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A Evolutionary Tale of a CFR and CTO

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Mount Elizabeth™ ORCHARD

EH Heart Specialist Private Limited

Cardiac PET

- Positron emission tomography (PET) myocardial perfusion imaging affords the assessment of regional myocardial blood flow (MBF) of the left ventricle in absolute terms (ml/gm/min).

- Non-invasive Cardiac evaluation with quantification of MBF and myocardial flow reserve (MFR) extend the scope of conventional myocardial perfusion imaging from detection of end-stage, advanced, and flow-limiting coronary artery disease(CAD) to early stages of atherosclerosis and microvascular dysfunction.

MBF Assessment With Rb-82 PET

El Fakhri et al (Brigham & Women's Hospital) J Nucl Med 2005

Back in Year 2006

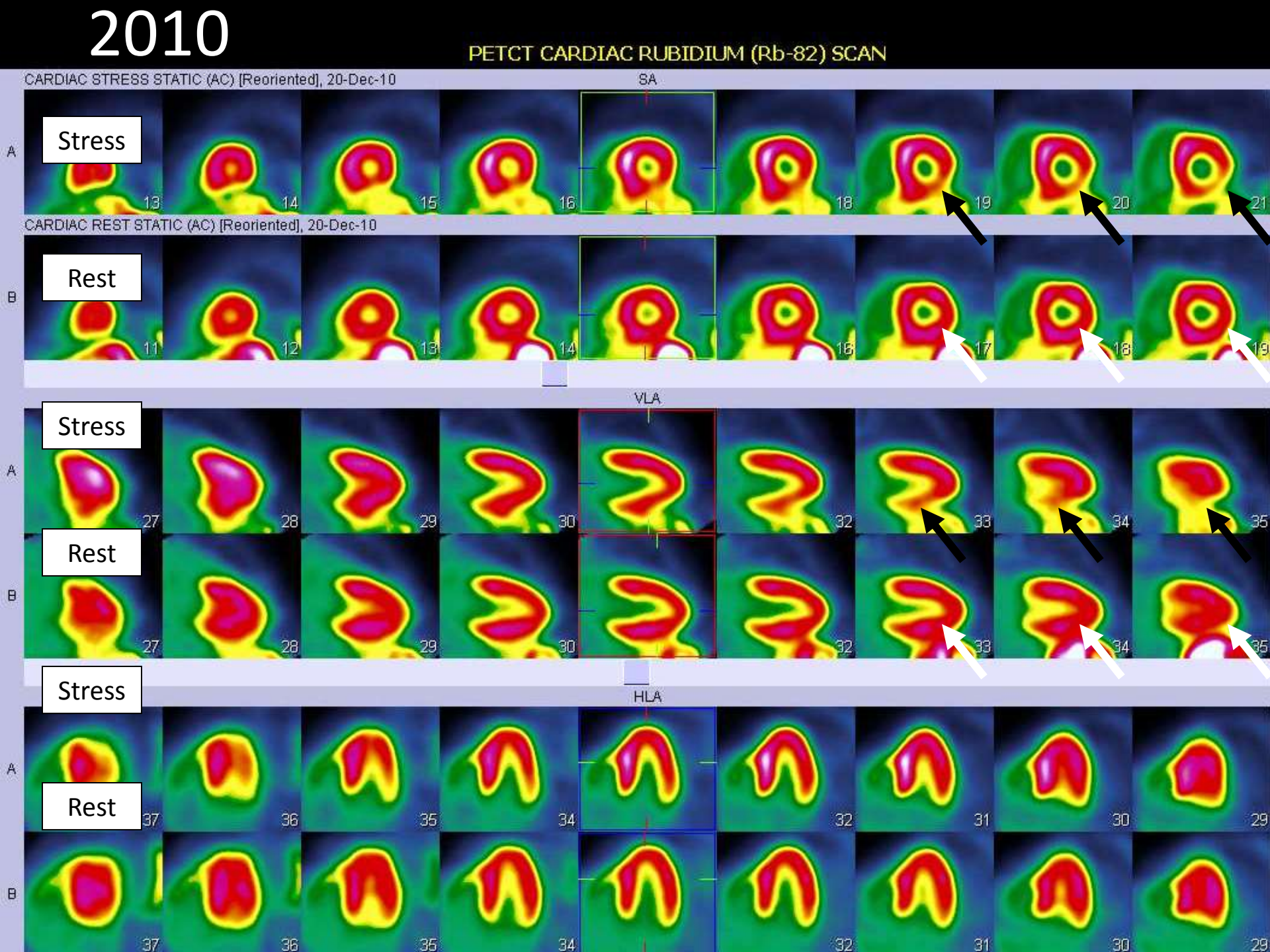
- 37 year old man
- Clinically asymptomatic
- For health screening
- Positive treadmill at a very low cardiac workload
- Found to have Double Vessel Disease – pLAD and pRCA (CTO)
- Had PCI in another center (pLAD only)

In Year 2010

- Presented for second opinion
- Anxious regarding incomplete revascularisation
- Keen to return to active lifestyle
- Anxiety neurosis and fearful of invasive procedure
- Family disharmony

- Non-invasive Myocardial Perfusion performed – Cardiac PET (Positron Emission Tomography)

2010


PETCT CARDIAC RUBIDIUM (Rb-82) SCAN
CARDIAC STRESS STATIC (AC) [Reoriented], 20-Dec-10
SA
Stress
A
13
14
15
16
18
19
20
21
CARDIAC REST STATIC (AC) [Reoriented], 20-Dec-10
Rest
B
11
12
13
14
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17
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19
VLA
Stress
A
27
28
29
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32
33
34
35
Rest
B
27
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Stress
HLA
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Rest
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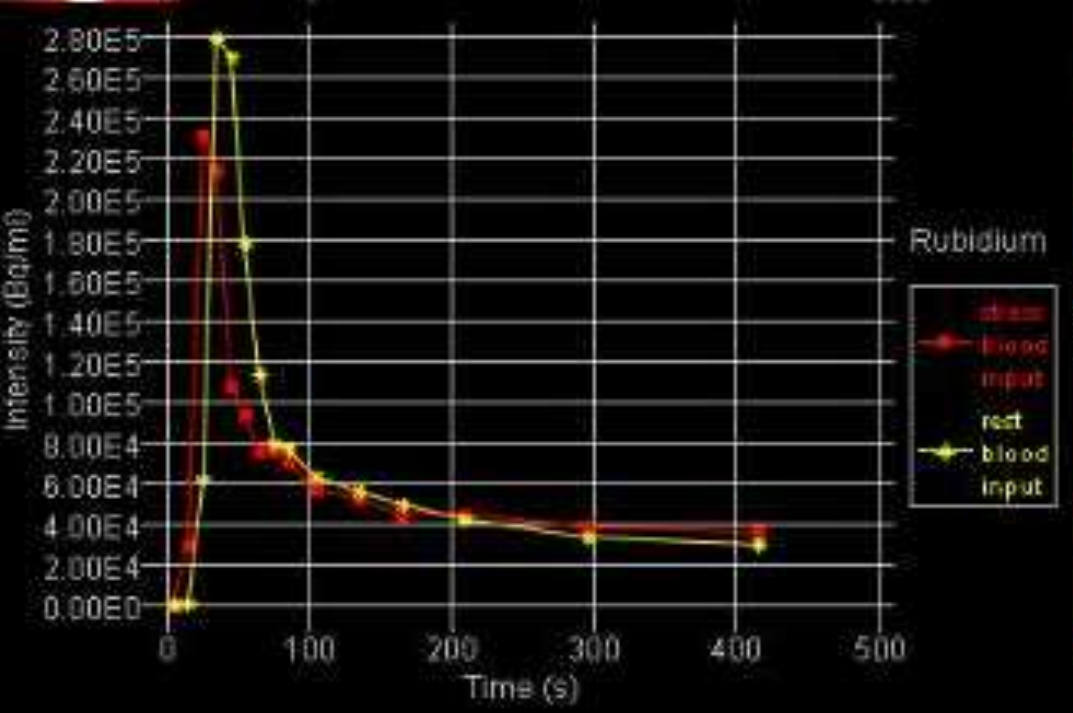
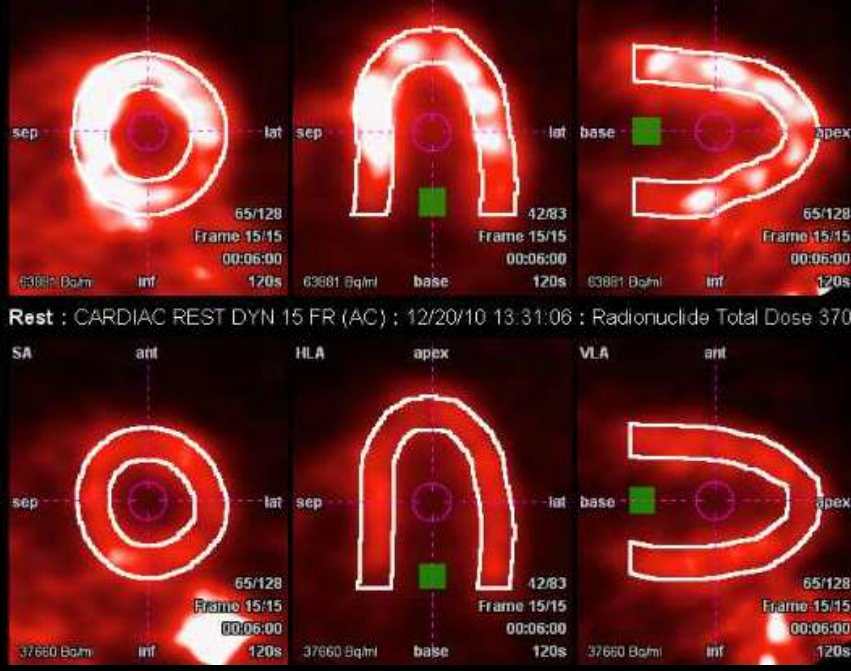




	QMP (ml/g/min)				Reserve	
	Stress		Rest			
	mean	std dev.	mean	std dev.	mean	std dev.
LAD	2.86	0.59	0.92	0.21	3.16	0.53
LCX	2.15	0.80	0.93	0.35	2.38	0.63
RCA	1.82	0.75	0.96	0.27	1.89	0.54
Global	2.42	0.82	0.93	0.27	2.65	0.78

In Year 2010

- Cardiac PET demonstrates
  - Mild ischemia in RCA territory
  - Abnormal Coronary Flow Reserve (CFR) in RCA territory
- Coronary Angiogram
  - Patent Stent in LAD
  - CTO of RCA with good collaterals
- Optimal Medical Therapy
  - Anti-platelet
  - Statins
  - Beta-Blockers

But in Year 2012

Presented with:

- Exertional Shortness of Breath

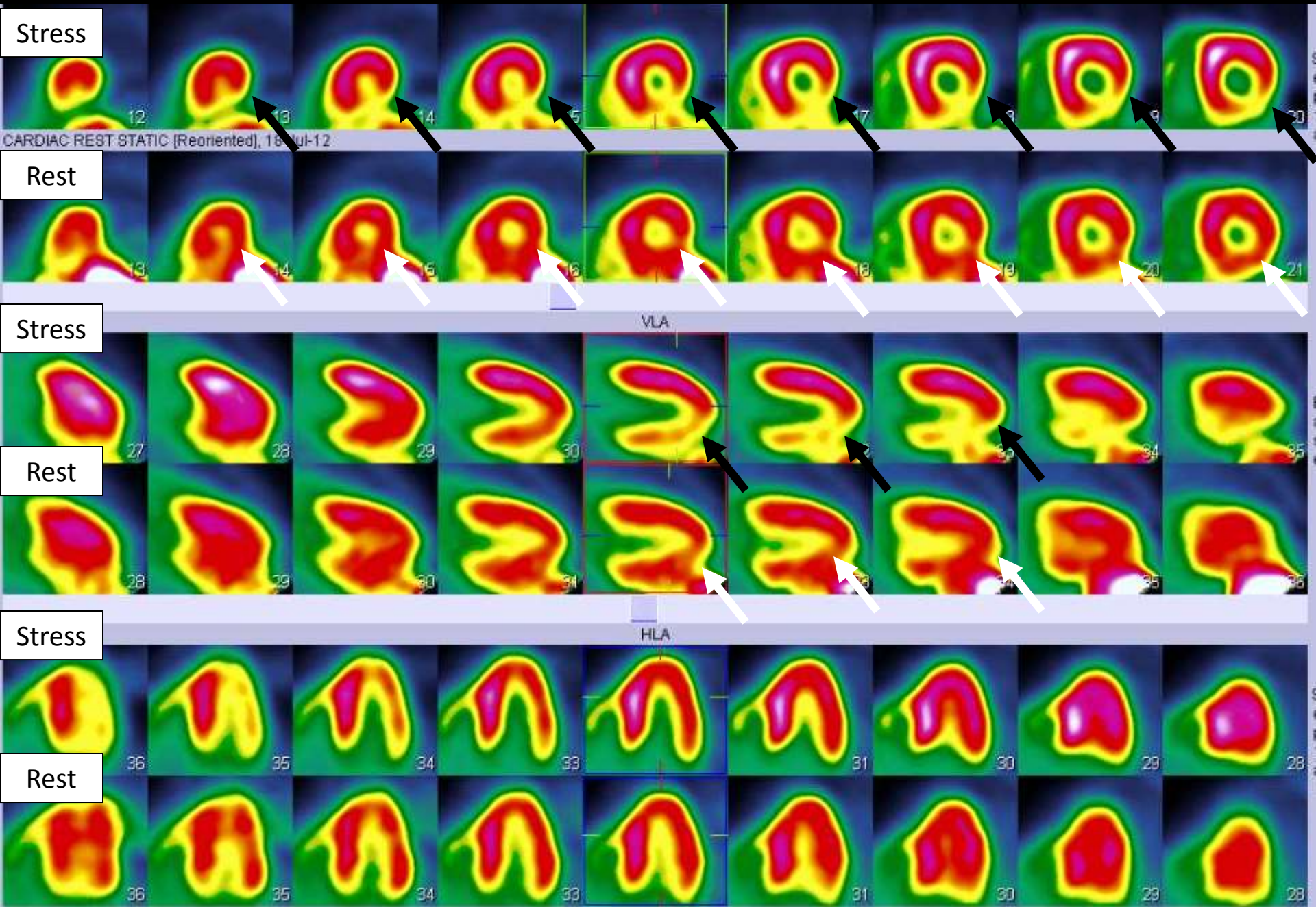
However:

- Decline invasive assessment again

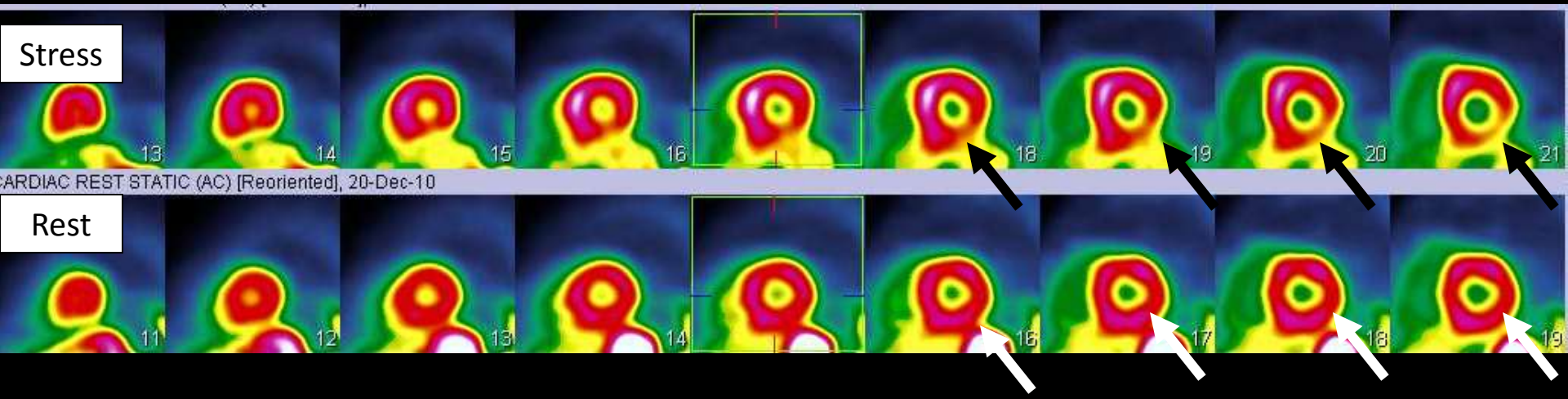
Advise:

- Repeat Cardiac PET

2012


Stress
CARDIAC REST STATIC (Reoriented), 18 Jul-12
Rest
Stress
VLA
Rest
Stress
HLA
Rest

2010


Stress
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ARDIAC REST STATIC (AC) [Reoriented], 20-Dec-10
Rest
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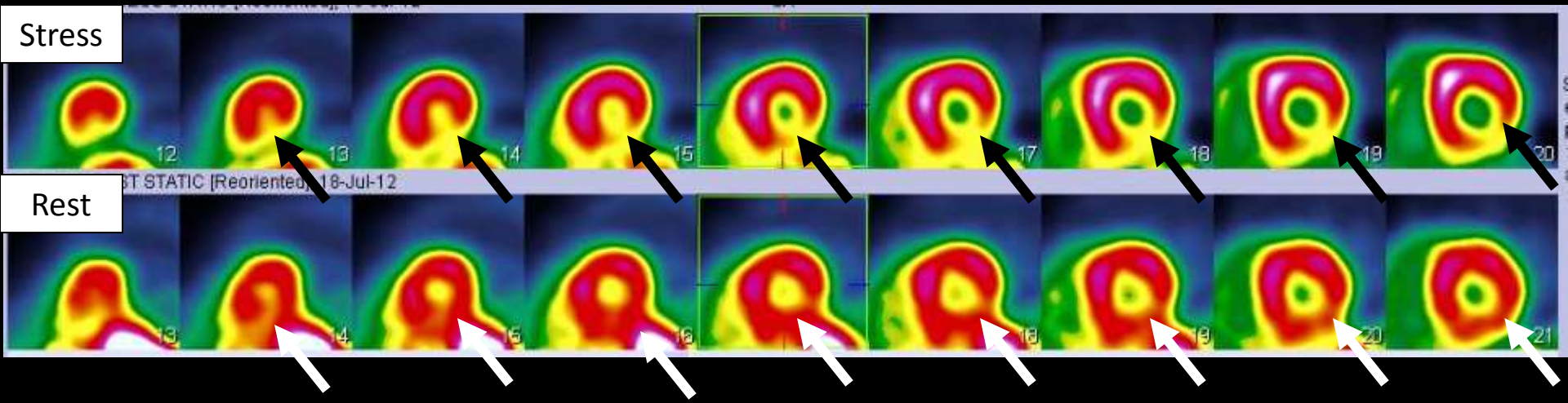
2012


Stress
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T STATIC [Reoriented] 18-Jul-12
Rest
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CFR

2010

	QMP (ml/g/min)				Reserve	
	Stress		Rest			
	mean	std dev.	mean	std dev.	mean	std dev.
LAD	2.86	0.59	0.92	0.21	3.16	0.53
LCX	2.15	0.80	0.93	0.35	2.38	0.63
RCA	1.82	0.75	0.96	0.27	1.89	0.54
Global	2.42	0.82	0.93	0.27	2.65	0.78

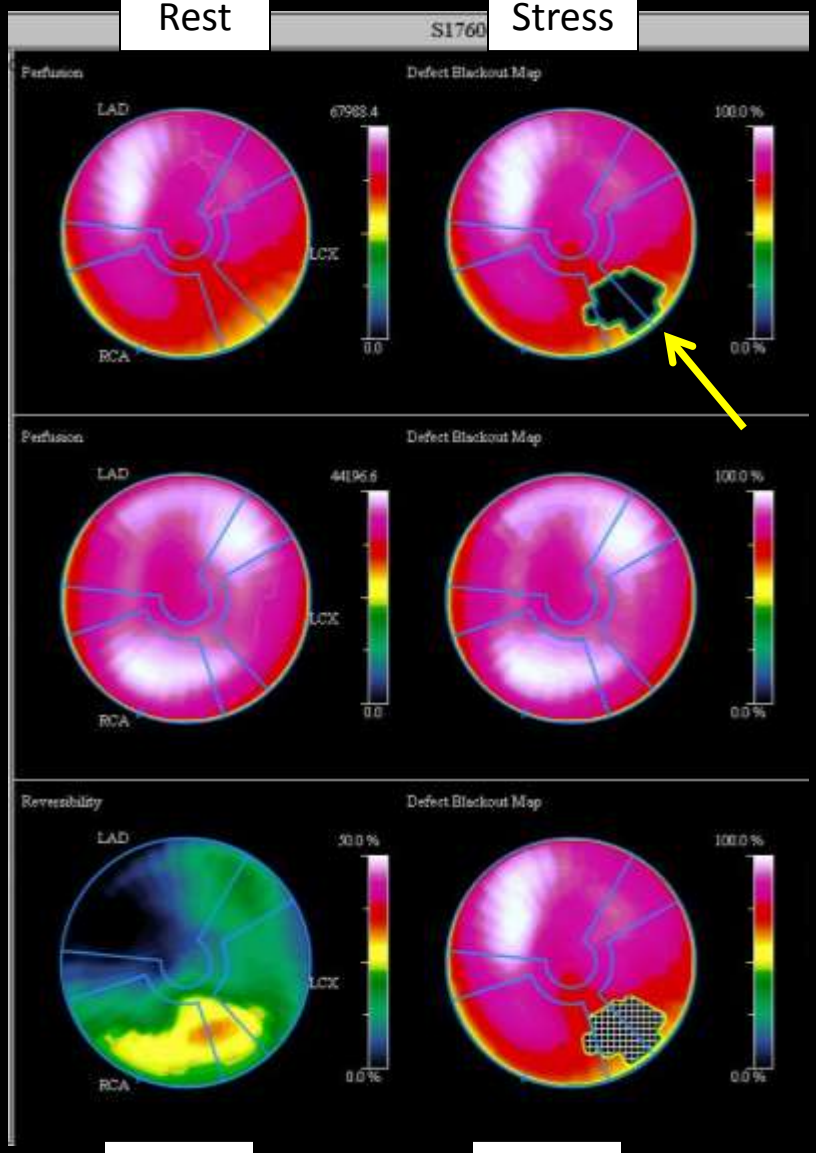
2012

	QMP (ml/g/min)				Reserve	
	Stress		Rest			
	mean	std dev.	mean	std dev.	mean	std dev.
LAD	2.43	0.71	0.92	0.17	2.62	0.58
LCX	1.53	0.52	0.82	0.20	1.87	0.49
RCA	1.52	0.65	0.76	0.15	1.99	0.78
Global	1.97	0.79	0.86	0.19	2.27	0.71

2010

Rest

Stress



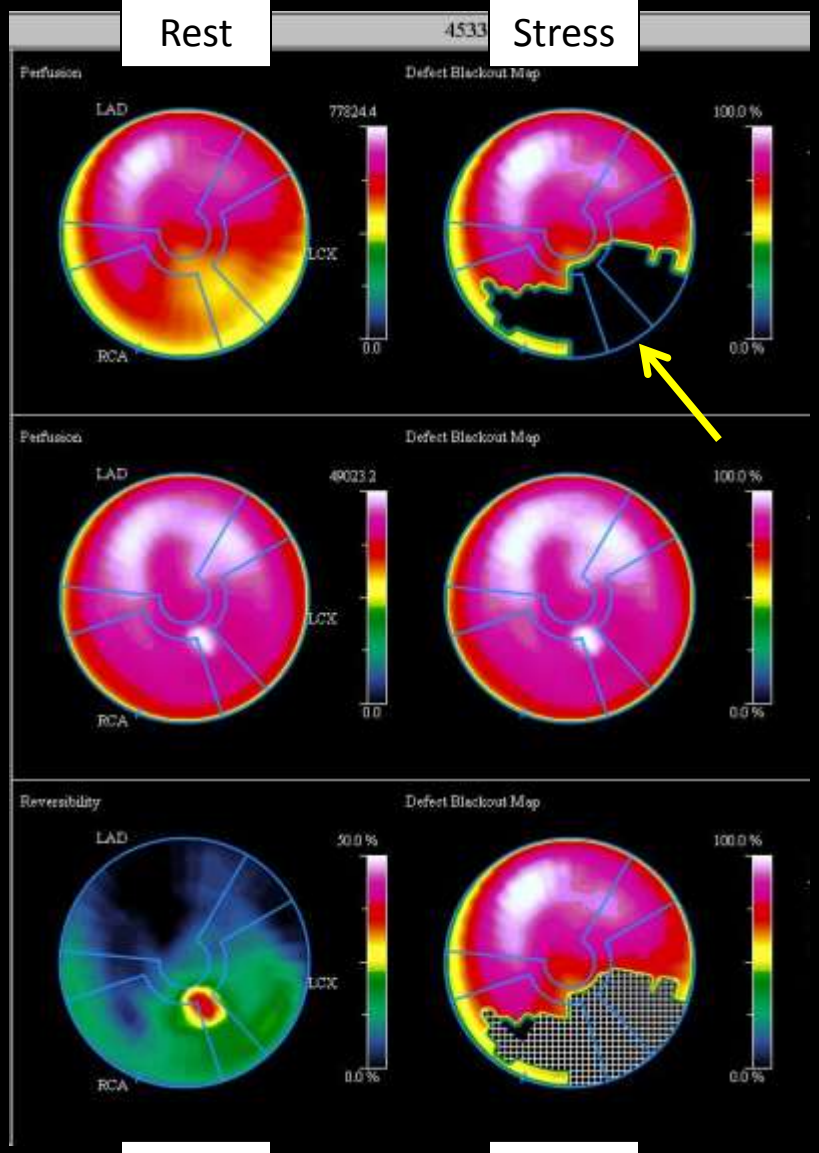
Rest

Stress

2012

Rest

Stress



Rest

Stress

Year 2012

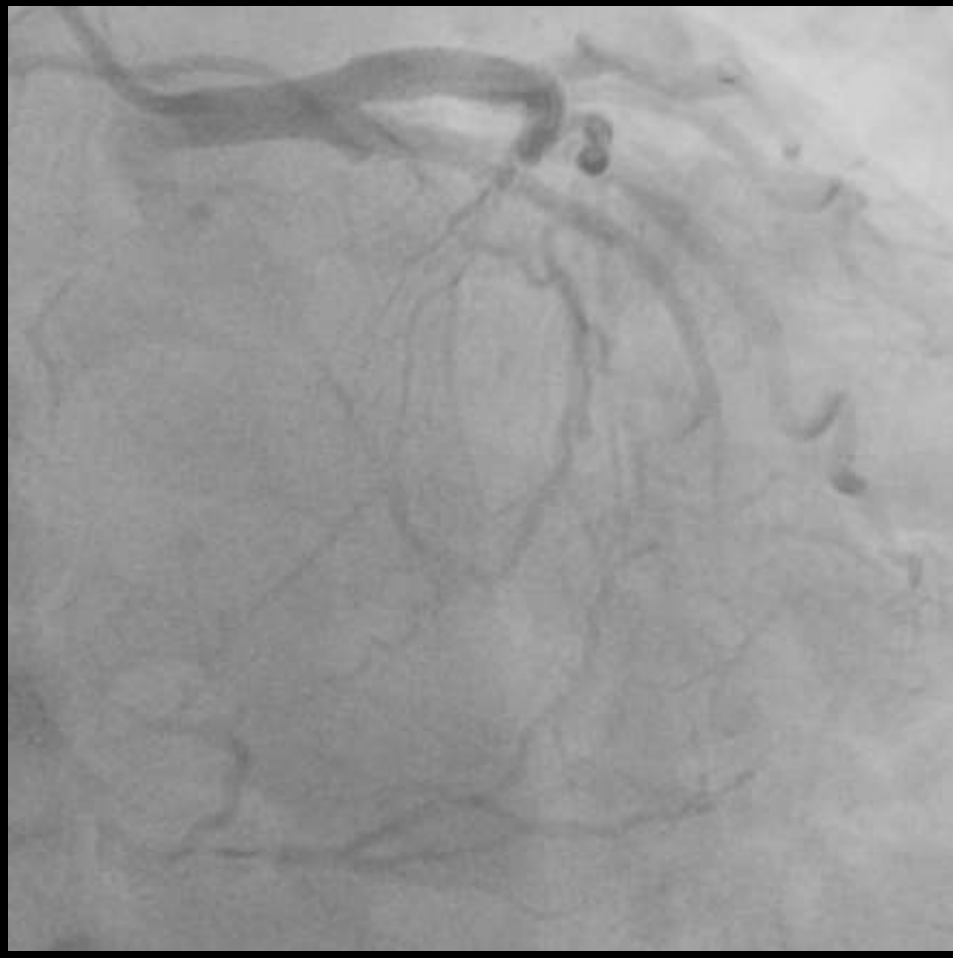
2012 Cardiac PET image shows

- Interval progression
- Moderate-severe ischemia in the Right Coronary artery territory
- Marked reduction of CFR in

Right and Left circumflex Coronary arteries

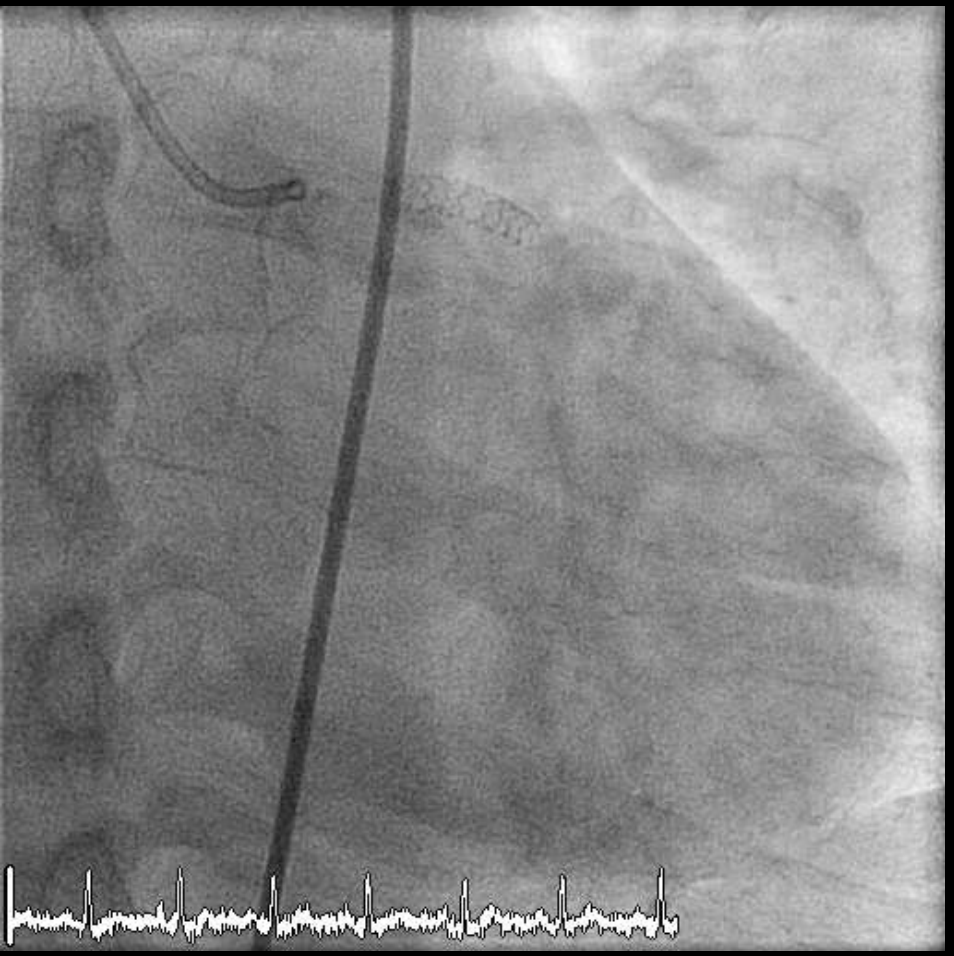
2010

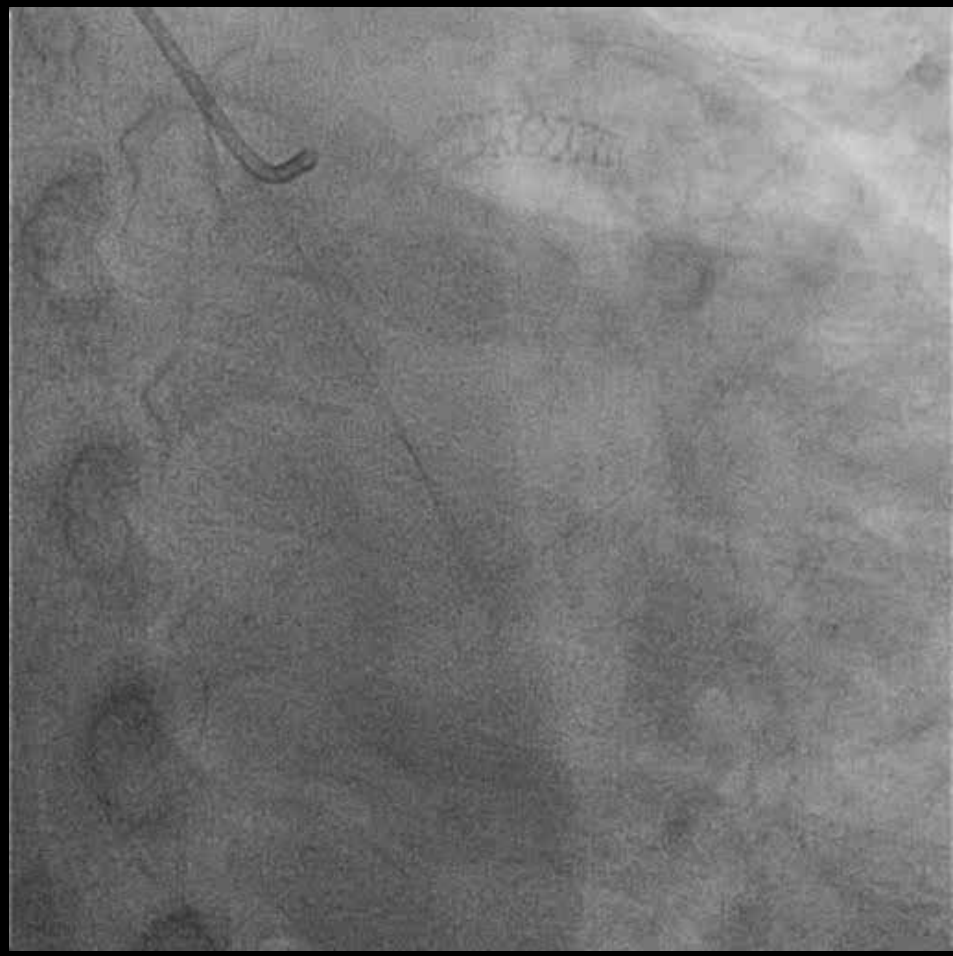
2012



2010

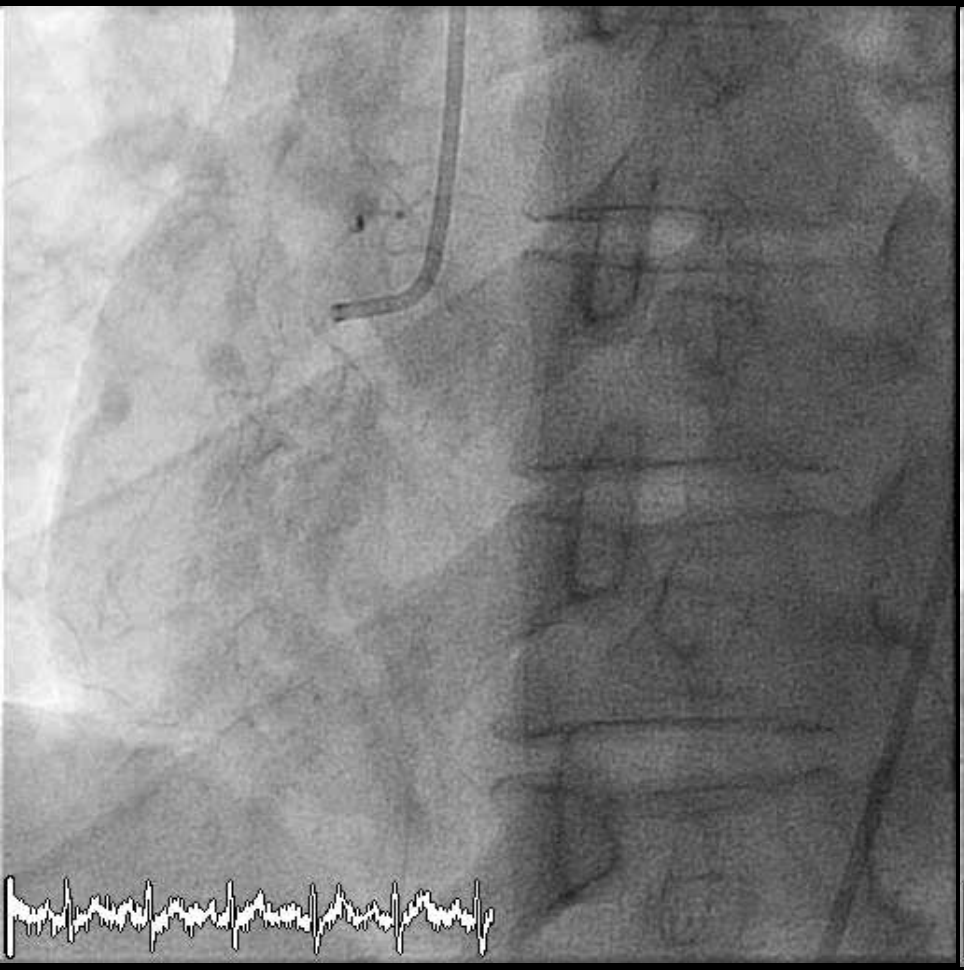
2012

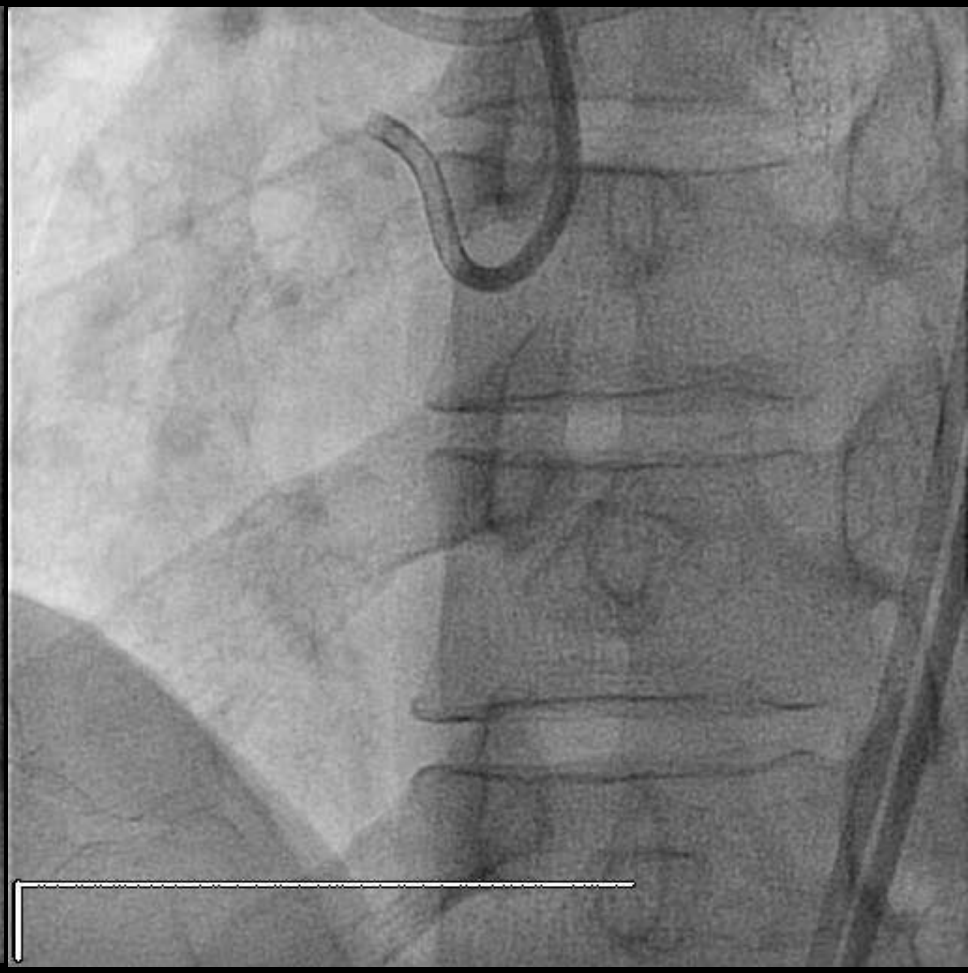




2010

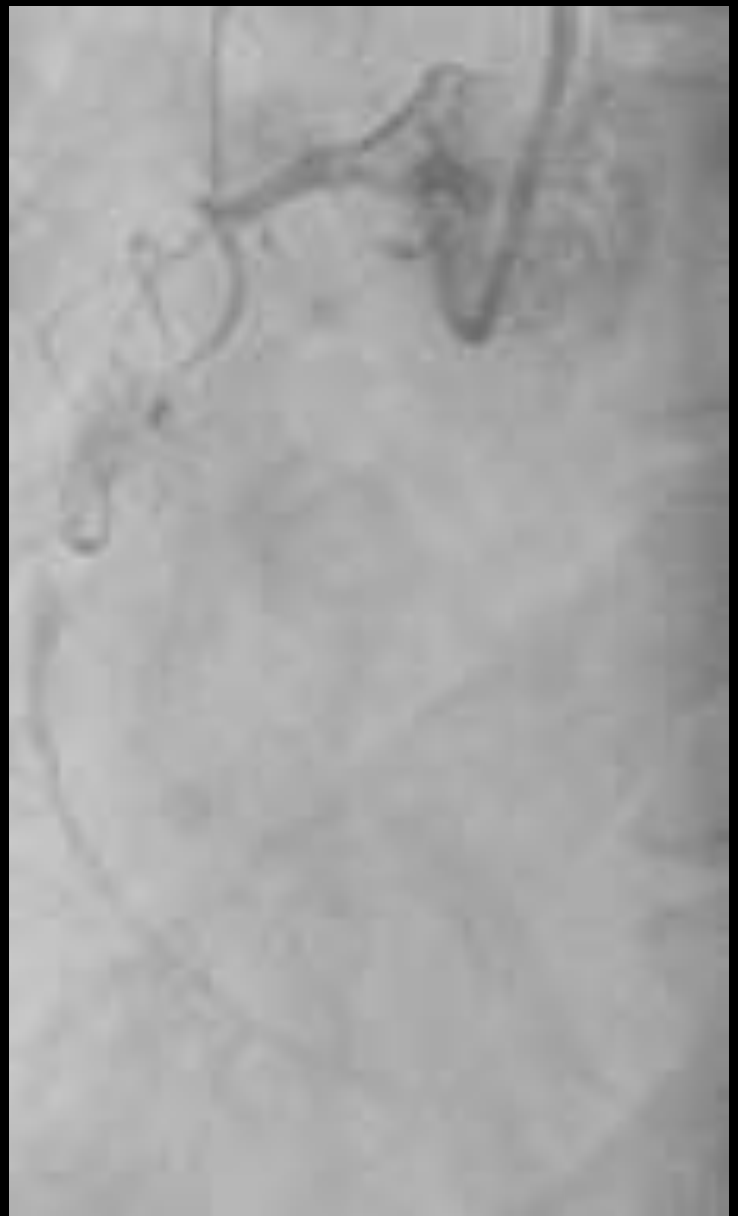
2012



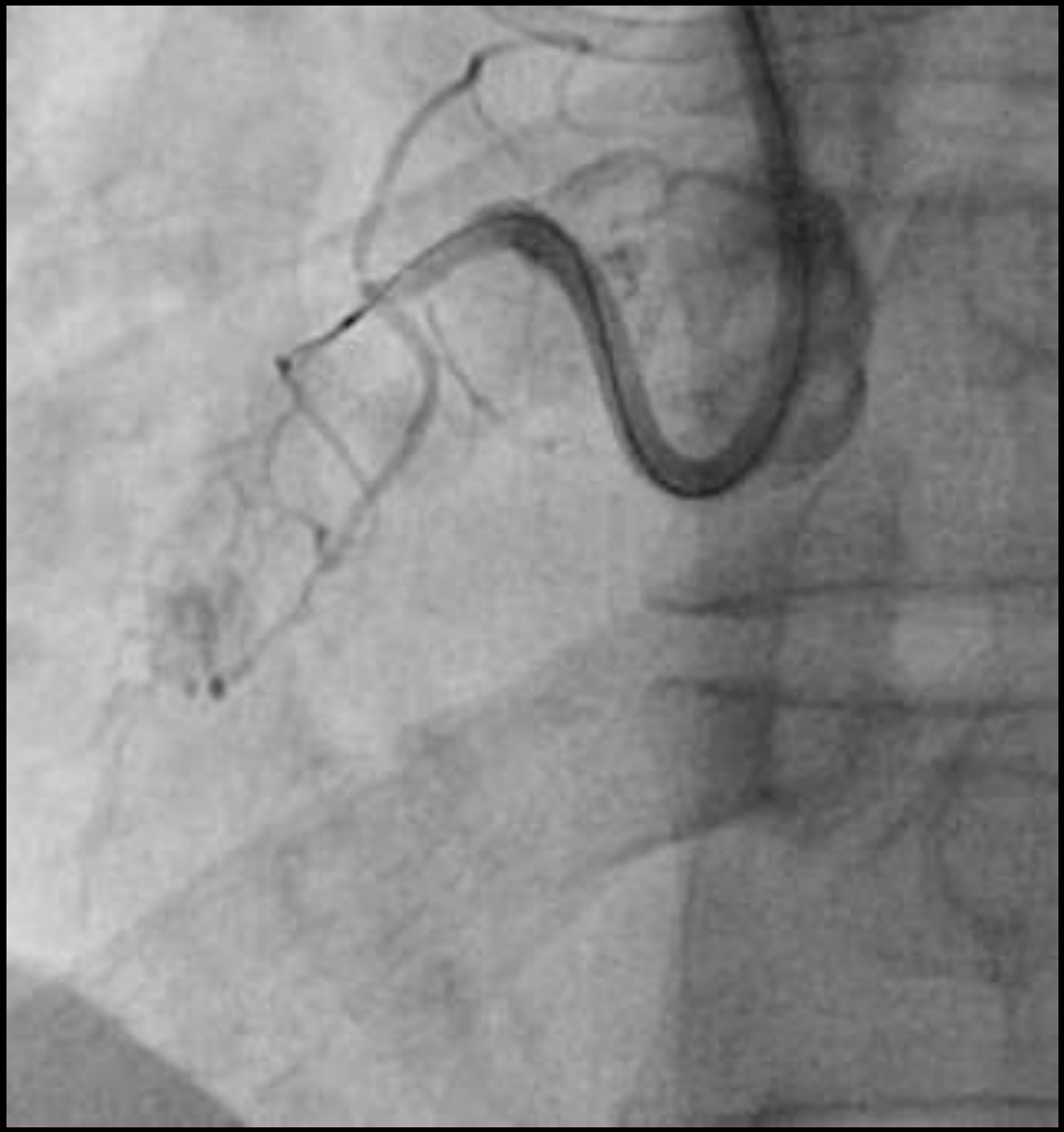


2010

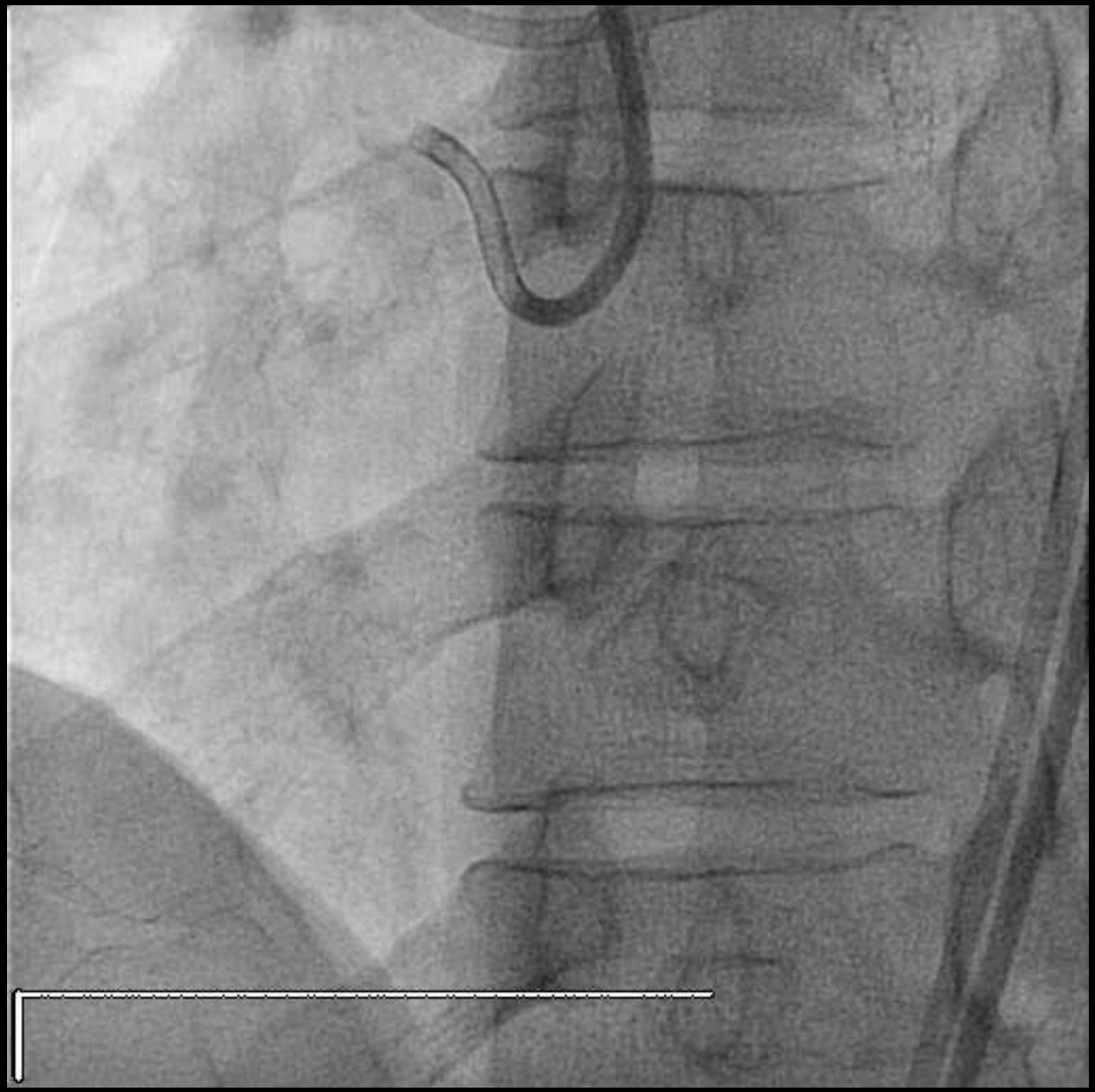
2012



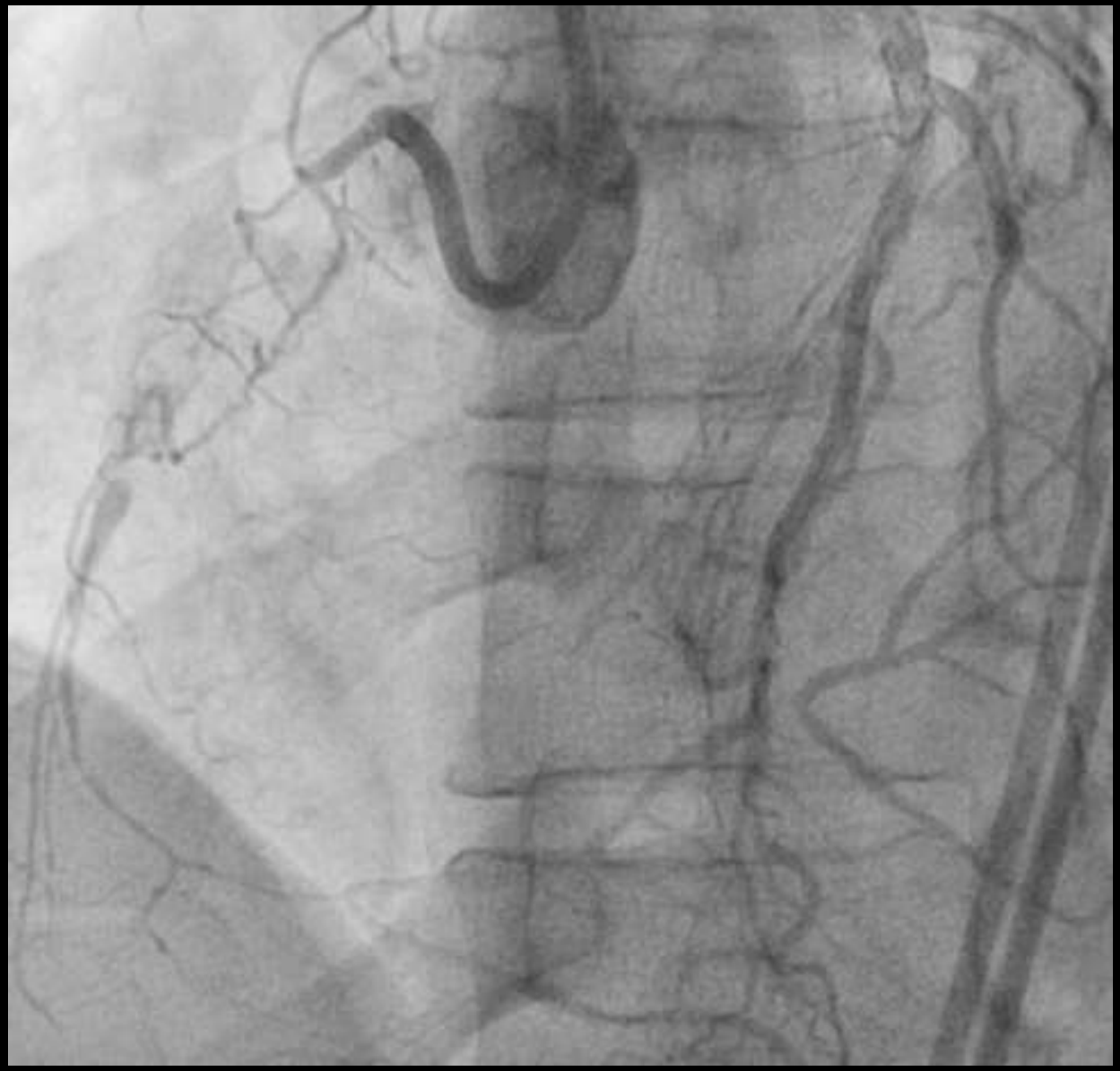
Failed antegrade approach



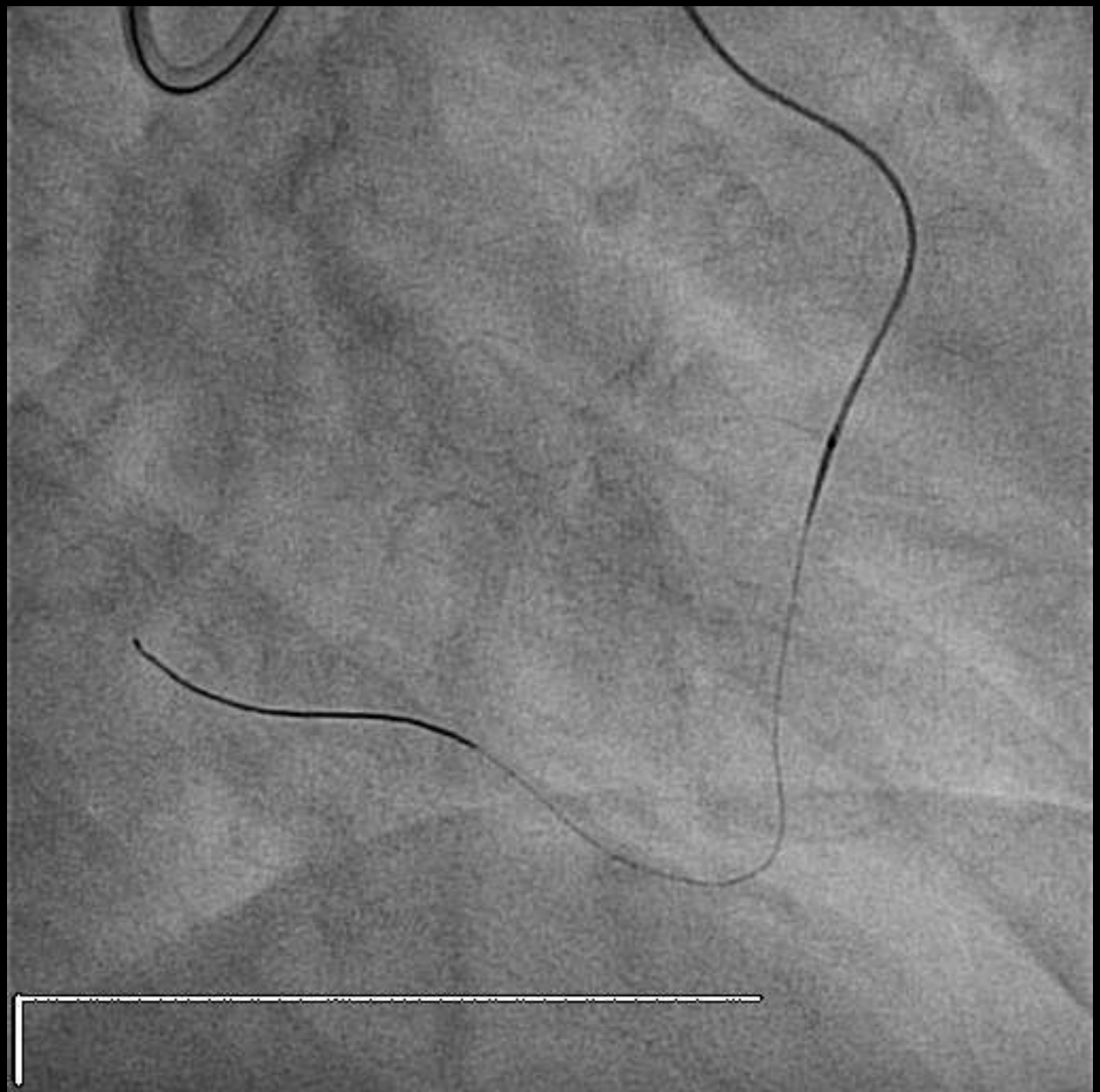
Dual Cannulation



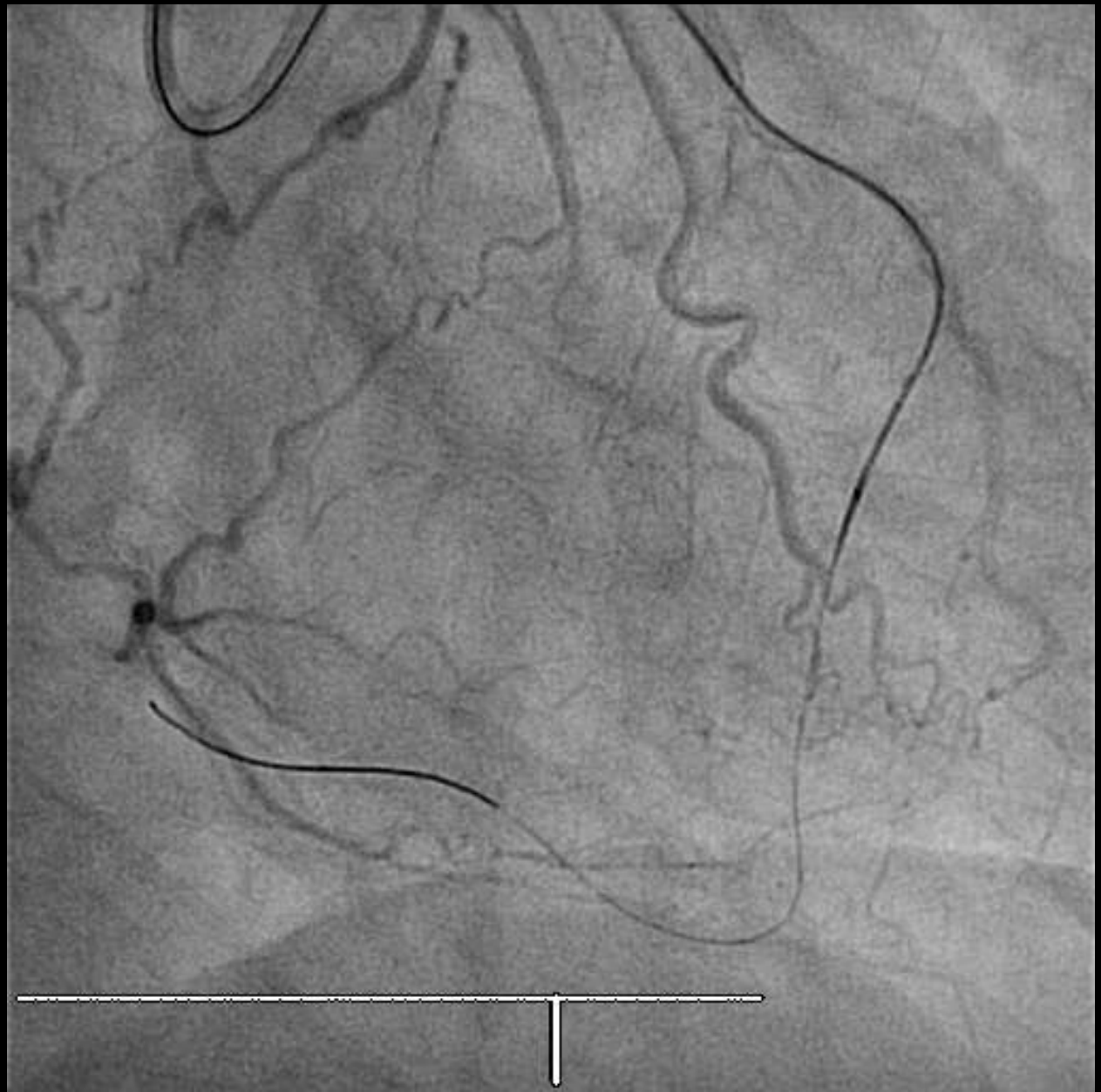
Dual Cannulation



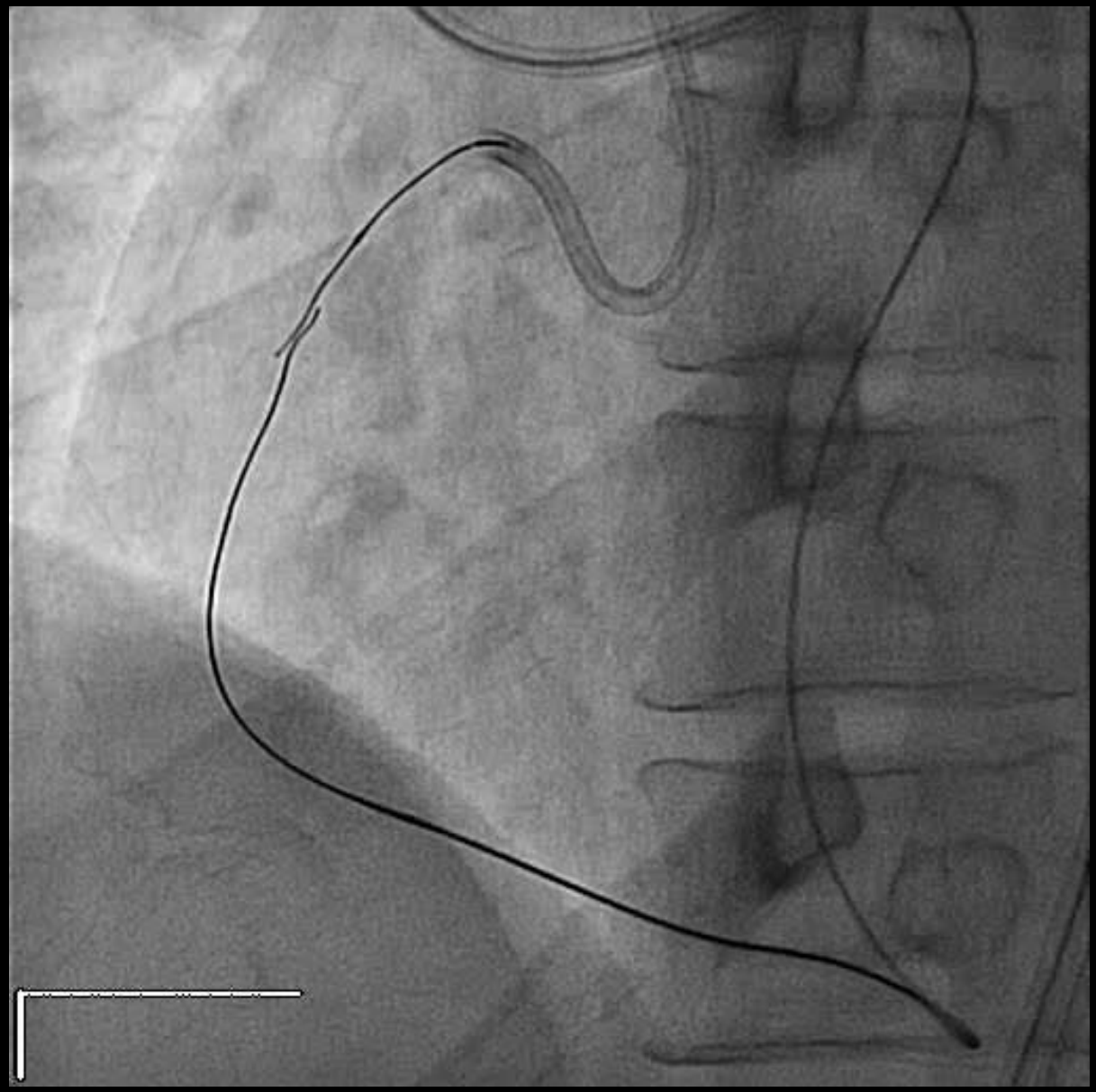
Retrograde from LAD



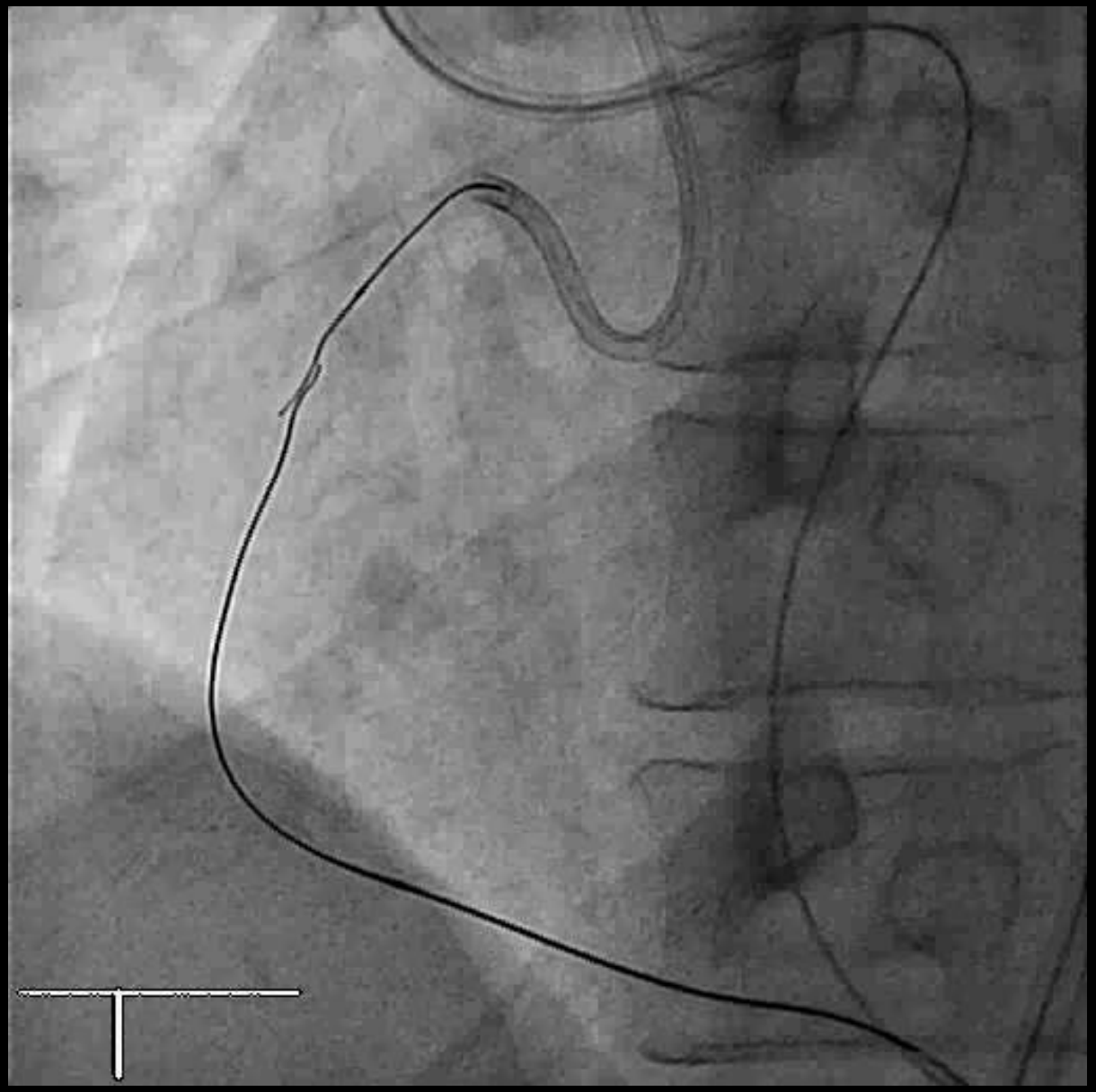
Retrograde from LAD



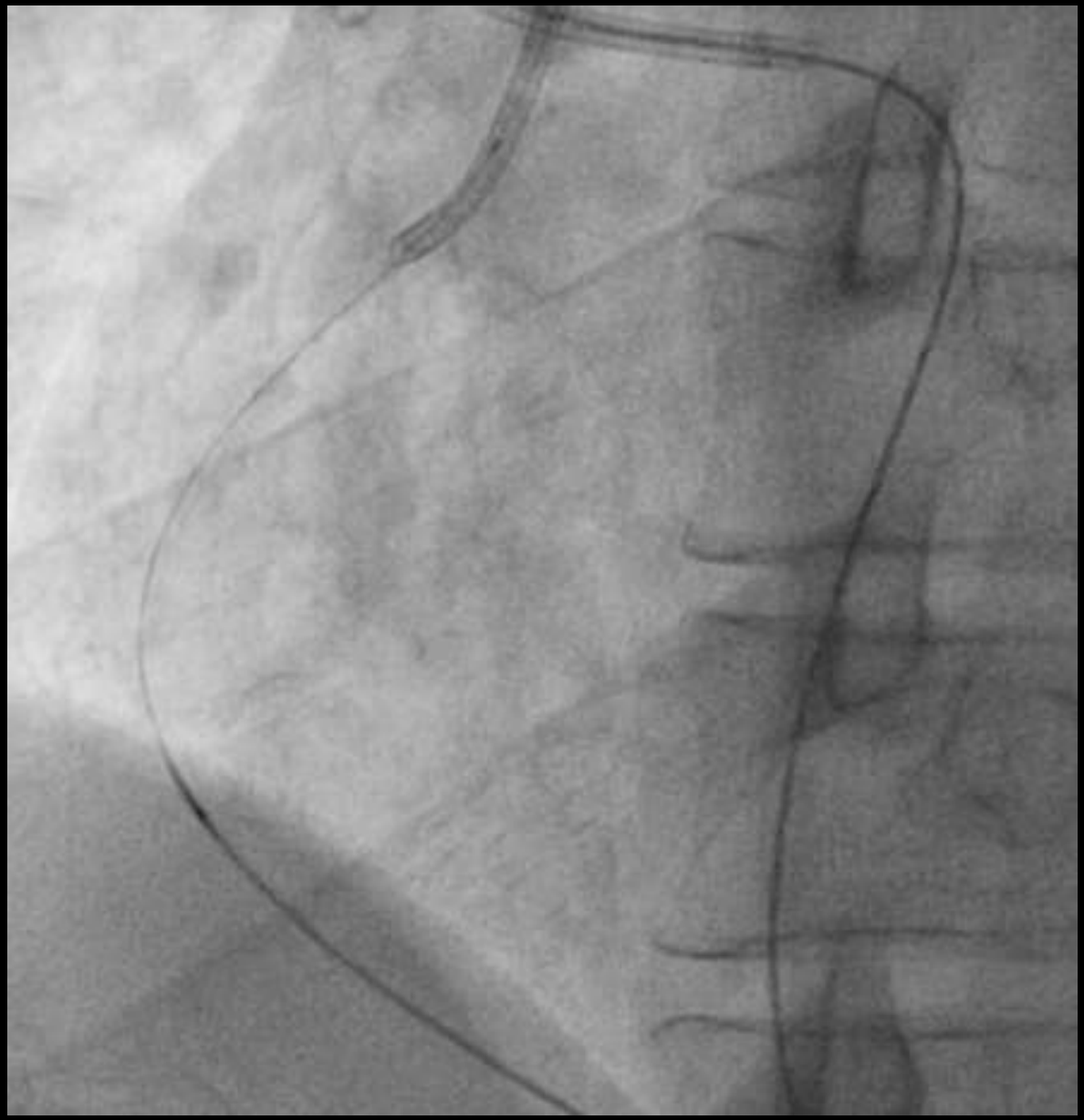
Retrograde from LAD



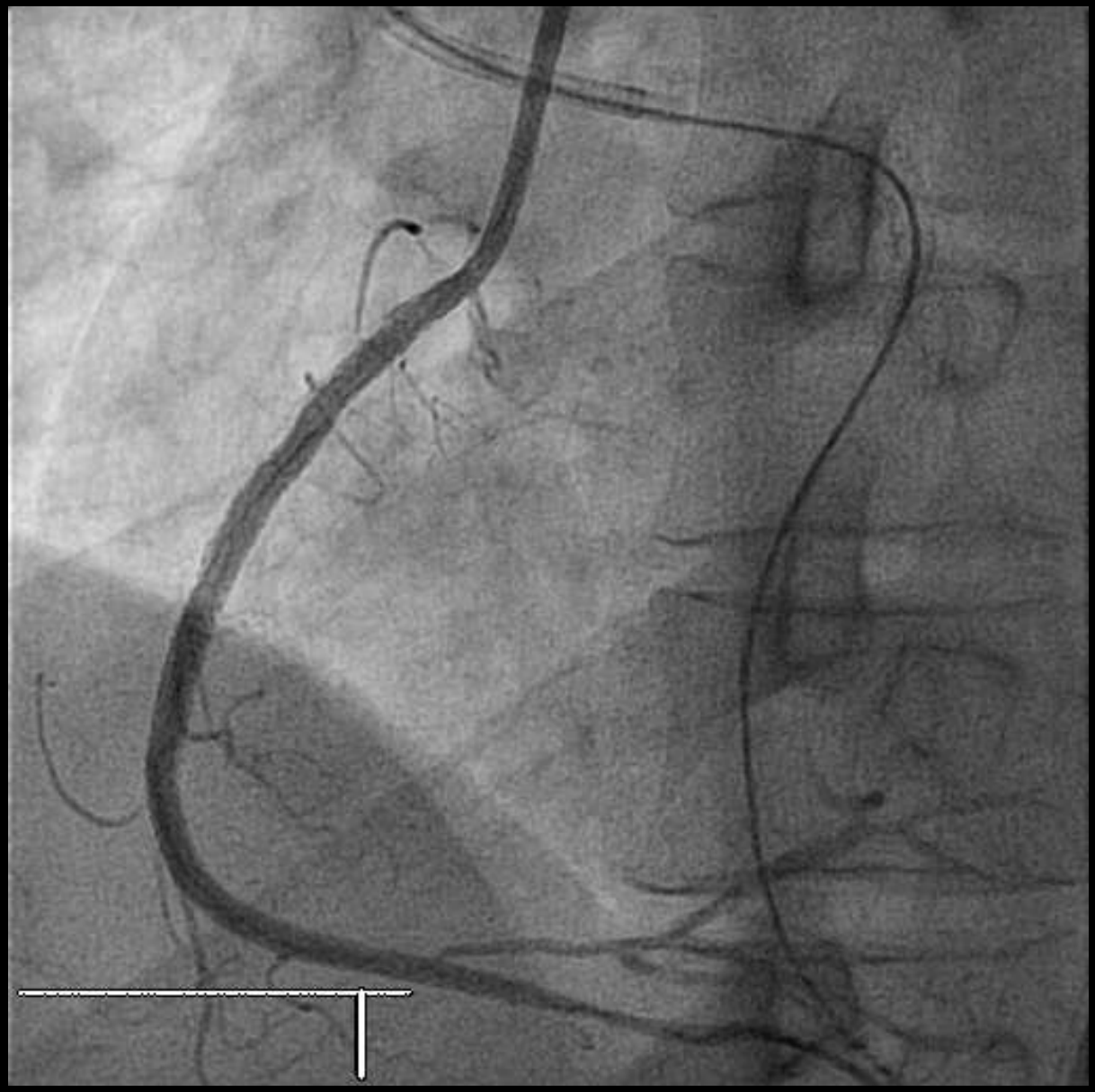
Retrograde from LAD



Retrograde wiring from LAD septal to RPDA



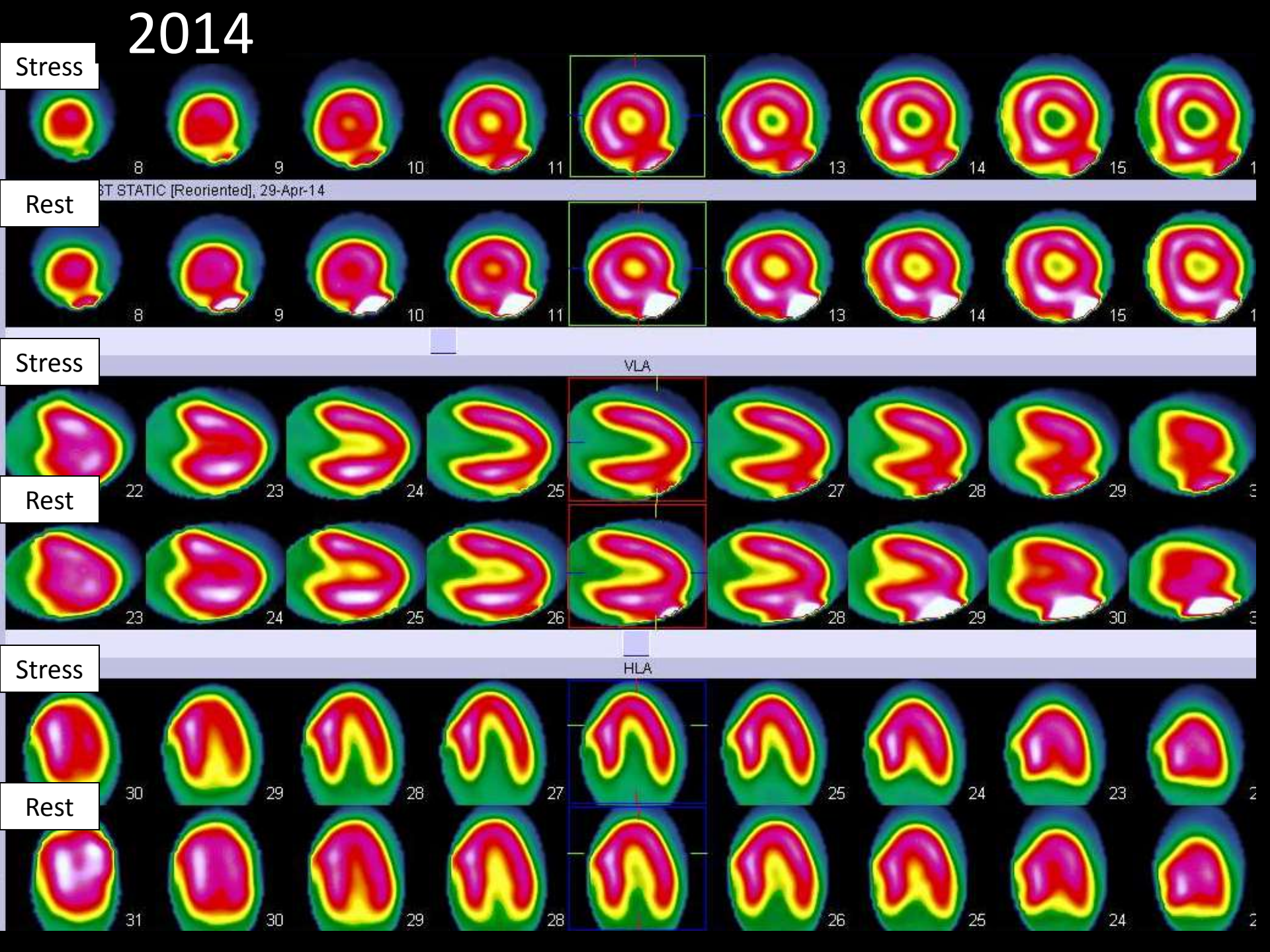
Retrograde wiring from LAD septal to RPDA



Successful revascularization with x2 Xience (Expedition) 48 x 3.5 mm

Now in Year 2014

- Patient presented with atypical chest pain
- Concerned about In-stent Restenosis (ISR)
- Cardiac PET repeated


2014
Stress
Rest
ST STATIC [Reoriented], 29-Apr-14
Stress
VLA
Rest
Stress
HLA
Rest

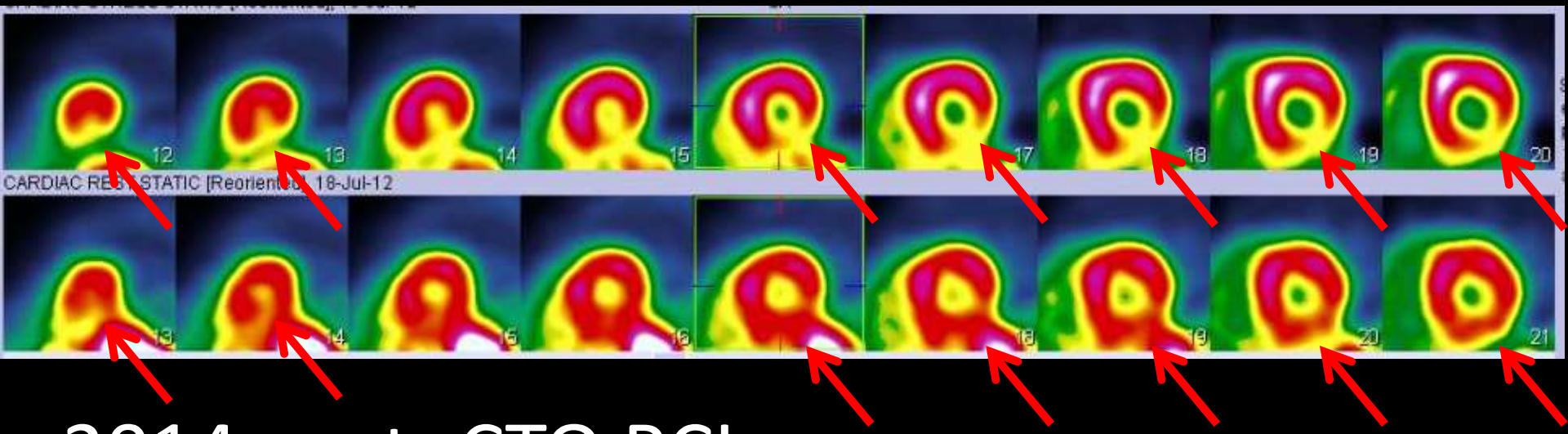
2012
Pre-PCI

	QMP (ml/g/min)				Reserve	
	Stress		Rest			
	mean	std dev.	mean	std dev.	mean	std dev.
LAD	2.43	0.71	0.92	0.17	2.62	0.58
LCX	1.53	0.52	0.82	0.20	1.87	0.49
RCA	1.52	0.65	0.76	0.15	1.99	0.78
Global	1.97	0.79	0.86	0.19	2.27	0.71

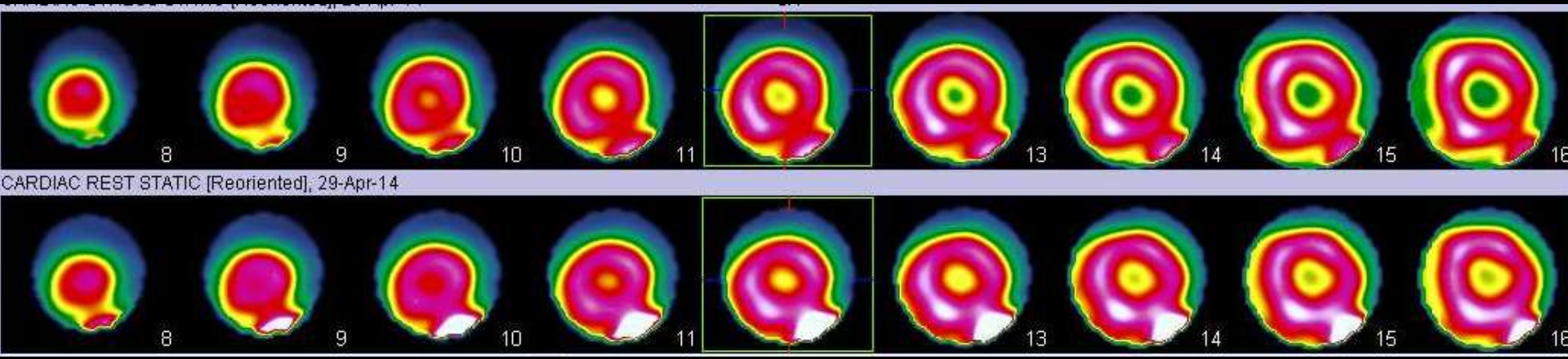
2014
post-PCI

	Flow (ml/g/min)				Reserve	
	Stress		Rest			
	mean	std dev.	mean	std dev.	mean	std dev.
LAD	3.18	0.60	1.22	0.28	2.69	0.49
LCX	2.42	0.66	0.88	0.22	2.77	0.56
RCA	3.11	0.83	1.25	0.37	2.57	0.50
Global	2.96	0.75	1.13	0.33	2.68	0.52

2012 pre- CTO PCI



2014 post- CTO PCI



Advantages of PET vs Conventional SPECT

- Absolute CFR values in absolute terms (millilitres per gram per minute).
- Short t ½ of Rubidium-82 (72s), reduced radiation and shorter working protocol
- Reduced radiation compared with SPECT (2.76 vs 10 msV)

Senthamizhchelvan S, Bravo PE, Lodge MA, Merrill J, Bengel FM, Sgouros G. Radiation dosimetry of 82Rb in humans under pharmacologic stress. J Nucl Med, 2011;52:485-91.

Summary

- As we refine our technical skill sets for CTO lesions, the complementary roles of in advanced non invasive imaging modalities can prove to be very useful in clinical decision making .
- Absolute measures of MBF with non invasive PET can be used as a surrogate marker for coronary vascular health, and also to monitor therapeutic interventions.