

Angioplasty Summit 2006
TCT Asia –Pacific
Seoul, Korea
April 26_28

Crossing the CTO: New Techniques and Technologies

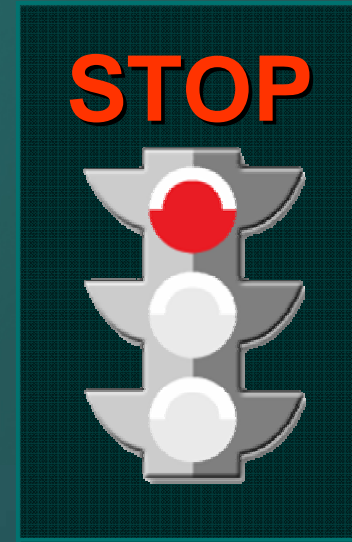
Jeffrey W. Moses, MD
Professor of Medicine
Director, Center for Interventional
Vascular Therapy

The Cardiovascular Research Foundation
Columbia University Medical Center



REASONS TO STOP

- **Complications**
 - **Real**
 - **Incipient**
- **Futility**
- **Partial Success**



IS THIS FUTILITY ?

- **Wire Won't Advance**
- **Wire Goes Offline**
- **Wire diverts into Side Branch**
- **Dilating Device Won't Advance**

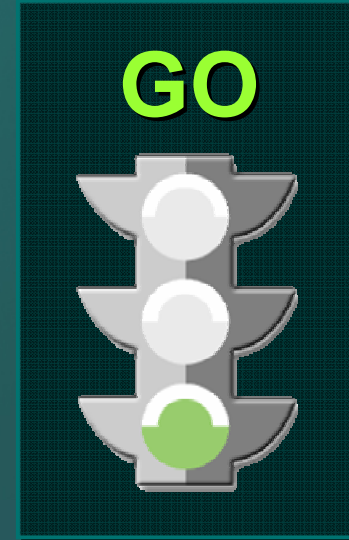
GO



Problem: Wire Won't Advance

Escalate !!

- Miracle 3,6,12,
Persuaders Confianza,
Confianza Pro 9,12
- Hydrophilic
(with Visible Lumen)
- Retrograde entry
- STAR



Simple Technique

Conventional technique

Drilling strategy

Intermediate GW

↓ Not cross

Standard GW

↓ Not cross

Stiffer GW (0.014 inch)

↓ Not cross

Other stiffer GWs

↓ Not cross

Stiff Tapered GW)

New technique

Penetrating strategy

Intermediate GW



Not cross

Stiff Tapered +/-
Hydrophilic
coating



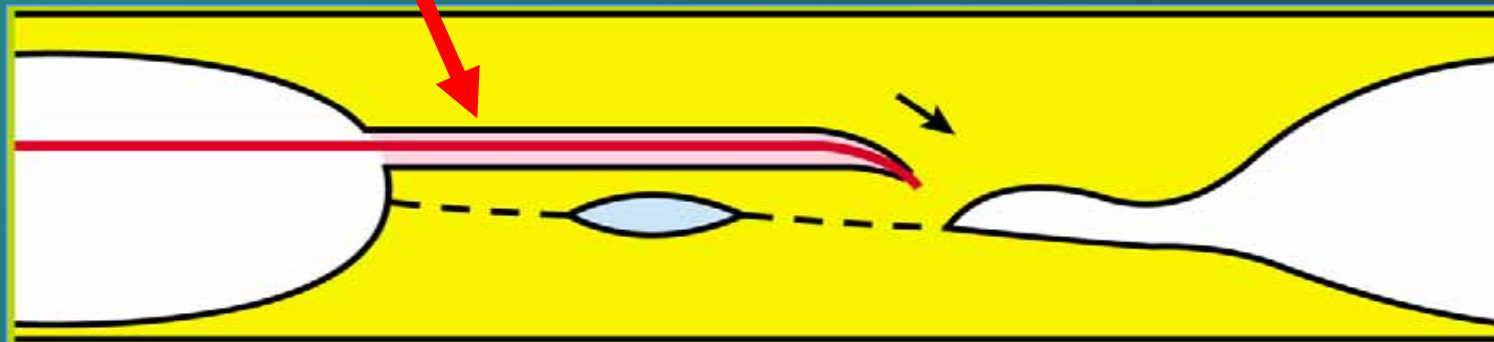
For penetrating the entry point

**For reentering to the
true lumen from the subintima**



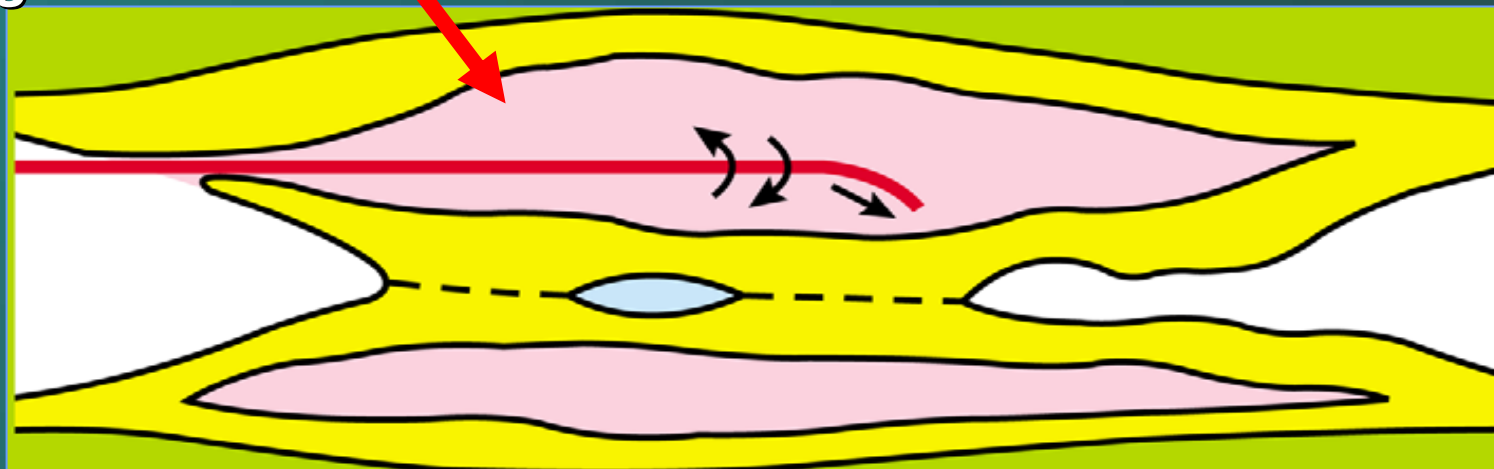
Creation of Re-entry

Small false lumen



Easy to make re-entry

Large false lumen



Difficult to make re-entry



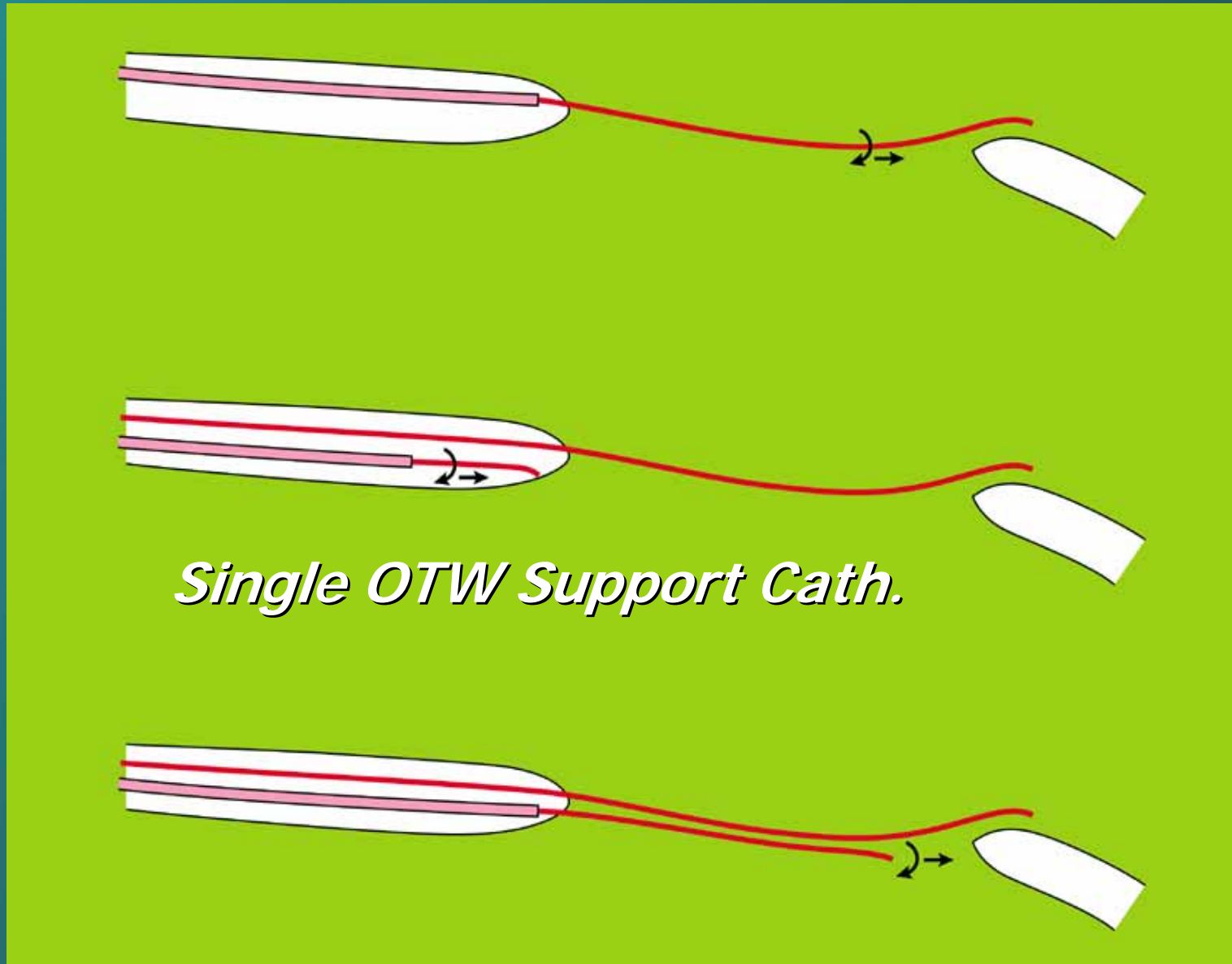
Problem: Wire Goes Offline

- **Parallel wire technique**
- **Grab Sidebranch**

GO

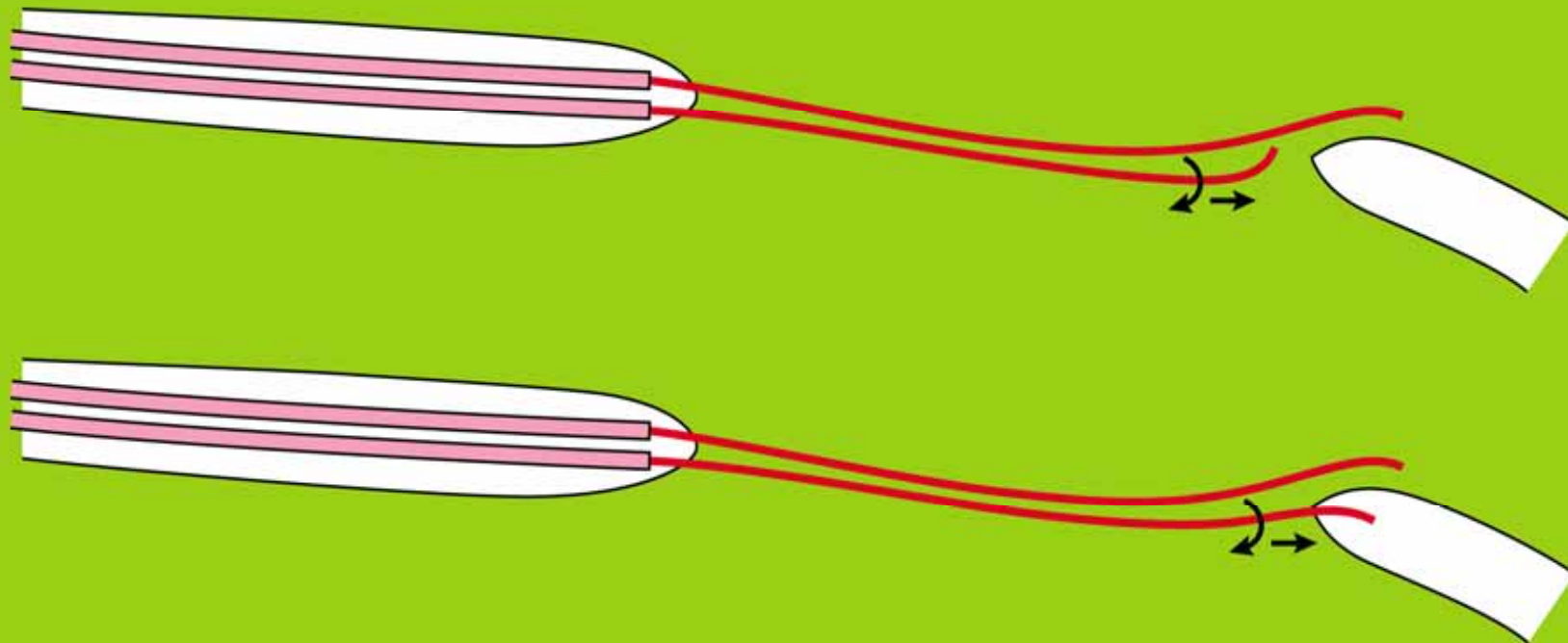


Parallel Wire Method

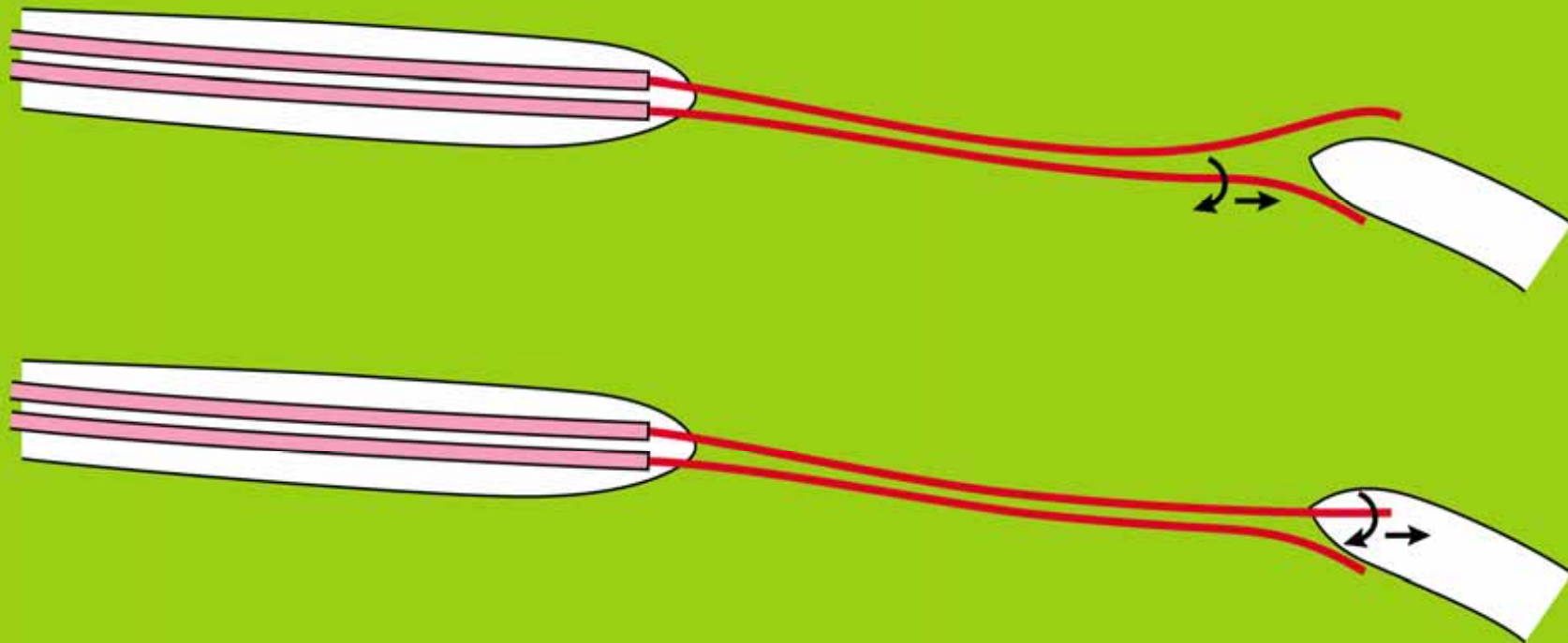


Seesaw Wiring

Parallel Wire Method with Double Support Catheters



Seesaw Wiring

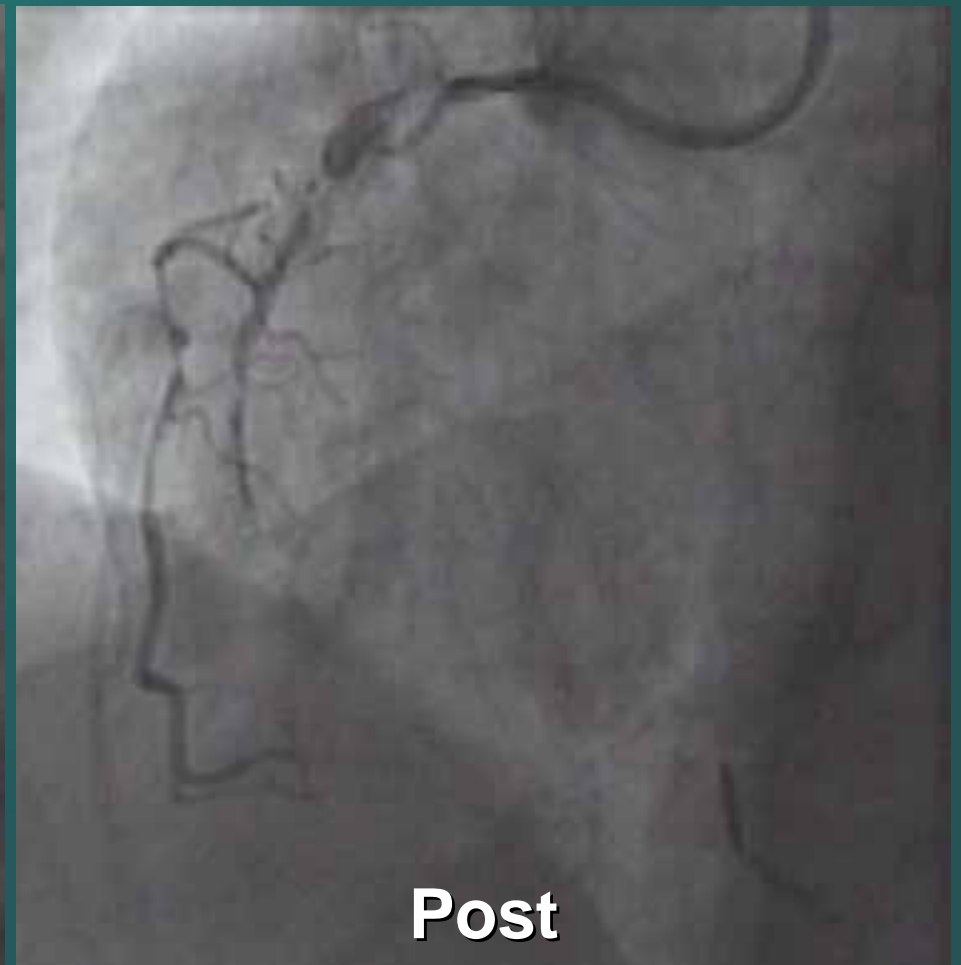


These guide wires can exchange their roles each other very easily.



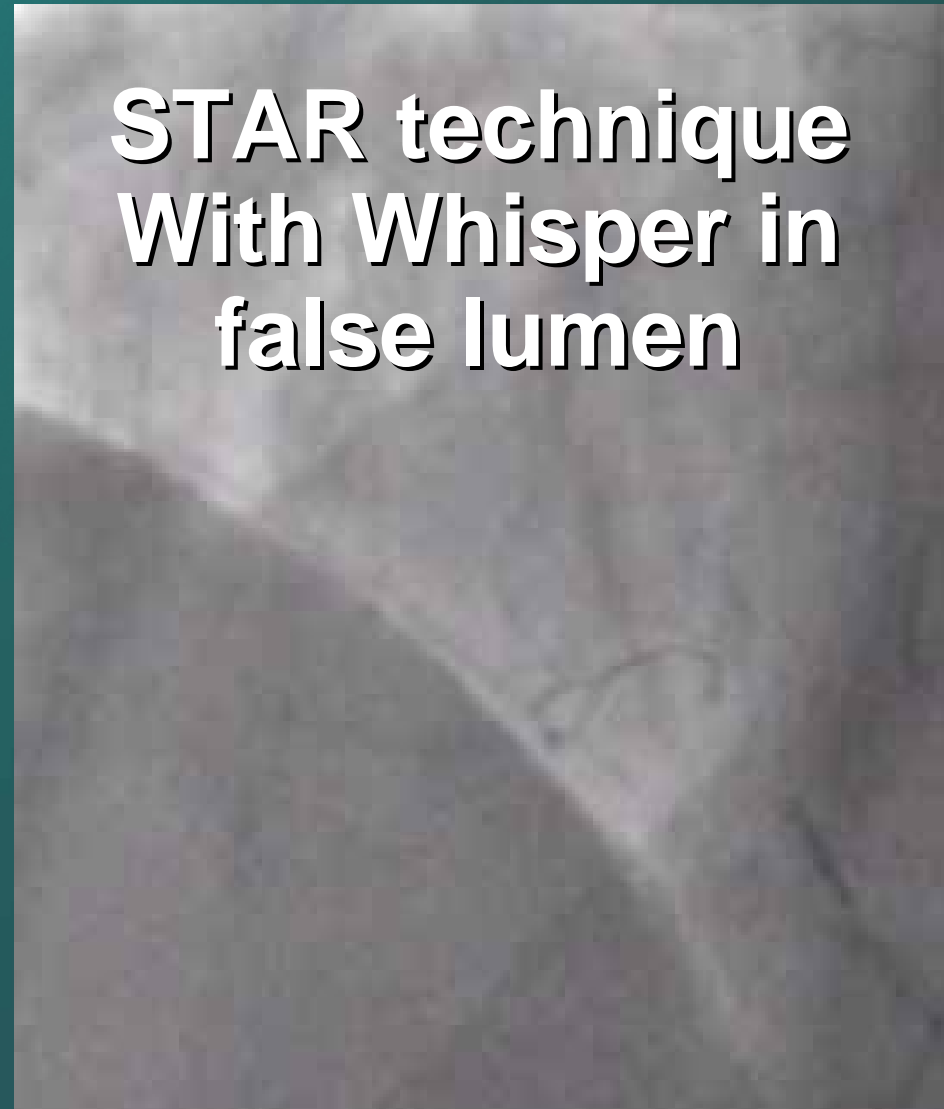
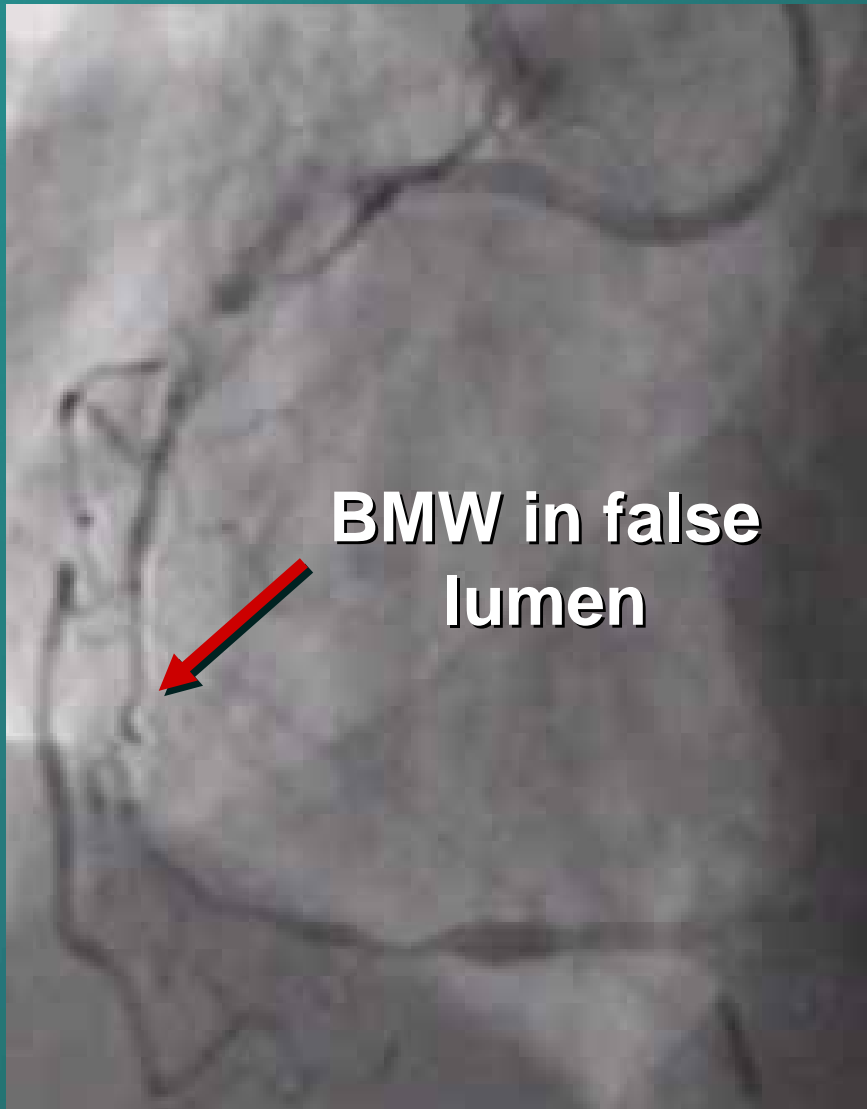
STAR Technique

Failed prior attempt with parallel wire technique,
resulting in dissection

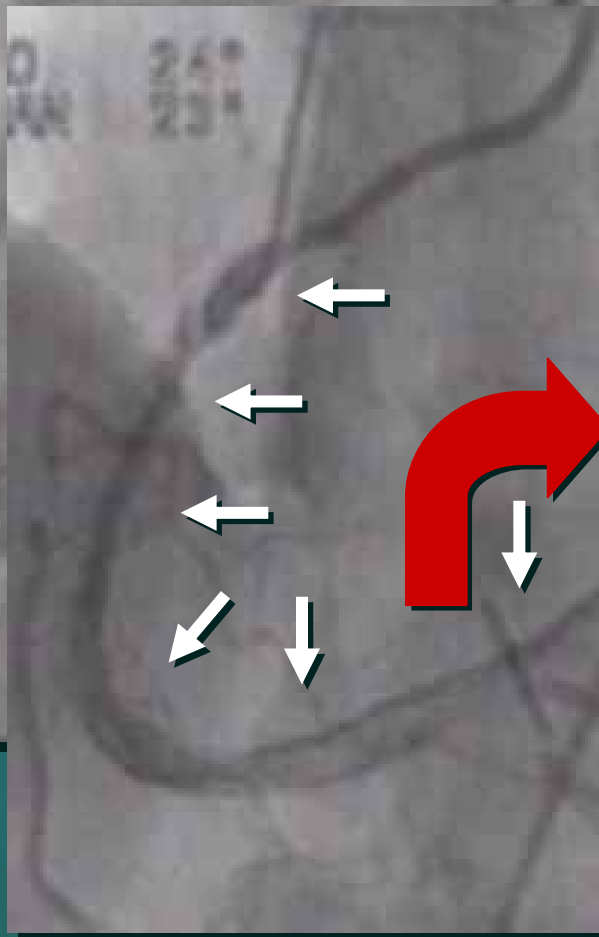


6 weeks later

**Parallel wire technique
with 2 Confienzas failed**



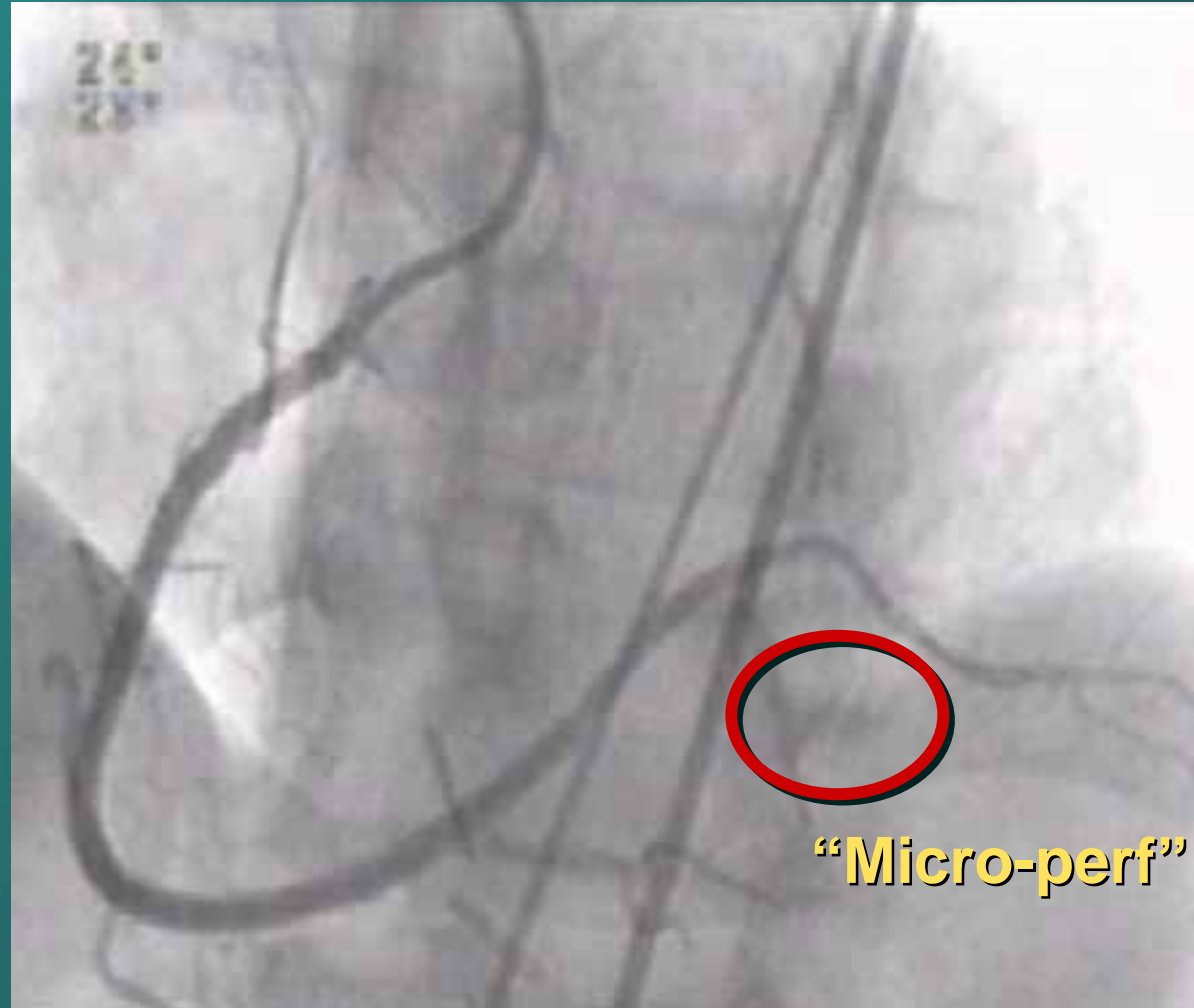
Percutaneous endarterectomy



Post PTCA
(arrow sites)



Final result after 5 stents and PTCA of PLA and PDA



Problem: Device Won't Advance

- Laser
- Roto
- 1.5 Maverick Rail
- Tornus
- Deep-seat Guide/
↑ French Size
- Sidewire or anchor balloon

GO



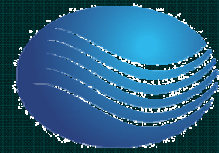
Problem:

Wire Goes Into Sidebranch

- Stiff Straight Wire
- Support Catheter
- Velocomed Venture Directional Catheter
- IVUS Guidance

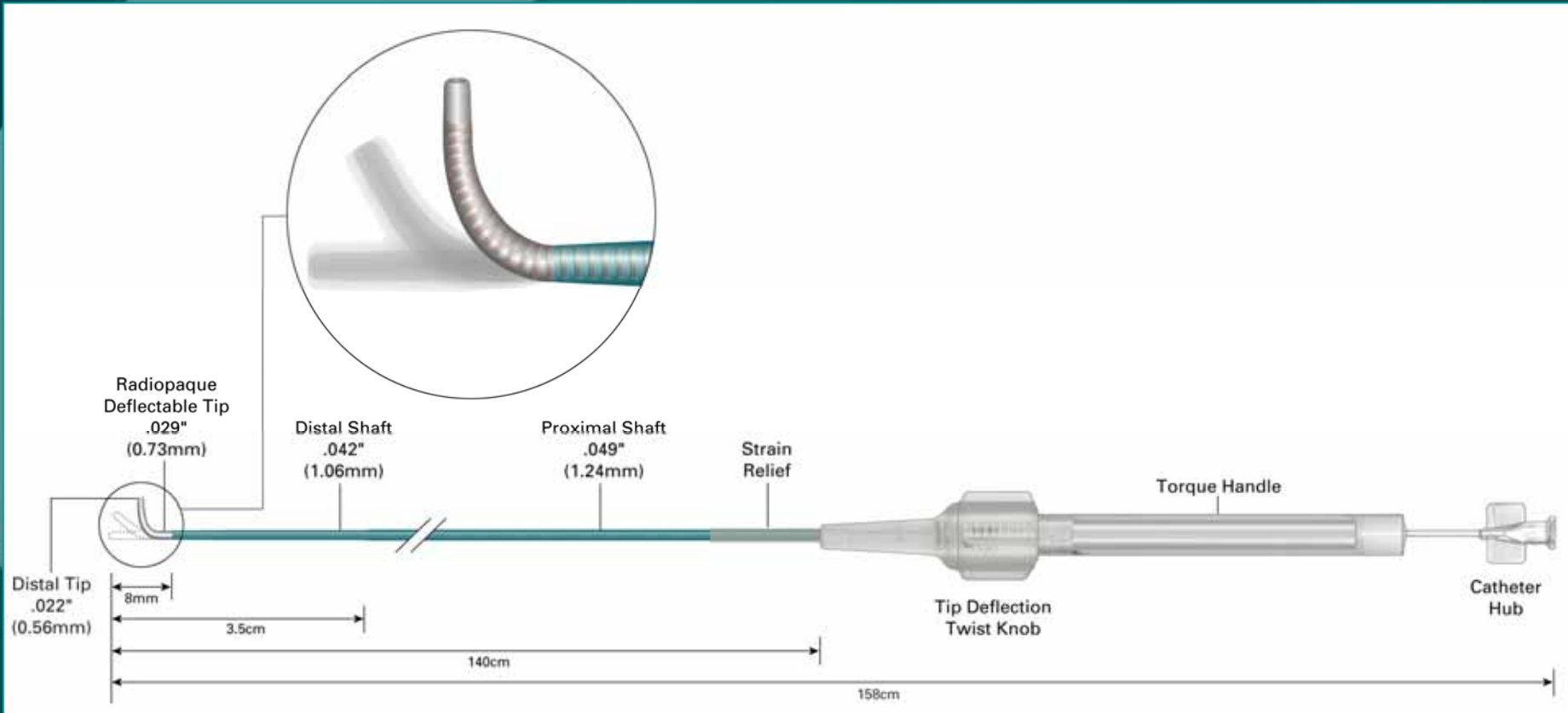
GO





VENTURE™

WIRE CONTROL CATHETER

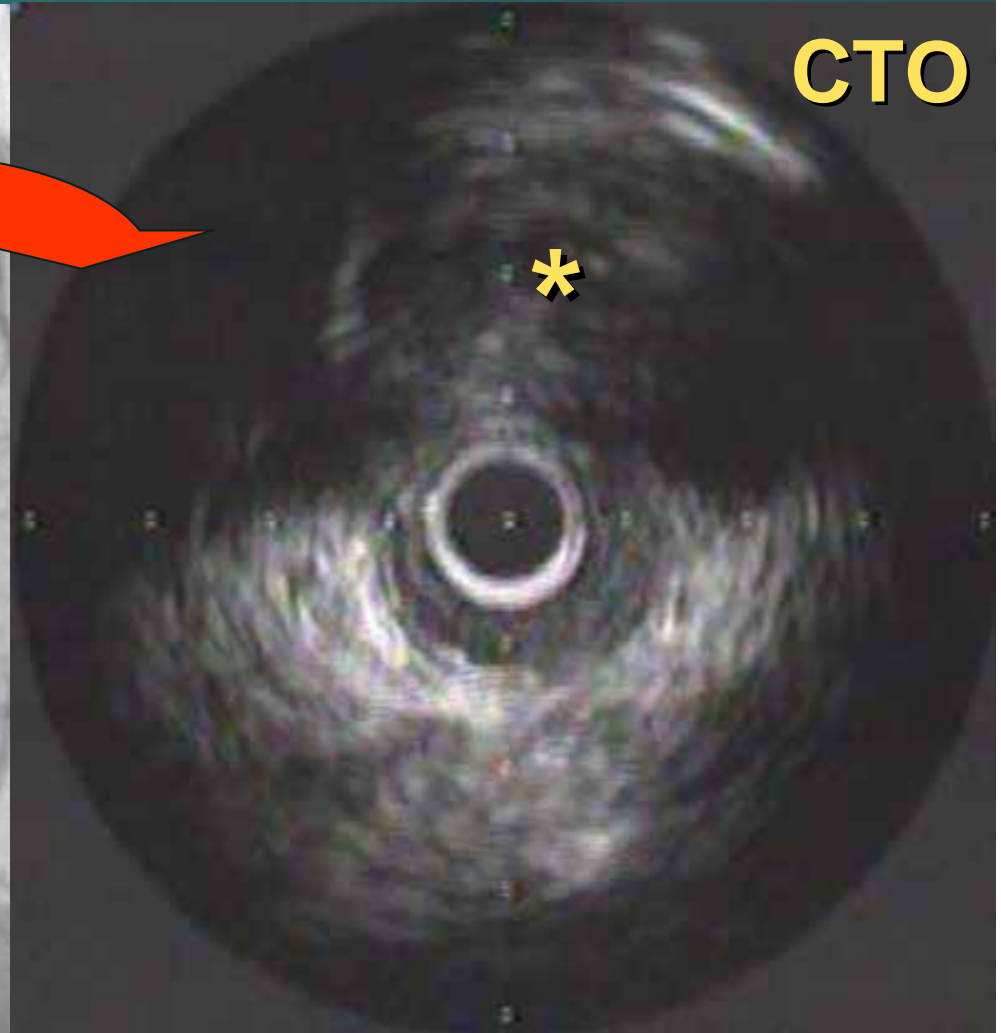
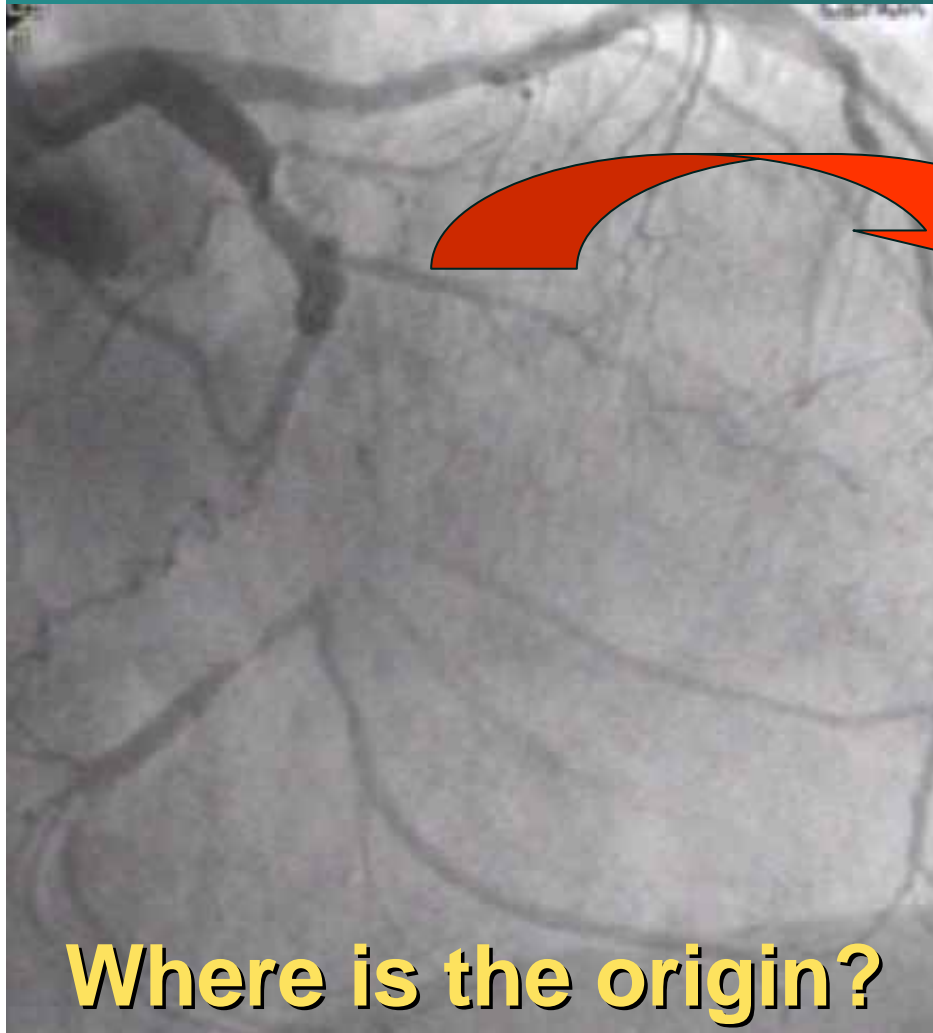


*The Cardiovascular Research Foundation
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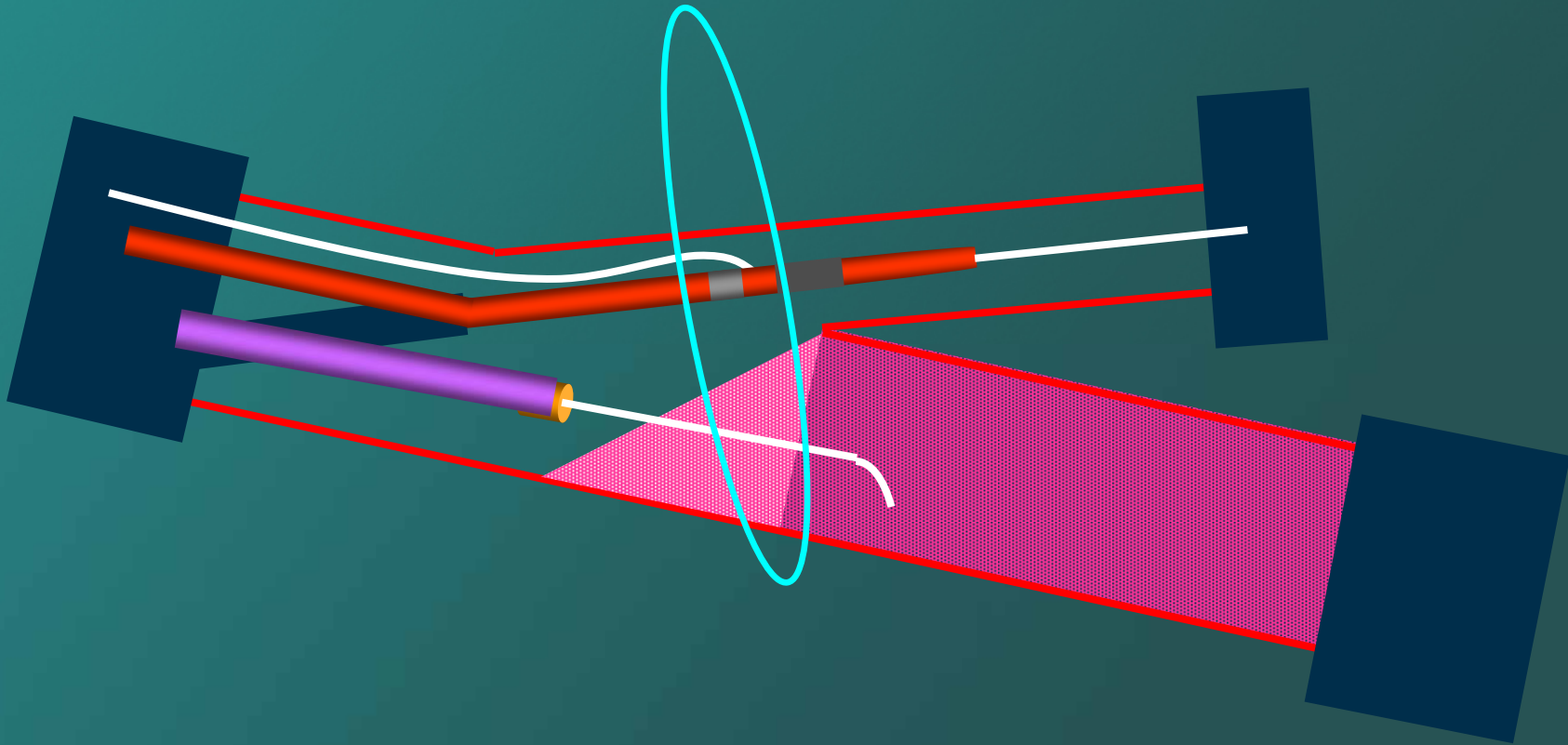


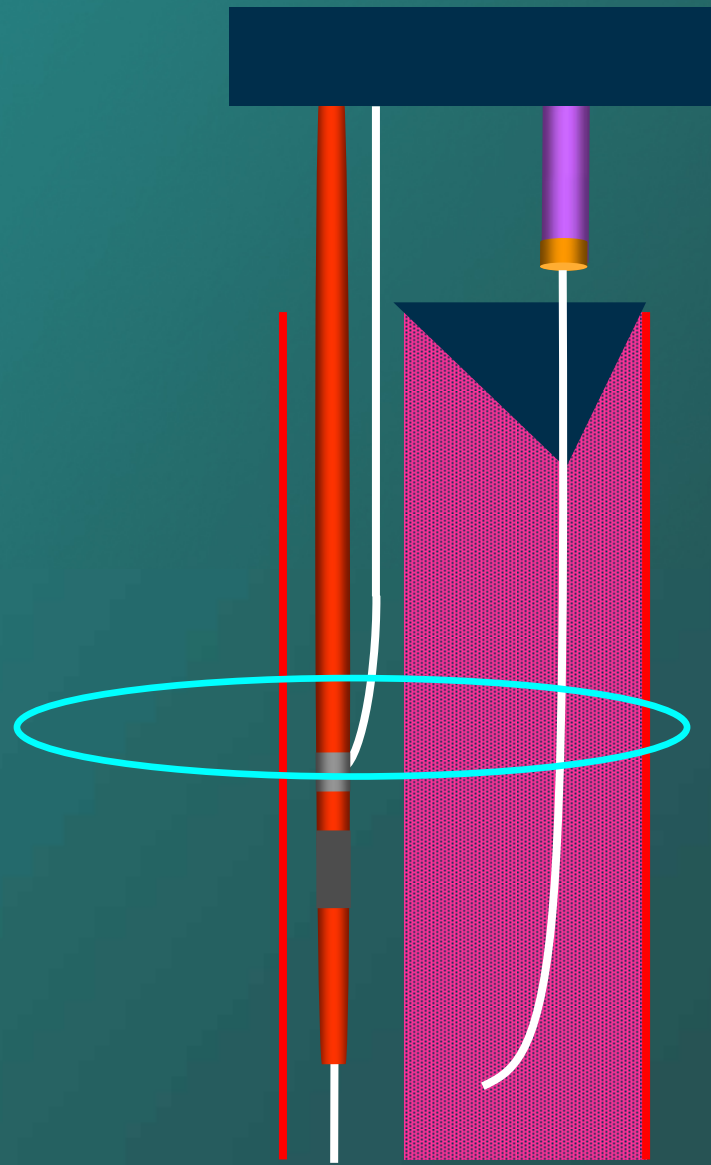
6. Complex CTO of MLCX

IVUS in LA branch



Identification of the Entry





The Latest Strategy for Complex CTO

Identification of the entry with IVUS

Parallel wire technique
in the occlusion

Identification of
distal vessel
by the retro-grade wiring



What to do if the Distal Lumen is Compressed

IVUS guided re-entry from the false lumen

Retro-grade dilatation of the false lumen and ante-grade puncture (CART)

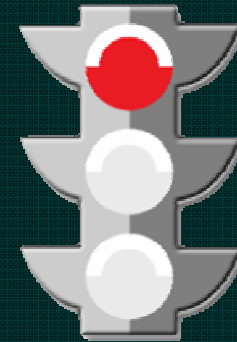
Identification of distal vessel by the retro-grade wiring



Problem: Perforation

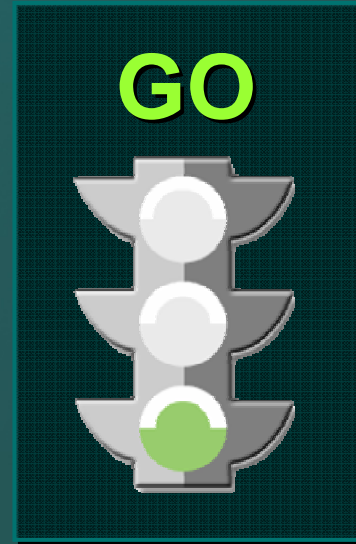
- Wire Exit with Large Stain (or worse!)
- Device Exit
 - Balloon
 - Frontrunner
 - Catheter
- Distal Perforation

STOP

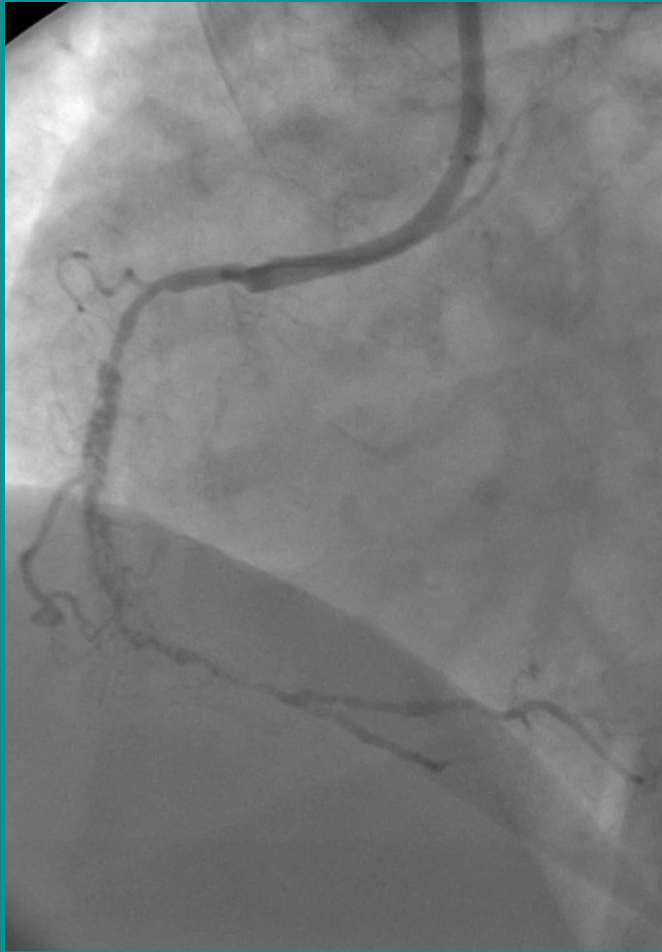


Perforation

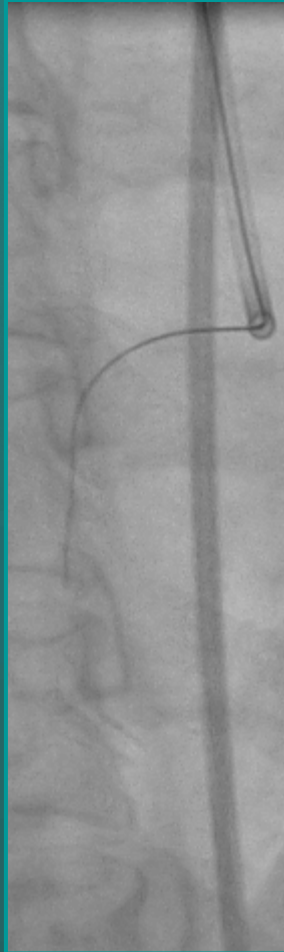
- Wire “Exit” Off Course Without Contrast Stain
- “Adventitial Haze”



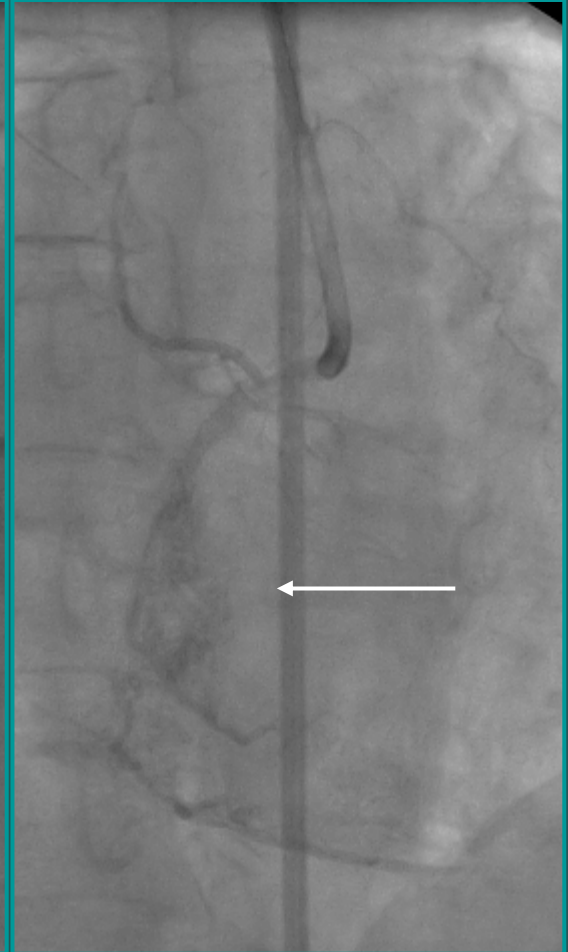
Epicardial Stain



Base-line



Wiring



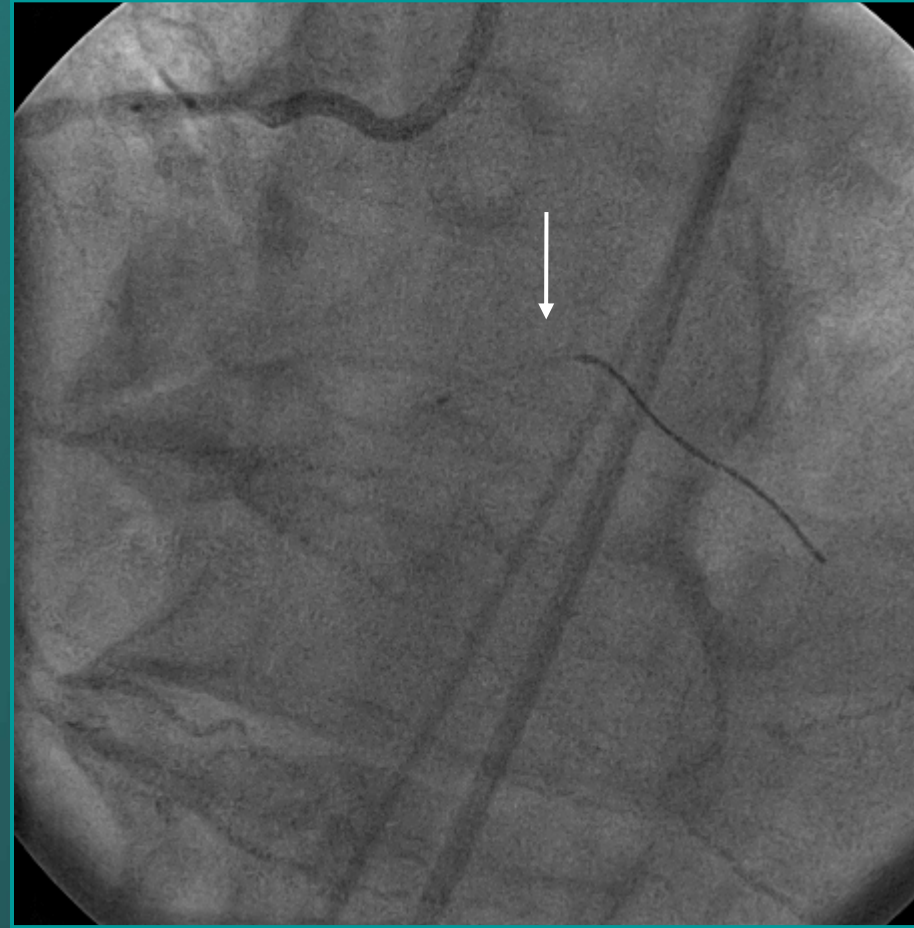
Stain



Distal Perforation (1)



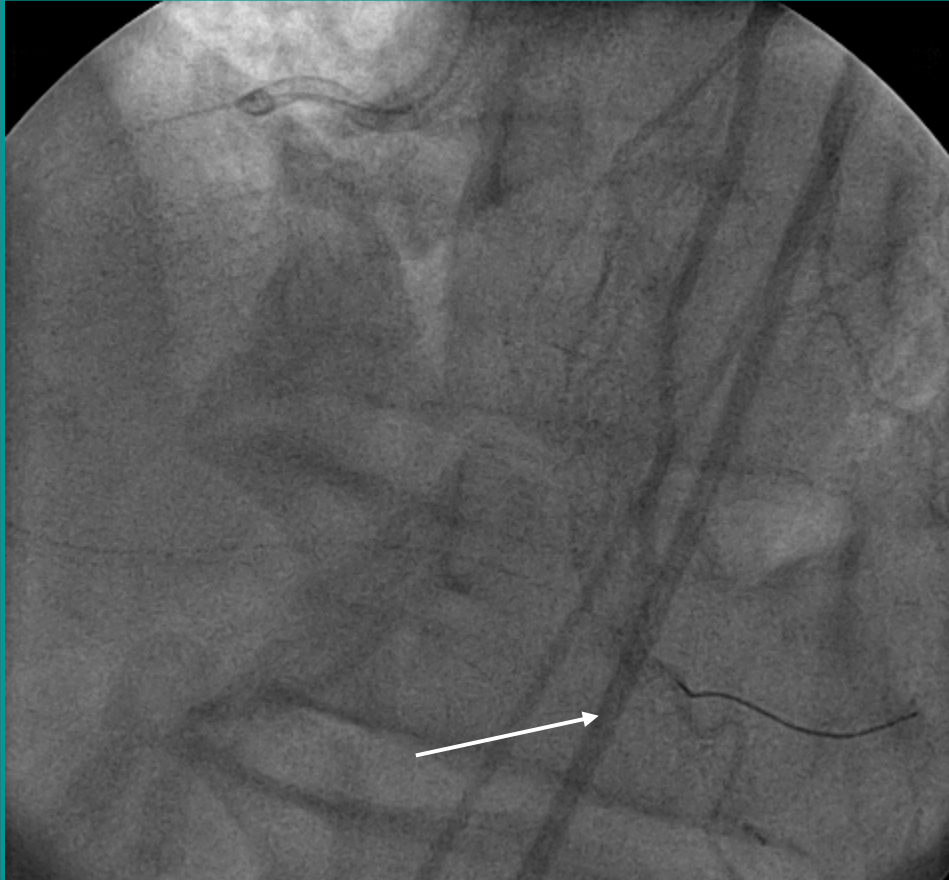
Base-line



PLB wiring



Distal Perforation (2)



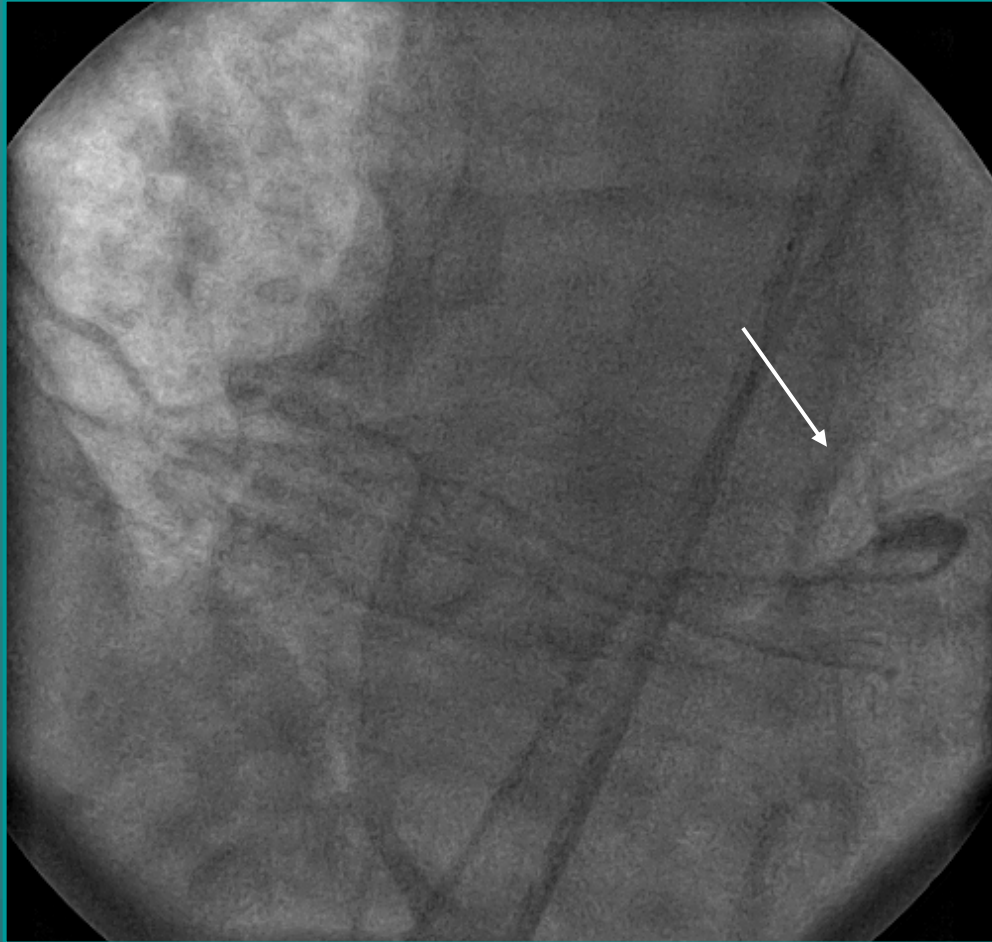
PDA branch wiring (1)



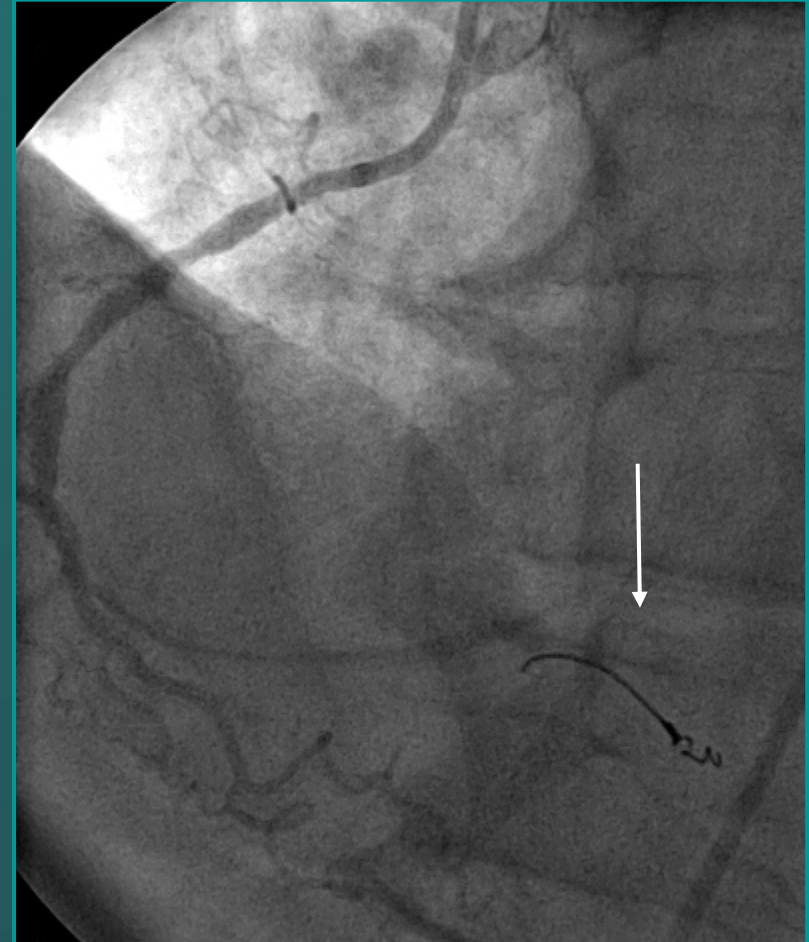
PDA branch wiring (2)



Distal Perforation (3)



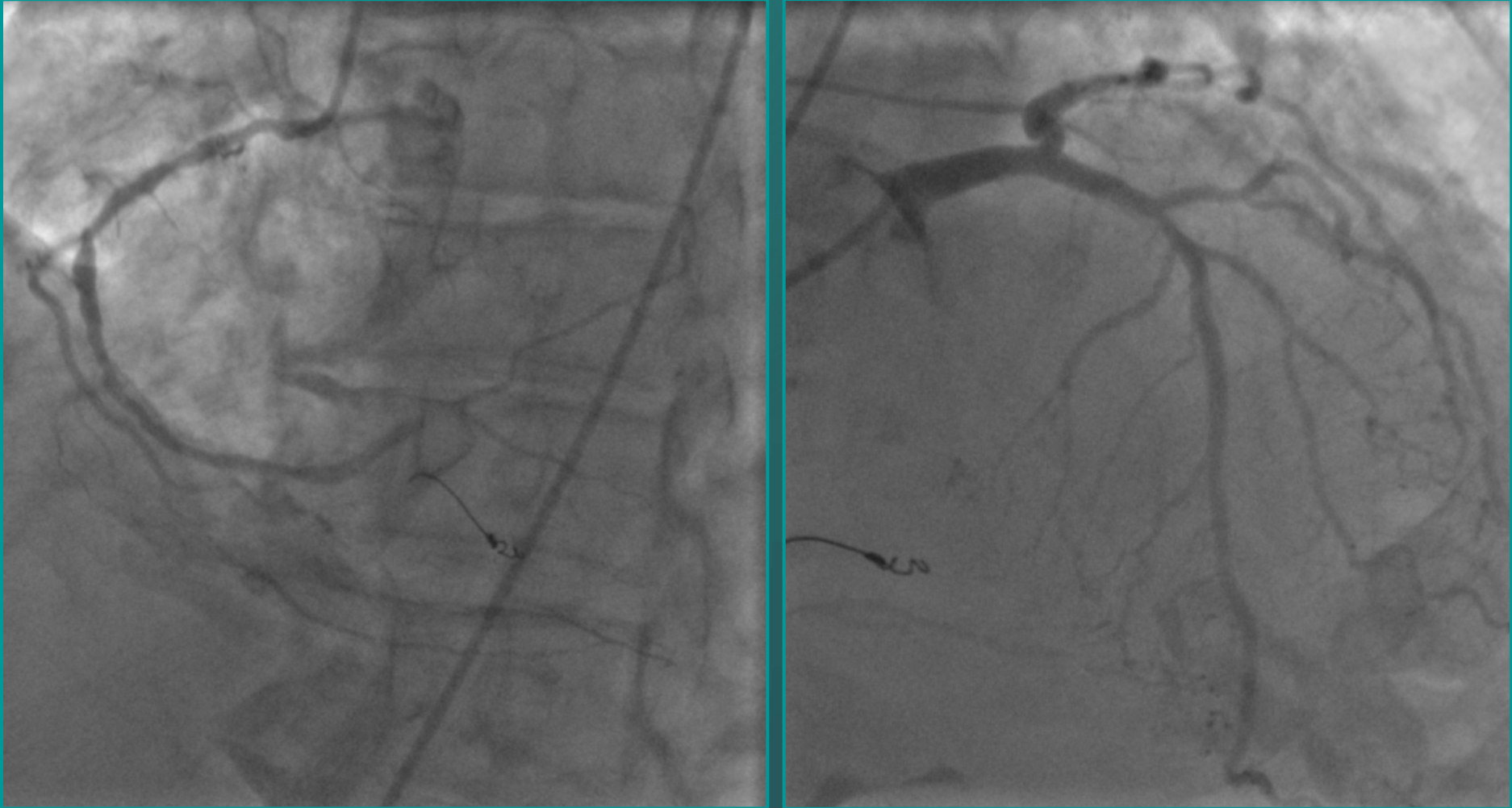
Distal Stain



Coiling



Distal Perforation (4)



3-days follow-up



COLUMBIA UNIVERSITY
MEDICAL CENTER

CHRONIC TOTAL OCCLUSION SUMMIT

CARDIOVASCULAR
RESEARCH FOUNDATION



Perforations: TIPS (1)

- Watch Heart Borders
- On Line Echo
- Pan Over Whole Heart and Branches in Several Views
- Use UFH
- No DTI, IIB/IIIA, LMWH

GO



Perforations: TIPS (2)

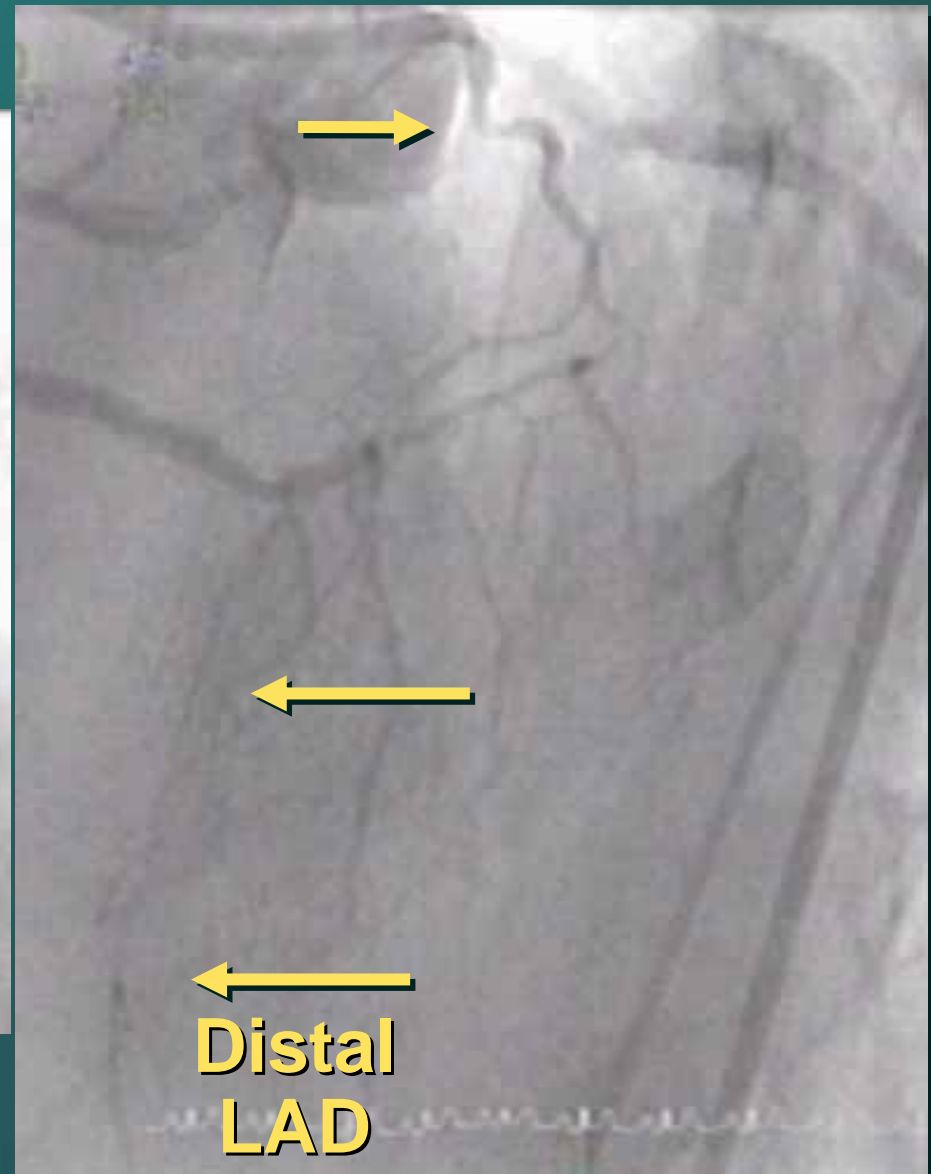
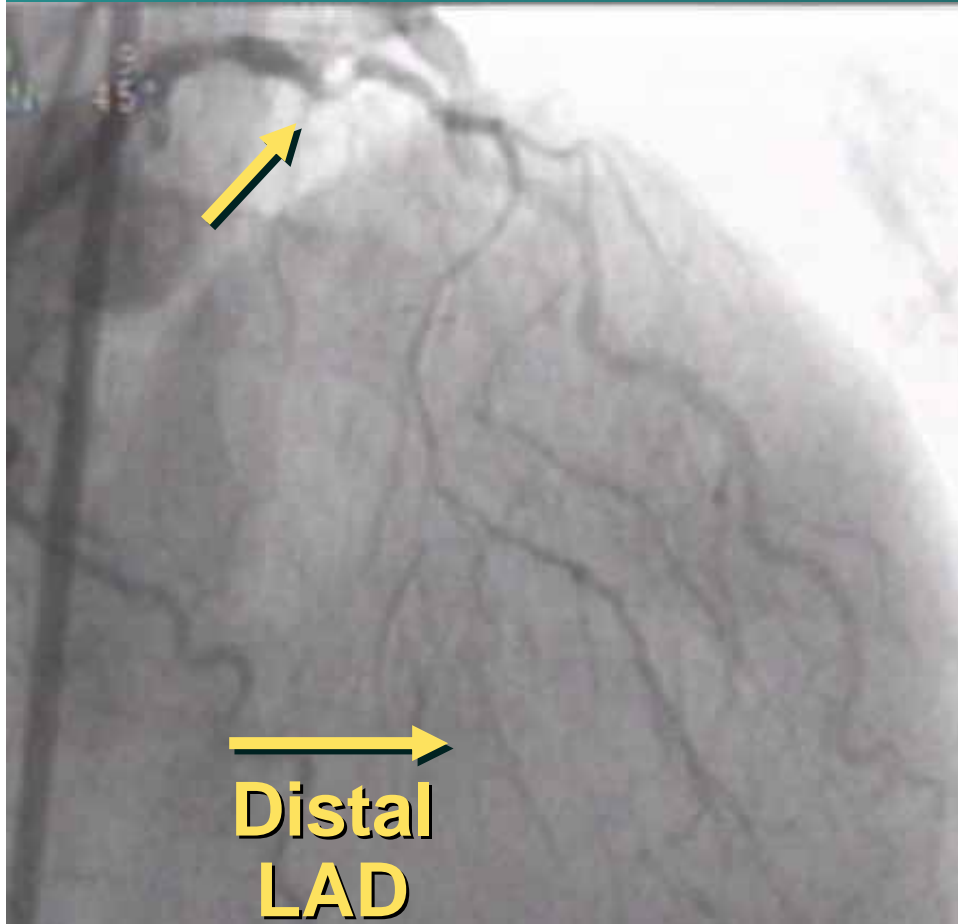
- Reverse Heparin Freely
- Remember the Contralateral Vessel Can Supply the Perf as well
- Have Coils/Microspheres/Jomed Stents and Centesis Tray at Hand
- Never Advance a Device Unless You Know Wire is Intraluminal
- Never Inject Distally Though the Balloon!



After All These Talks and Cases is There a Time Not to Try?



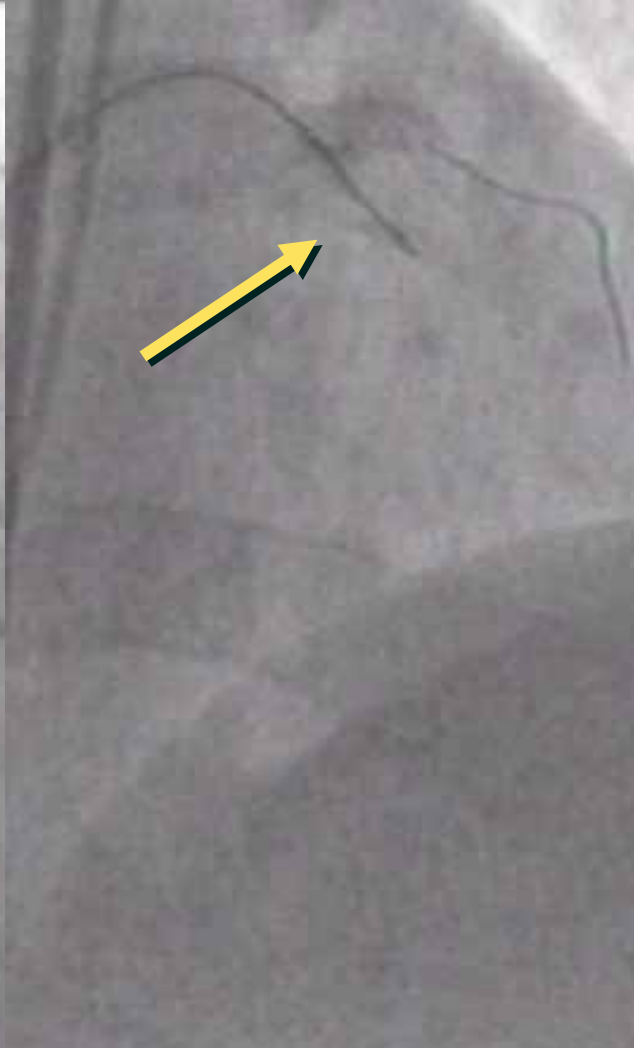
45 y.o. with flush occlusion of LAD after D1



Pre

Miracle 3
20°, 30°, 45° bend

Confianza Pro
in Dg



Confianza Pro in MLAD and Dg



See Saw
technique

2 Confianza
Pros, both in
false lumen

LAD from
contralateral
injection



After All These Talks is There a Time Not to Try?

Maybe

- 1) Long CTO +
- 2) Heavy Calcium +
- 3) POOR DISTAL VESSEL VISUALIZATION!
- 4) No prospect for Retrograde

New Technologies for Chronic Total Occlusions

Guidewire

Tapered tip: CROSS IT, Conquest, Miracle
Steerable guidewire, Hydrophilics
Optical coherence reflectometry OCT

Ablative

Excimer laser
Ultrasound
Radio frequency ablation

Mechanical

Blunt microdissection
Fibrinolysis
Demineralization, collagenase

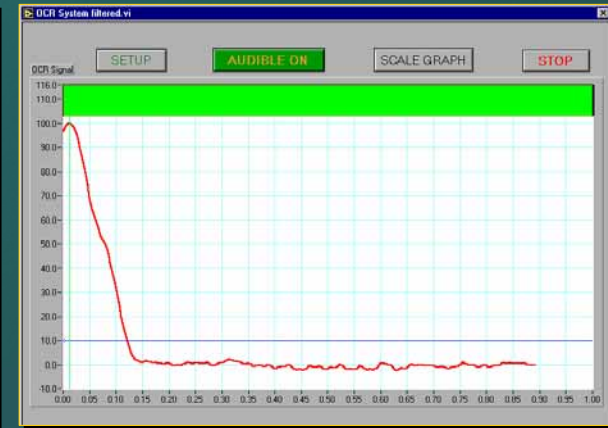
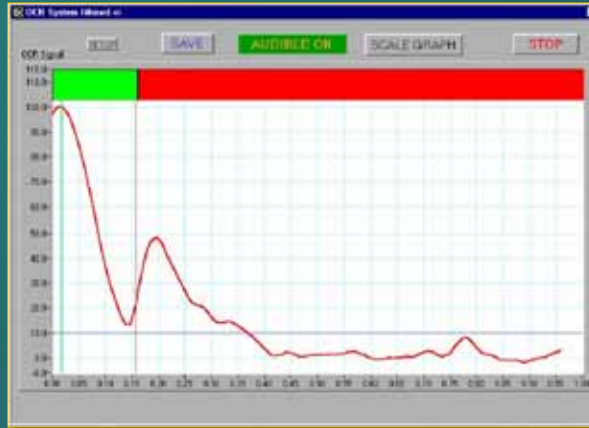
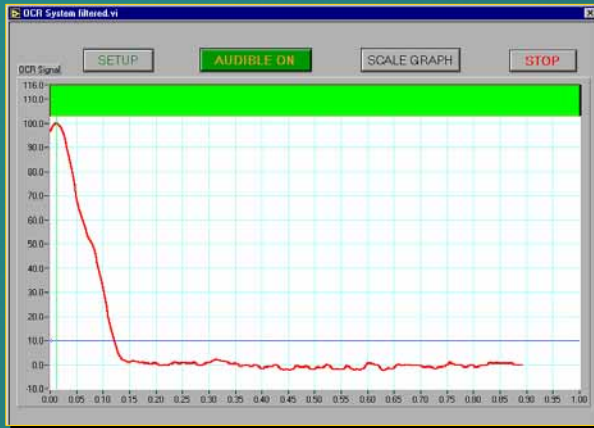
Re-Entry

Percutaneous bypass and reentry
techniques



OCR Waveform Displays

Simple Display Feature

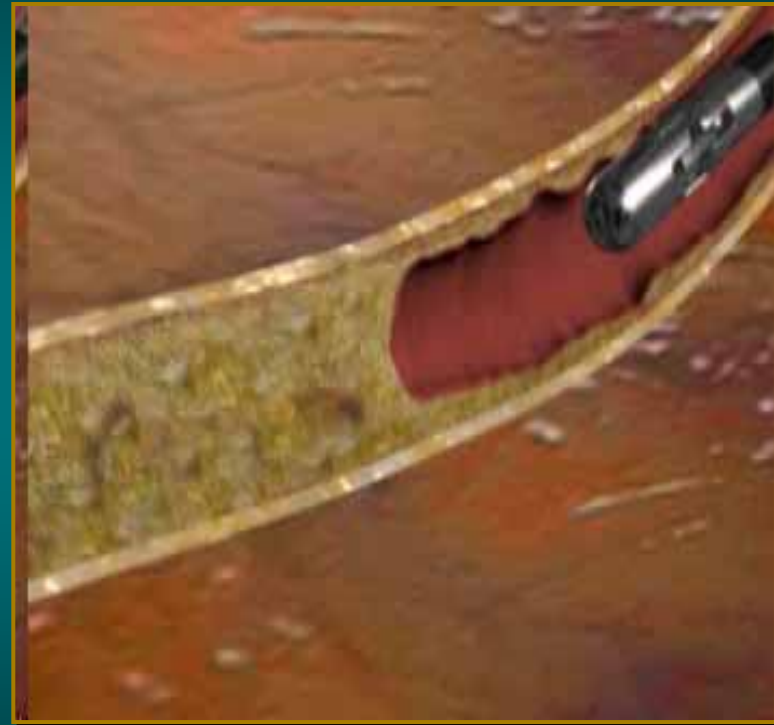


Investigational Device, Not available for sale in the US.

Frontrunner™ CTO Catheter

Controlled Blunt Micro-Dissection Technique

- Gently separates atherosclerotic plaque in various tissue planes, creating a passage through the CTO
- Uses elastic properties of adventitia versus inelastic properties of fibrocalcific plaque to create fracture planes



LUMEND FRONTRUNNER CORONARY CATHETER CONTROLLED BLUNT MICRO-DISSECTION TECHNIQUE

Chronic Total Occlusion Revascularization Alternative Technologies

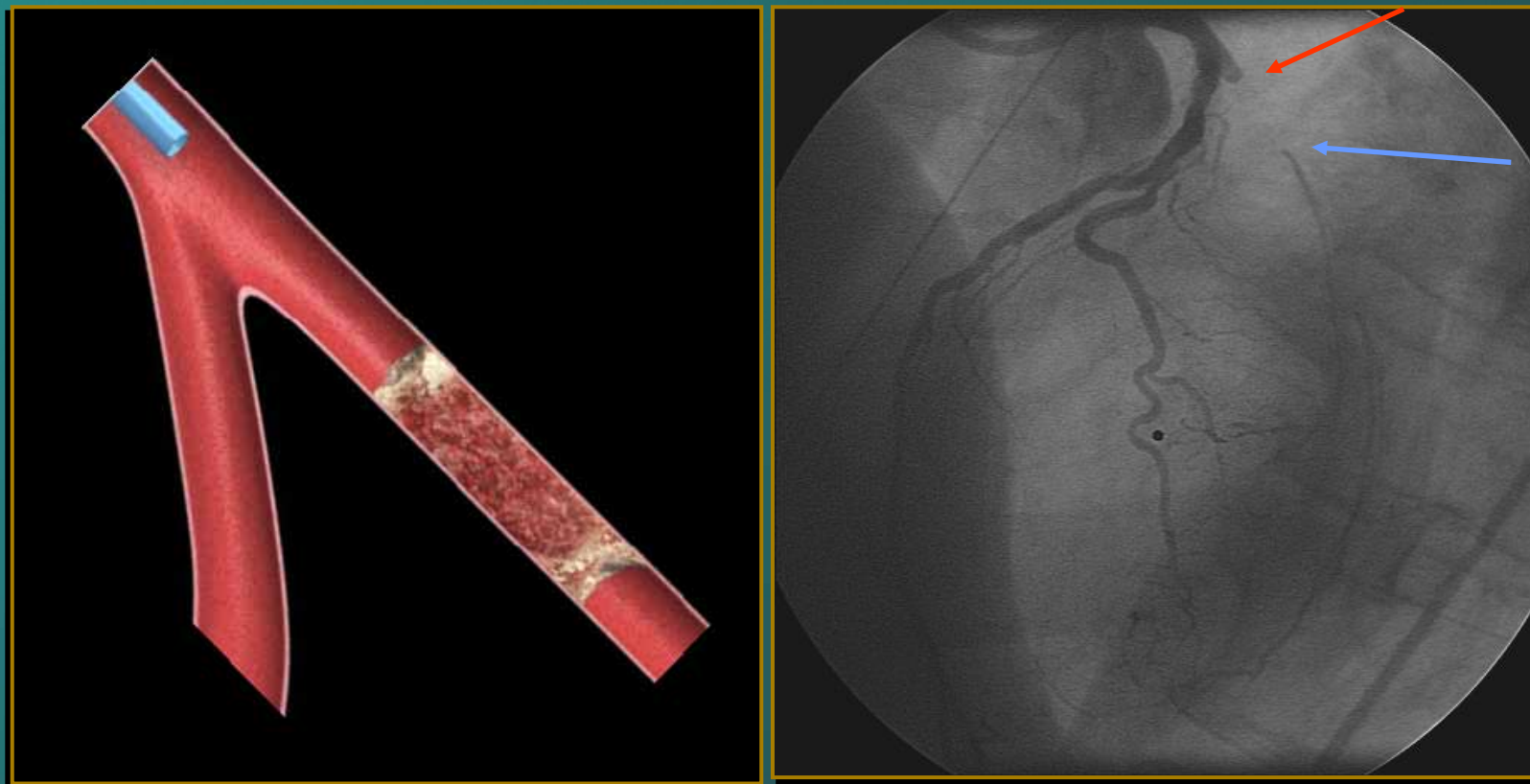


- **FlowCardia CROSSER System**
 - High frequency mechanical revascularization
 - Monorail, and OTW
 - 0.014" wire and 6 Fr guide compatible

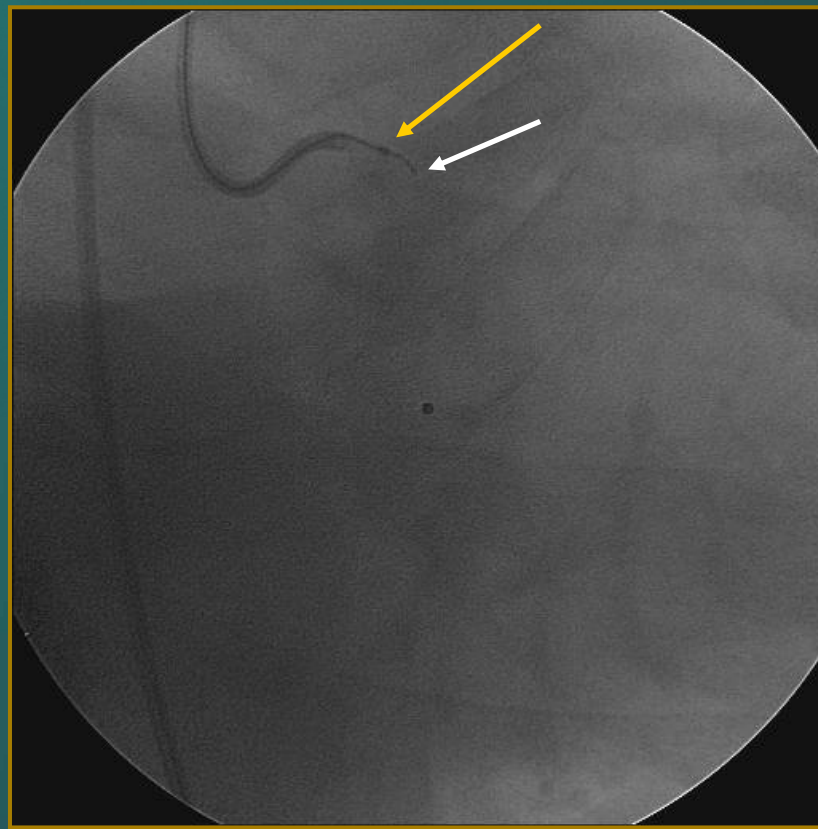
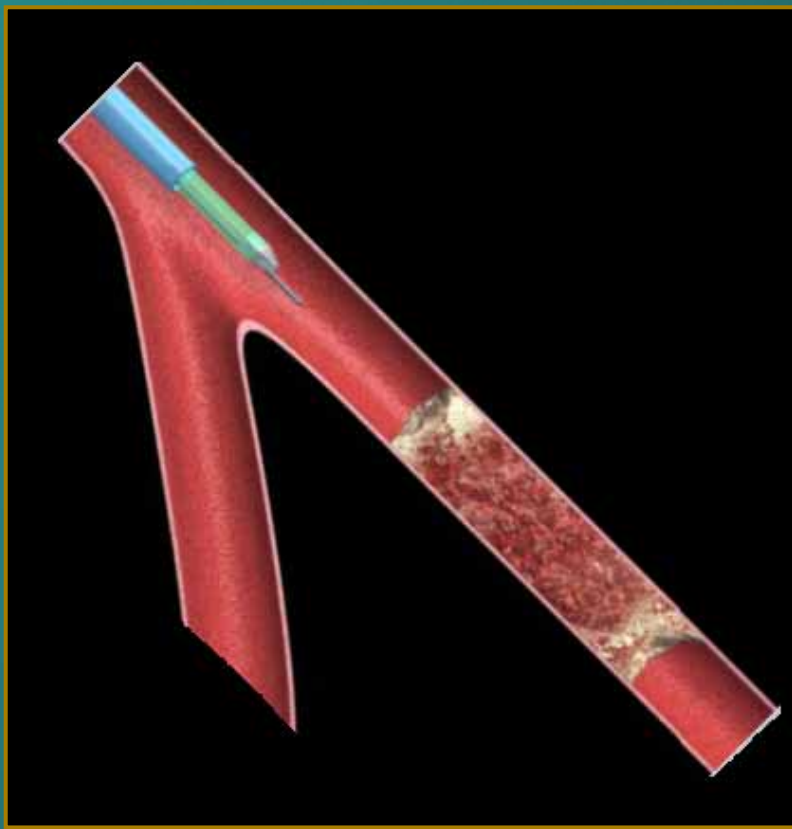
Investigational Product Only. Not Available for Sale in the U.S.



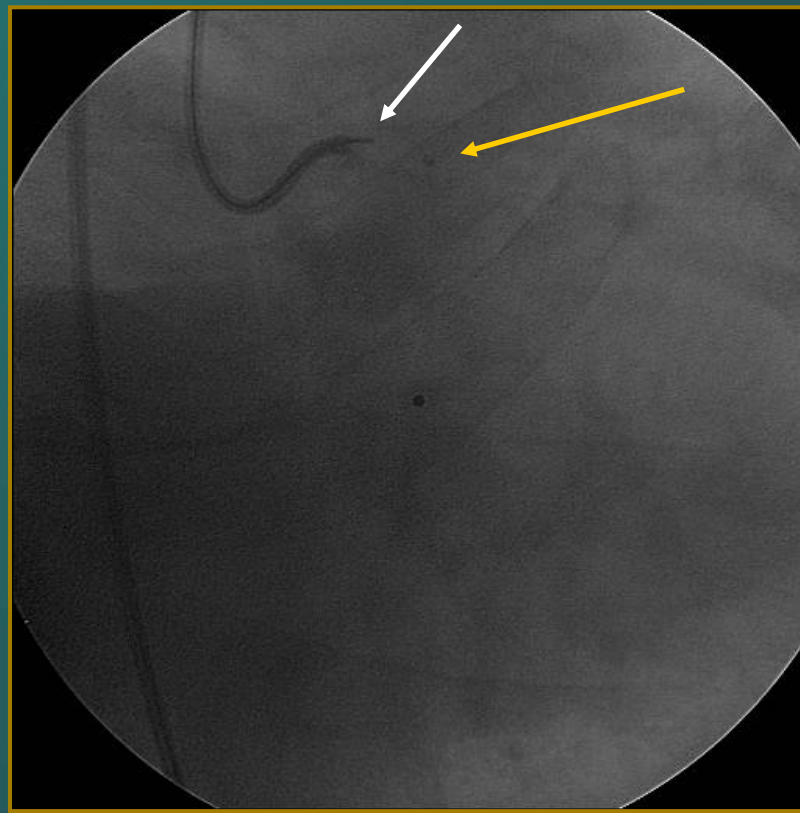
Technique



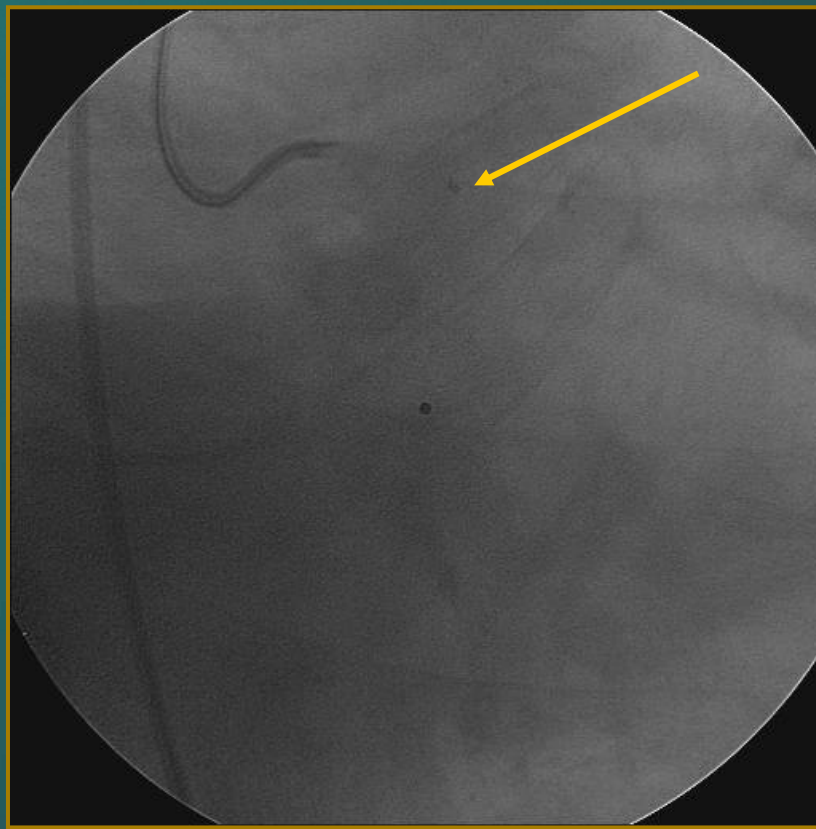
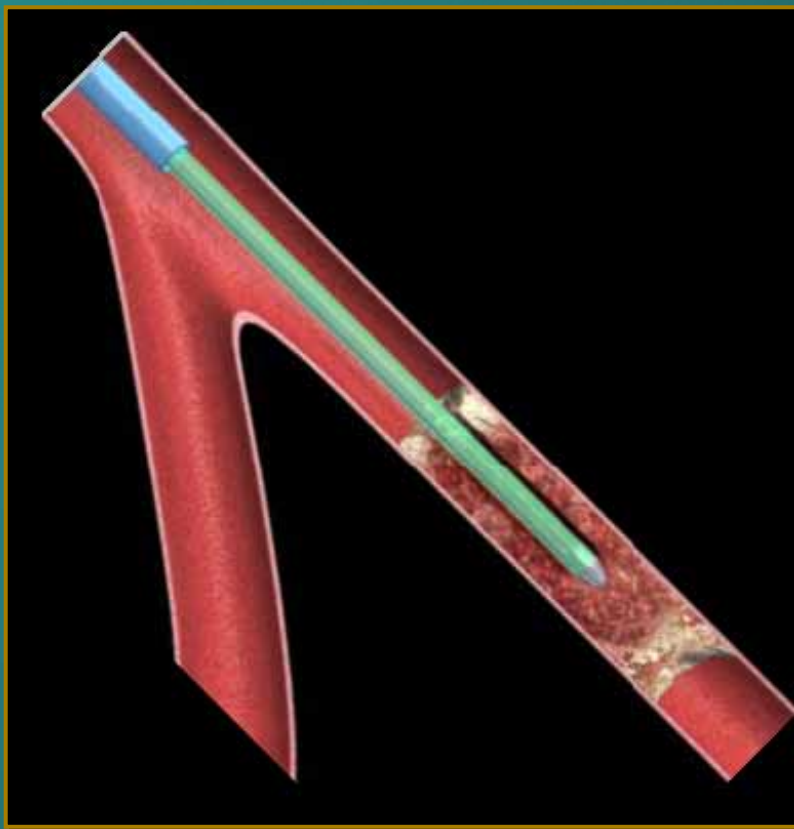
Technique



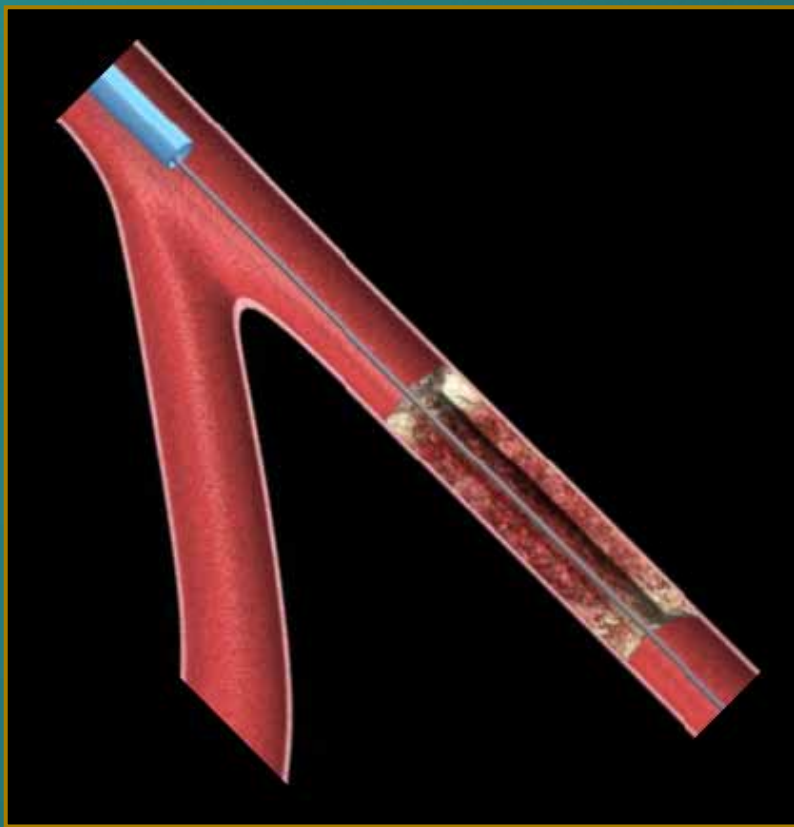
Technique



Technique



Technique



OmniSonics Resolution[®] System



- Generator provides an electrical signal to the reusable handpiece

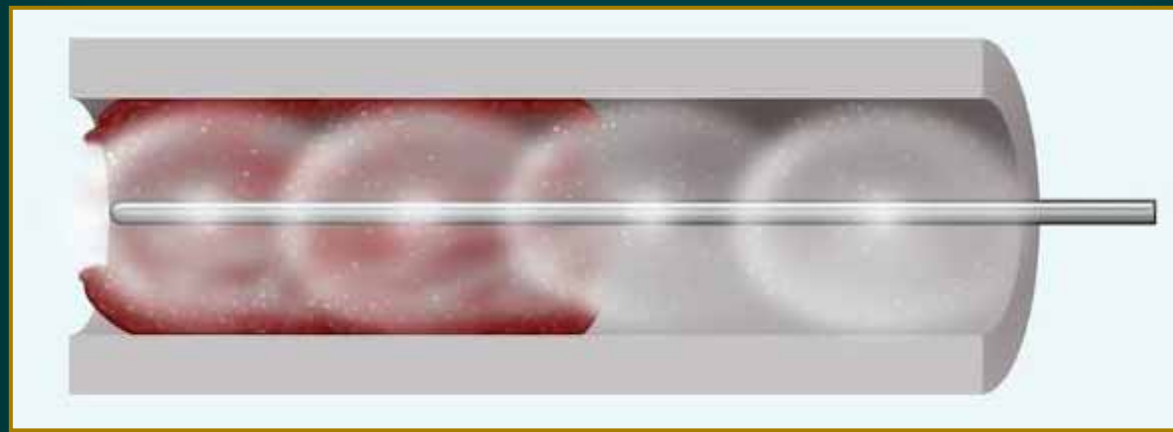


- Handpiece converts the signal to acoustic energy
- Small diameter flexible guidewire vibrates at 20 kHz, ablating tissue via cavitation along distal 20 cm active length



OmniWave Technology

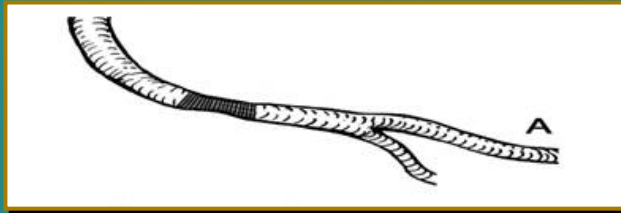
- **OmniWave Technology is the first technology that delivers controlled acoustic energy along the active section of a flexible 0.004” – 0.025” wire**



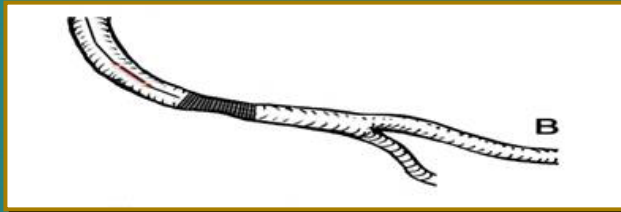
OmniWave Technology Energy Delivery



Description of Procedure



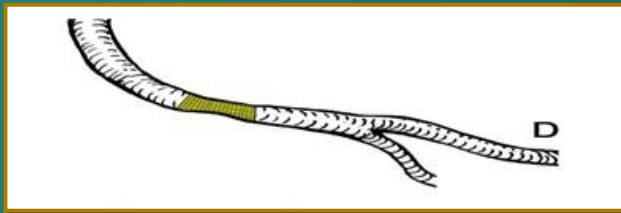
A: Chronic Total Occlusion



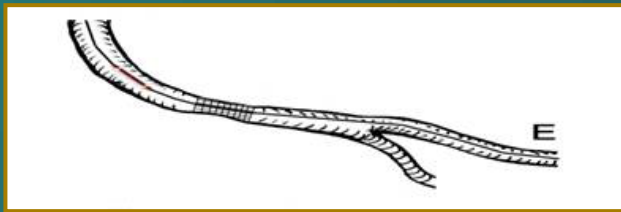
B: Failure to Cross with Guide Wire (Choice PT, Wizdom)



C: Infusion of Collagenase through Wire Port



D: Collagenase Diffusion Through Occlusion



E: Successful Guide Wire Crossing



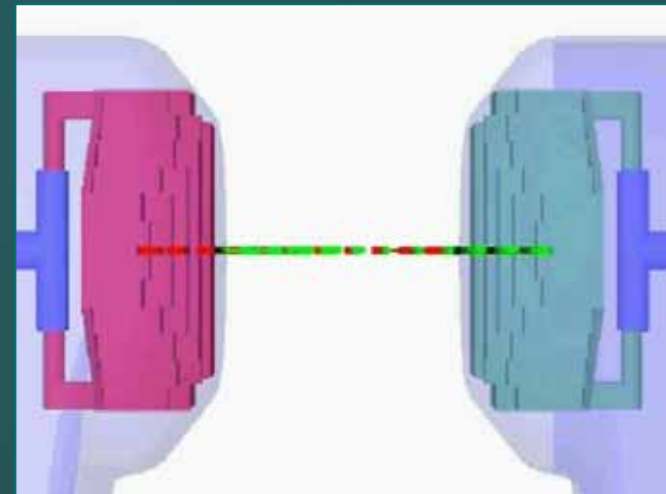
Value of Magnetic Assisted Intervention

Clinical Value:

- Enables New and More Complex Interventional Procedures
- Reduces Time for Existing Procedures
- Reduces Staff X-Ray Exposure and Permits Remote Control

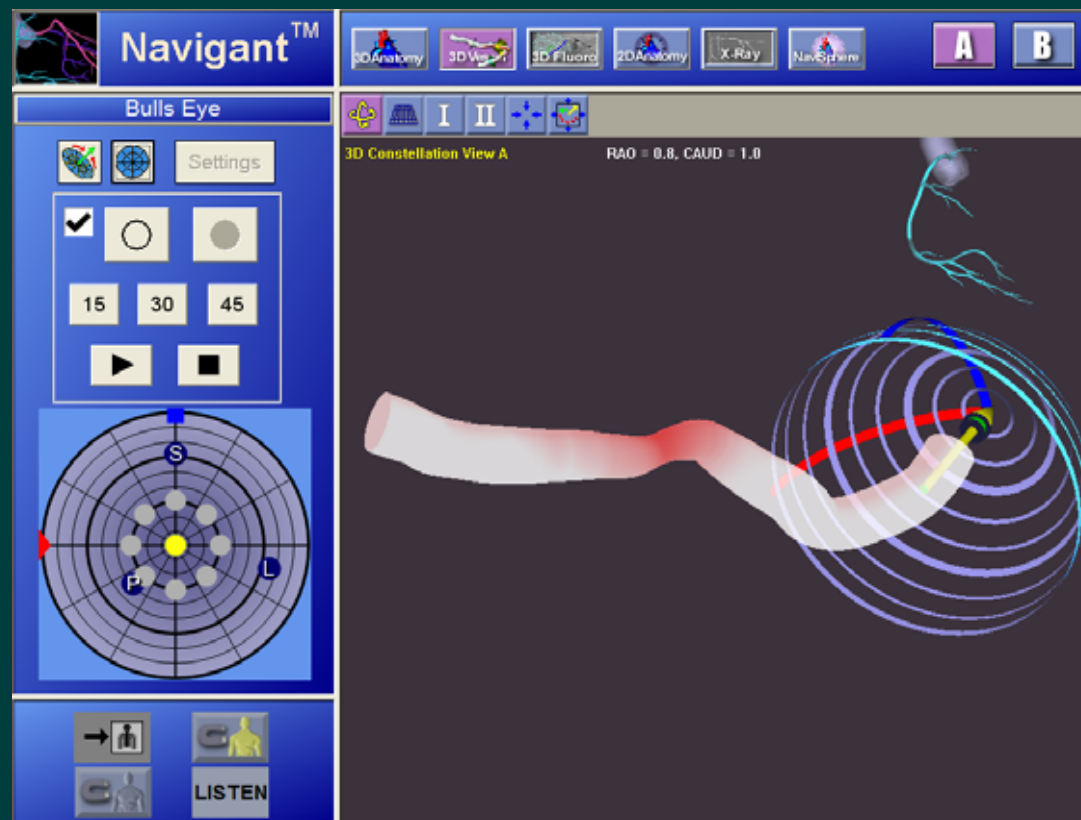
3 System Components:

- Magnet System & Integrated Navigation Software: Relatively uniform magnetic field, steerable in any direction
- Guidewires / Catheters: Small magnets on tips, steered by magnet system
- Catheter Advancement System: Initially for EP catheters



IC NaviView* – From the Touch Screen

- Simply touch the vessel location to align the guidewire



* Powered by Paieon Inc., 3-D Reconstruction Software

Identify Point on CT Data

The screenshot displays the Cronus™ software interface for CT data analysis. The main window is titled "Cronus™ Moderate Support Guidewire" and includes a toolbar with navigation and zoom controls. A red circle highlights the "Alignment" panel, which contains two tables for identifying points on the CT data.

Manual		Auto	
ID	Fluoro Point	ID	Preop Point
MT		BCI	

Below the tables are buttons for "Add Selected Points", "Adjust", and "Reset All". To the right of the alignment panel is a "Navigations" section with a "LAD Vector" table and "Store", "Edit", and "Delete" buttons. Further right is a "Reference" section with "Set" and "Remove" buttons.

The interface also features three circular navigation views: "ANTERIOR", "LEFT", and "SUPERIOR", each with a "00:00" timer. The main display area shows a 3D reconstruction of a coronary artery with a guidewire, and two fluoroscopic views: "Preop View" (LAO = 86.0, CAUD = 83.9) and "New Fluoro B" (LAO = 50.0, CRAN = 30.2).

Navigator Workstation [jack : IC Left]
 Procedure Mode View Settings Help

15° 0% AP PA LAO RAO LL RL INF SUP ARB

NO DEVICE SELECTED
 Please click on the down arrow to select a navigable device

Preop View (LAO = 45.0, CRAN = 0.0)

ANTERIOR

LEFT

SUPERIOR

Zoom = 2.2

Nav Fluoro A (LAO = 36.7, CRAN = 0.9)

Nav Fluoro B (RAO = 27.1, CRAN = 1.0)

Zoom = 1.8

Points & Constellations

Group	ID	Annot...
Group 1	D	
Isosurface - 2	E	
Group 2		

Alignment

Manual Auto

ID	Fluoro Point	ID	Preop Point
B		D	
C		E	

Add Selected Points Adjust Reset All

Presets

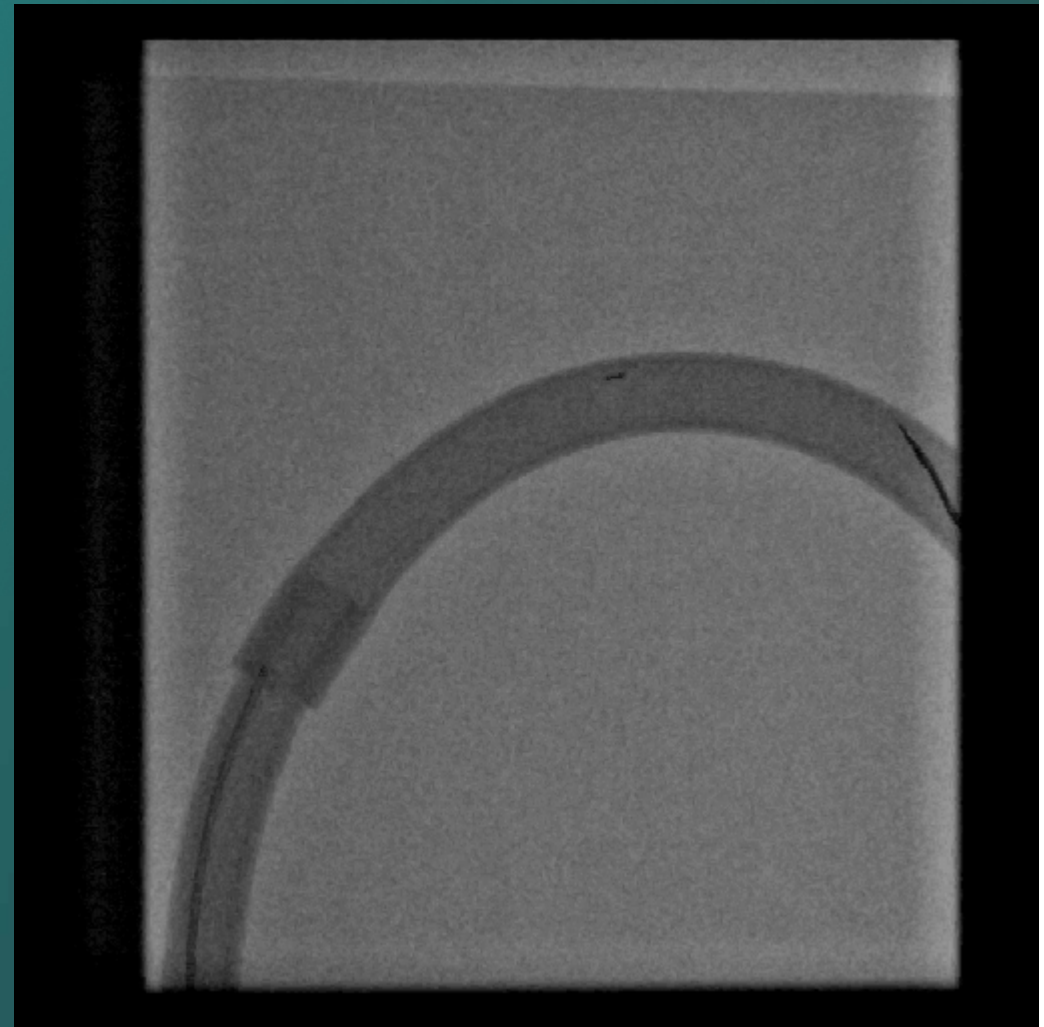
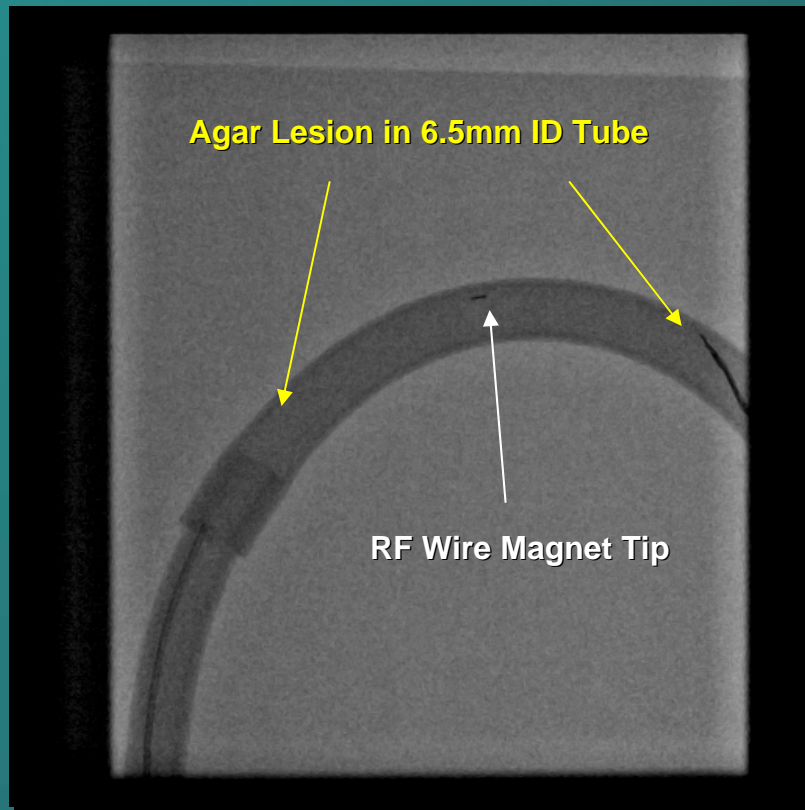
List	ID	Direction	Adj
ic-left			
ic-right			
cardinal			

Bull's Eye

15 30 45 60

Prototype Magnetic RF Wire* Steering and Ablation

Test in Agar Lesion Phantom



Methodology: Magnetic directional enhancement of .014" / .018" RF guidewire

Clinical Advantages: Provides distal tip steerability and flexibility (for optimized magnetic tip deflection)- while providing ablative energy at tip



COLUMBIA UNIVERSITY

*Developed in collaboration with Baylis Medical

EUROPEAN TOTAL OCCLUSION SUMMIT

CARDIOVASCULAR
RESEARCH FOUNDATION



SUMMARY

KEY TO SUCCESS:

BALANCE RISK VS. CLINICAL NEED

- “Complete Revascularization vs. Surgical Alternative”
- “Silent Ischemia vs. Limiting Symptoms”

