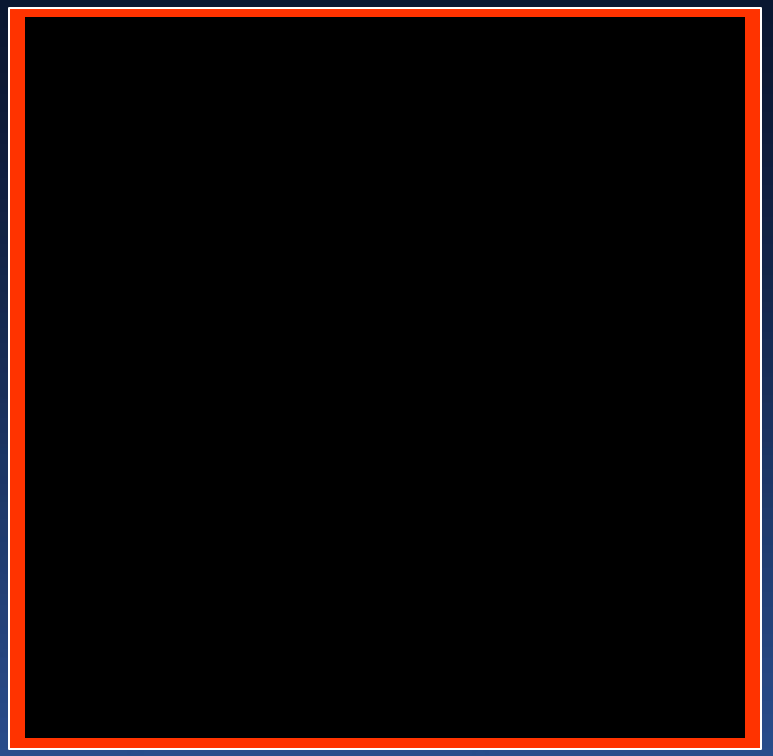
Limited Antegrade Subintimal Tracking

- Antegrade re-entry technique accomplished by entering the subintimal space and then using a stiff guidewire with 90 degree bend to “catch” tissue and puncture through the subintimal flap and re-enter the true lumen down stream from the occluded segment

STAR

Subintimal Tracking And Re-entry

- Antegrade re-entry technique described by Antonio Columbo by entering the subintimal space with a knuckle wire and advancing the knuckled wire distally until it spontaneously re-enters the distal true lumen



STAR

Subintimal Tracking And Re-entry

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Mini-STAR

Subintimal Tracking And Re-entry

- Usually a serendipitous re-entry of a knuckled wire local to the CTO segment in which the knuckled wire falls into the true lumen.

Mini-STAR

Subintimal Tracking And Re-entry

- Usually a serendipitous re-entry of a knuckled wire local to the CTO segment in which the knuckled wire falls into the true lumen.

Carlino – Contrast-guided STAR

- Technique described by Mauro Carlino in which an antegrade dissection is created and a microcatheter is advanced into the false lumen and contrast is injected to create a visualized dissection plane to allow guidewire advancement

BAM or Grenadoplasty

Balloon Assisted Micro-dissection

- Small (1.2-1.5 mm) balloon is advanced as far as possible into the proximal cap and is then inflated until the balloon ruptures resulting in cap fracture or small hydraulic dissection planes created around the cap to allow subintimal access to advance past the occluded segment or further advancement of a second balloon

Skills/Skillsets

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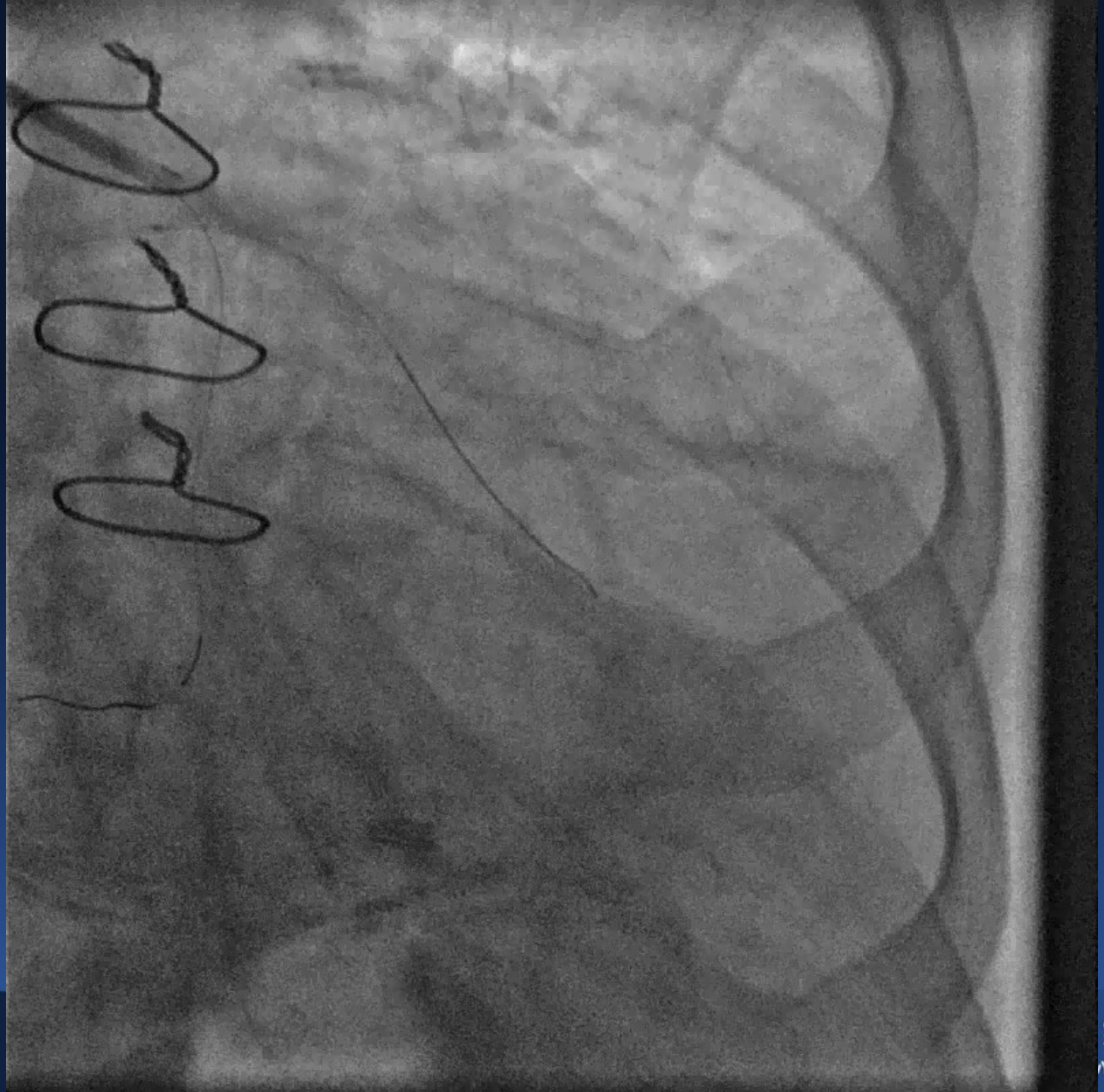

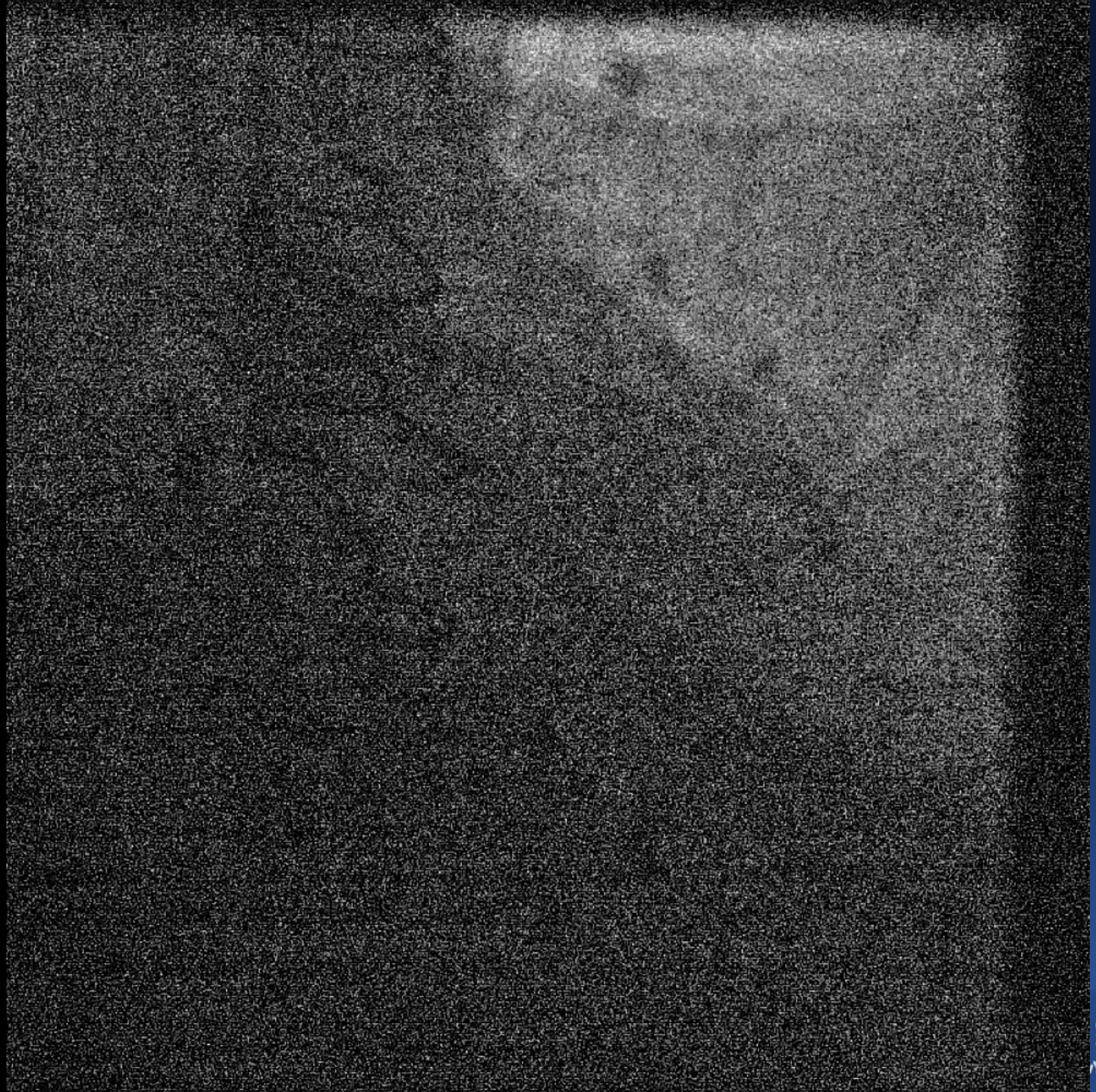

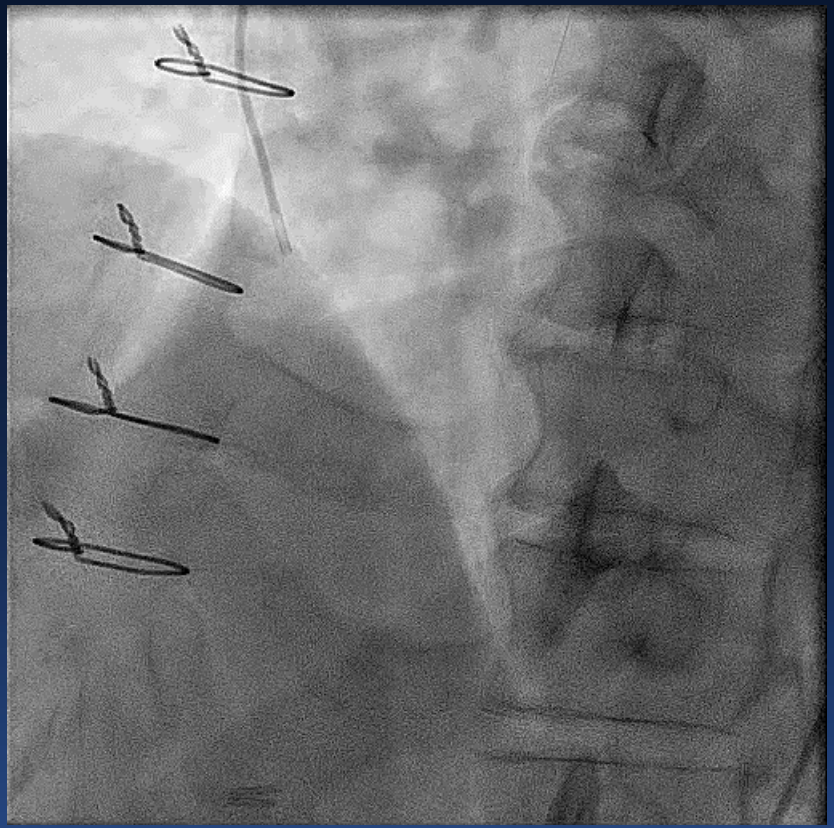

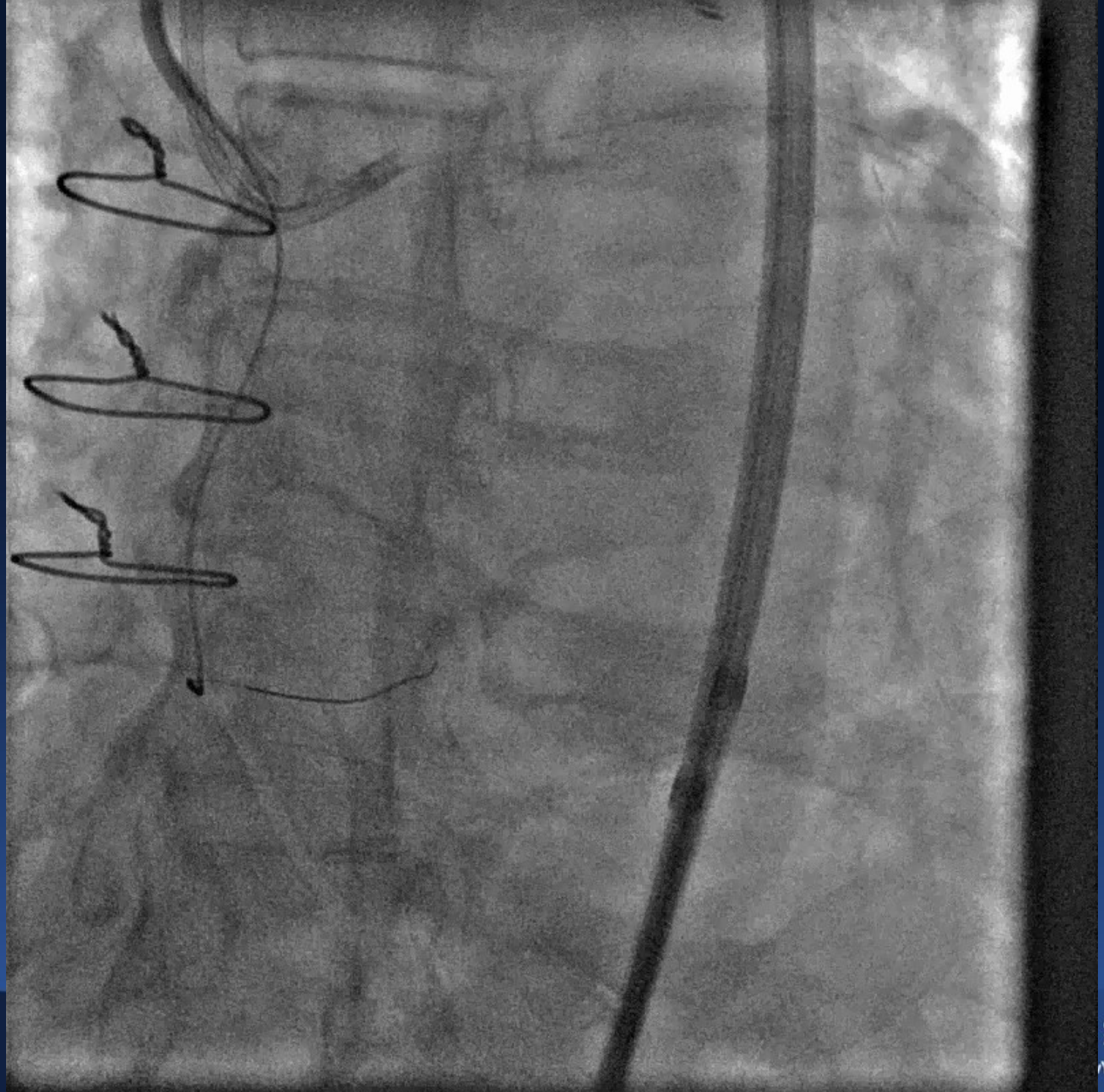

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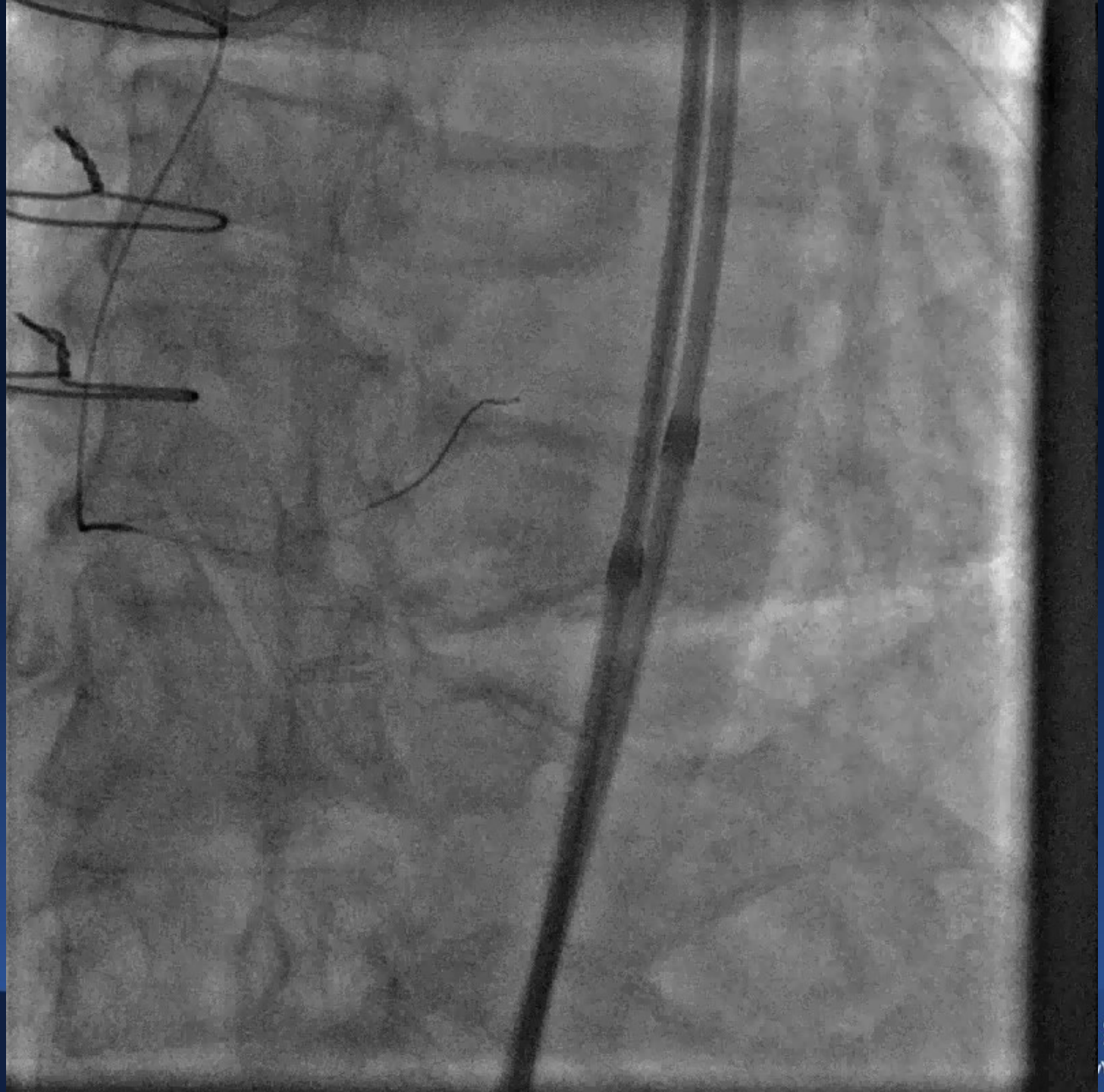

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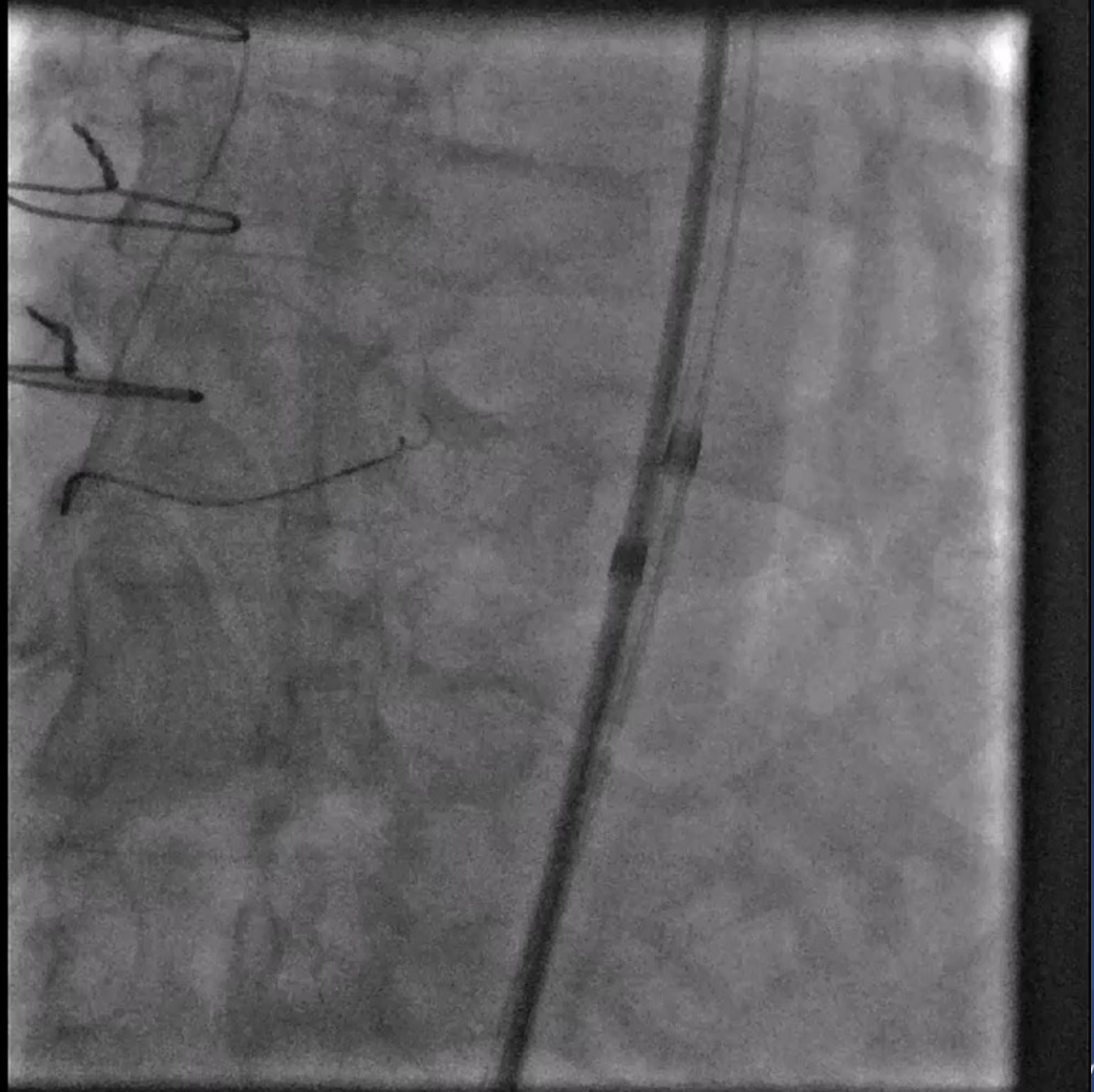

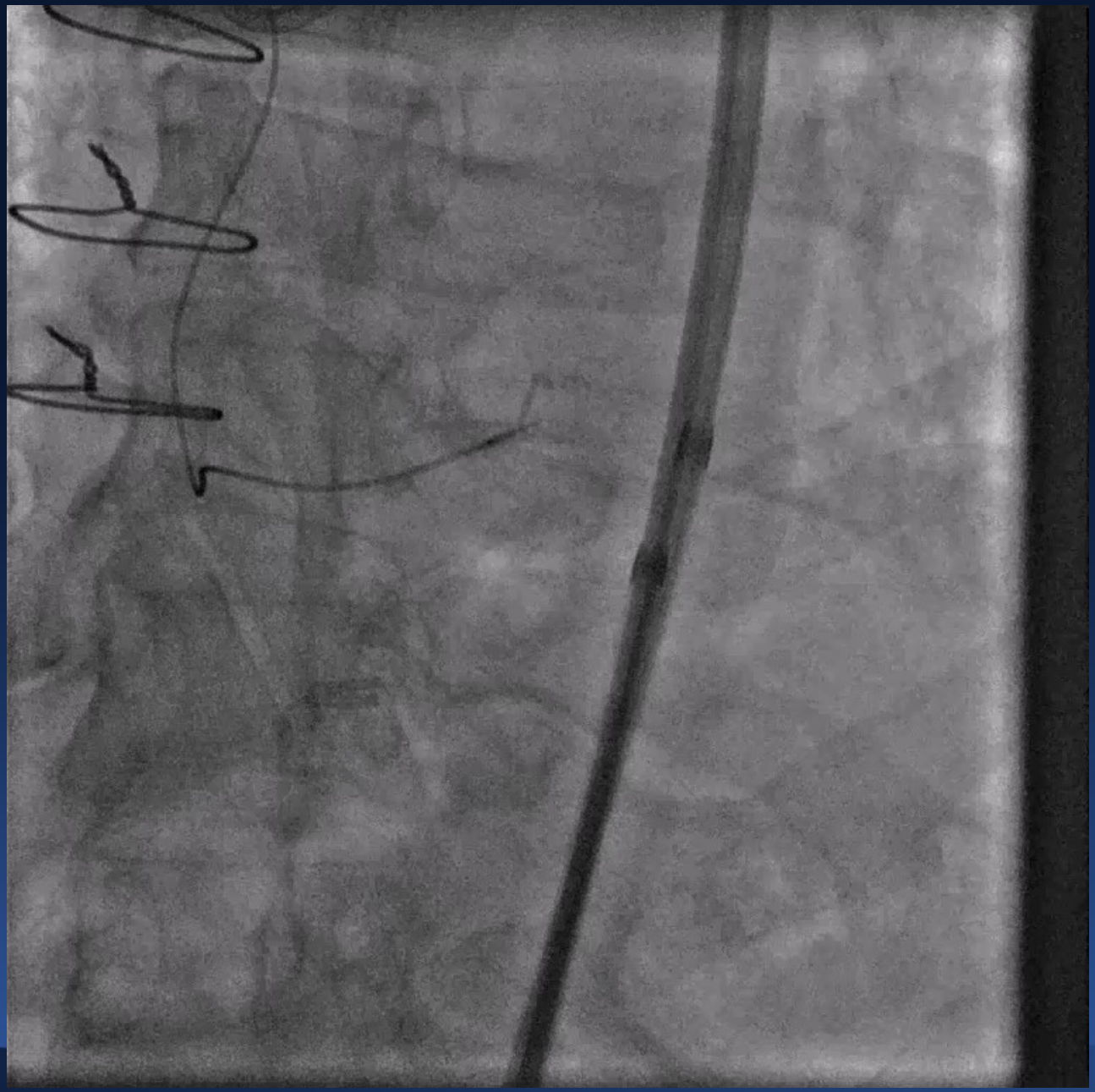

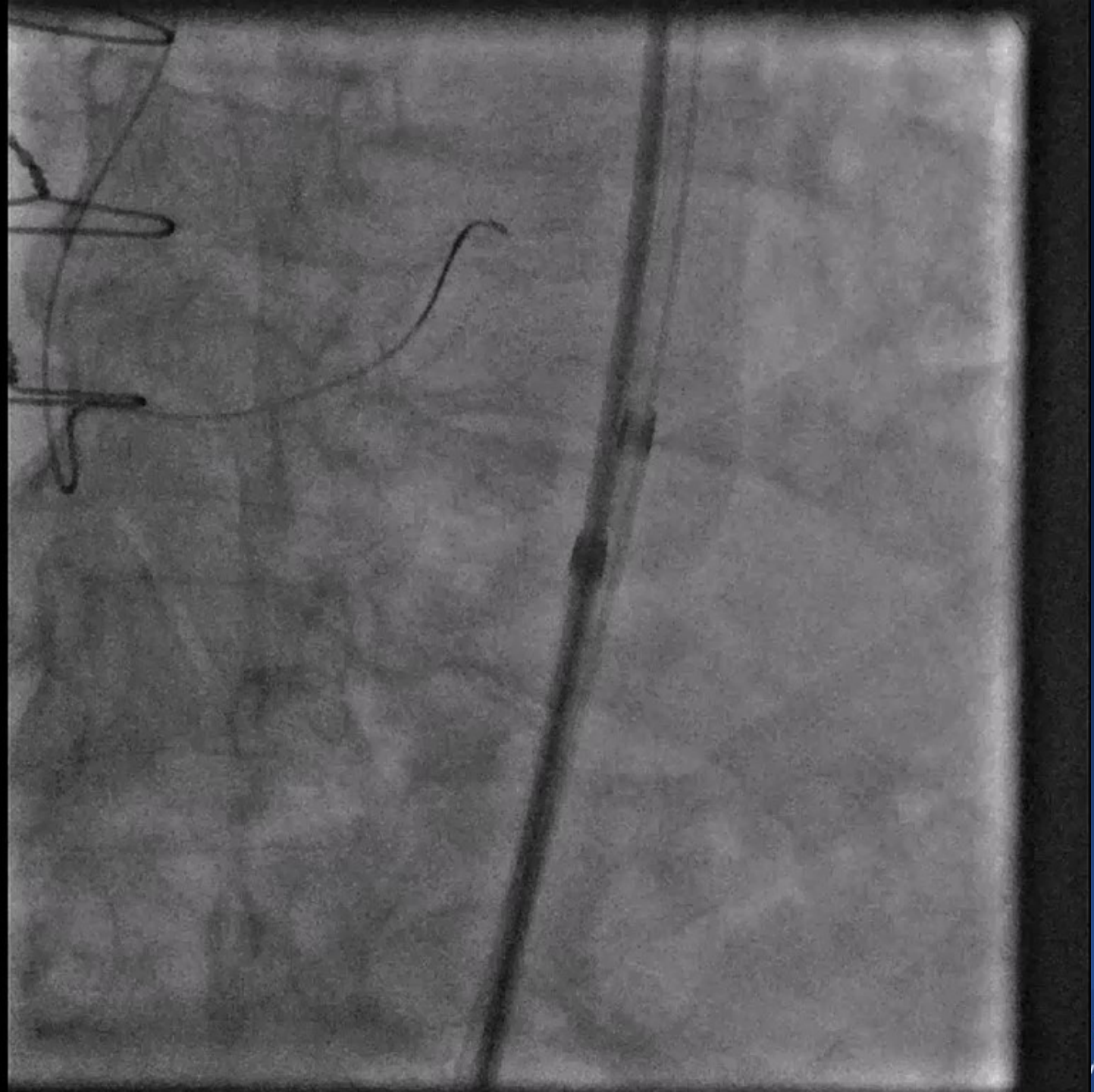

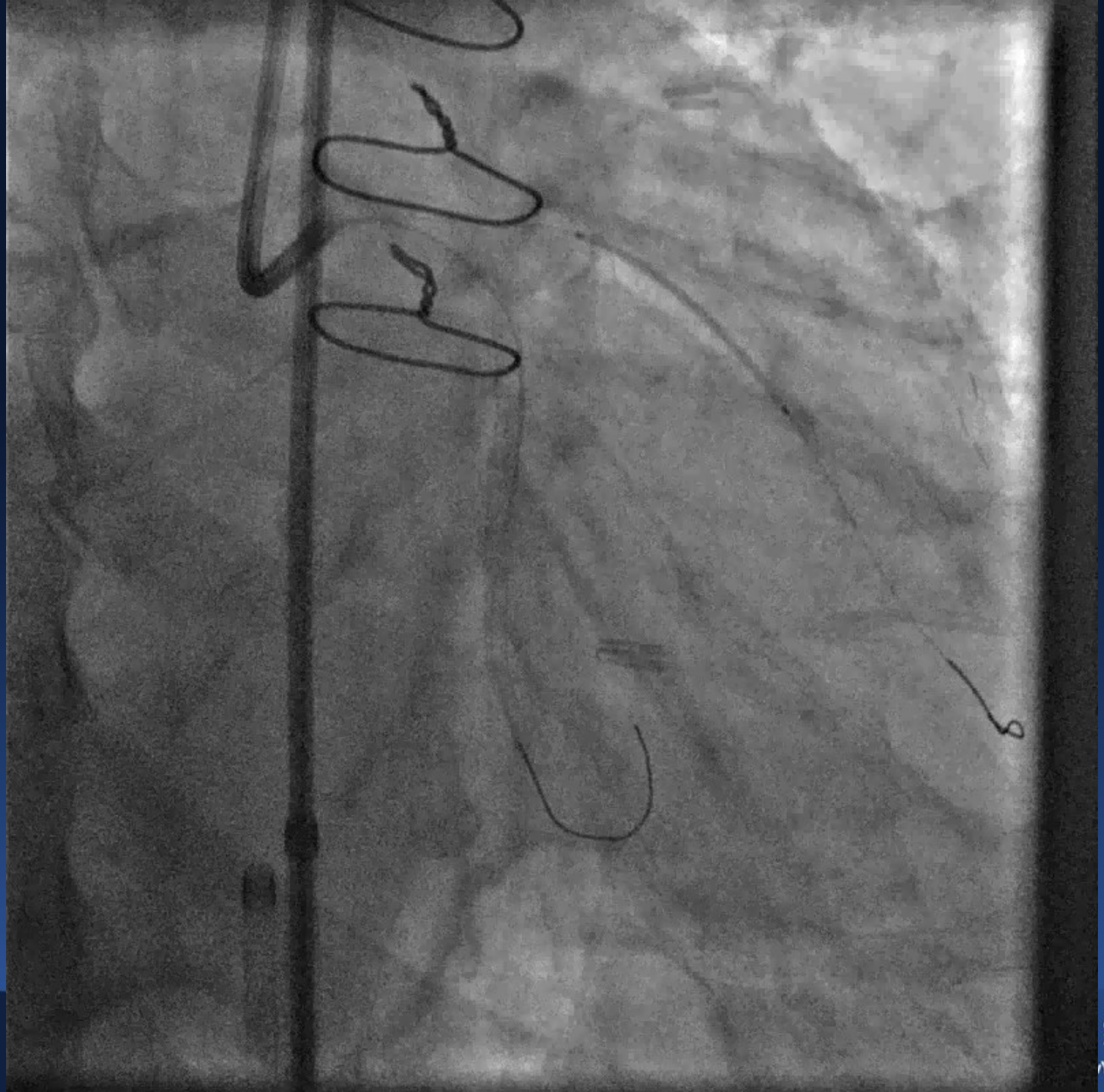

Kissing balloon inflation

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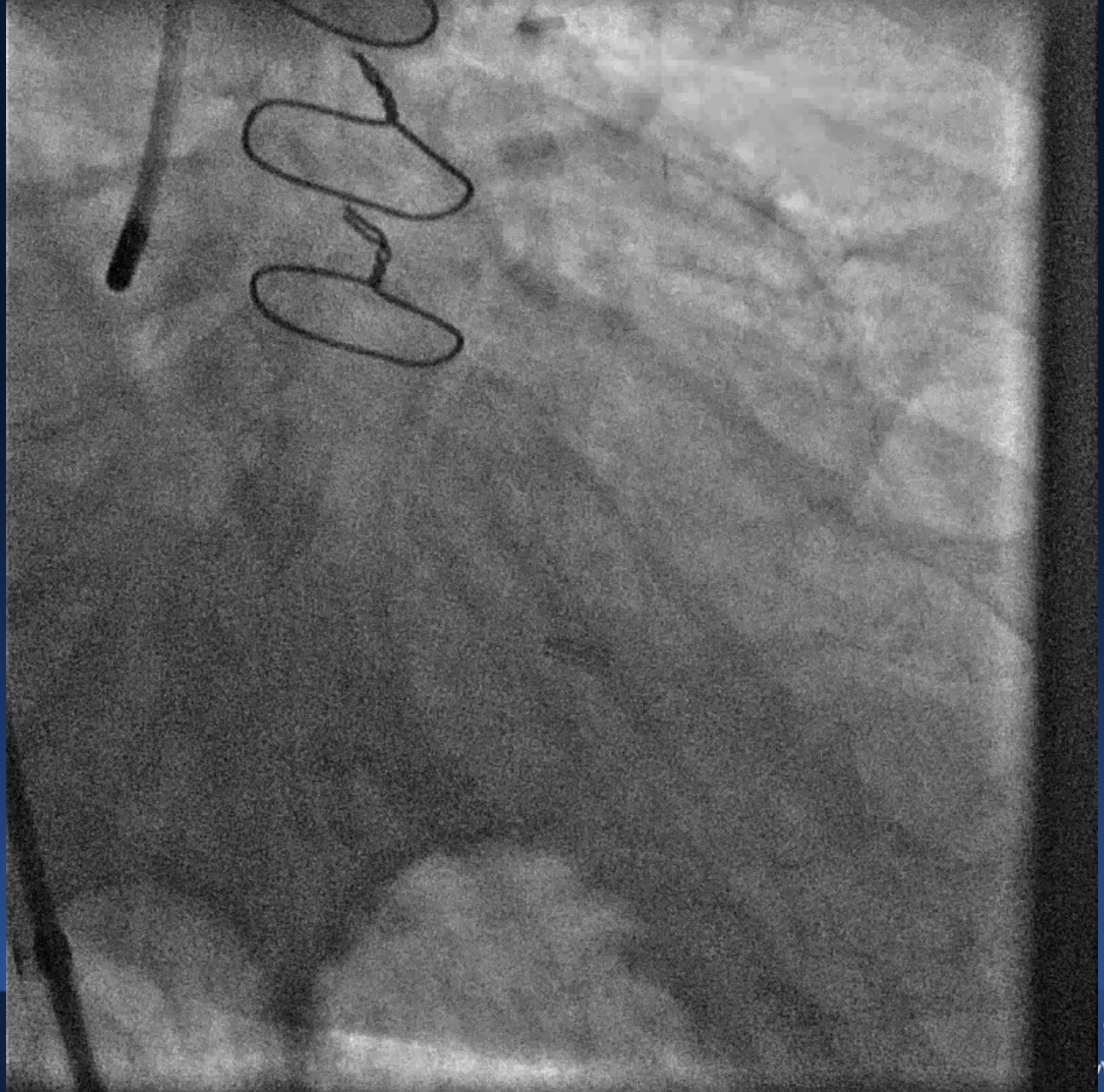

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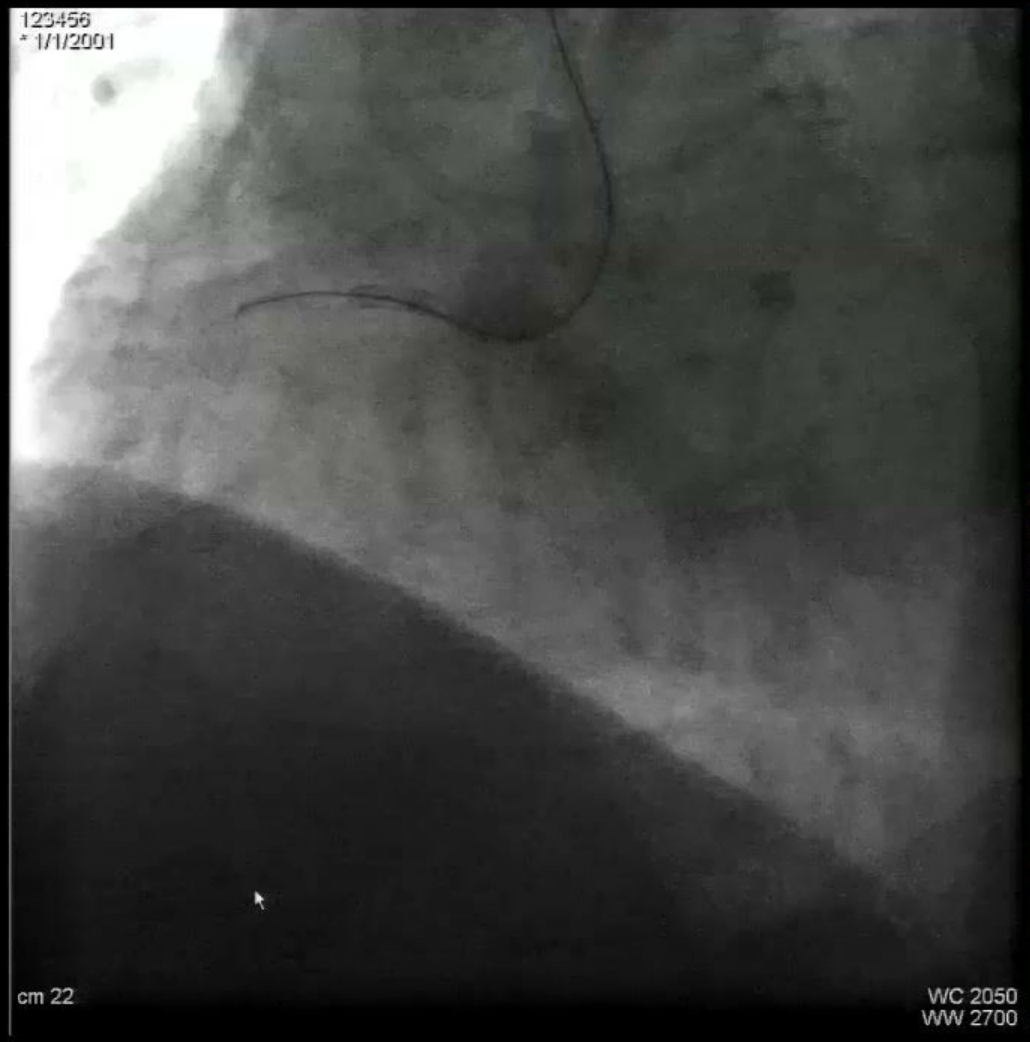
4444
* 4/4/1944
cm 32
WC 2050
WW 2700


AO
AO
103/48/71
103/56/75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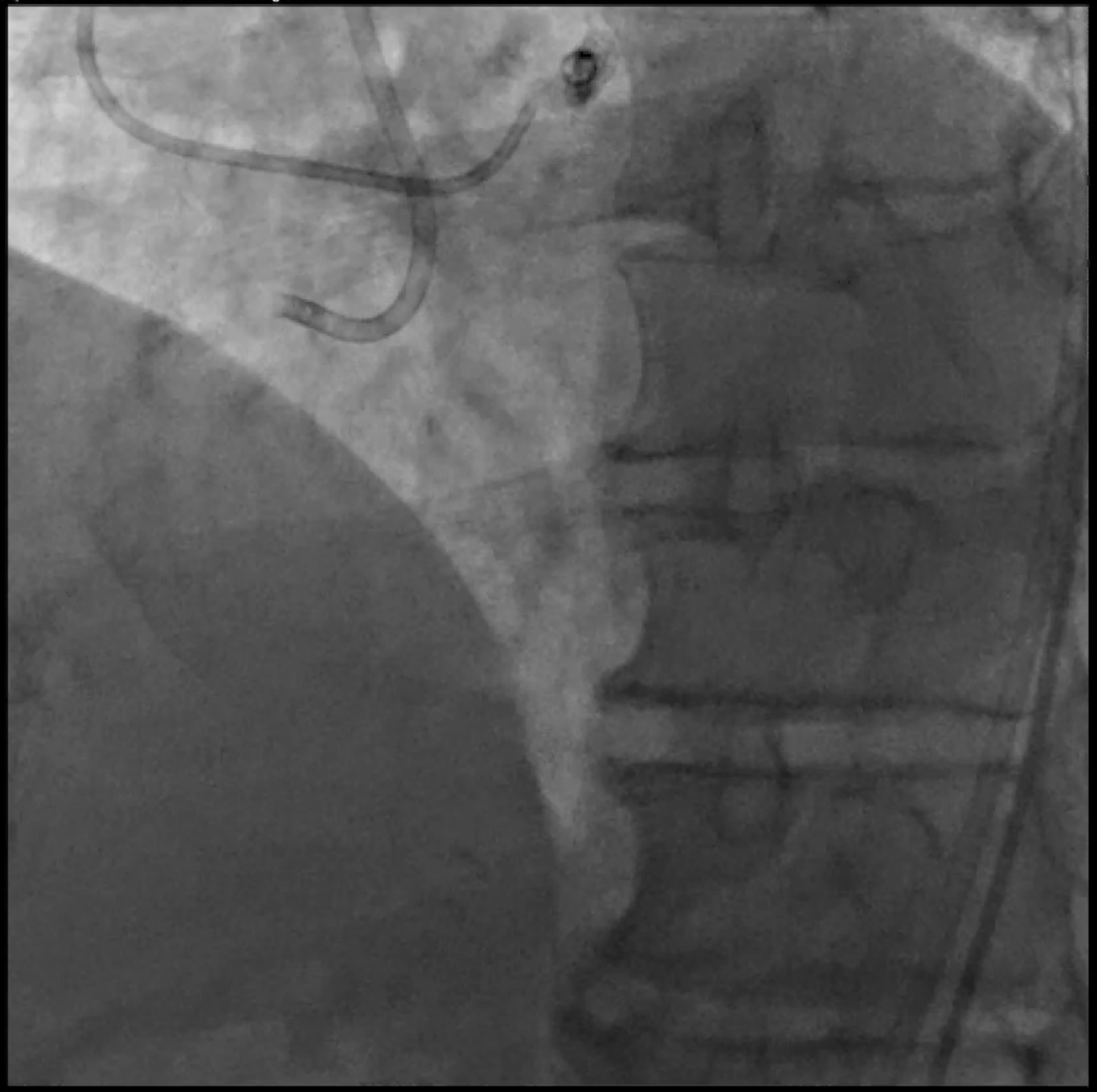
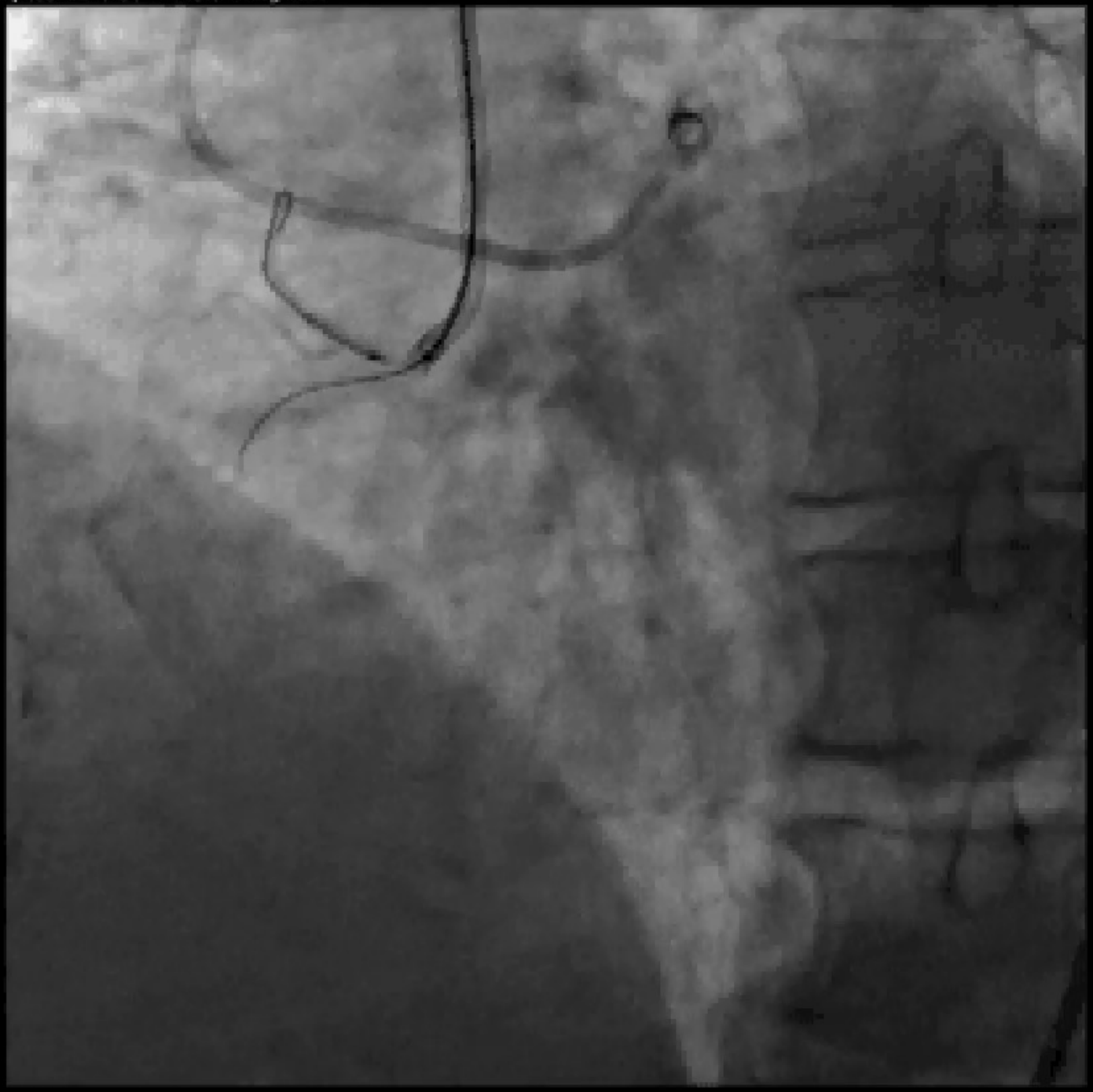
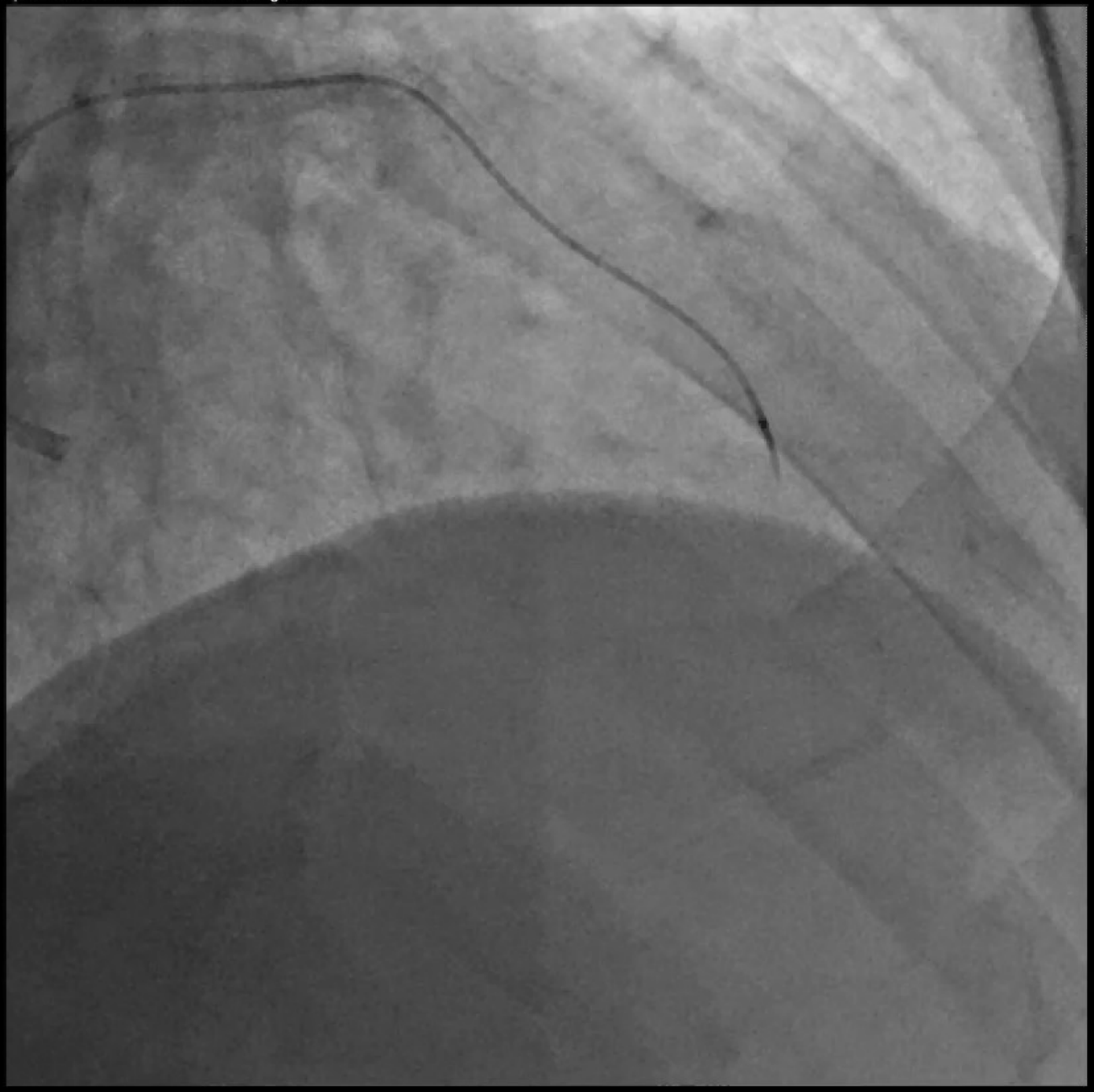
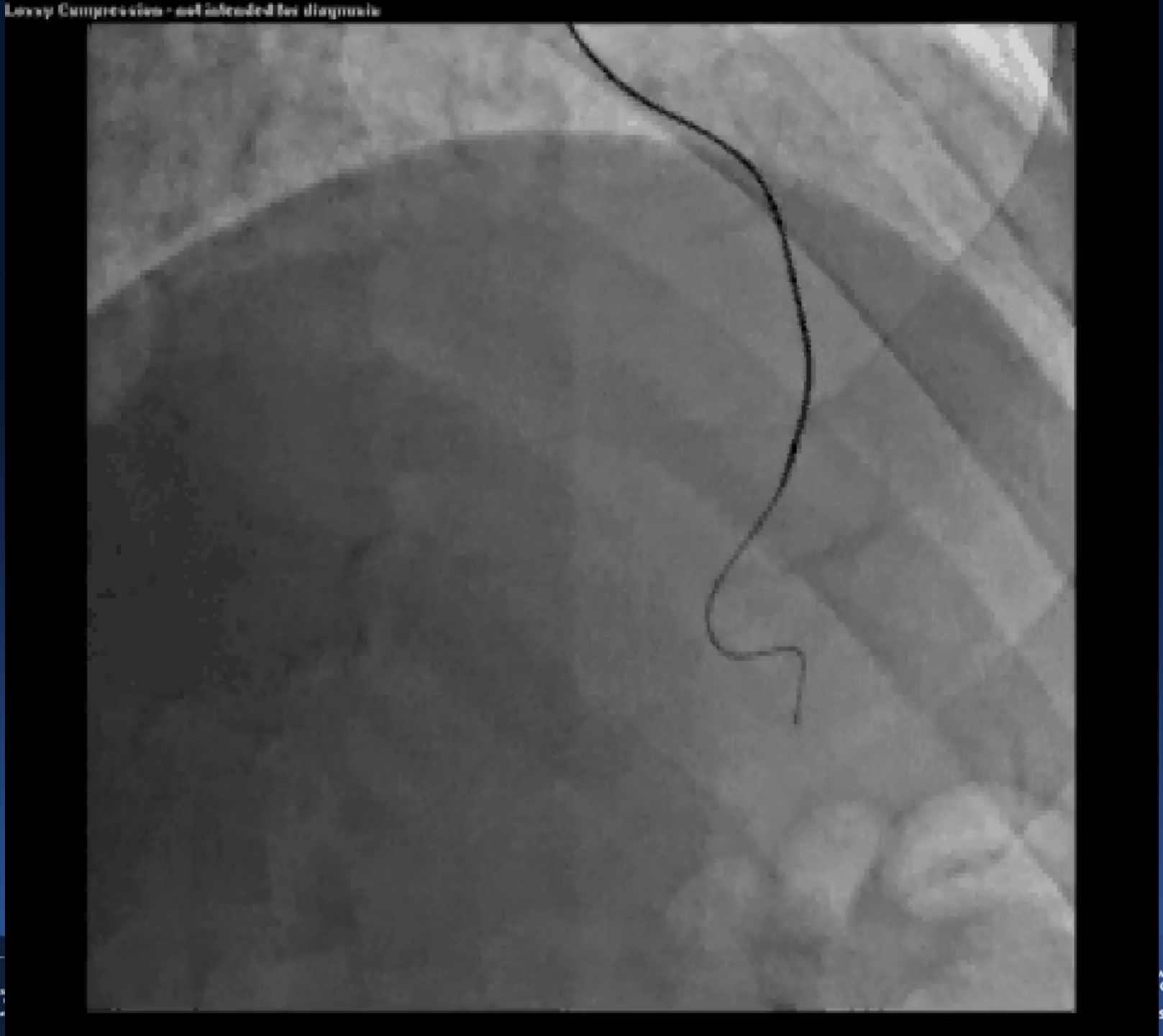
AO
AO
140/60/95
140/68/95

Putting it all together

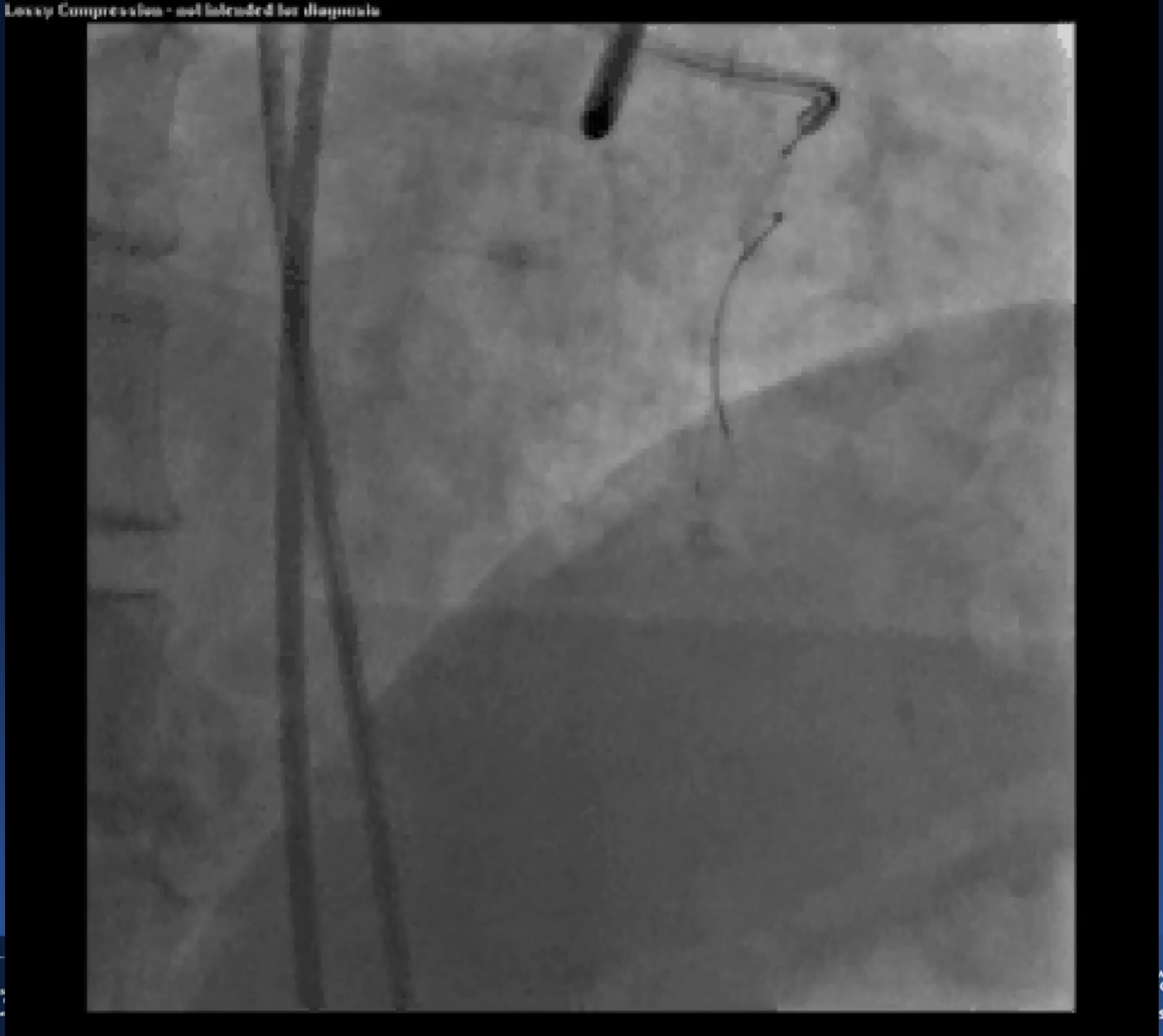


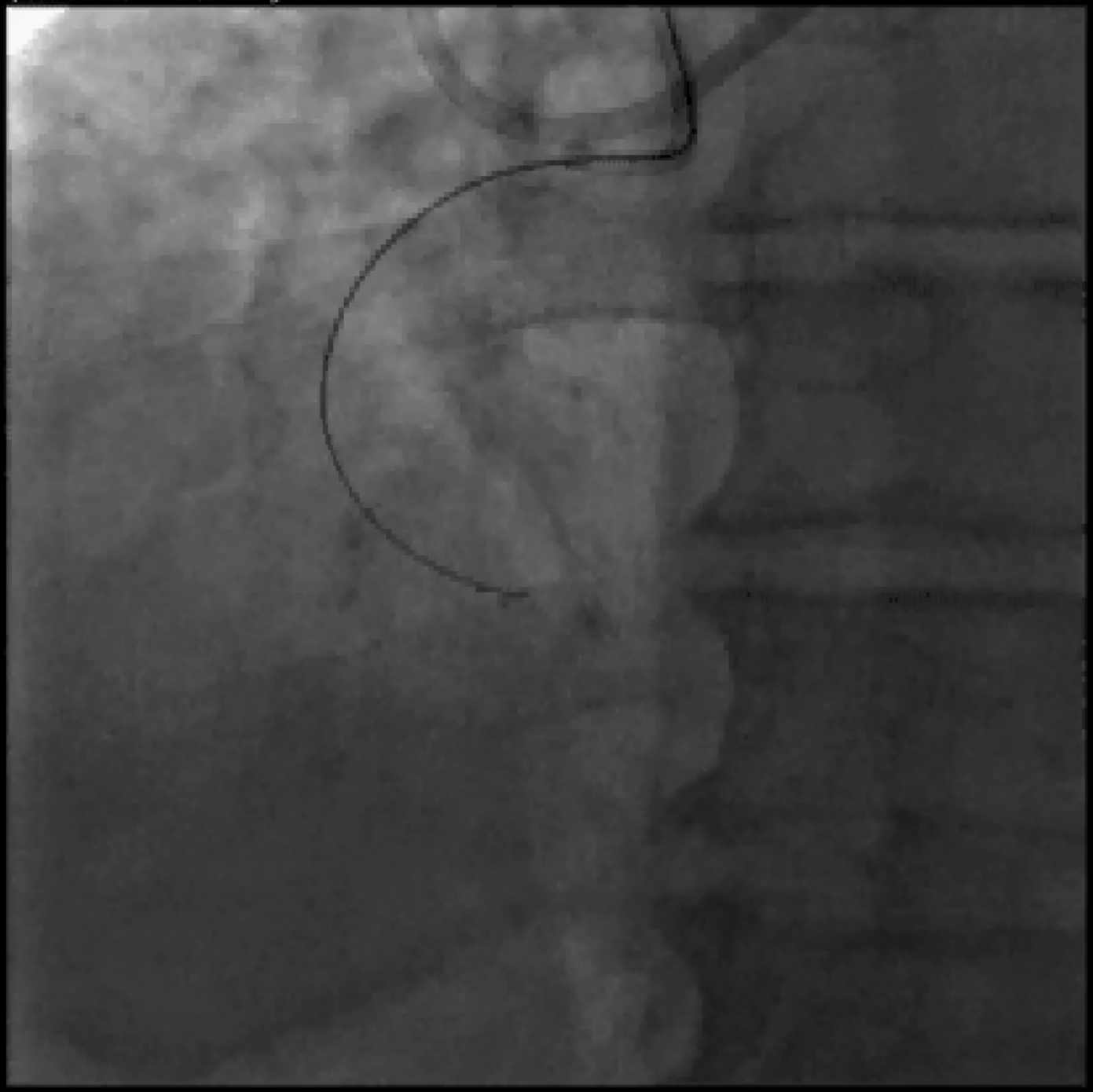


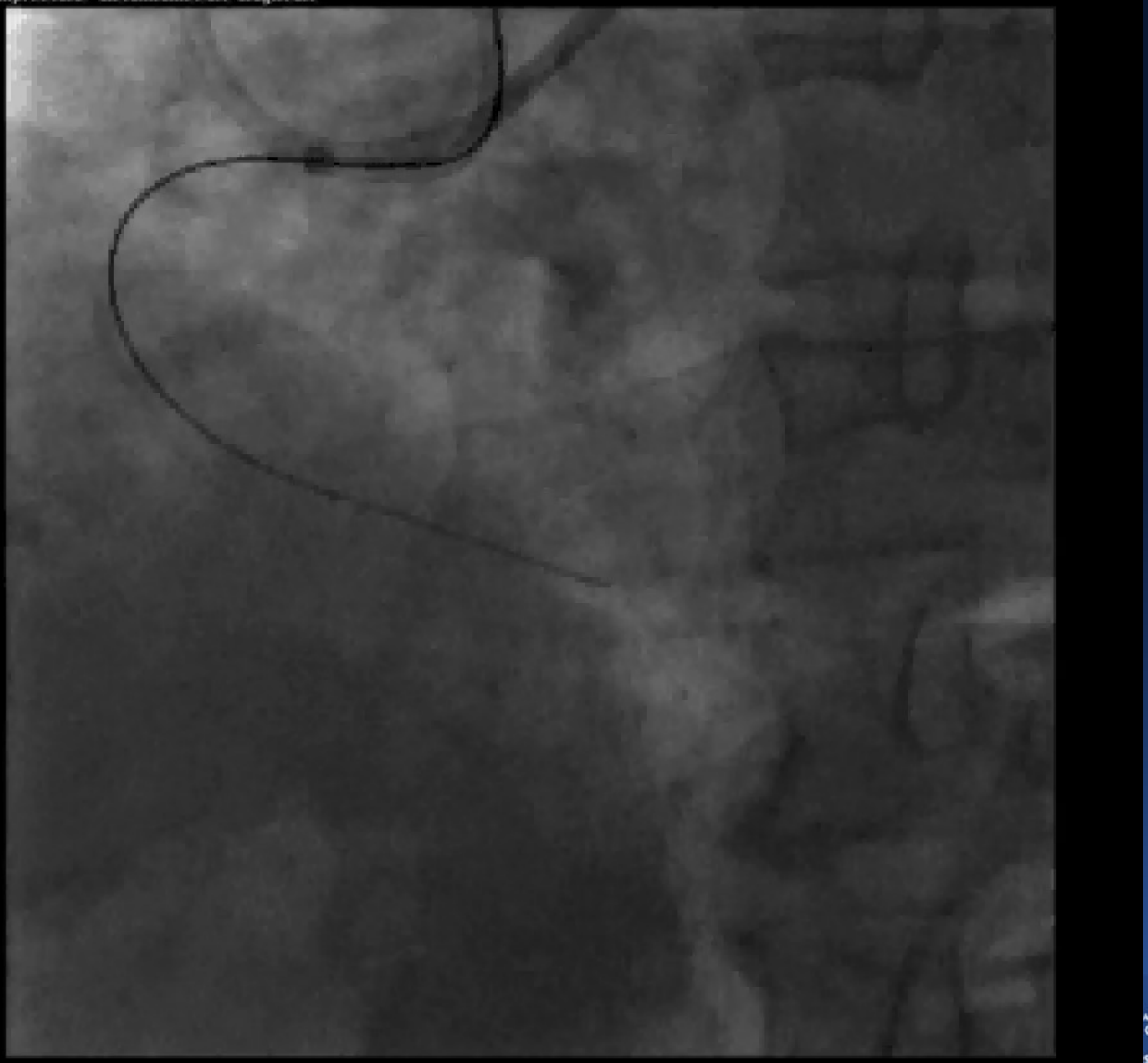



Lumen Compression - not intended for diagnosis


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

I am not advising you to show up in your new job, Day 1 in your new cath lab and

- Ask for 2 manifolds
- Two 8x45 Bright tip sheaths
- Start wiring Epicardial Collaterals
- Intentionally dissect vessels
- Inflating 3.5 and 4.0 balloons in the sub-intimal space
- Perform Reverse CART
- Externalize wires
- Occupy the lab for 4 hours
- Give 6 Grays of radiation and 400 cc of contrast to your first PCI case
- Use 7 wires, 9 balloons and implant 4 stents

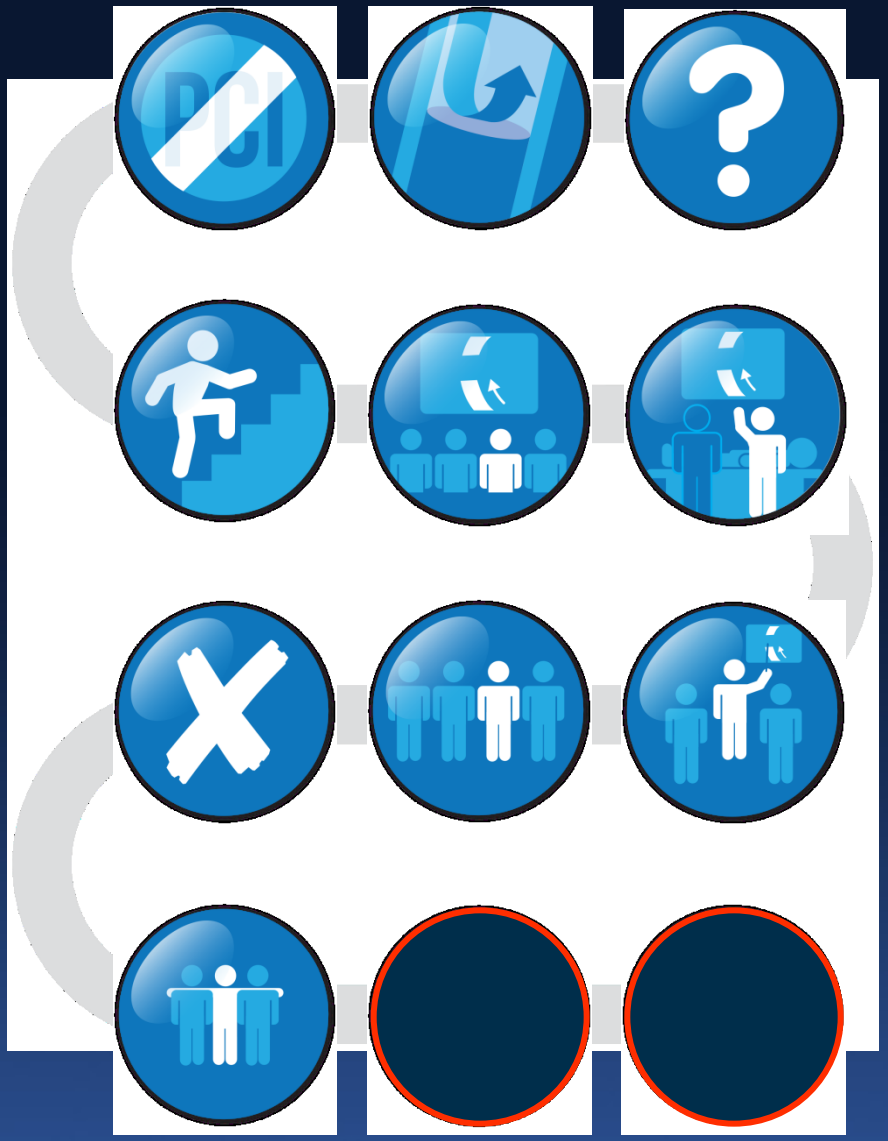
Meetings

Proctoring

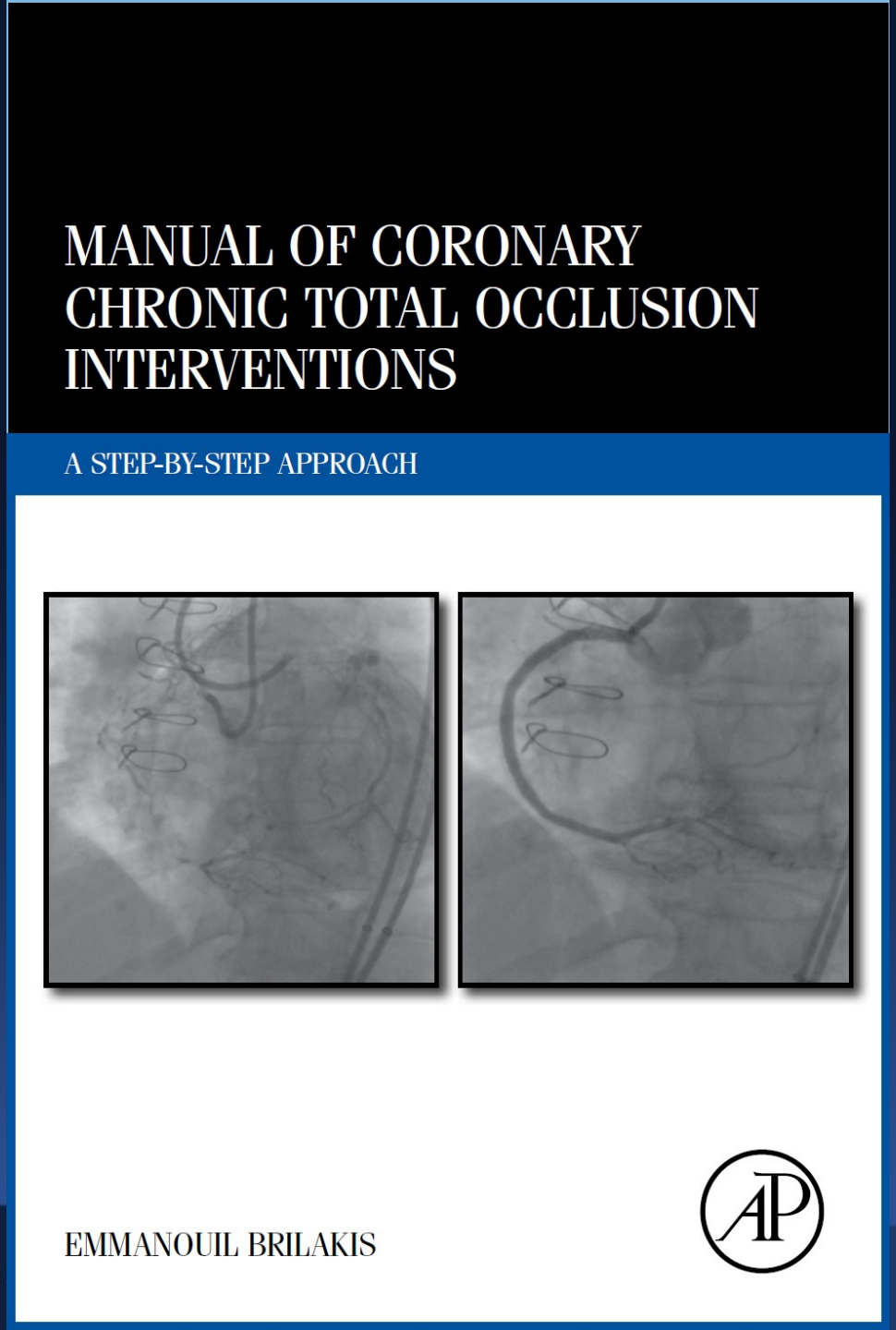
Online Education

Workshops

iBooks`


PCI


CTO
CTOFUNDAMENTALS.ORG



Release: TCT 2013

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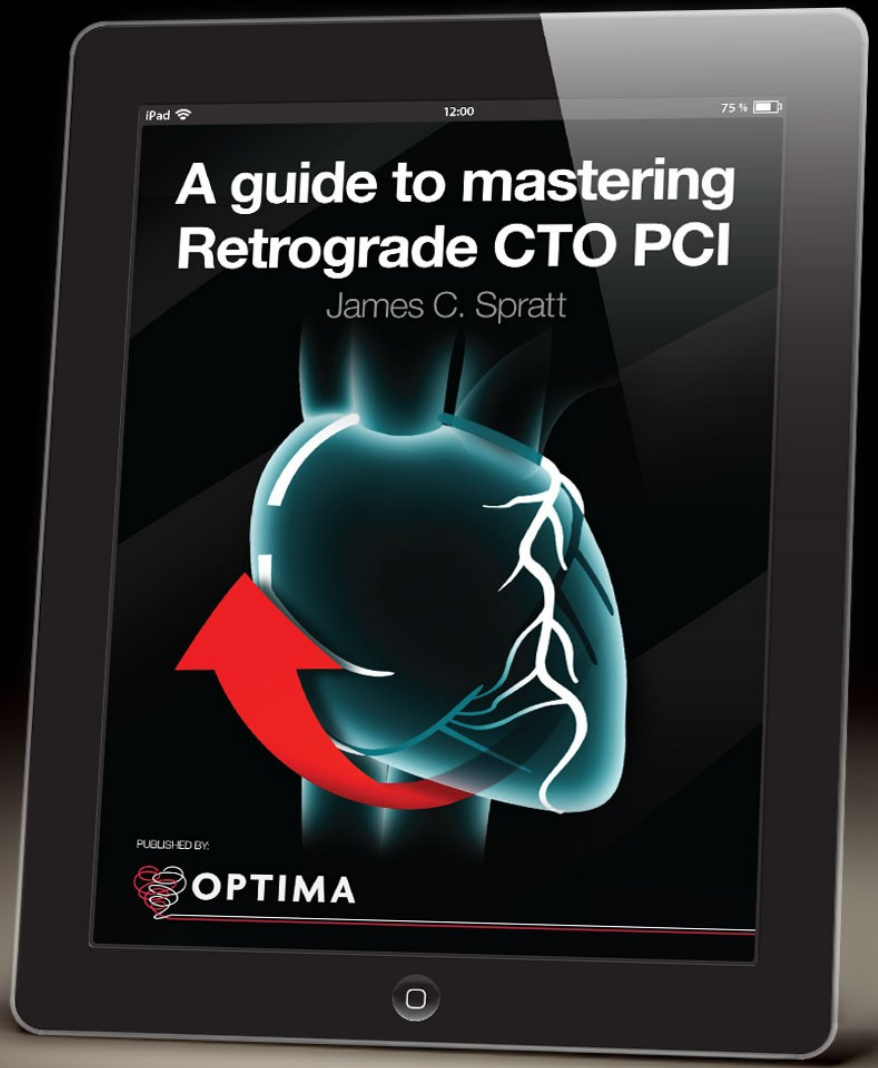

Retrograde iBook due for launch very soon!

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