

***Complex PCI:
IVUS-Guided PCI***

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Roles of IVUS during PCI

- 1. IVUS before PCI (automatic pullback)**
 - Device selection: direct stenting?**
 - Pretreatment with POBA or Rotablator?**
 - To decide stent size and length**
 - To predict probable complications**
- 2. IVUS during PCI: Repeat IVUS if necessary**
 - Marking technique**
- 3. IVUS after PCI (automatic pullback)**
 - Stent expansion (MLD, MSA)**
 - Incomplete stent apposition, Edge injury**
- 4. IVUS when complication occurred**
 - Acute occlusion**
 - Slow flow / no-reflow phenomenon**
 - Perforation**

Calcium...

Atherosclerosis in Angiographically “Normal” Coronary Artery Reference Segments: An Intravascular Ultrasound Study With Clinical Correlations

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Washington, D.C.

Table 6. Multivariate Predictors of Reference Segment Arc of Calcium

	Coefficient	R	ΔR	p Value
Patient age	0.9707	0.1884	0.1884	< 0.001
Serum creatinine	9.6046	0.2250	0.0366	< 0.005
Hematocrit	-1.7415	0.2452	0.0202	< 0.01

Calcified lesions

- **People can live longer.**
- **Patients with multiple co-morbidity (older age, diabetes, CRF on hemodialysis etc.) can live longer because of dramatic improvement of medical therapy.**
- **We have to struggle with this kind of patients with complex lesion subsets.**

Role of IVUS in calcified lesions

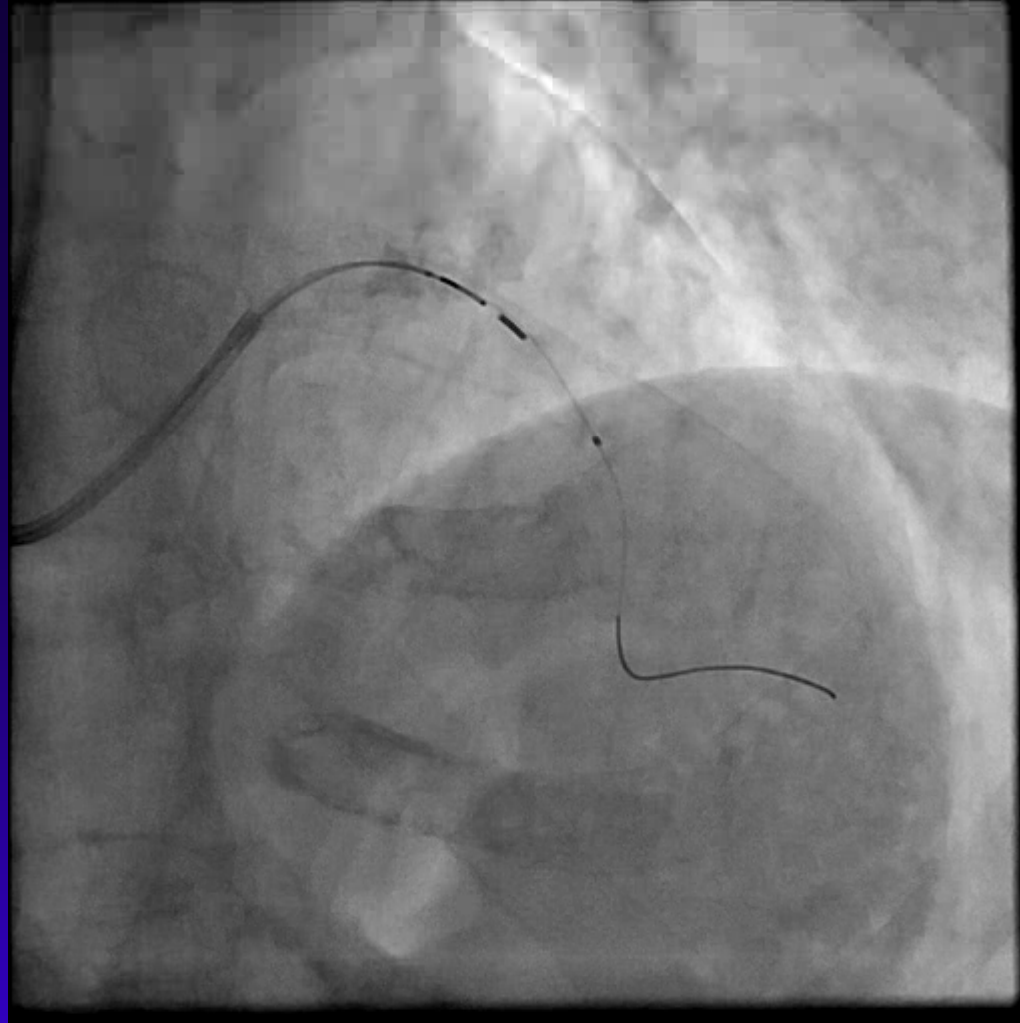
- **Unable to cross the lesion**
Rotablator, Scoring balloon or
conventional balloon with buddy wire

Calcified lesion



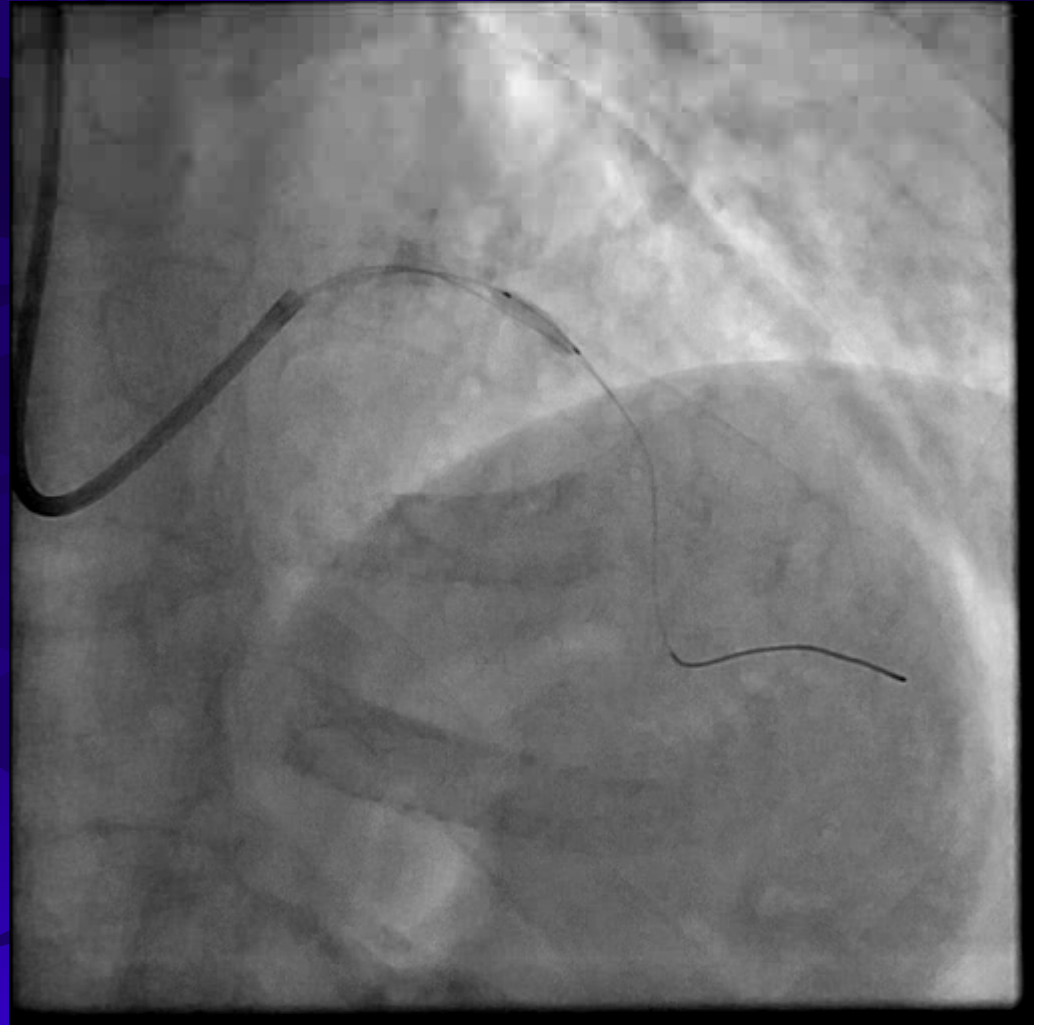
Diagonal branch

Calcified lesion



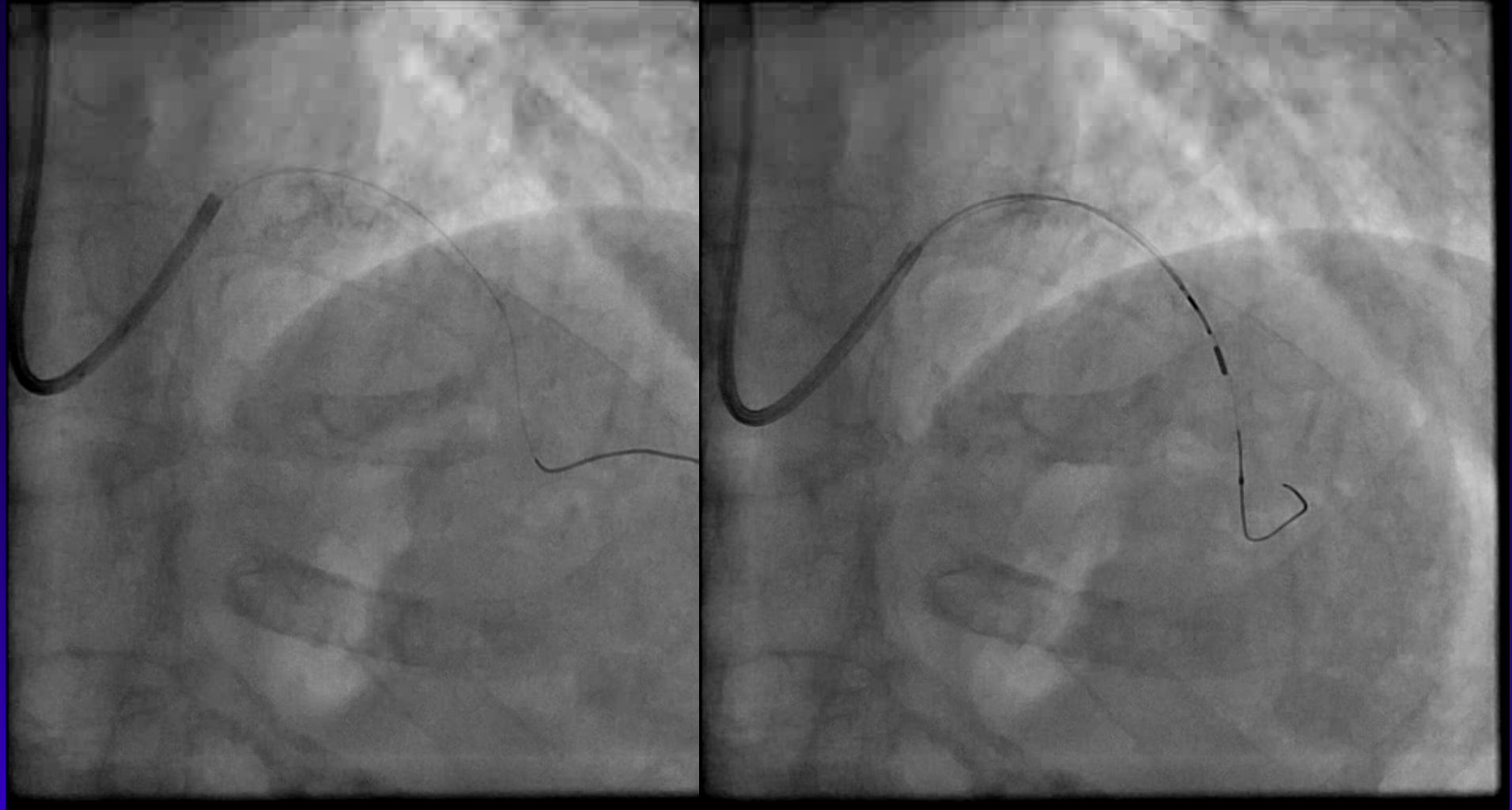
IVUS could not pass the lesion

Calcified lesion

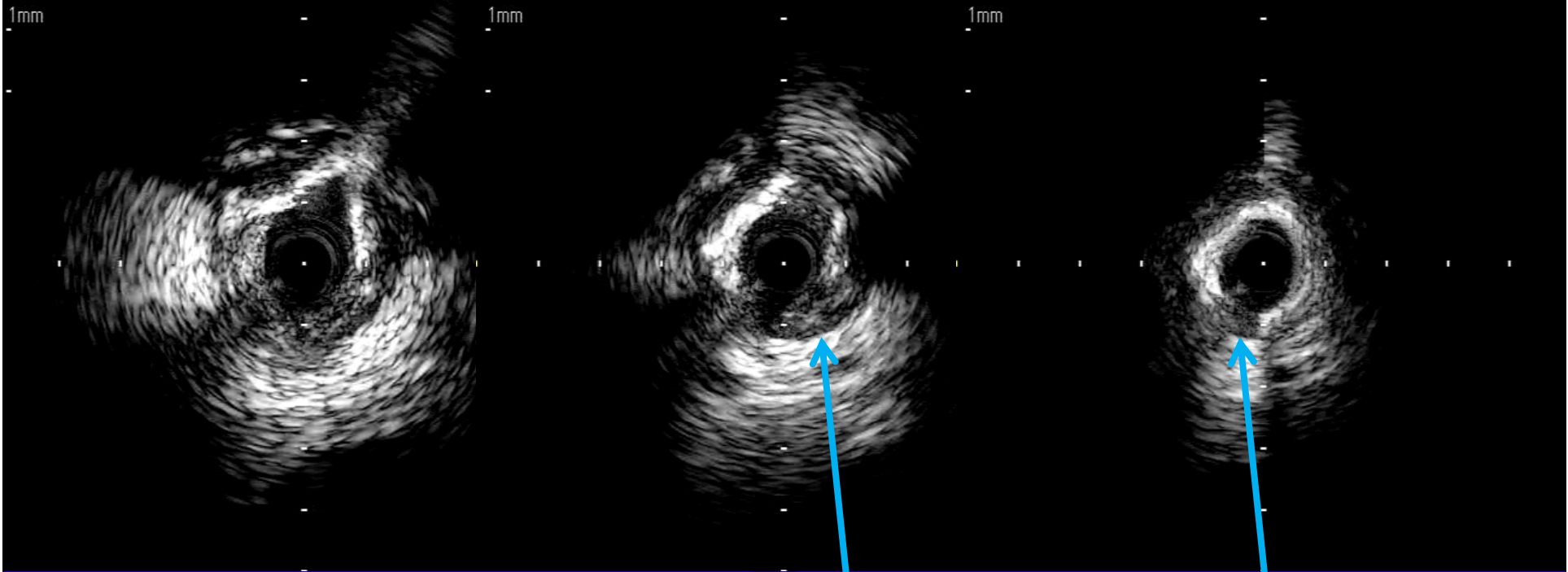


ScoreFlex 2.0x10mm

Calcified lesion



IVUS post ScoreFlex

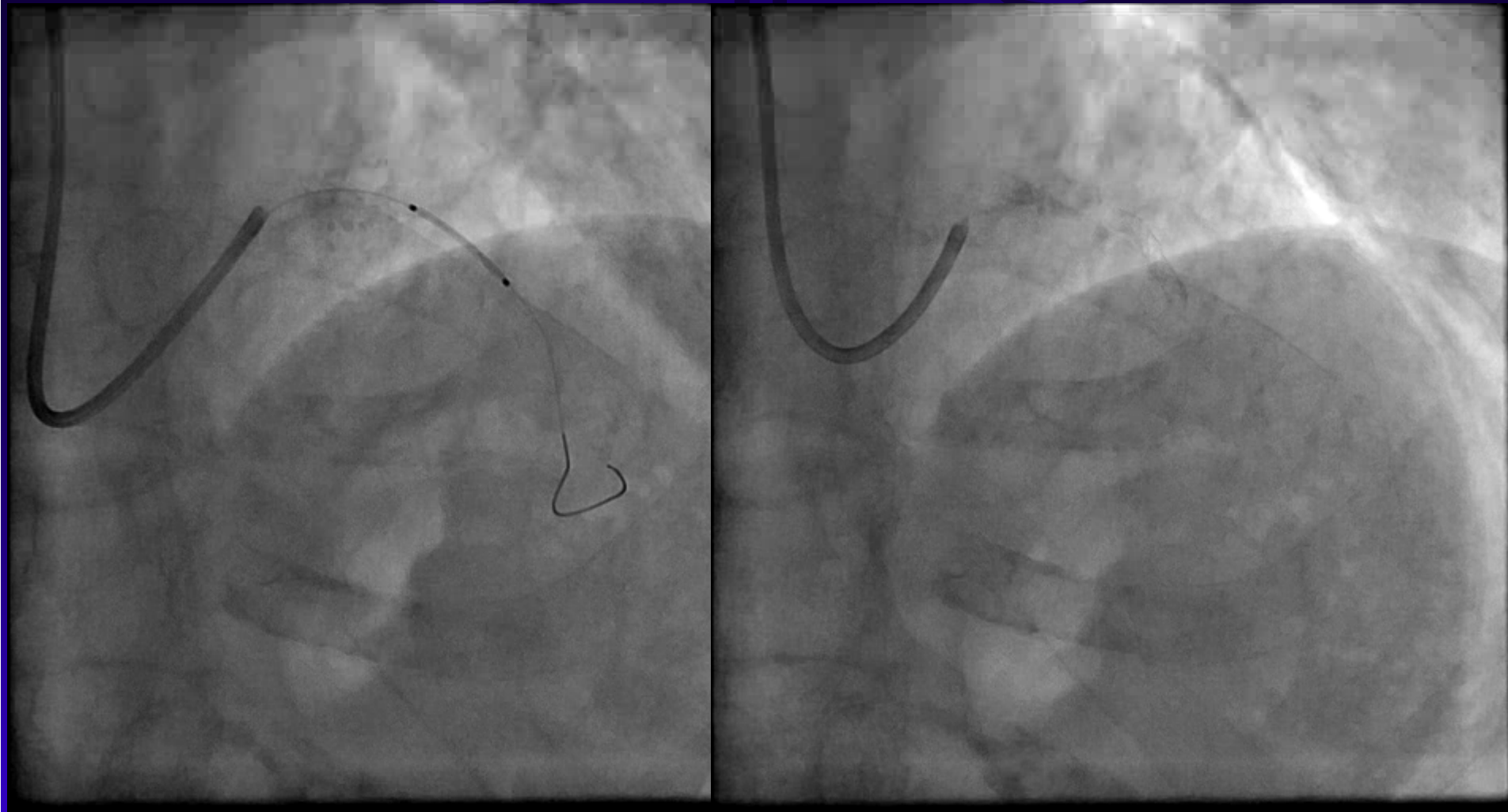


Dissection

Score

Once discontinuation of calcium has been achieved, adequate stent expansion can be obtained.

Calcified lesion



Driver Sprint 2.5x14mm

Role of IVUS in calcified lesions

- **Unable to cross the lesion**
Rotablator, Scoring balloon or conventional balloon with buddy wire
- **Check location and distribution of calcium**
Superficial → Rotablator
Deep → Pre-dilatation with balloon
- **Check position of the IVUS catheter within the lumen → to understand the guidewire bias for effective debulking with Rotablator**

Rotablator: Vessel modification

- **Thickness of calcium → thinner**
- **Circumferential calcium**
→ **localized or not circumferential**
- **Inhomogeneous morphology with rough surface**
→ **round shape**
- **POBA after Rotablator to create dissection**
→ **to achieve adequate expansion of the stent**

Dissection is necessary ...

- 1. To obtain enough stent expansion.**
- 2. Pre-dilatation is inevitable in lesions with superficial calcium or concentric plaque.**
- 3. If lesions are not fully dilated with pre-dilatation, appropriate stent expansion cannot be achieved with even higher pressure.**
- 4. Stent underexpansion because of heavy calcium is one of the worst case of scenario which is very difficult manage following initial PCI.**

Rotablator: Vessel modification

- **Thickness of calcium → thinner**
- **Circumferential calcium**
→ **localized or not circumferential**
- **Inhomogeneous morphology with rough surface**
→ **round shape**
- **POBA after Rotablator to create dissection**
→ **to achieve adequate expansion of the stent**
- **It may be able to minimize incomplete stent apposition**
- **To prevent severe complication including vessel perforation following vigorous dilatation**

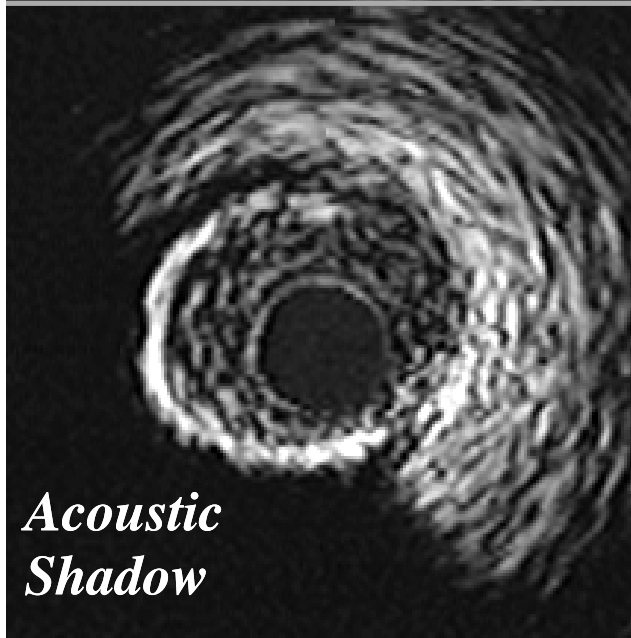
Effective ablation

- **To minimize calcium**
→ **begger size of the burr**
- **No complication**
vessel perforation, no-reflow phenomena
- **It is not necessary to use maximum size of the burr to the lesion, once calcium has been adequately ablated with only one burr.**
- **IVUS can help you to determine the optimal procedures during PCI.**

IVUS findings post Rotablator

- 1. Morphological changes of calcium**
- 2. If calcium was adequately ablated, IVUS demonstrates smooth surface and round-shape calcium with reverberation behind calcium.**
- 3. It is important to check the position of the IVUS catheter within the lumen and the location of calcium, that help you determine to use bigger size of a burr.**

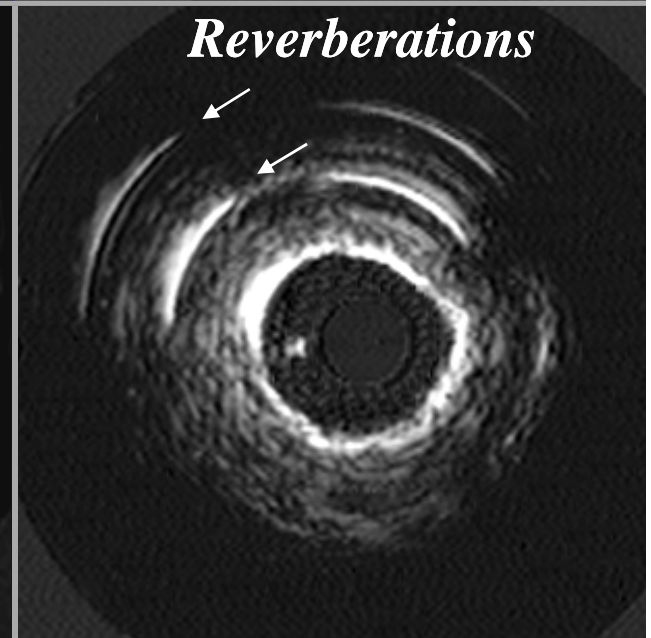
Different types of calcium



Deep Calcium

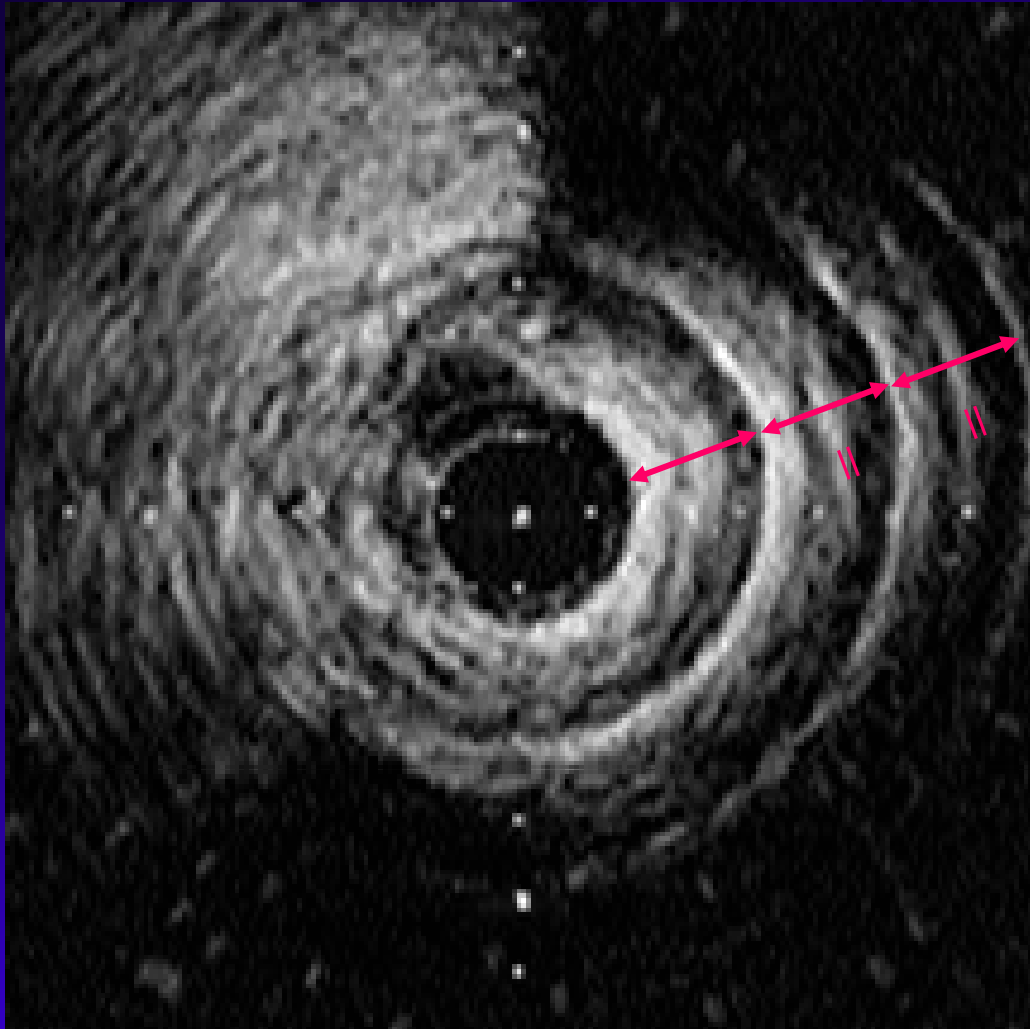


Superficial Calcium



Napkin-ring

Reverberation: artifact

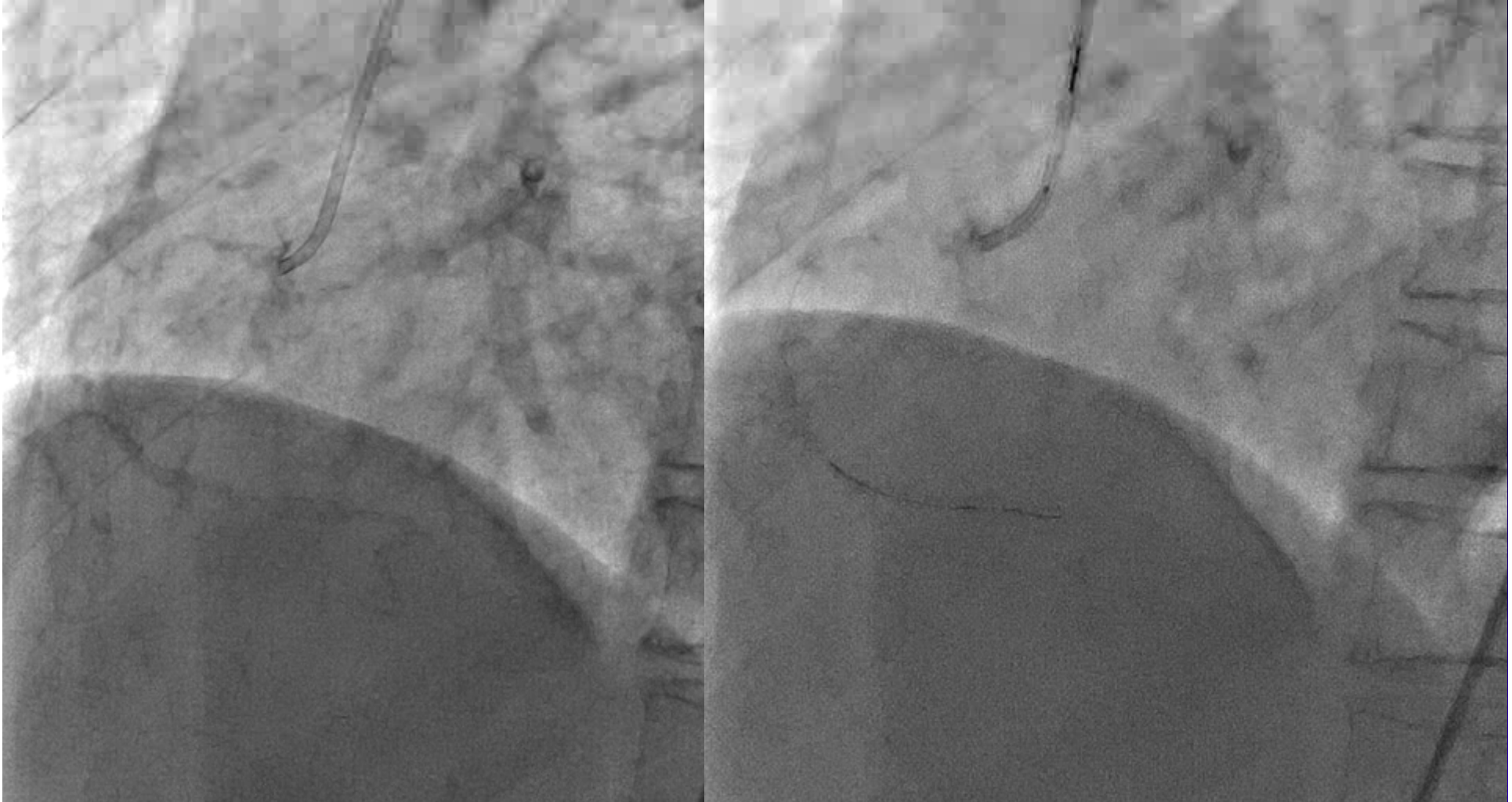


- **Multiple reflections behind calcium with equal intervals**
- **Typical findings of adequate ablation**

Role of IVUS in calcified lesions

- **Unable to cross the lesion**
Rotablator, Scoring balloon or conventional balloon with buddy wire
- **Check location and distribution of calcium**
Superficial → Rotablator
Deep → Pre-dilatation with balloon
- **Check position of the IVUS catheter within the lumen → to understand the guidewire bias for effective debulking with Rotablator**
- **Check if effective ablation has been achieved and residual calcium to decide using bigger size of the burr**

Case: 70's female, CRF on HD

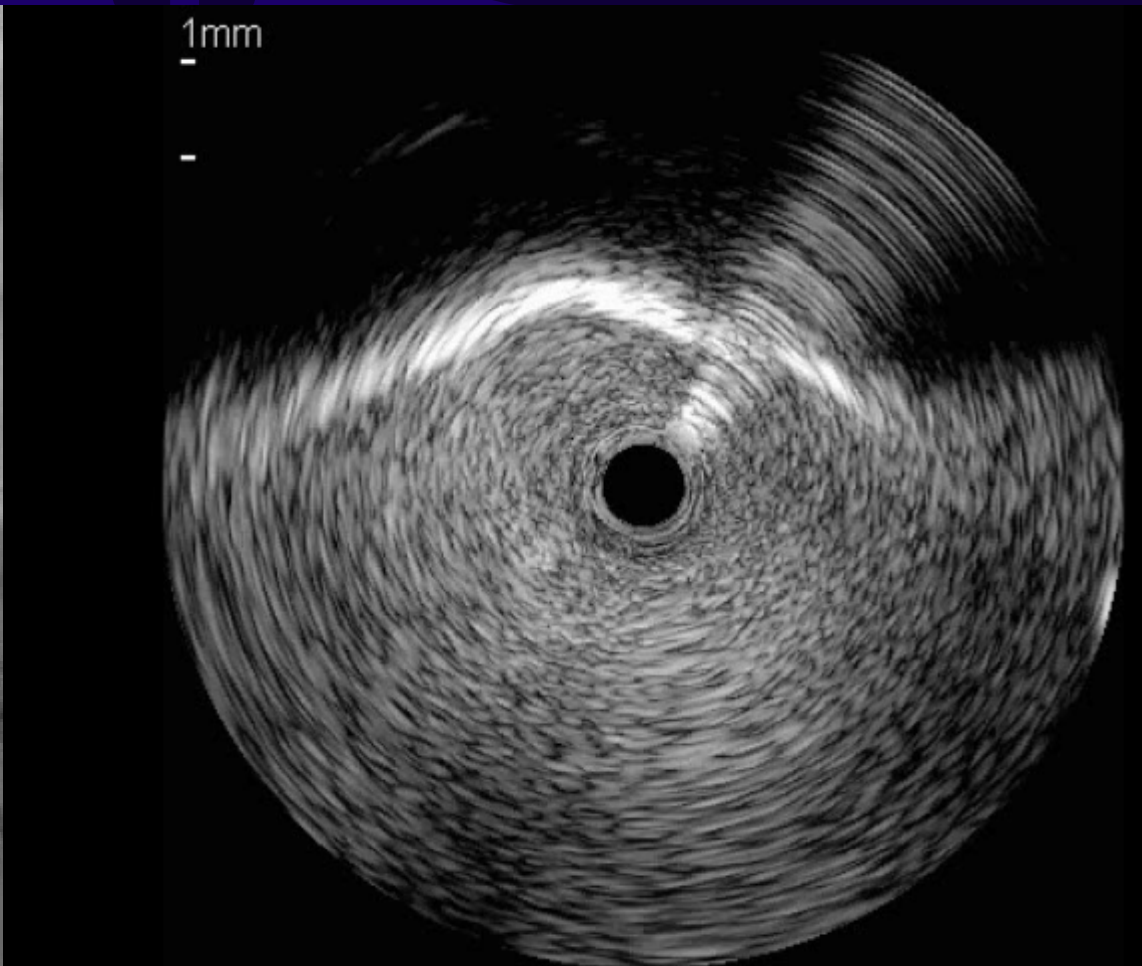


Terumo Intrafocus WR

Rotablator 1.25mm

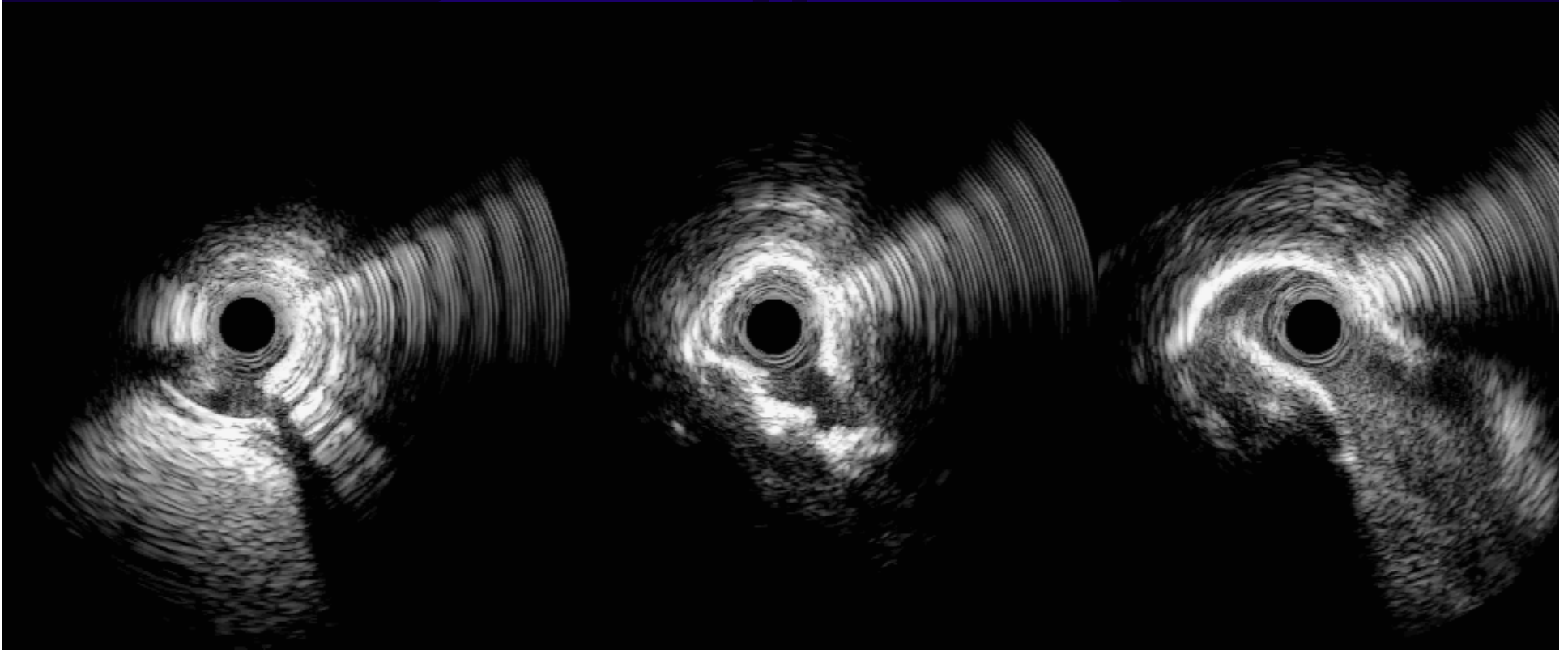


Post Rotablator 1.25mm



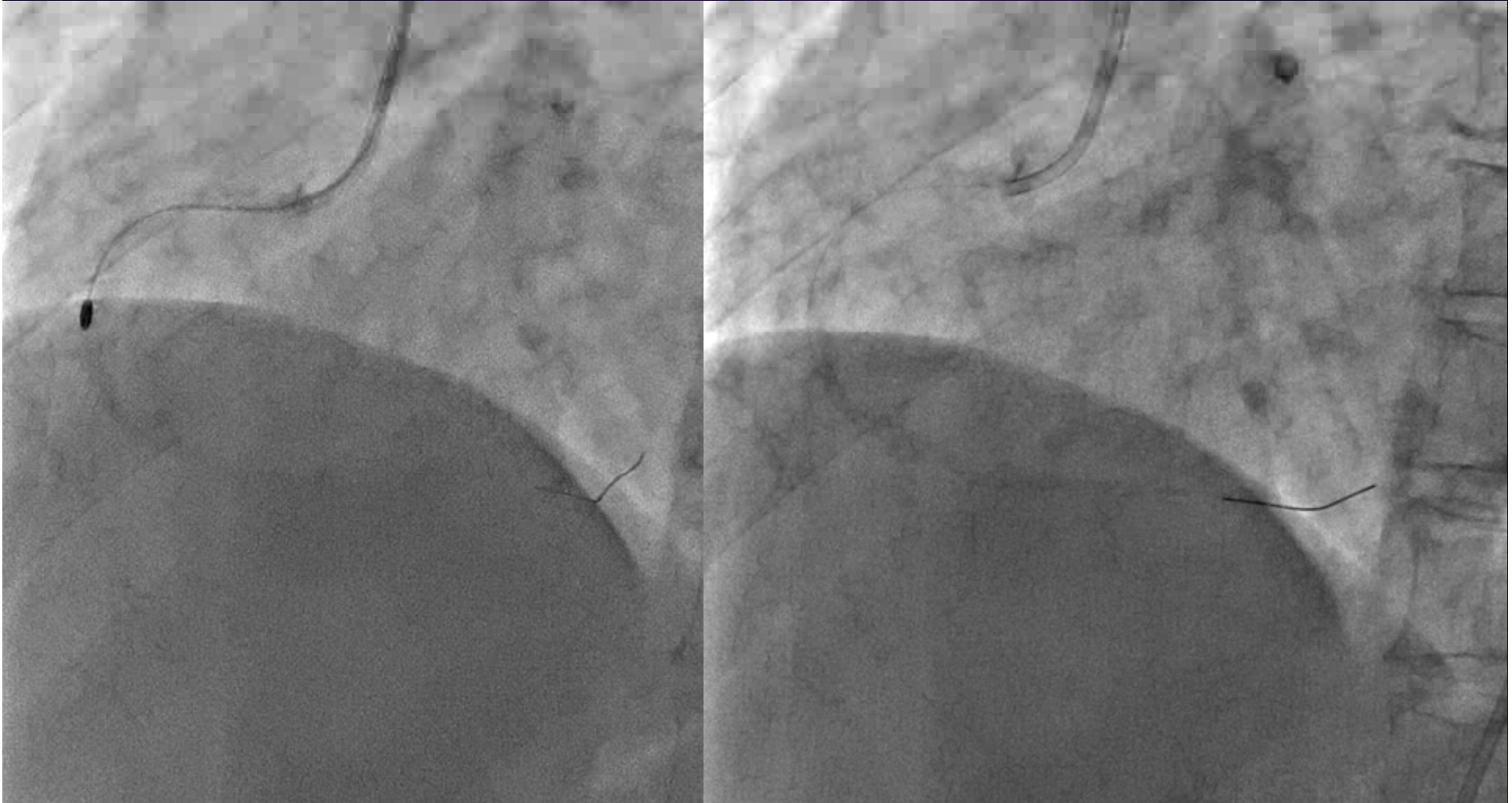
Terumo Intrafocus WR
Manual pullback

IVUS post Rotablator 1.25mm



Check position of IVUS catheter, which is very close to ablated but residual heavy calcium

Rotablator 1.75mm



Rotablator 1.75mm

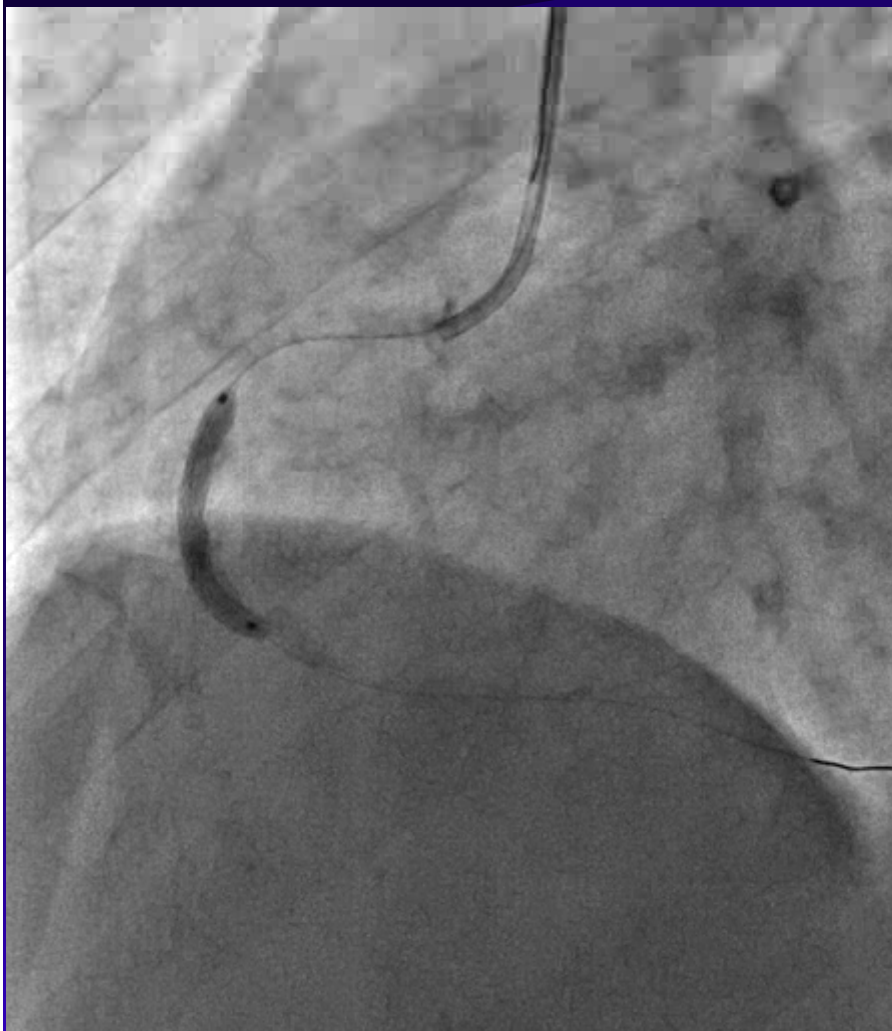


Terumo Intrafocus WR
Manual pullback

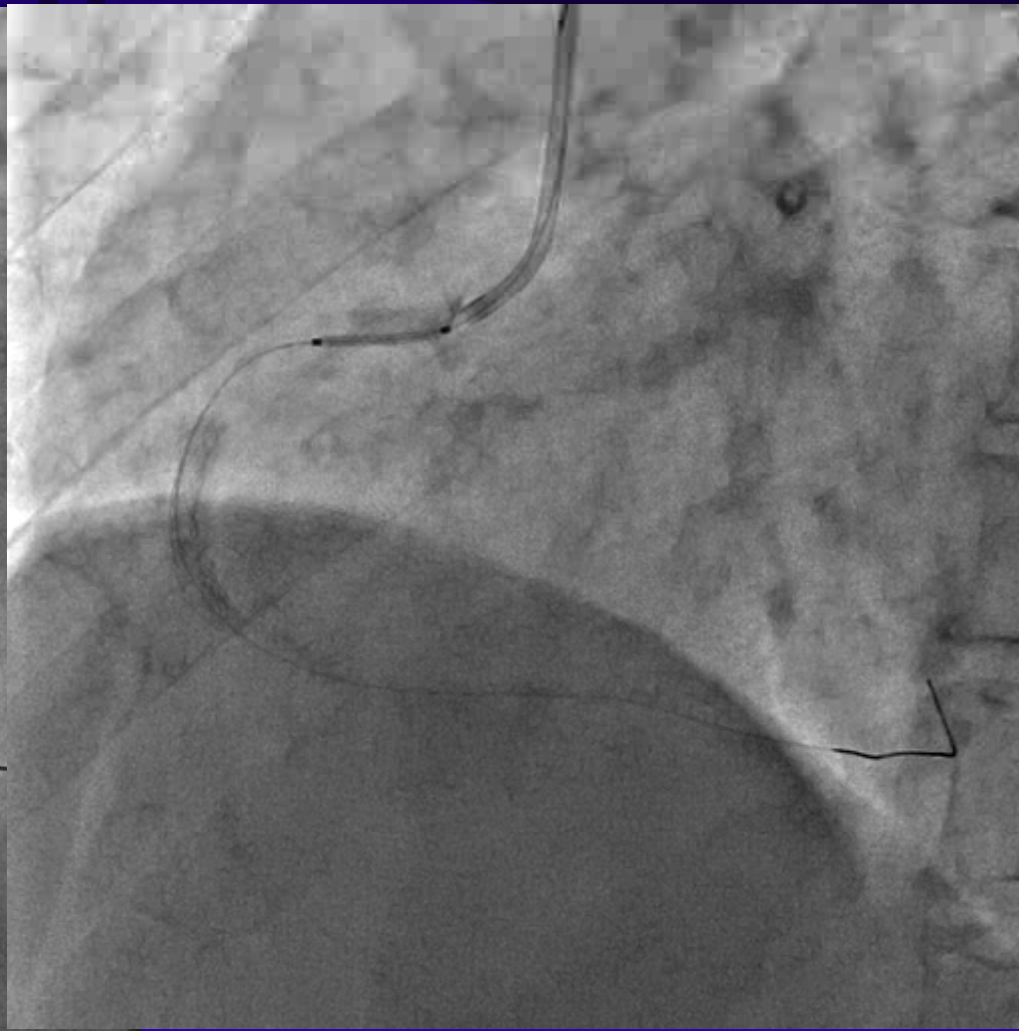
ScoreFlex 3.0mm post Rotablator



Stent implantation

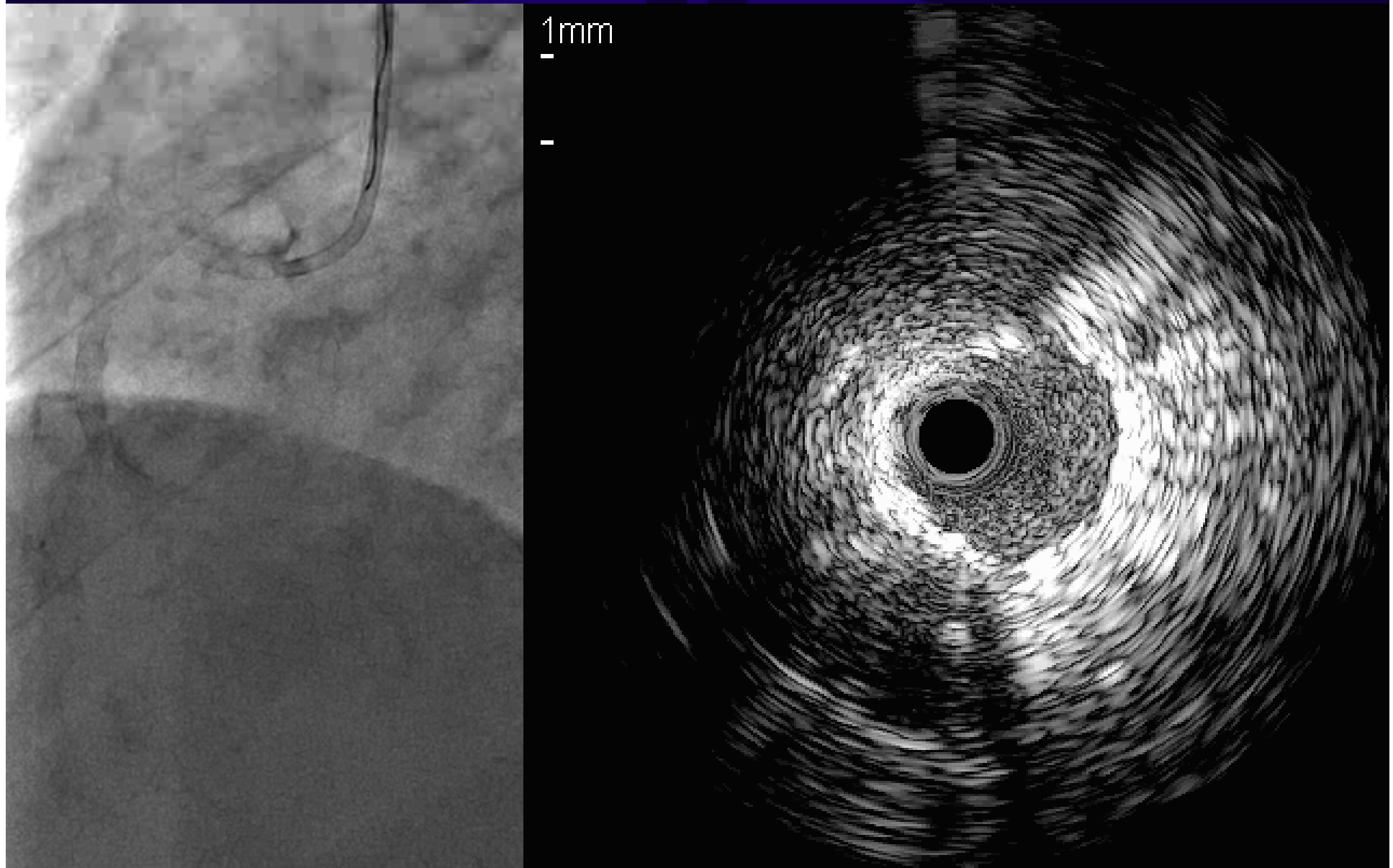


Endeavor 3.0x24mm

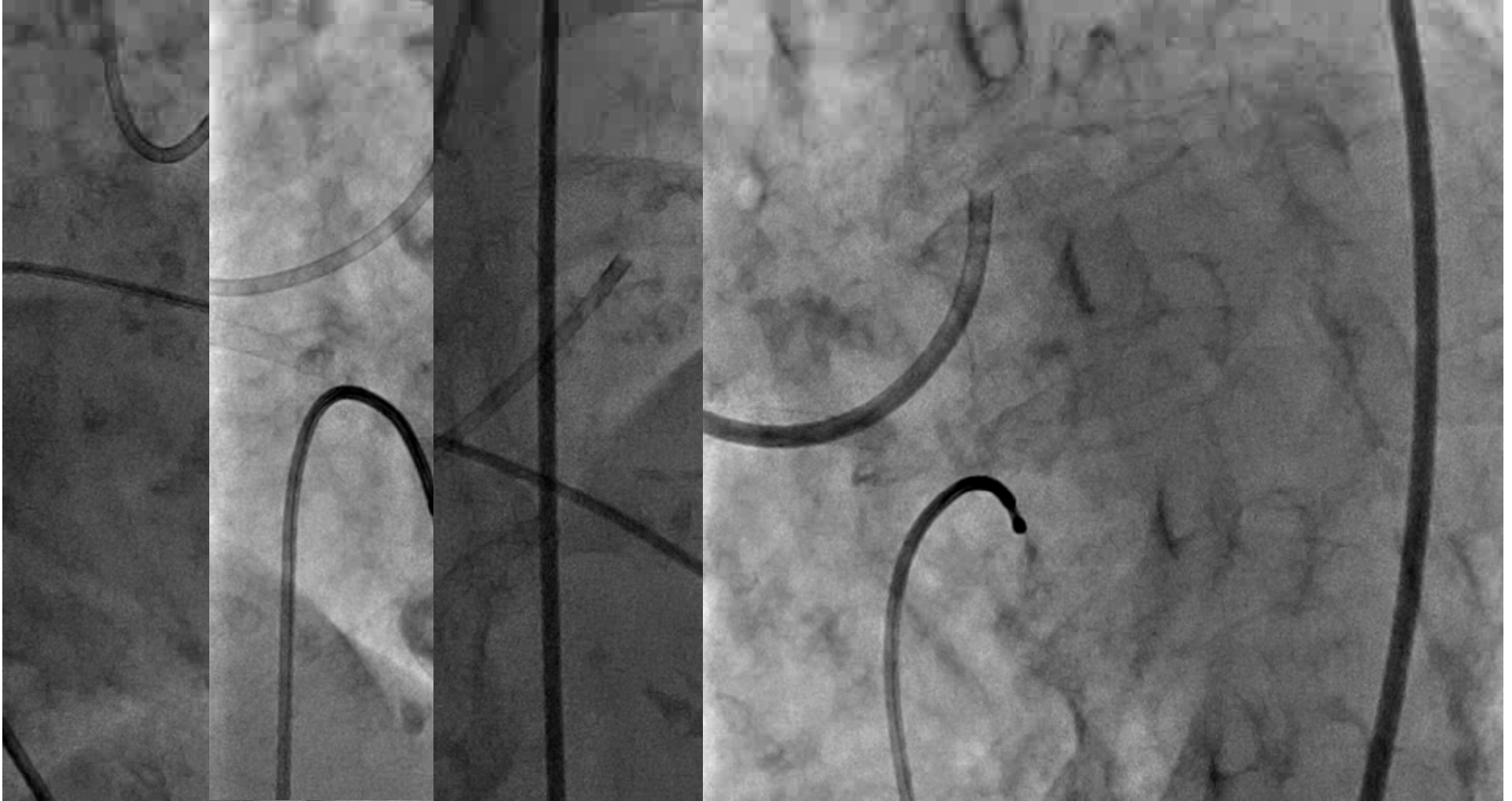


Endeavor 3.0x12mm

Final CAG and IVUS



Case: Angina, 80's female

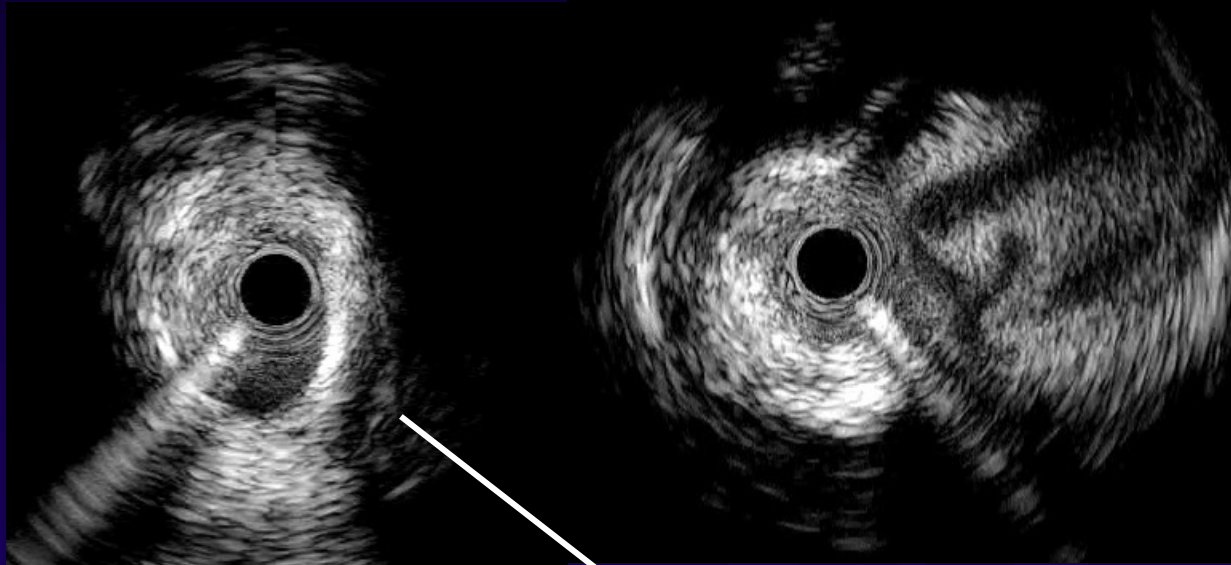


Heavily calcified bifurcation

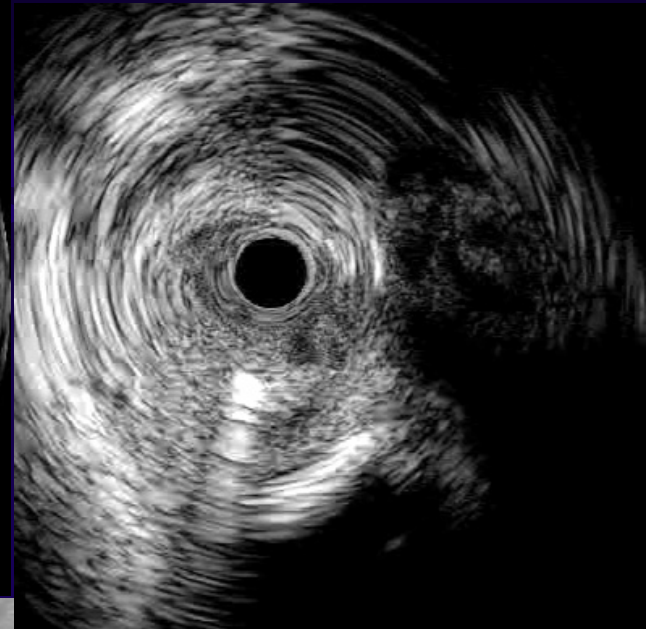


**Rotablator?
LMT to LAD or
LMT to LCX or
Both?**

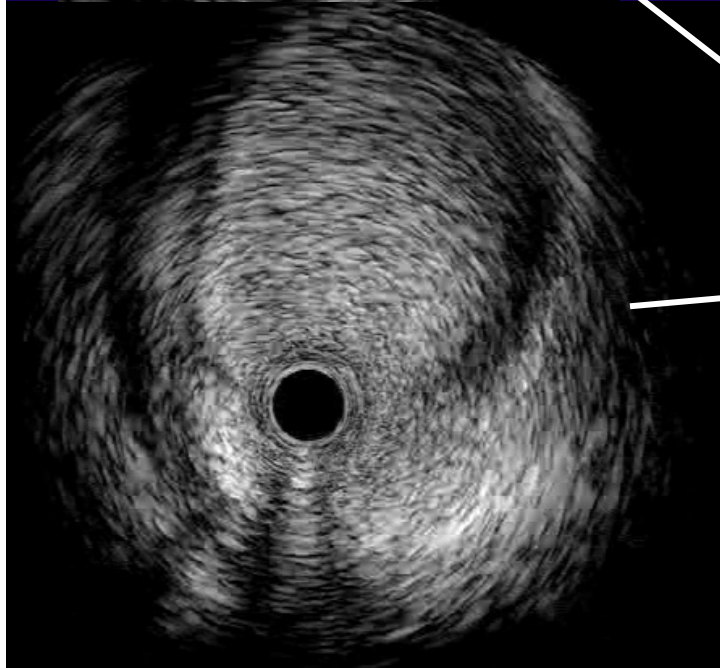
Bifurcation



Ostial LAD



Ostial LCX



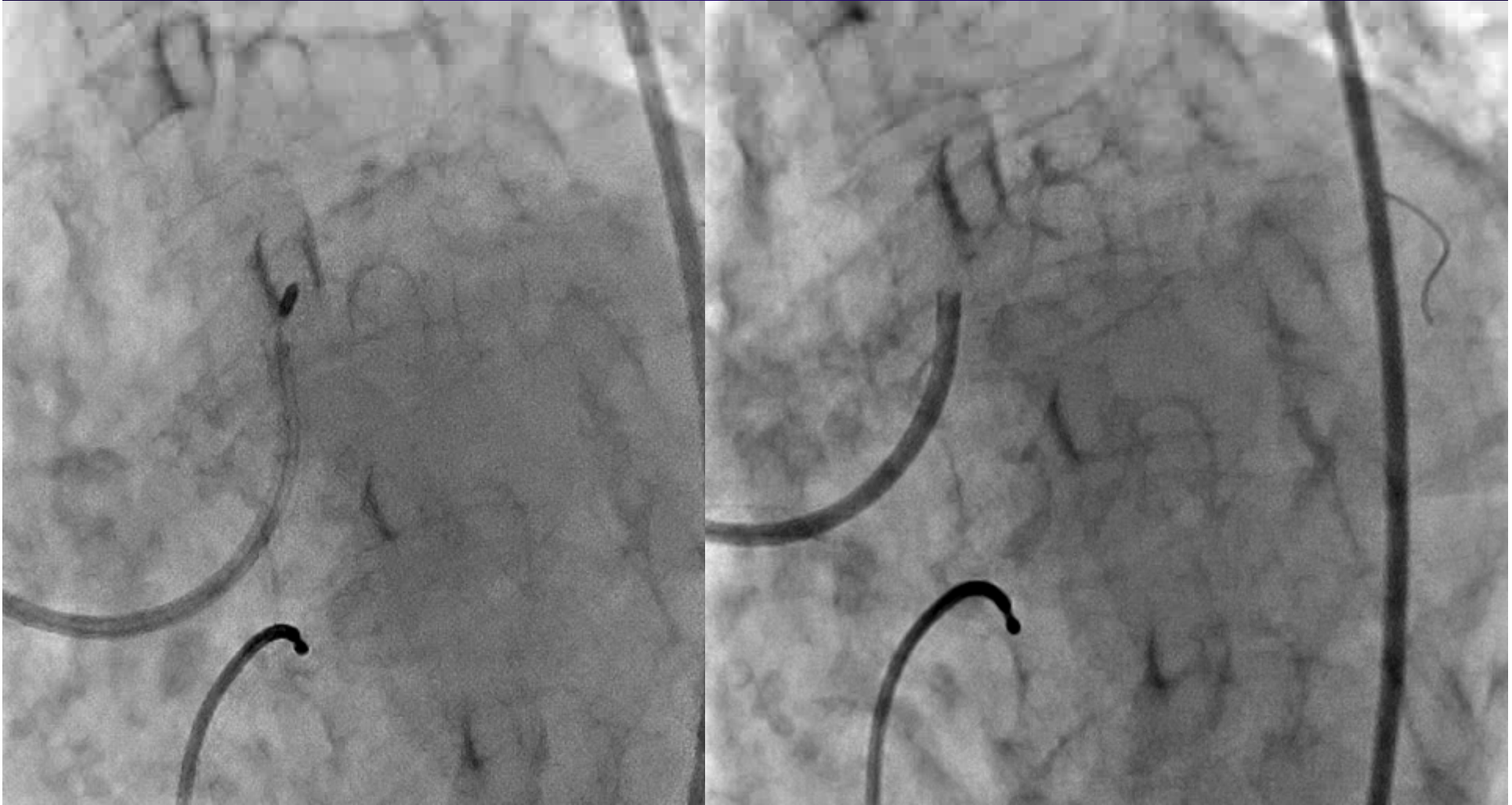
Heavily calcified bifurcation



**Rotablator?
LMT to LAD or
LMT to LCX or
Both?**

We decided to ablate from LMT to ostial LCX to obtain more effective debulking of calcium.

Rotablator to LCX



1.75mm burr

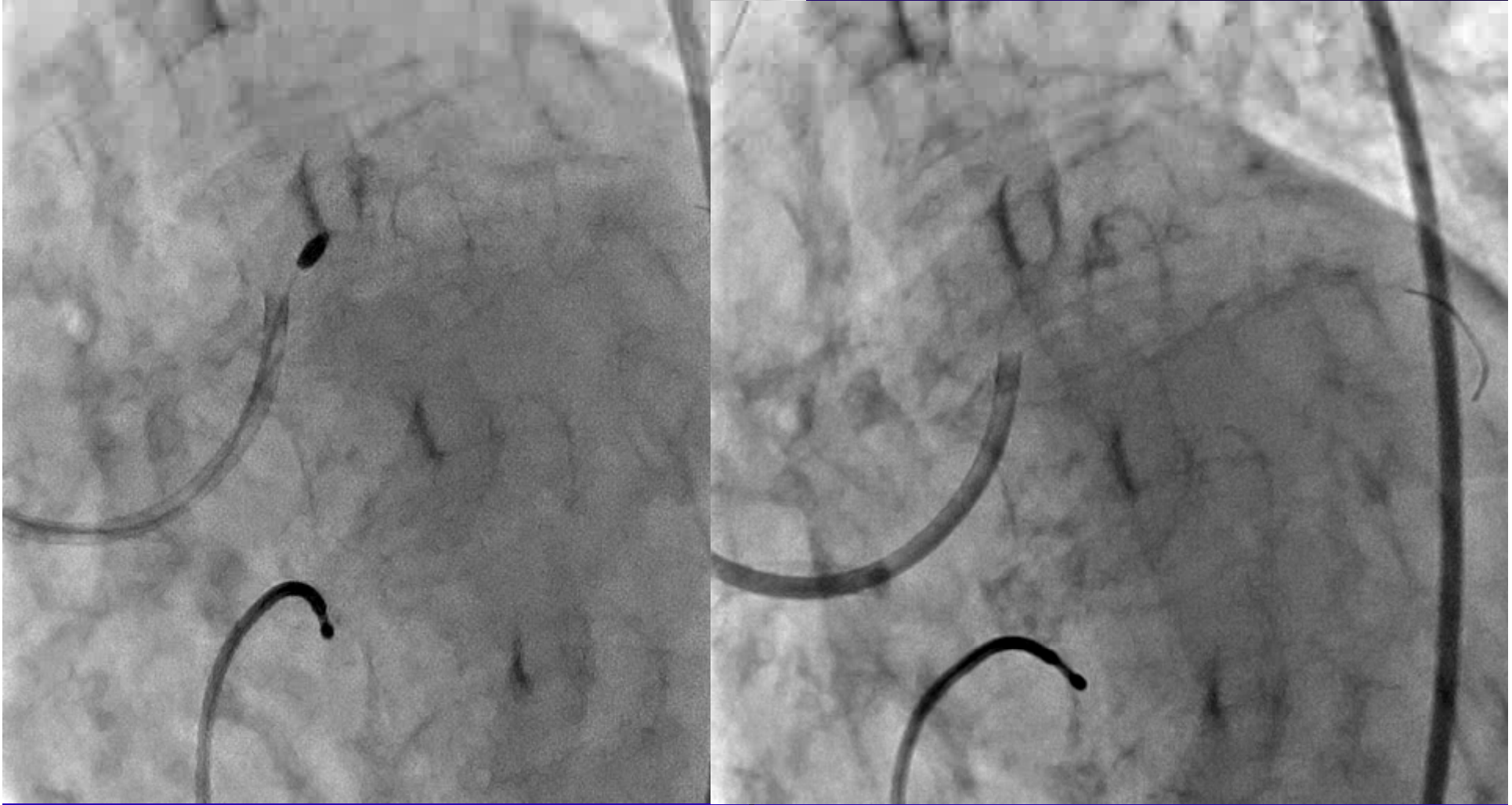
Rotablator to LCX



Post 1.75mm burr



Rotablator to LCX



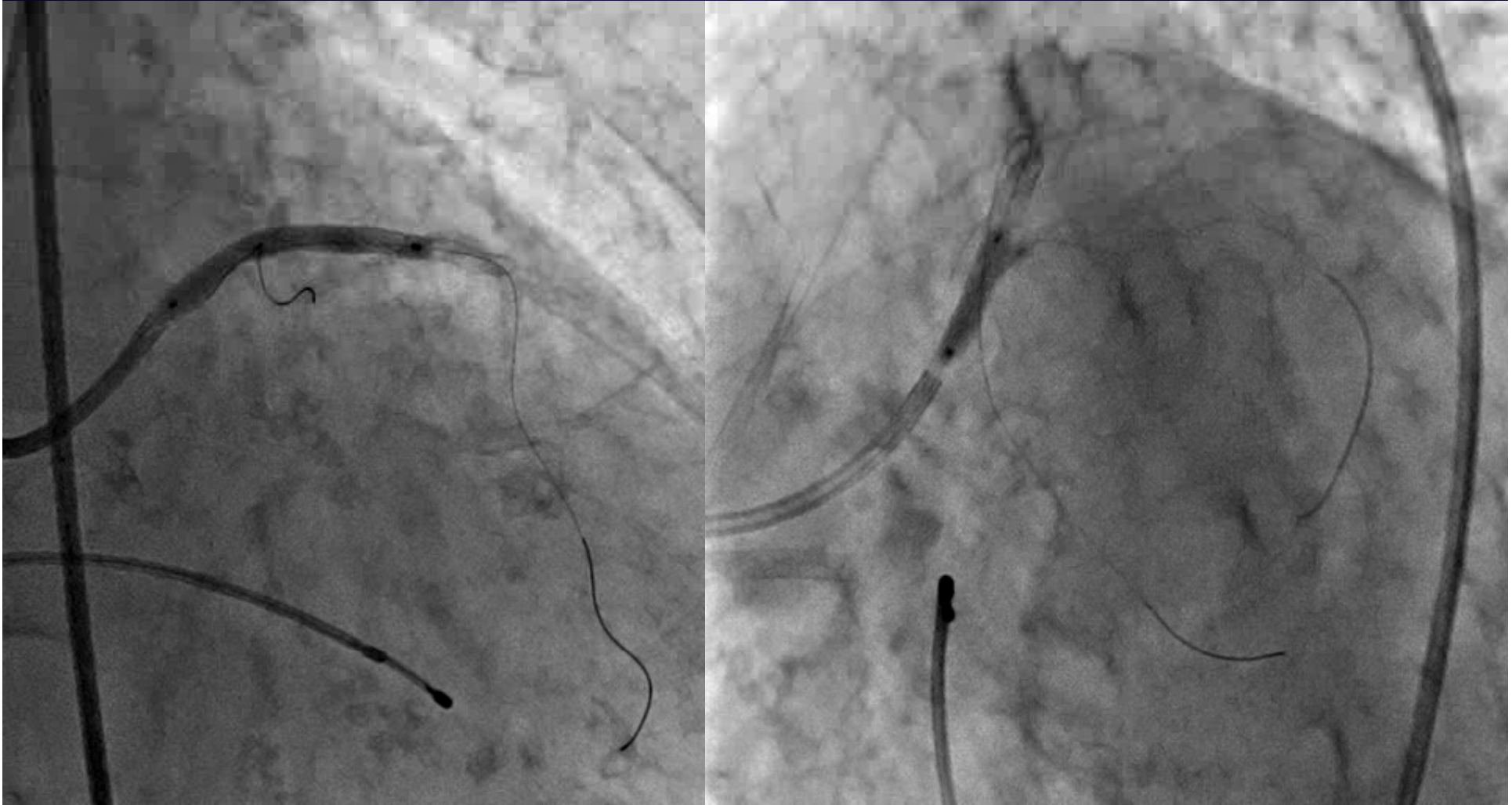
2.25mm burr

Stent implantation



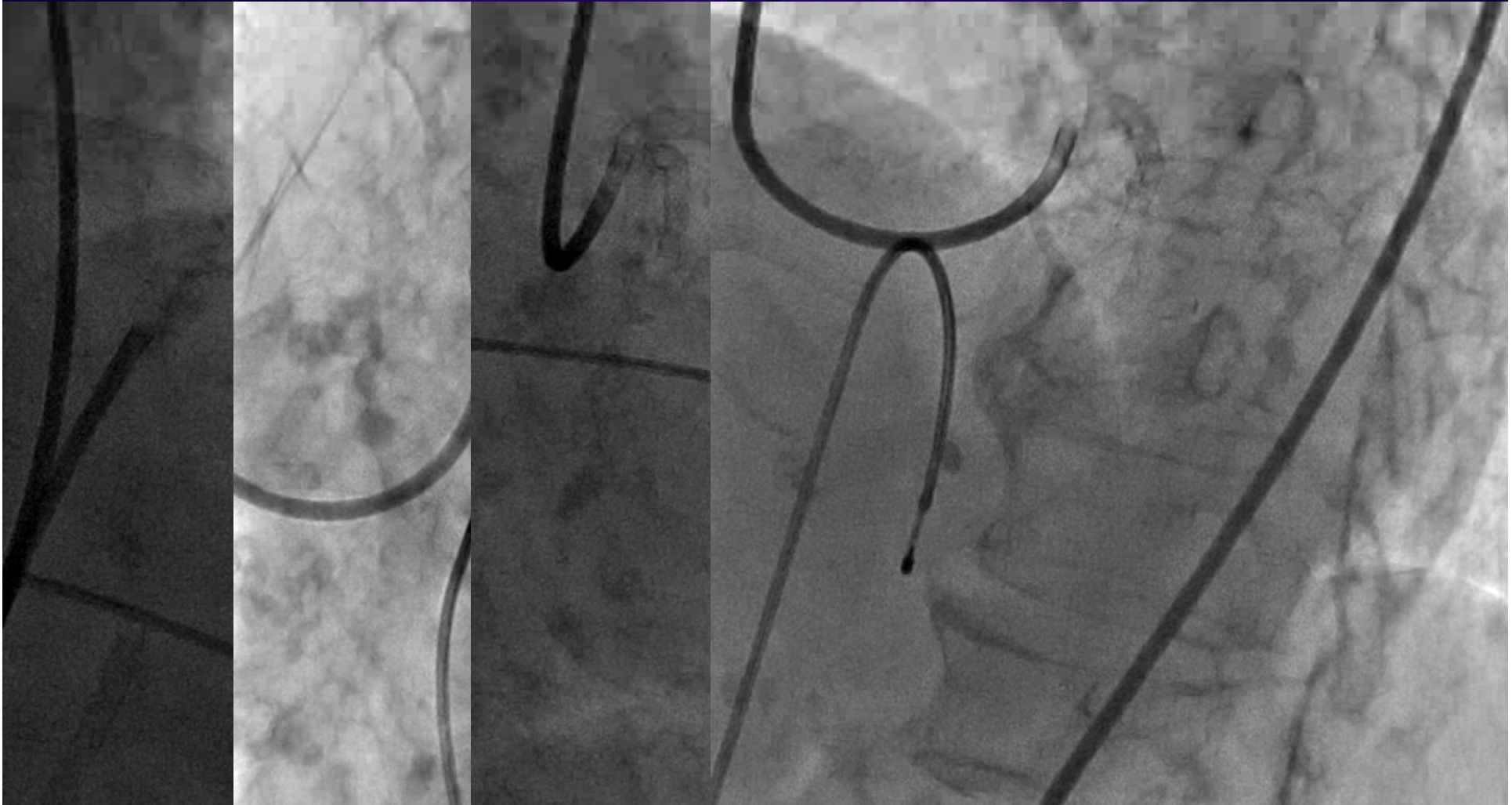
Marking technique

Stent implantation



Kissing balloon

Final CAG



Recommended procedure

- 1. IVUS catheter cannot cross the lesion, start Rotablator with 1.25 or 1.5mm burr depending on the vessel size and lesion length.**
- 2. Image with IVUS following passage of Rotablator to identify degree of ablation, distribution, continuity and amount of residual calcium compared to the vessel size, and to decide to use larger size of the burr.**
- 3. Dilate with adequate size of the balloon including scoring features, then perform stent implantation.**

Summary

- 1. IVUS passage is another useful information to decide optimal strategy in heavily calcified lesions.**
- 2. Guidewire bias of Rotablator can be predicted based on a position of the IVUS catheter within the lumen.**
- 3. IVUS can demonstrate round shape calcium with reverberation which effectively ablated.**
- 4. Based on these findings, heavily calcified lesions should be treated adequately at the time of a first PCI.**