April 27th, 2006
Seoul, Korea

How to Penetrate the Proximal and Distal Fibrous Caps in Chronic Total Occlusion?

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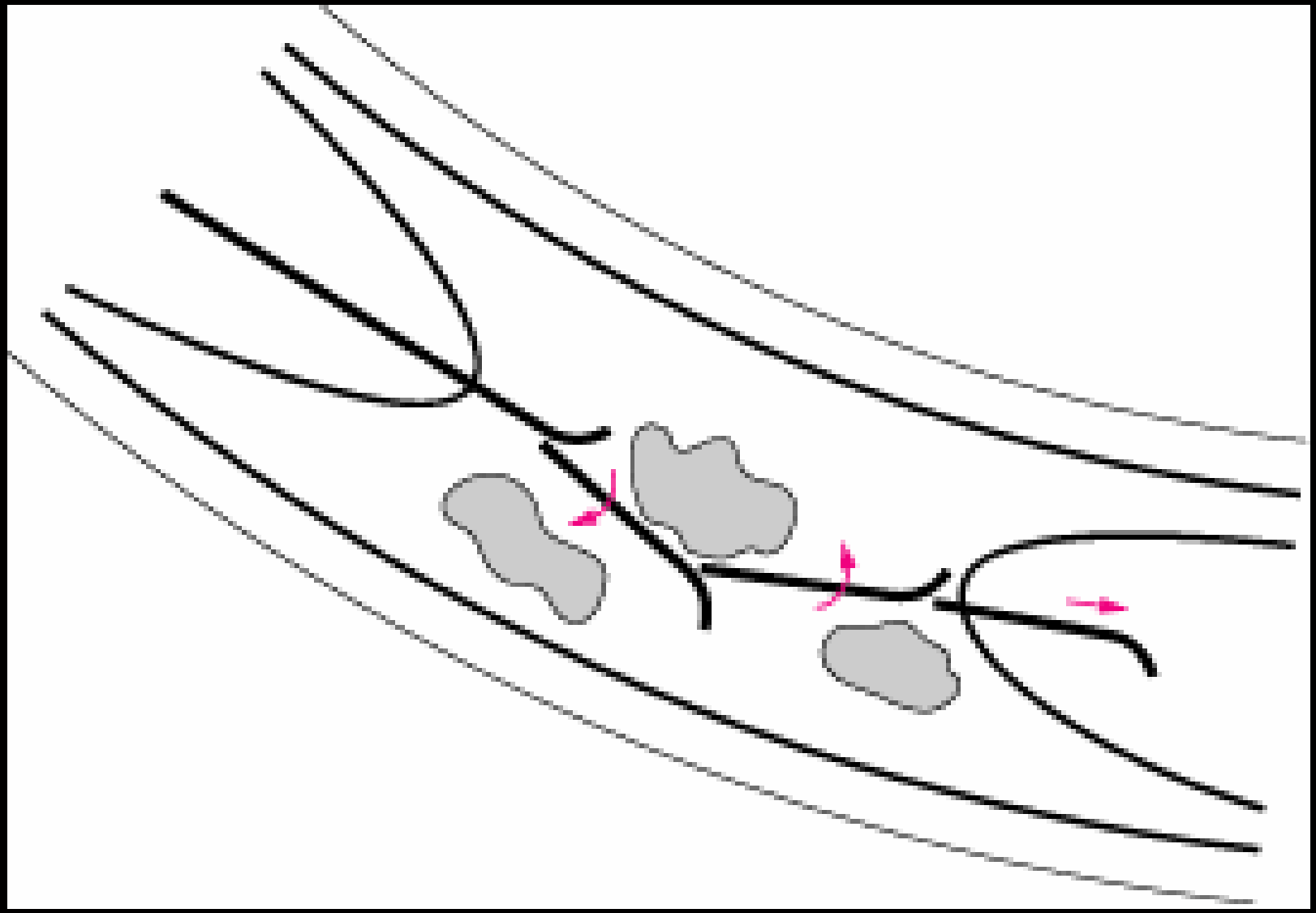
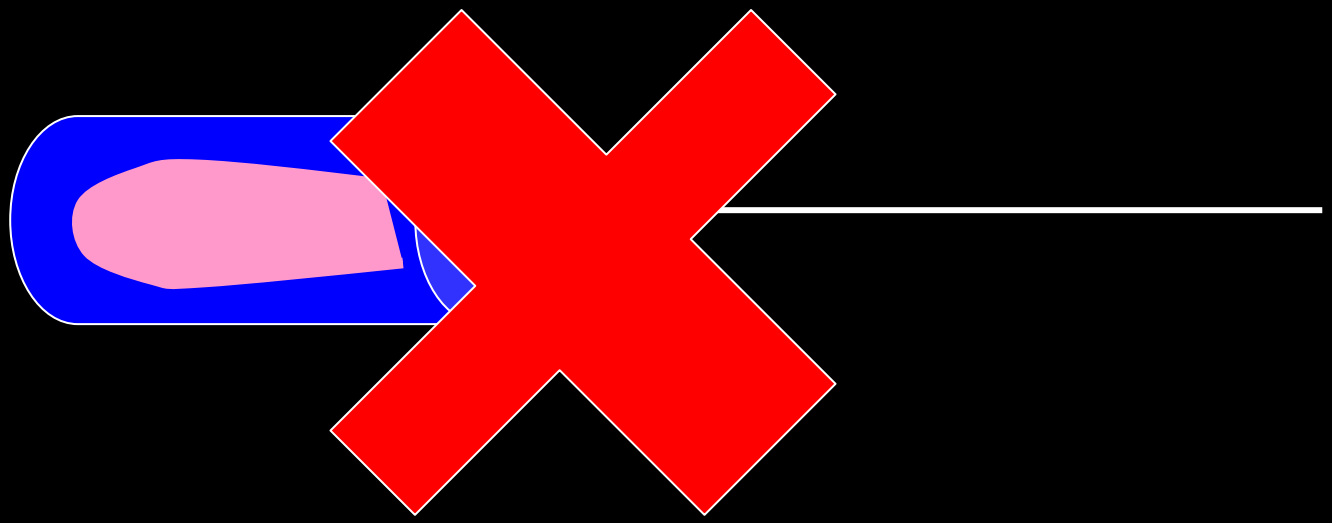
The Concept of “Conventional” Wiring for CTO

The operator ***advances*** the stiff wire ***with active rotation***.

The true or false lumen inside the CTO is judged ***by the tactile feelings in pulling-back the stiff wires***.

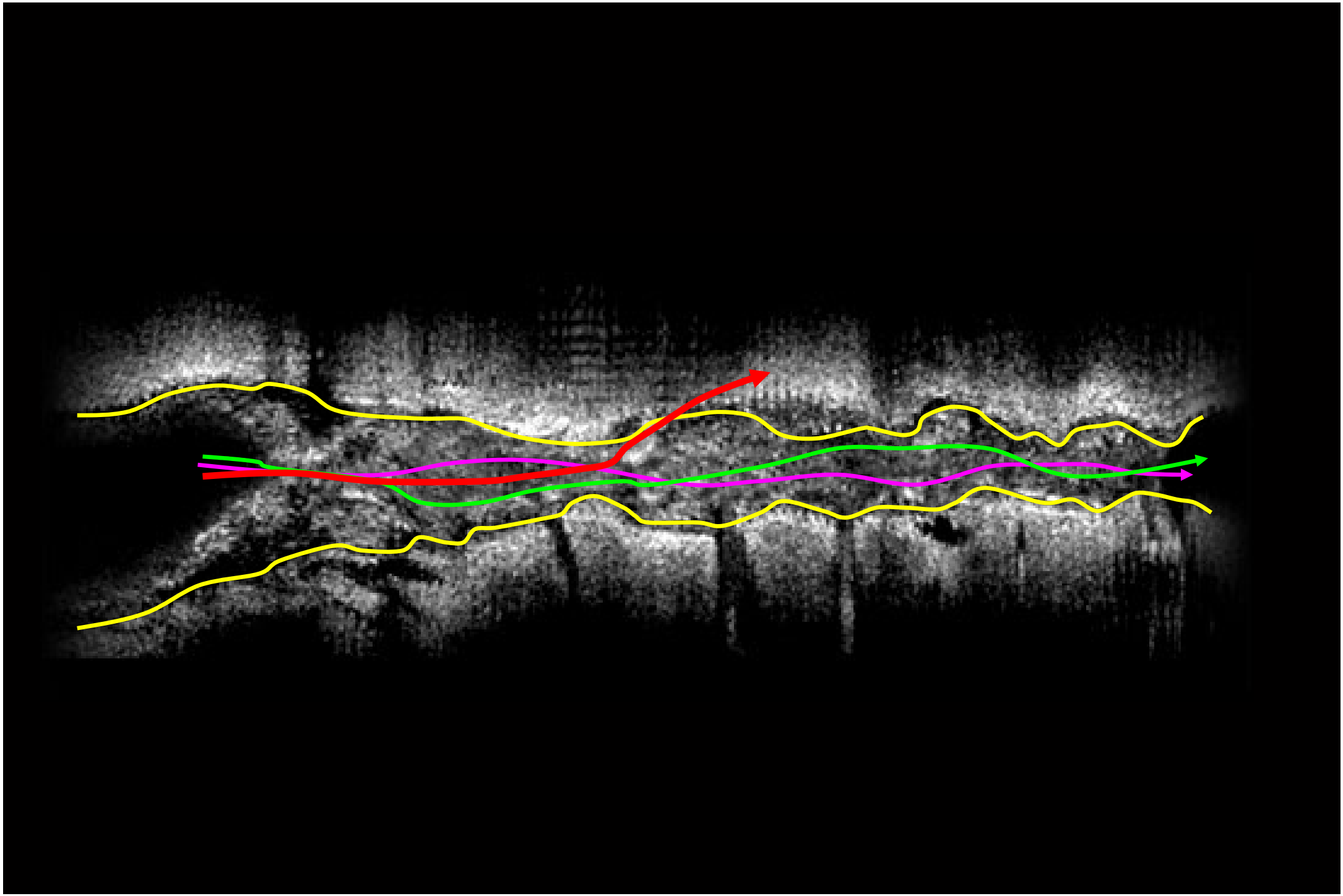


Actual Results of “the Conventional Wiring” (Active Rotation of the Wire)



Ideal Wiring inside the CTO

To keep the wire inside "the External Elastic Membrane" and to bring it to the distal true lumen

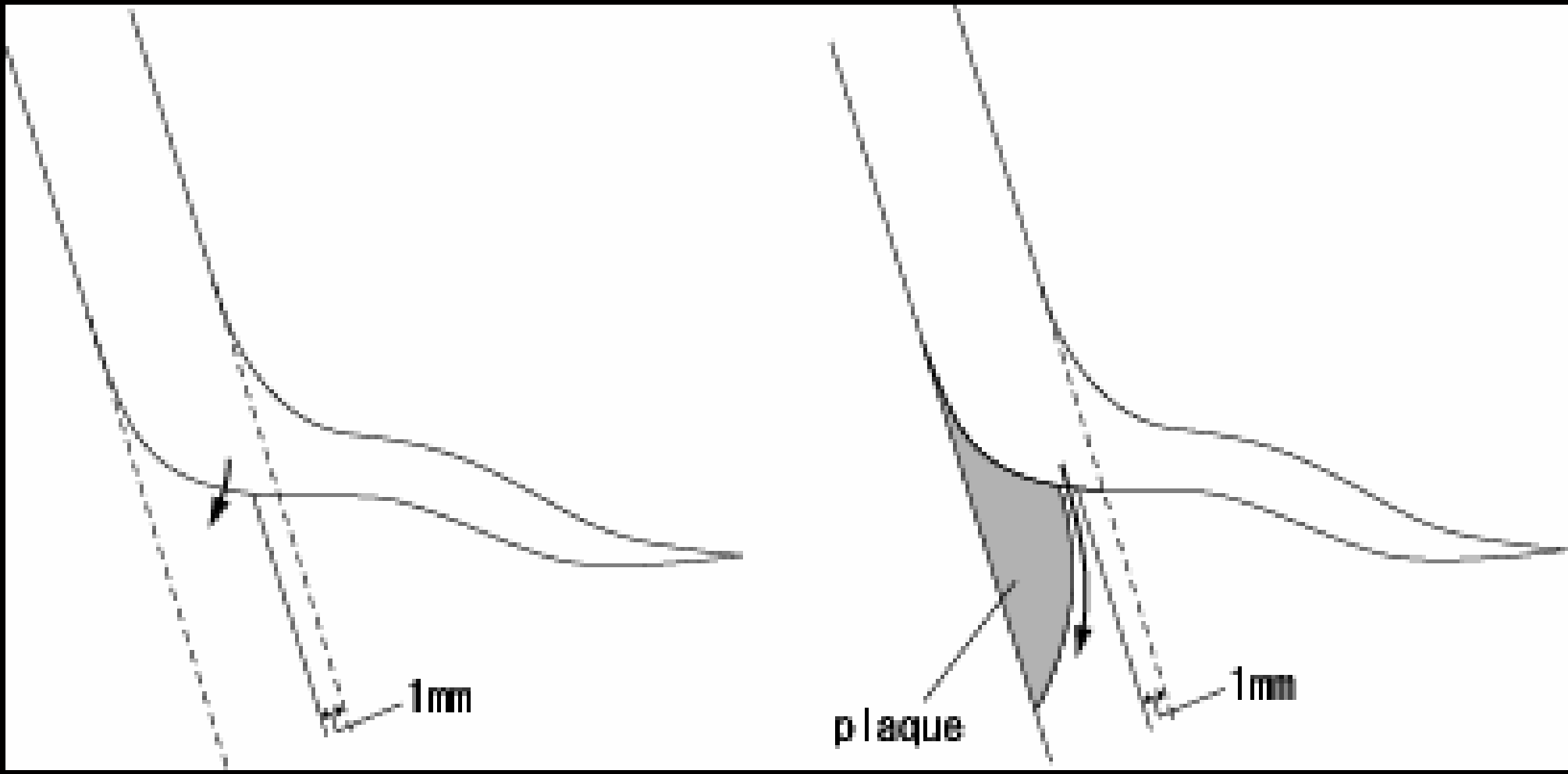


The “Modern” Concept of Wiring for CTO

The operator ***draws wiring lines in the CTO before the procedure***. Then, the wire should be advanced ***according to the lines***.

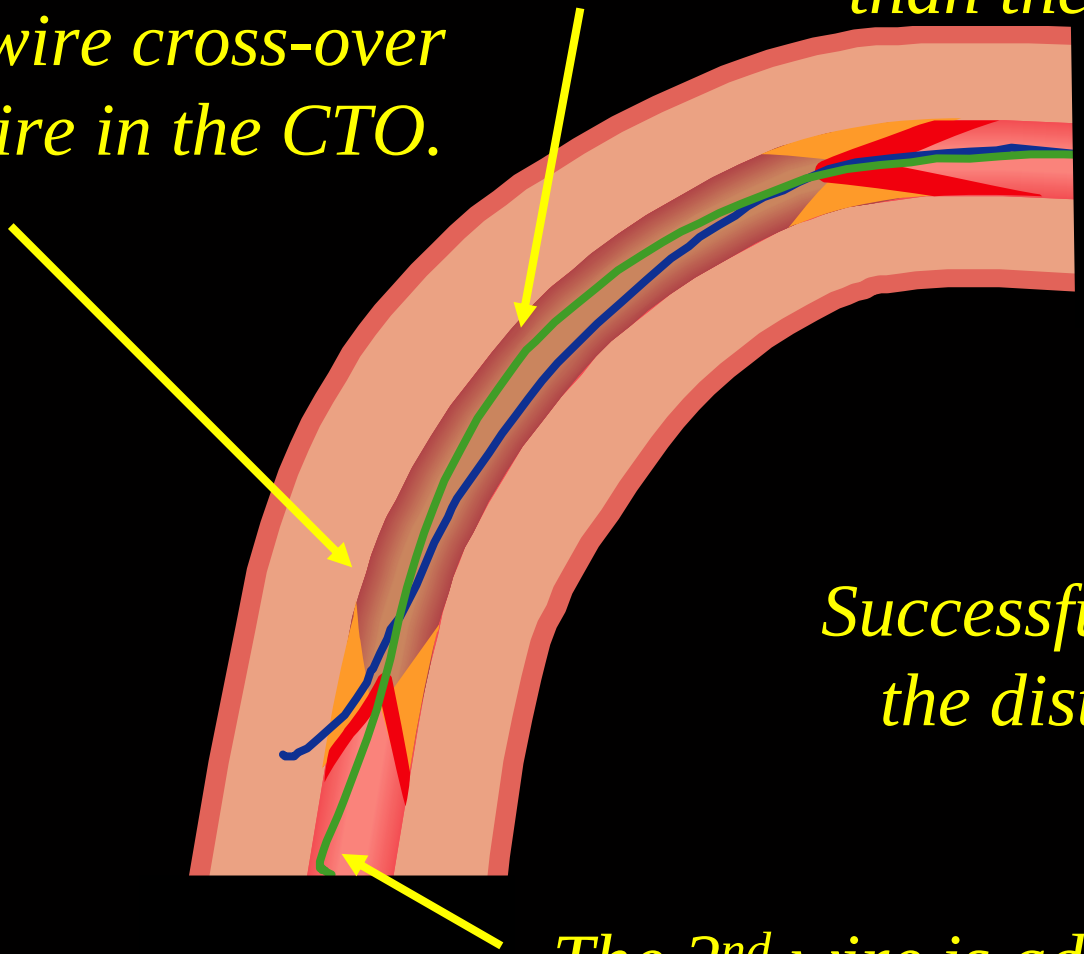
The lines should be drawn 3-dimentionally (or ***in 2 different projections***) and be based on ***the scientific analysis*** of the CTO.

Penetration of the Proximal Fibrous Cap in the Abrupt Type CTO at the Side-branch



The 2nd wire shows more acute curve than the 1st wire.

The 2nd wire cross-over the 1st wire in the CTO.



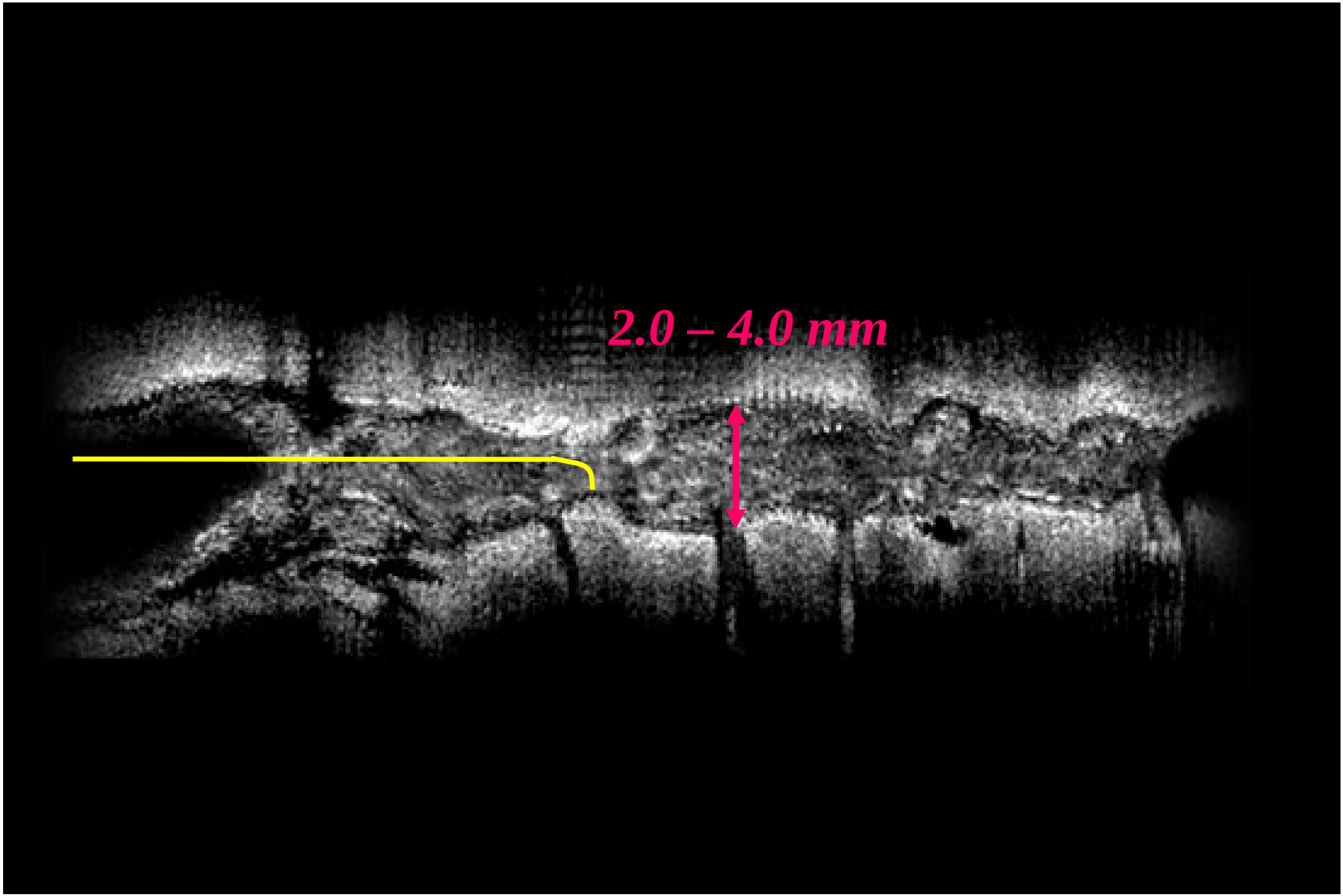
Successful penetration of the distal fibrous cap.

The 2nd wire is advance to the out-side of the distal vessel.

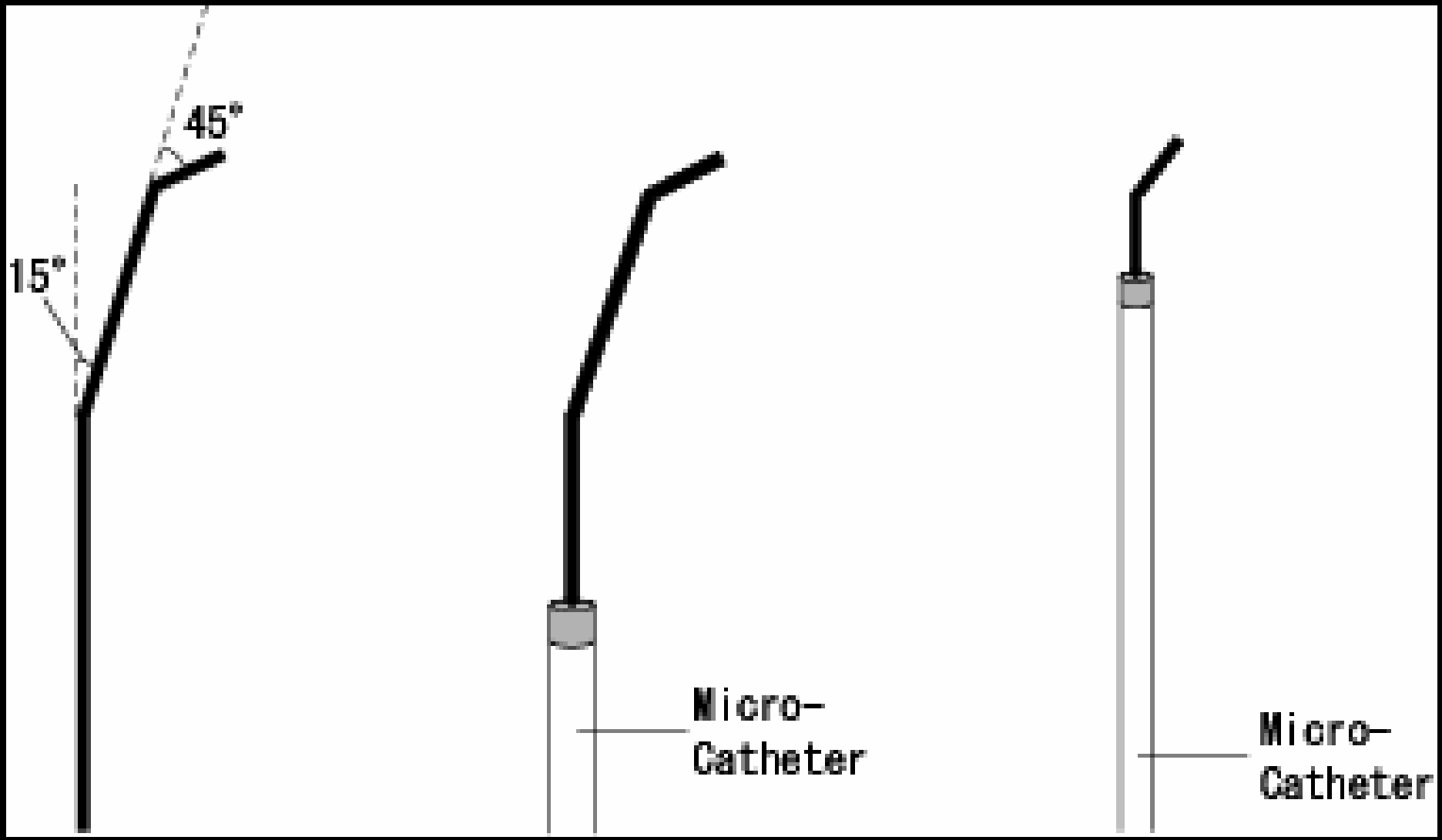
How can We Advance Wires according to the Lines in CTO?

Three Key Components for Successful Wiring

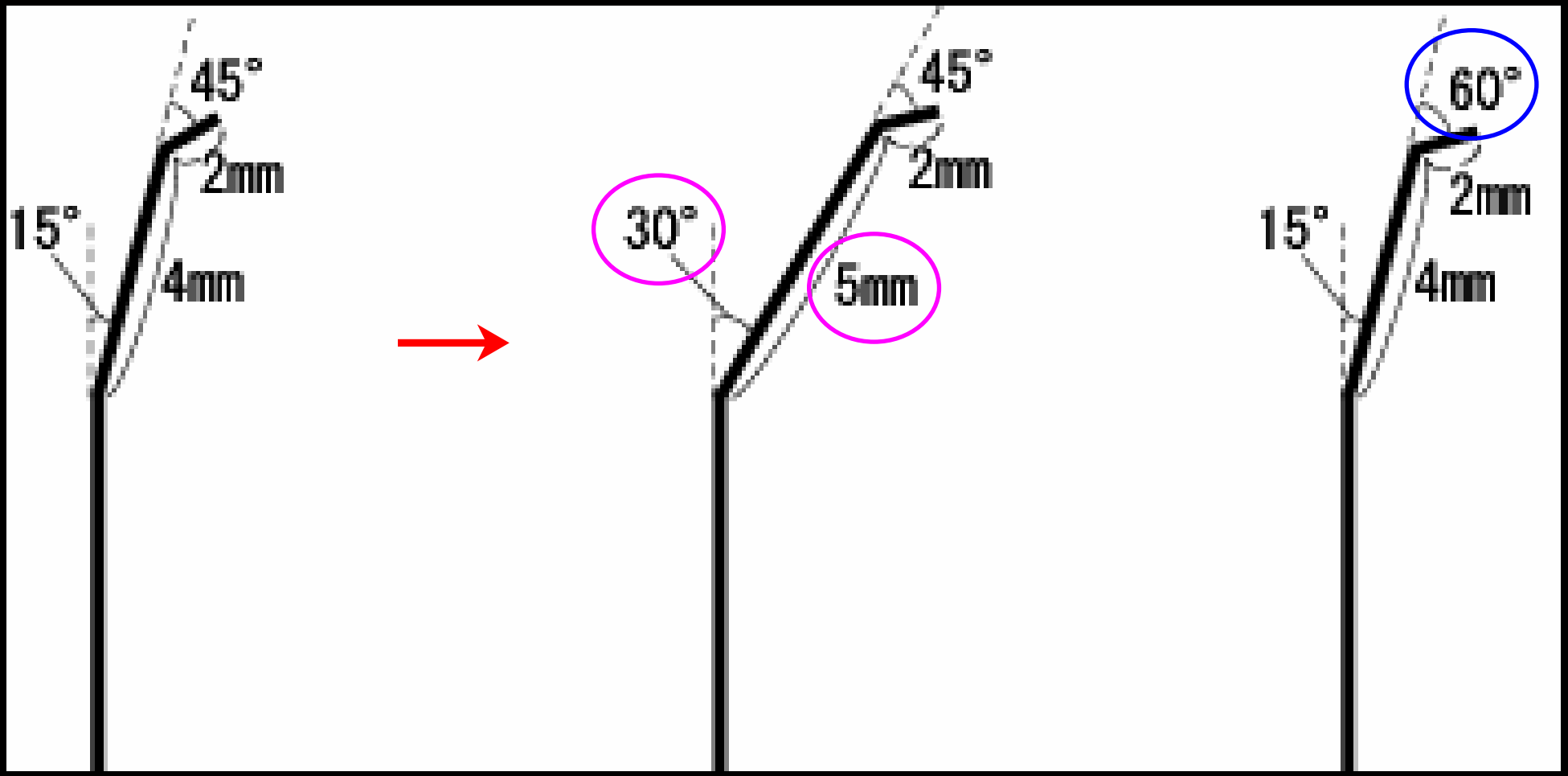
- 1) **The *shaping* of the wire tip**


2.0 – 4.0 mm

Shaping of the Wire



Impact of the “Double-bend” Shaping

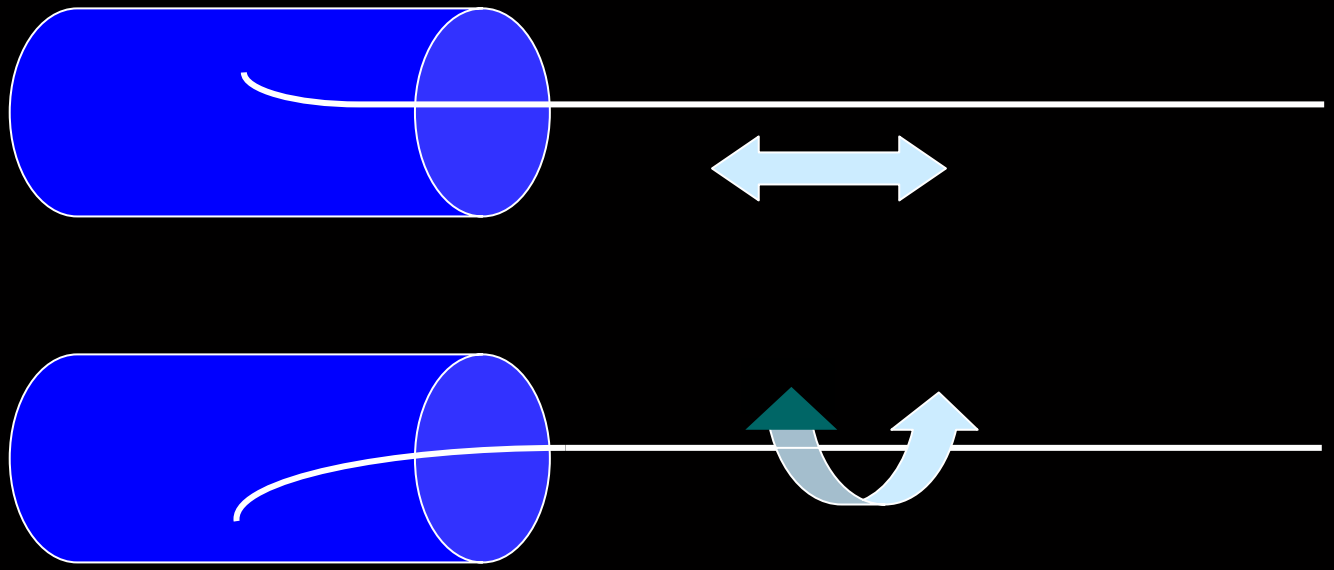


Three Keys for Successful Wiring

- 1) **The *shaping* of the wire tip**
- 2) **The *manipulation* of the wire**

Technique of the Wire Manipulation

- Penetration vs. Controlled Drill

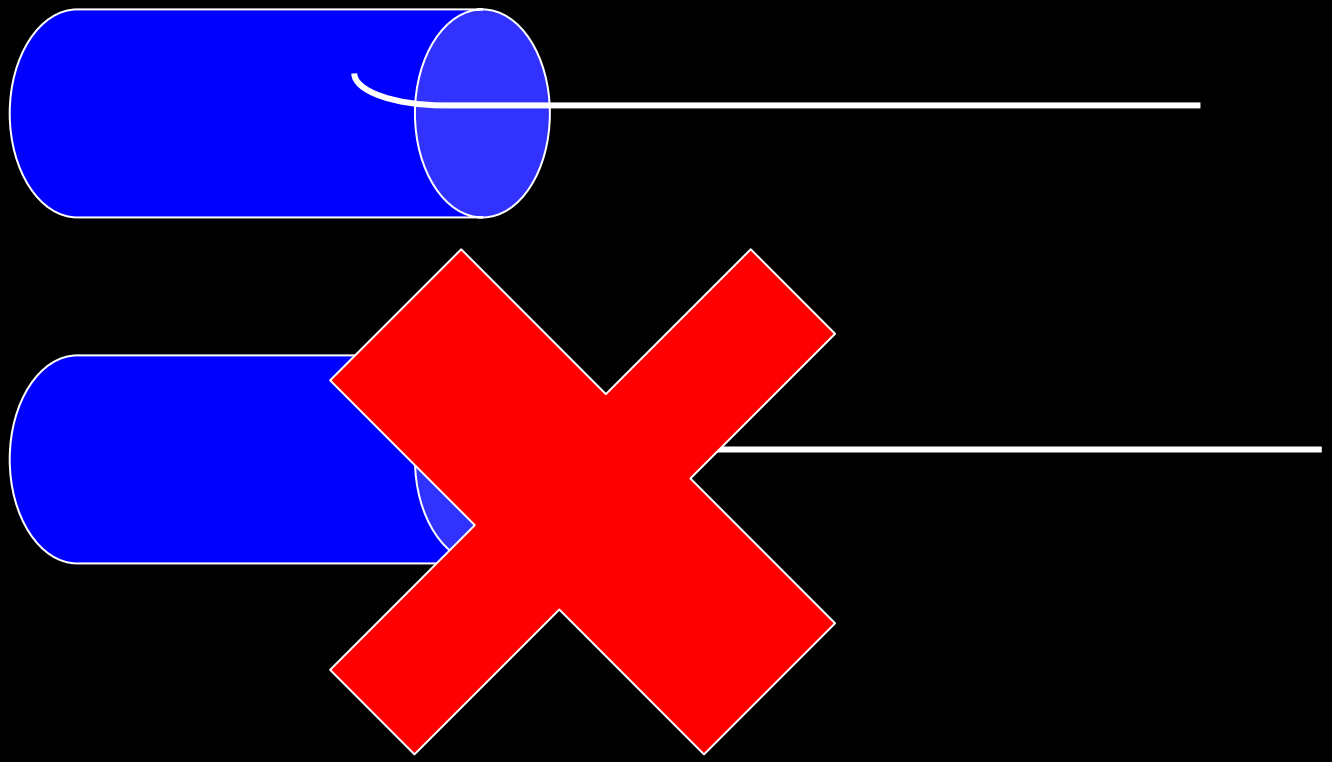


Directional control of the wire tip is more precise in "**Penetration**".

Advancement of the wire tip is easier in "**Controlled Drill**".

Technique of the Wire Manipulation

- Penetration vs. Controlled Drill ≠ Drilling



Techniques of Wire Manipulation among 6 Debaters

Classification by Dr Satoru Sumitsuji

- Penetration or Controlled Drill… ???
- Confianza or Miracle… ???

	Penetration	Controlled Drill
Confianza	Mitsudo, Ochiai	Sumitsuji
Miracle	Tamai	Kato, Tsuchikane

CTO Club JAPAN 2005

Gregg W. Stone M.D.

"Zen Philosophy -The Key to CTO Success"

October 1st , 2004 during TCT2004

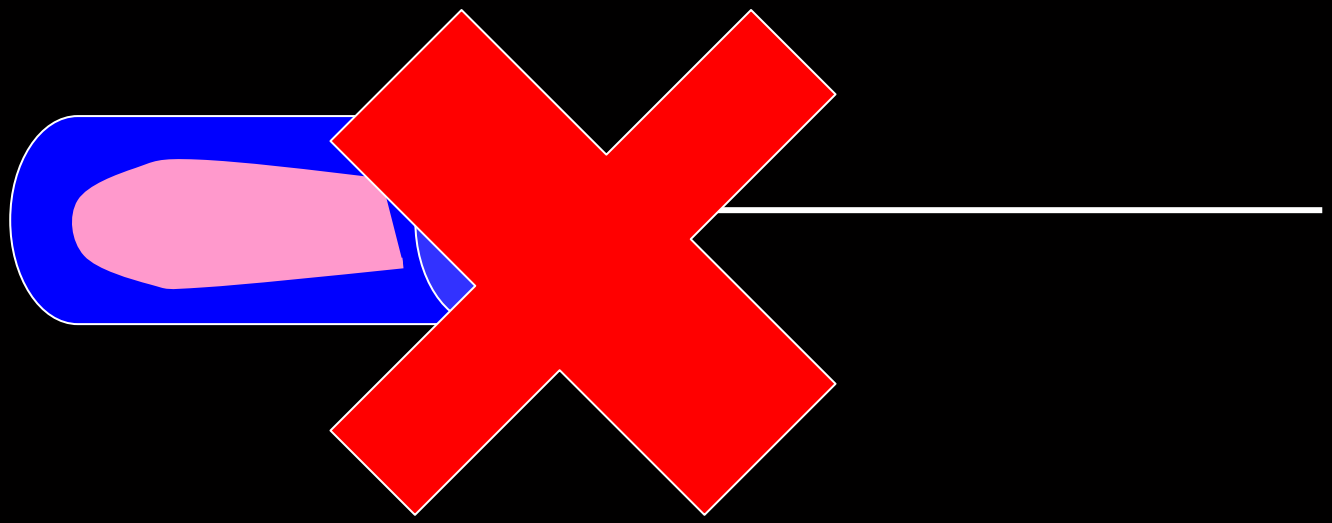
“Zen Philosophy” in the PCI for CTO

We should ***overcome the temptation*** to rotate actively or advance rapidly the dedicated stiff wires for CTO.

“Zen Philosophy” in the PCI for CTO

In other words, “Zen Philosophy” is to advance dedicated CTO wires ***maintaining “the directional control”*** according to the “penetration” or the “controlled drill” strategy.

“Zen Philosophy” in the PCI for CTO



Three Keys for Successful Wiring

- 1) **The *shaping* of the wire tip**
- 2) **The *manipulation* of the wire**
- 3) **The *penetration power* of the wire**

December, 2004 Yokohama (Japan)

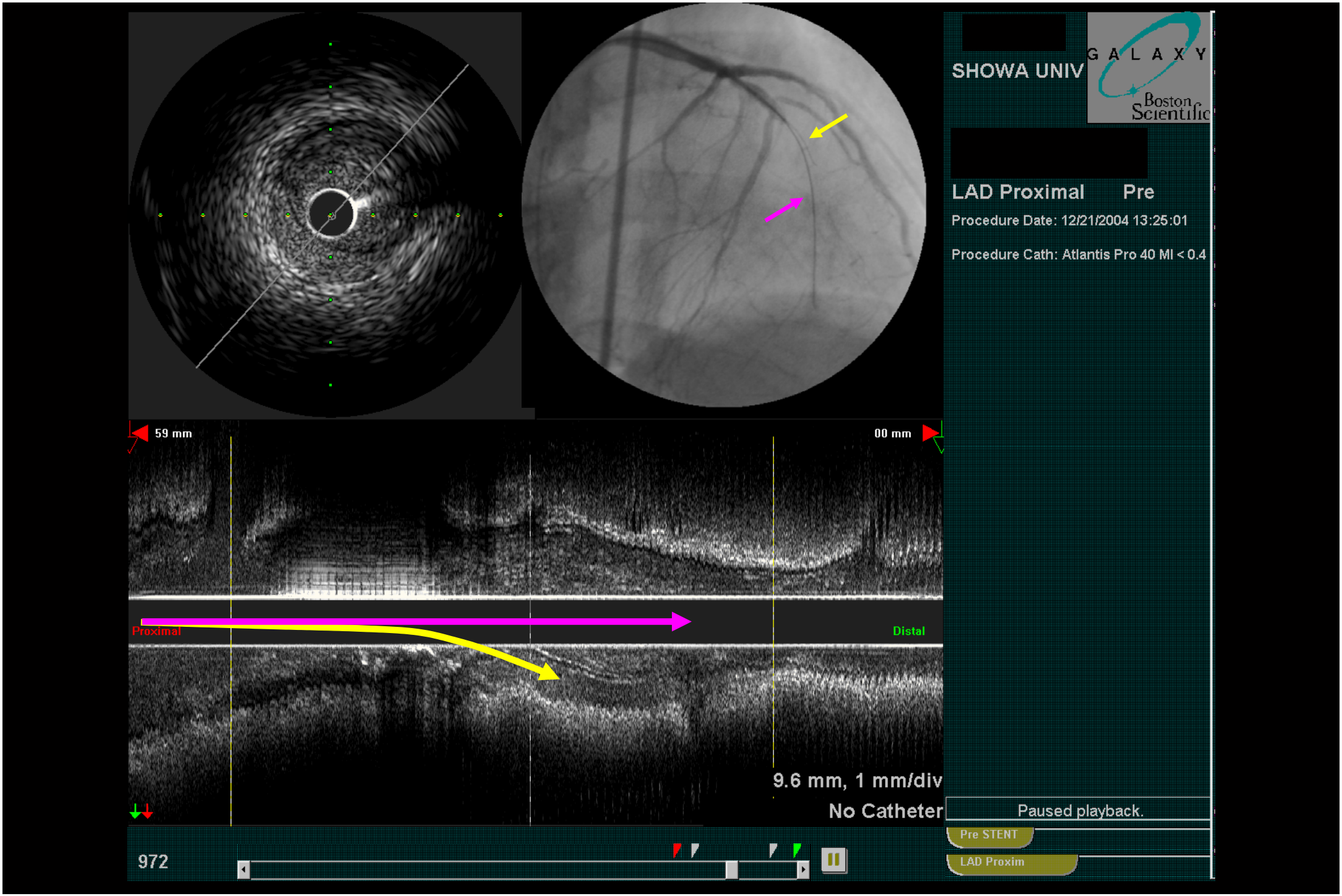
50years, male. AMI (posterior) / Shock

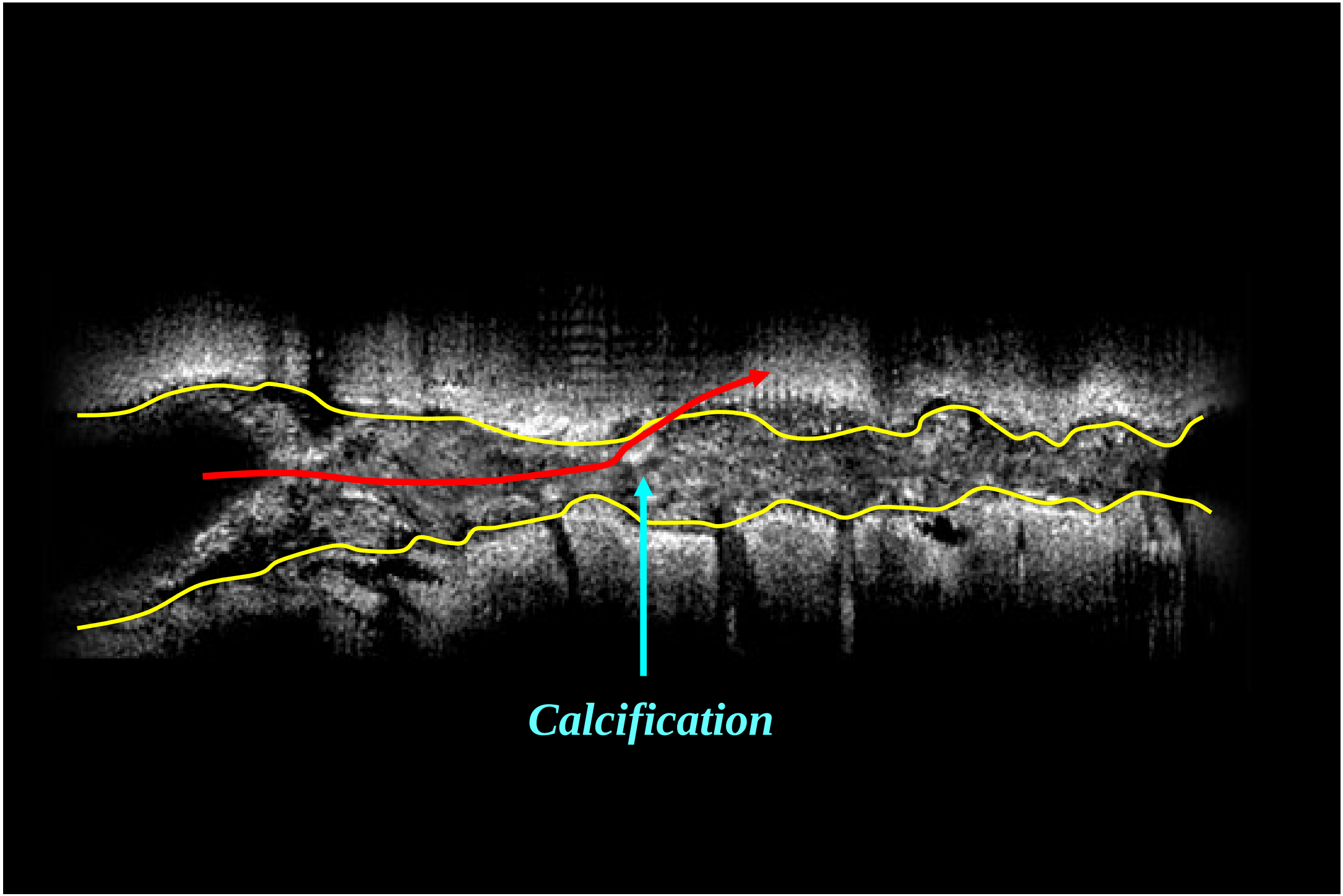
Primary PCI was performed to the LCx with the bare-metal stents.

On the Next Day…….

50years, male. AMI (posterior) / Shock

PCI for CTO at the Mid LAD & the Proximal RCA


SHOWA UNIV
GALAXY
Boston Scientific
LAD Proximal Pre
Procedure Date: 12/21/2004 13:25:01
Procedure Cath: Atlantis Pro 40 MI < 0.4
59 mm
00 mm
Proximal
Distal
9.6 mm, 1 mm/div
No Catheter
Paused playback.
Pre STENT
LAD Proxim
972

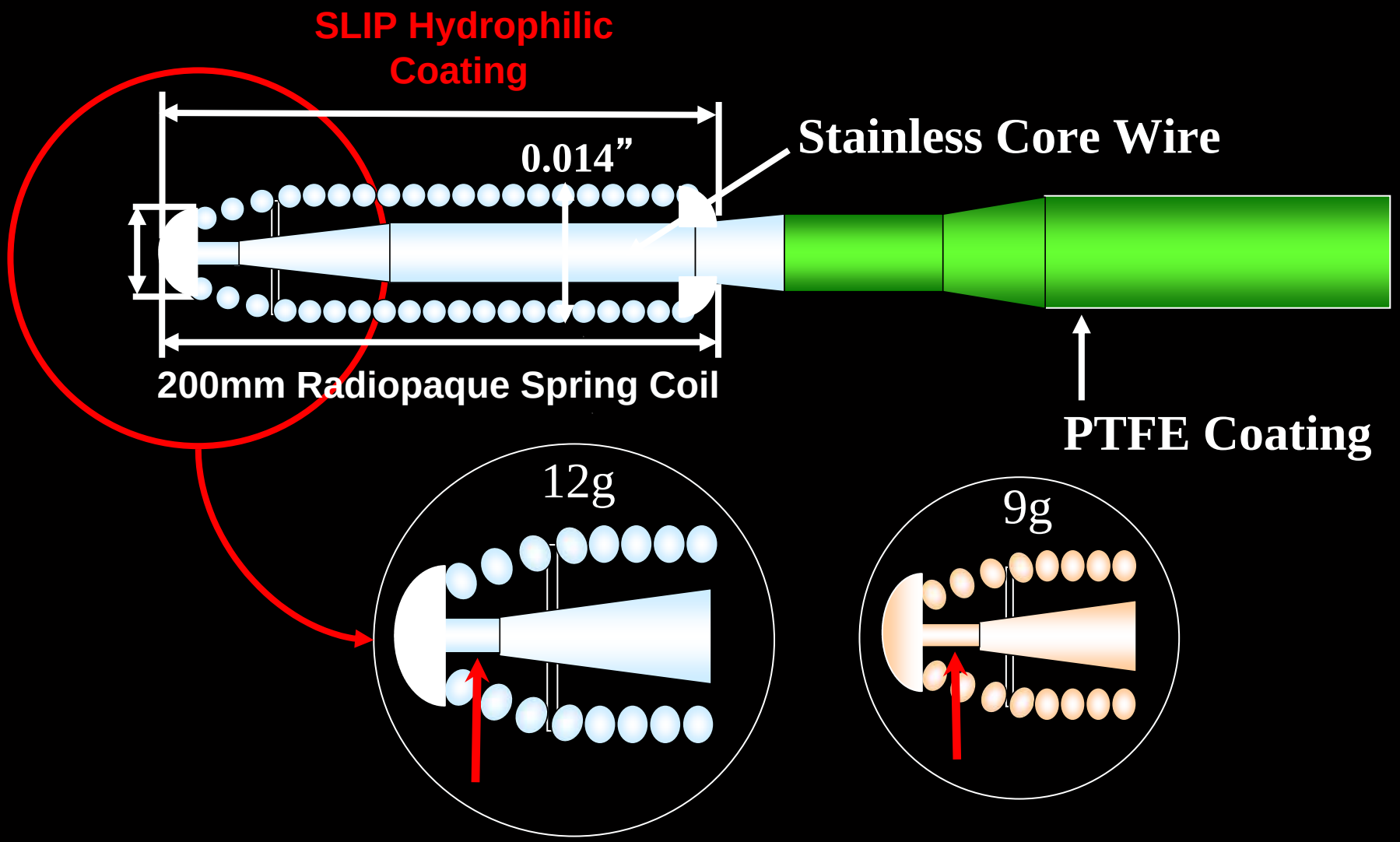

Calcification

Credo of the “Penetrationist”

- The wire ***whose tip is softer than the calcium*** in the CTO is ***re-directed*** during its manipulation. It will enter and enlarge the sub-intimal space (the space outside the external elastic membrane) .

- The tip of the wire ***must be stiffer than the calcium*** in the CTO.

Confianza Pro (9gr) and Confianza Pro 12gr

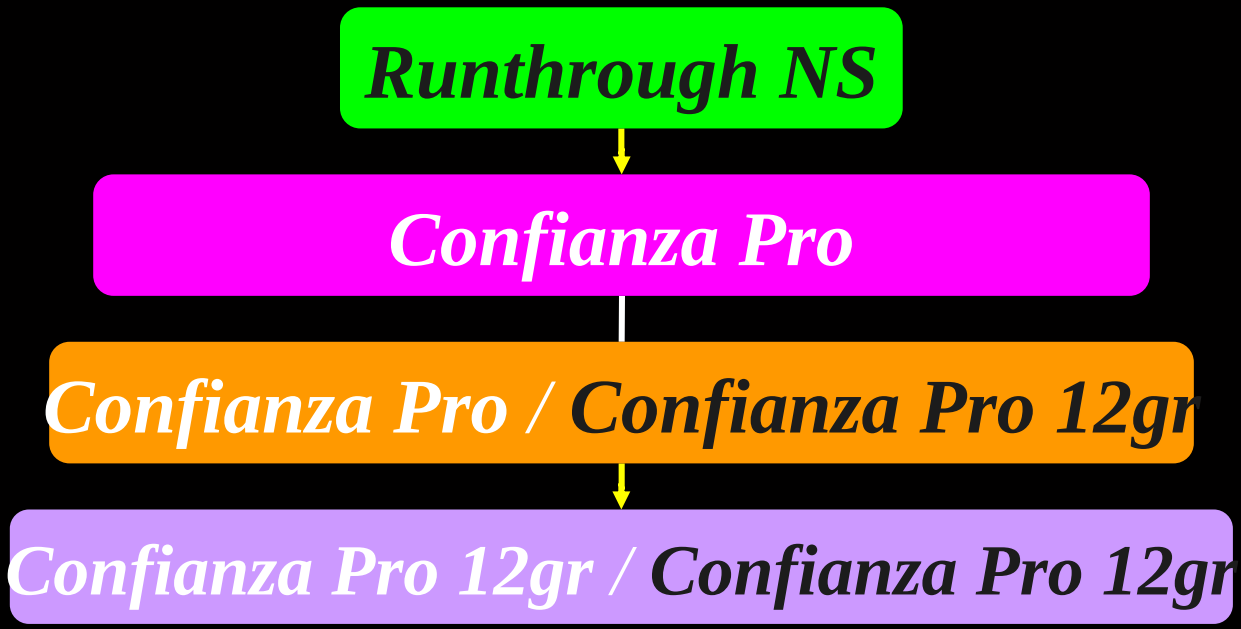


The Stiffer, the Safer!

Warning against the “Medium Stiff Wires”

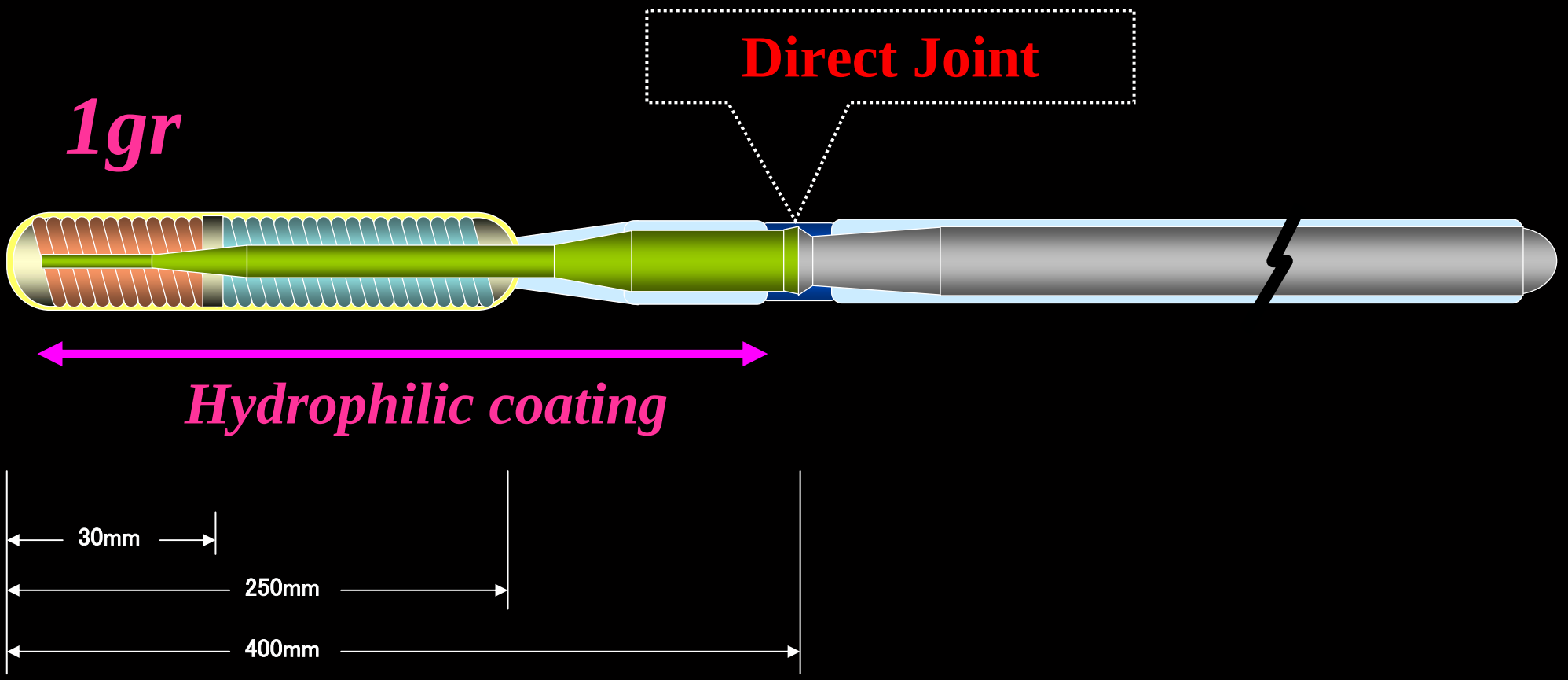
Although **Intermediate or Miracle 3.0gr** is **not stiff enough** *to penetrate very hard calcium in CTO*, it is **stiff enough** *to penetrate the external elastic membrane and migrate into the false lumen*.

Basic Selection of Stiff Wires in the Current Penetration Strategy



So called "medium stiff wires" such as Intermediate or Miracle 3.0gr are ***not required*** *in my latest strategy for complex CTO.*

Runthrough NS (Terumo)



Runthorugh NS is available in Japan, Asia and Europe.

Technical Advancement for Successful Wiring

- 1) The ***penetration power*** of the wire: Confianza Pro (9gr), Pro 12gr and Pro 8-20
- 2) The ***shaping*** of the wire tip: the “double-bend” method
- 3) The ***manipulation*** of the wire: penetration or controlled drilling, parallel wire technique and side-branch technique

Limitations of Wiring Based on Conventional Coronary Angiography

- 1) How can we identify ***the entry in the abrupt type CTO with a side-branch***?

- 2) What is the next step ***when we loose visualization of the distal collateral*** despite the parallel wire technique with 2 Confianza wires?

Beyond Conventional Coronary Angiography

- 1) **IVUS guided wiring**
- 2) **Retro-grade approach**

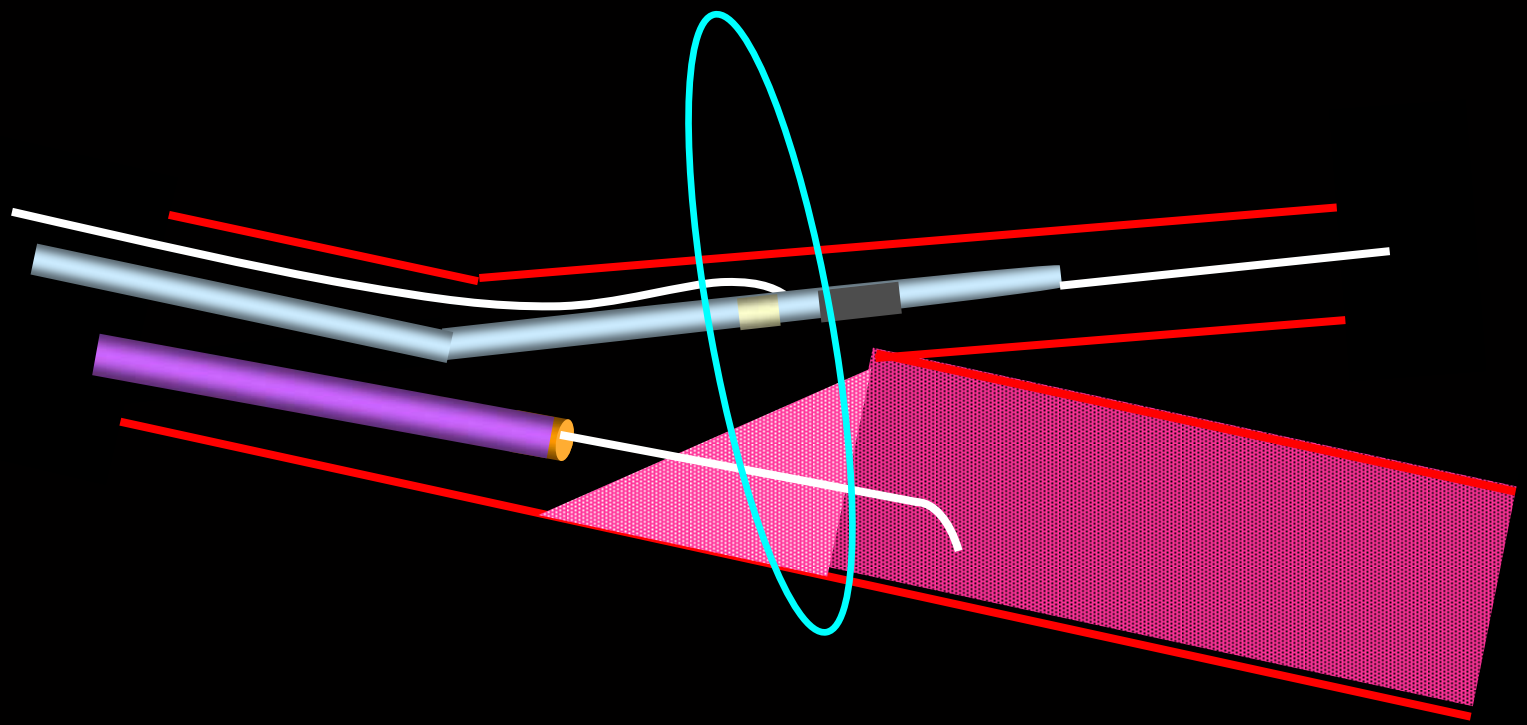
IVUS Guided Wiring

IVUS Guided Wiring for CTO

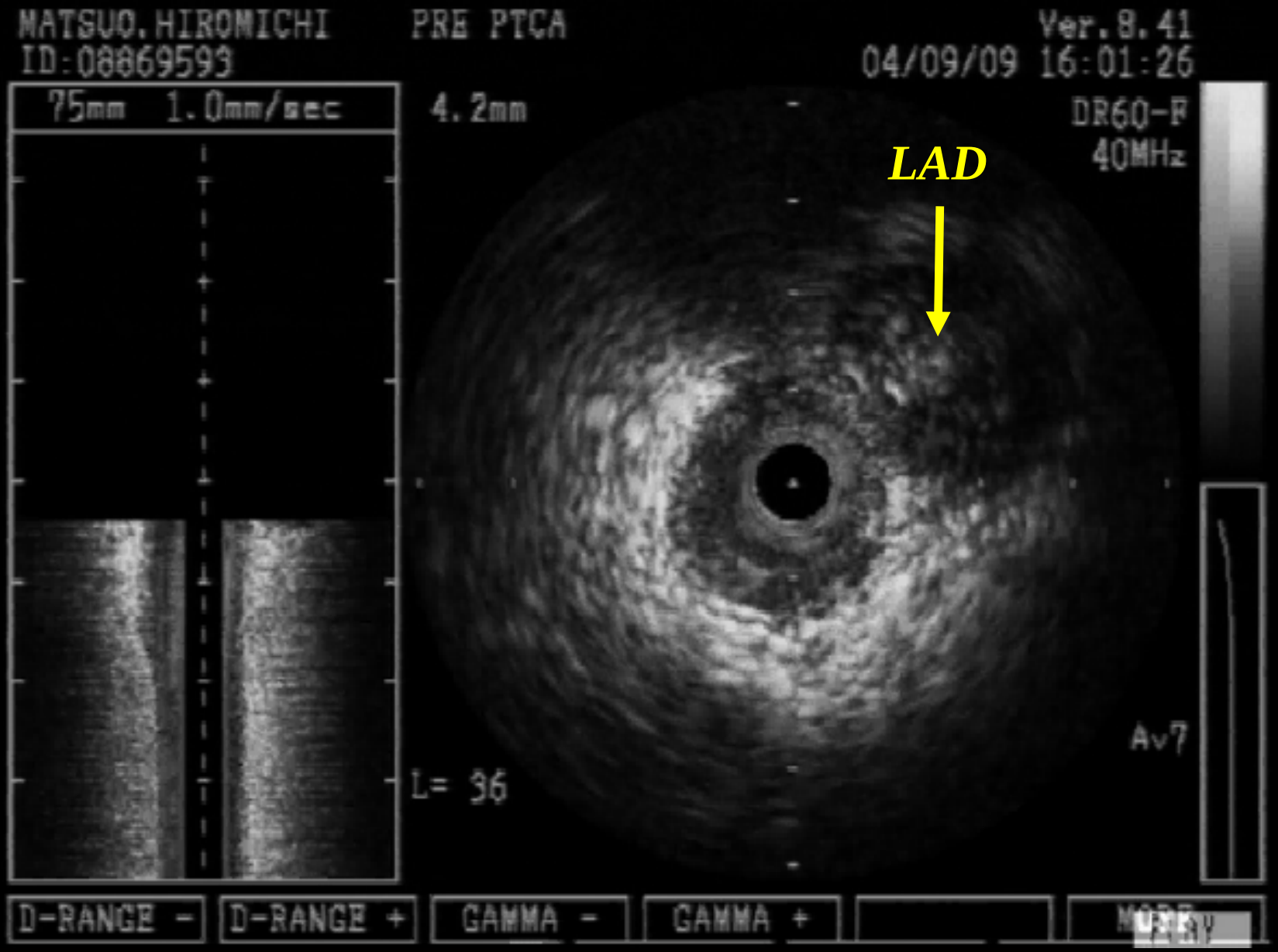
1) Identification of the Entry

2) Re-entry from the Sub-intimal Space

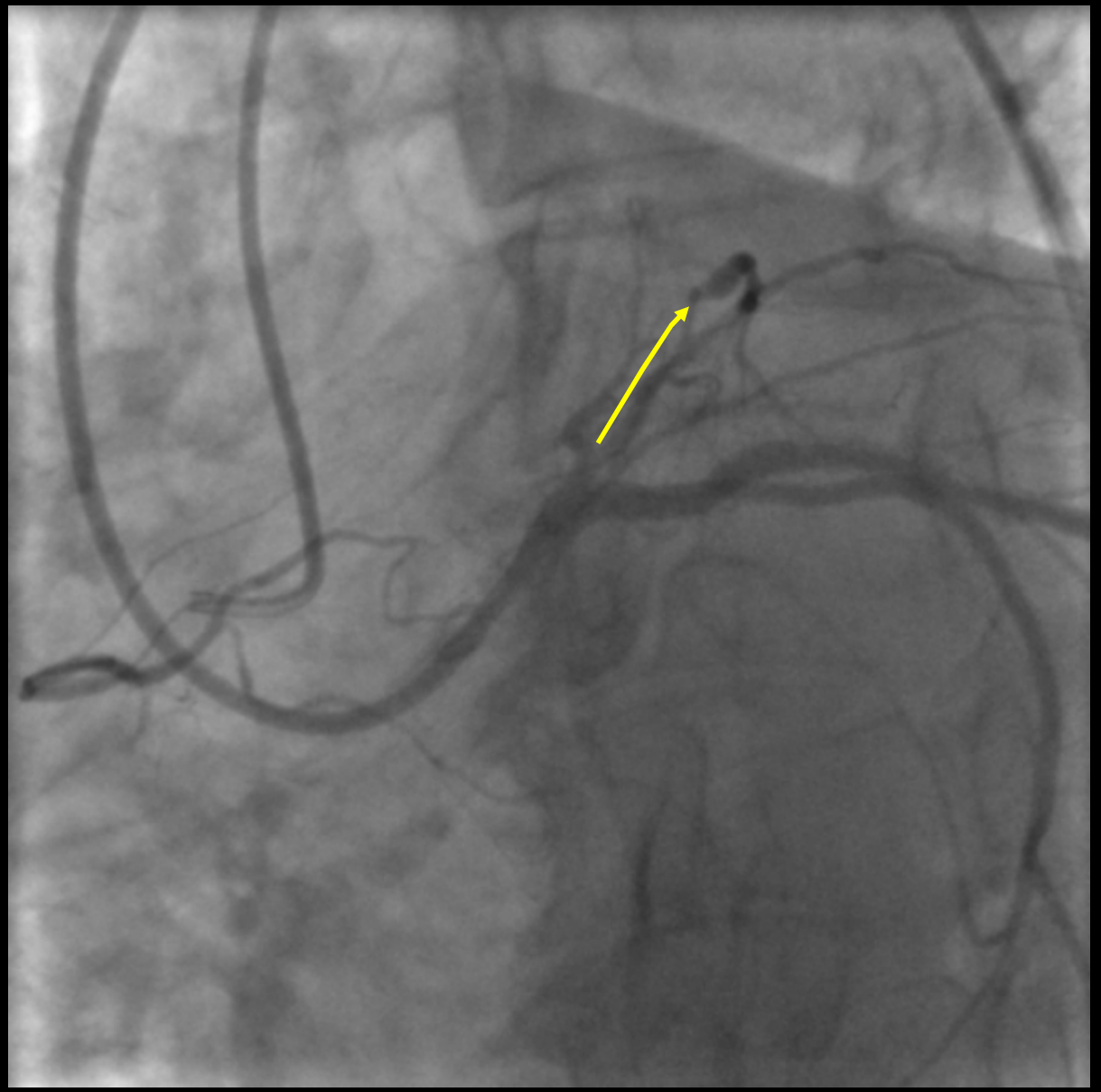
Identification of the Entry



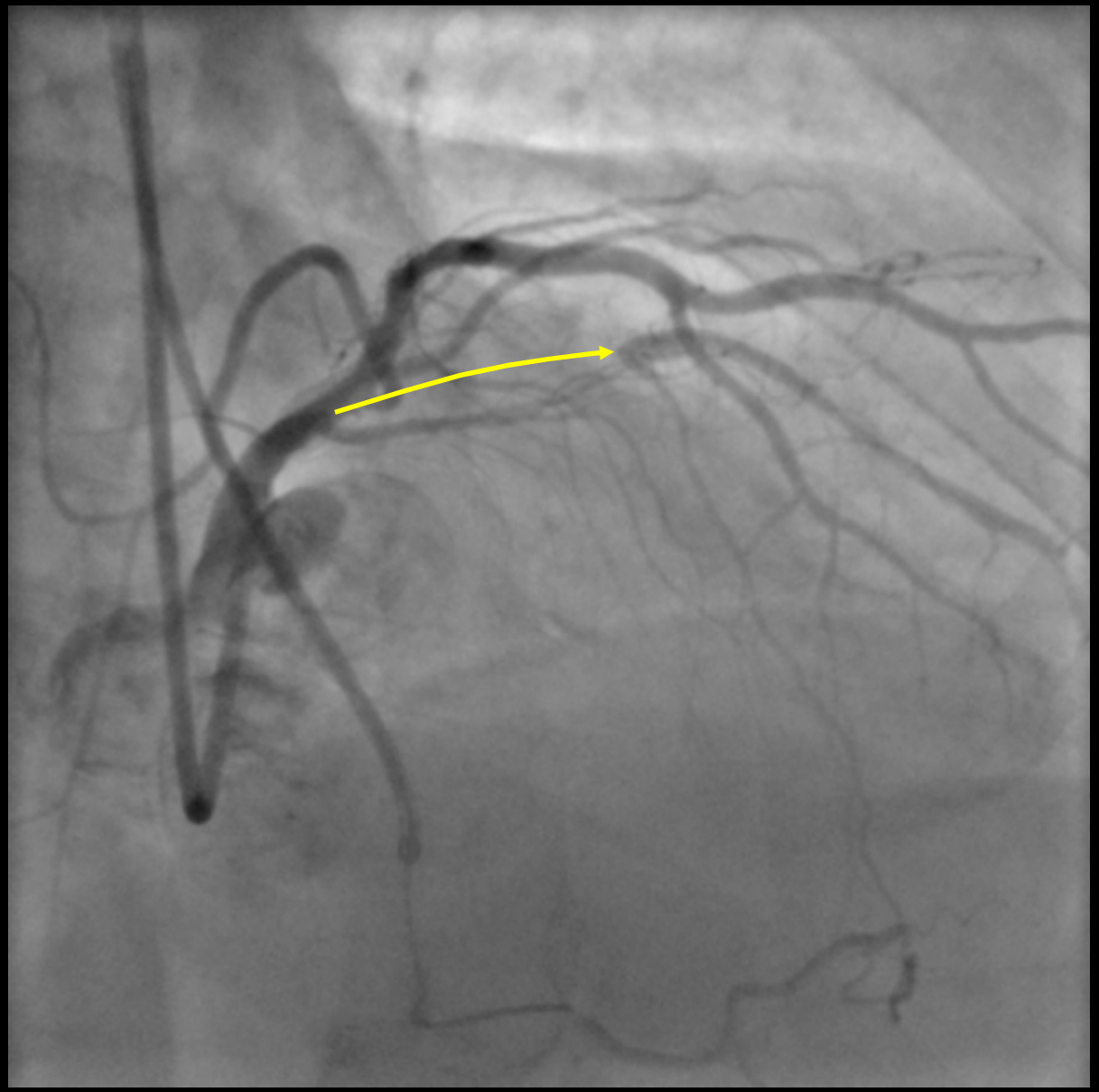
Identification of the Occluded LAD with IVUS



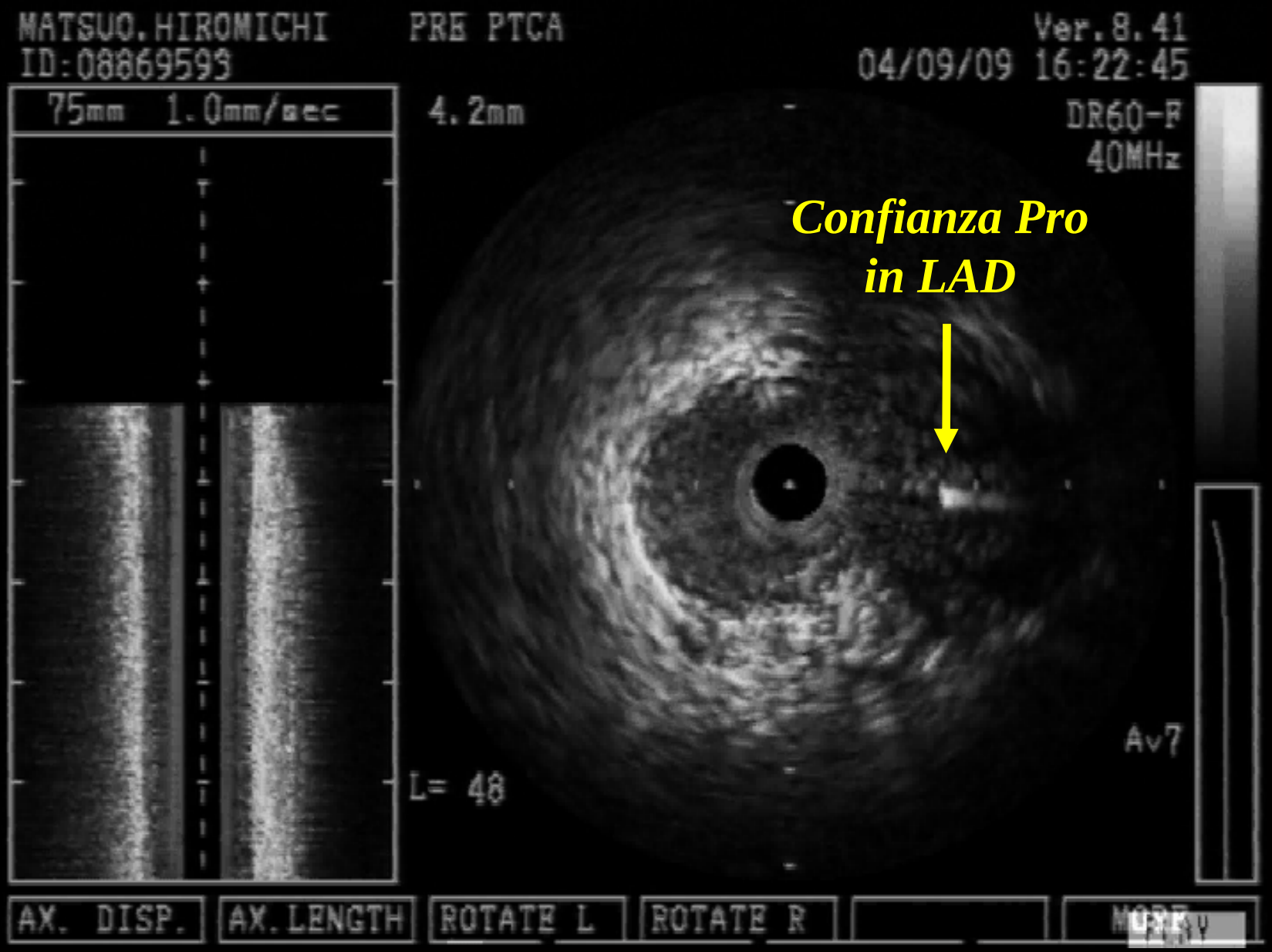
Wiring Line in the LAO Caudal View



Wiring Line in the RAO Cranial View



Identification of the Confianza Pro in LAD with IVUS

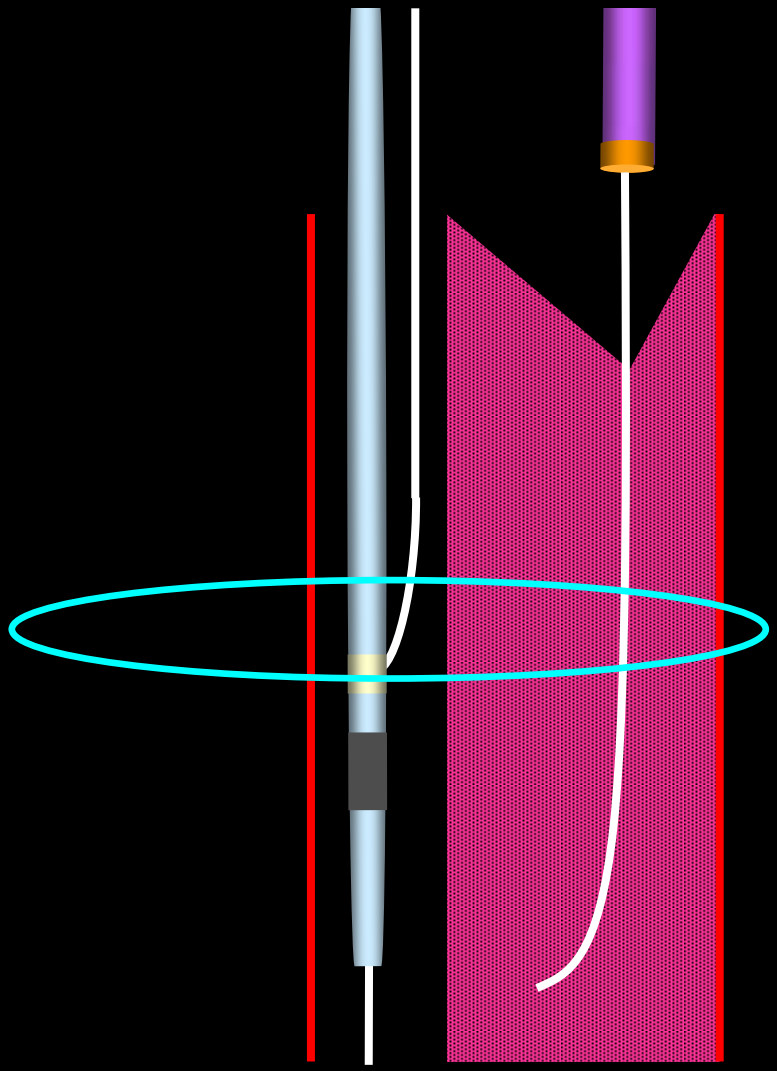


It is very important to confirm the proper entry into the CTO before starting parallel wire technique.

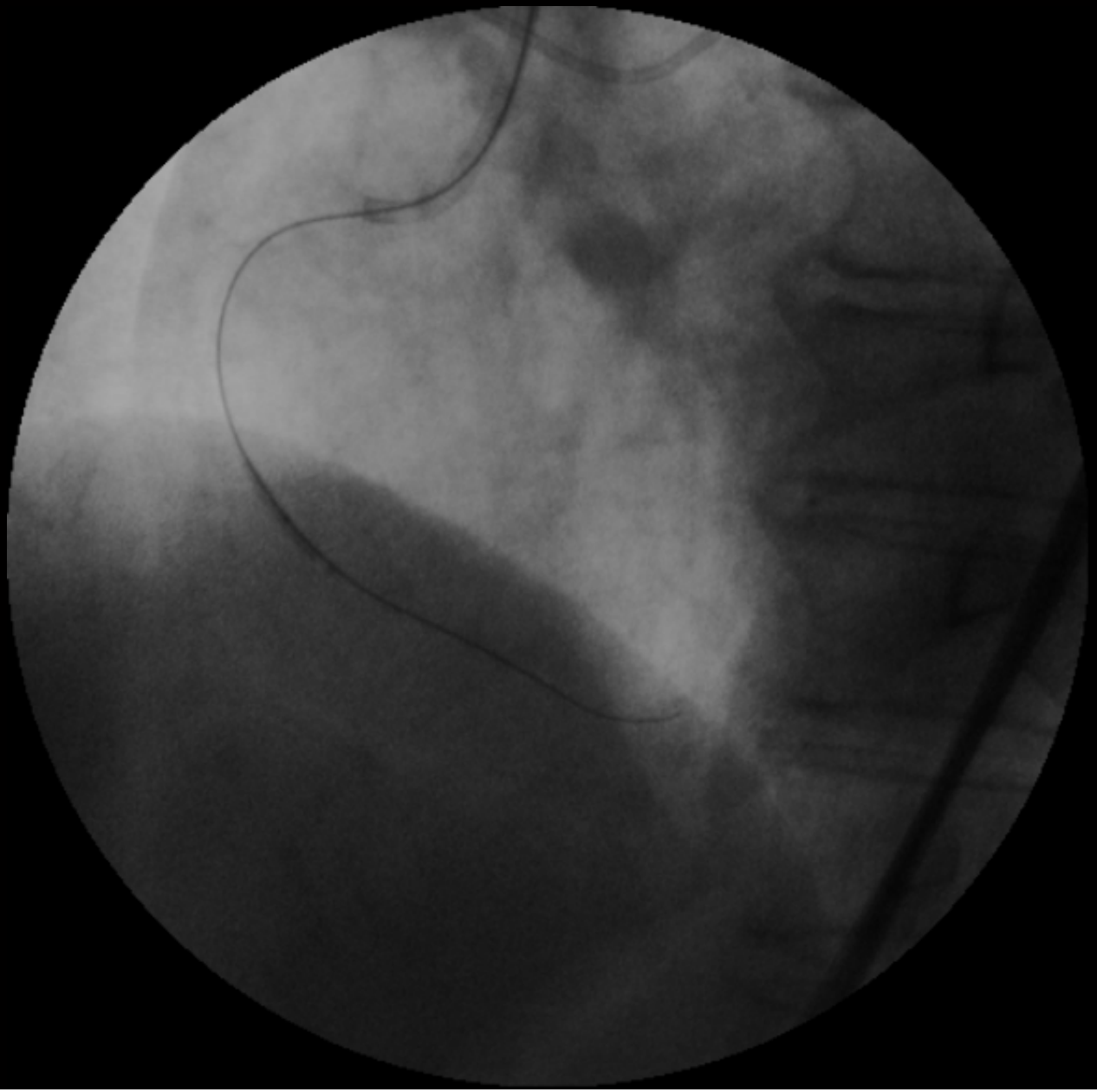
IVUS Guided Wiring for CTO

1) Identification of the Entry

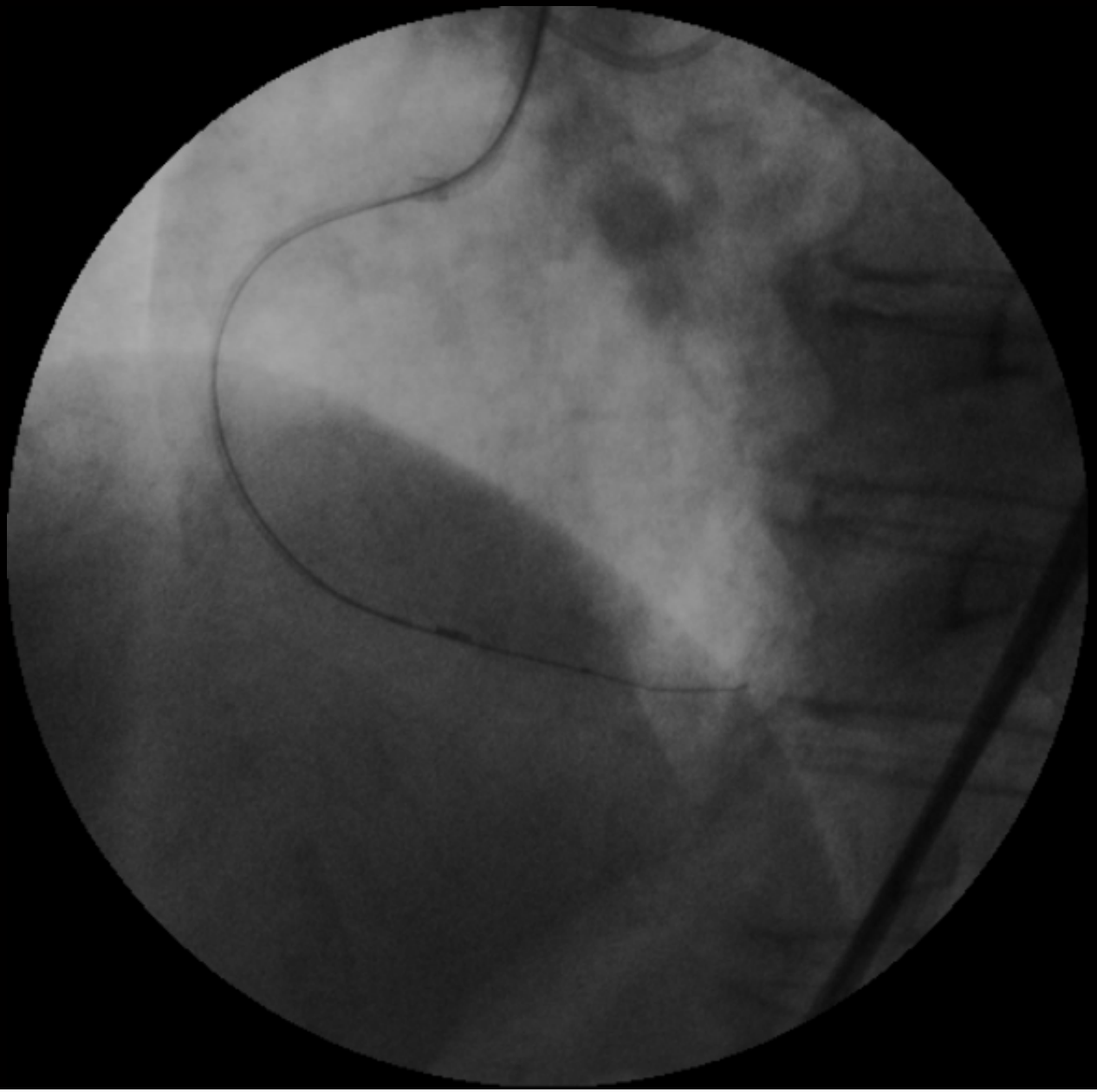
2) Re-entry from the Sub-intimal Space



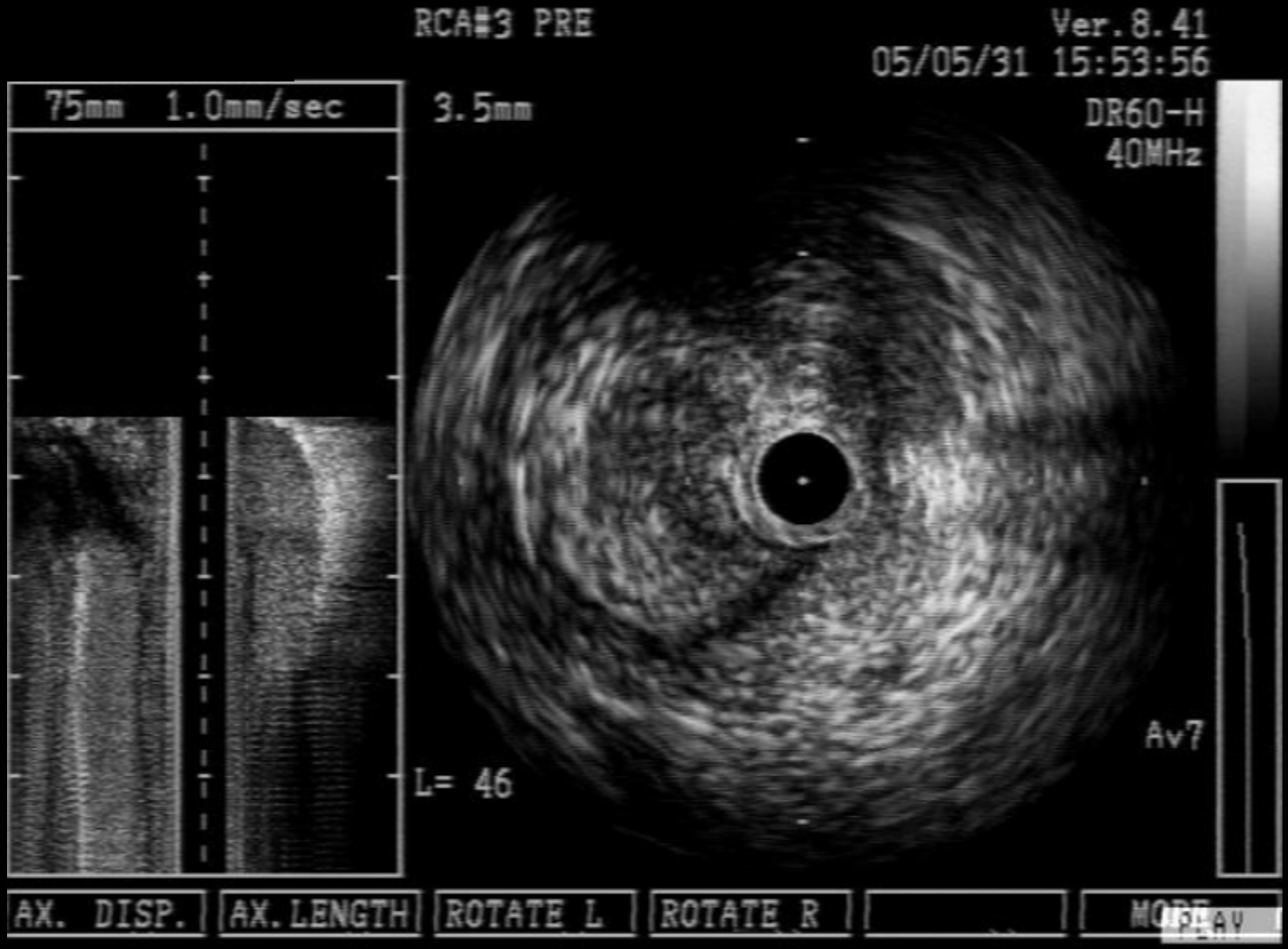
Dilatation of the Sub-intimal Space with a 1.5mm Balloon



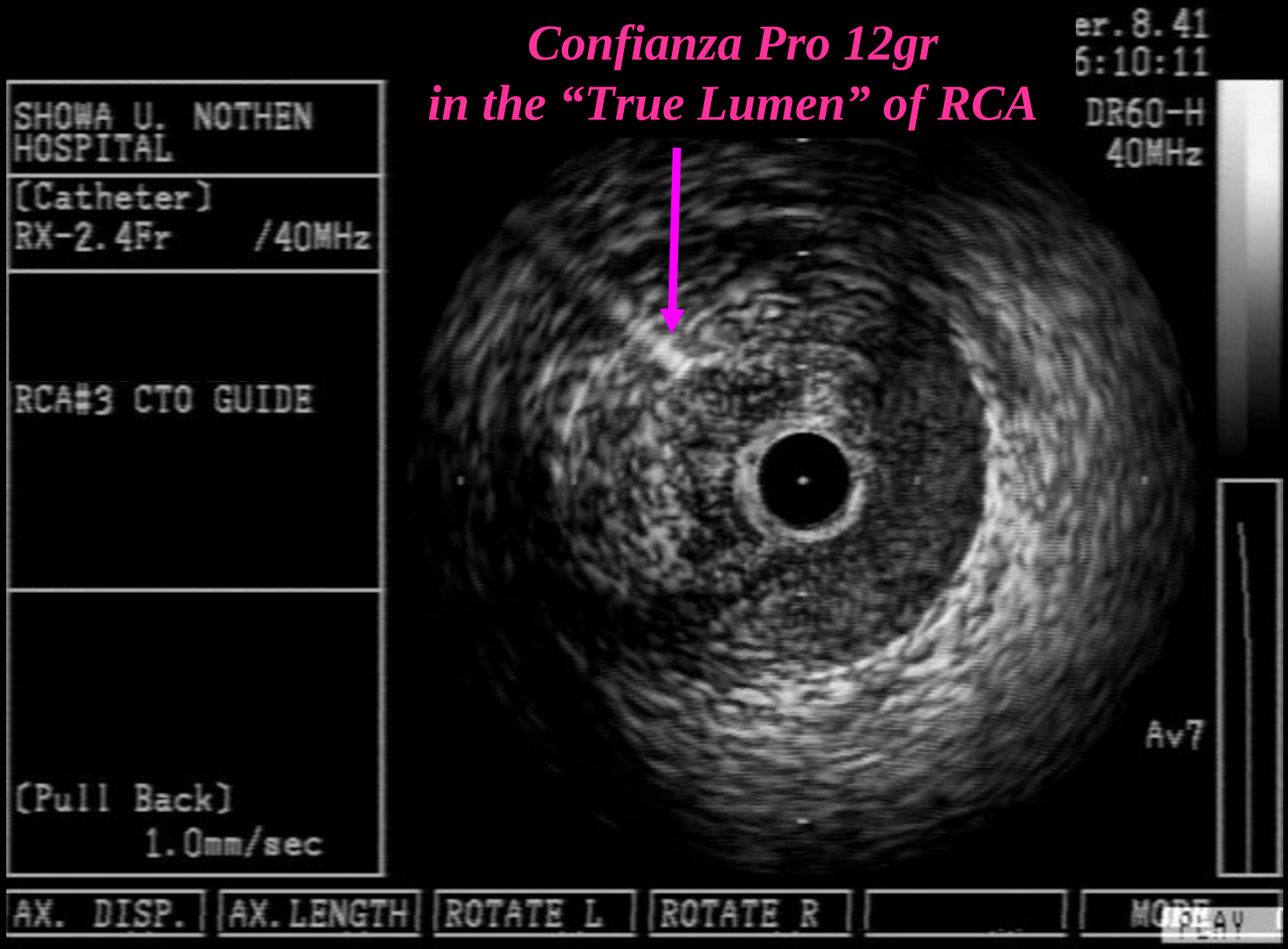
IVUS (Intrafocus 40MHz, Terumo) Examination from the Sub-intimal Space (False Lumen)



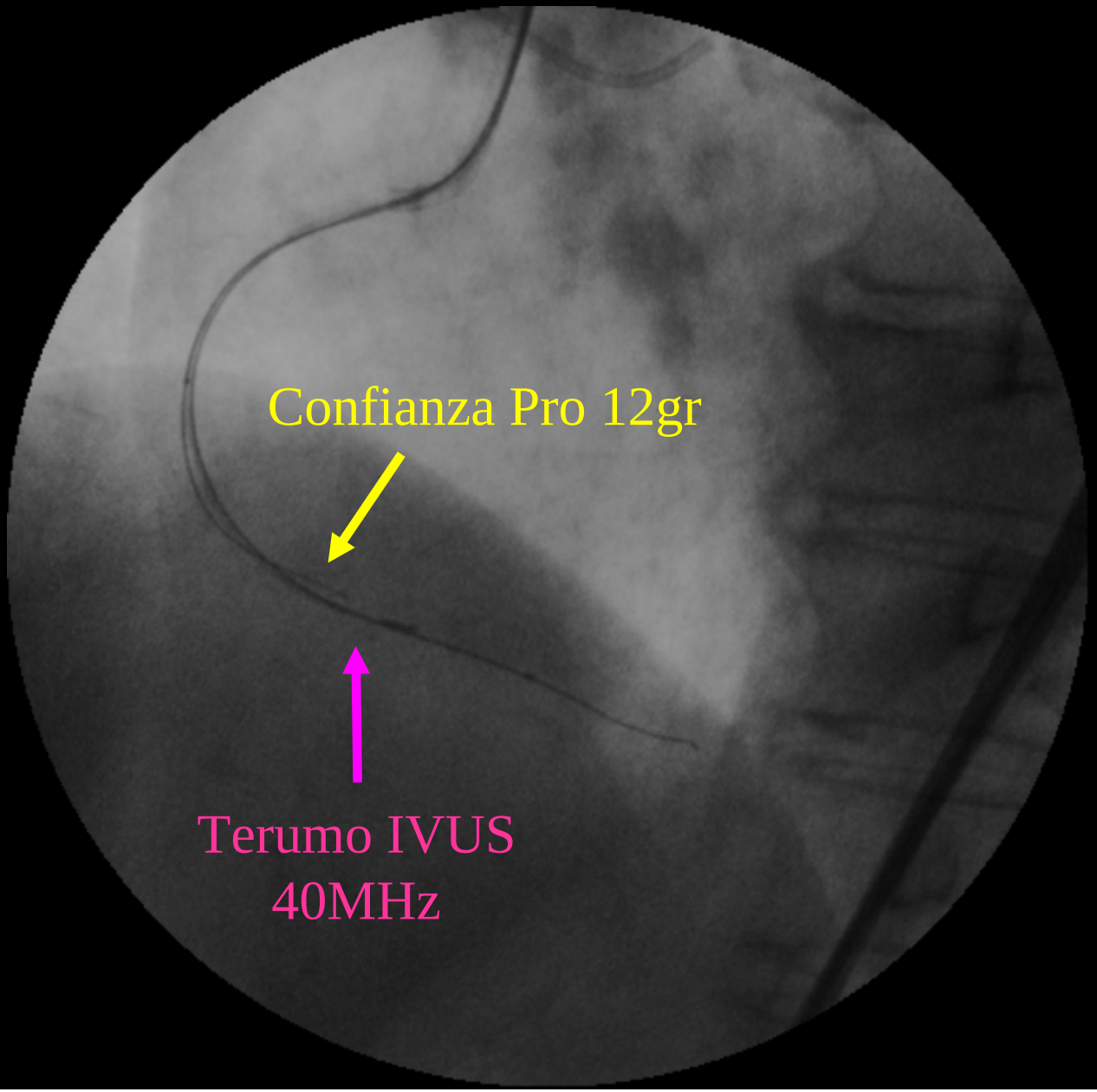
IVUS Examination
from the Sub-intimal Space (False Lumen)



Confianza Pro 12gr under IVUS Guidance



Confianza Pro 12gr in the Distal True Lumen under the Guidance of Terumo IVUS 40MHz



IVUS Guided Wiring for CTO

1) Identification of the Entry

2) Re-entry from the Sub-intimal Space

Pre-dilatation with a small balloon is essential to put an IVUS catheter into the sub-intimal space.

Long dissection is usually made up to the bifurcation with a large side branch. Besides, there is some risk of coronary perforation.

This is definitely the last resort of bail-out procedure!

Retro-grade Approach

Basic Procedures of the Retrograde Approach

- 6Fr or 7Fr (with side hole) shorter (preferably 85cm) guiding catheter from left femoral or left brachial artery.
- Super-selective dye injection from a micro-catheter
- Select a “visible” collateral!
- A slippery wire (Runthrough: Terumo or Fielder: Asahi Intec) with a Micro-catheter (Finecross: Terumo) or 1.25mm OTW balloon (Ryujin: Terumo)

Comparison between the IVUS Guided Re-entry and the Retro-grade Approach

	IVUS Guide	Retro-grade
Guiding catheter	≥8Fr *	no limitation
Contra-lateral catheter	no limitation	≥6Fr guiding
Dilatation of the false lumen	yes	no
Long dissection	yes	no
Coronary perforation	possible	possible

*: If Intra-focus 40MHz (Terumo) is used, this procedure can be done with a 7Fr guiding catheter (≥ 0.081inch).

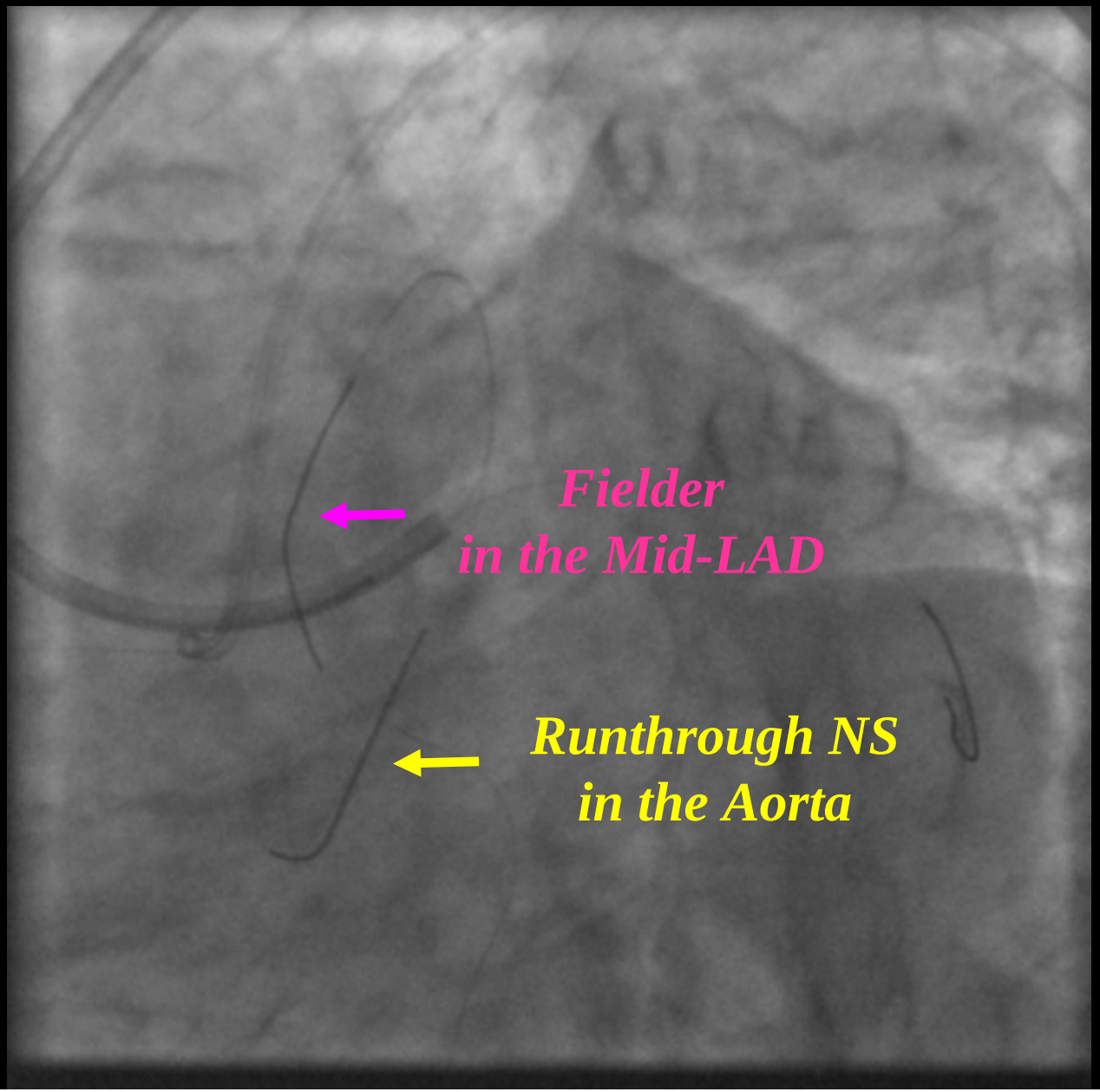
Strategies of the Retro-grade Approach

If a Soft and Slippery Wire could be Delivered into the Distal Coronary Artery

- We can attempt 2 strategies

  1) Retro-grade lesion cross with the soft and slippery wire

Successful Kissing Wire Technique
Fielder with Navicath



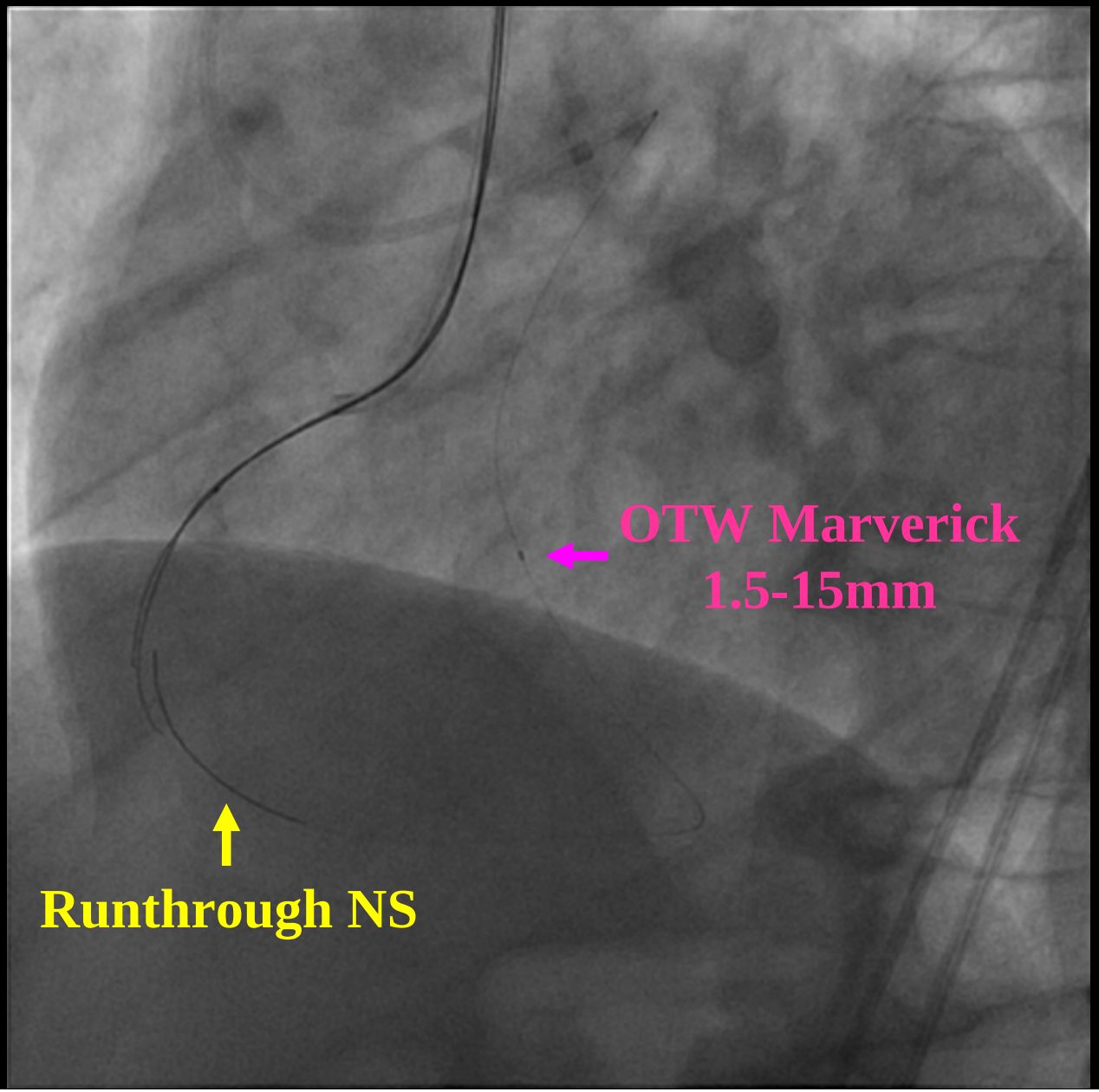
If a Soft and Slippery Wire could be Delivered into the Distal Coronary Artery

- We can attempt 2 strategies

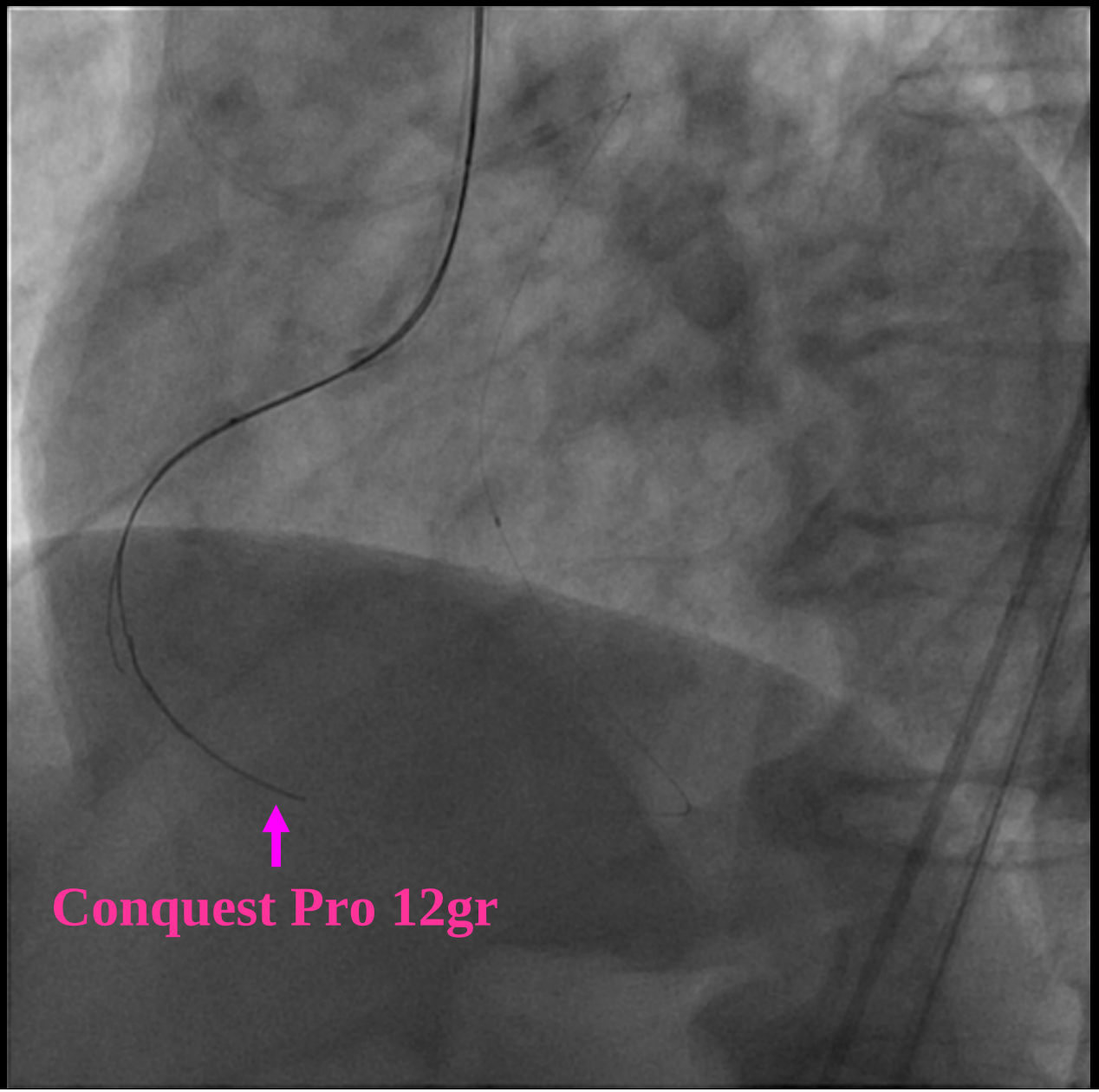
  1) Retro-grade lesion cross with the soft and slippery wire

  2) Advance the soft and slippery wire up to the proximal end of the distal vessel. Then try ante-grade wiring (kissing wire technique) using the soft and slippery wire as a landmark.

Retro-grade Wiring through the 1st Major Septal Branch



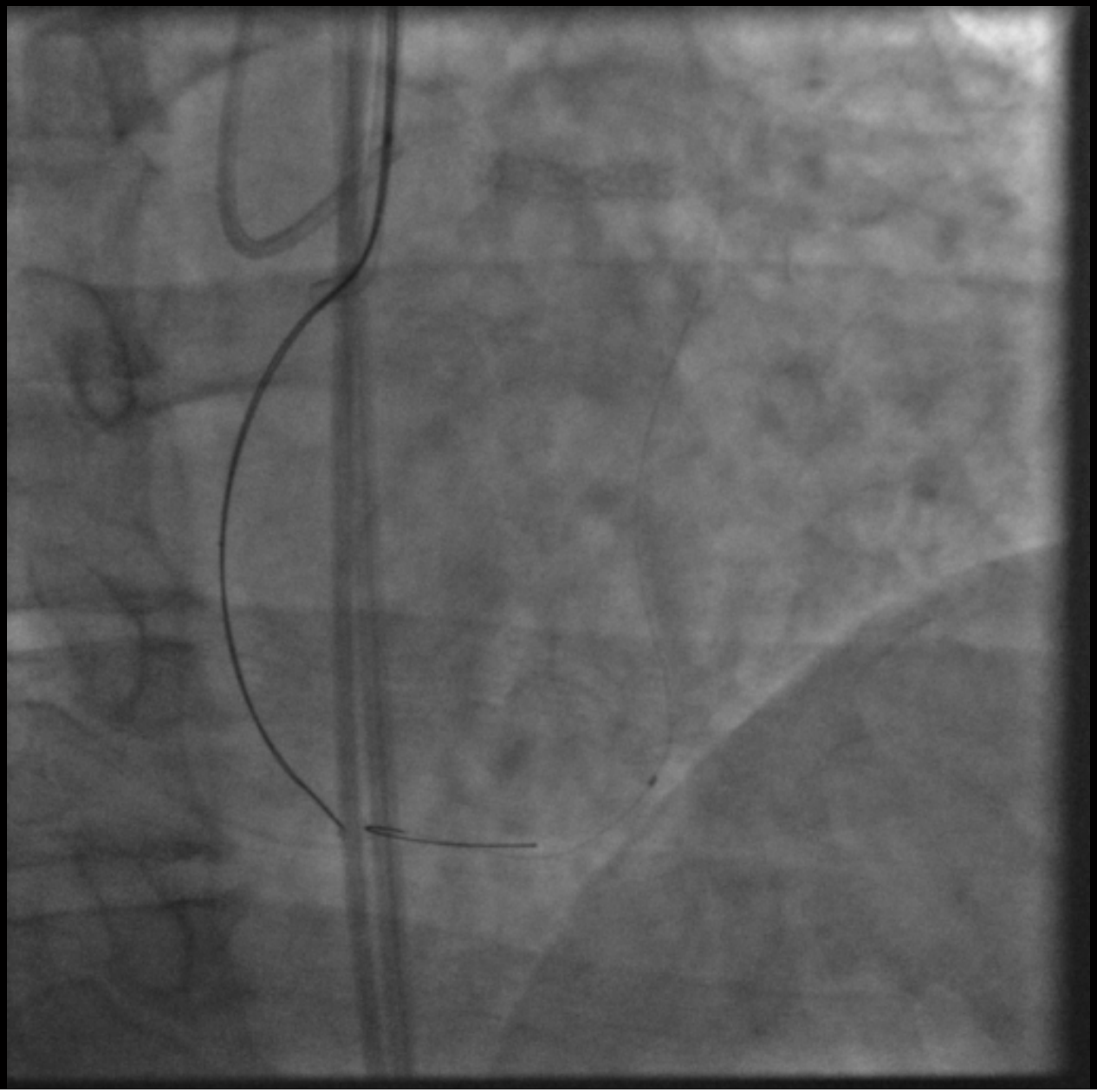
Successful Wire Cross with Conquest Pro 12gr



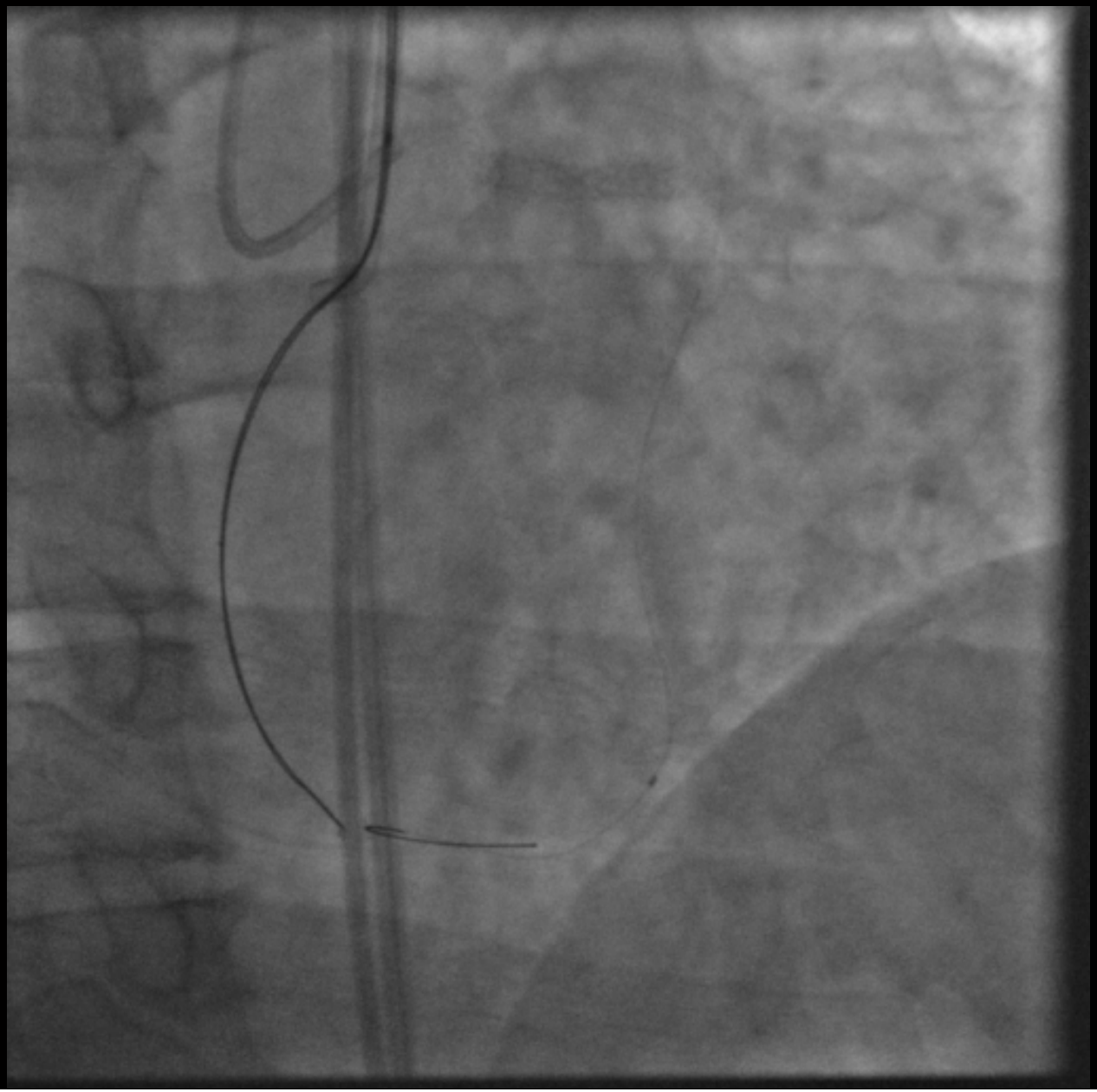
If an OTW Balloon or a Microcatheter can be Advanced into the Distal Coronary Artery

- We can ***exchange a soft and slippery wire into the stiff one***
  1) ***Retro-grade lesion cross*** with the stiff wire

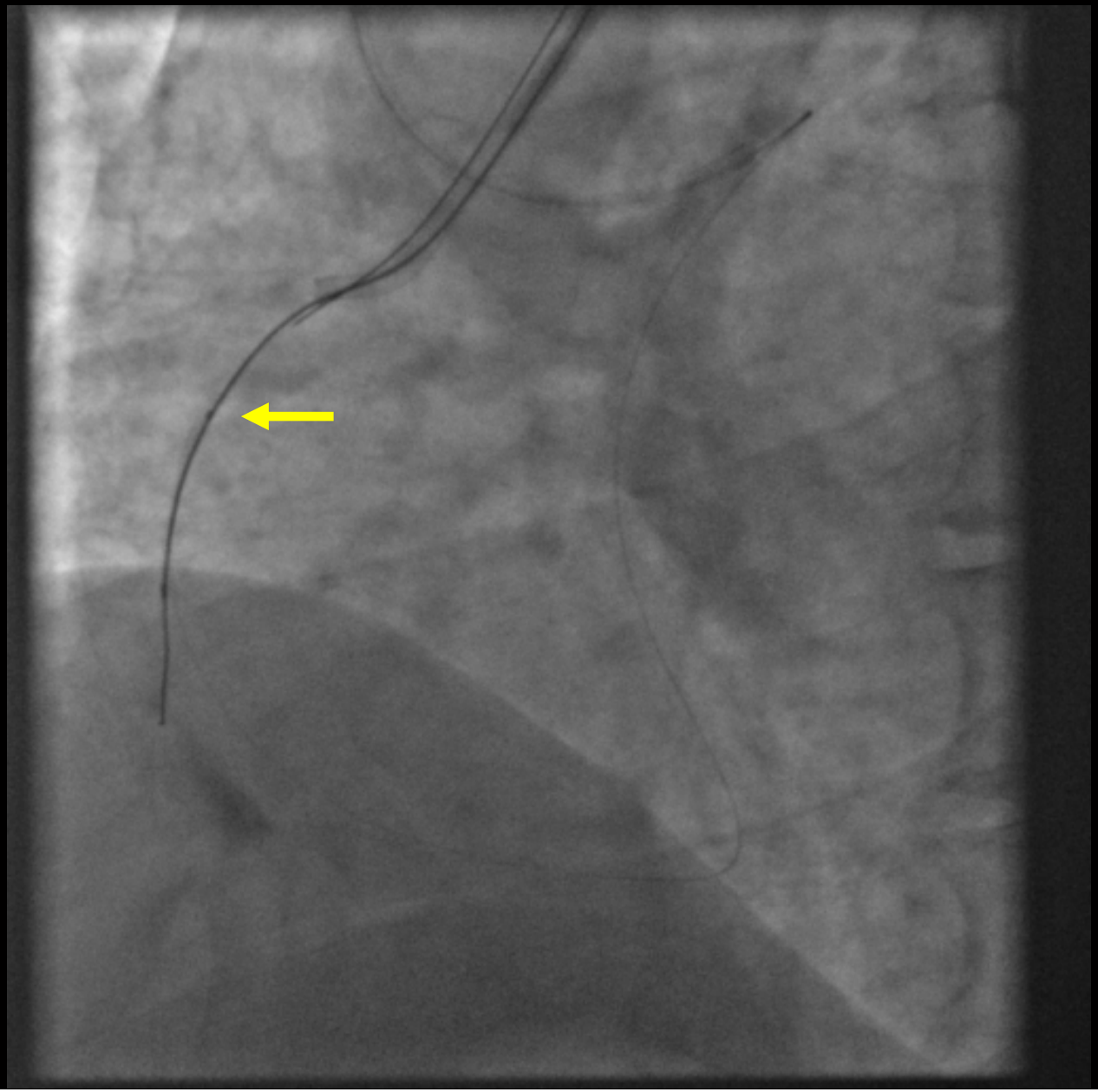
Retrograde Approach by Fielder and OTW Marveric1.5mm with Septal-dilatation Tecinique (1atm)



Retrograde Approach by Fielder and OTW Marveric1.5mm with Septal-dilatation Tecinique (1atm)



Retrograde Dilataion of the CTO with 1.25mm Balloon



If an OTW Balloon or a Microcatheter is Advanced into the Distal Coronary Artery

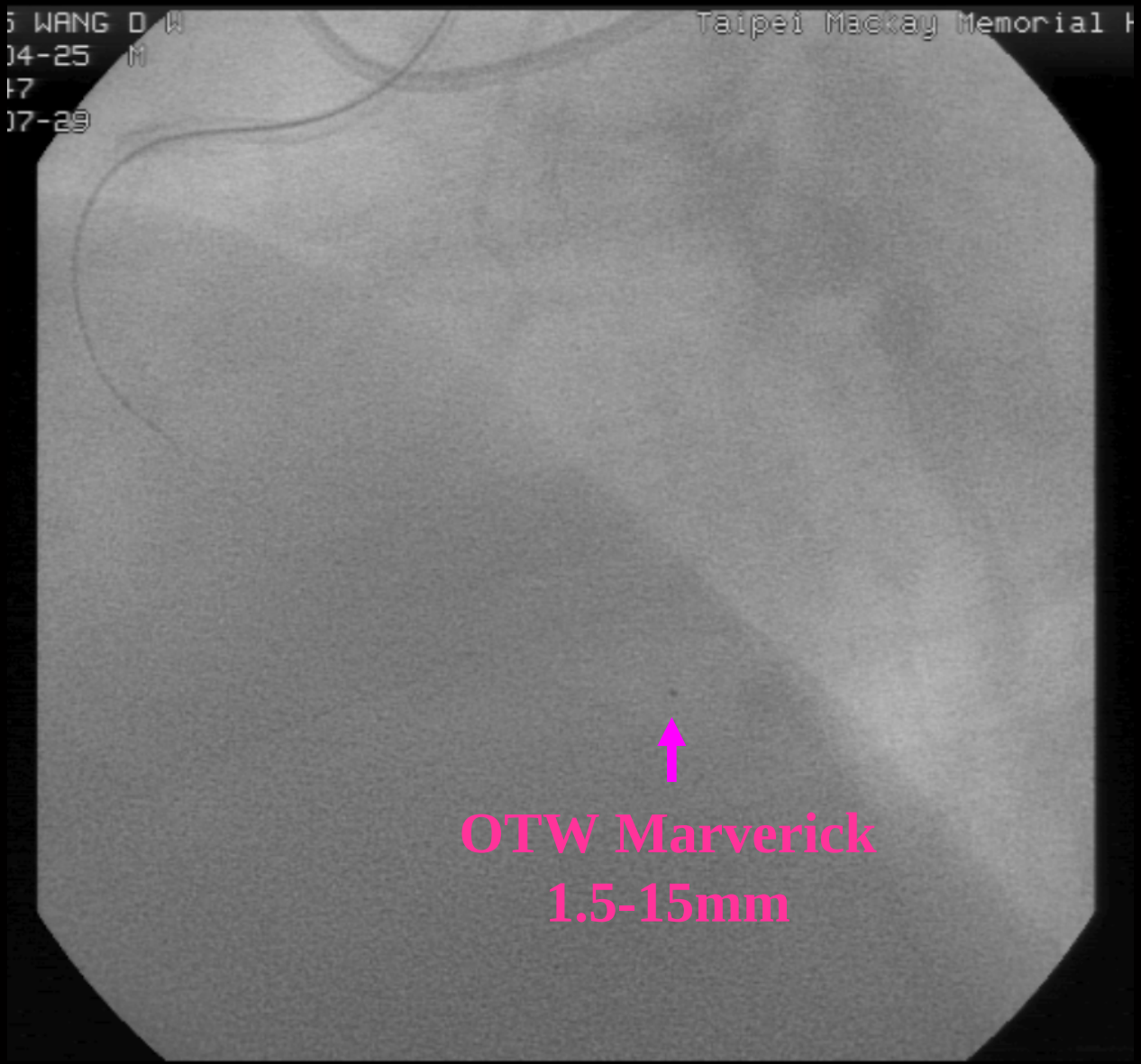
- We can ***exchange a soft and slippery wire into the stiff one***

  1) ***Retro-grade lesion cross*** with the stiff wire

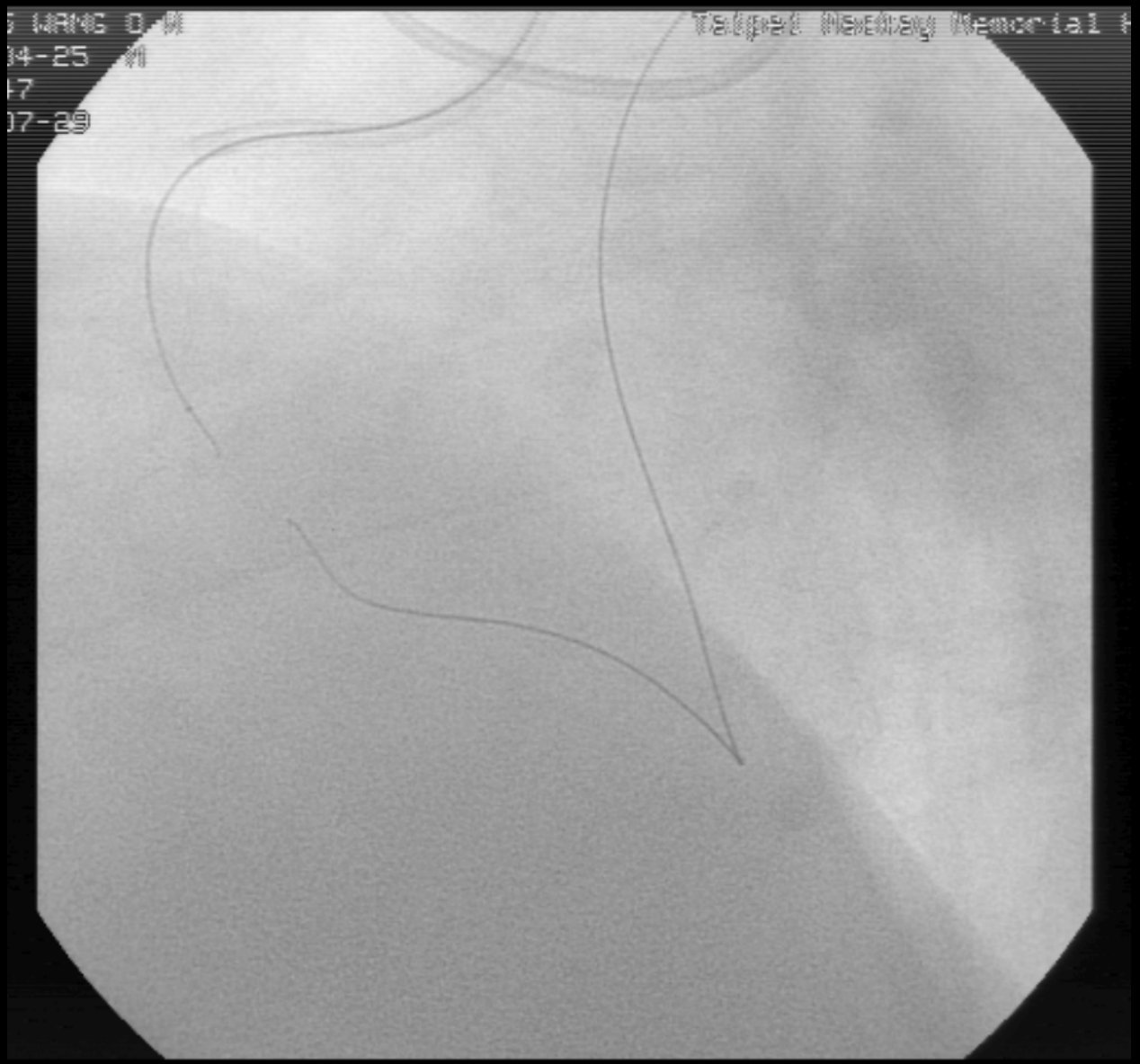
  2) Advance the stiff wire inside the CTO towards proximal fibrous cap

     i) ***Kissing wire technique***

OTW Marverick 1.5mm was Advanced into the Distal True Lumen for Wire Exchange



Conquest Pro was Advanced from Distal to Proximal



If a OTW Balloon or a Microcatheter is Advanced into the Distal Coronary Artery

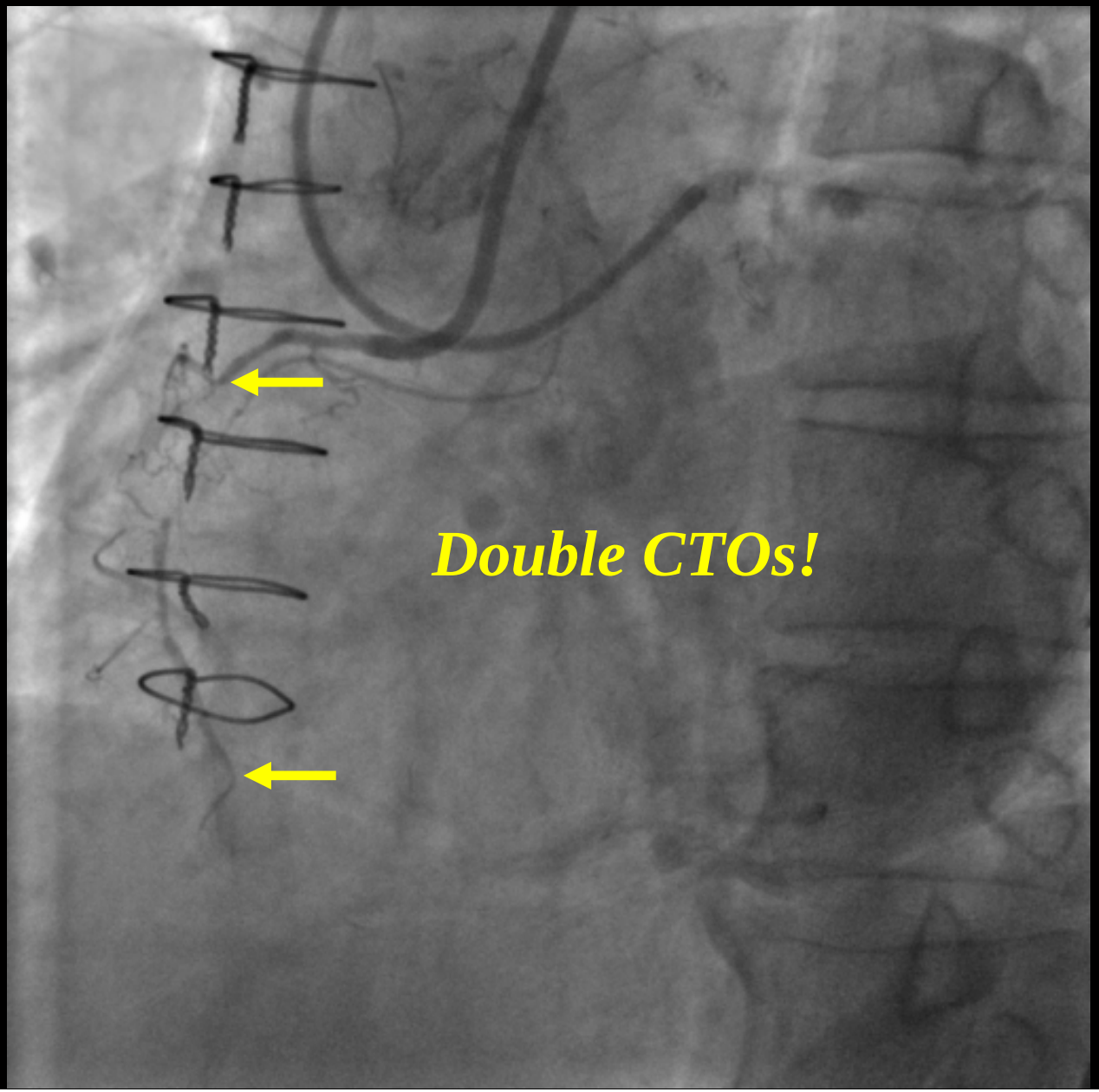
- We can ***exchange a soft and slippery wire into the stiff one***
  1) ***Retro-grade lesion cross*** with the stiff wire

  2) Advance the stiff wire inside the CTO towards proximal fibrous cap
     - i) ***Kissing wire technique***
     - ii) ***The CART*** ***(Controlled Antegrade and Retrograde subintimal Tracking) technique***

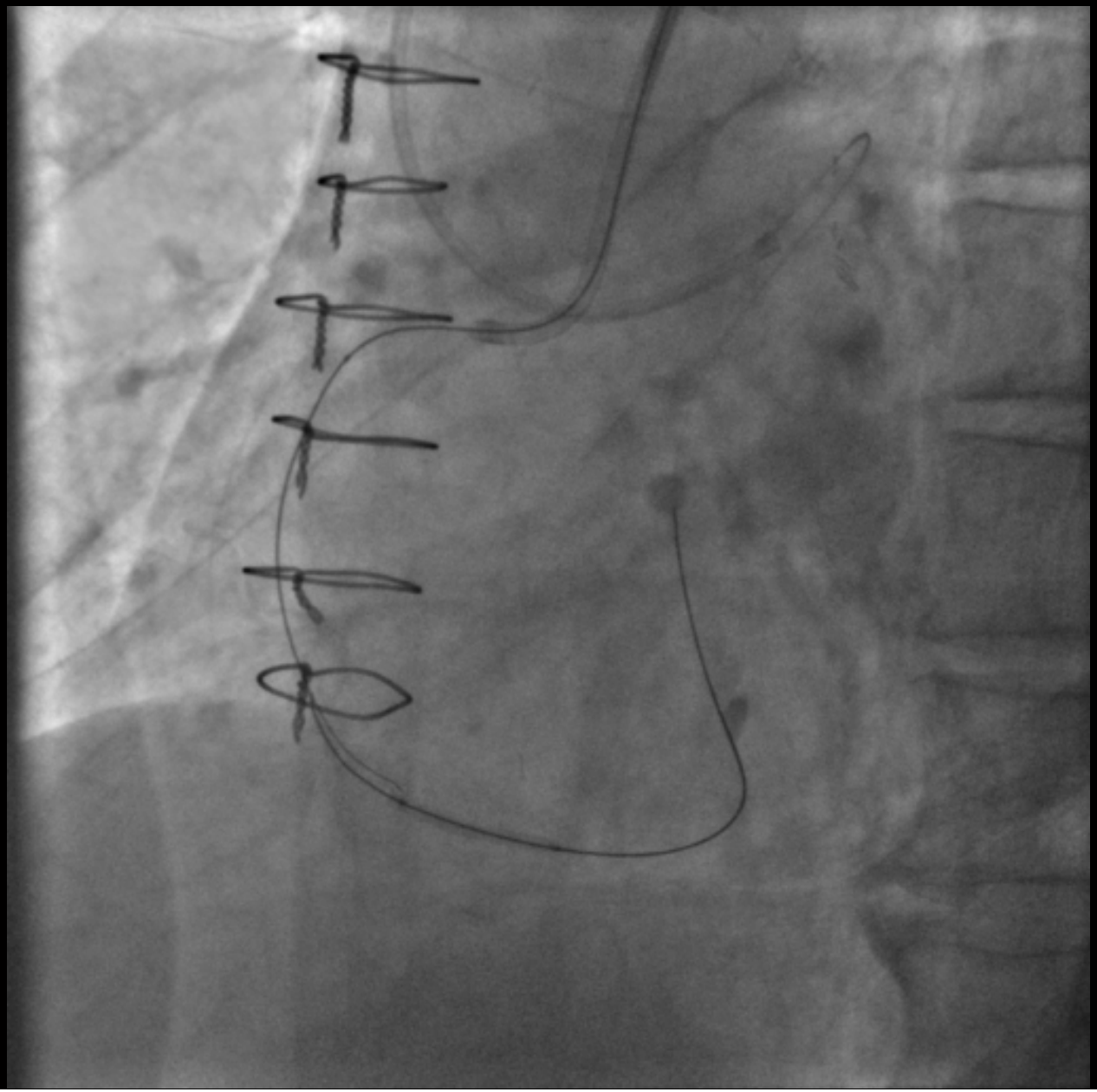
AP, 64 years, male: Effort AP, post CABG

8Fr Mach1
IM-SH

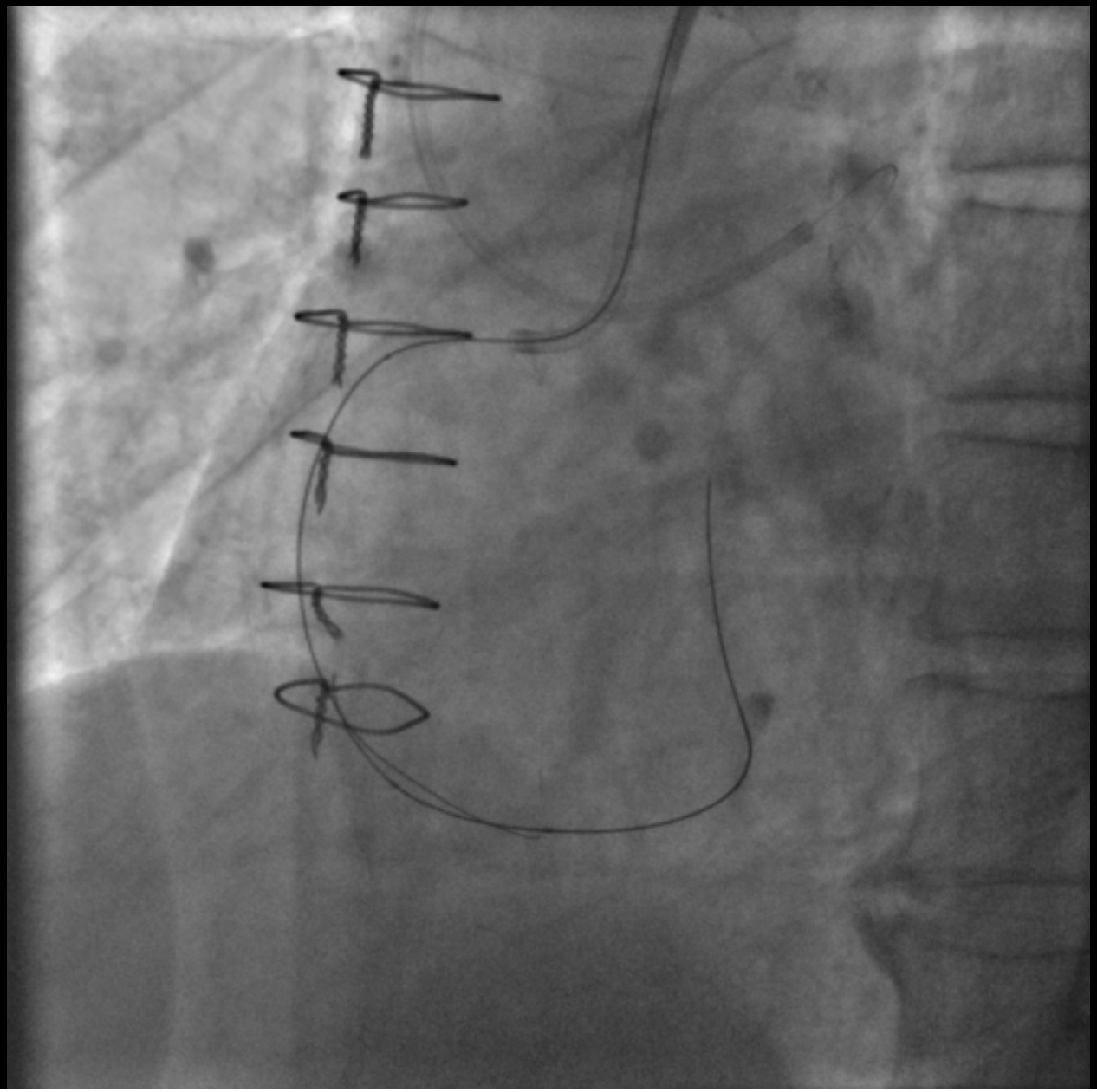
6Fr Brite-tip
XB 3.5
(hand cut)



Retrograde Dilatation of the Sub-intimal Space with OTW Ryujin 2.0-20mm / 10atm

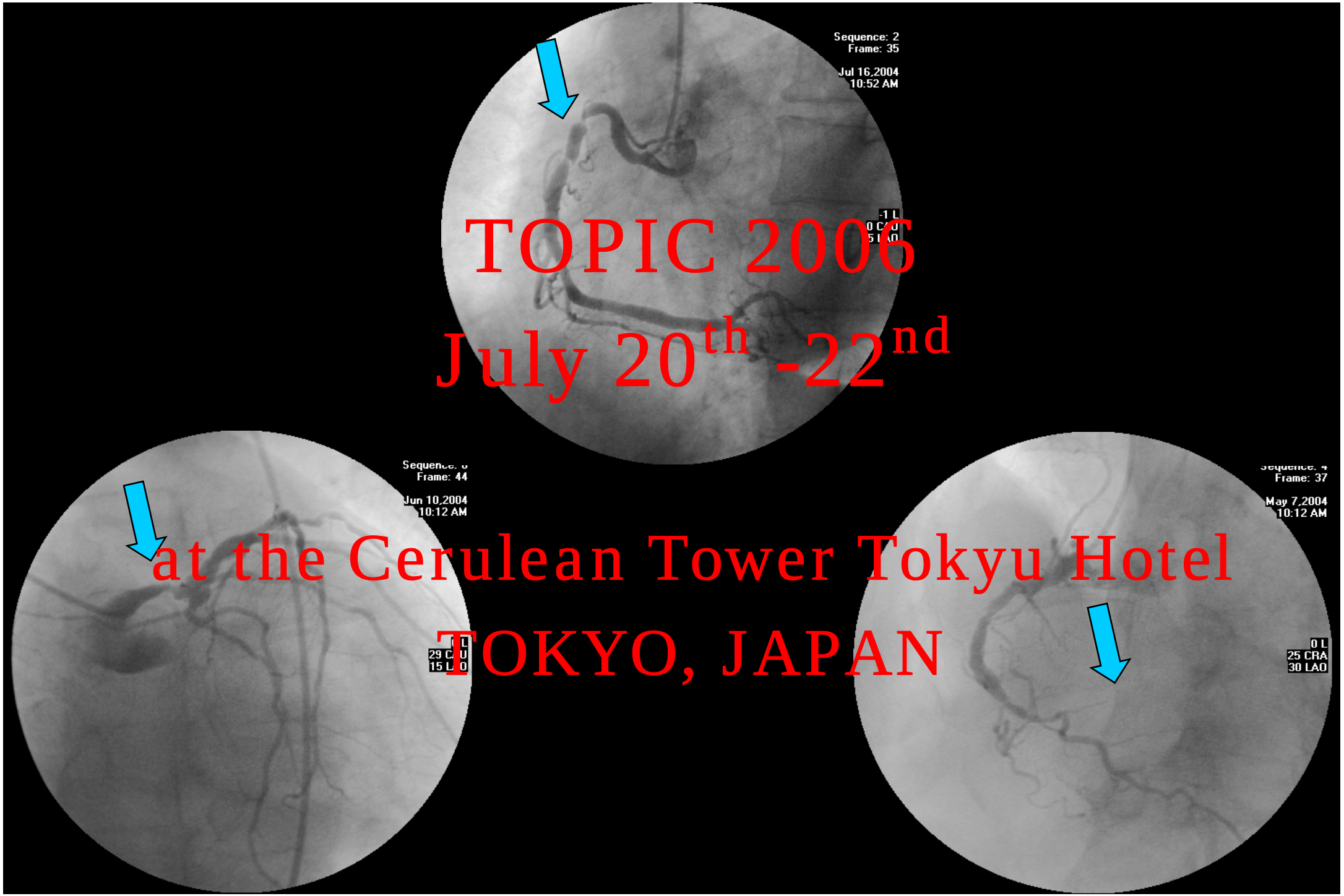


Antegrade Puncture of the Dilated Sub-intimal Space with Conquest Pro 12gr (CART Technique)



The PCI strategies for CTO, especially the retrograde approach, is so complex and diverse.

It should be systematized in the near future.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TOKYO, JAPAN
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30 LAO