

# Practical Interpretation of Intracoronary Imaging for PCI

## *The Basics*

**Ziad A Ali MD DPhil**

St Francis Hospital & Heart Center  
Cardiovascular Research Foundation, New York, USA

**[zali@crf.org](mailto:zali@crf.org)**

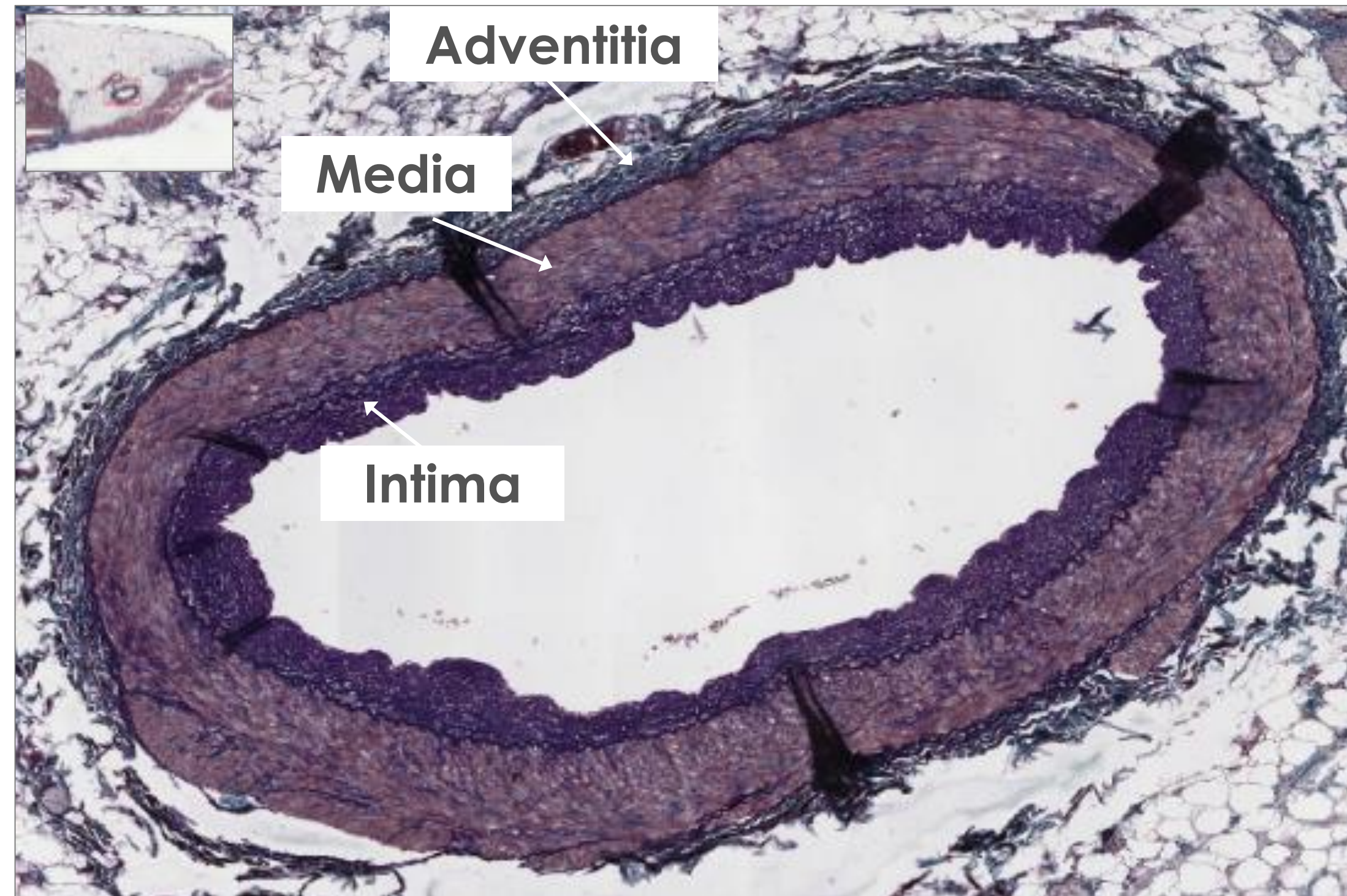
 **Follow me @ziadalinc**

# Disclosure Statement of Financial Interest

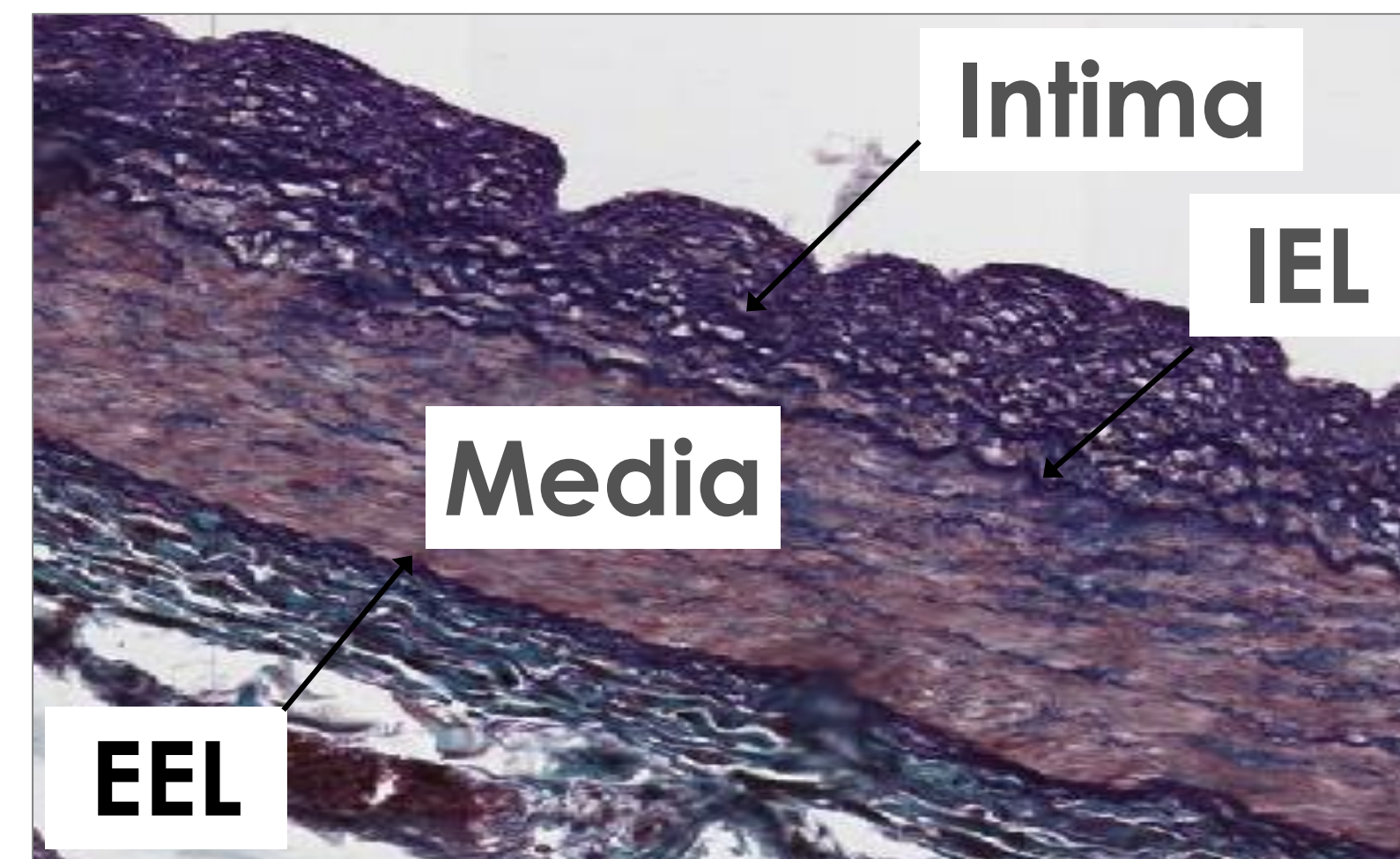
Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

Affiliation/Financial Relationship	Company
Grant/Research Support ( <i>Institutional</i> )	NIH/NHLBI, Abbott, Philips, Boston Scientific, Abiomed, Opsens, Acist Medical, Medtronic Cardiovascular Systems Inc
Consulting Fees/Honoraria	Amgen, Astra Zeneca, Boston Scientific
Equity	Shockwave Medical

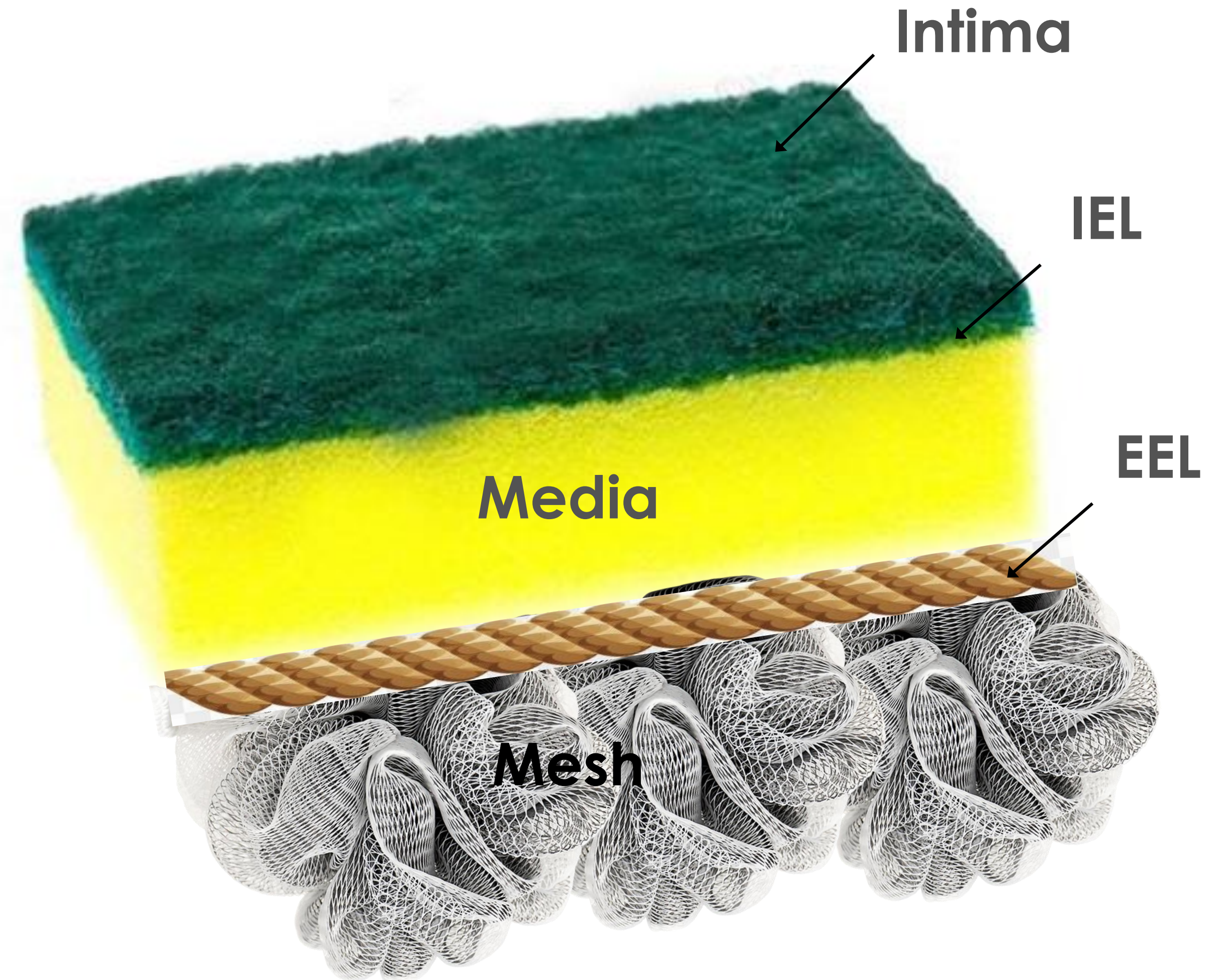
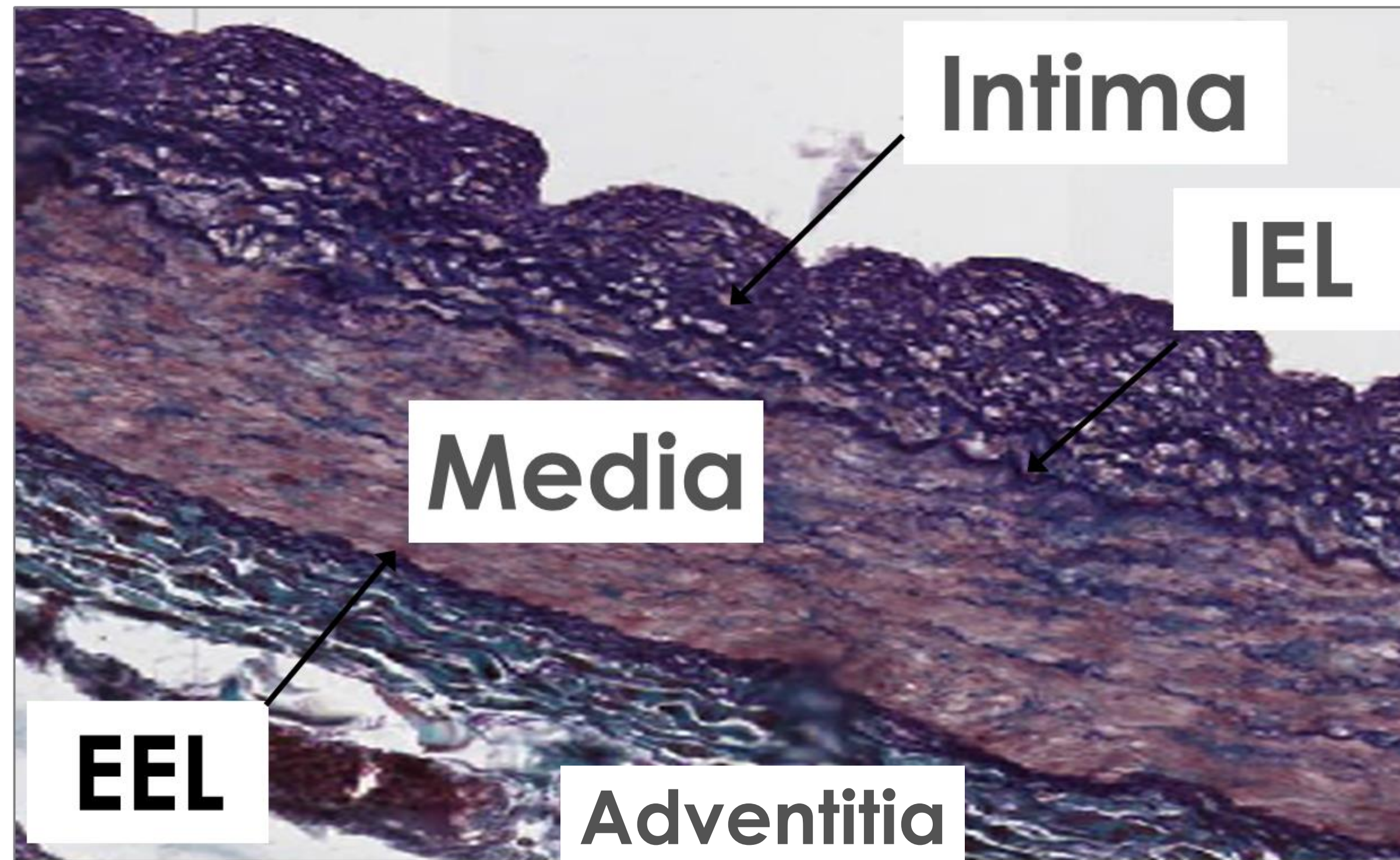
# Normal Artery Morphology



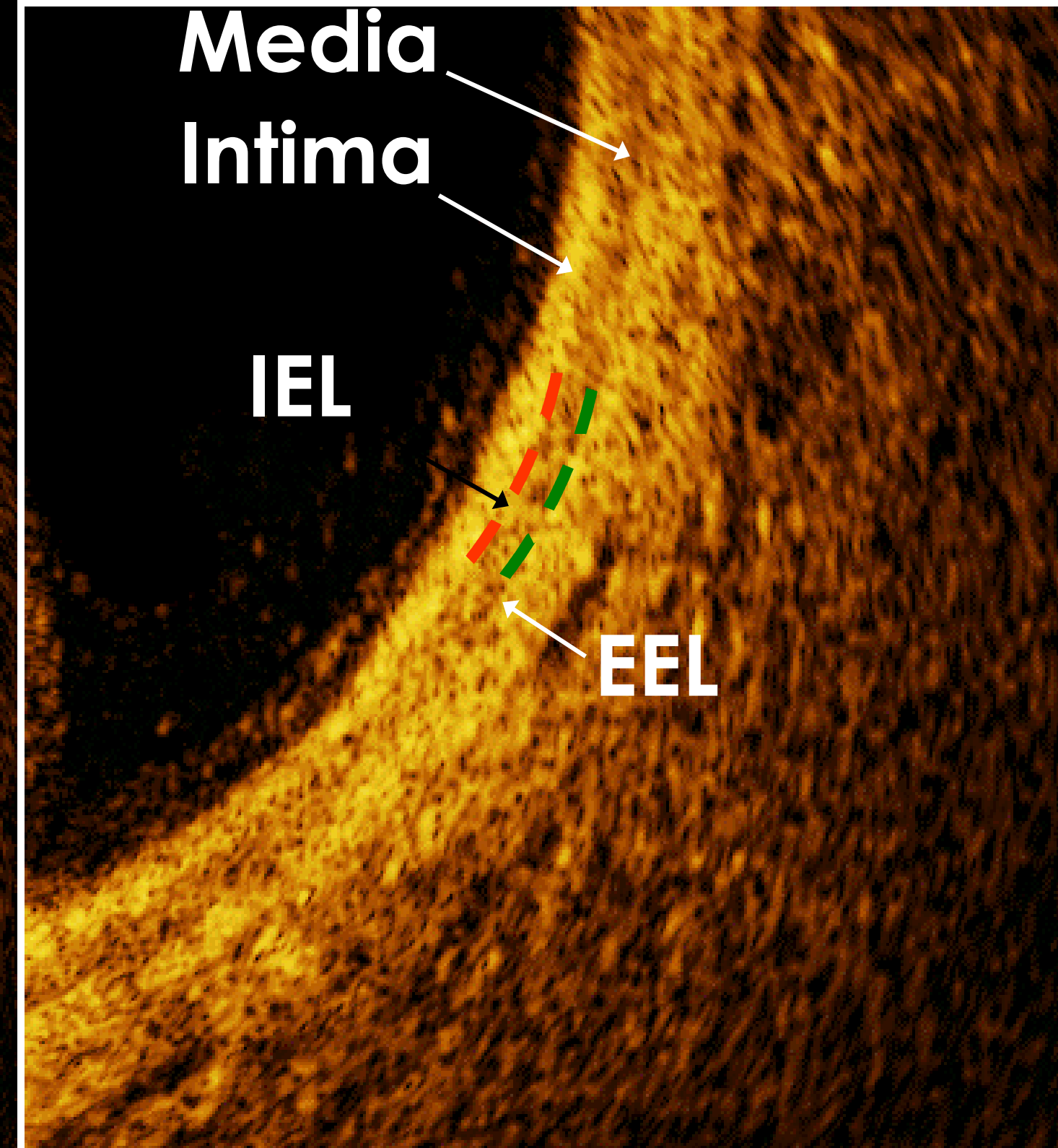
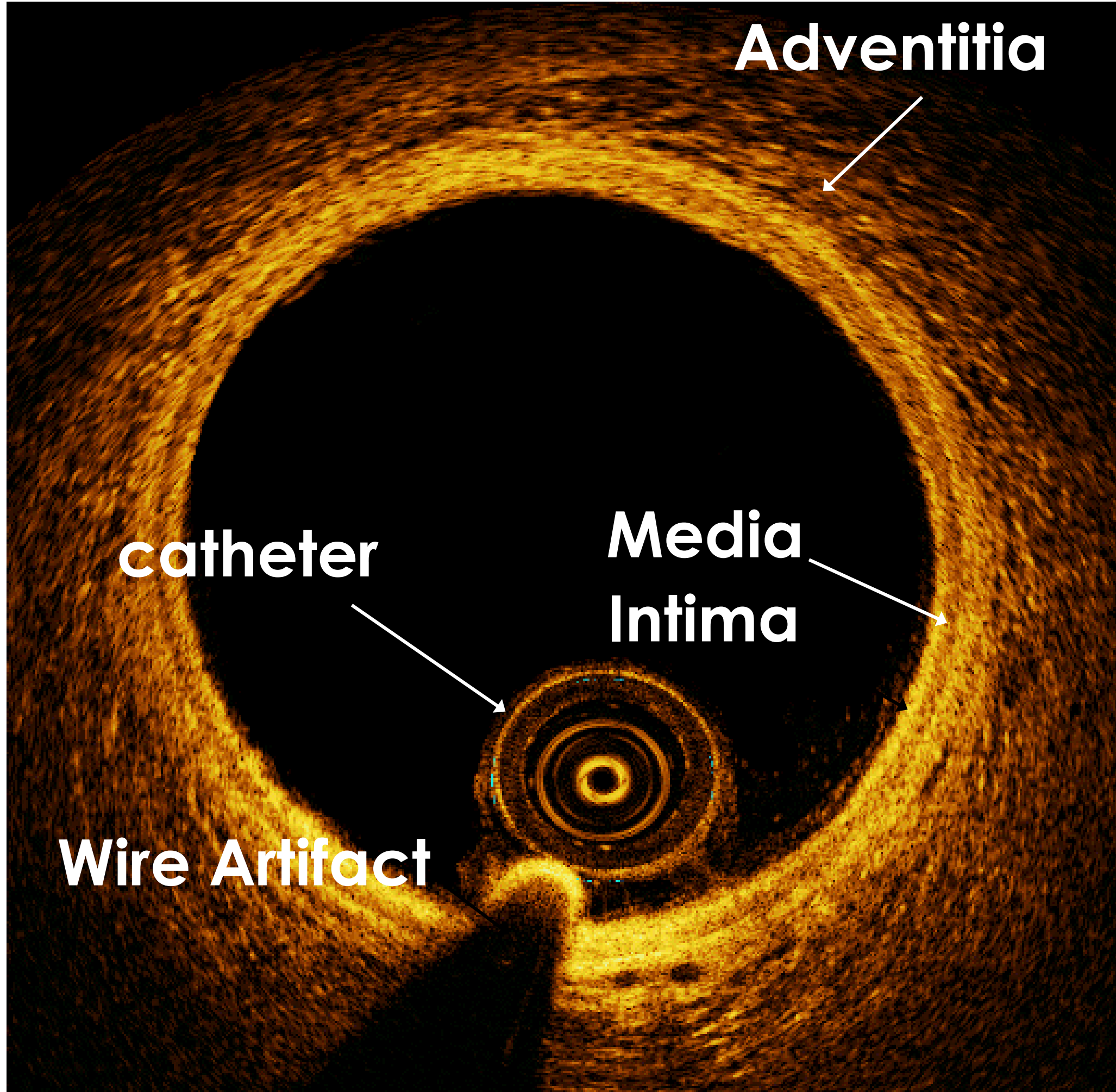
- 1) Intima = scouring pad
- 2) IEL = rubber band
- 3) Media = dense sponge
- 4) EEL = rubber band
- 5) Adventitia = mesh



# Normal Artery Morphology

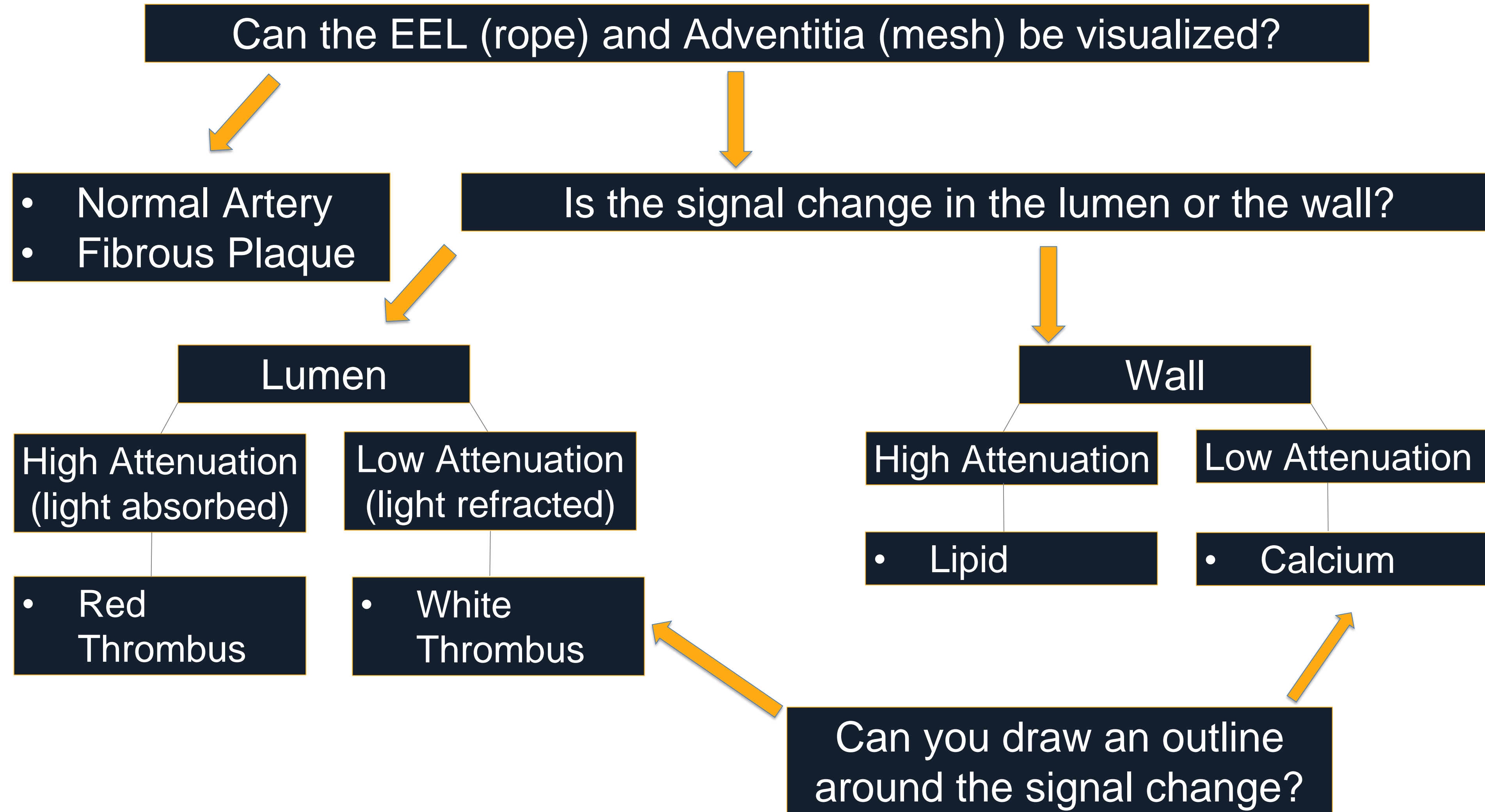


# Normal Artery Morphology on OCT



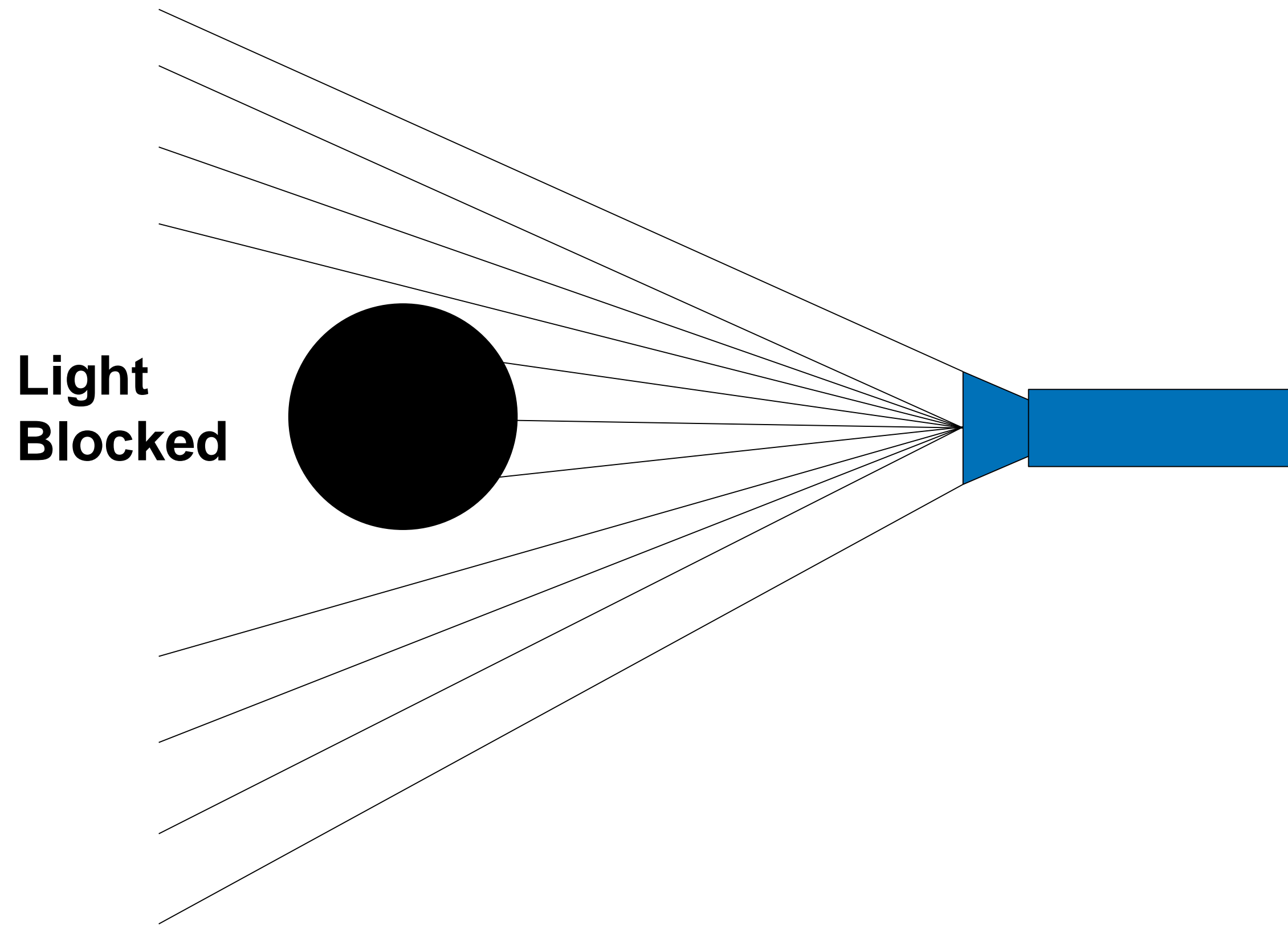
- 1) Intima = scouring pad
- 2) IEL = rubber band
- 3) Media = dense sponge
- 4) EEL = rubber band
- 5) Adventitia = mesh

# OCT Image Interpretation

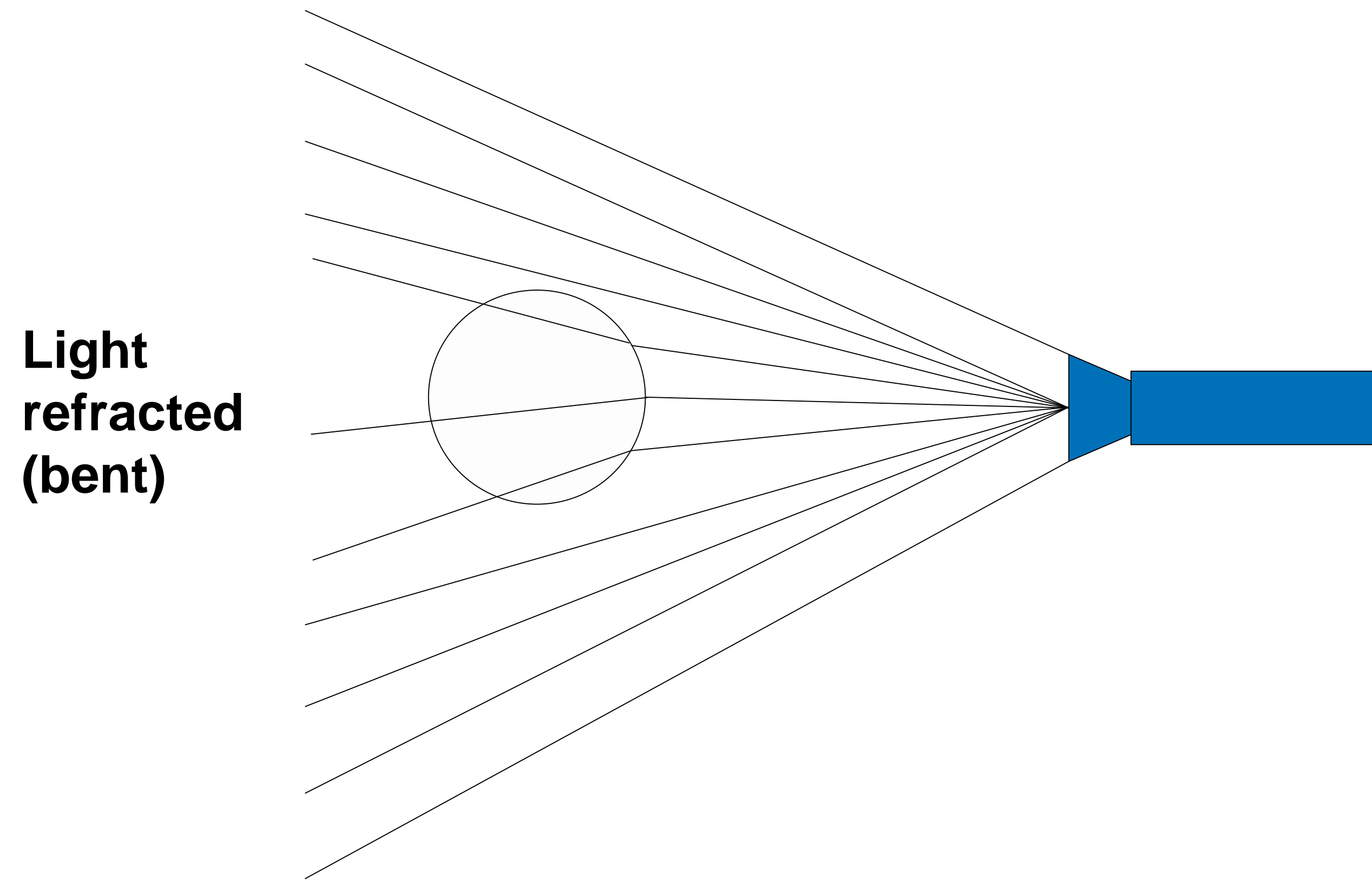


# OCT Signal Attenuation

## High Attenuation



## Low Attenuation

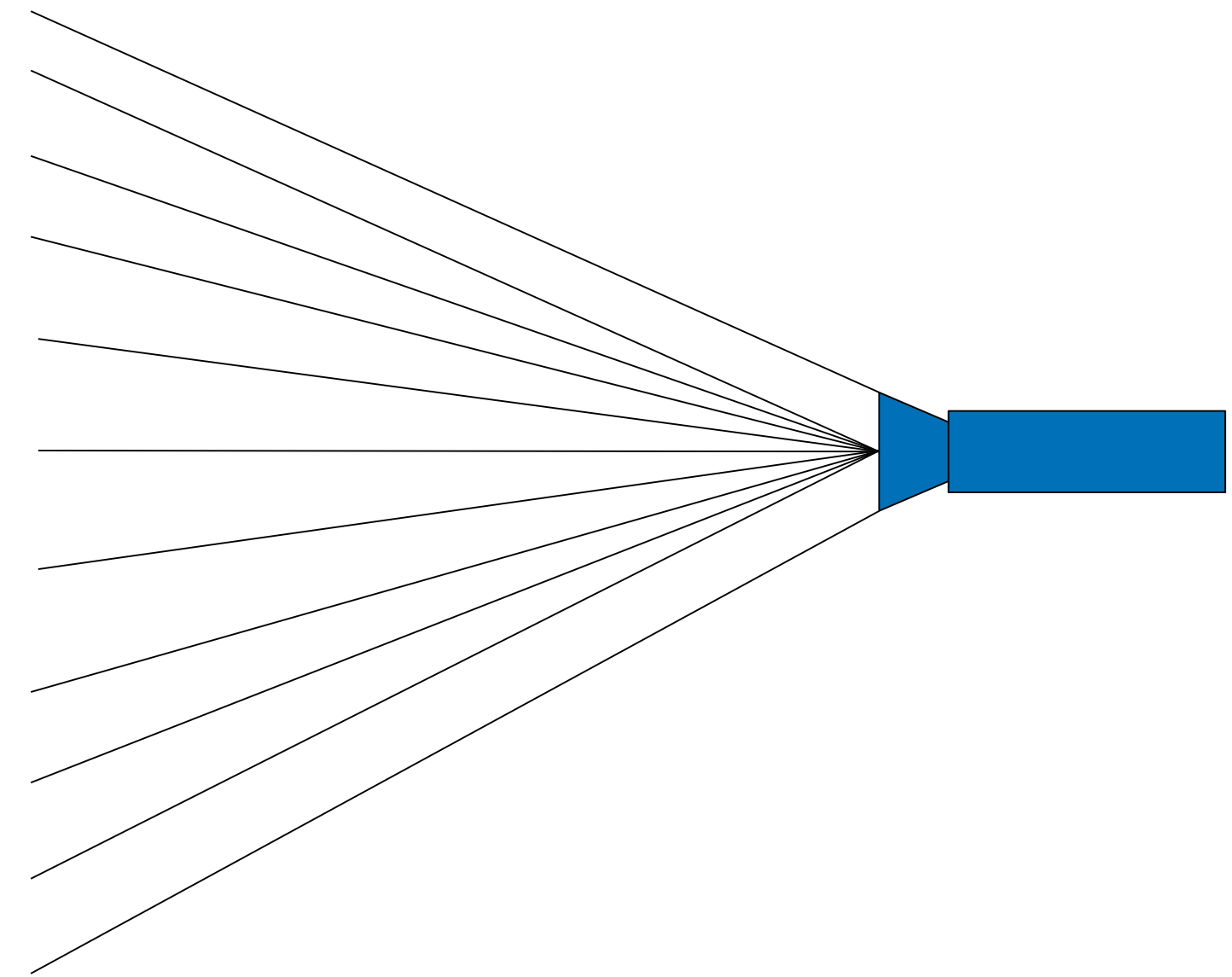
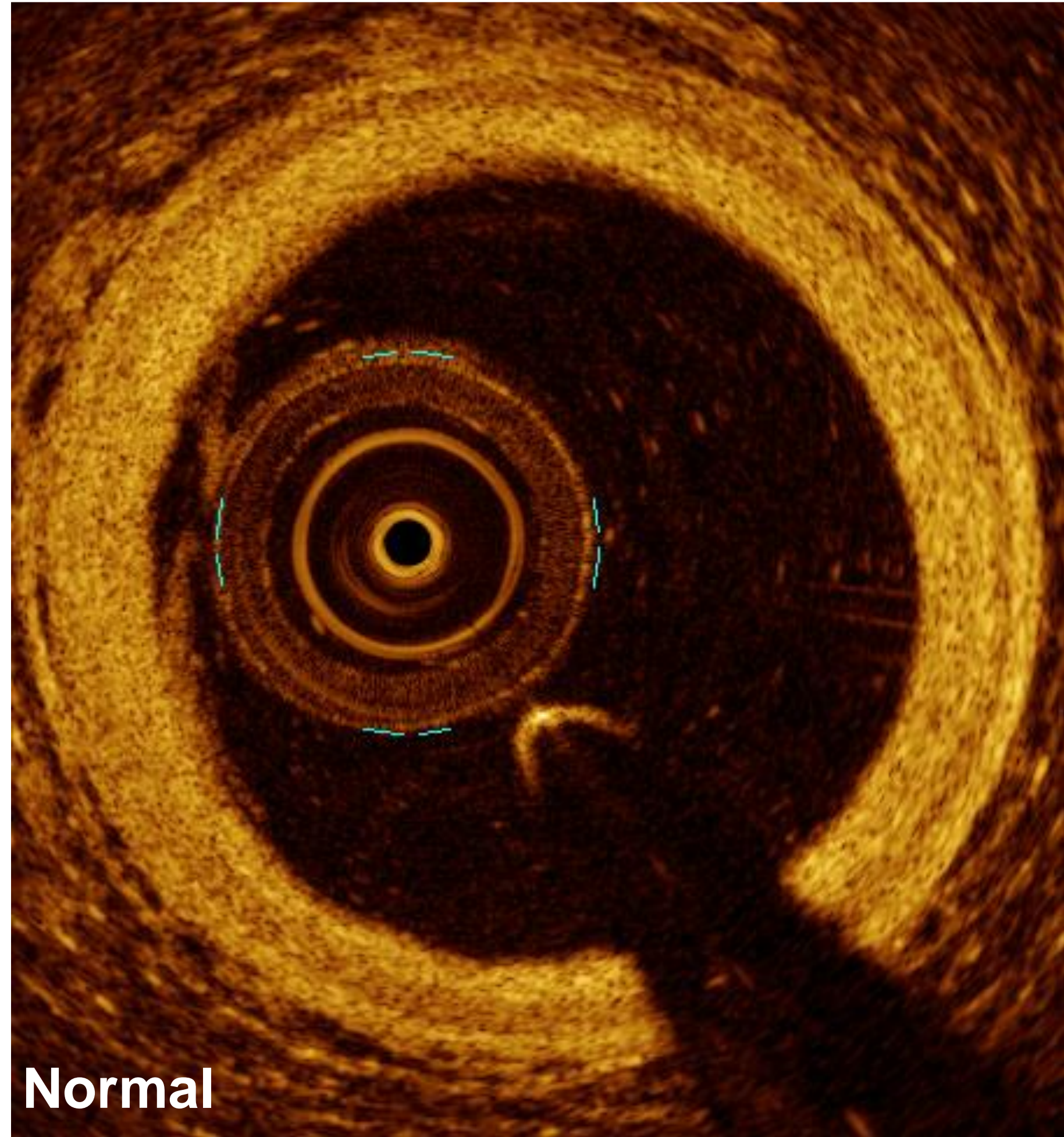


# OCT Image Interpretation

Can the EEL and Adventitia be visualized?

Yes ↙

- Normal Artery
- Fibrous Plaque



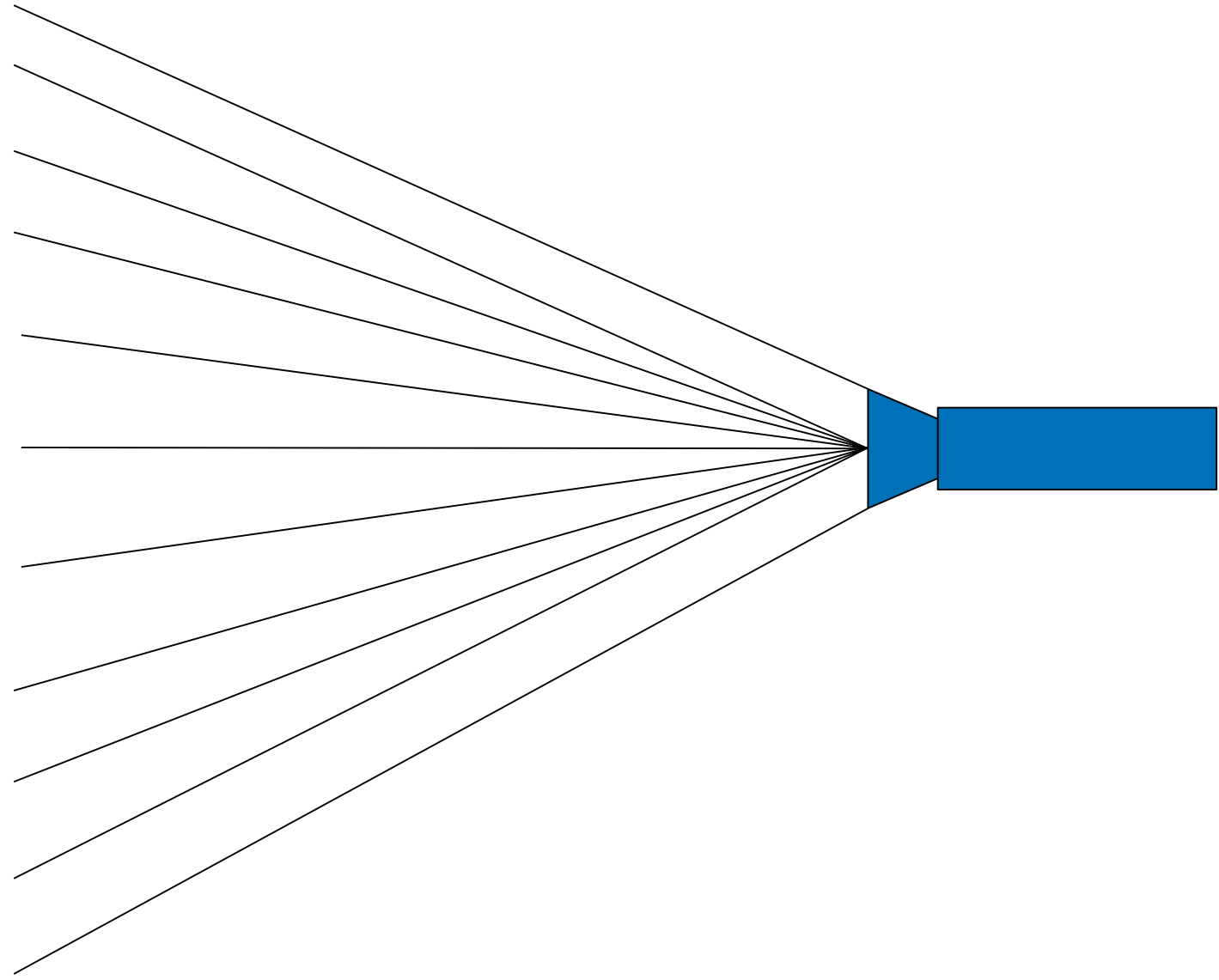
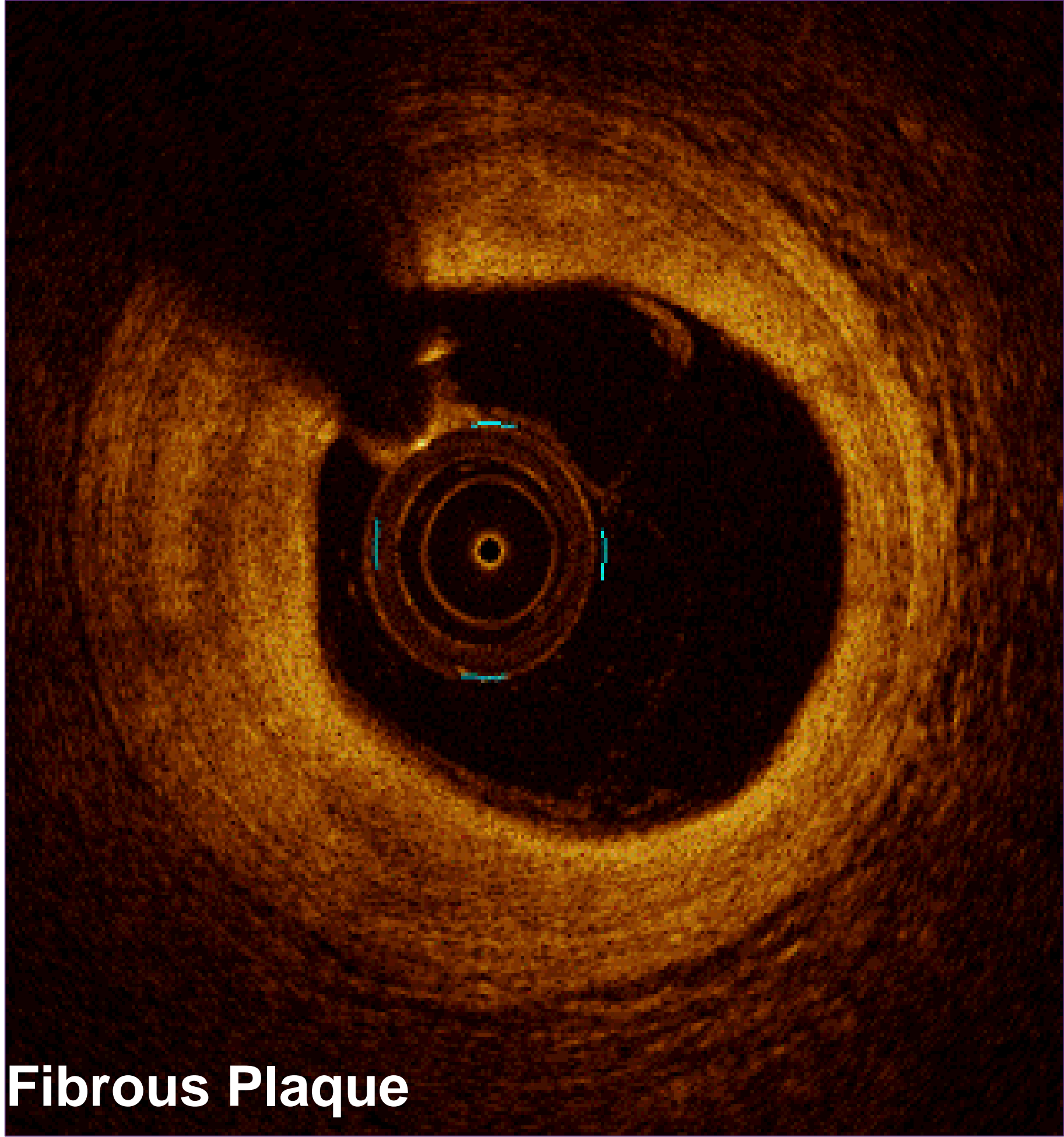


# OCT Image Interpretation

Can the EEL and Adventitia be visualized?

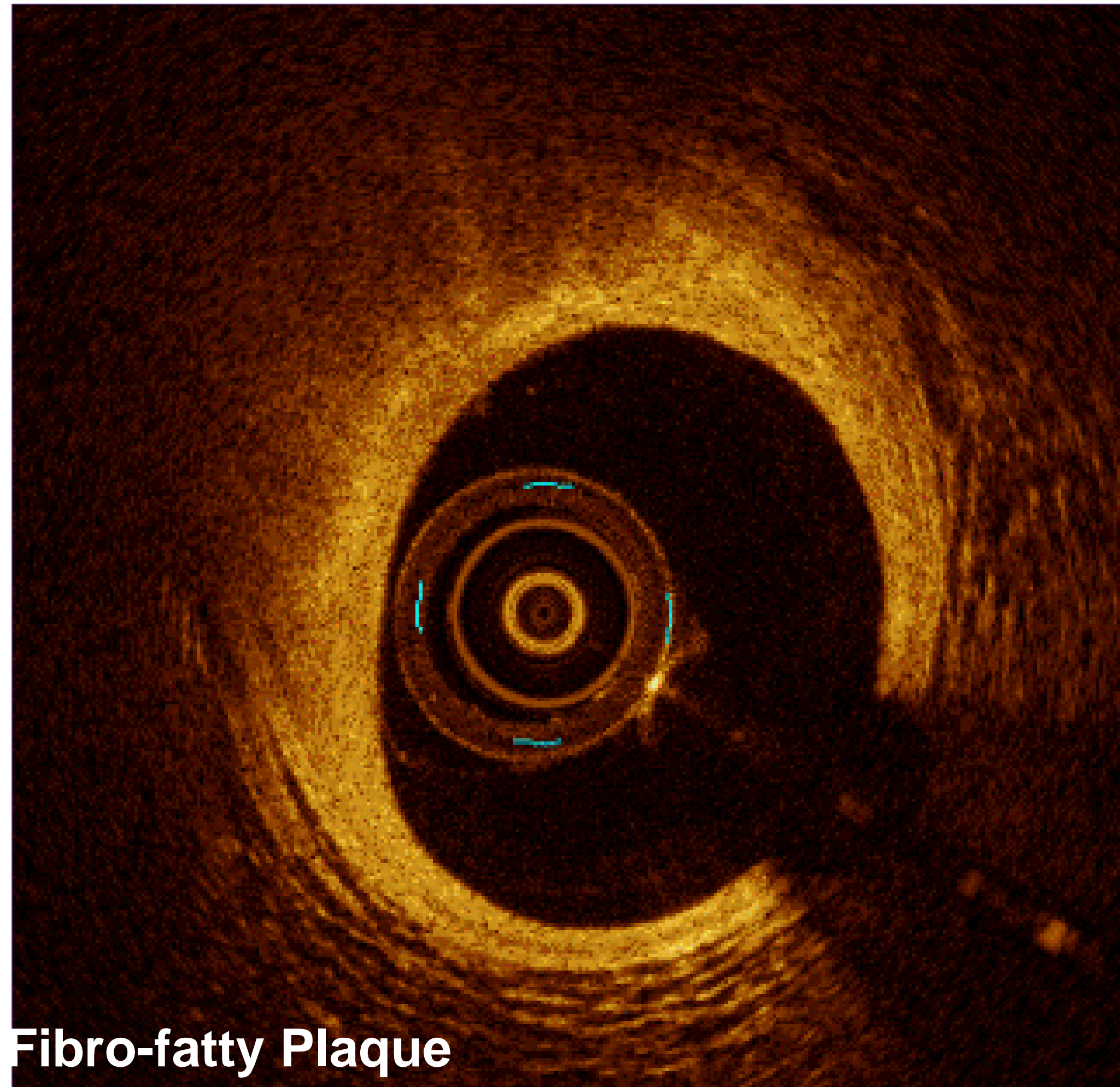
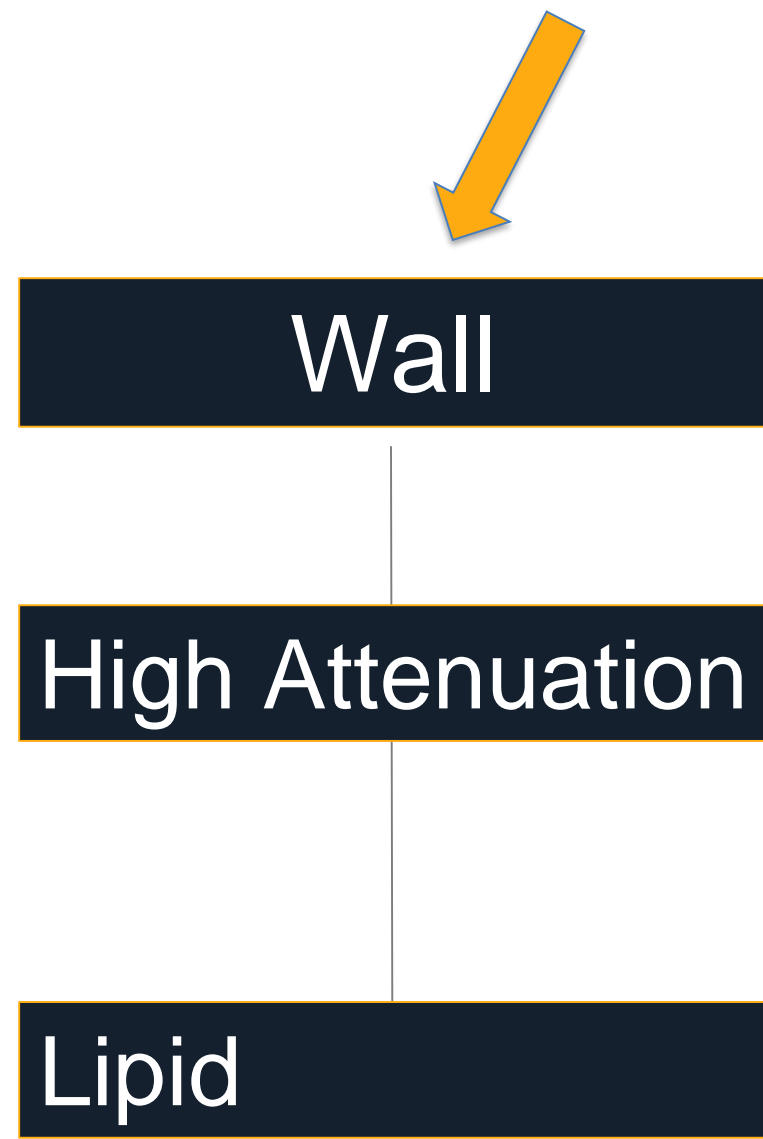
Yes 

- Normal Artery
- Fibrous Plaque

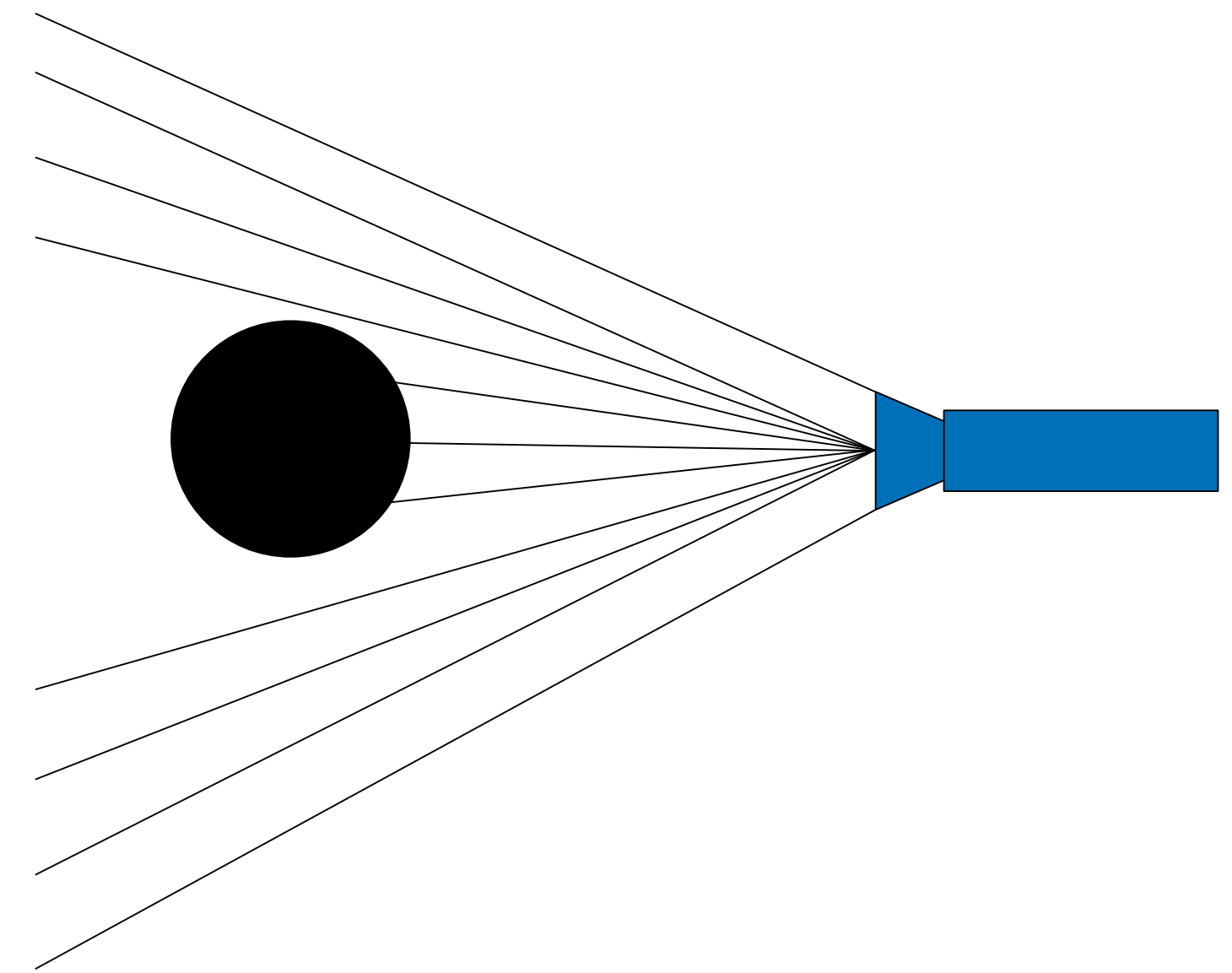


# OCT Image Interpretation

Is the signal change in the lumen or the wall?

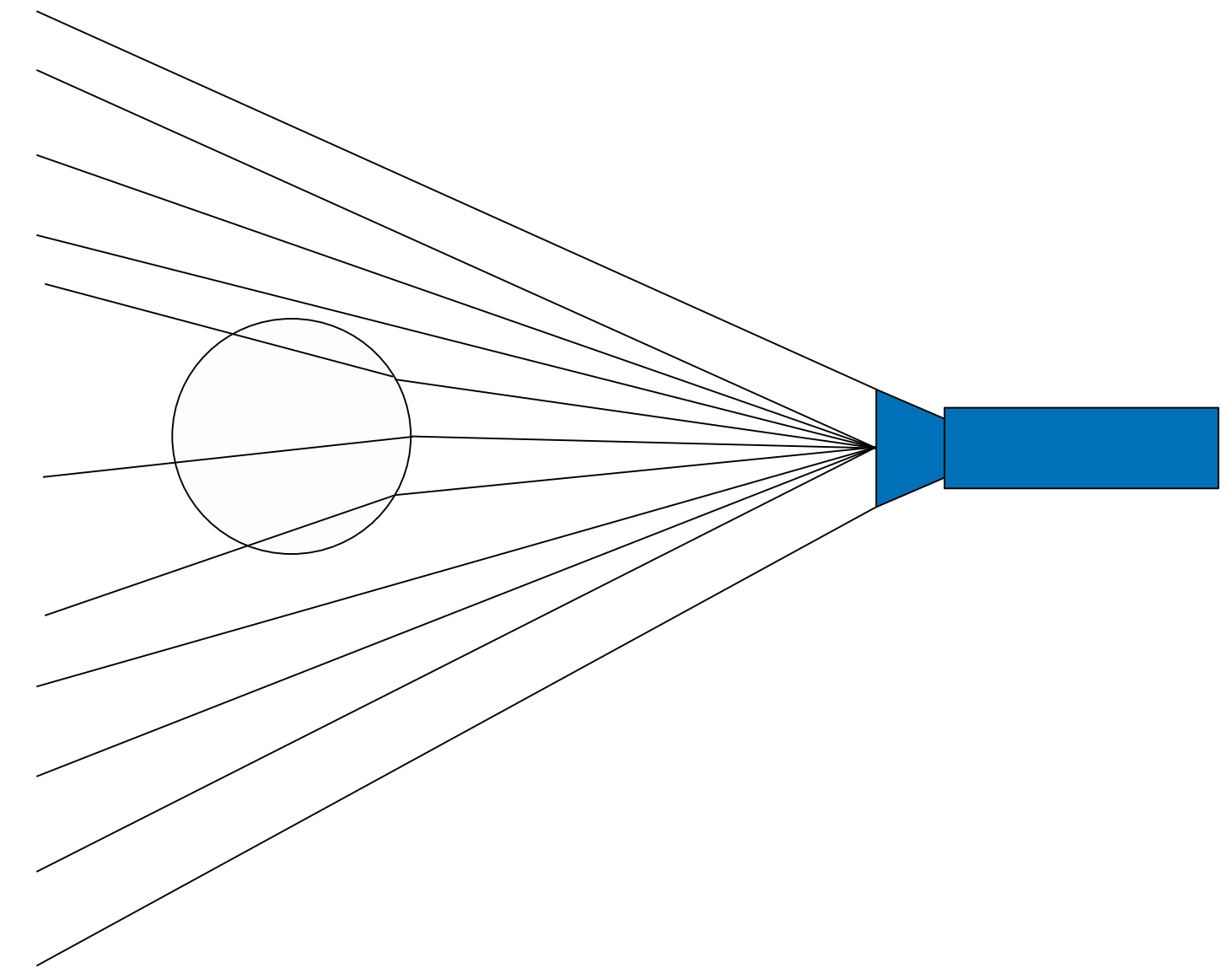
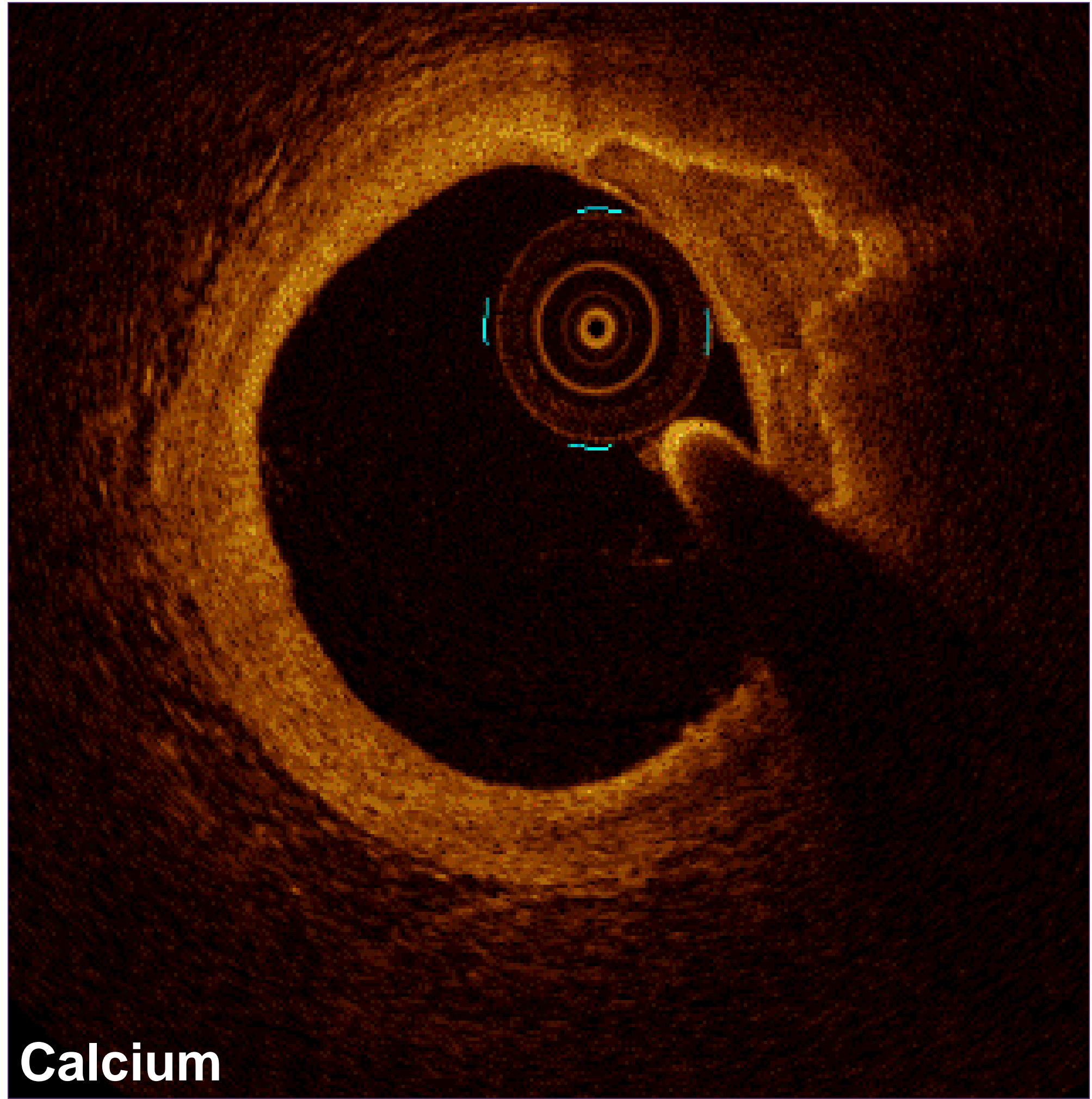
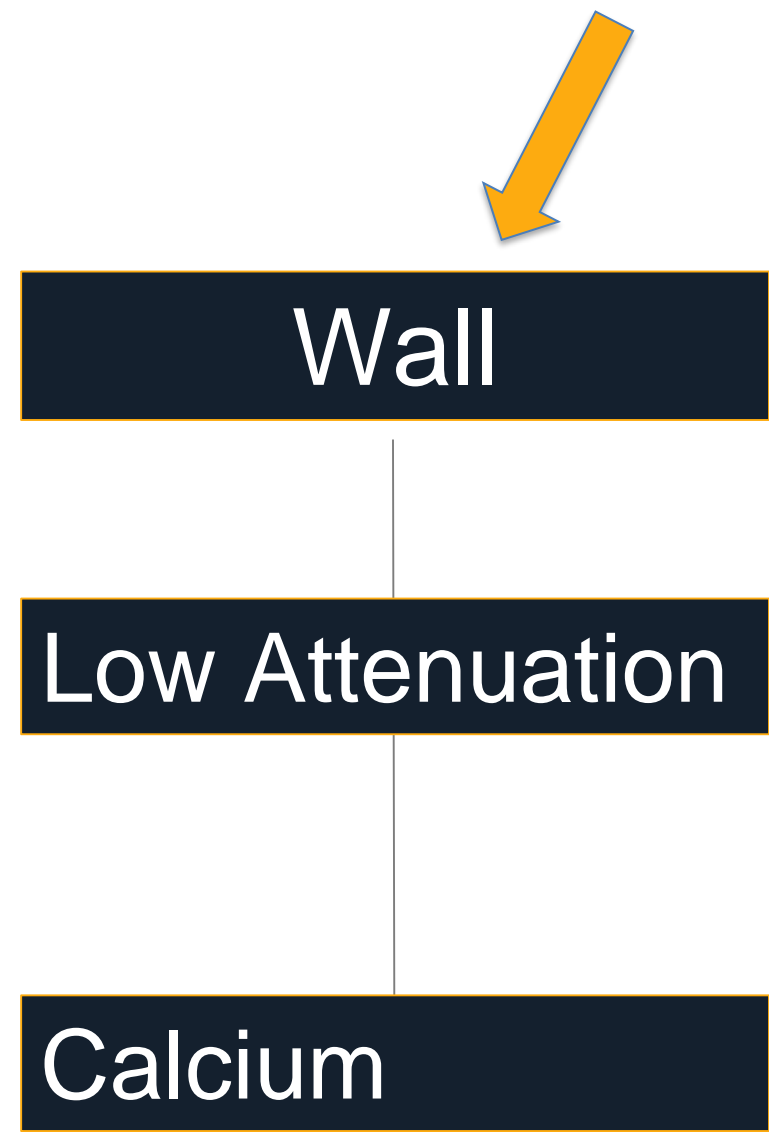


Fibro-fatty Plaque



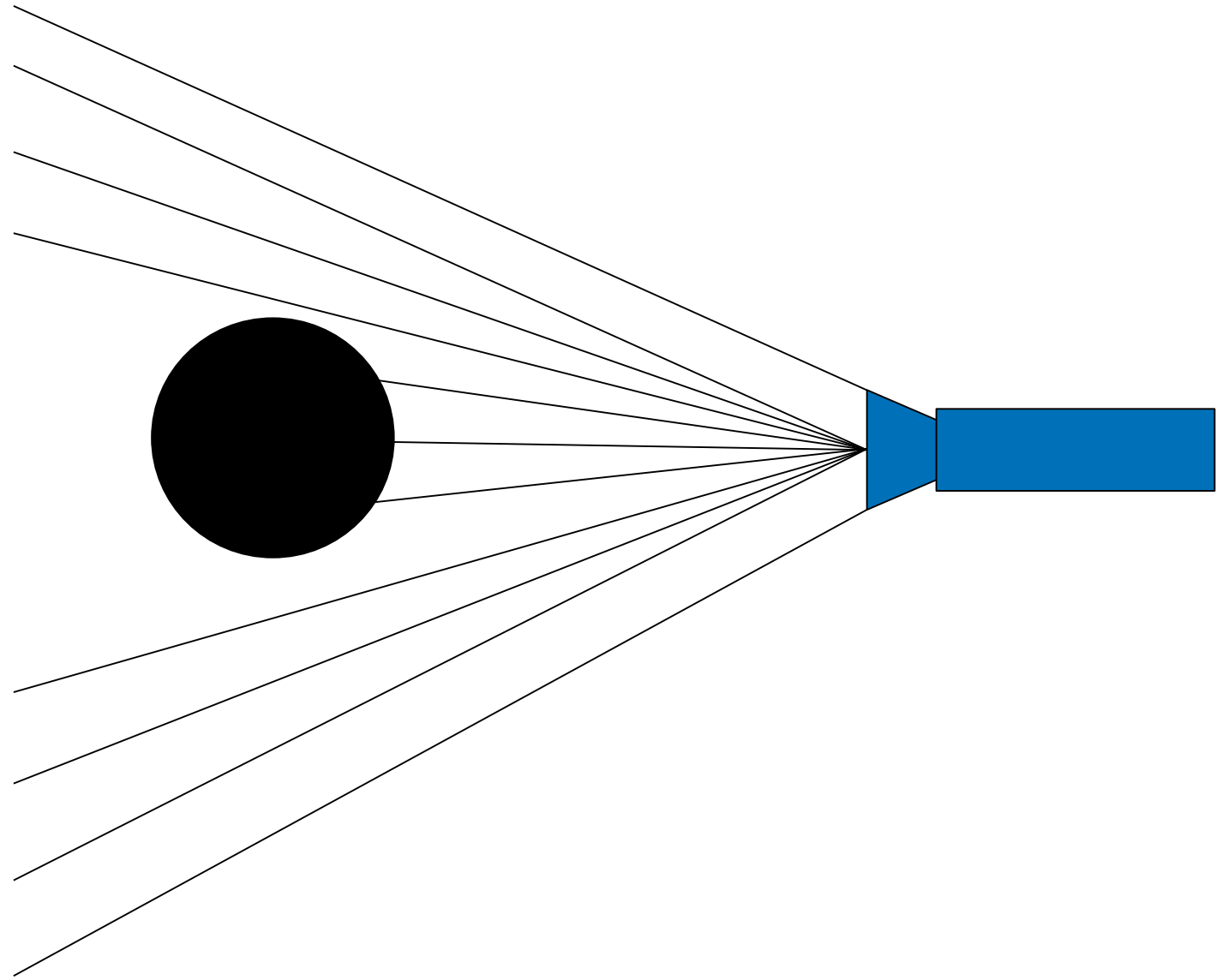
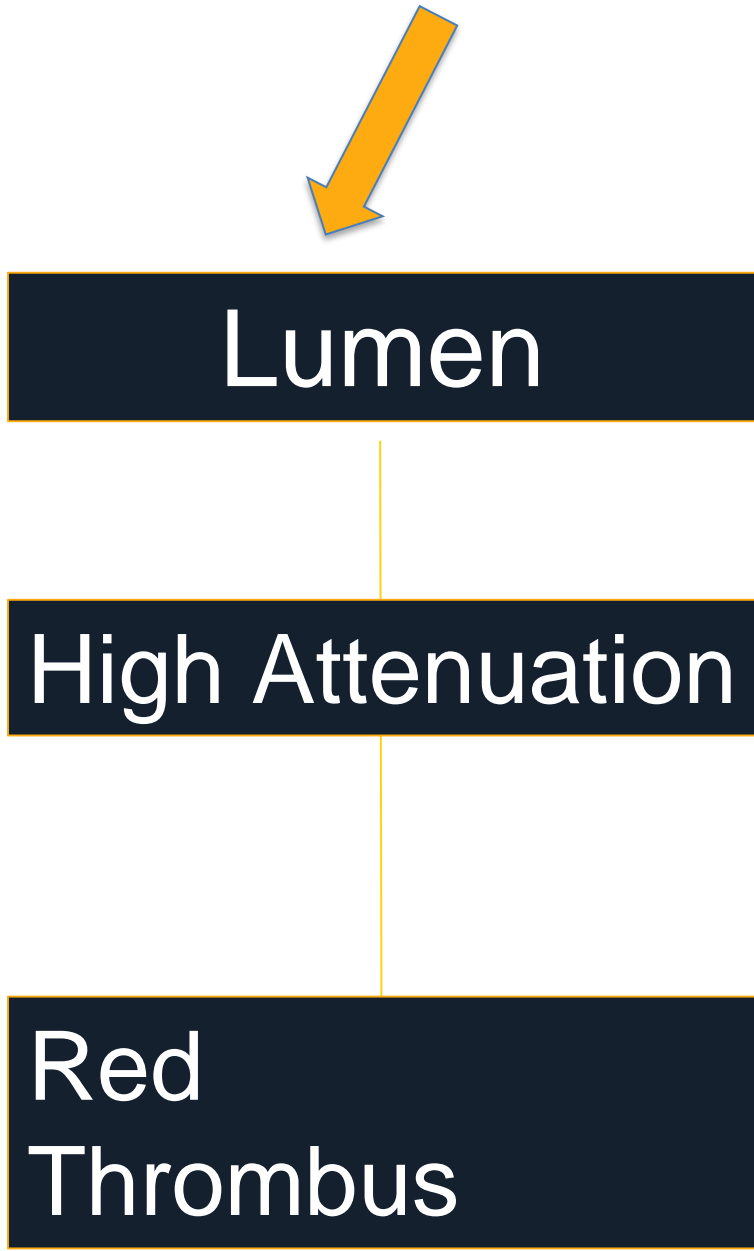
# OCT Image Interpretation

Is the signal change in the lumen or the wall?



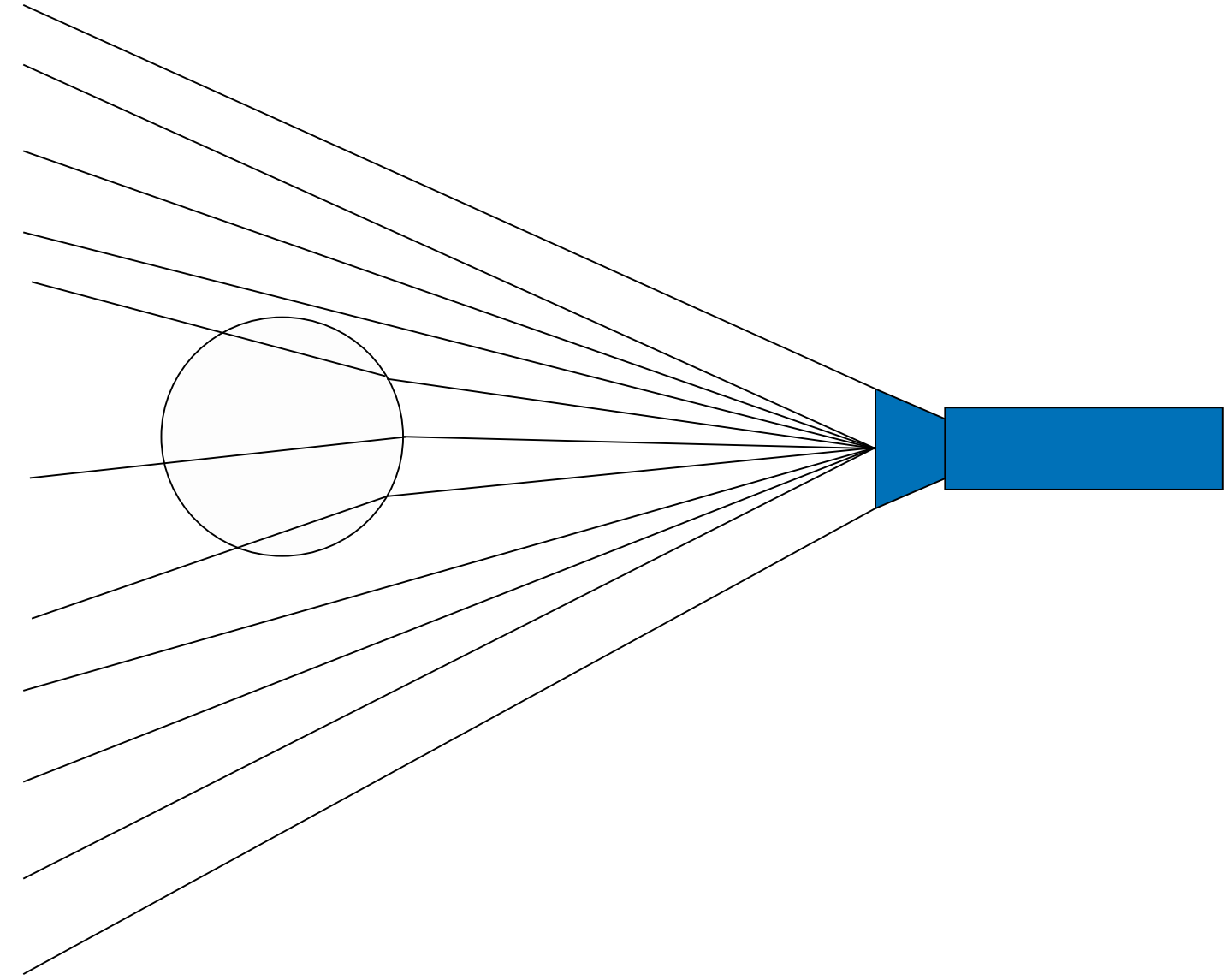
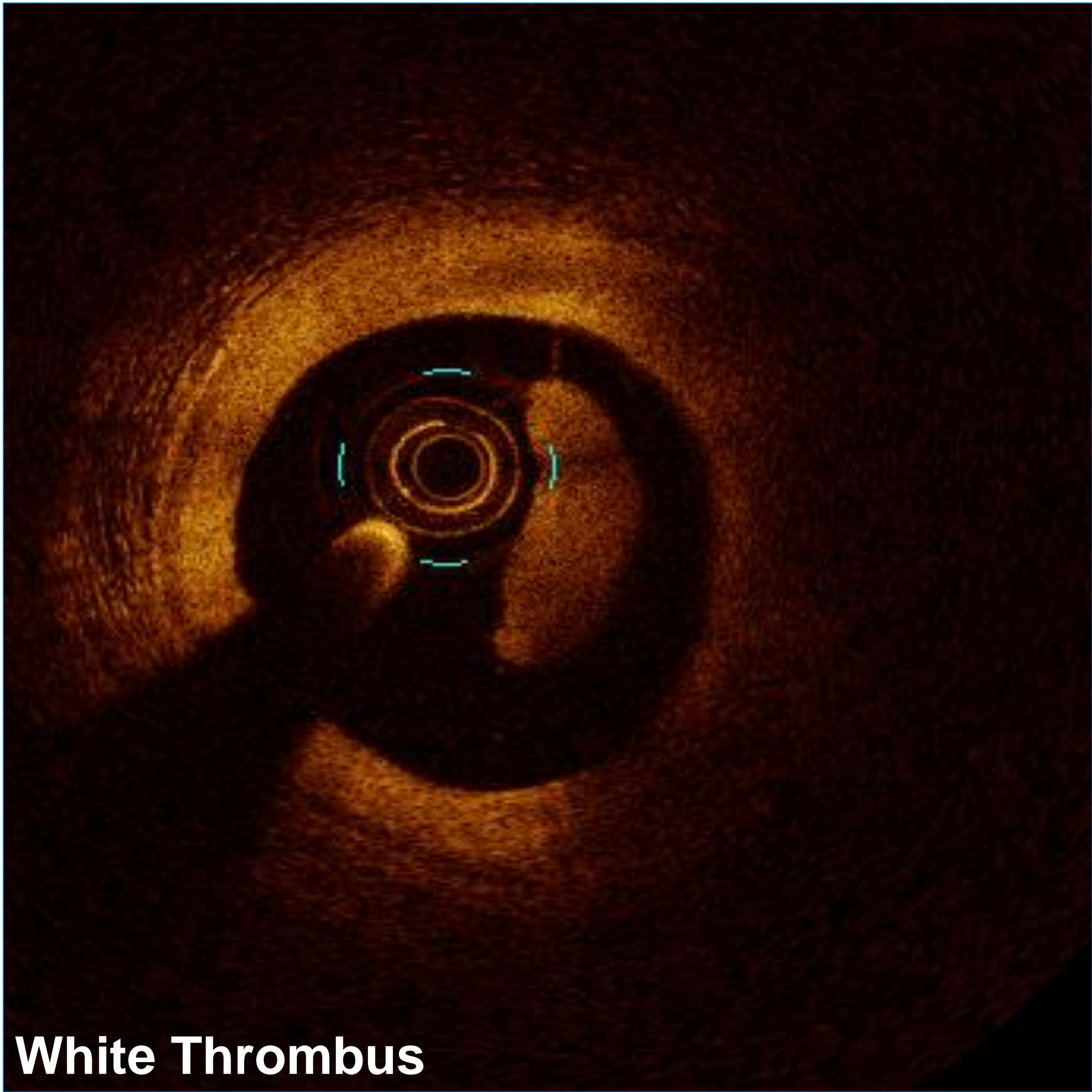
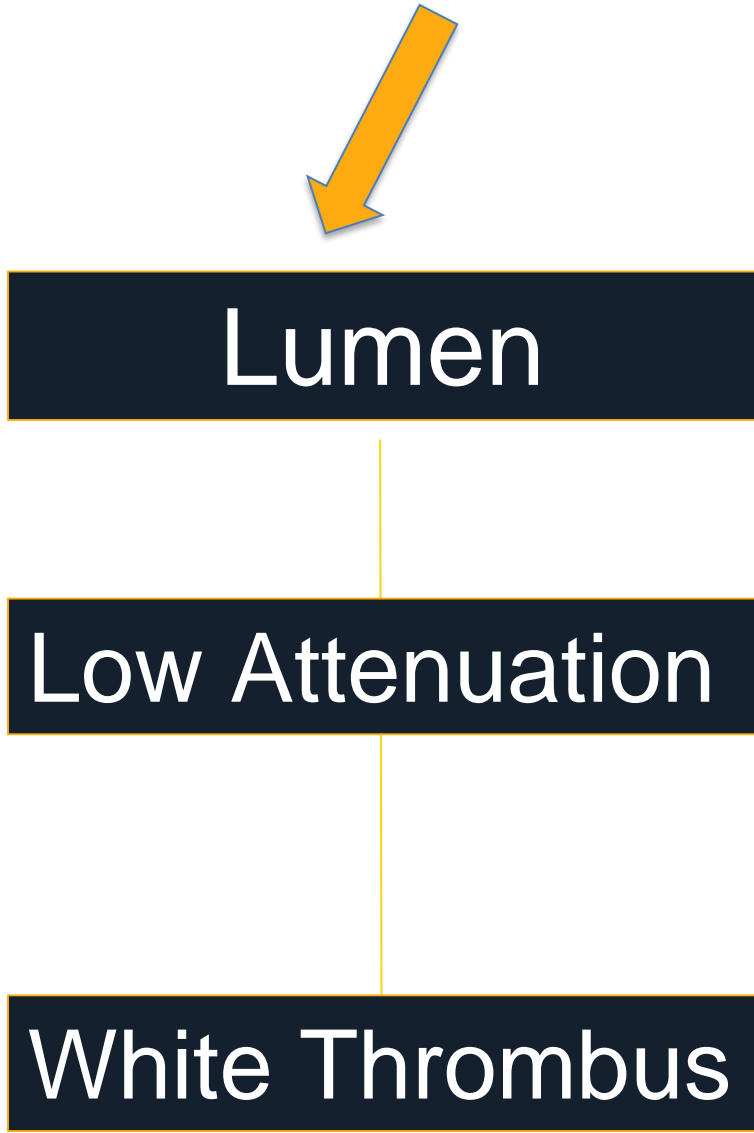
# OCT Image Interpretation

Is the signal change in the lumen or the wall?



# OCT Image Interpretation

Is the signal change in the lumen or the wall?



# OCT Image Interpretation

Can the EEL and Adventitia be visualized?

Is the signal change in the lumen or the wall?

Lumen

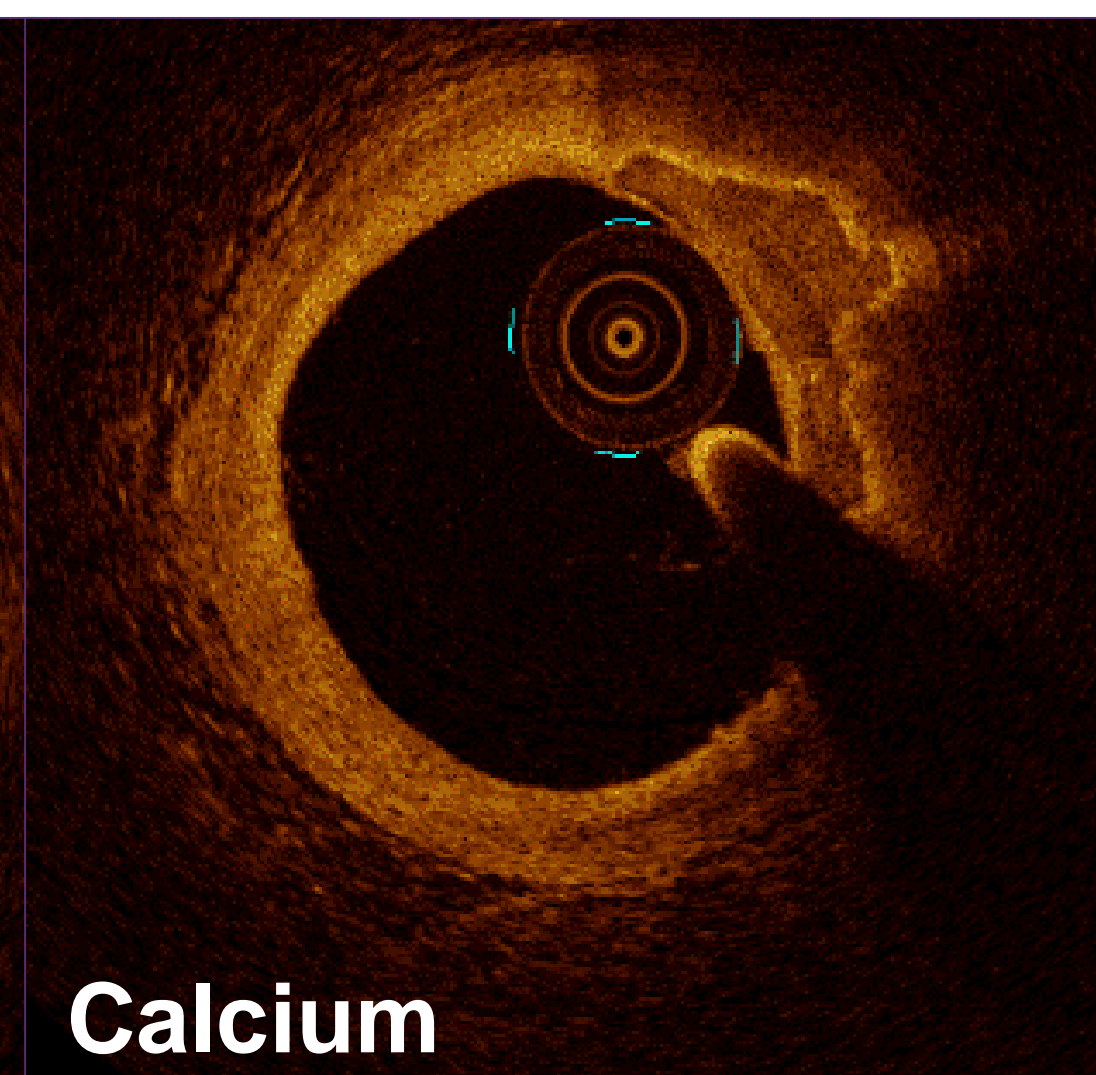
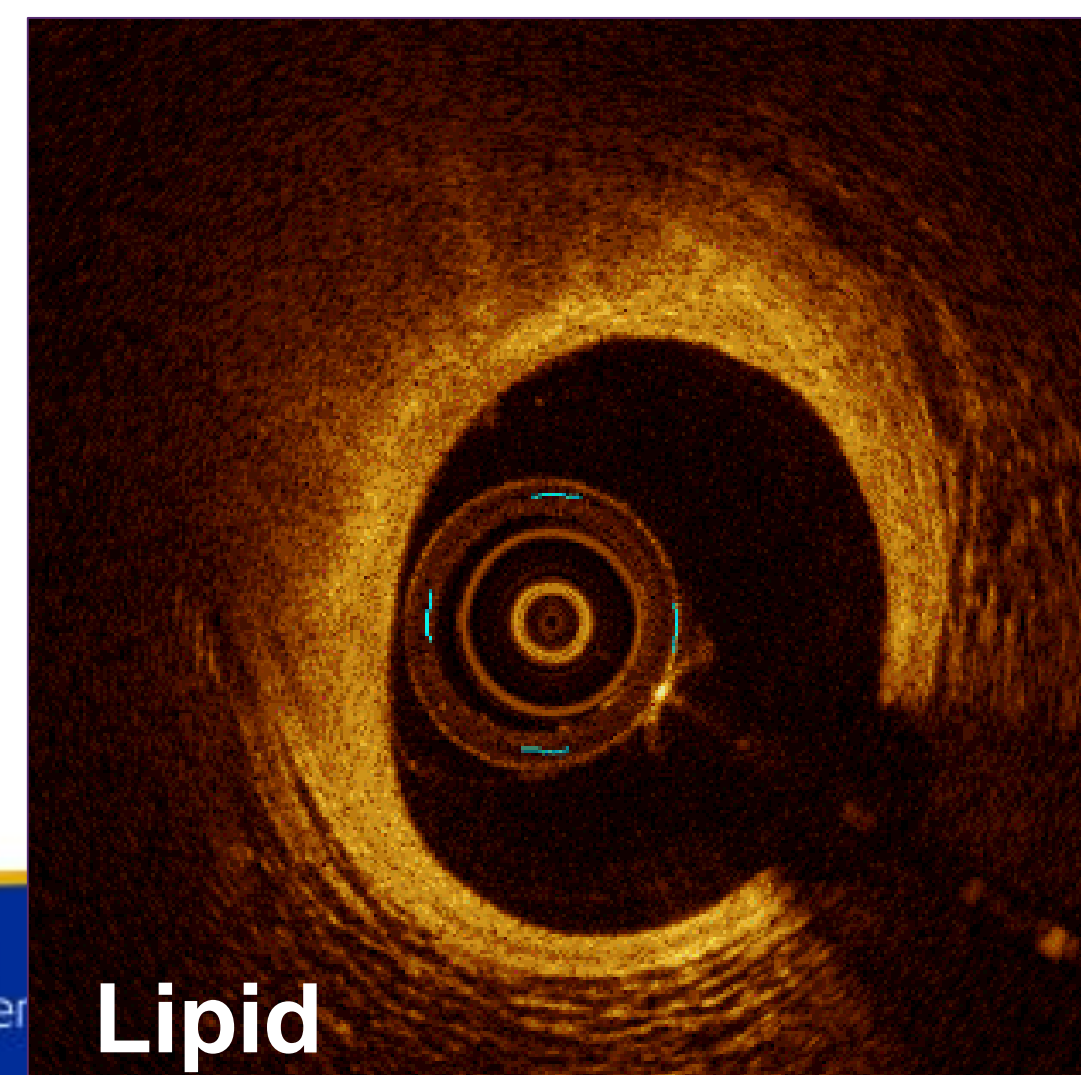
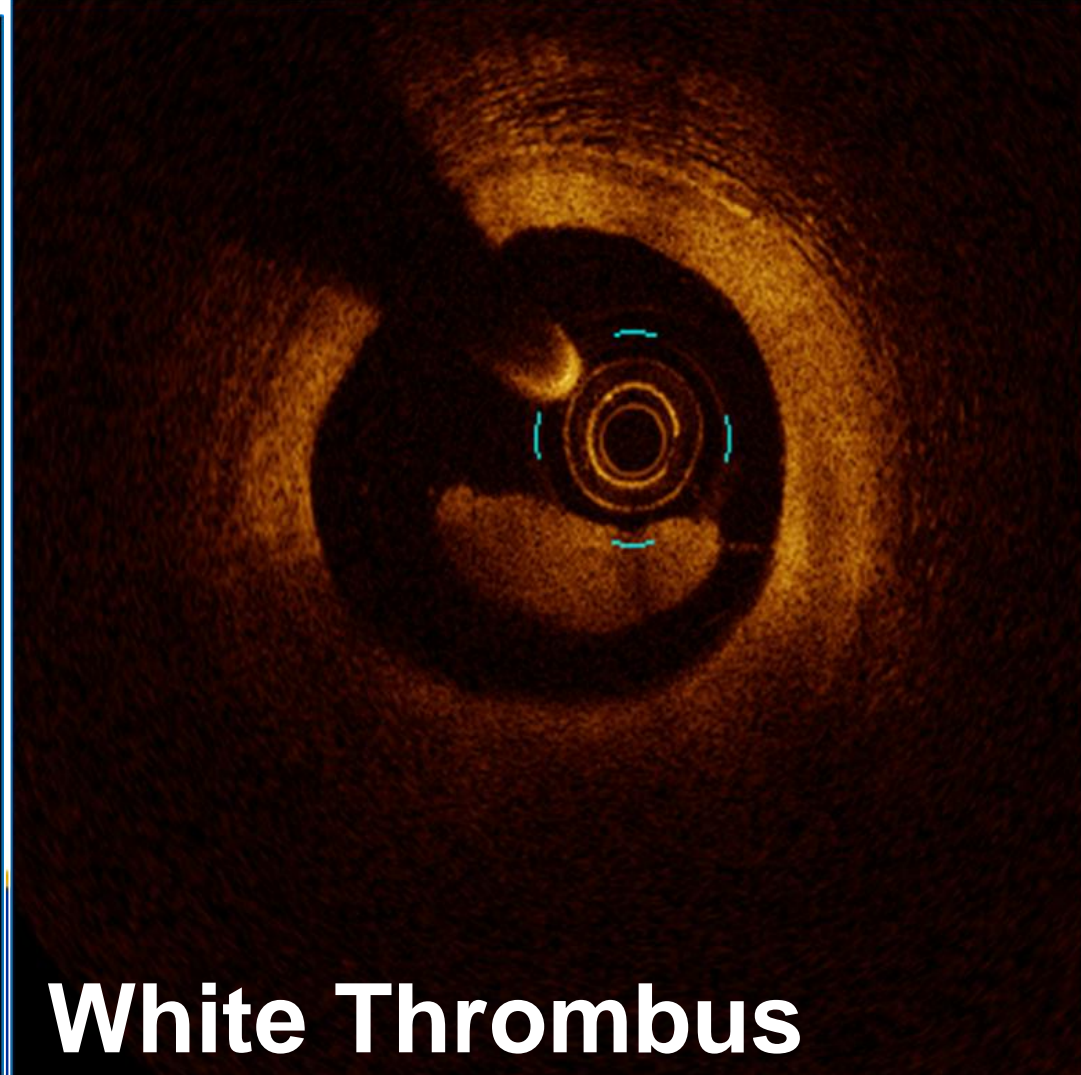
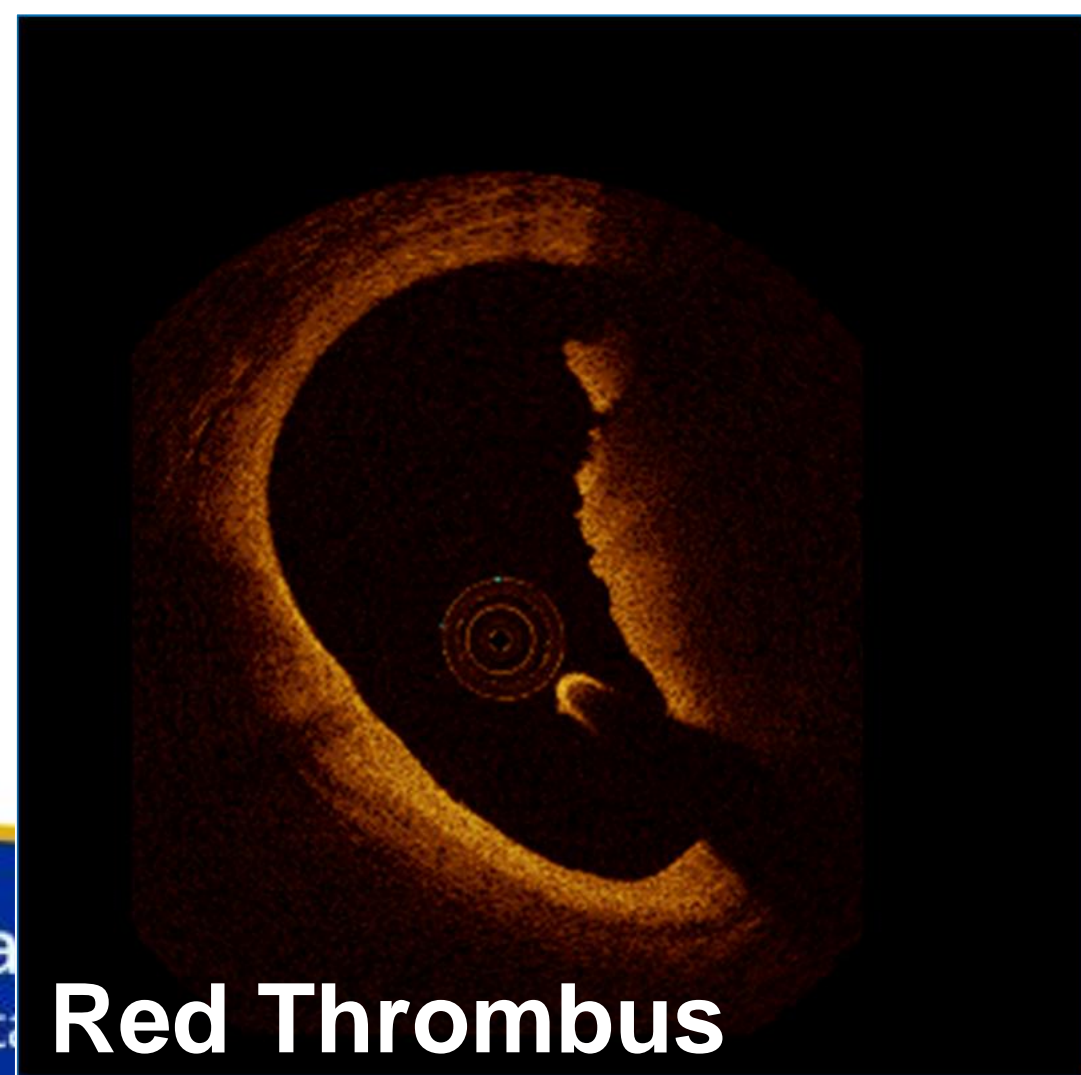
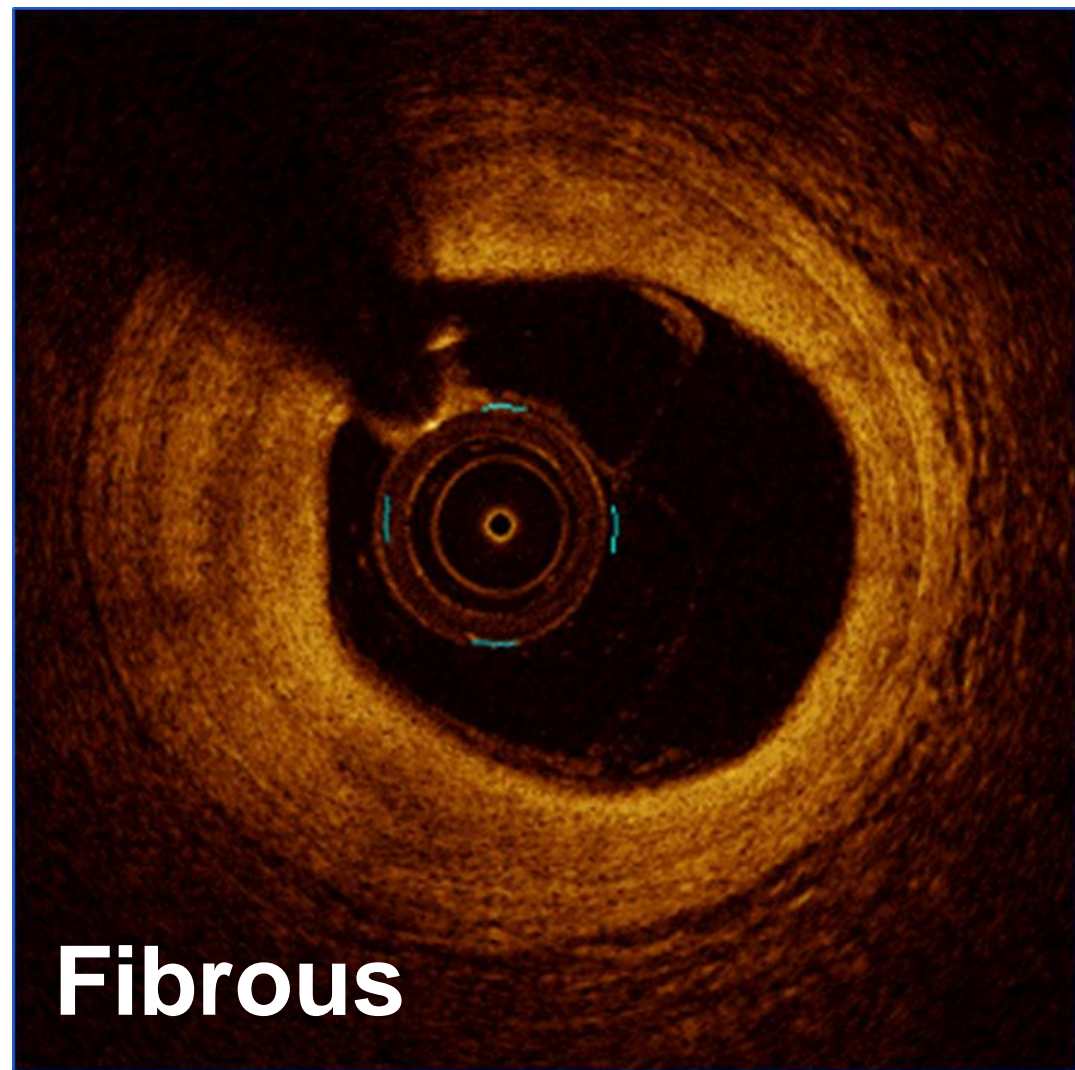
Wall

High Attenuation

Low Attenuation

High Attenuation

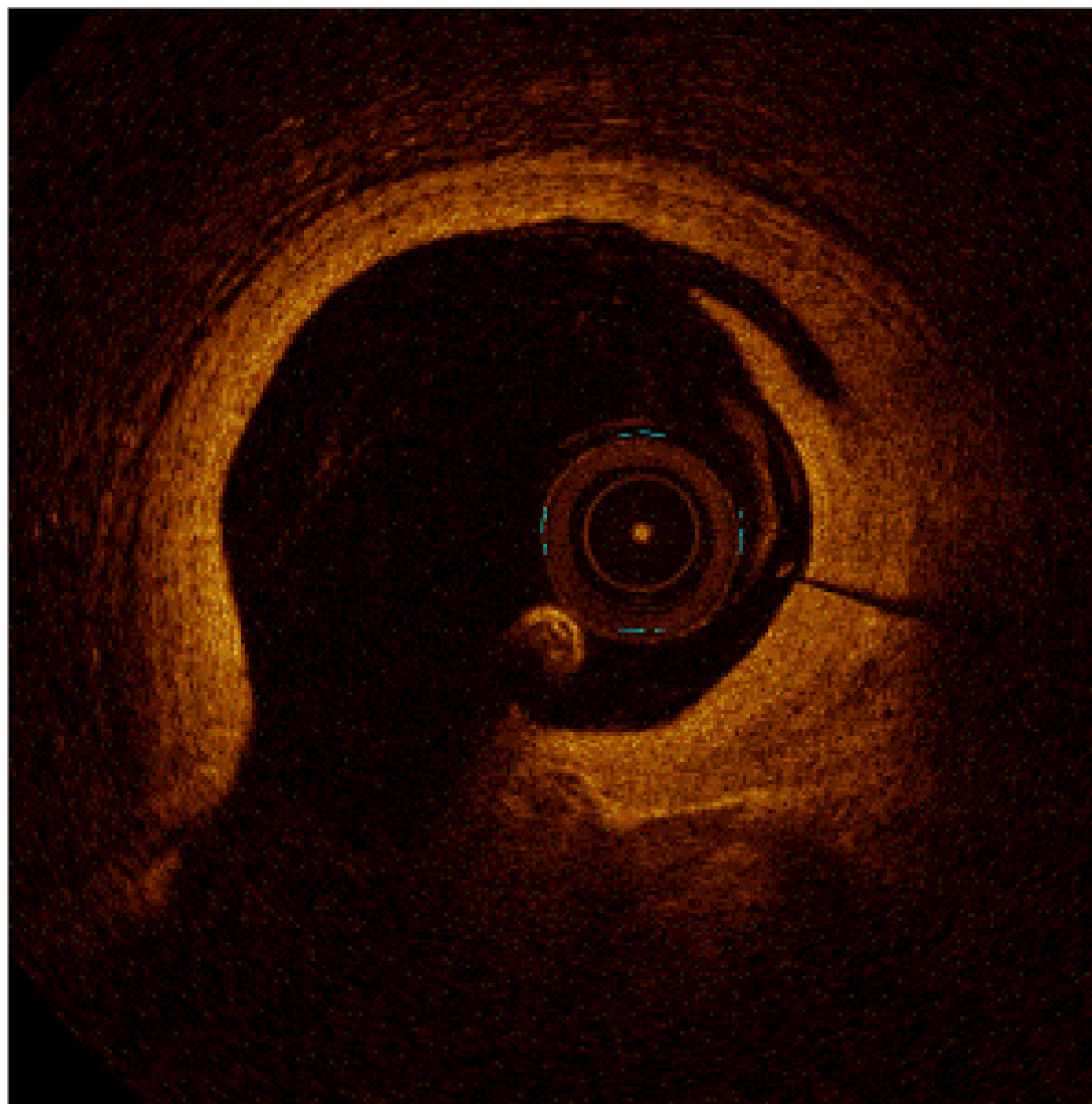
Low Attenuation



# Post-PCI

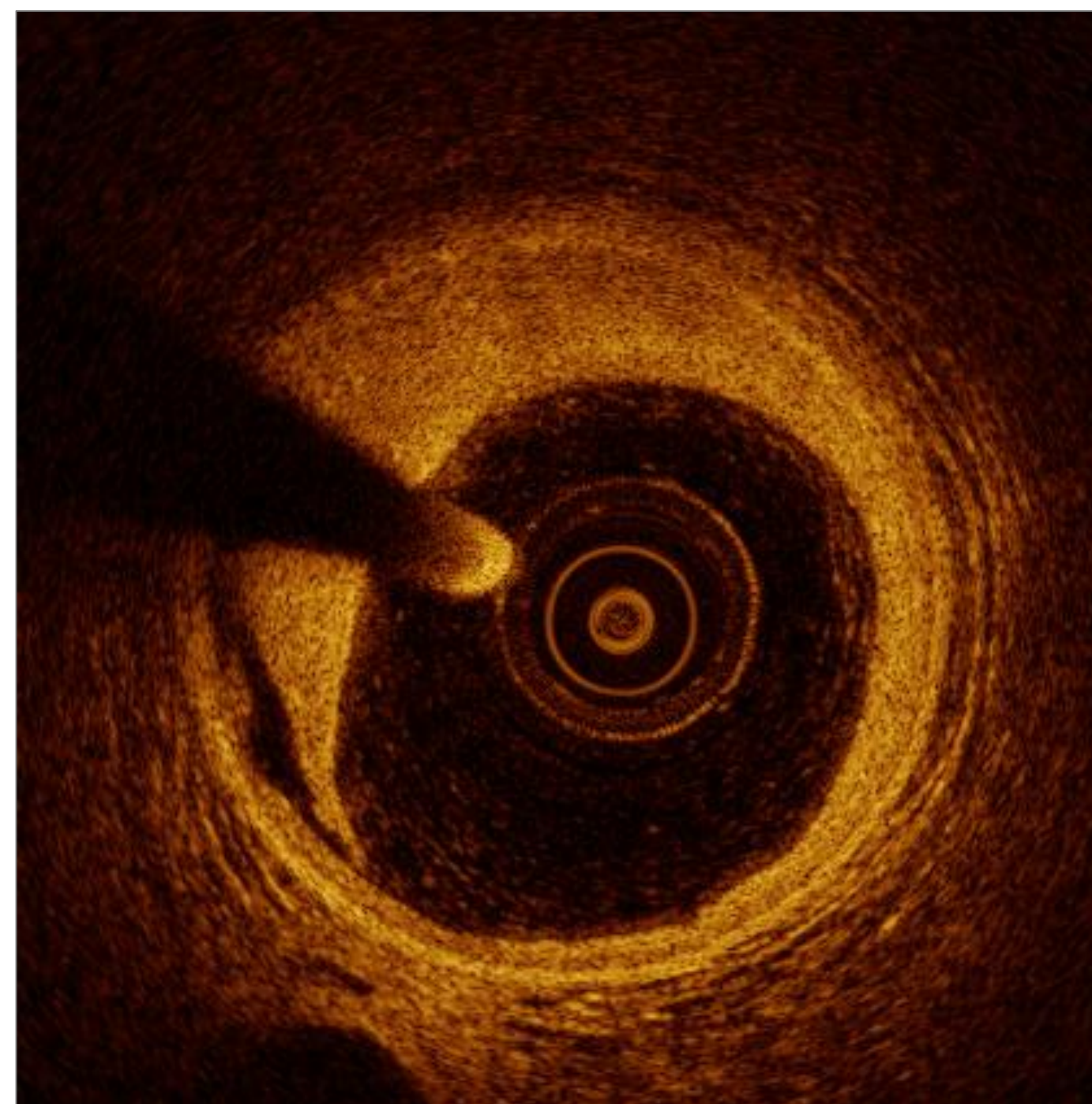
# Dissections

Intimal



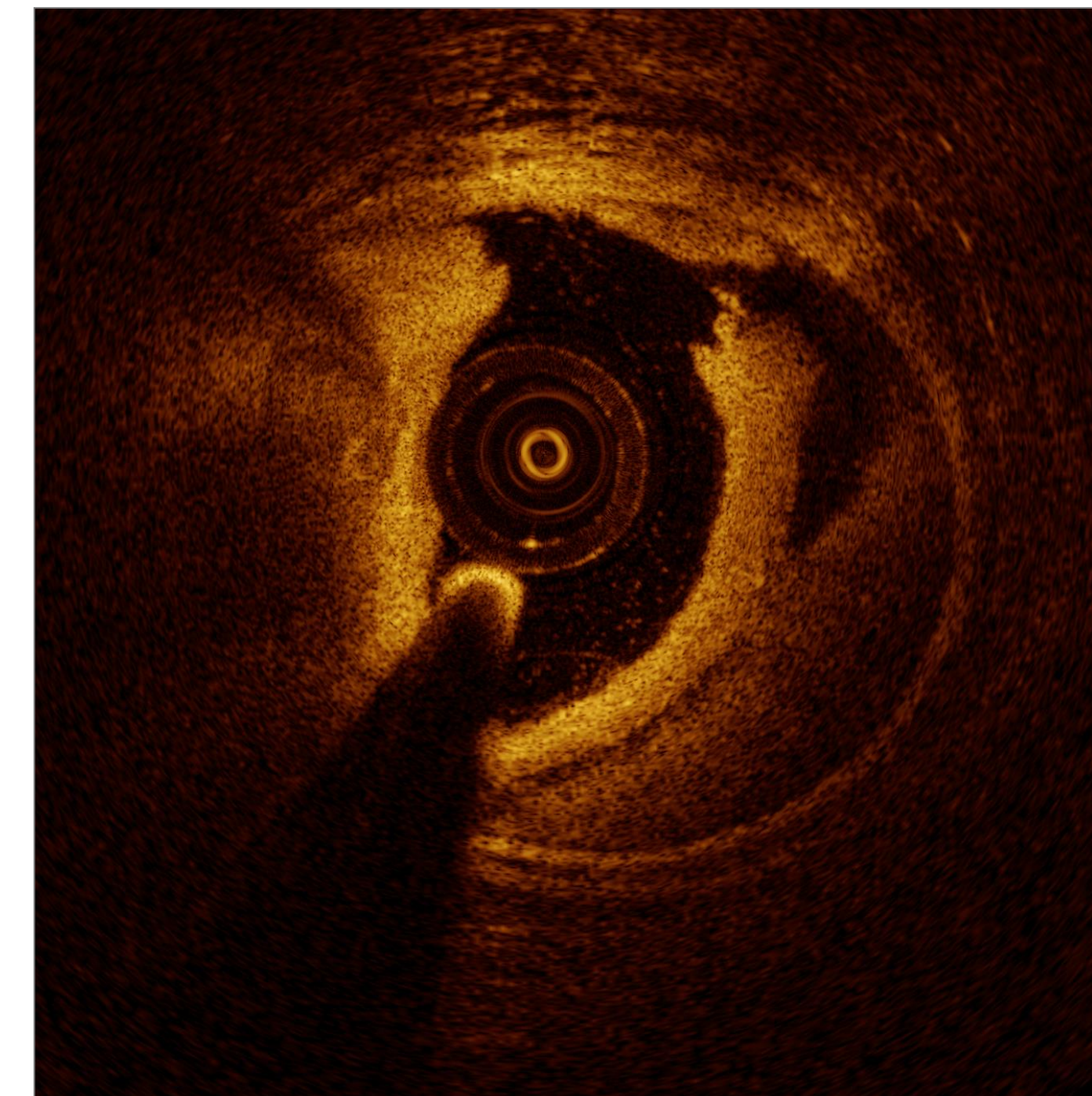
Slit scouring pad

Medial



Torn scouring pad

Intramural Hematoma



Torn scouring pad

***Consider additional DES (particularly distal)***

- $\geq 1$  quadrant in arc from the center of the vessel
- Penetrates the medial layer

EuroIntervention. 2014 22;(9):1085-94.

Circulation. 2014 28;129(4):463-70

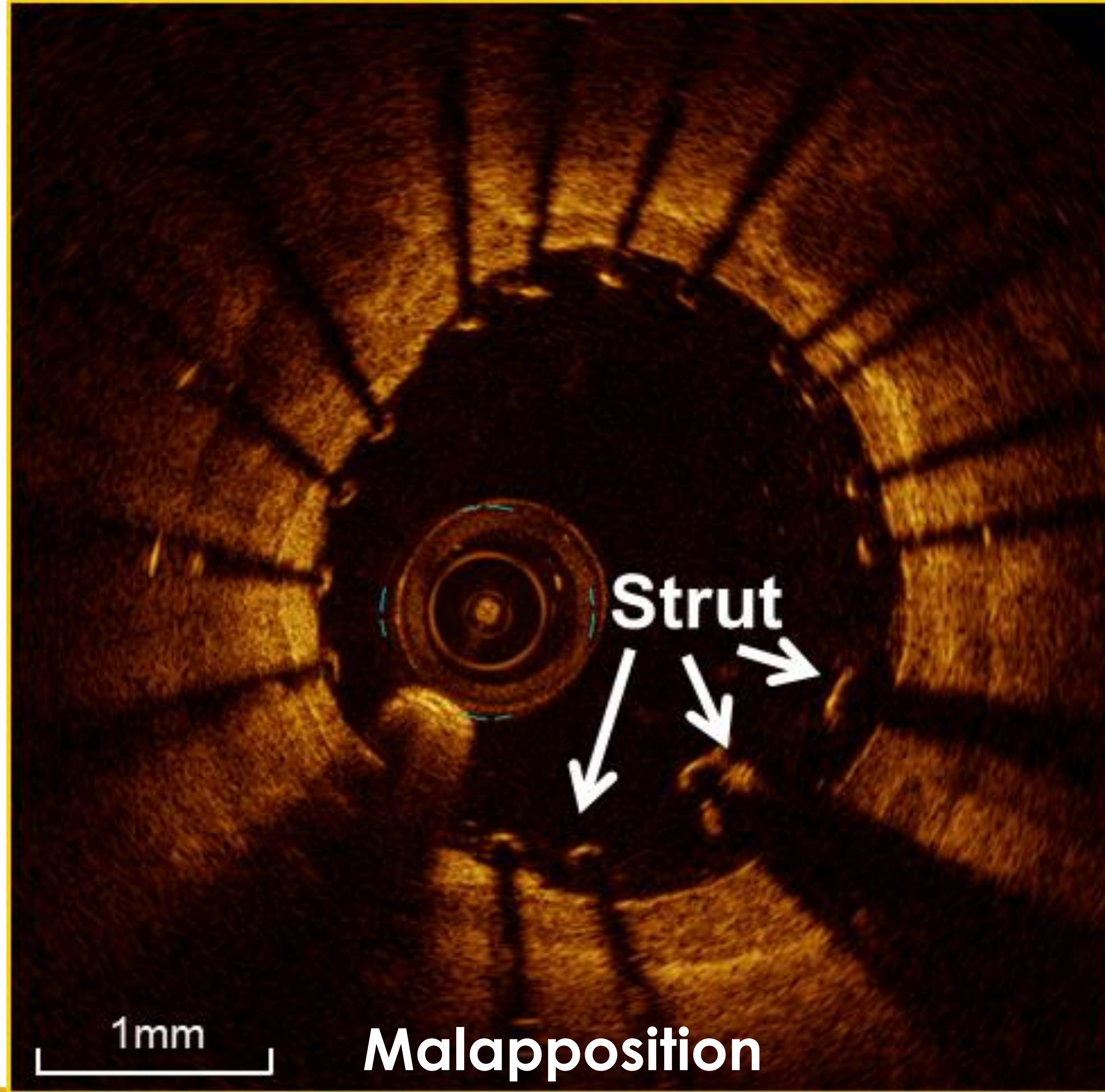


# Apposition

**If the stent struts are in contact with the artery wall, the stent is apposed**

***Consider dilation with semi-compliant balloon at low atm;***

- **Proximal malapposition that may interfere with re-wiring, or gross malapposition for long segments (>3mm identified on automated malapposition indicator)**



# Tissue protrusion

**If there is a signal change inside the stent**

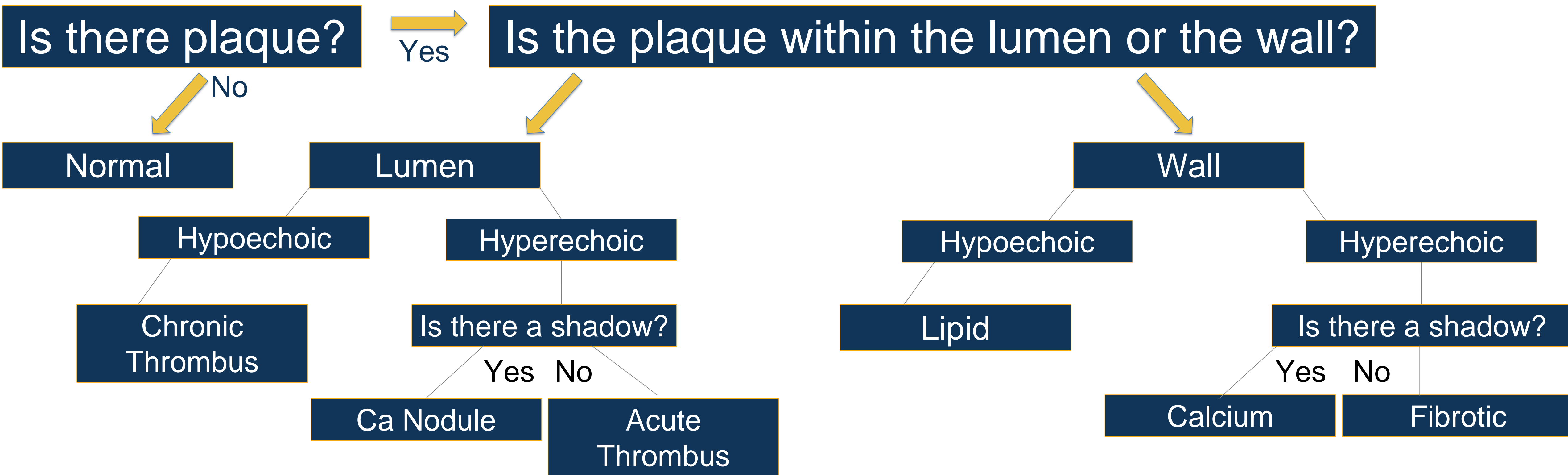
**following a freshly protruding stent  
Tissue Protrusion**

***Consider dilation with Non-compliant balloon at high atm;***

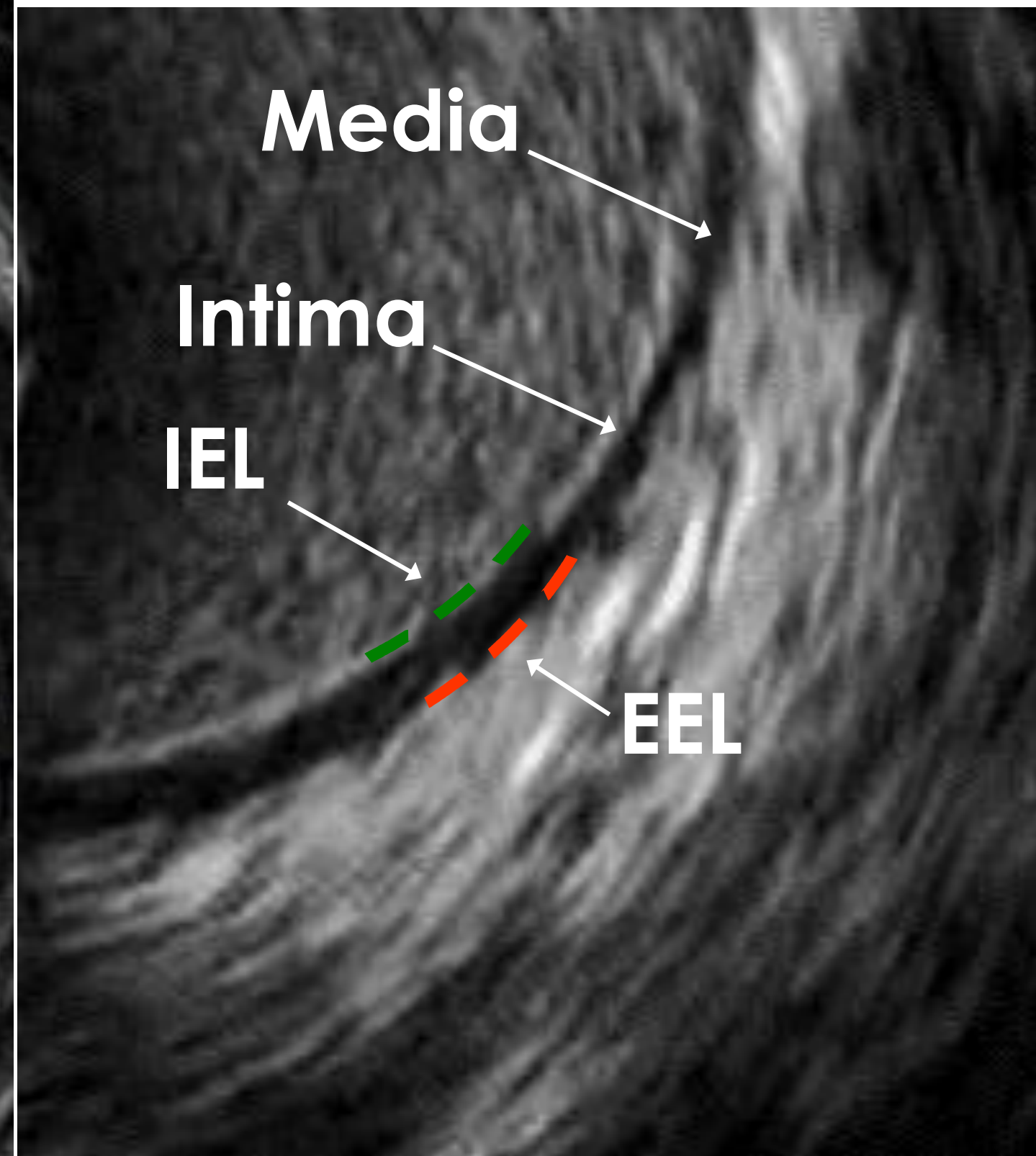
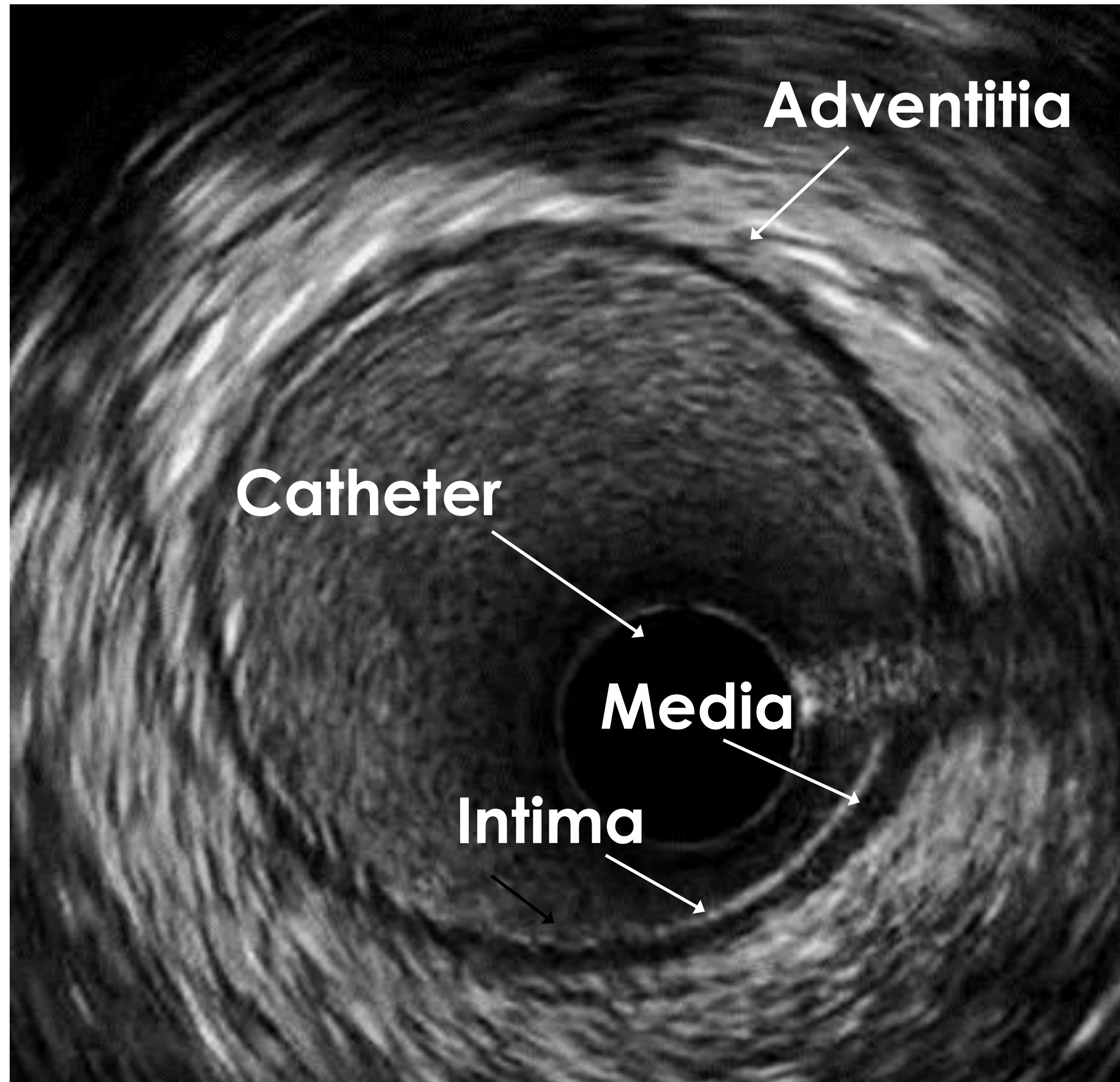
- **Tissue protrusion that impacts >10% of the effective flow area may require and additional DES**

**Sponge sticking through**

# IVUS Image Interpretation



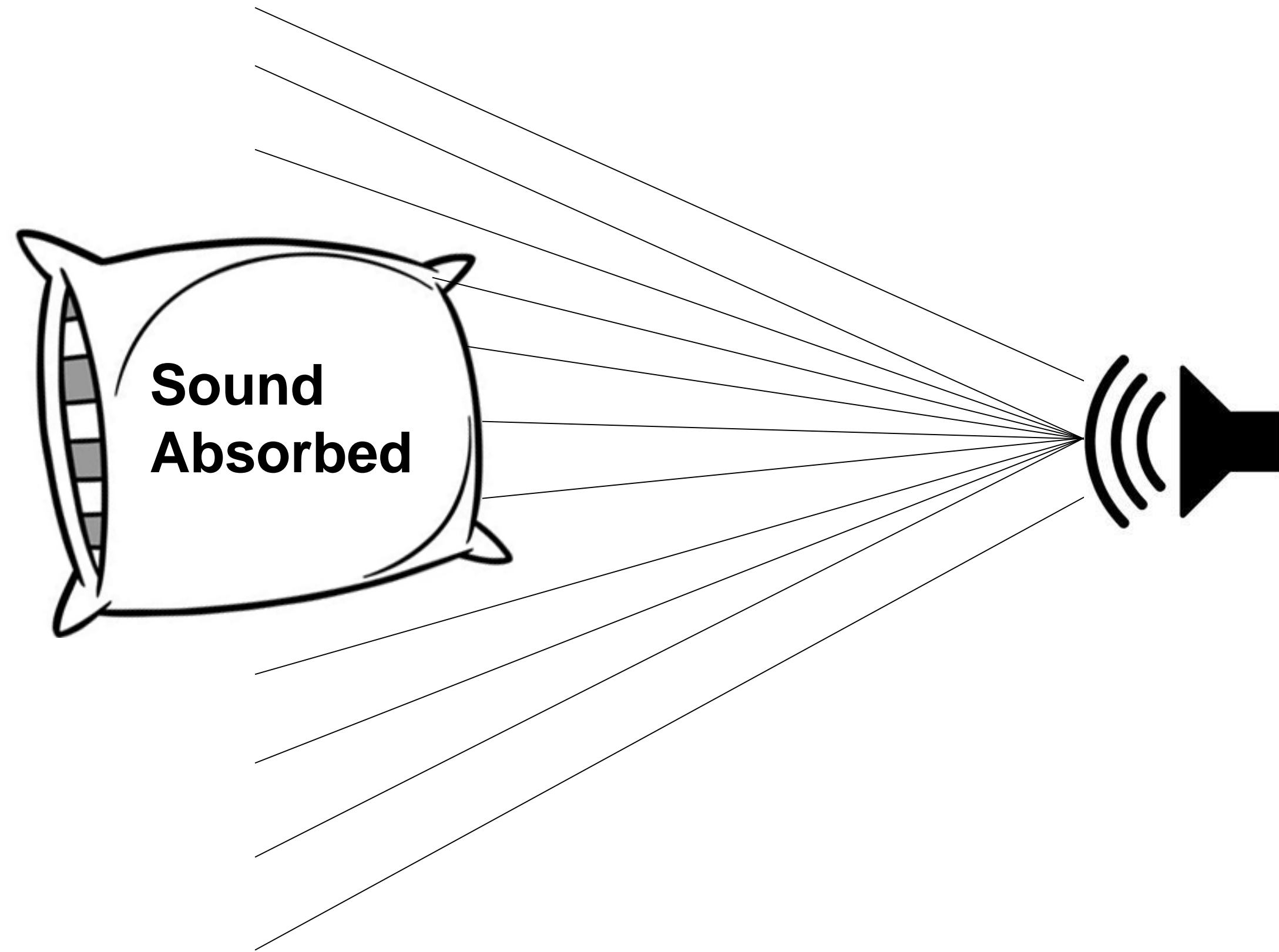
# Normal Artery Morphology on IVUS



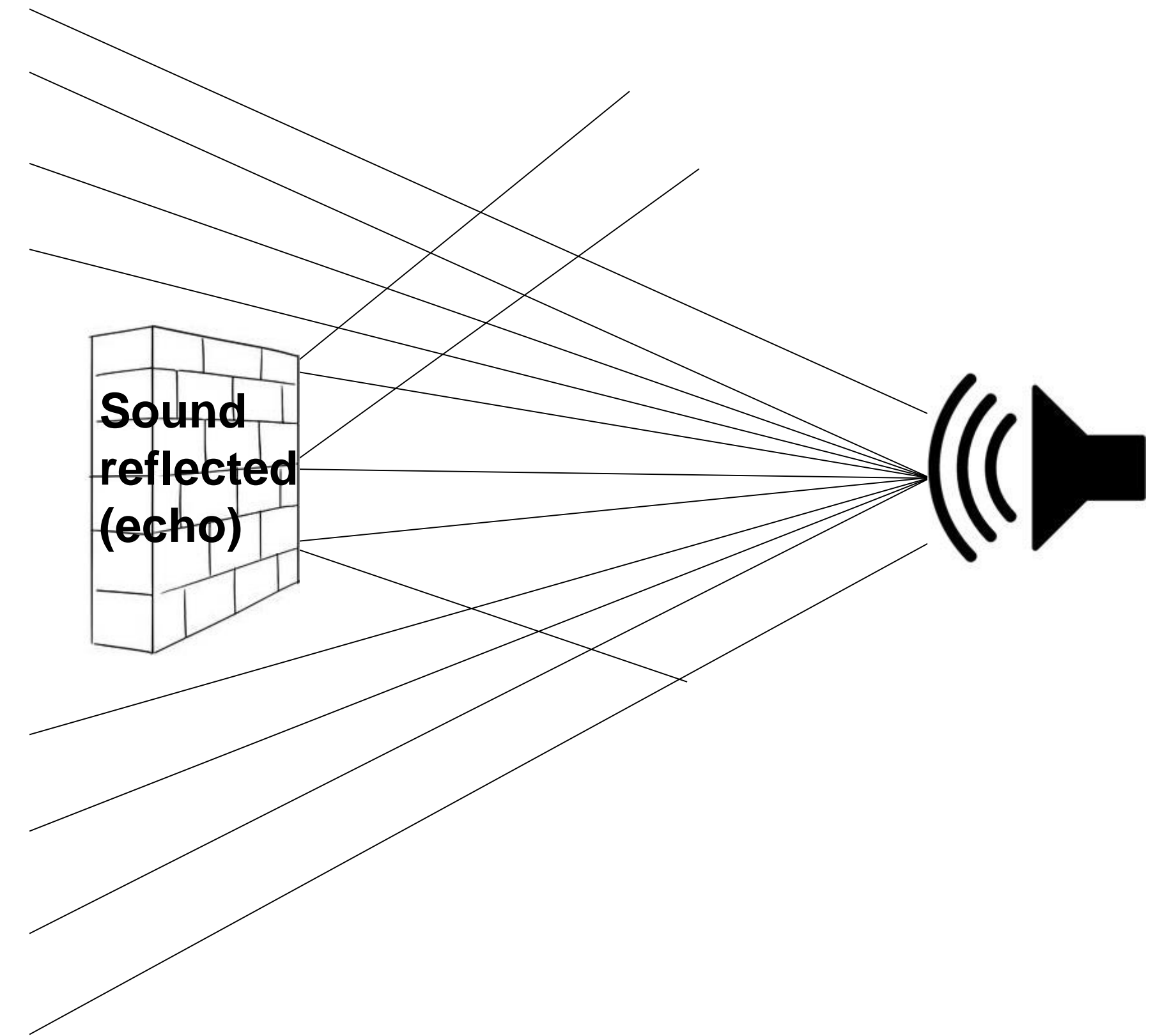
- 1) Intima = scouring pad
- 2) IEL = rubber band
- 3) Media = dense sponge
- 4) EEL = rubber band
- 5) Adventitia = mesh

# IVUS Signal

## Hypoechoic



## Hyperechoic



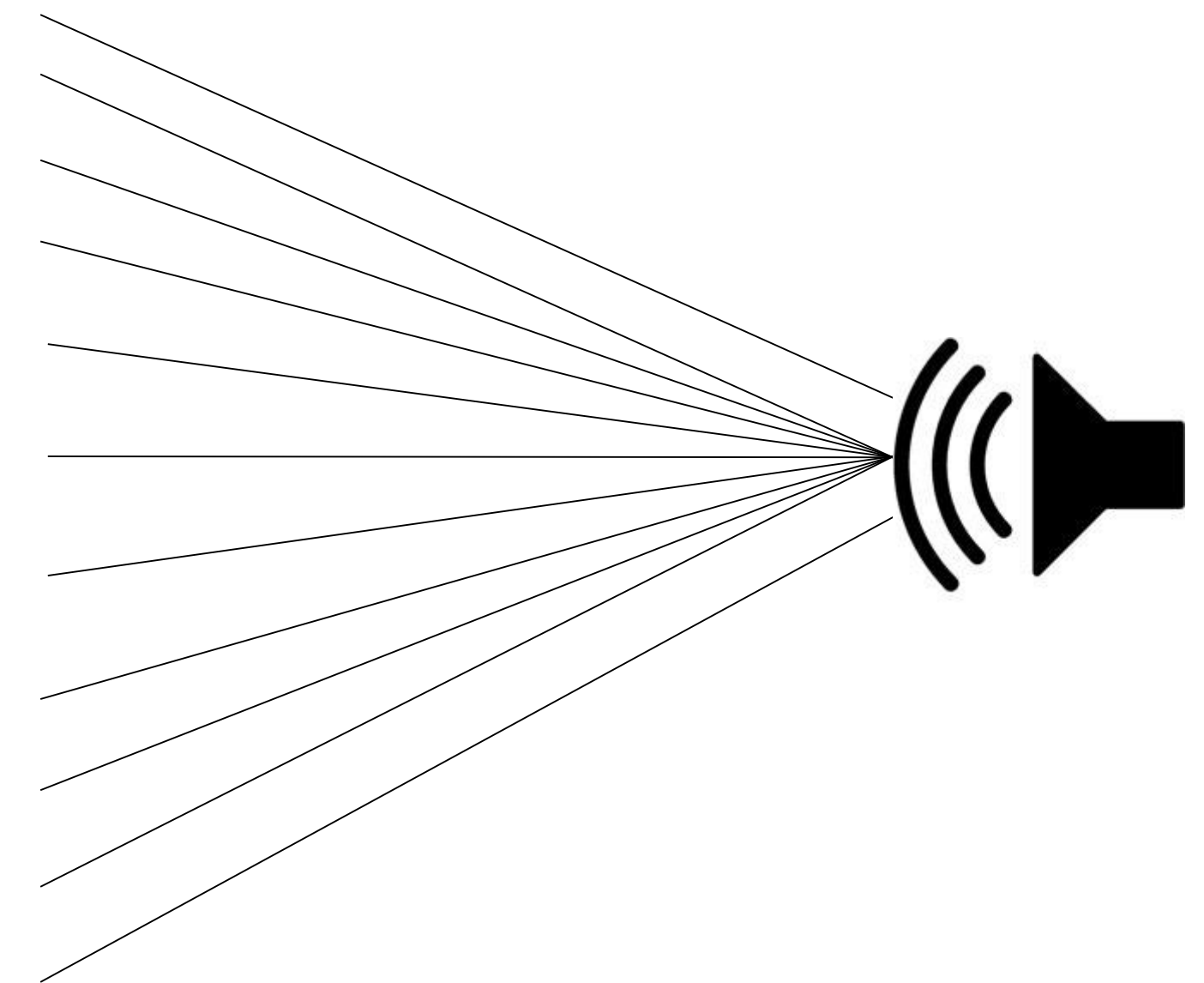
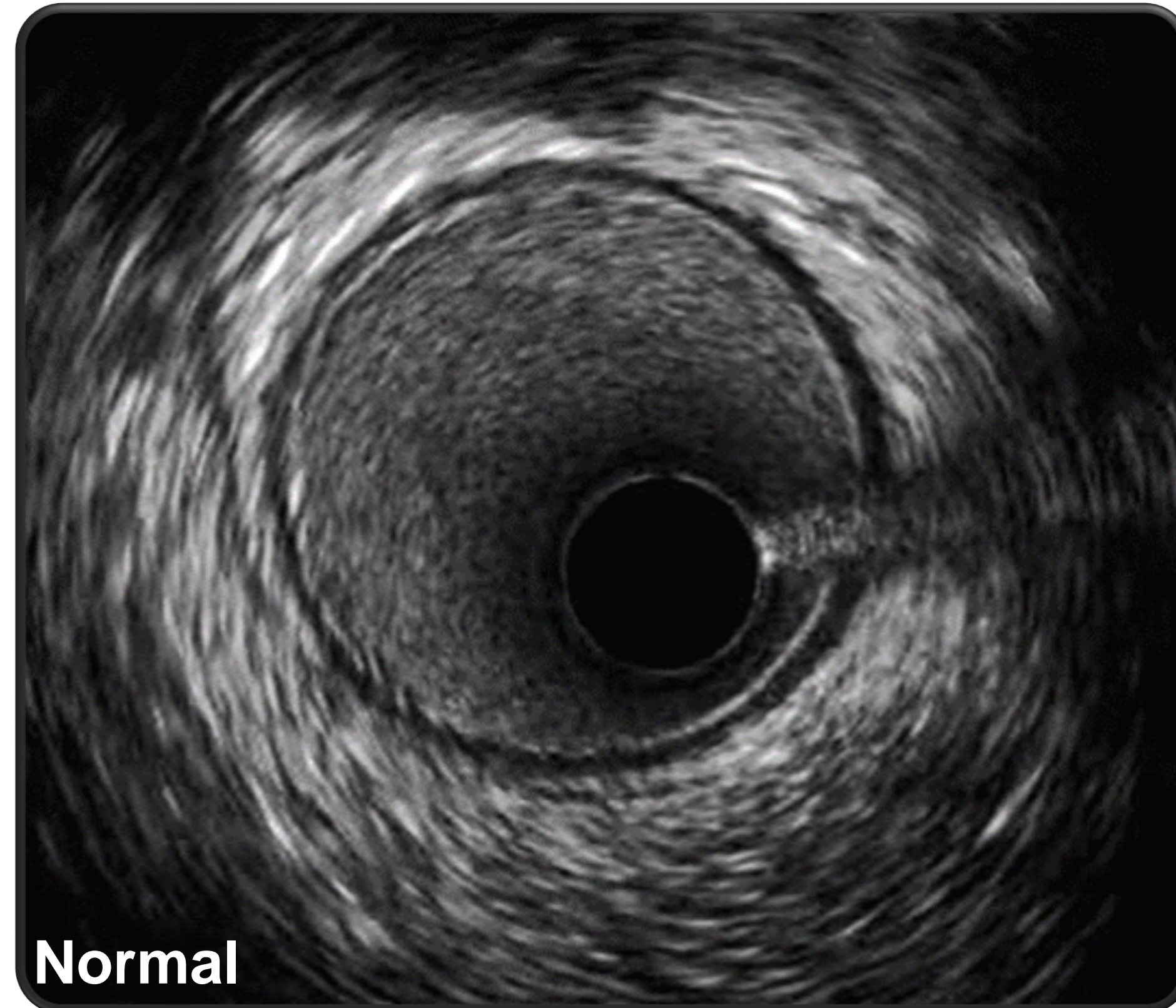
# IVUS Image Interpretation

Is there plaque?

No

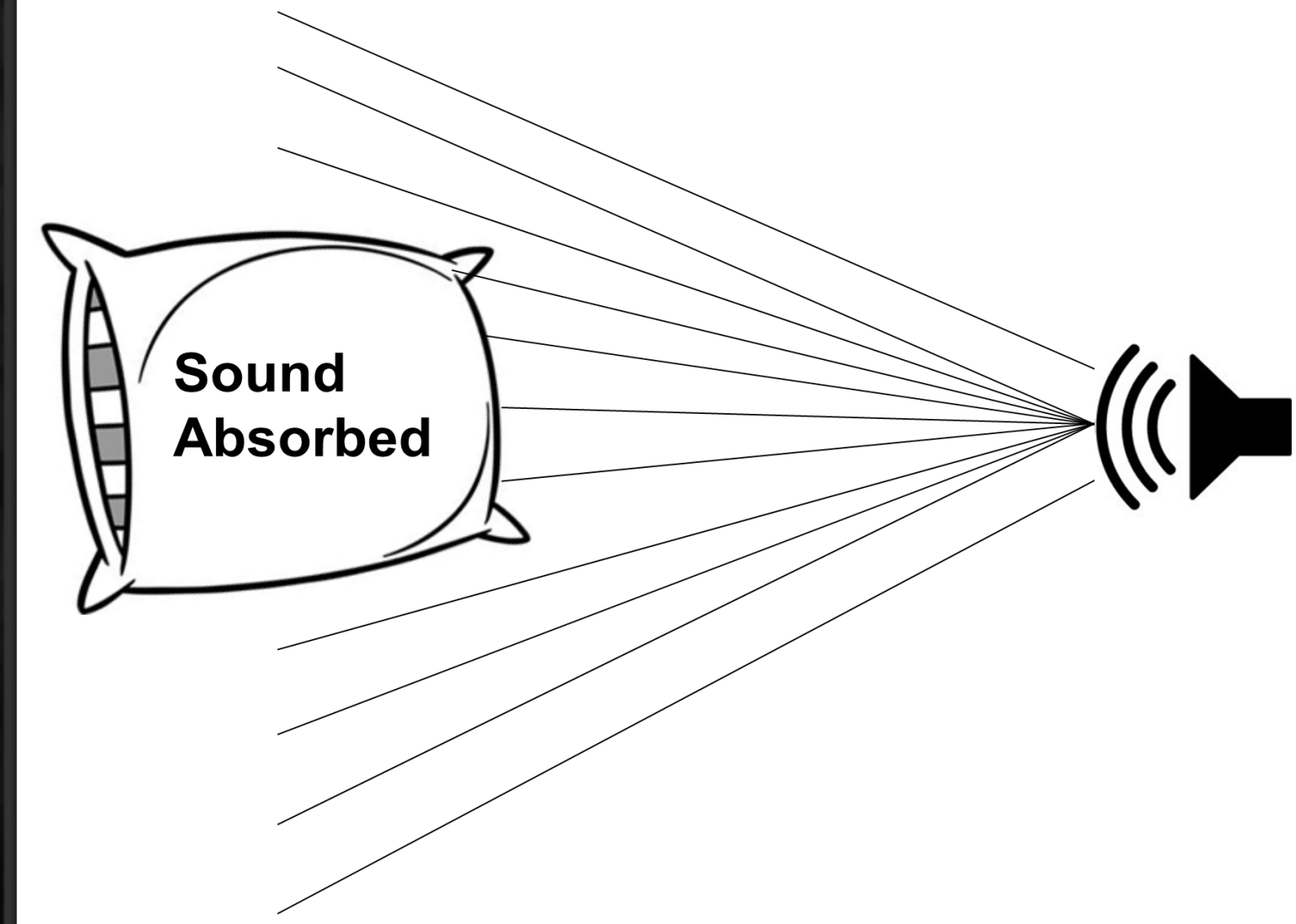
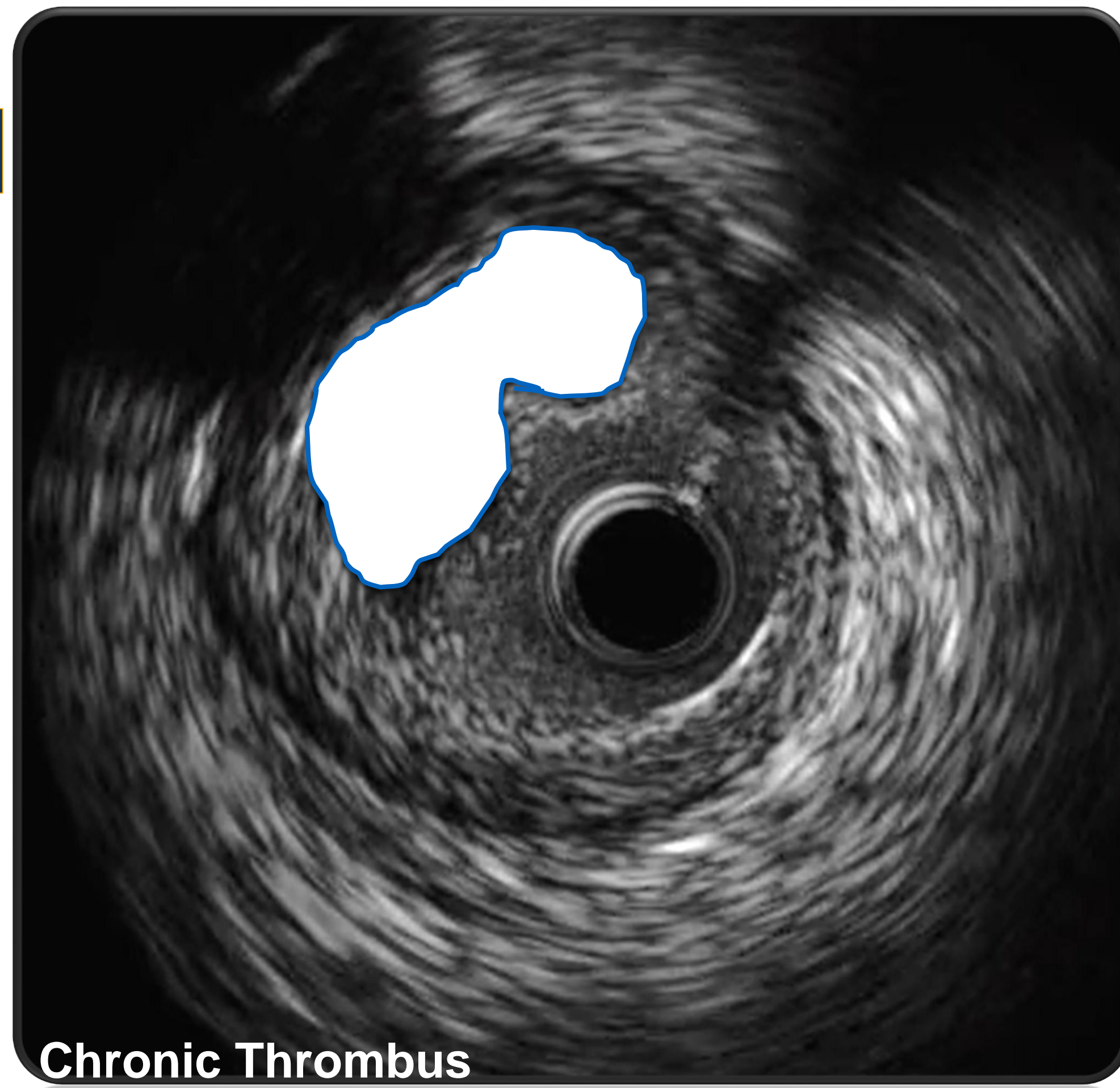
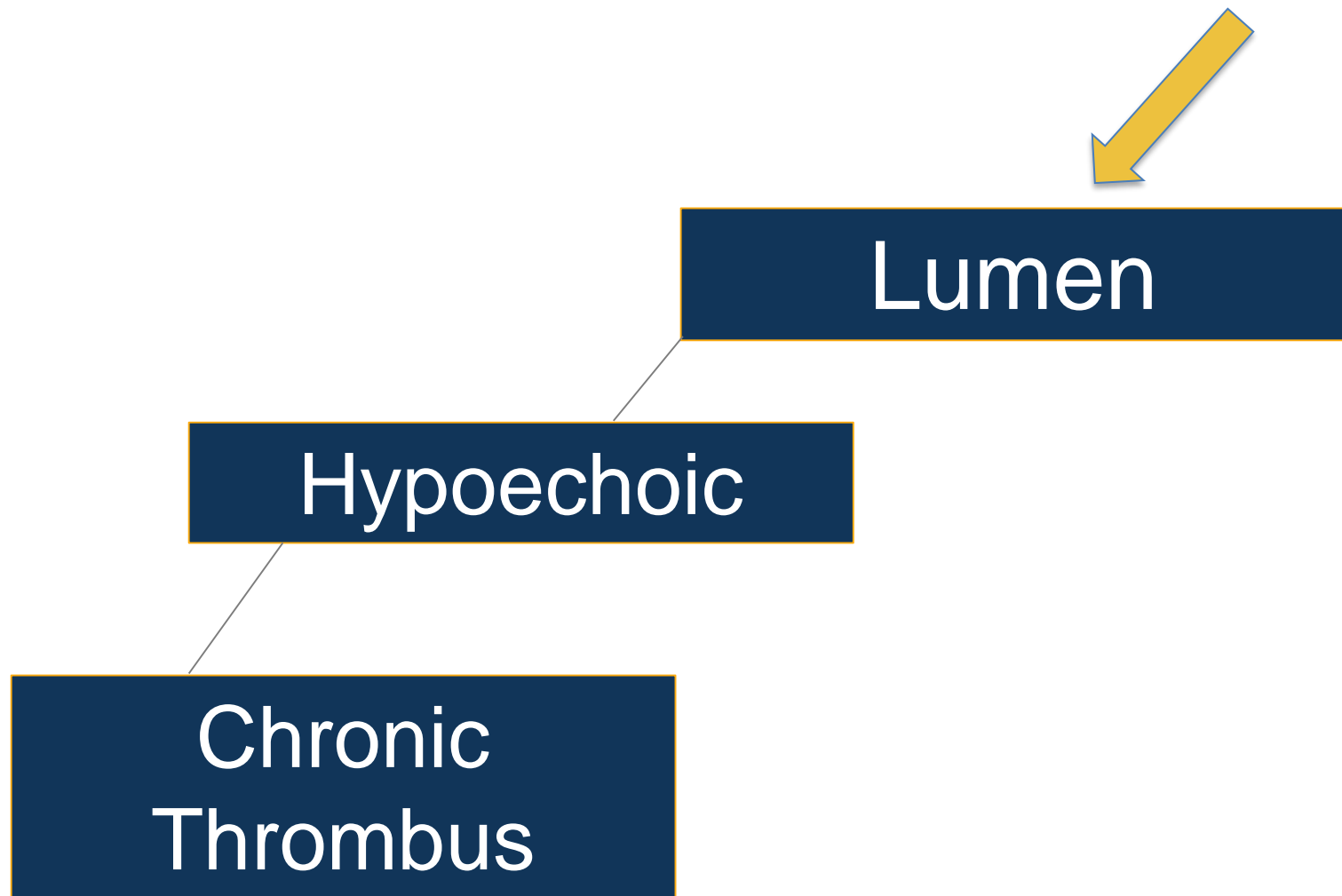


- Normal Artery



# IVUS Image Interpretation

Is the plaque within the lumen or the wall?



# IVUS Image Interpretation

Is the plaque within the lumen or the wall?

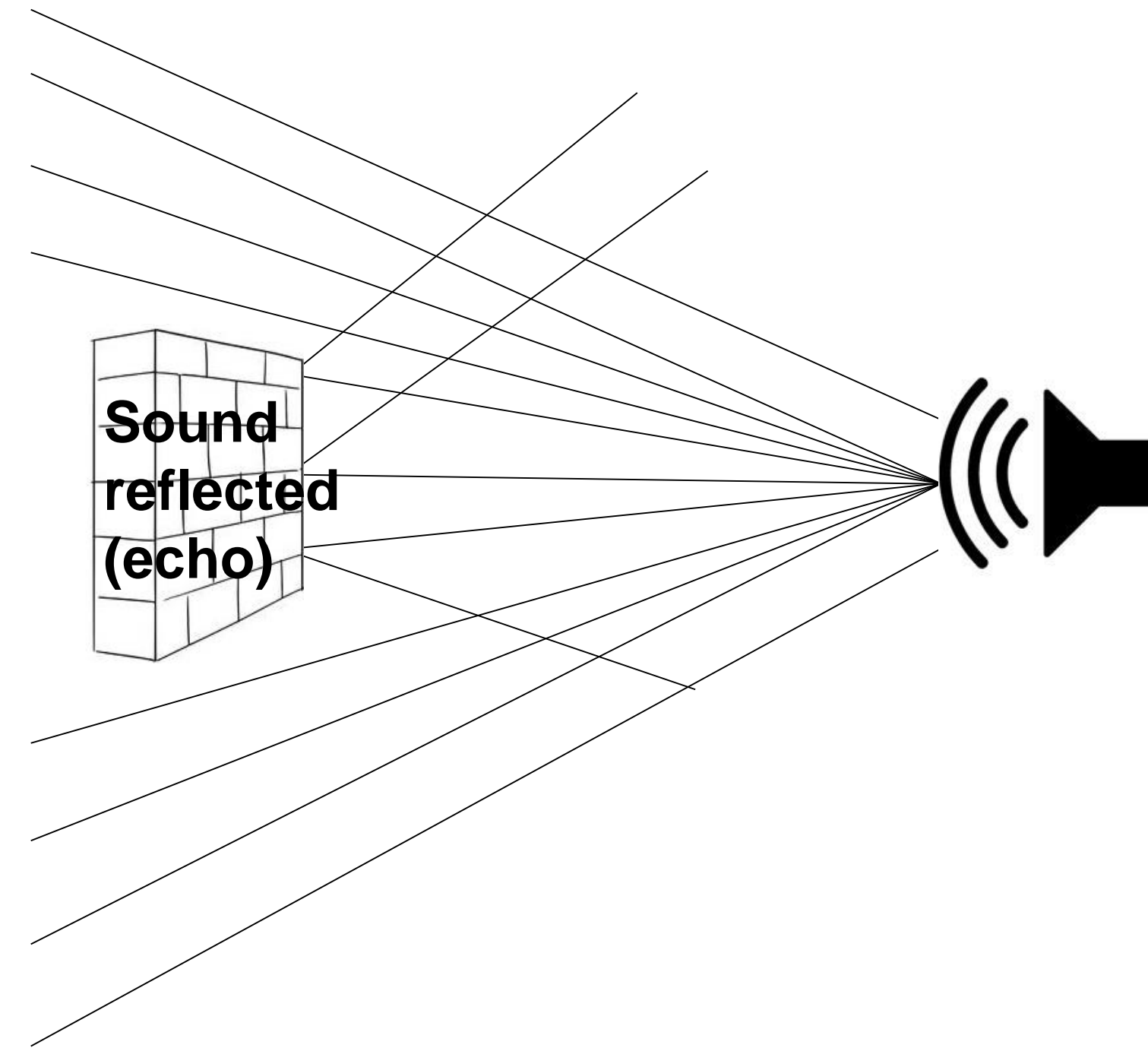
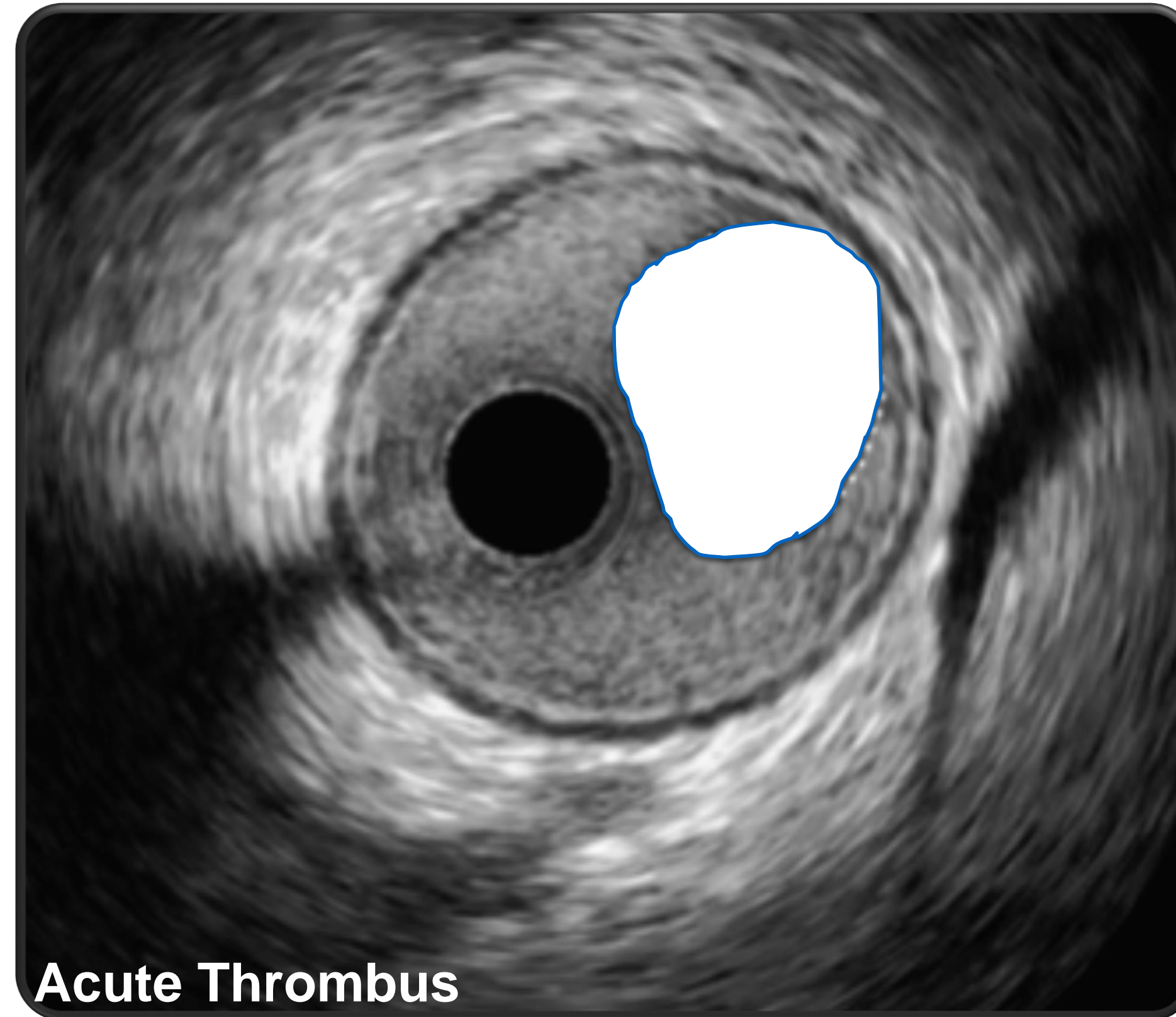
Lumen

Hyperechoic

Is there a shadow?

No

Acute Thrombus





# IVUS Image Interpretation

Is the plaque within the lumen or the wall?

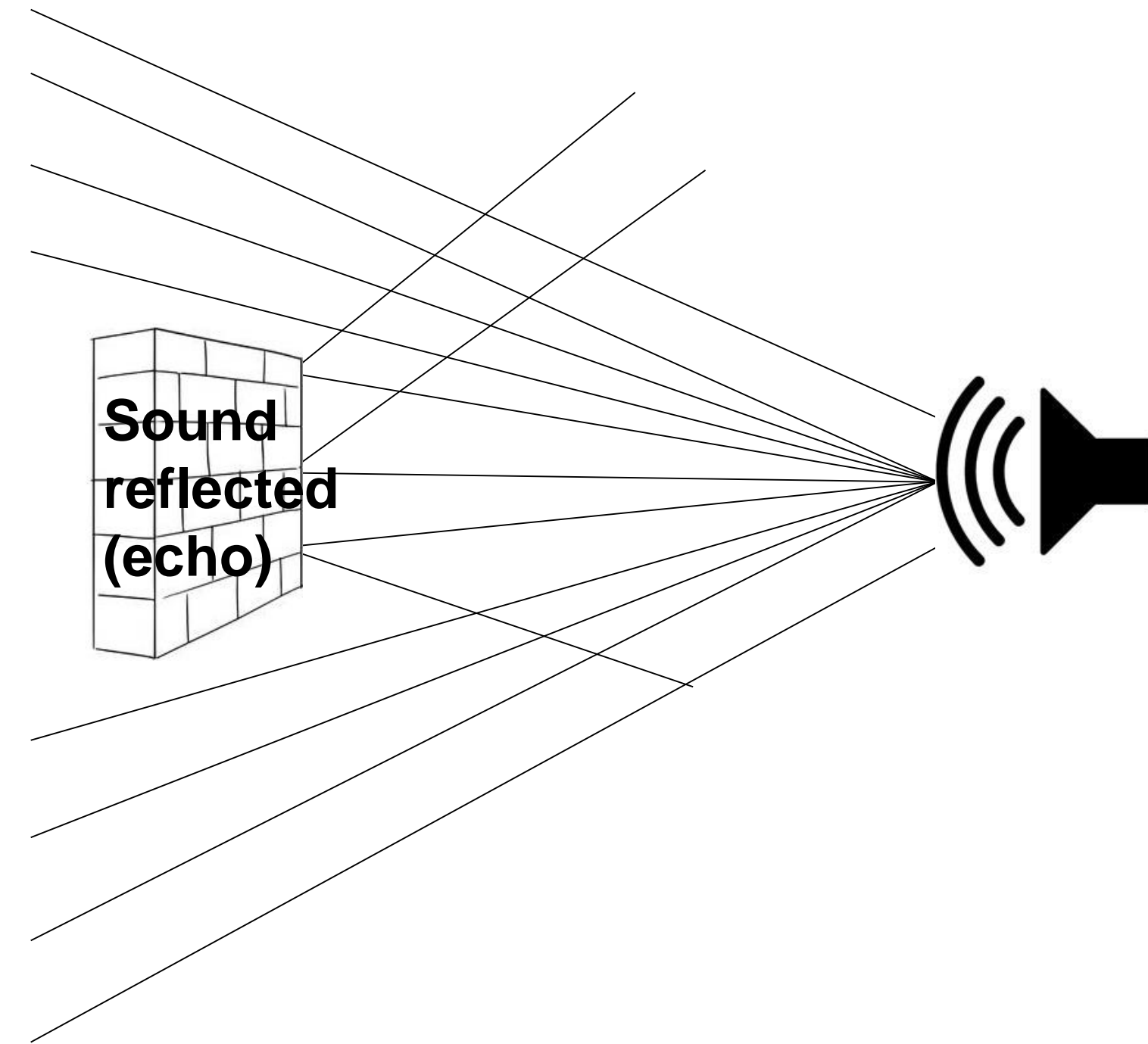
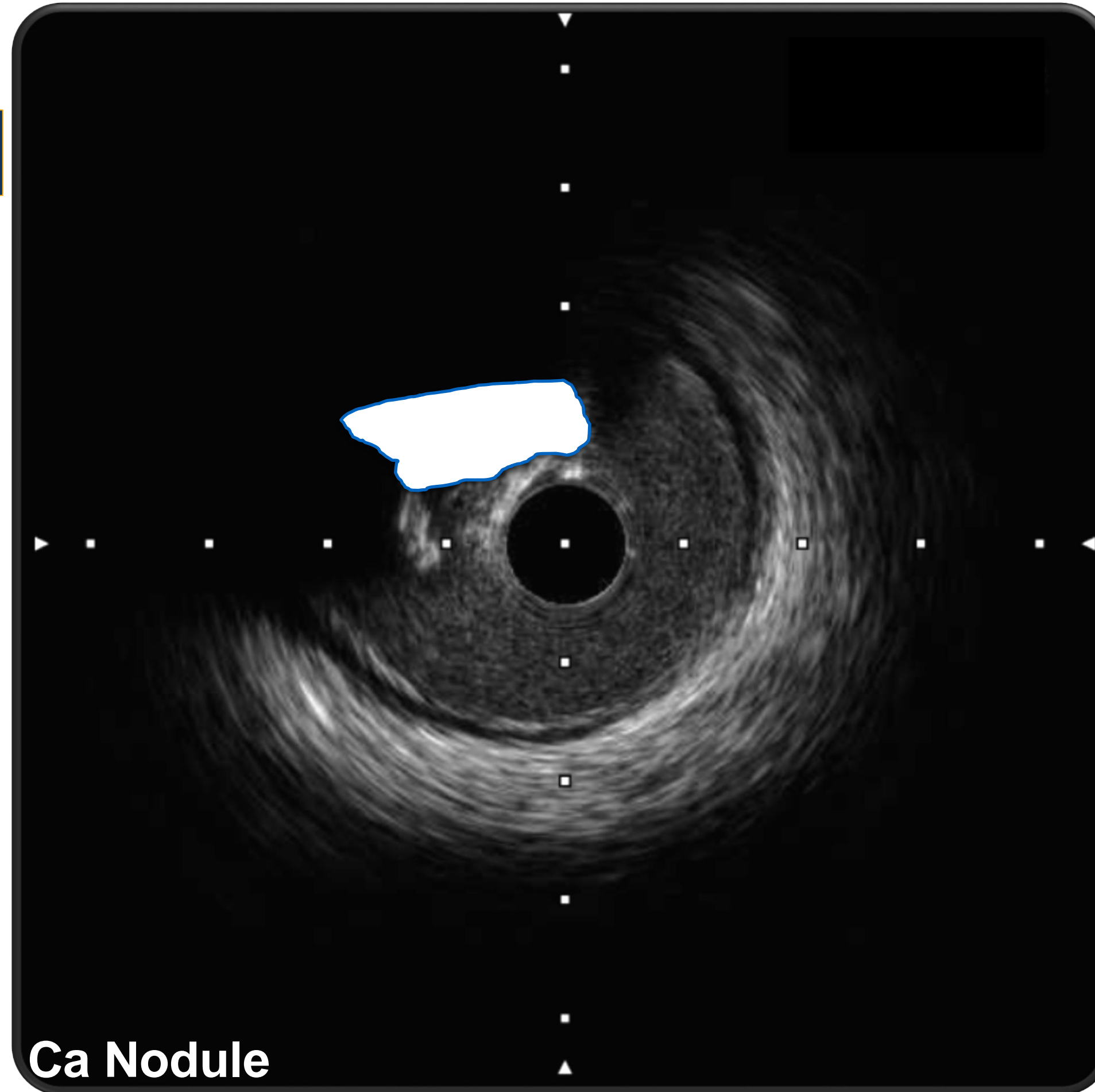
Lumen

Hyperechoic

Is there a shadow?

Yes

Calcified Nodule



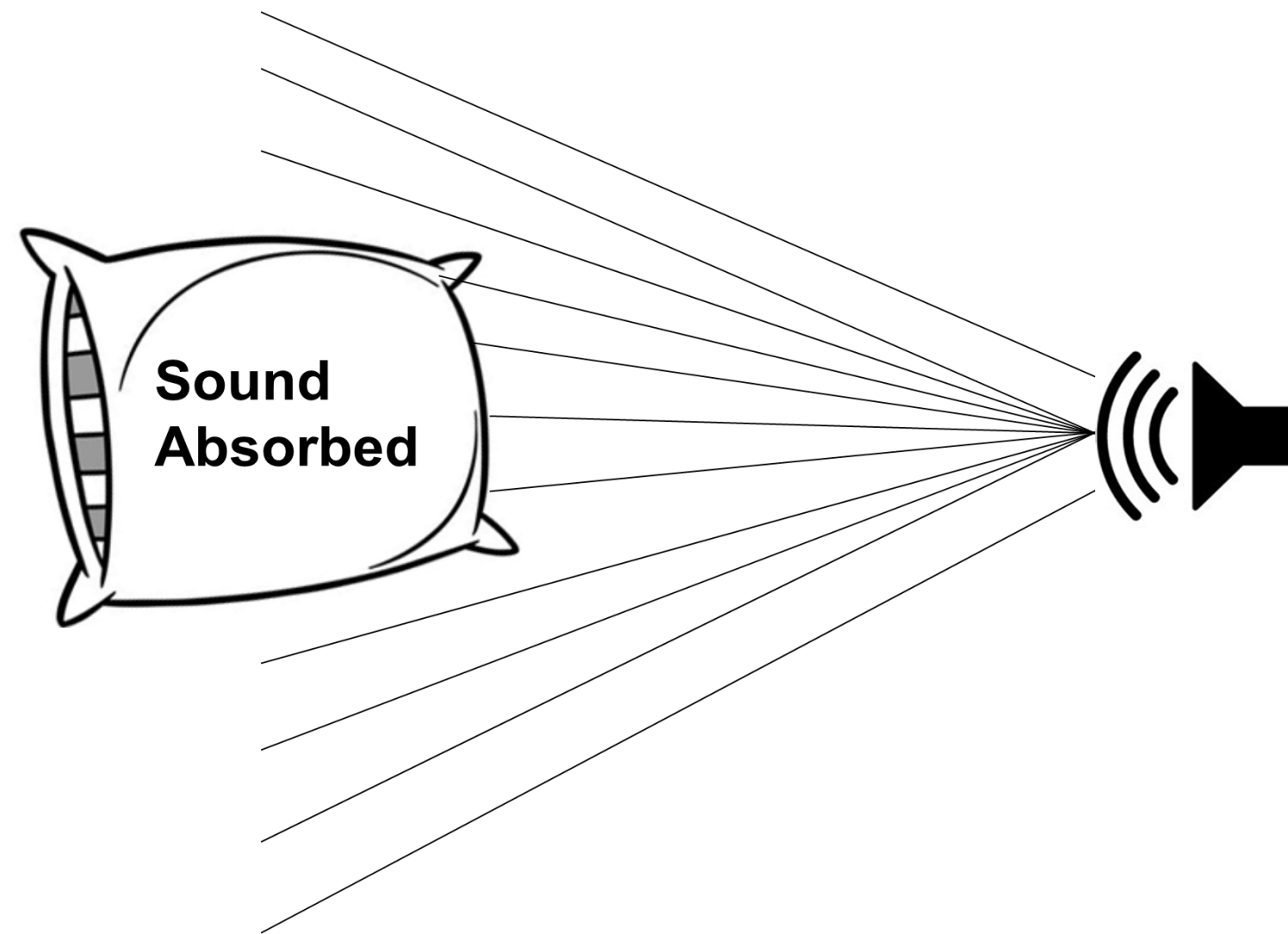
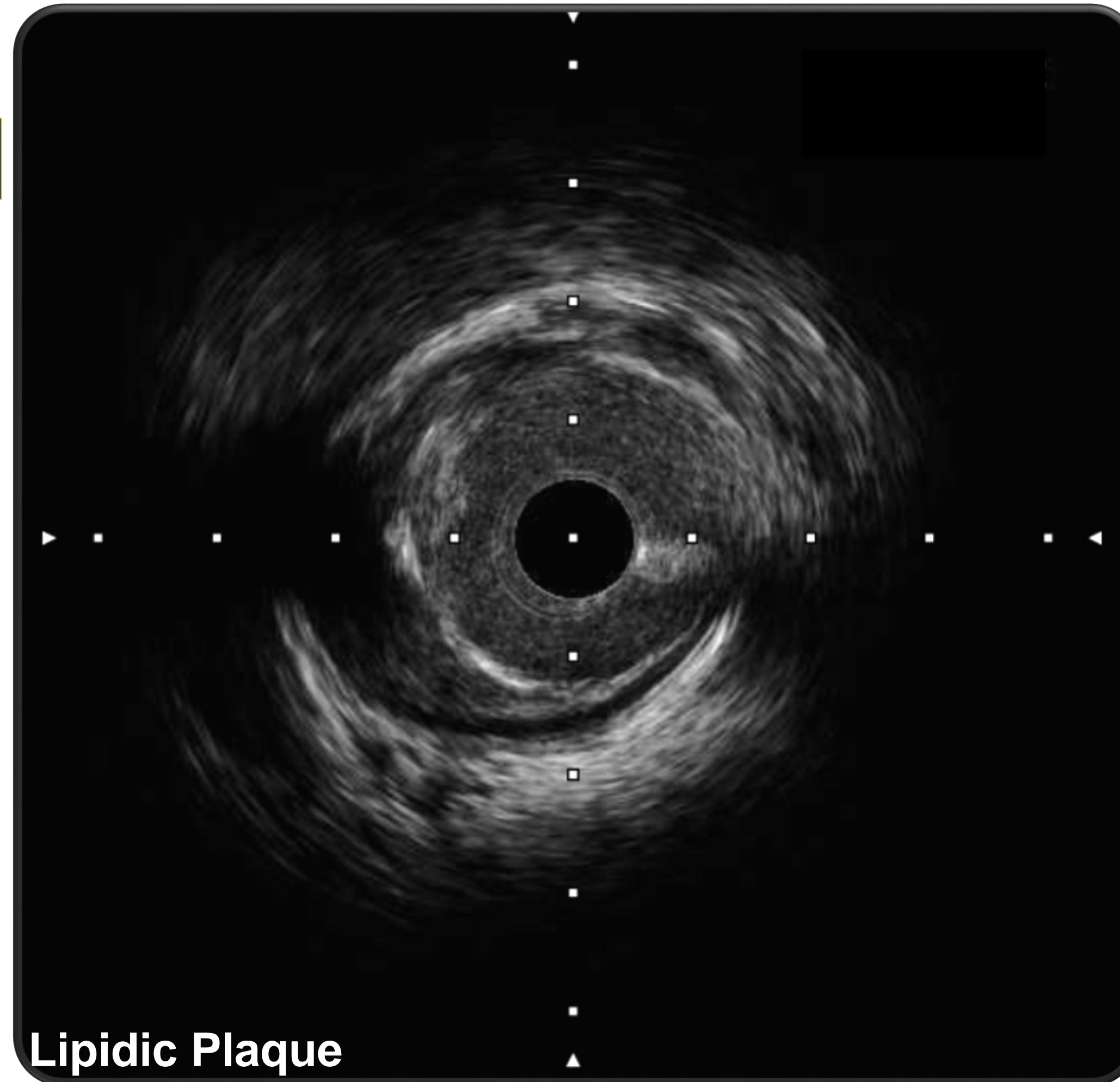
# IVUS Image Interpretation

Is the plaque within the lumen or the wall?

Wall

Hypoechoic

Lipid



# IVUS Image Interpretation

Is the plaque within the lumen or the wall?

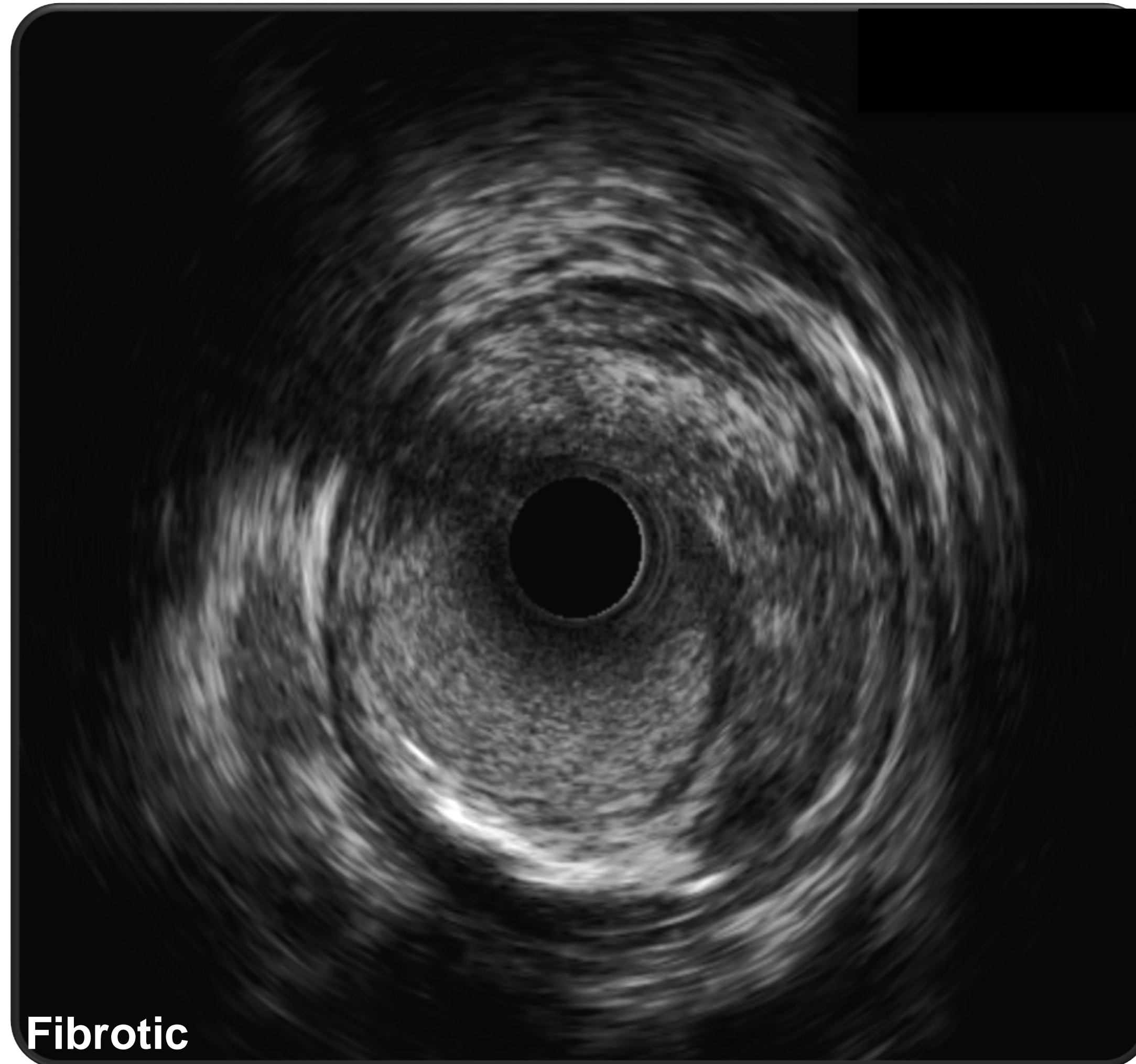
Wall

Hyperechoic

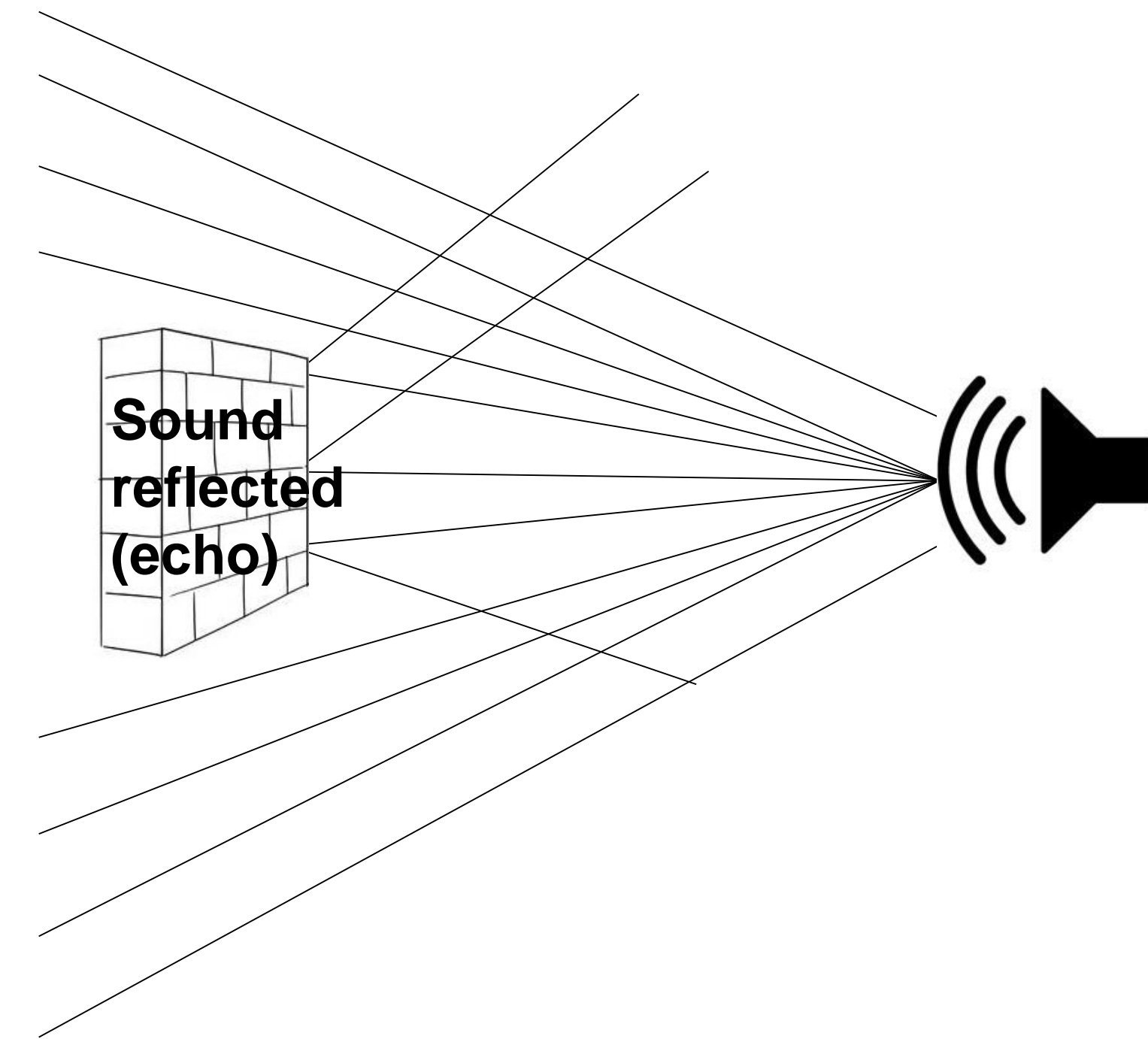
Is there a shadow?

No

Fibrous



Fibrotic



# IVUS Image Interpretation

Is the plaque within the lumen or the wall?

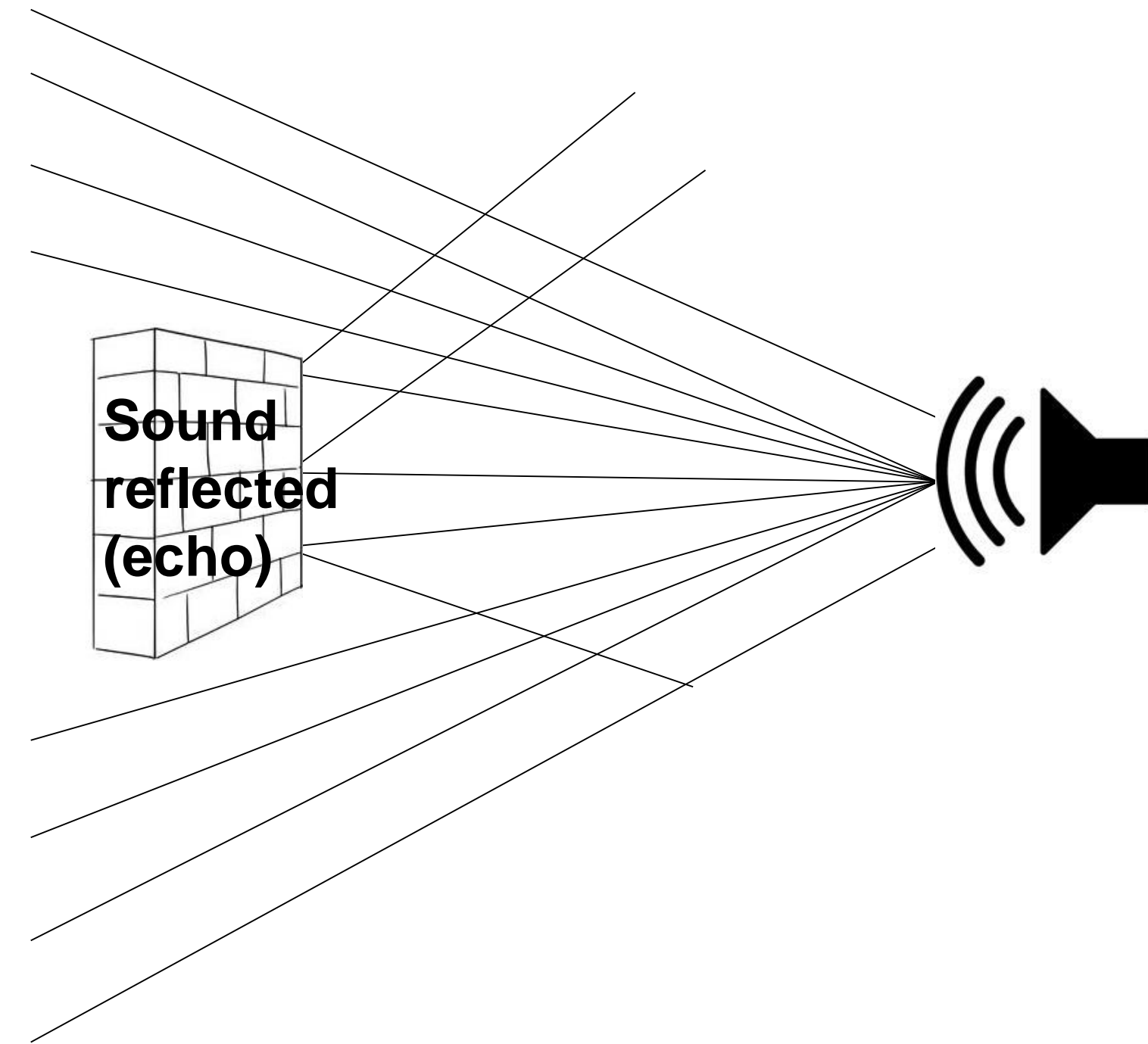
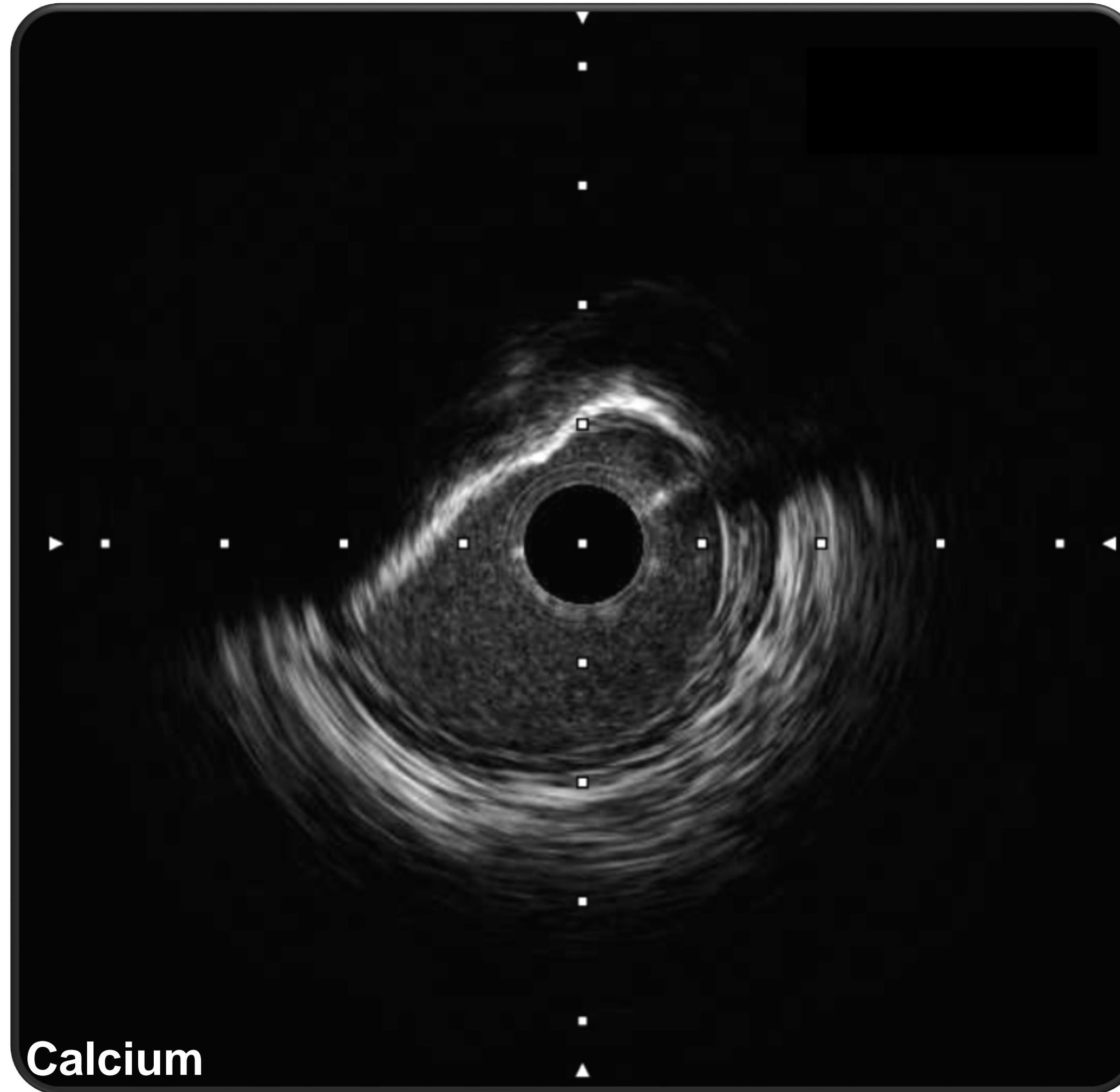
Wall

Hyperechoic

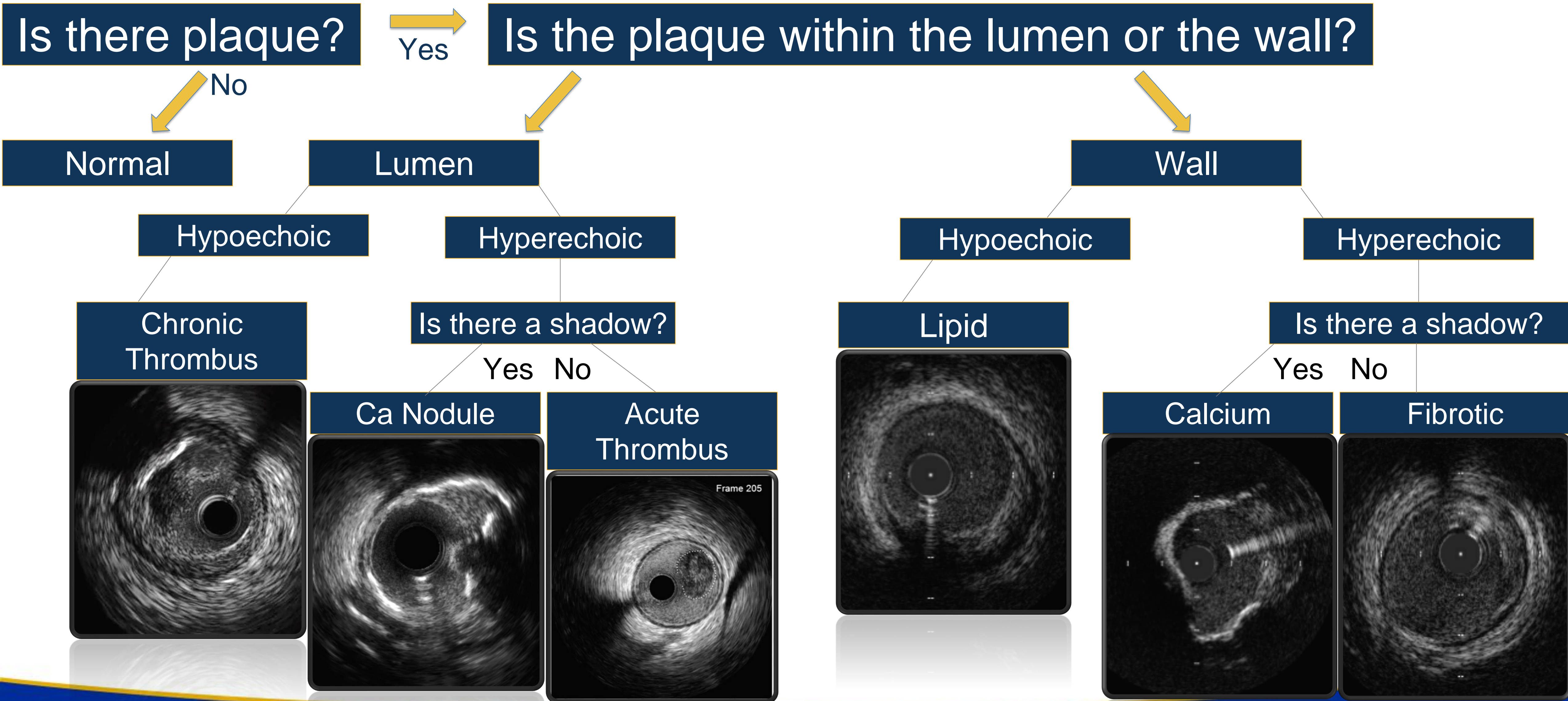
Is there a shadow?

Yes

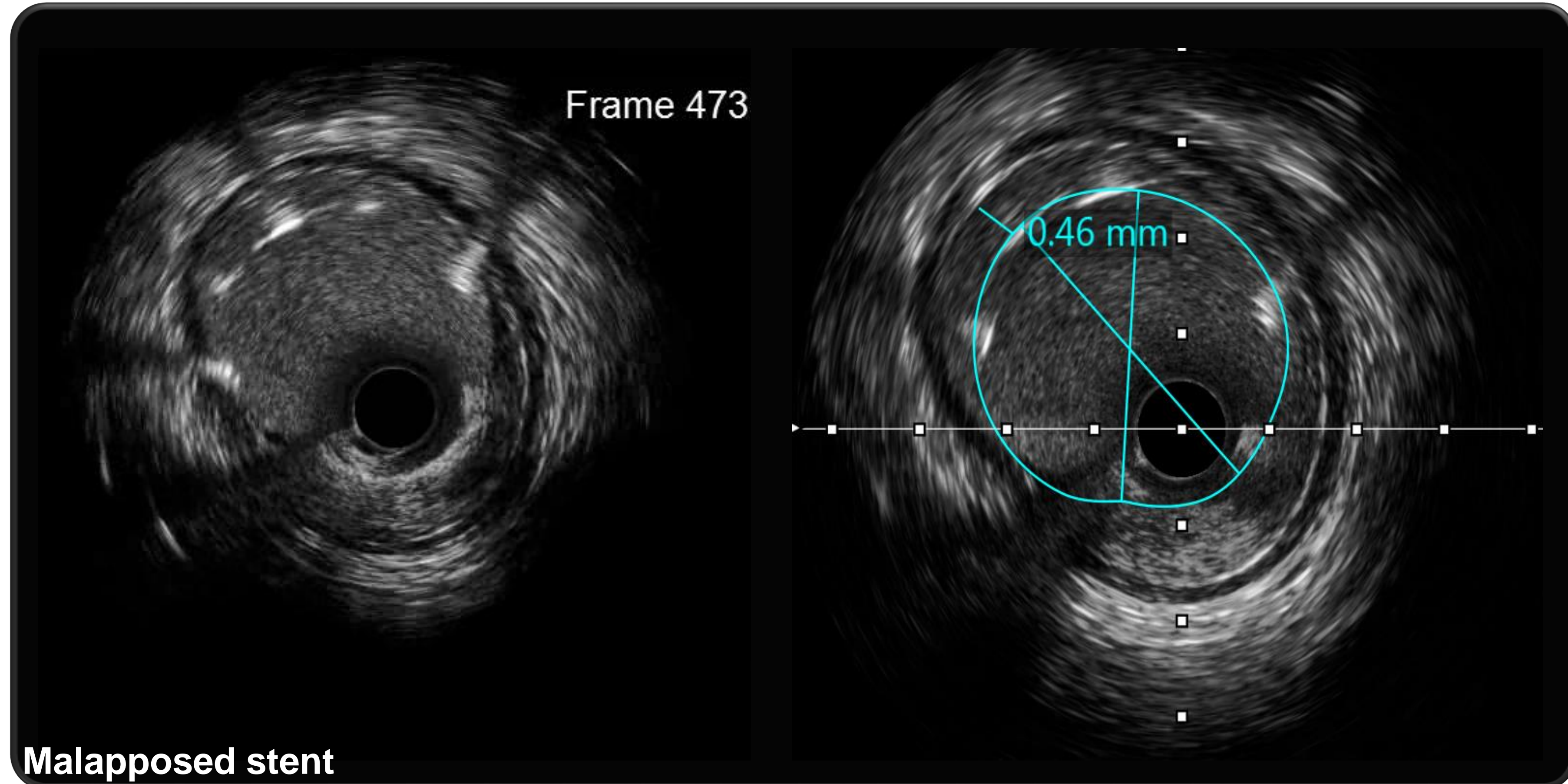
Calcium



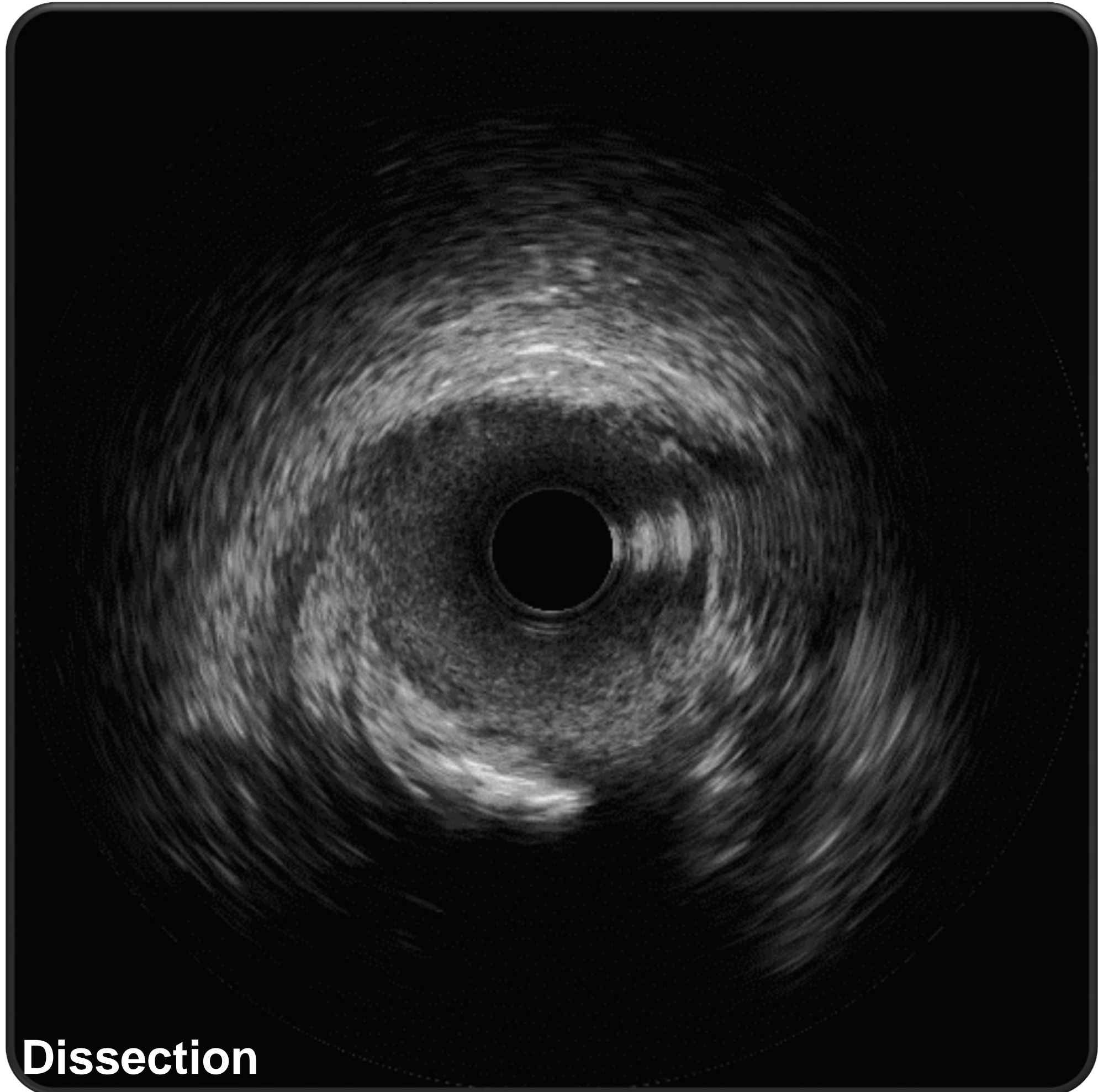
# IVUS Image Interpretation



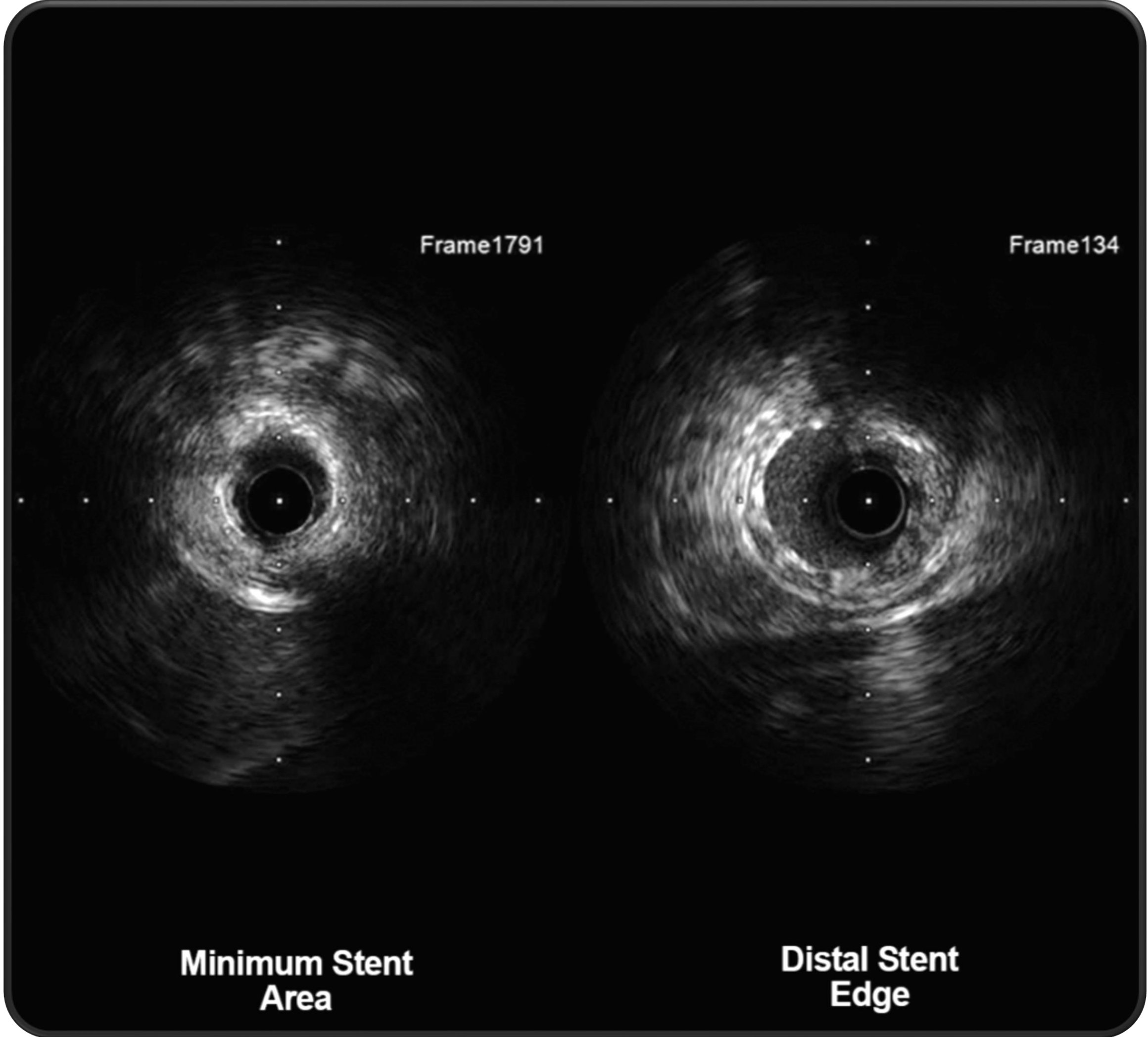
# IVUS Image Interpretation



# IVUS Image Interpretation



# IVUS Image Interpretation



Minimum Stent Area

Distal Stent Edge



# Summary

- Using an algorithmic approach to image interpretation can simplify what seems complex
- The fundamentals of OCT are based on the principles of light attenuation
- The fundamentals of IVUS are based on the principles of sound
- Practice makes perfect