Alcohol ablation of ventricular arrhythmias

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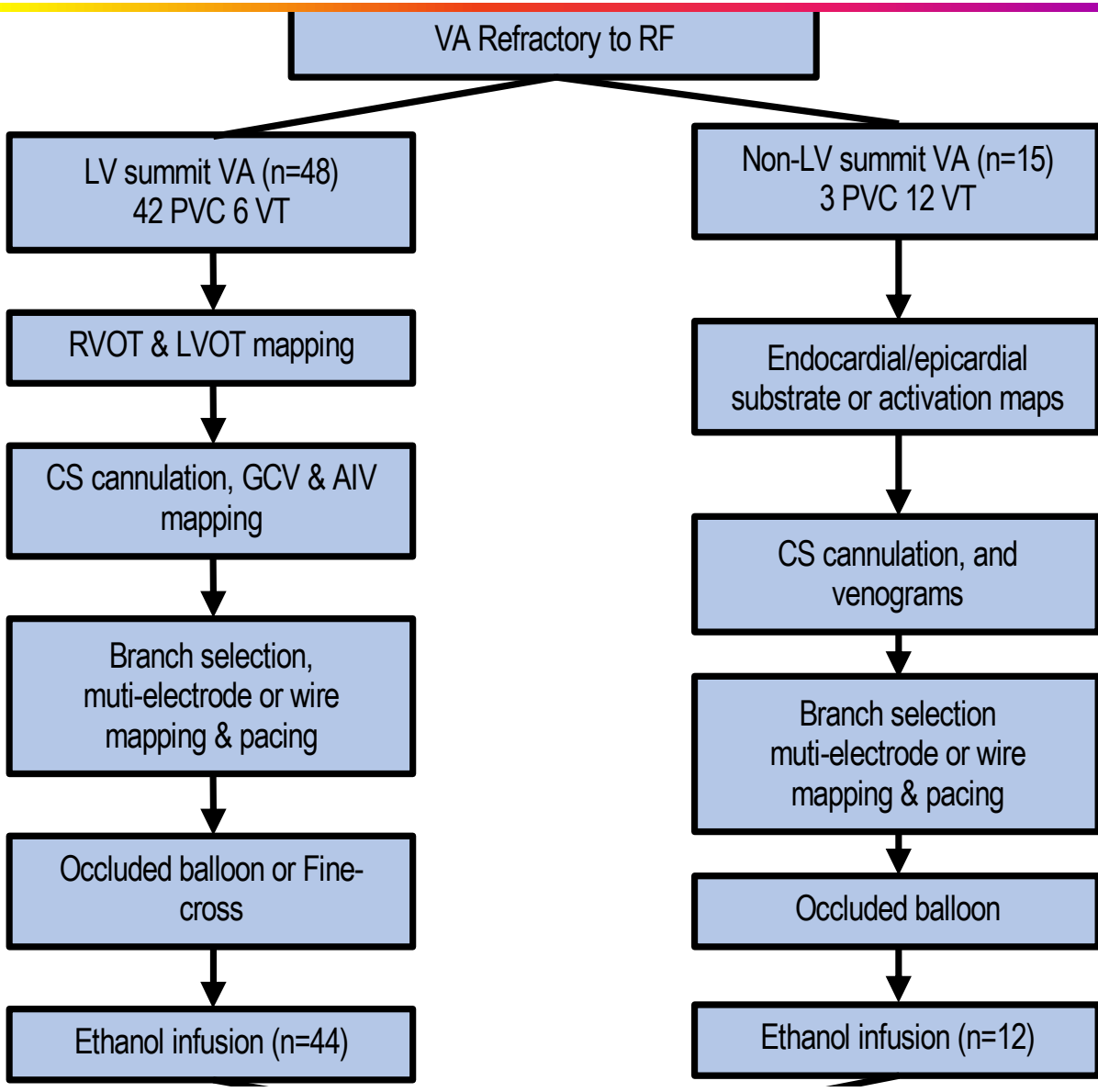
Venous ethanol ablation experience

Tavares et al. *JACC Clin Electrophysiol.* 2020 Oct 26;6(11):1420-1431

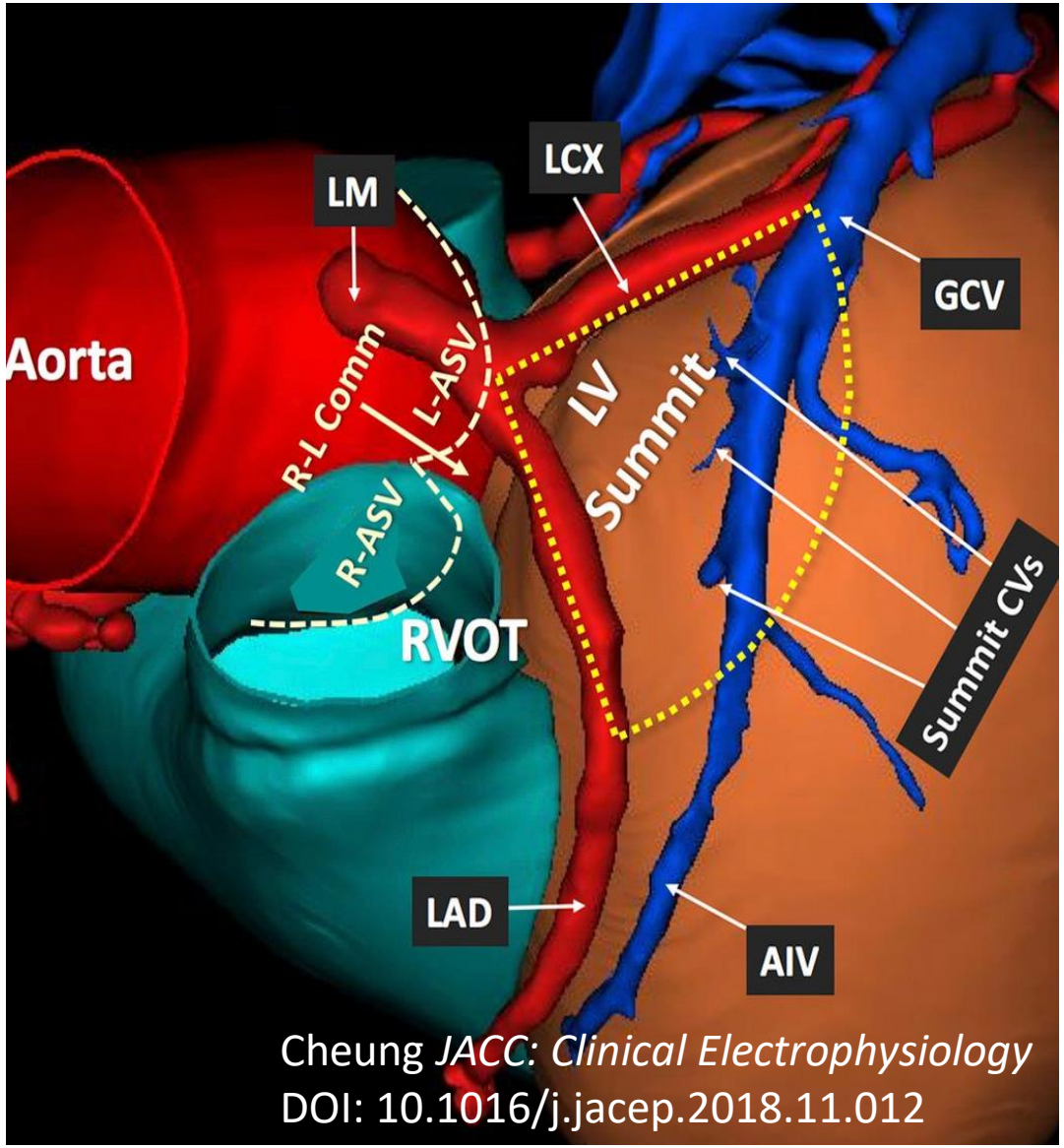
- 12 centers
- 63 patients with ablation-refractory ventricular arrhythmias (PVC &VT).
  - LV summit (n=48)
  - Other regions (n=15)
- Approach:
  - Mapping endo RV/LV/epi
  - CS cannulation, venograms, epicardial vein mapping
  - Intramural branch selection
  - Wire mapping
  - Ethanol delivery



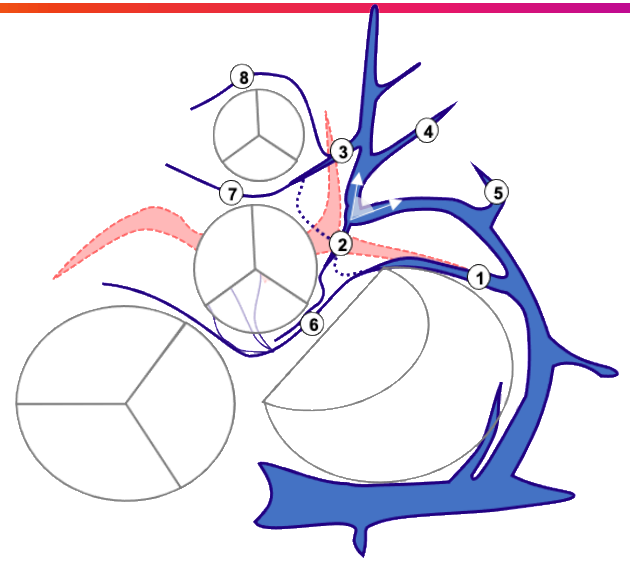
Targeted veins: LV summit and more

Tavares et al. *JACC Clin Electrophysiol.* 2020 Oct 26;6(11):1420-1431.

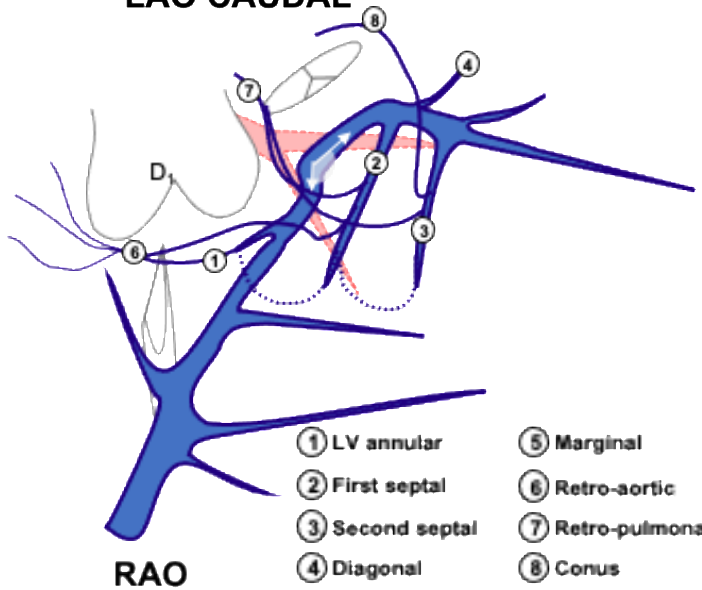
- LV summit veins (n=48):
  - LV annular vein from GCV (5/48)
  - GCV-AIV septal (36/48)
  - GCV-AIV diagonal (2/48)
  - AIV septals (1/48)
- Non summit veins (n=15)
  - Lateral (8)
  - Apical AIV (3)
  - Middle cardiac vein (2)



Cheung *JACC: Clinical Electrophysiology*
DOI: 10.1016/j.jacep.2018.11.012

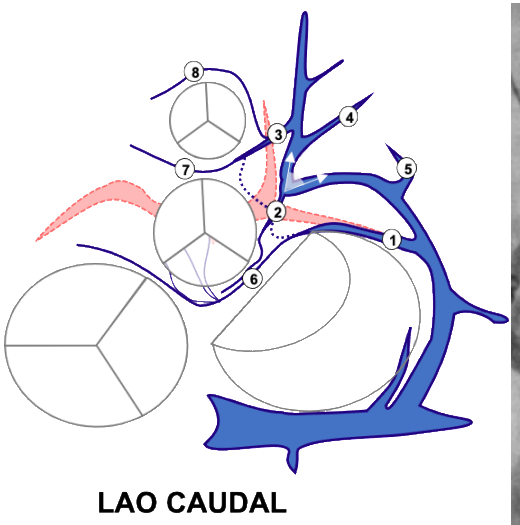


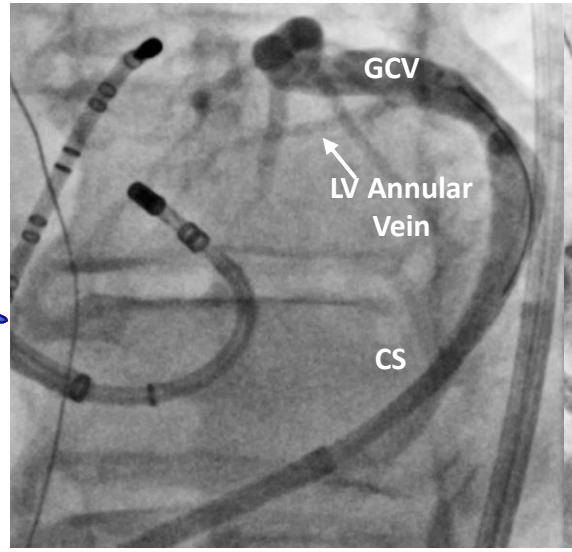
LAO CAUDAL

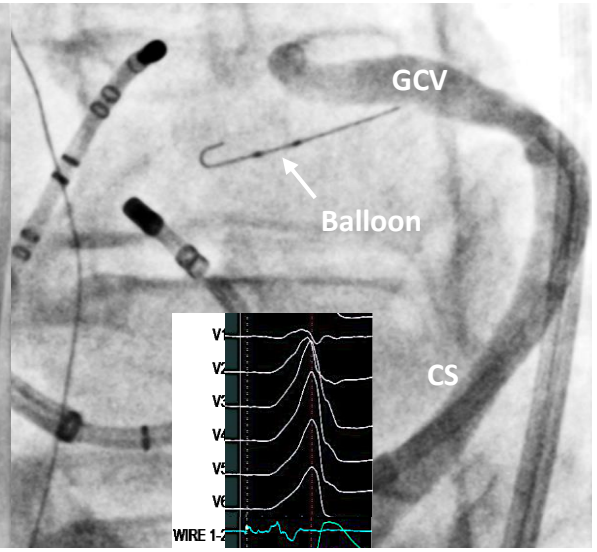


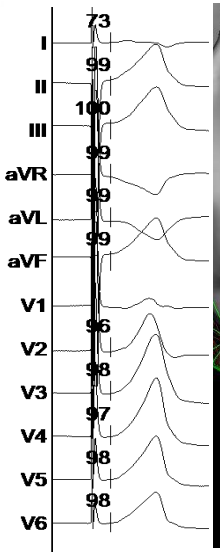
RAO

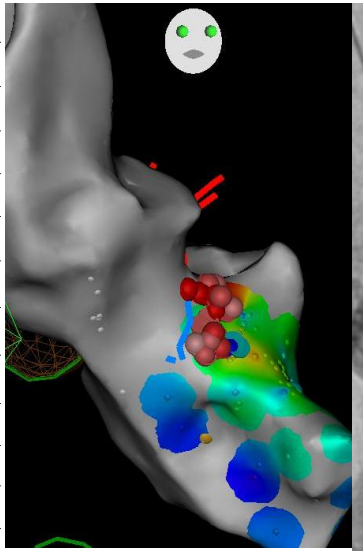
LV summit PVCs: LV annular vein

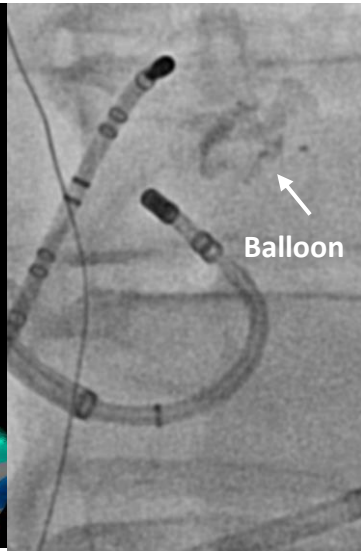




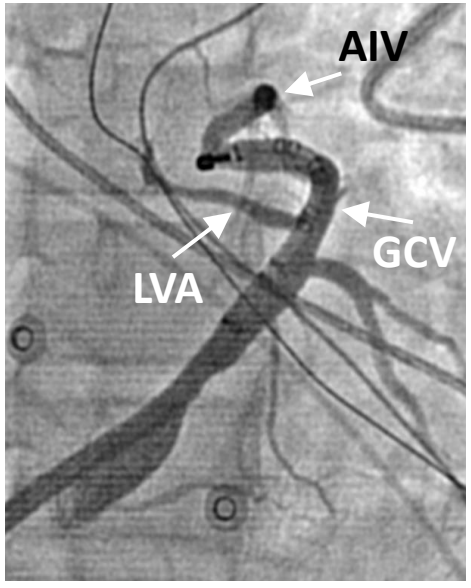


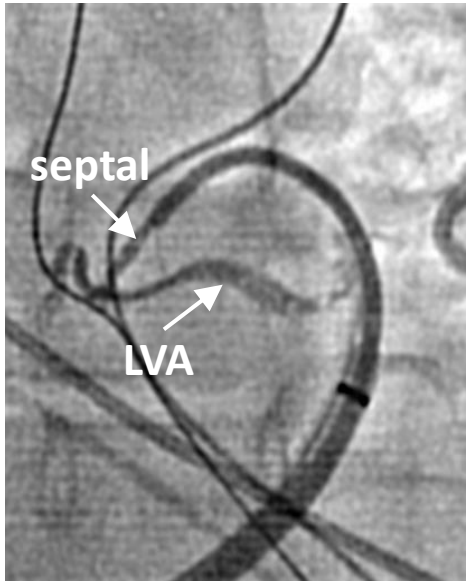






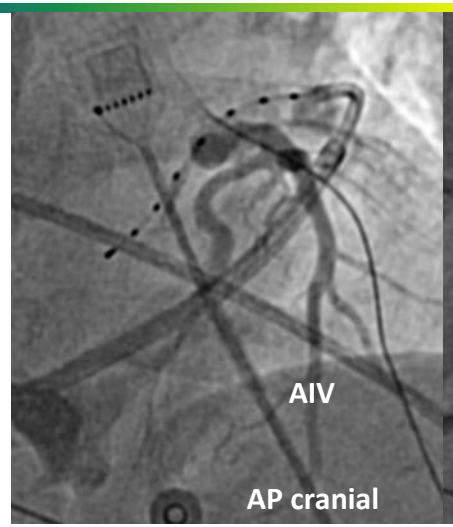
- Present in ~40% of cases
- 5/48 LV summit VT ablated from LV annular with ethanol
- Take-off from GCV
- Atrial and ventricular signals
- May have atrial/retroartic branches
- May communicate with AIV septal

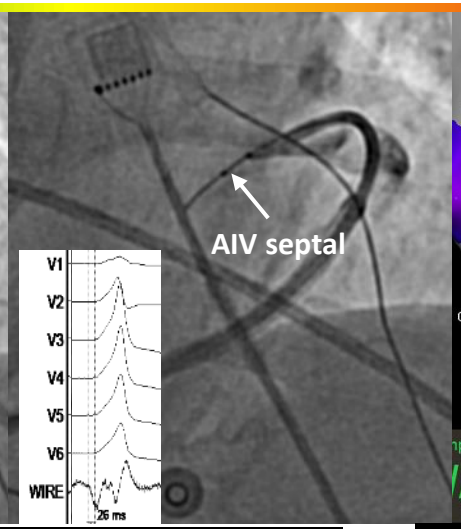


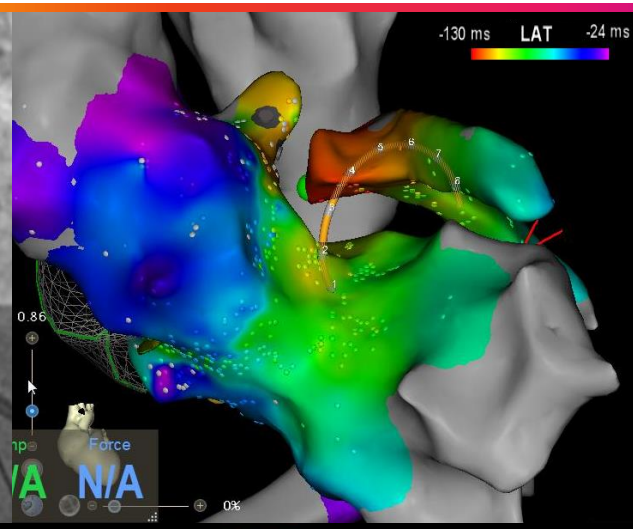


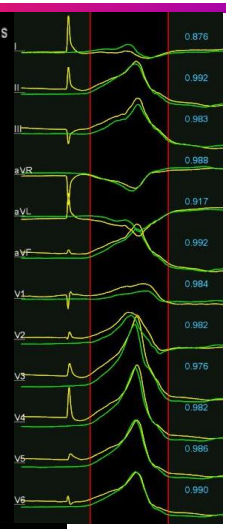
LV summit PVCs: GCV-AIV septals

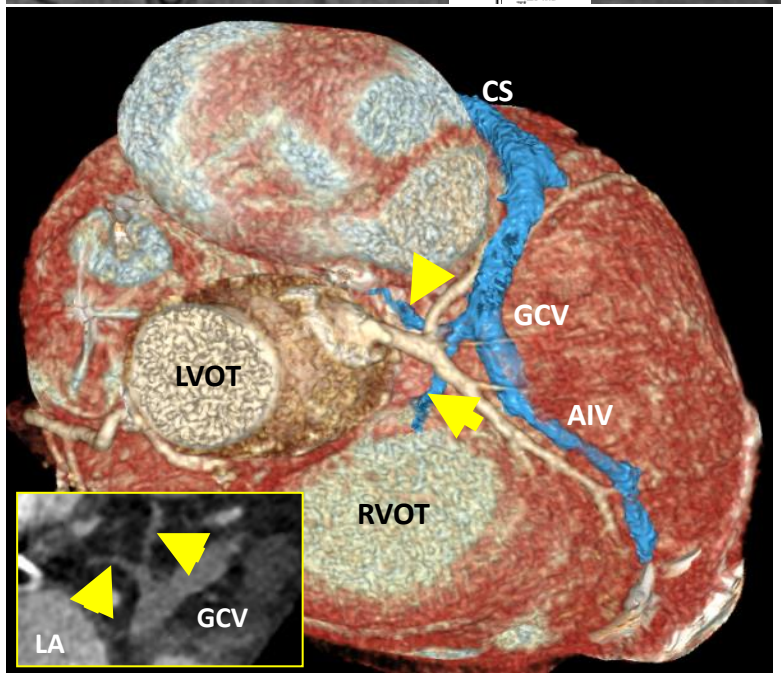
- Take-off from GCV-AIV angle
- Close to left main artery
- Retro aortic branches
- Retro-pulmonary artery branches
- Most common vein targeted (36/48).

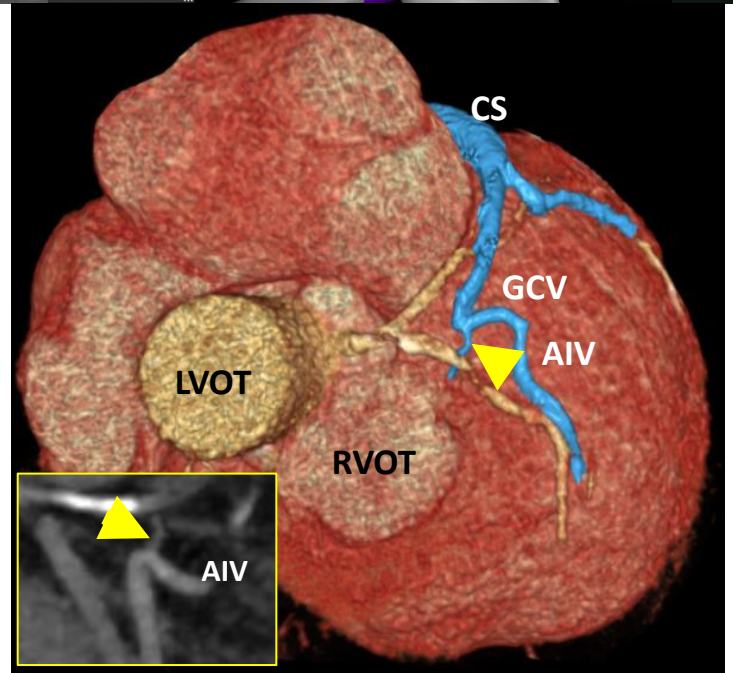




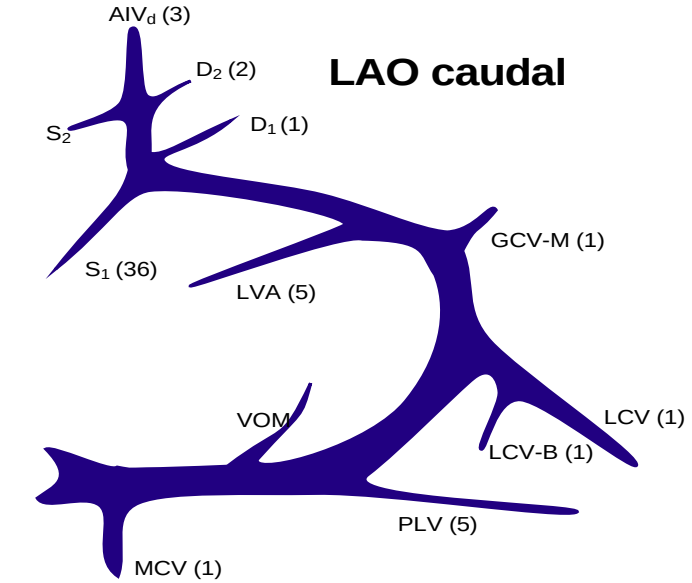


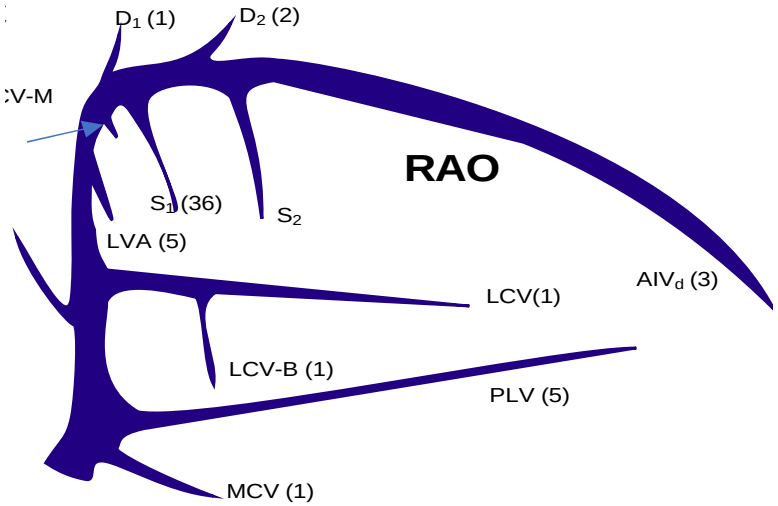


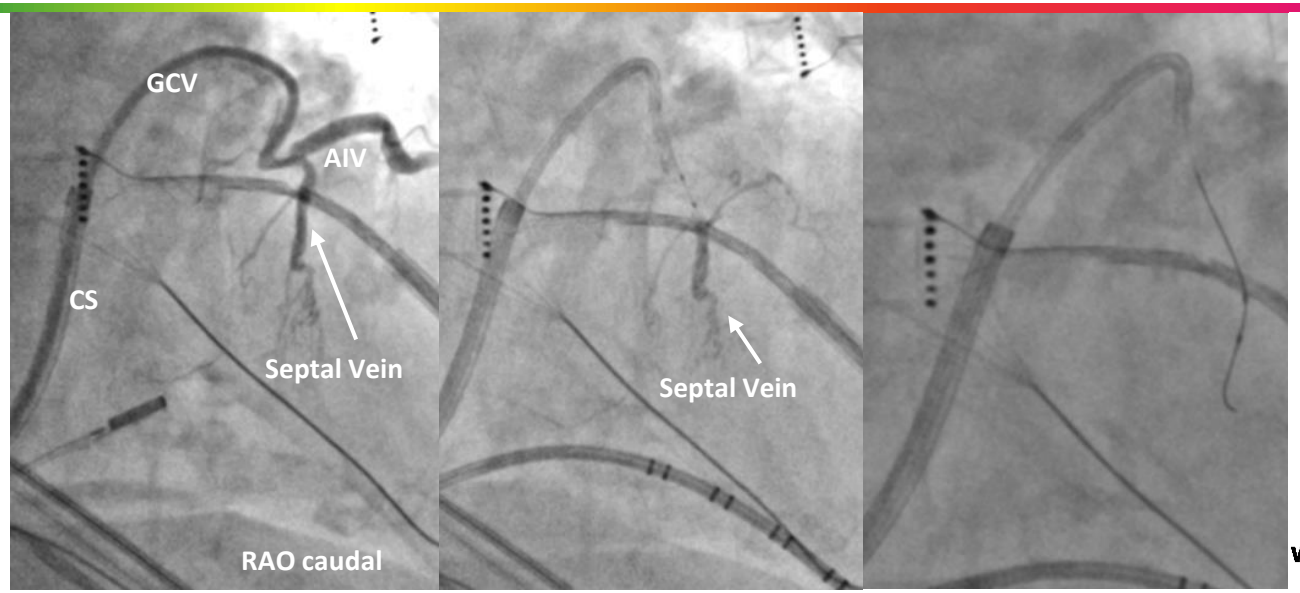


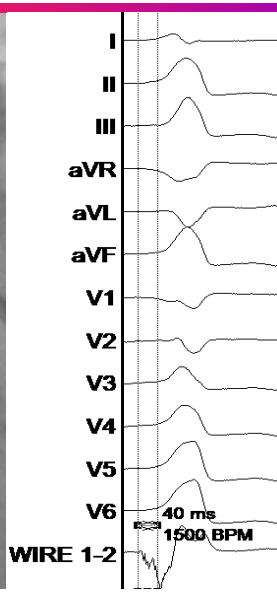


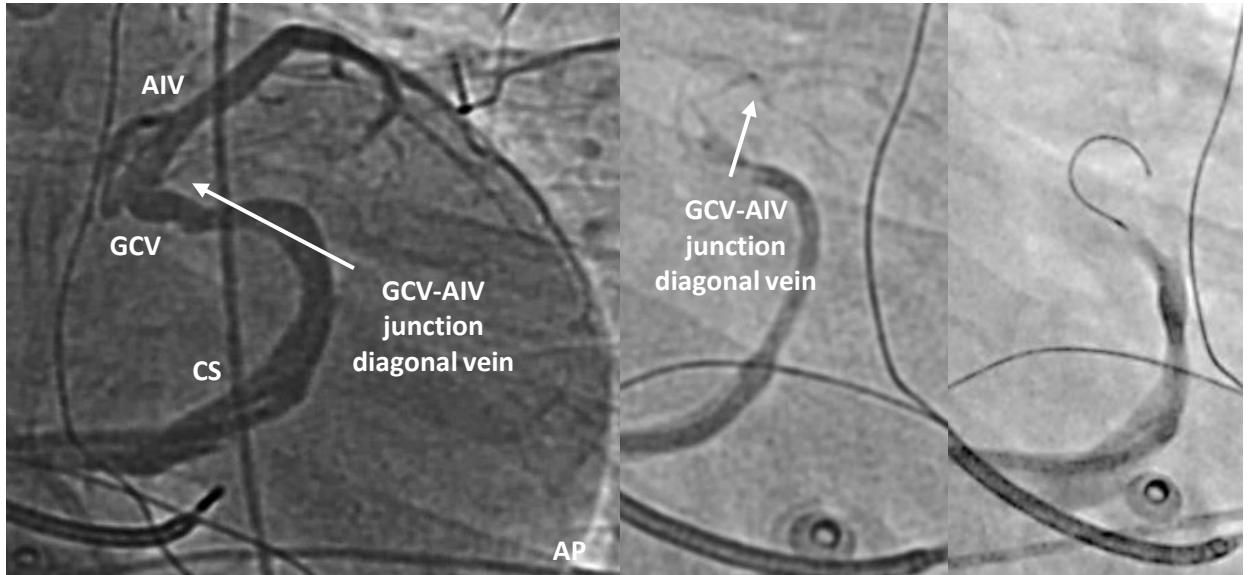
LV summit PVCs: AIV septal &diagnonal

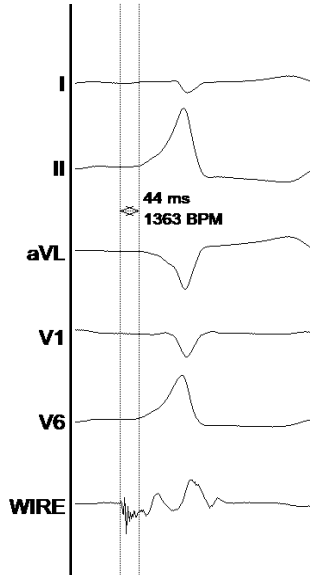






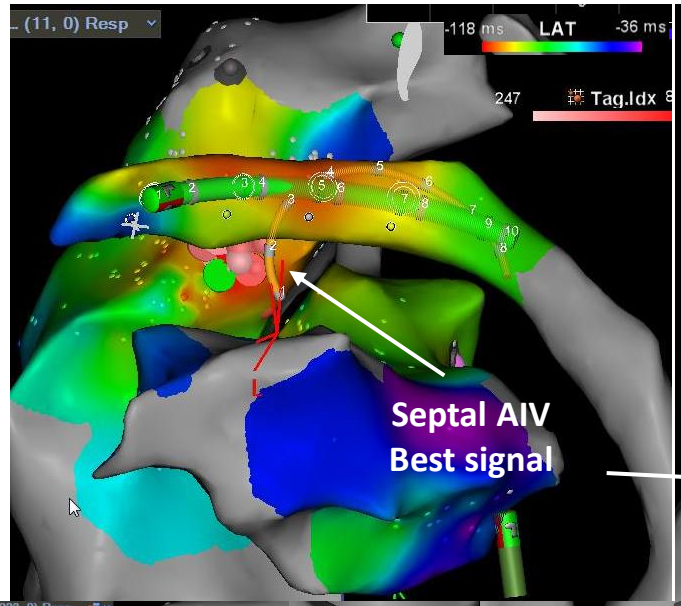


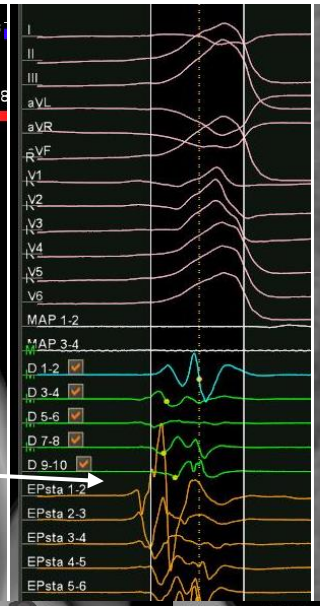


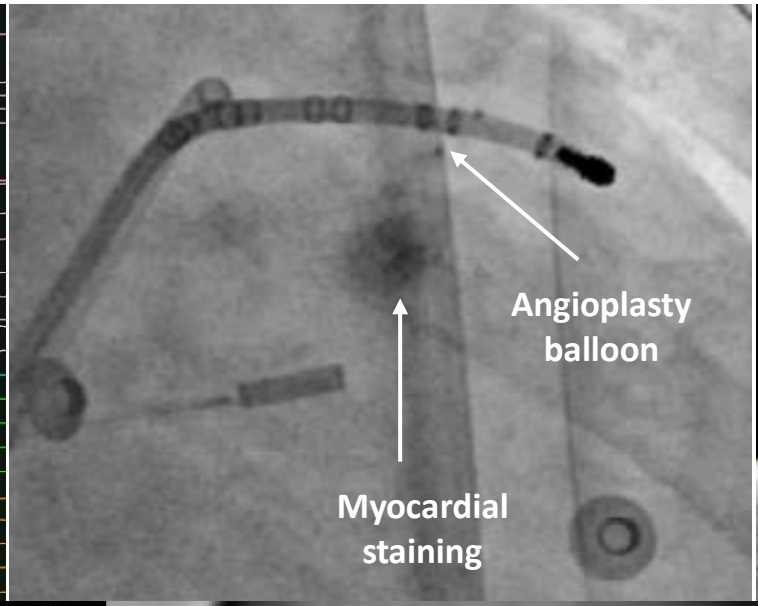


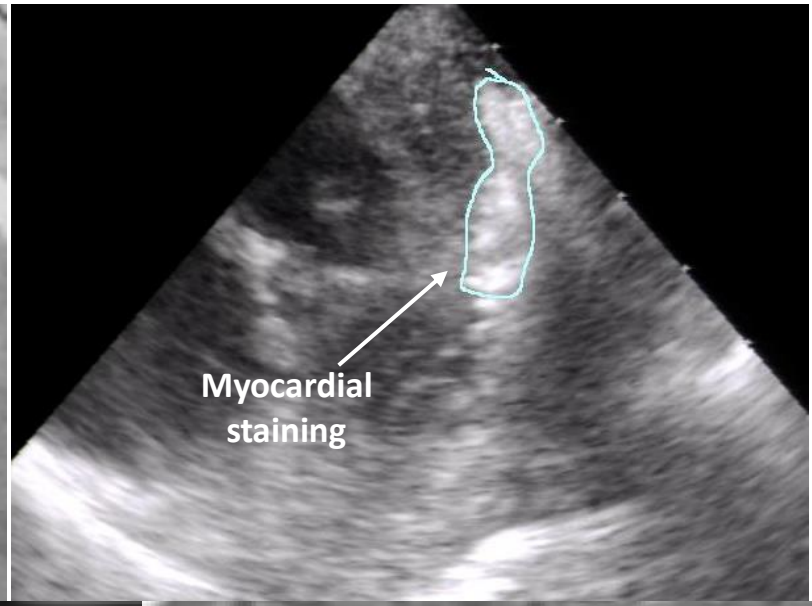
Ethanol-induced intramural ablation

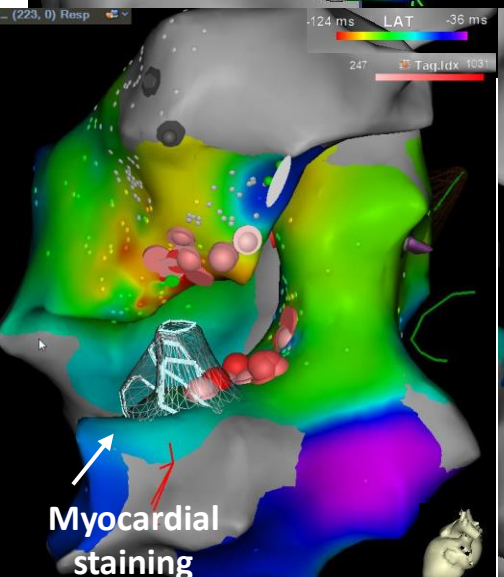
Microvascular obstruction on CMR

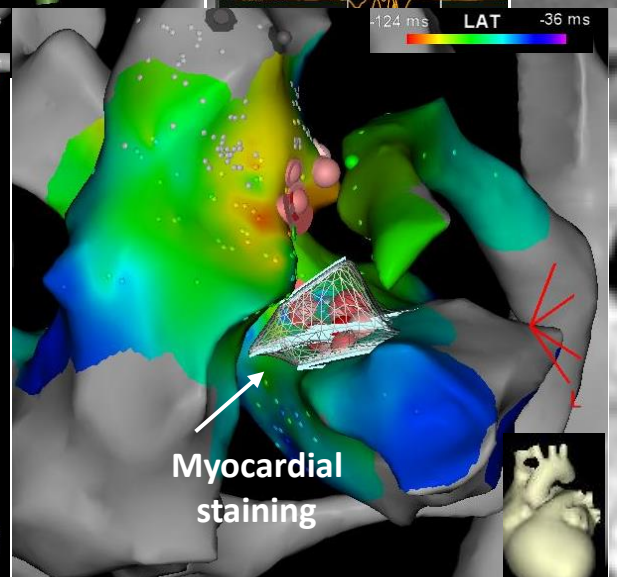


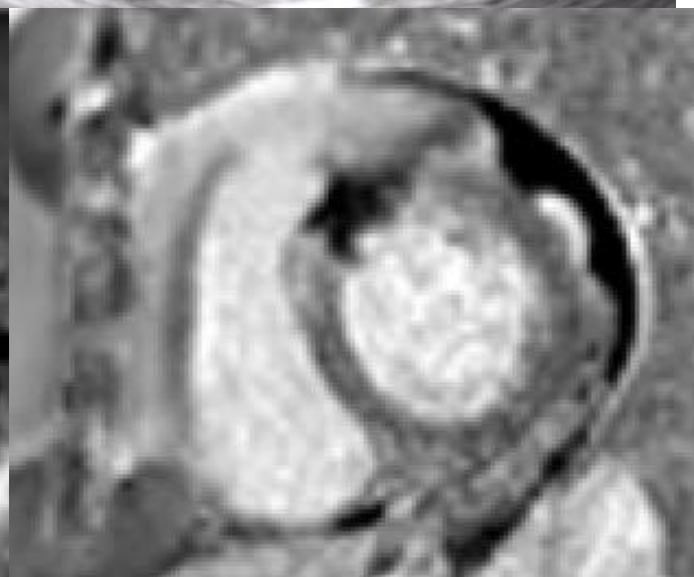






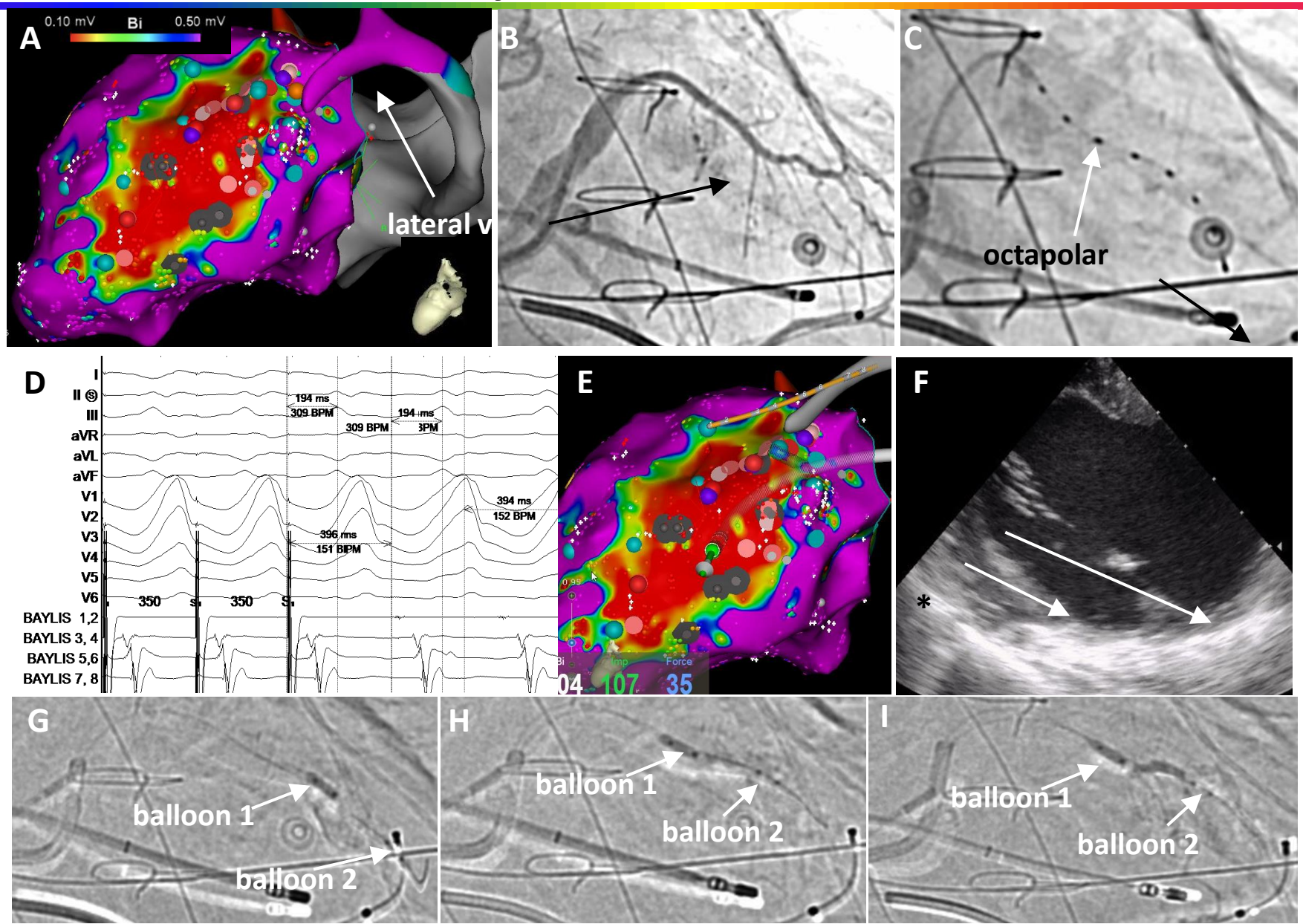




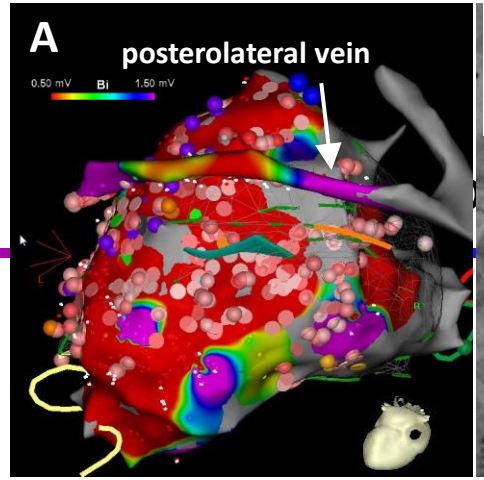


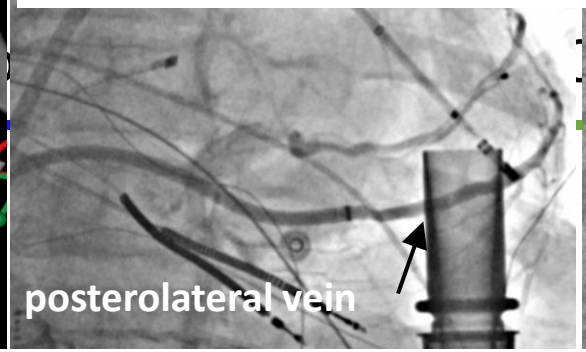
Lateral vein in ischemic VT: Double balloon

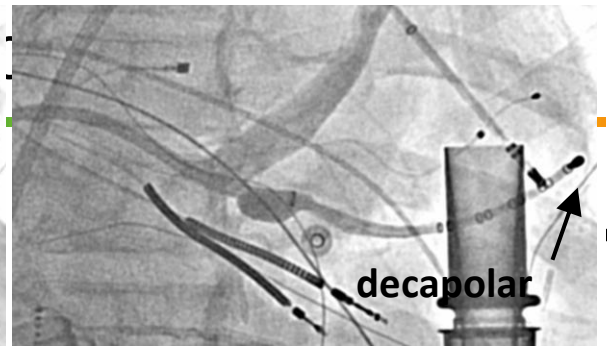
Da-Wariboko et al *Heart Rhythm*. 2020 Dec;17(12):2126-2134.

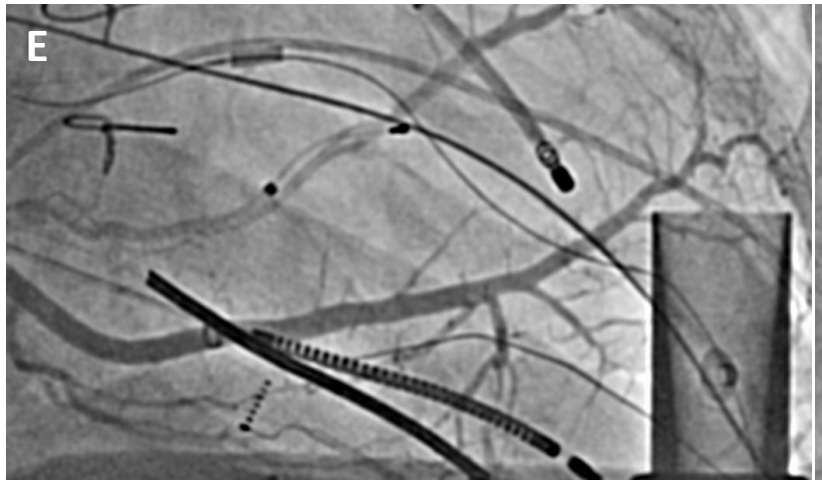


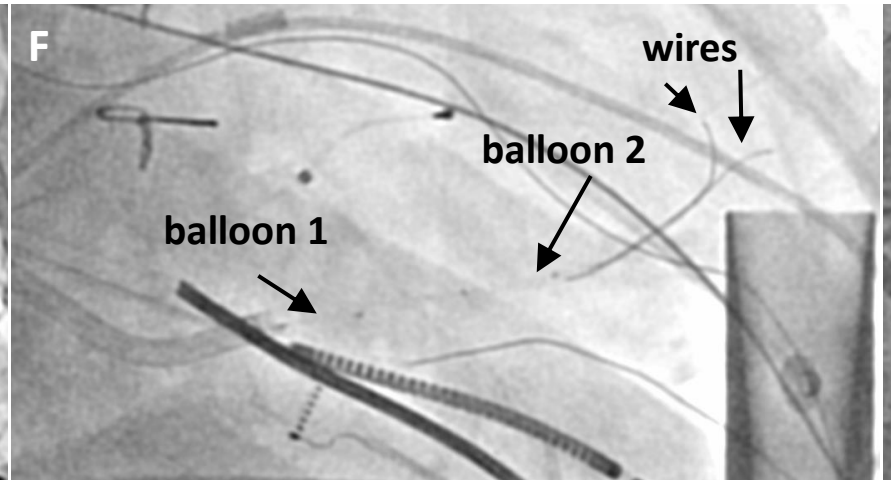
The infarct-related vein

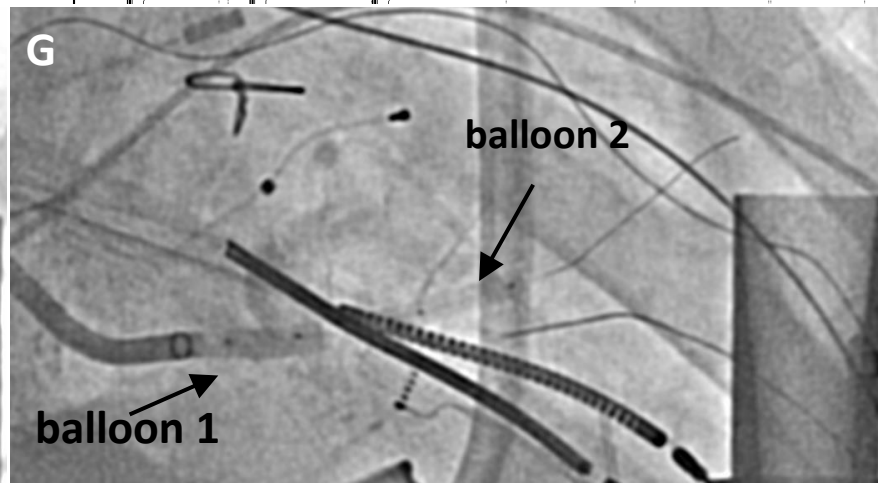


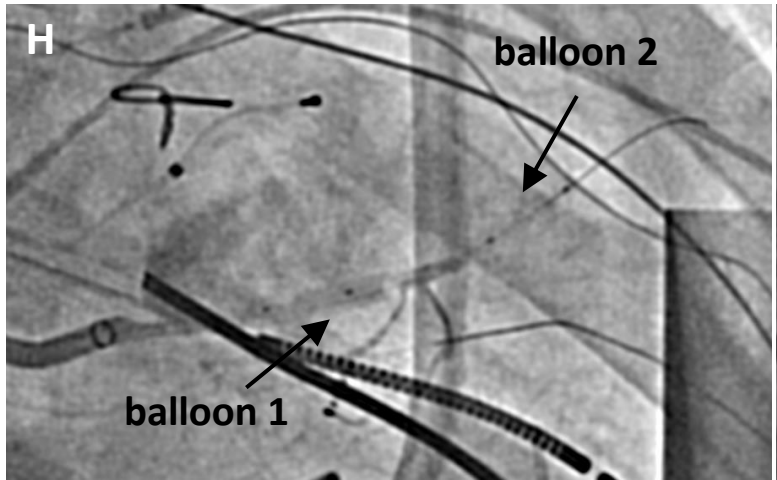


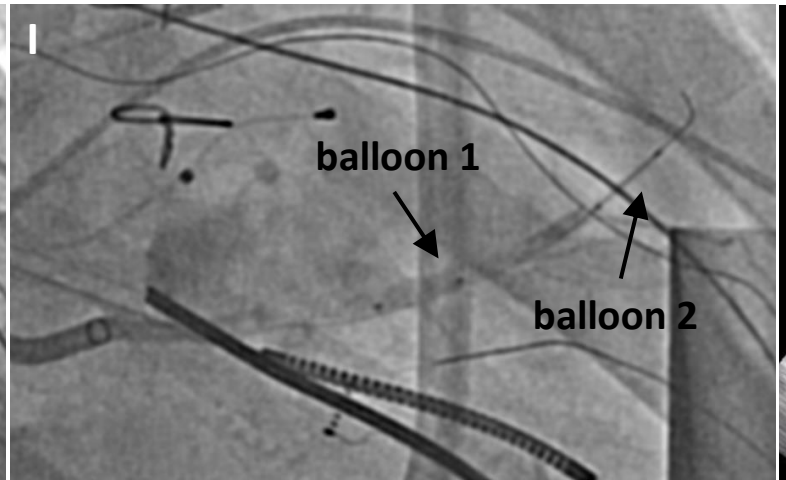


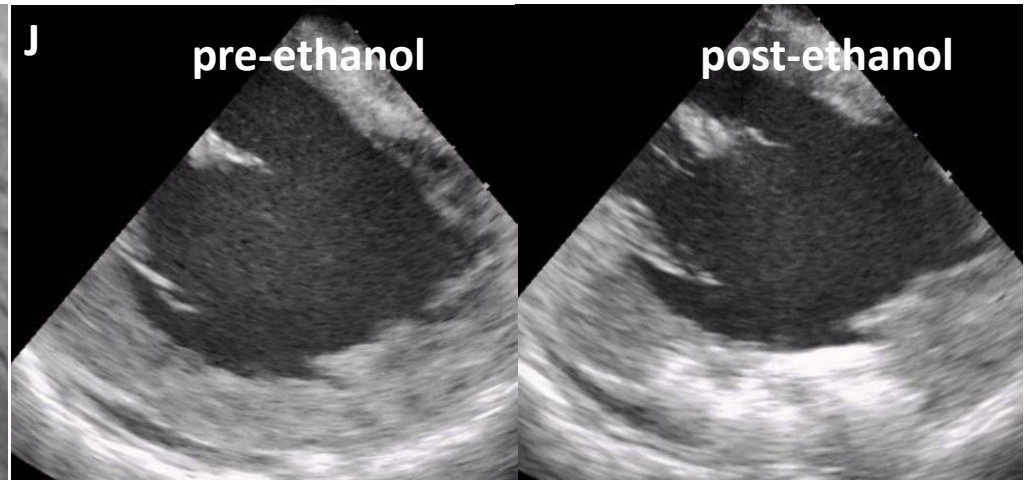




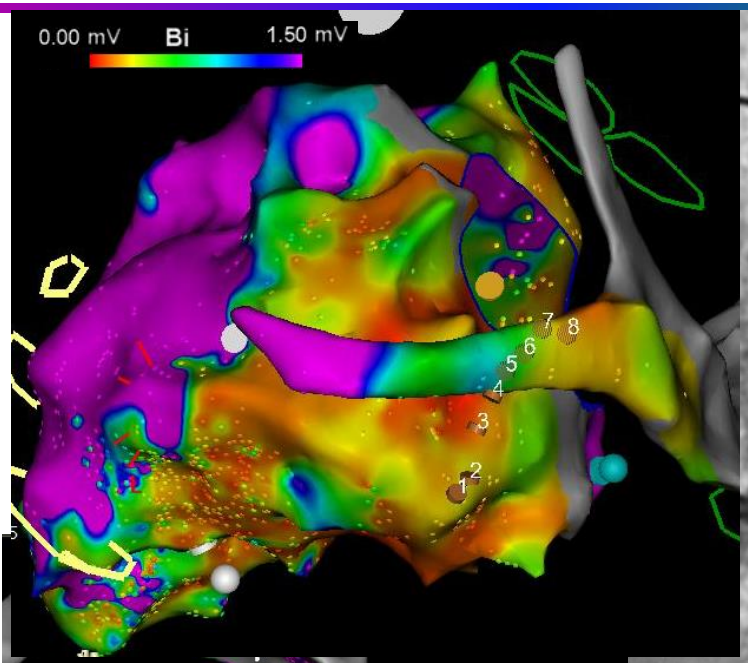


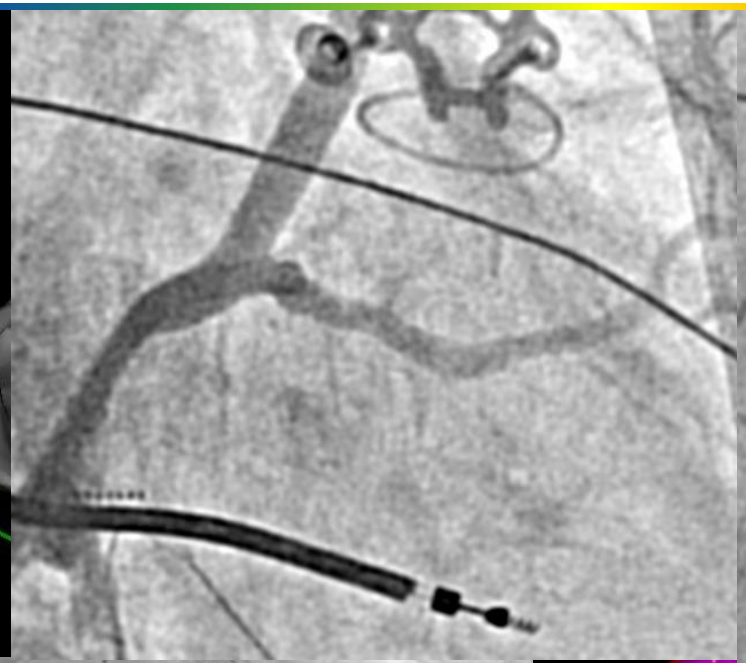


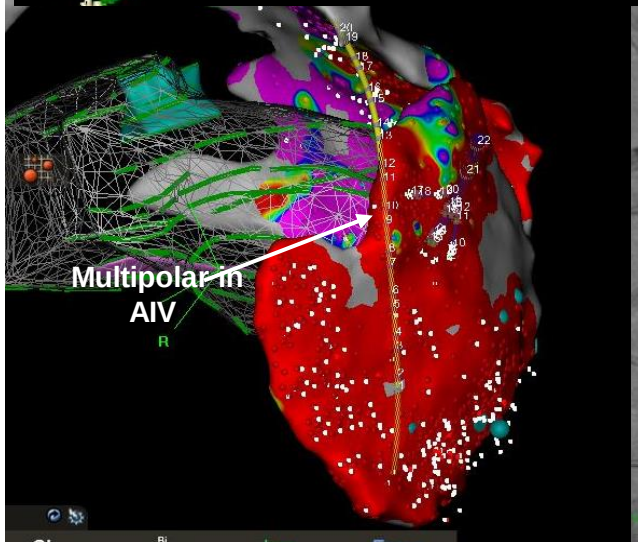


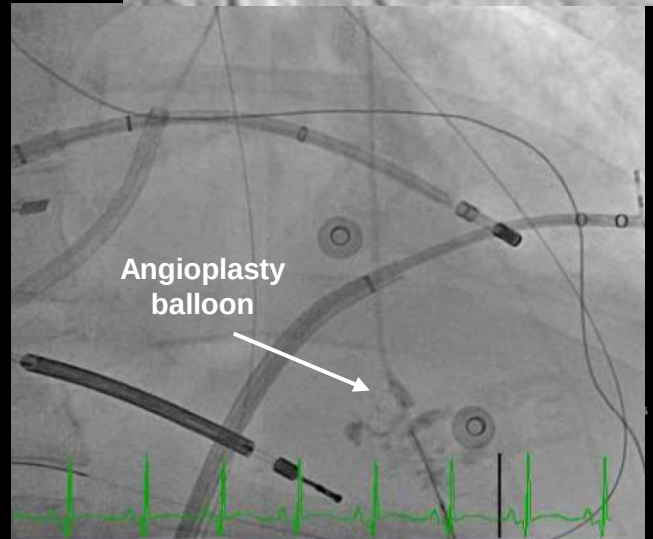


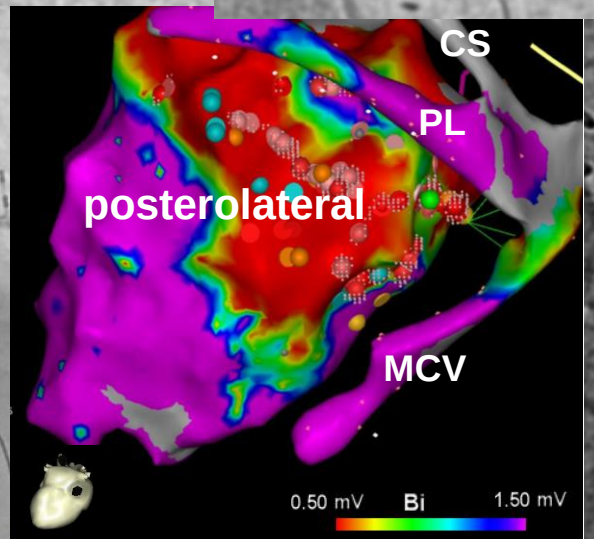
For every infarct, there is an epicardial vein

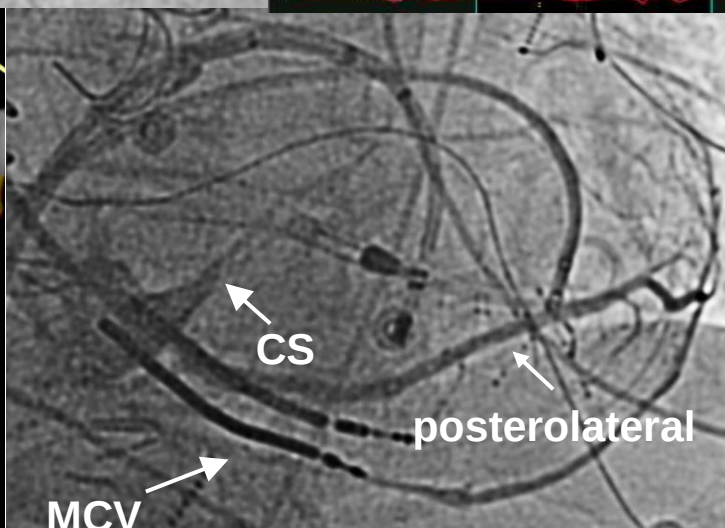






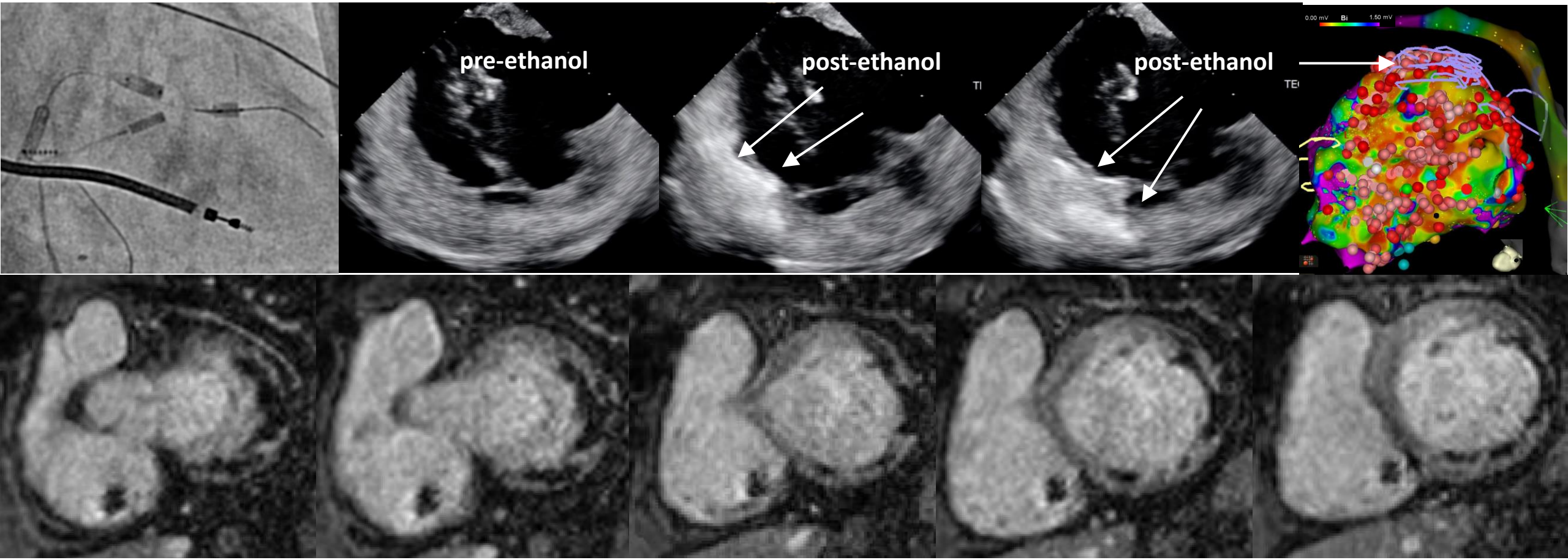






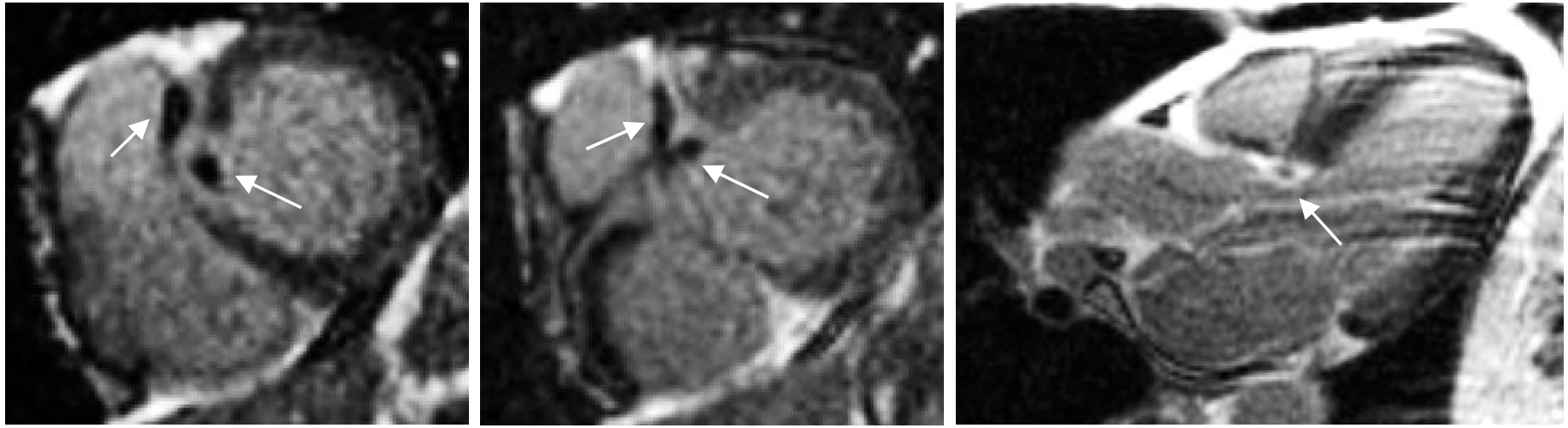
Ethanol-induced intramural ablation

Microvascular obstruction on CMR

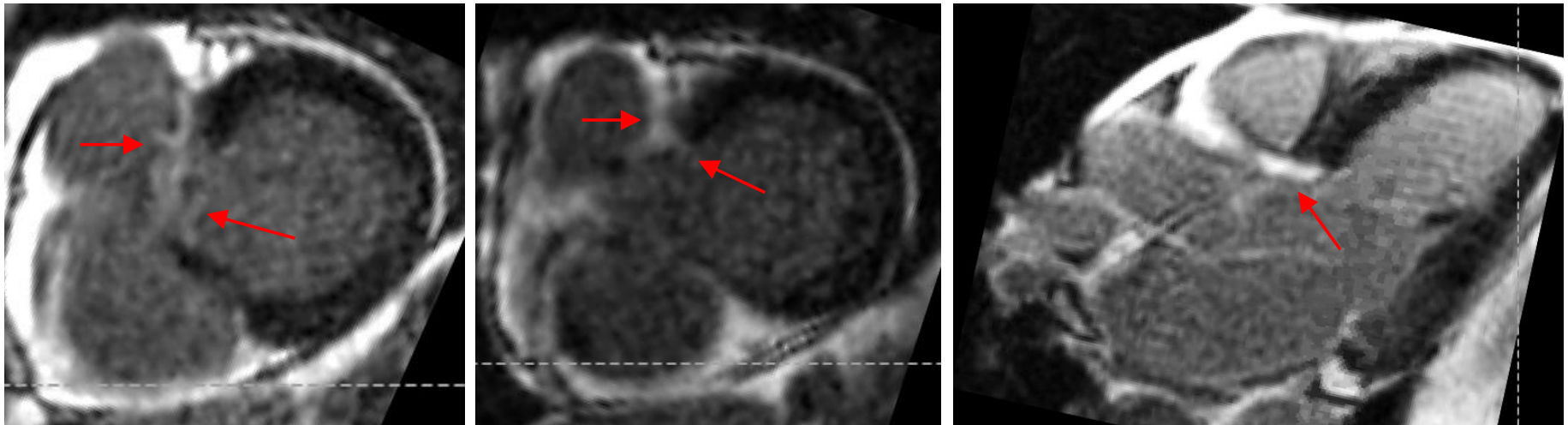


Microvascular occlusion replaced by scar

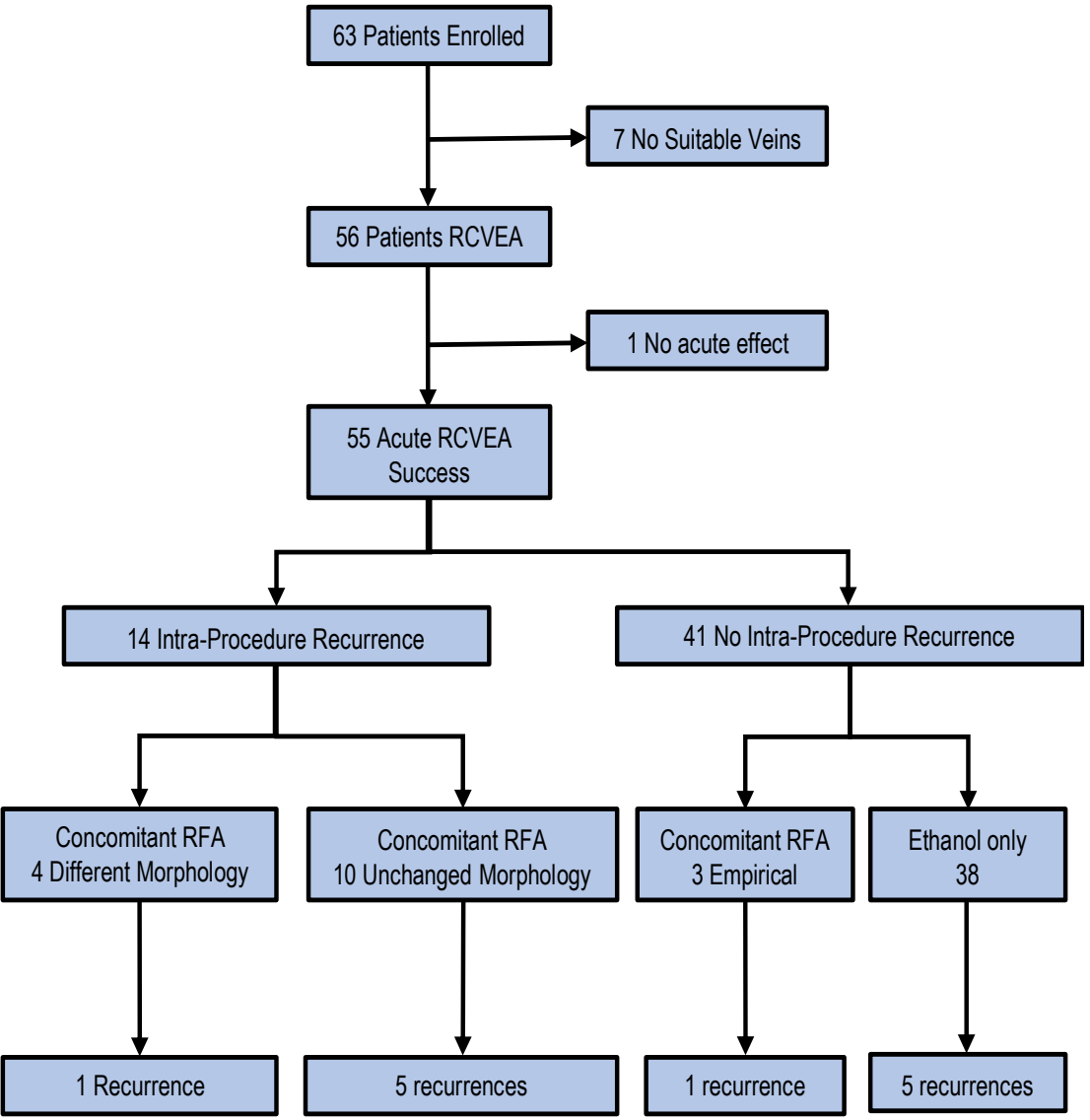
24 h post-ethanol

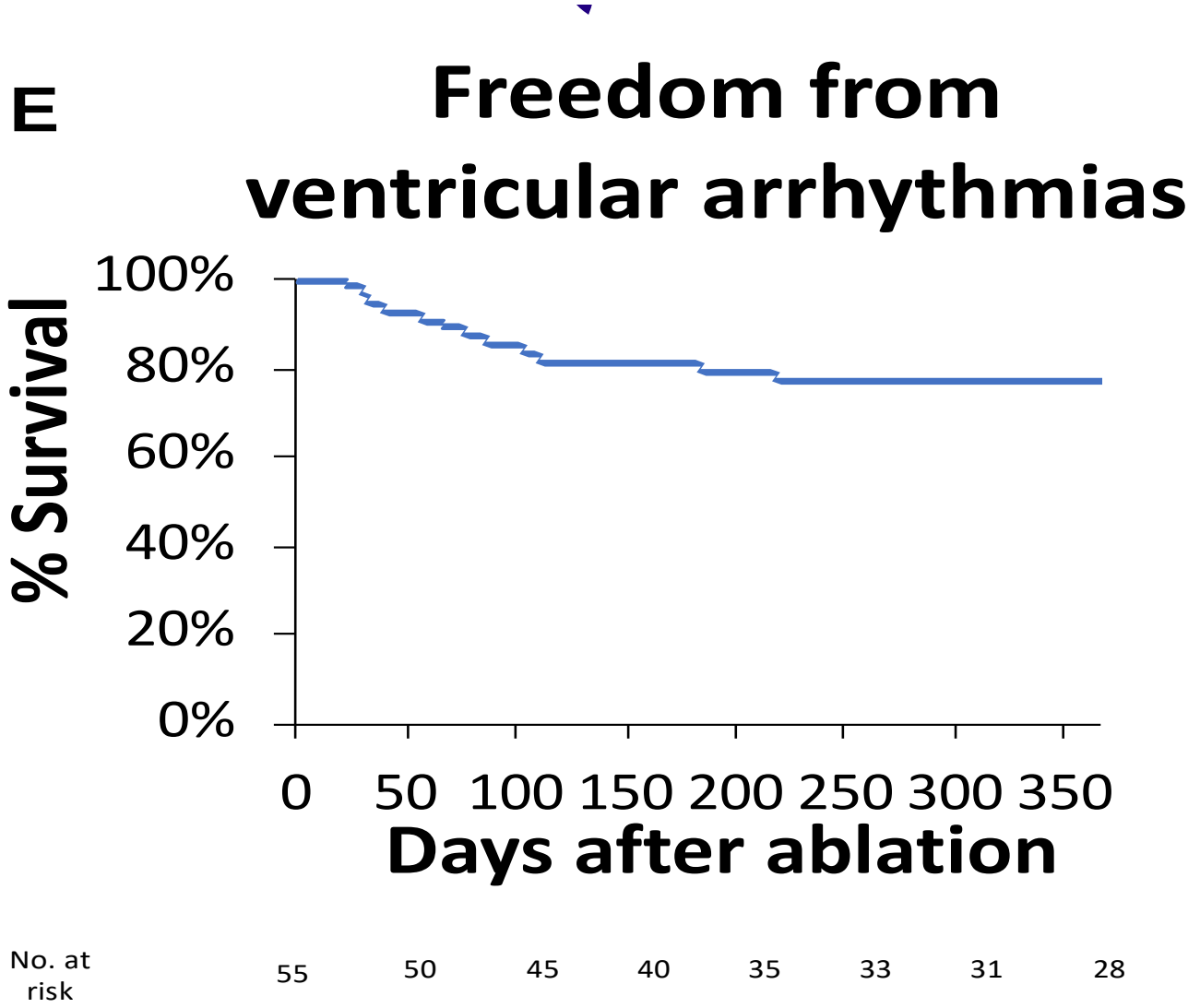


30 days post-ethanol



Venous ethanol for failed ablation: Outcomes



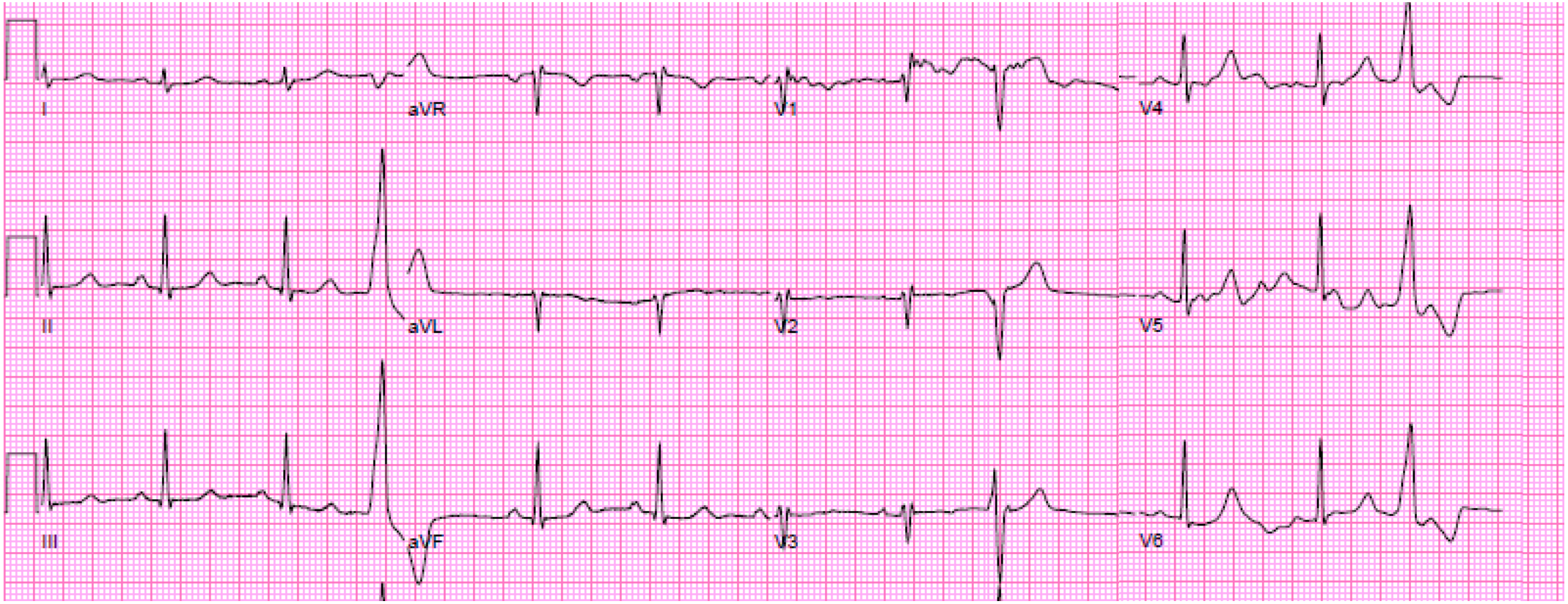


Conclusions

- Venous ethanol can target intramural focal sources –LV summit and others
- Large tissue ablation with double-balloon technique is achieved in infarct-related veins for ischemic VT: Lateral veins and others
- Microvascular occlusion detected on CMR acutely is replaced by scar
- Venous anatomy is challenging and variable and determines ethanol success
- Venous ethanol is a valuable tool for failed ablations of ventricular arrhythmias with 76% success at 1 year followup

54 y/o woman with recurrent palpitations

- Previous marathon runner. Palpitations for 3 years
- Failed ablation x2 elsewhere



CEPS / VT · Ablation · Unspecified 8:57:58

TM Template1

m/s

100 mm/s

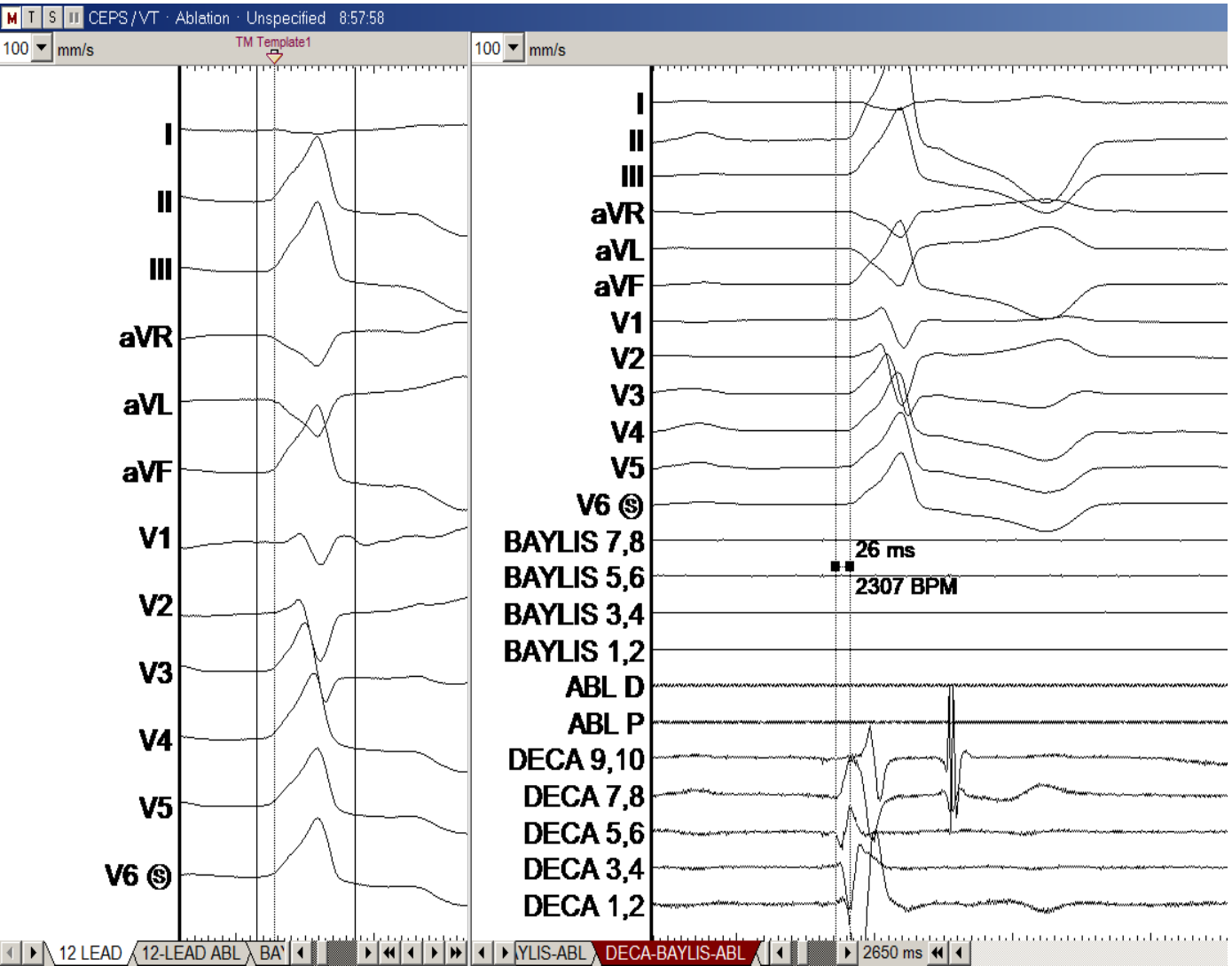
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6 Ⓢ

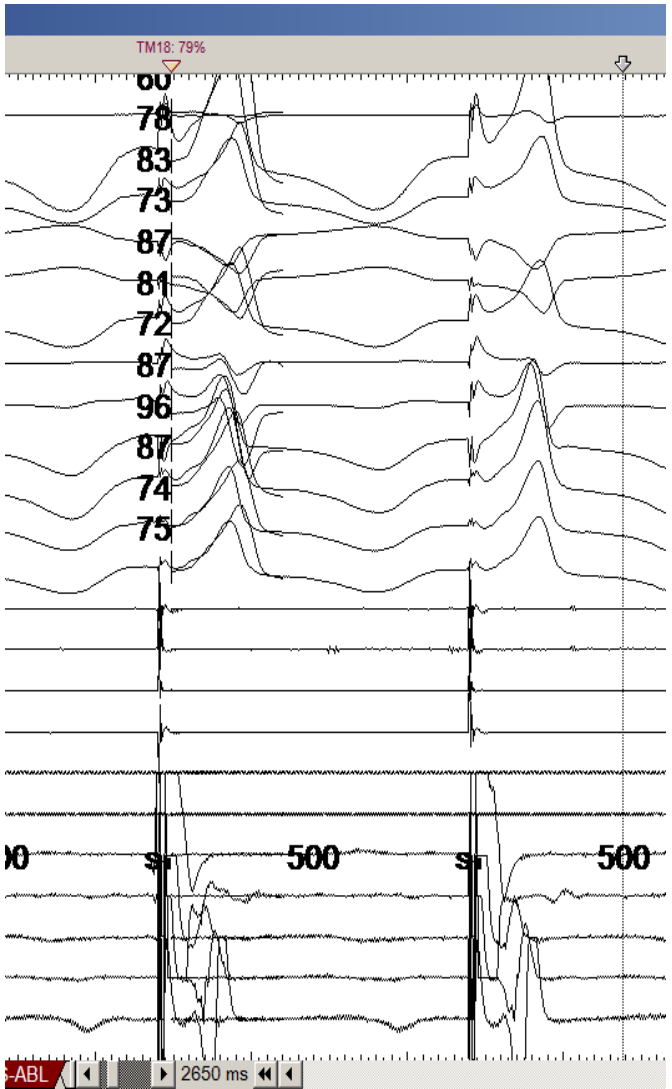
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6 Ⓢ
BAYLIS 7,8
BAYLIS 5,6
BAYLIS 3,4
BAYLIS 1,2
ABL D
ABL P
DECA 9,10
DECA 7,8
DECA 5,6
DECA 3,4
DECA 1,2

2 LEAD | 12-LEAD ABL | BA | YLIS-ABL | DECA-BAYLIS-ABL | 2650 ms

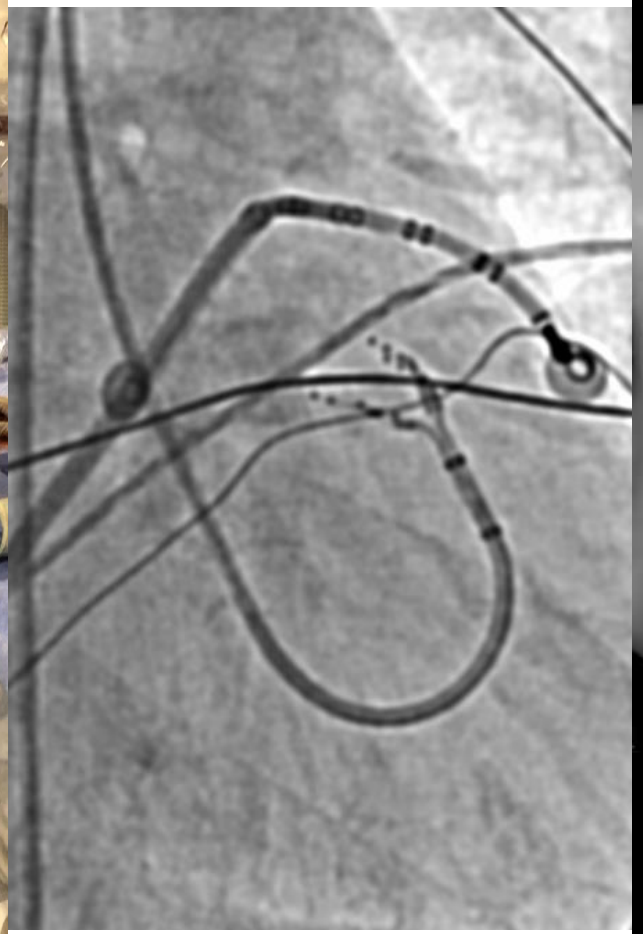
Signal from AIV

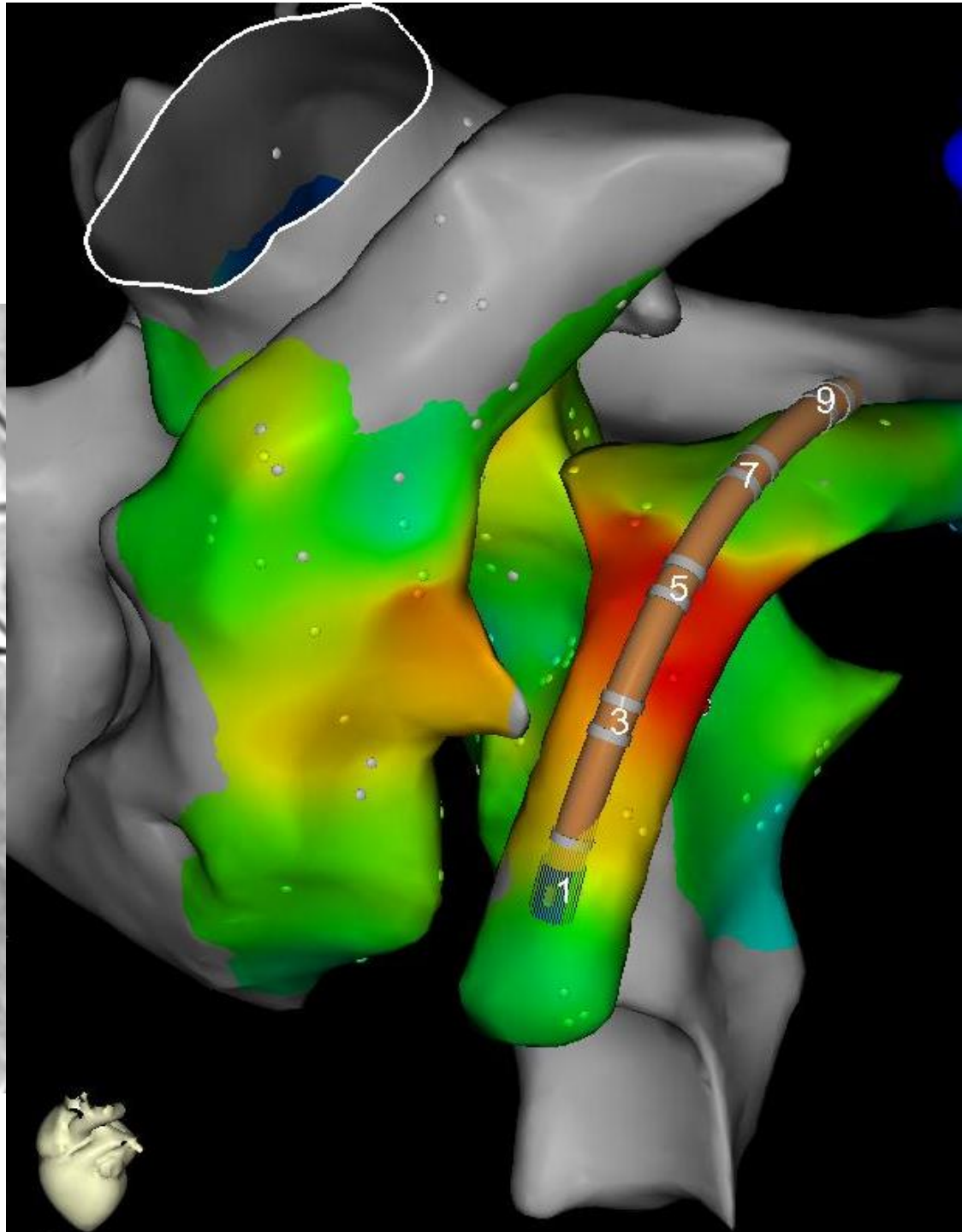
26 msec pre-QRS, 79% pace-map match



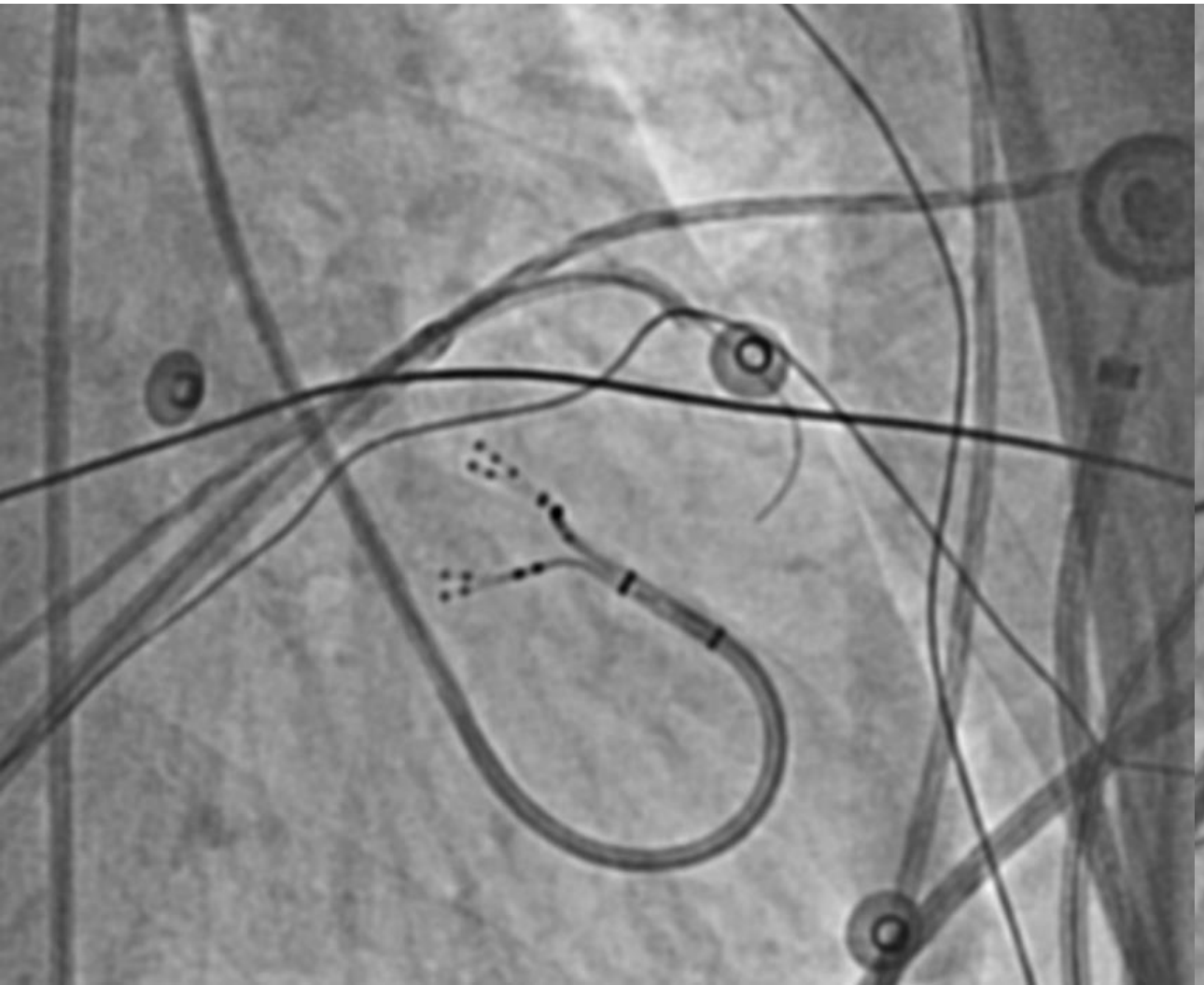


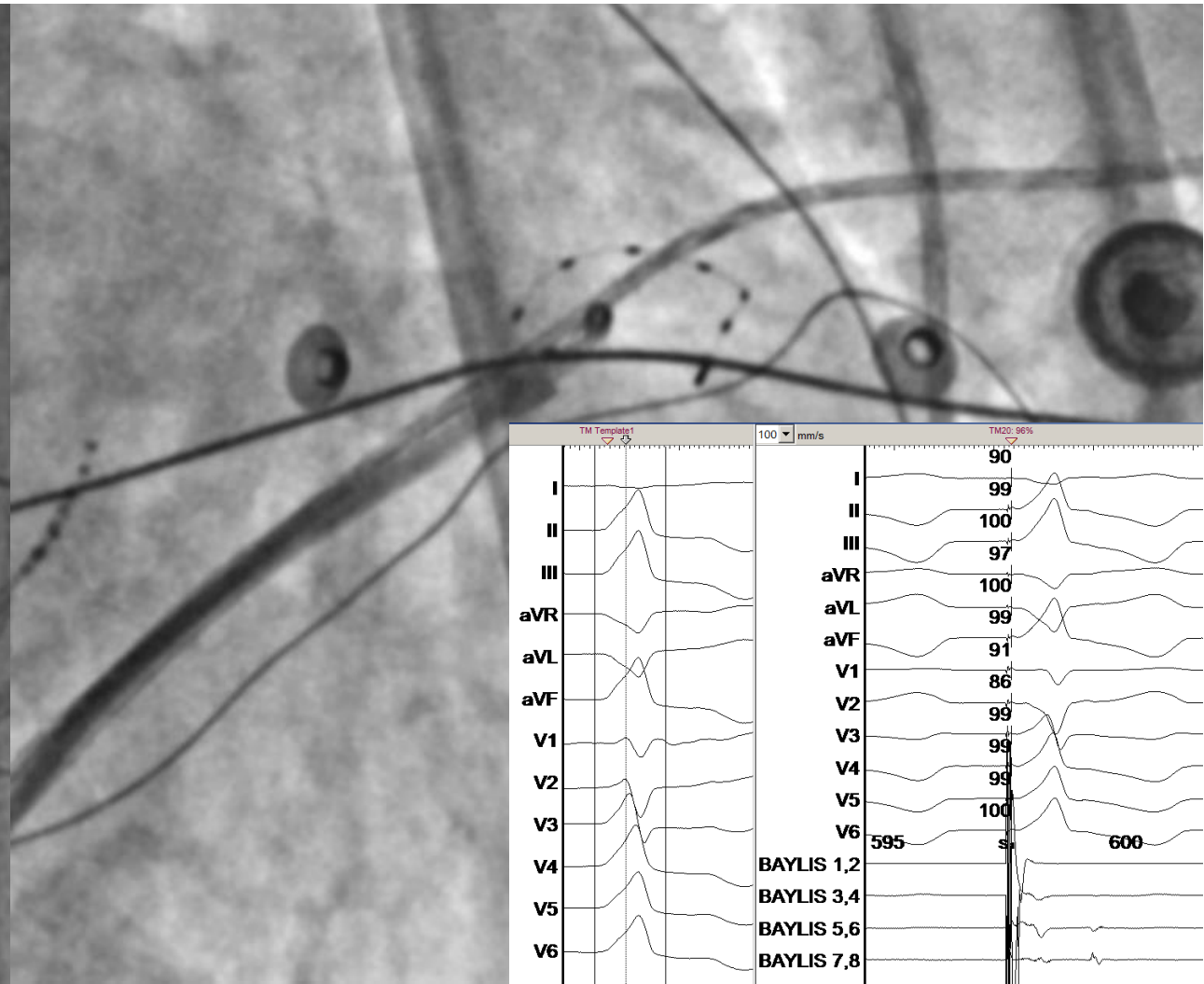

7-RA... (41, 0) Resp
-122 ms
LAT
-21 ms
618
-117 Loc
0.47
CL
LAT (ms)
Bi (mV)
200 mm/sec
I
II
III
aVL
aVR
aVF
R V1
R V2
R V3
R V4
R V5
R V6
CS 1-2
CS 3-4
M
CS 5-6
CS 7-8
CS 9-10
1
3
5
7
9
0.71
LAO
-222
0 sec

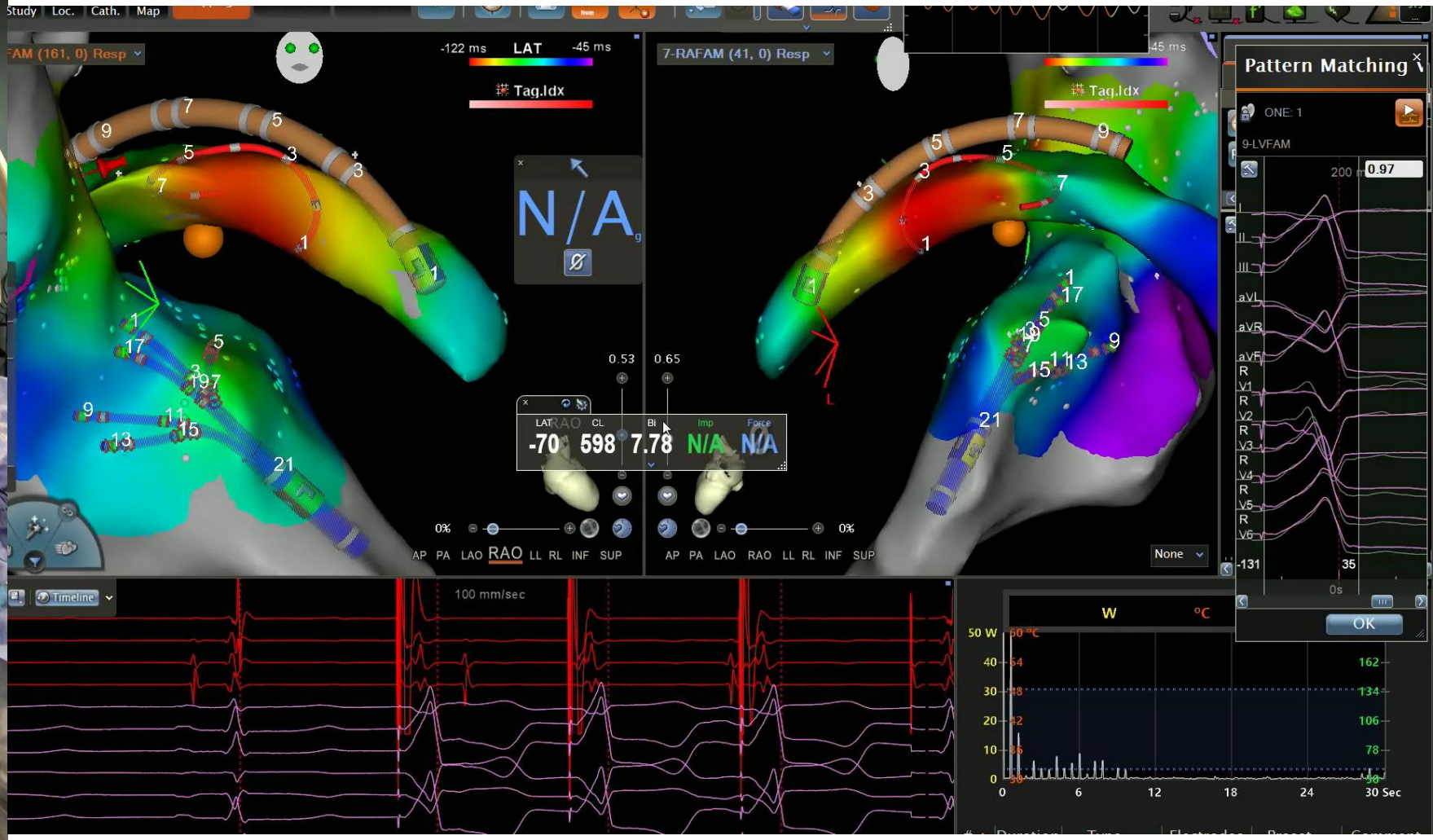



9
7
5
3
1

AIV venograms and AIV septal cannulation

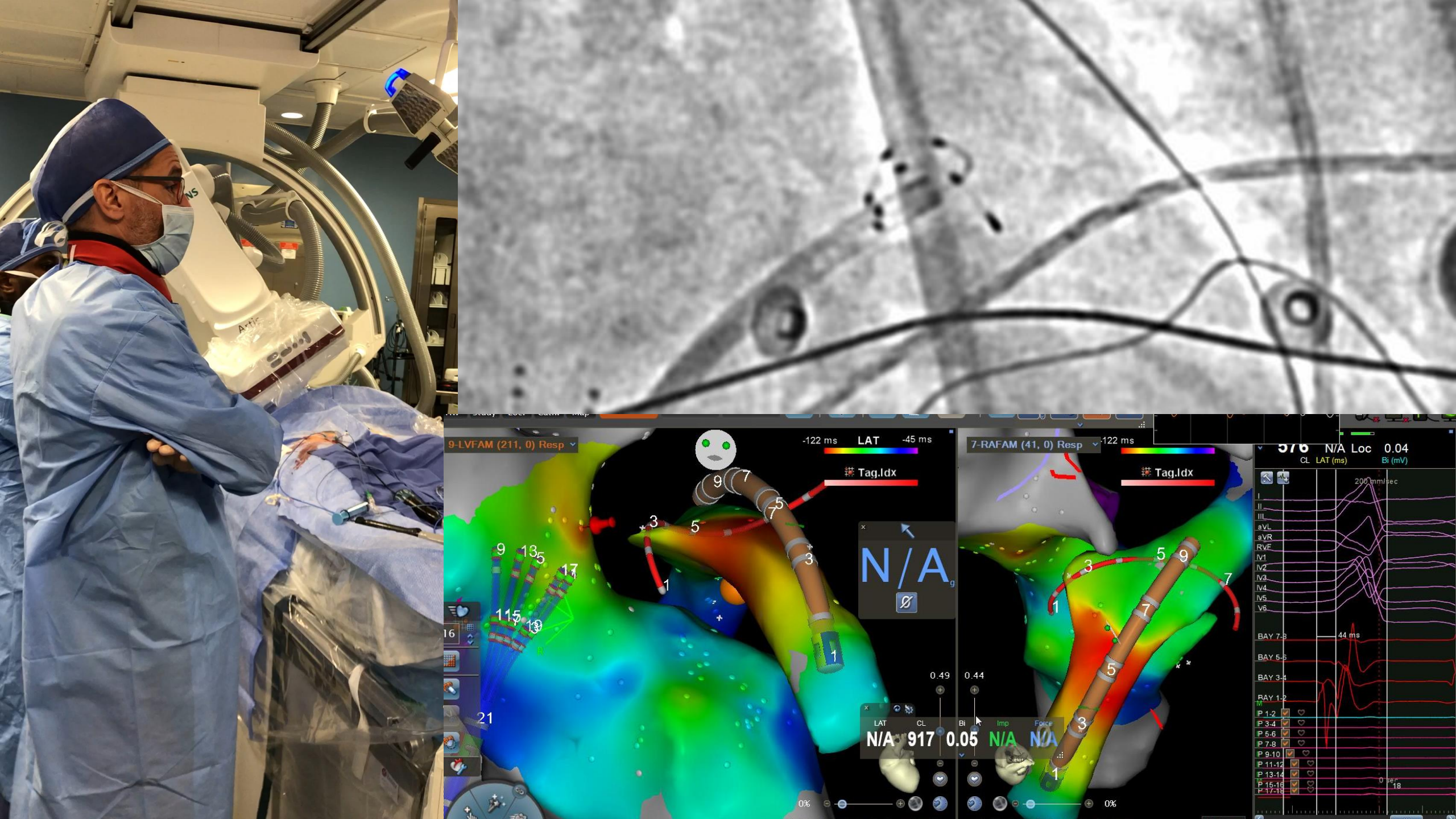





Study
Loc.
Cath.
Map
-122 ms
LAT
-45 ms
Tag.Idx
N/A
7-RAFAM (41, 0) Resp
Pattern Matching
ONE: 1
9-LVFAM
0.97
0.53
0.65
LAT
CL
Bi
Imp
Force
-70
598
7.78
N/A
N/A
AP PA LAO RAO LL RL INF SUP
None
OK

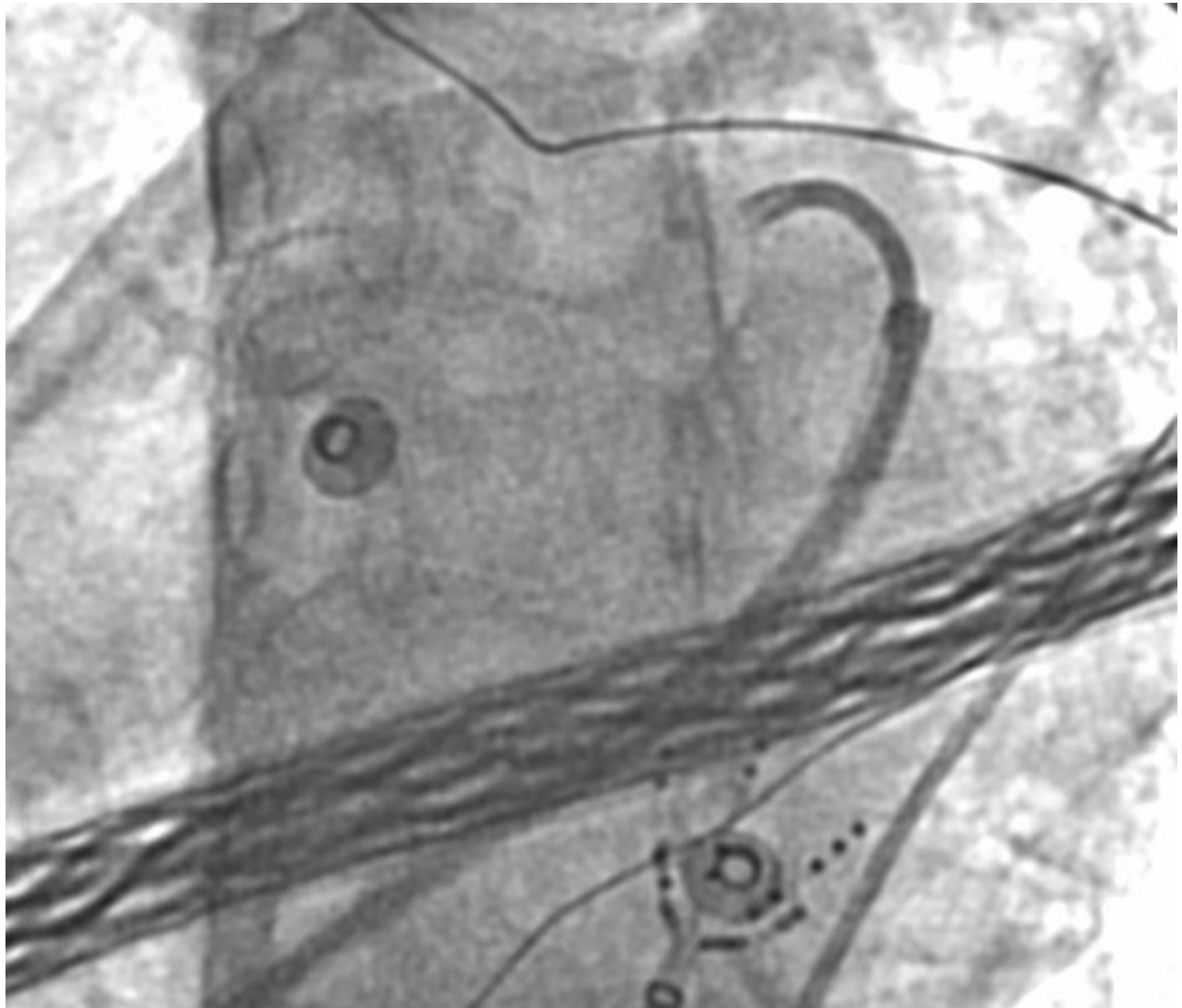
Timeline
100 mm/sec

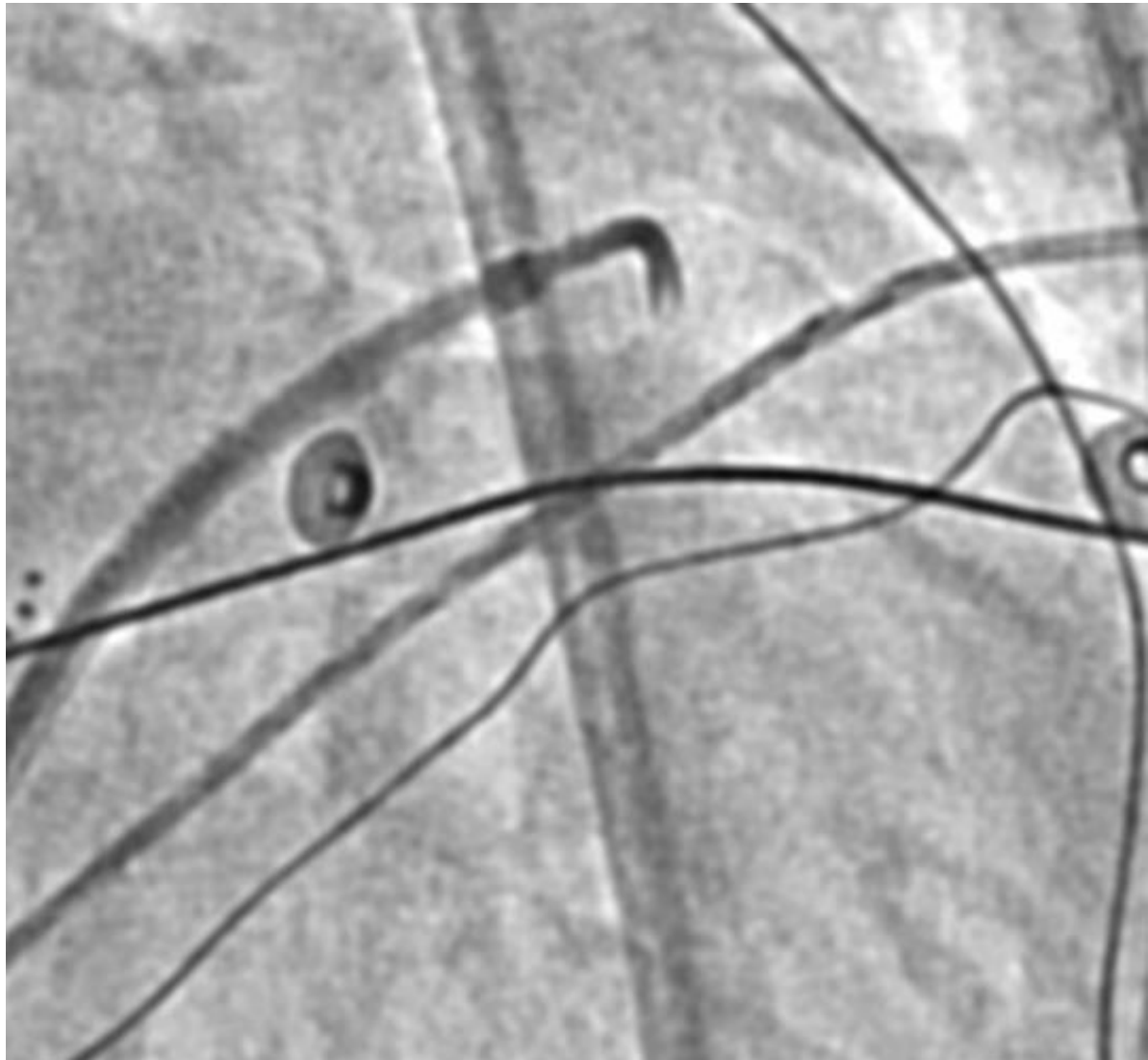
W
°C
50 W
60 °C
0
6
12
18
24
30 Sec


9-LVFAM (211, 0) Resp
-122 ms
LAT
-45 ms
Tag.Idx
N/A
7-RAFAM (41, 0) Resp
-122 ms
Tag.Idx
N/A Loc
0.04
CL
LAT (ms)
Bi (mV)
200 mm/sec
LAT
CL
Bi
Imp
Force
N/A
917
0.05
N/A
N/A
0.49
0.44
44 ms
0%
0%

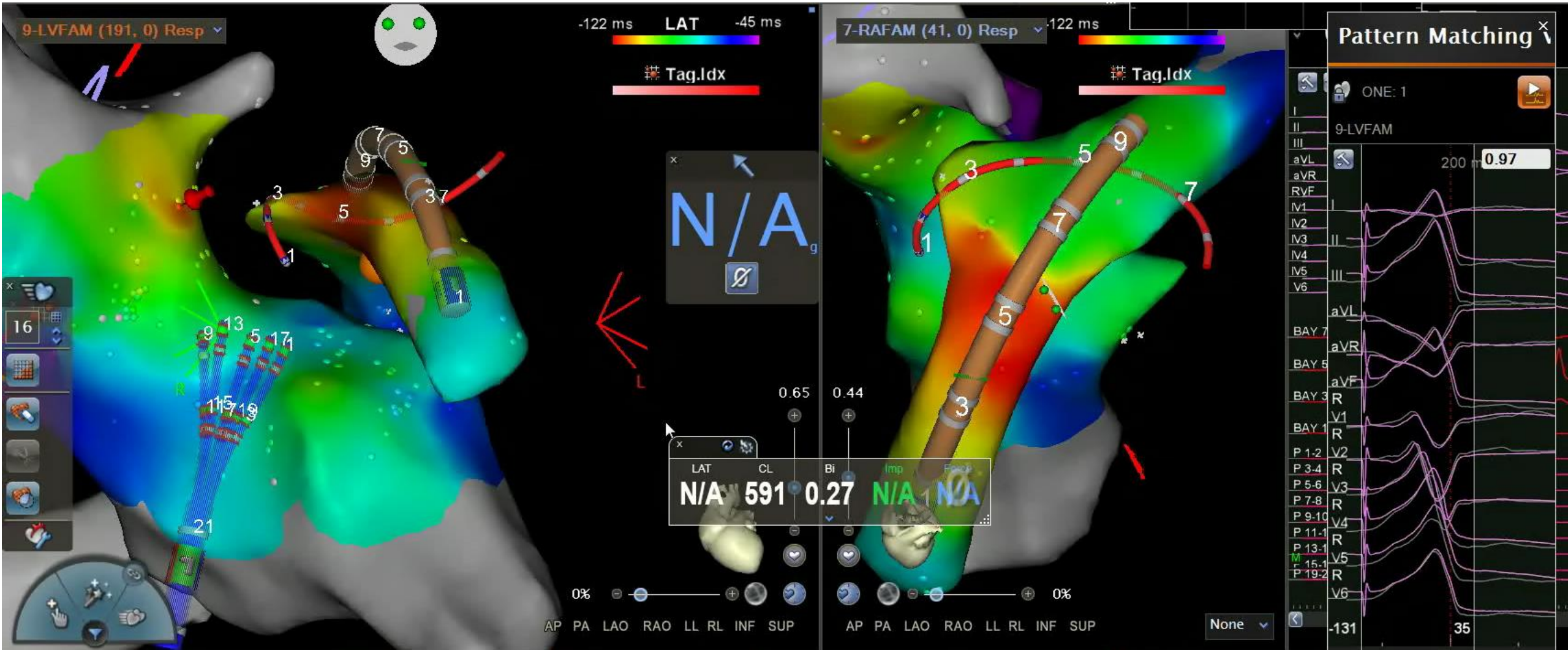
LV annular vein parallel to AIV

The importance of LAO caudal projection

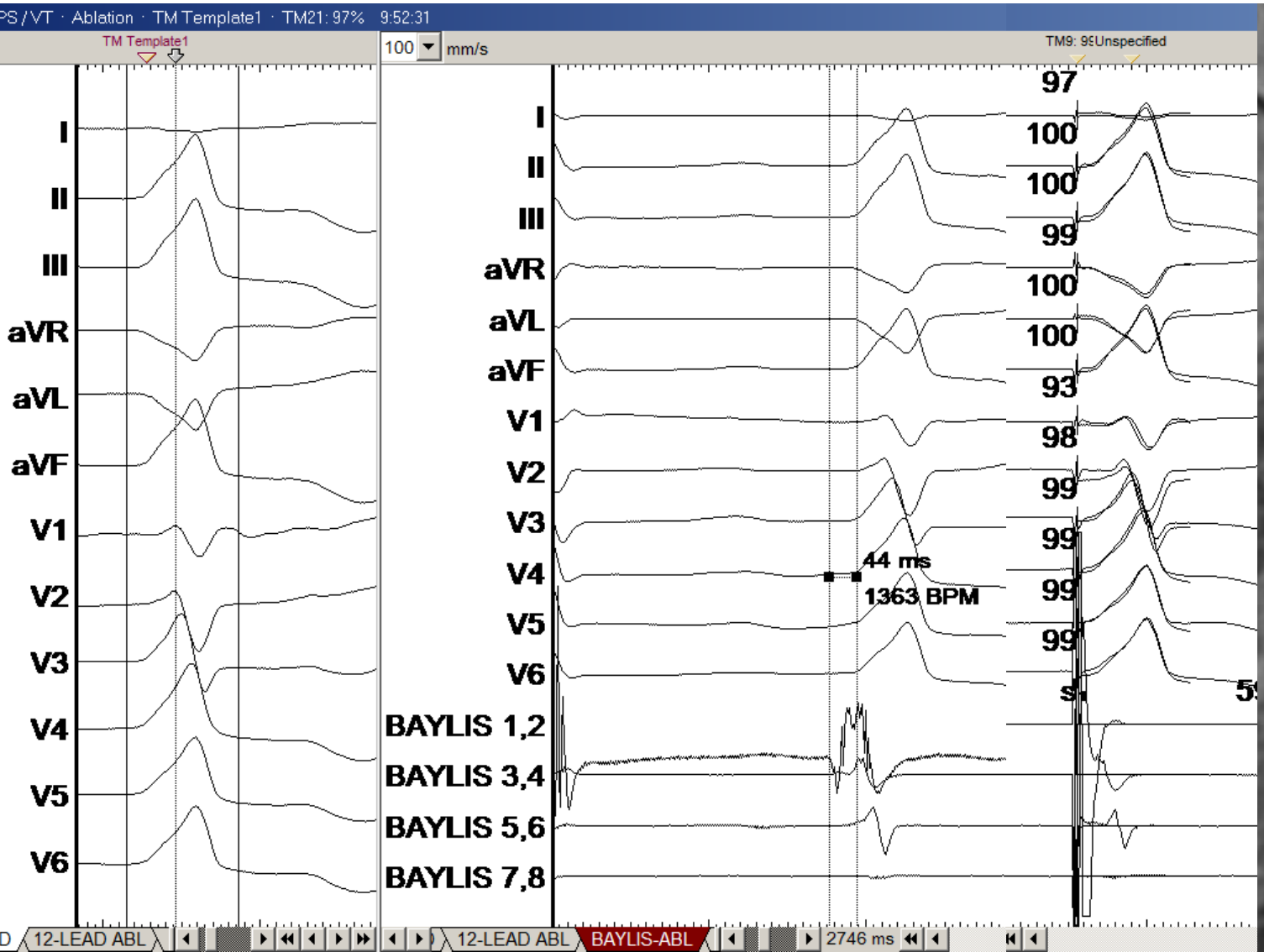


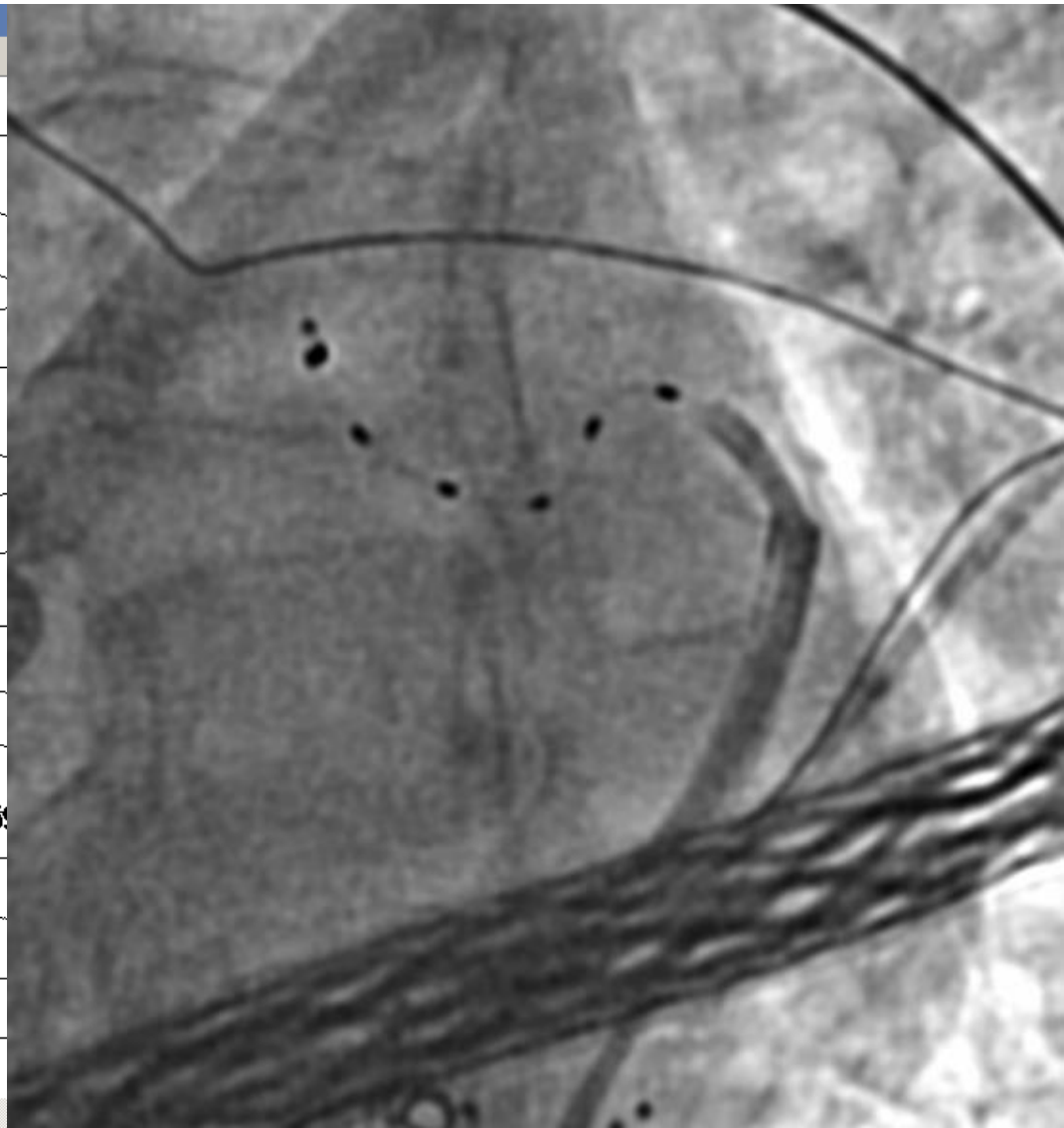


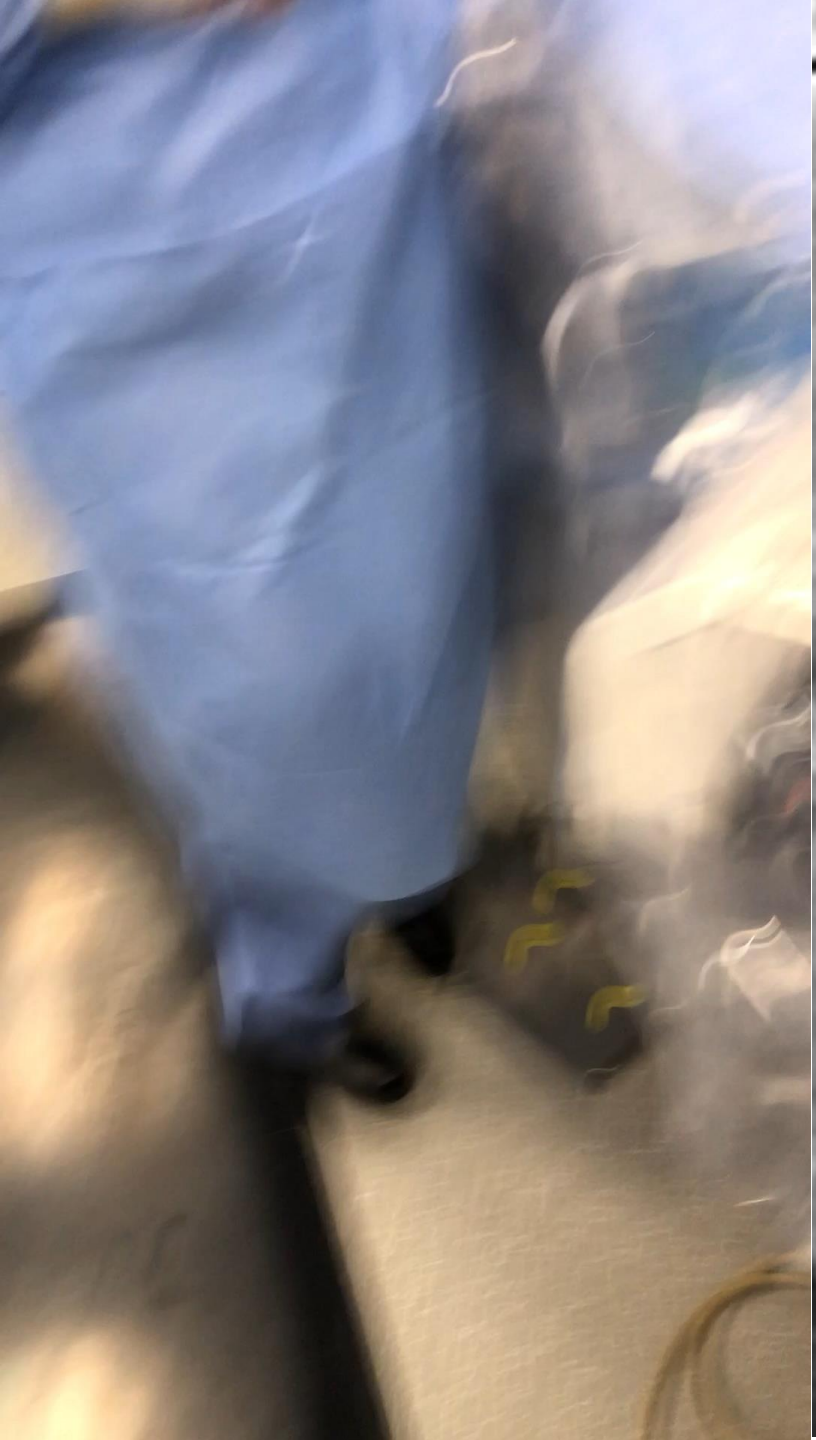
Perfect pace-map from LV annular

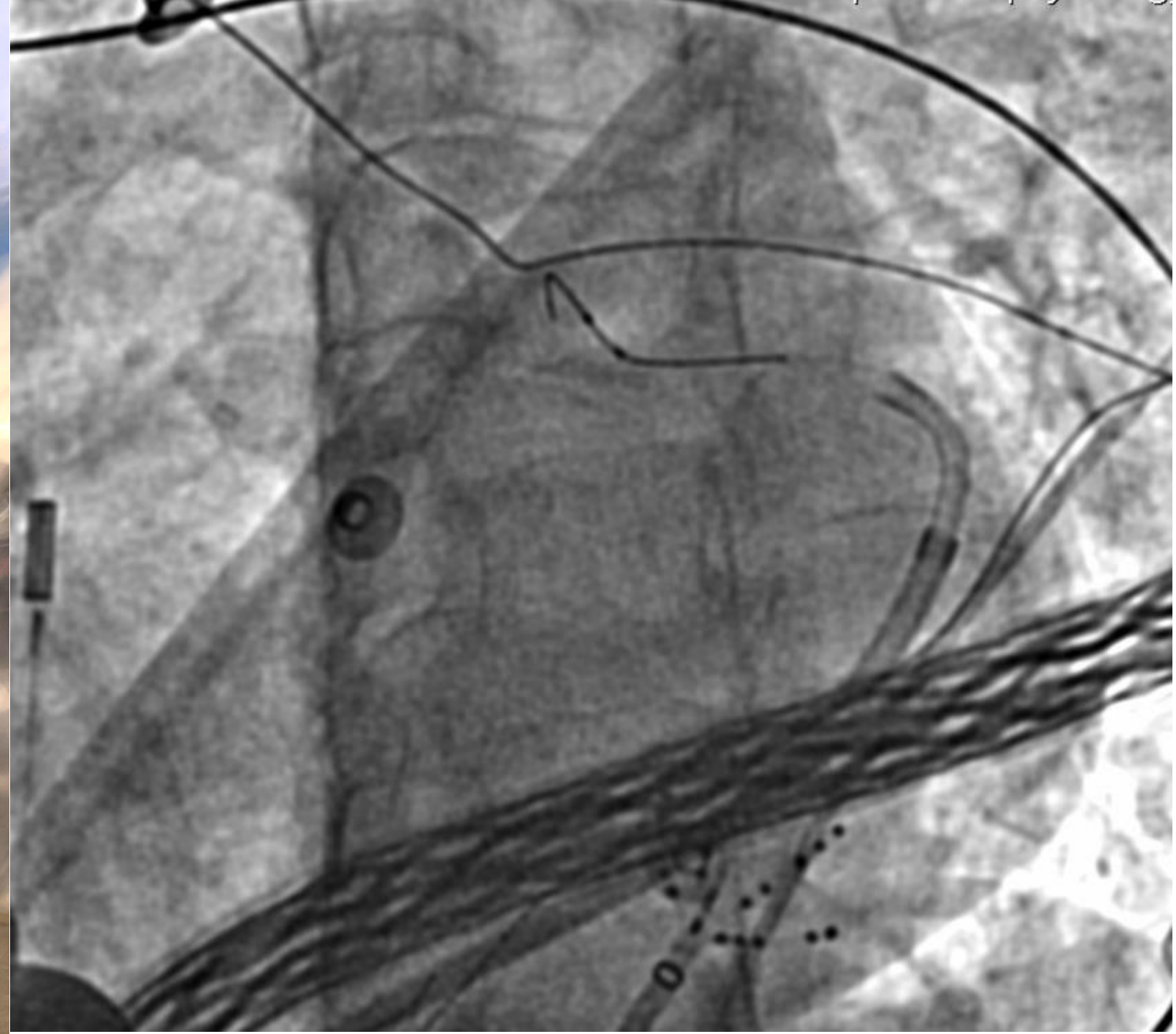


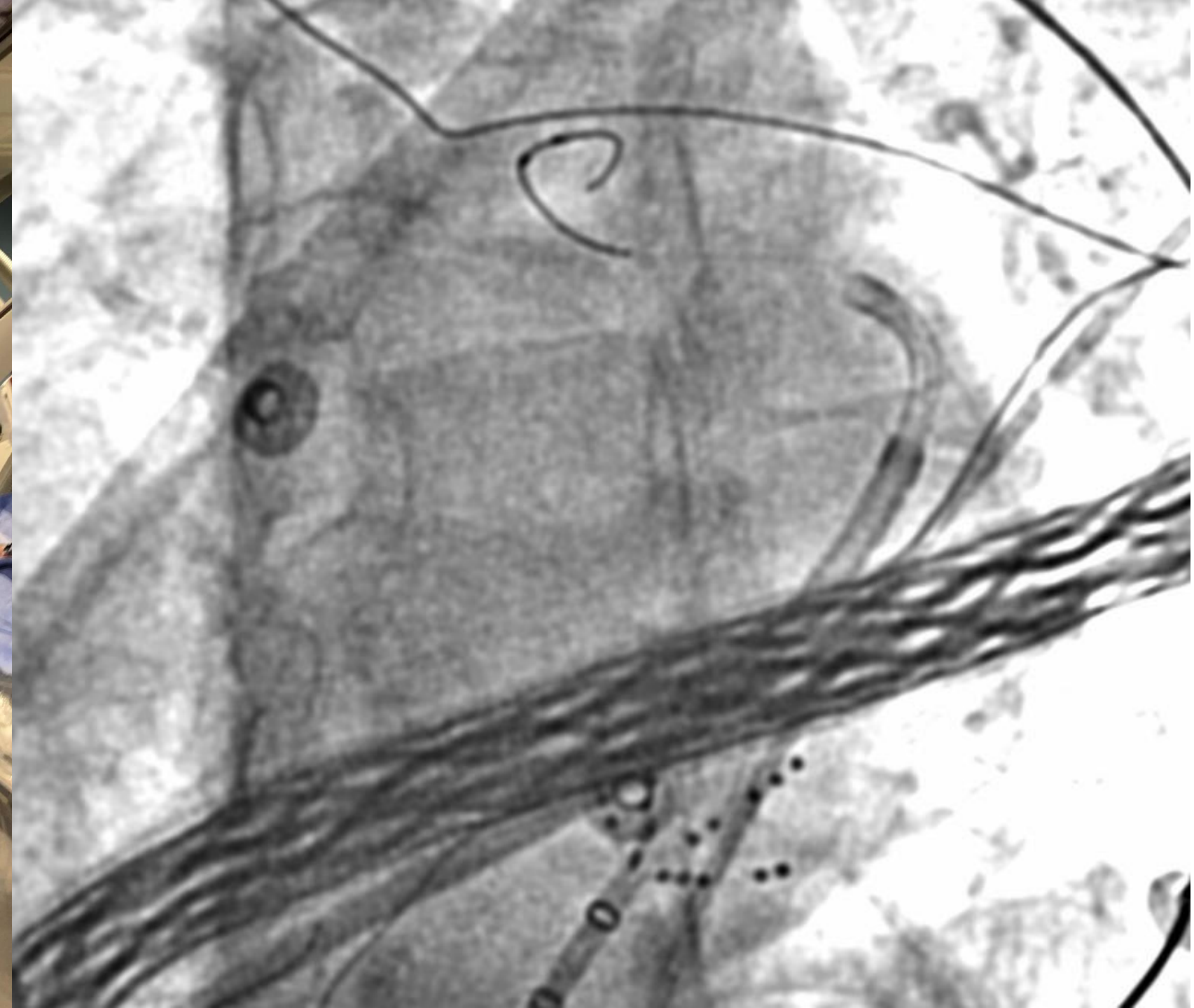
Branch of LV annular

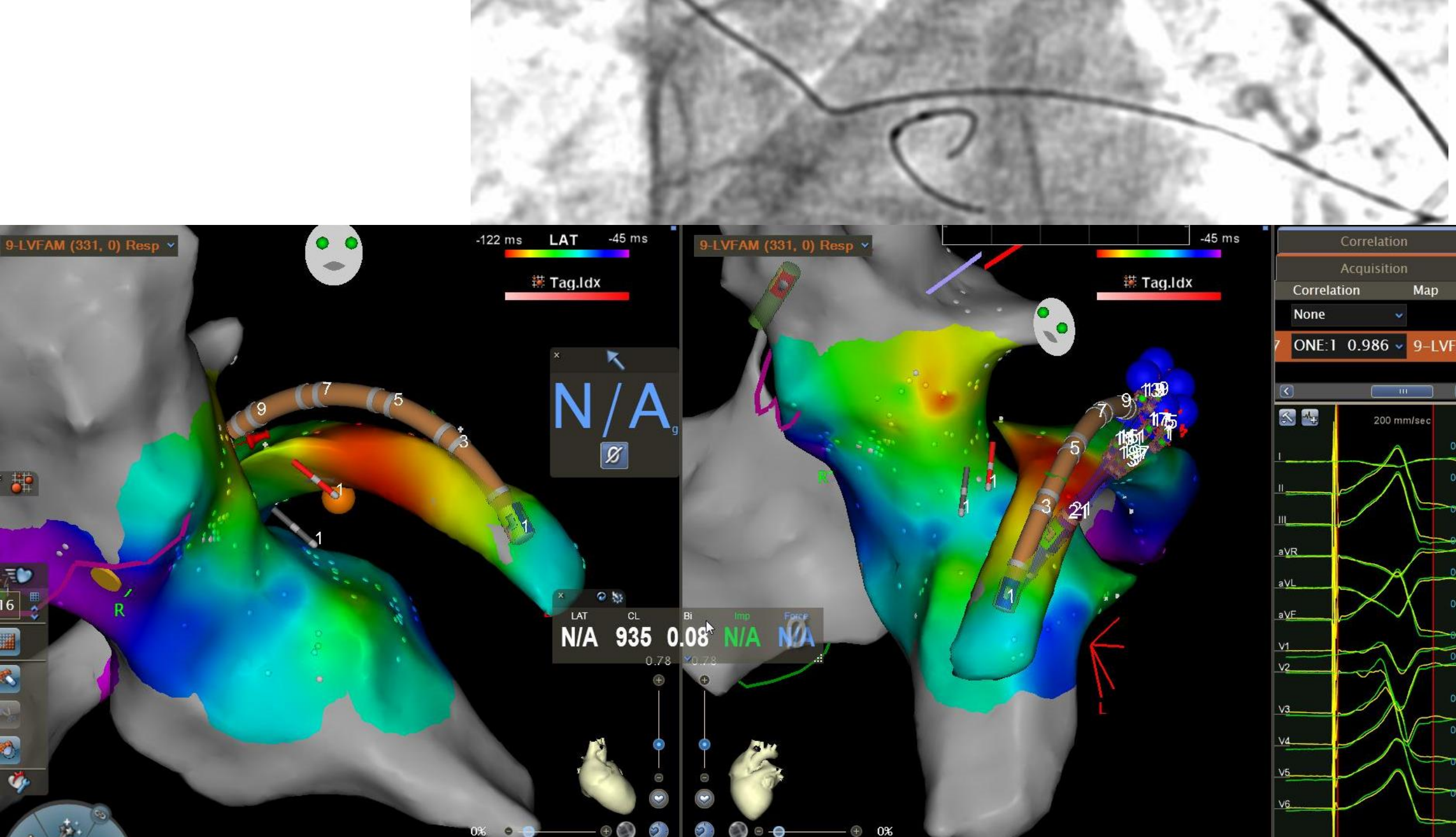




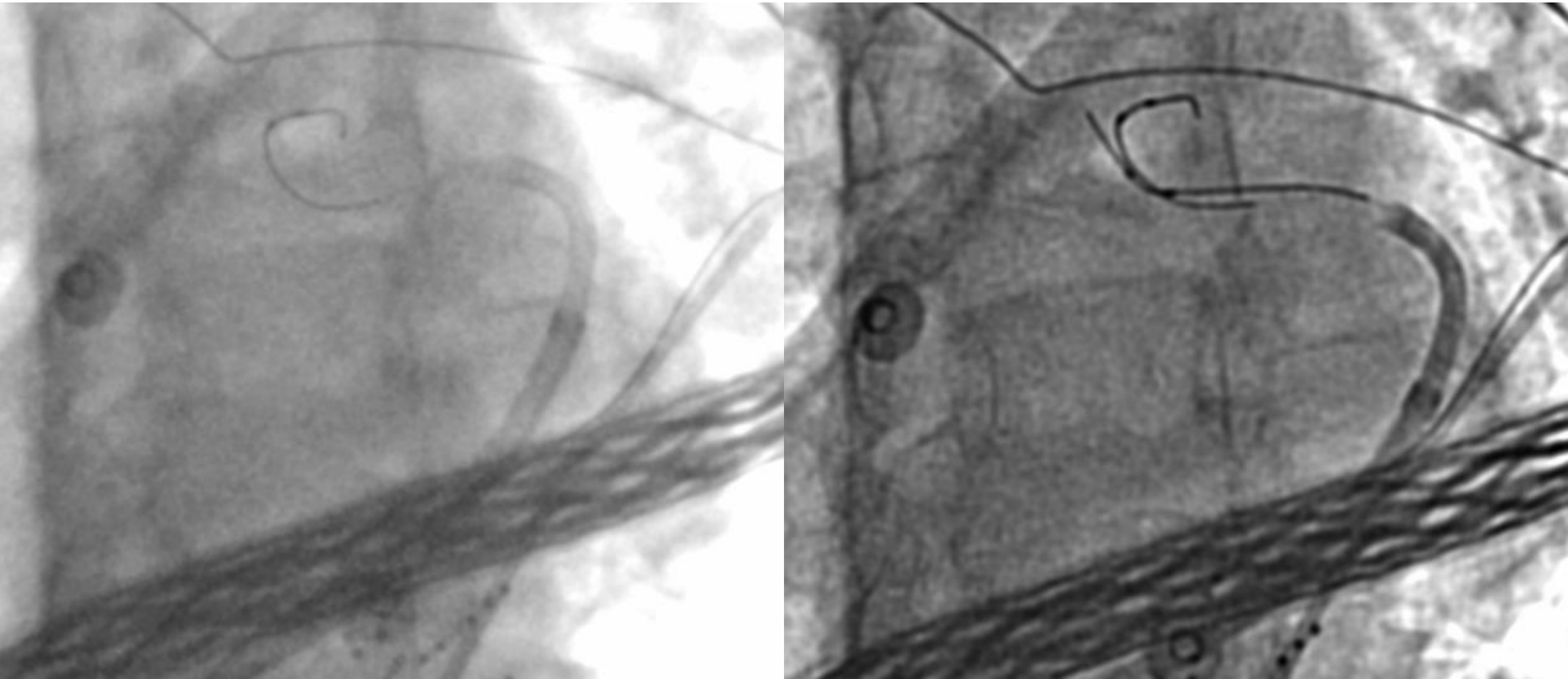




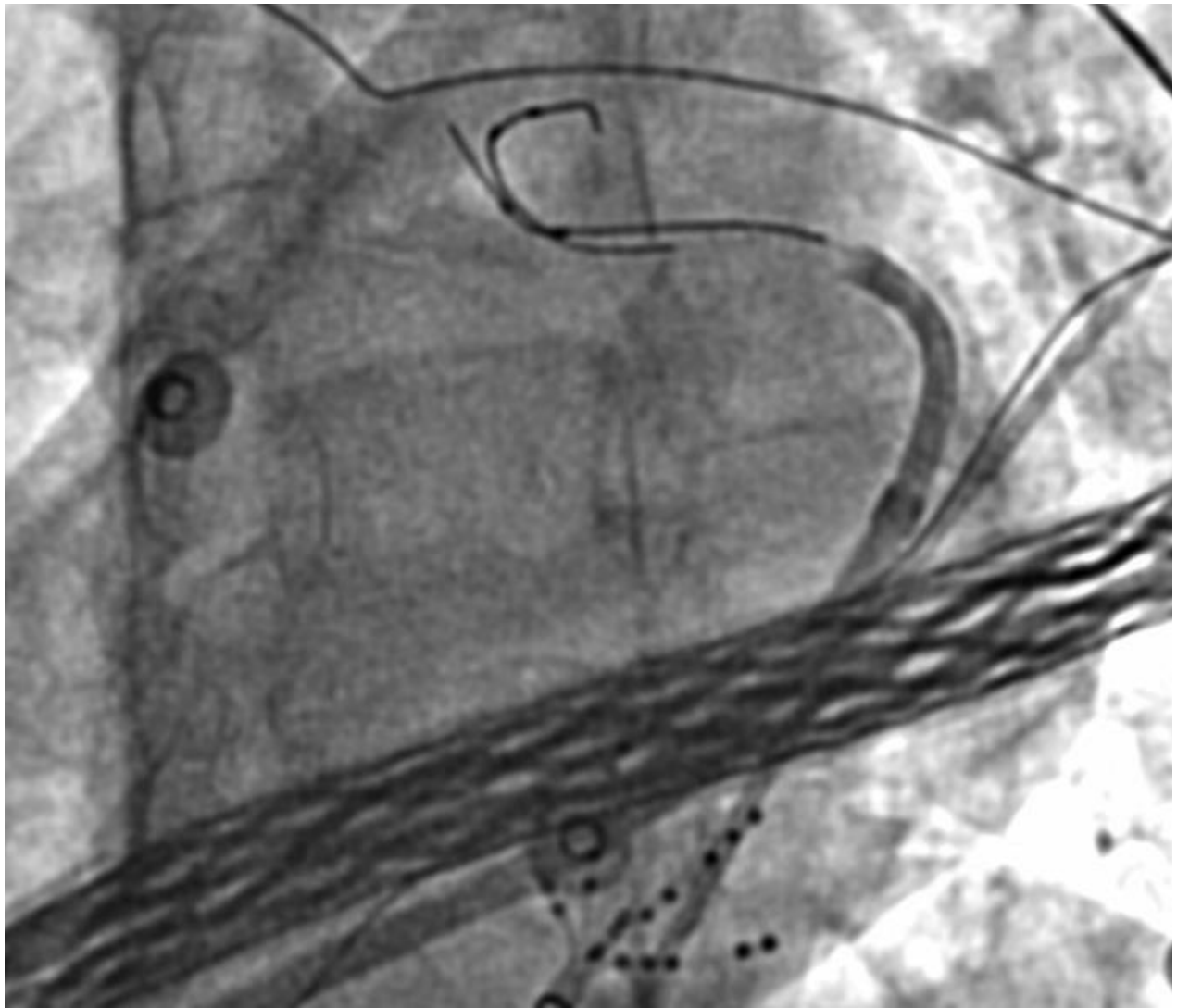


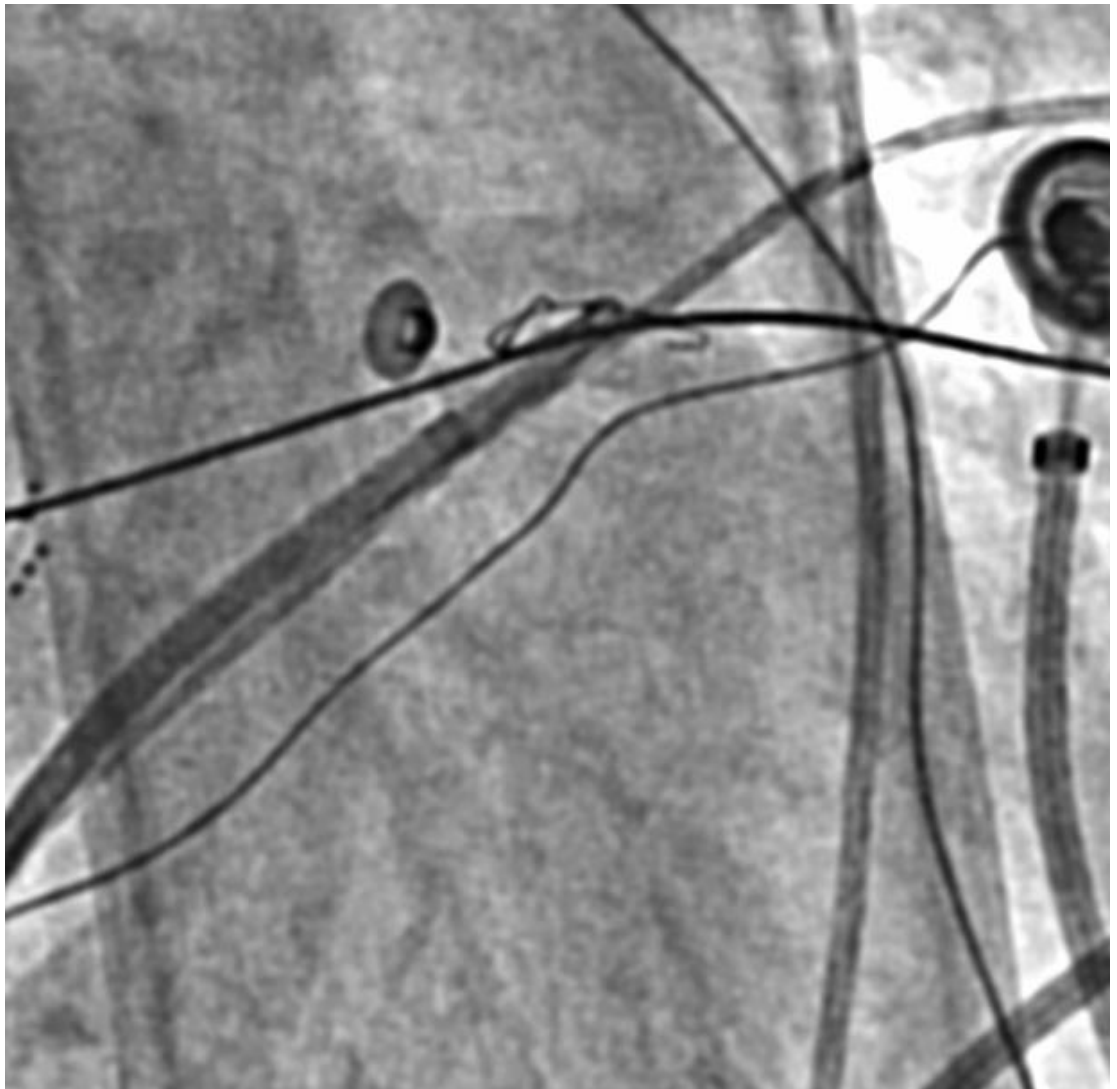

9-LVFAM (331, 0) Resp
-122 ms
LAT
-45 ms
Tag.Idx
N/A
LAT
CL
Bi
Imp
Force
N/A
935
0.08
N/A
N/A
9-LVFAM (331, 0) Resp
-45 ms
Tag.Idx
Correlation
Acquisition
Correlation
Map
None
ONE:1
0.986
200 mm/sec
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

Double wiring and balloon

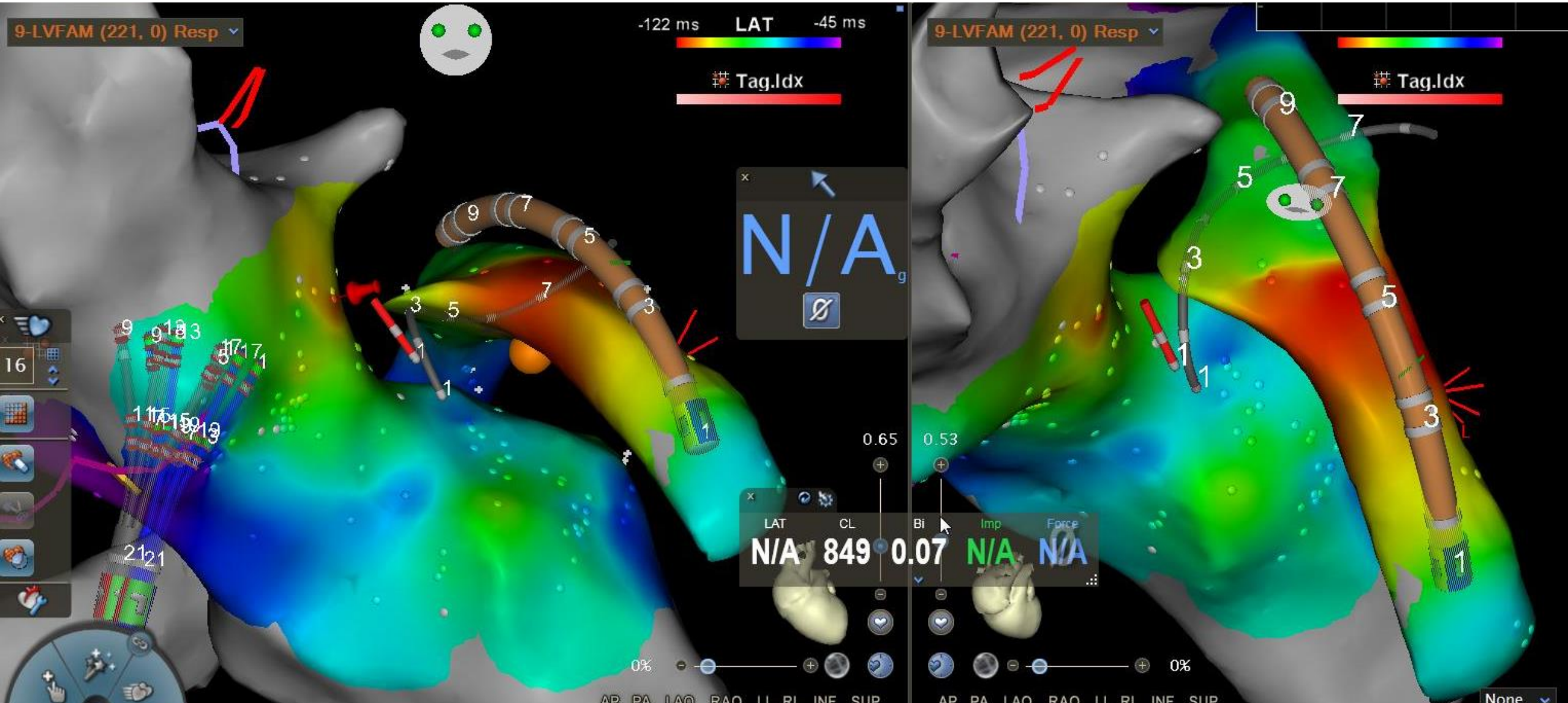


Double balloon-wire in LAO caudal vs RAO

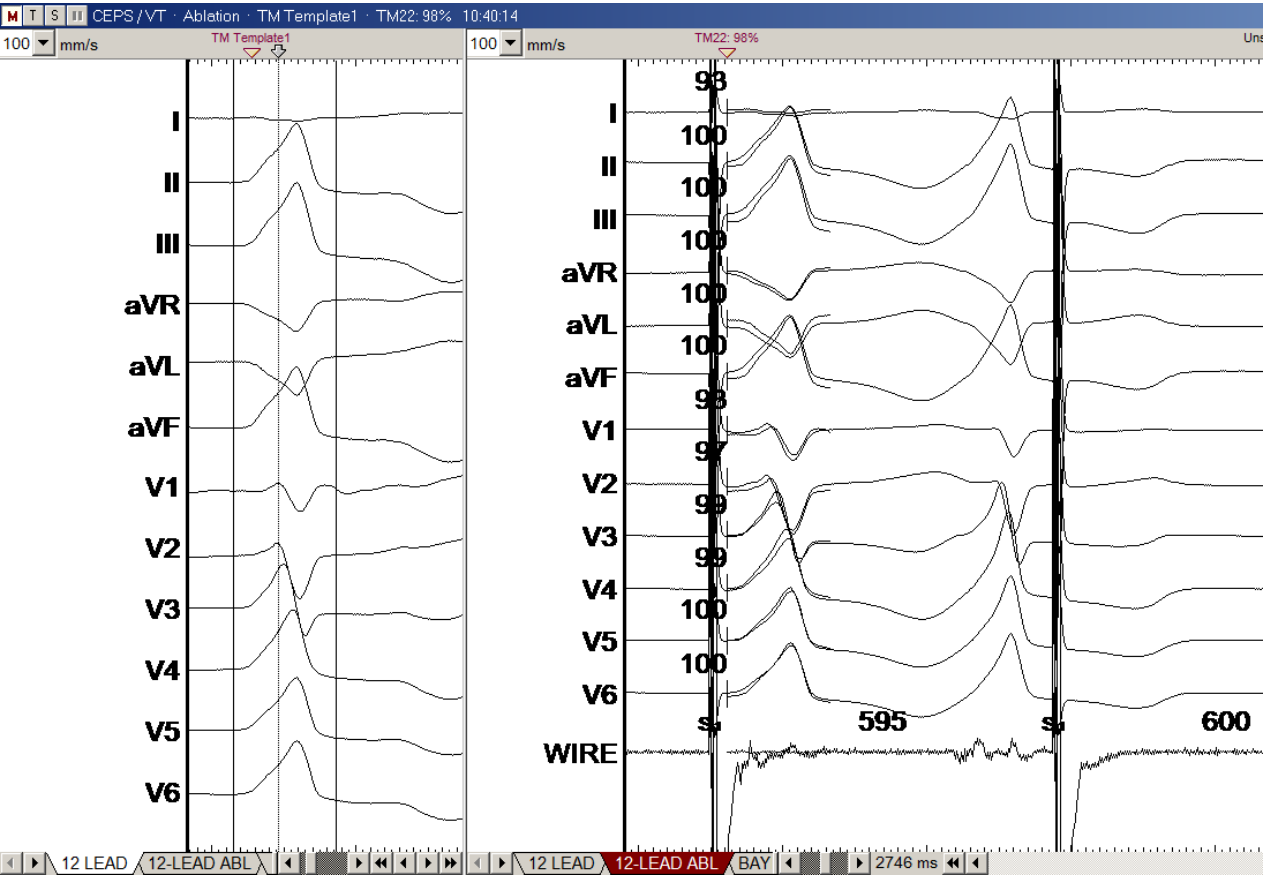


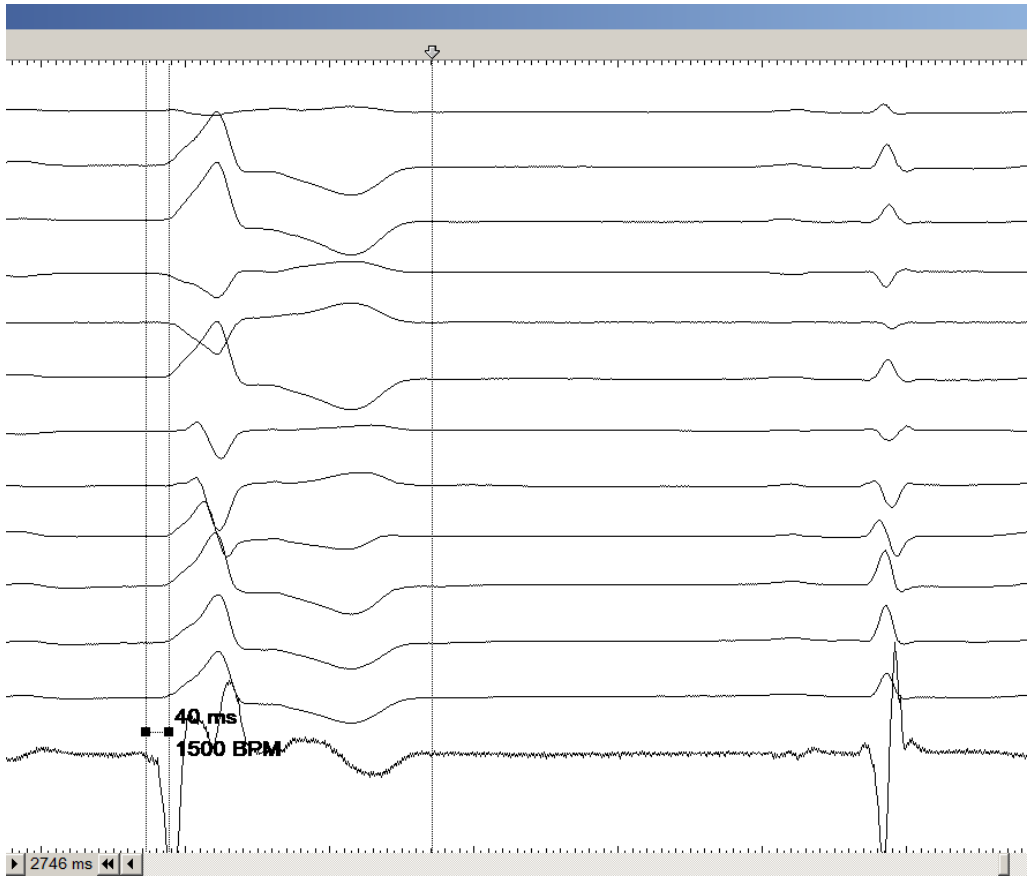


Proximal Wire placement vs EP Star placement

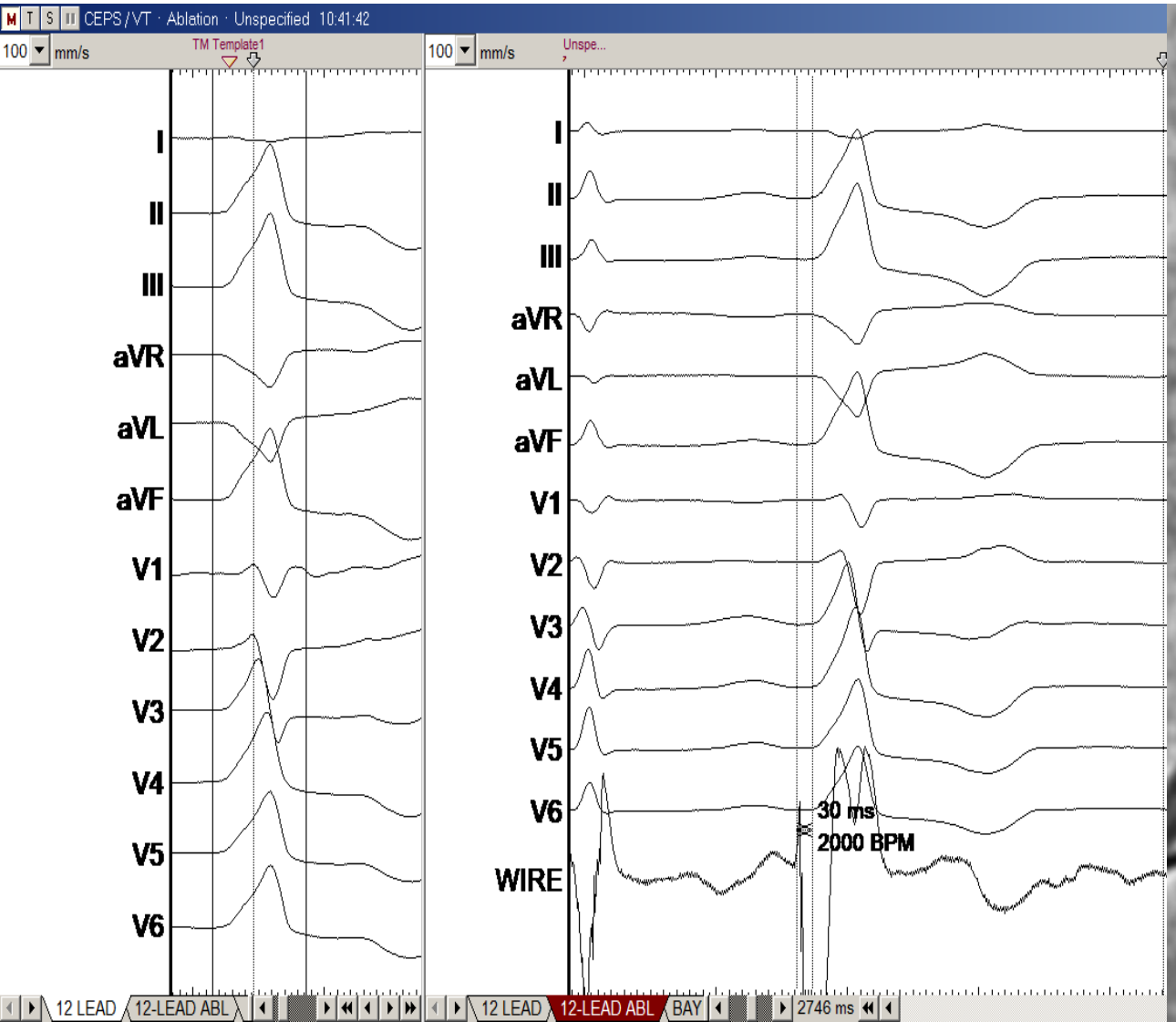


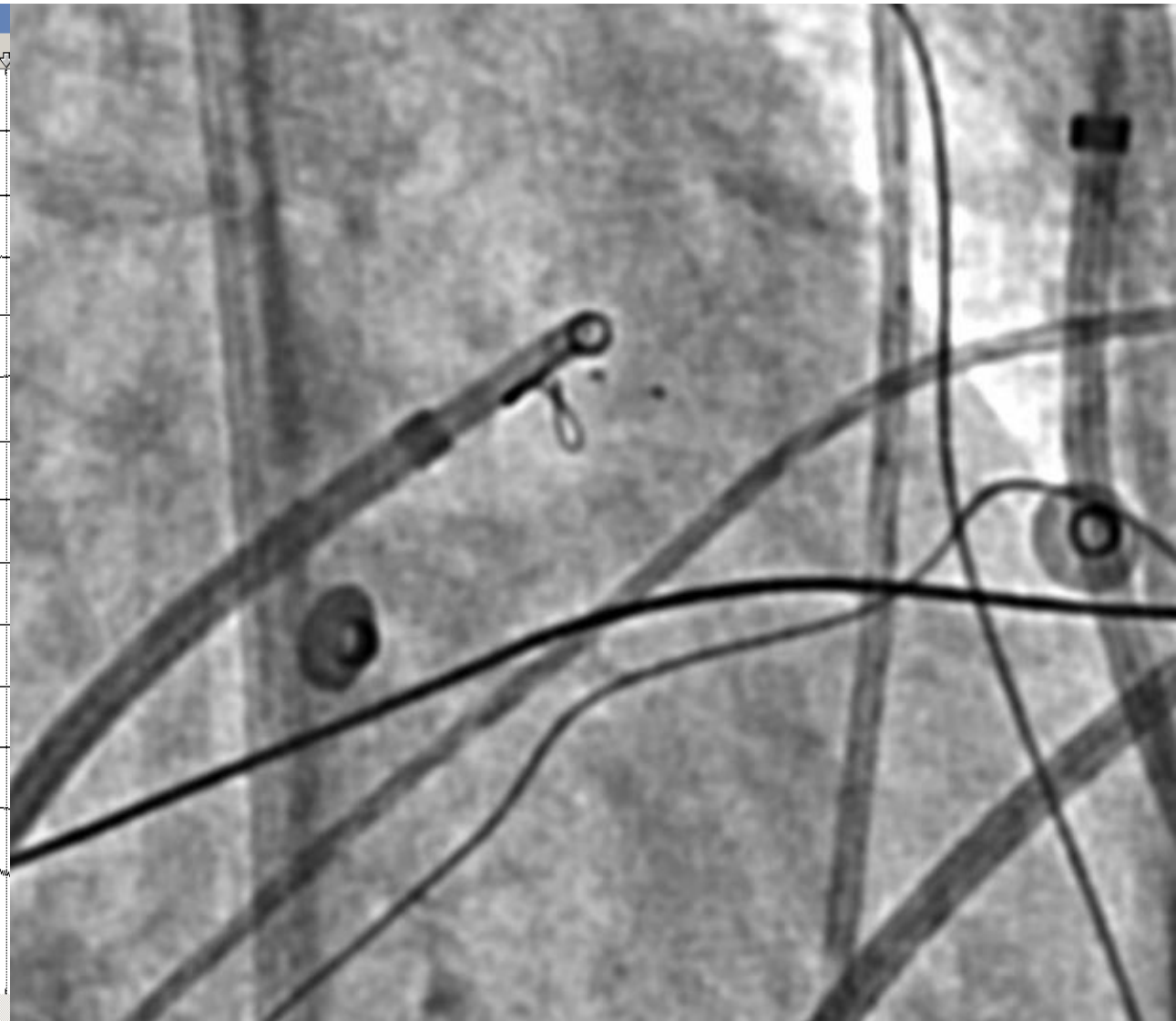
Proximal WIRE signal and pace-map

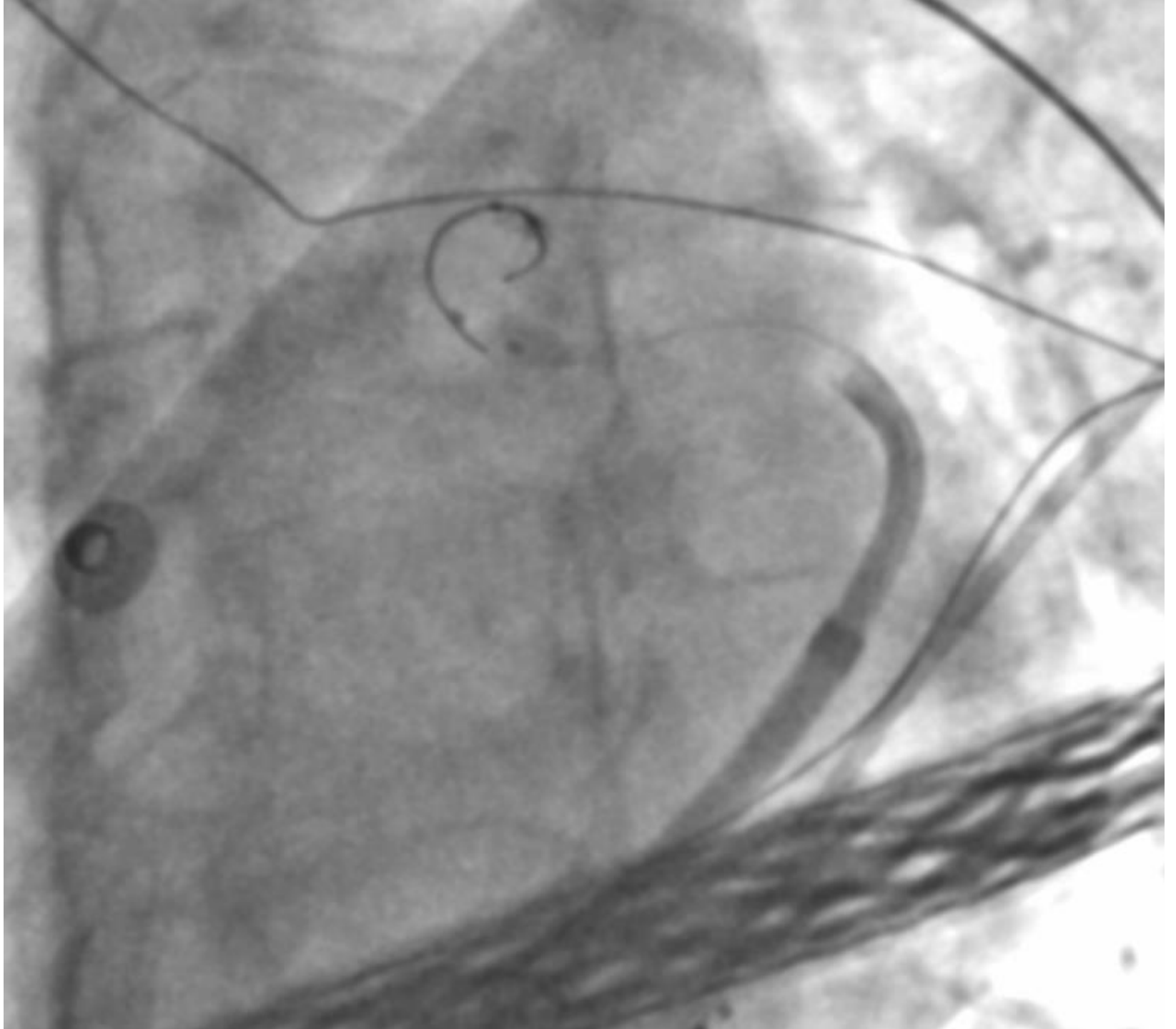




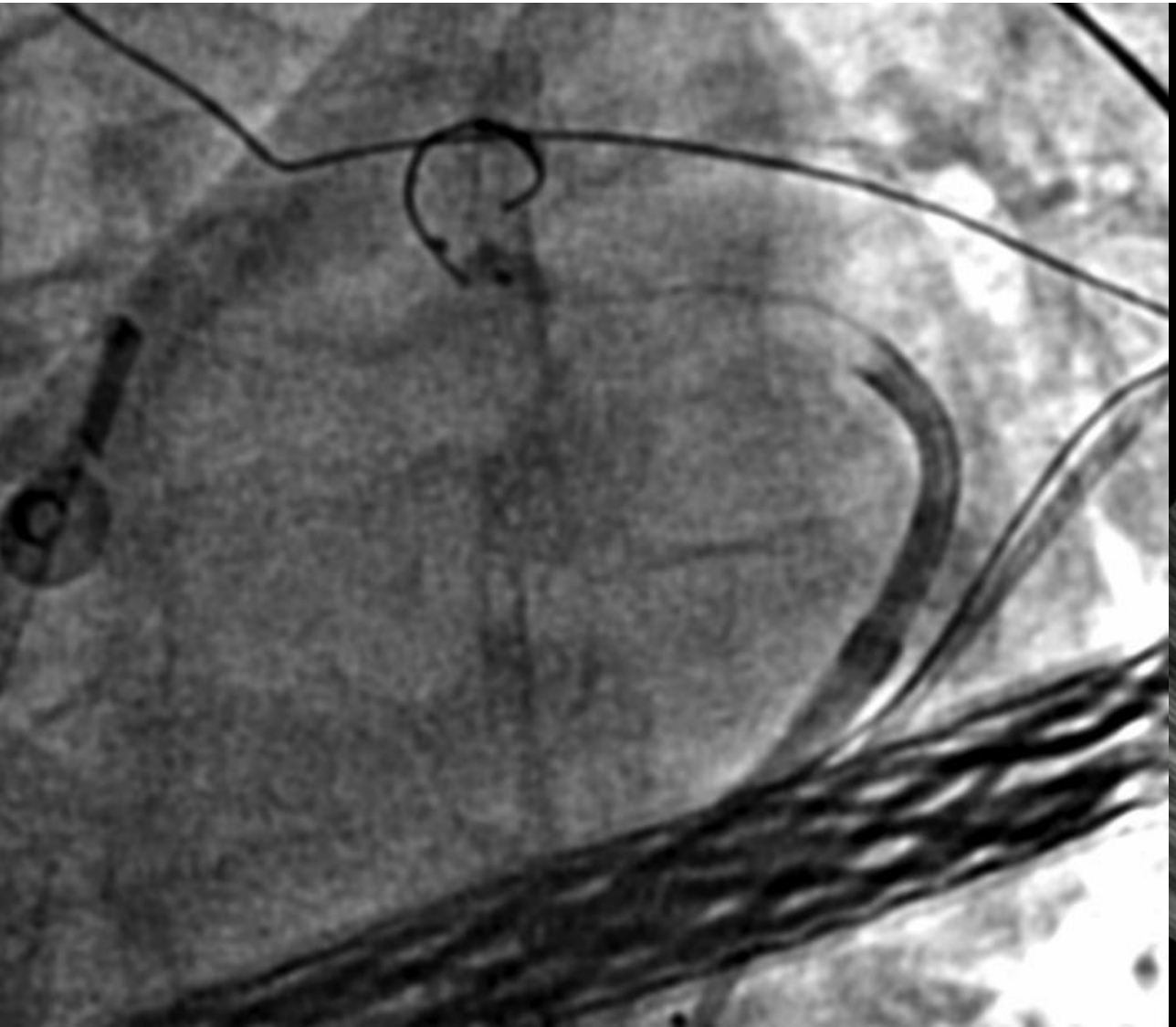
Distal WIRE signal and vein

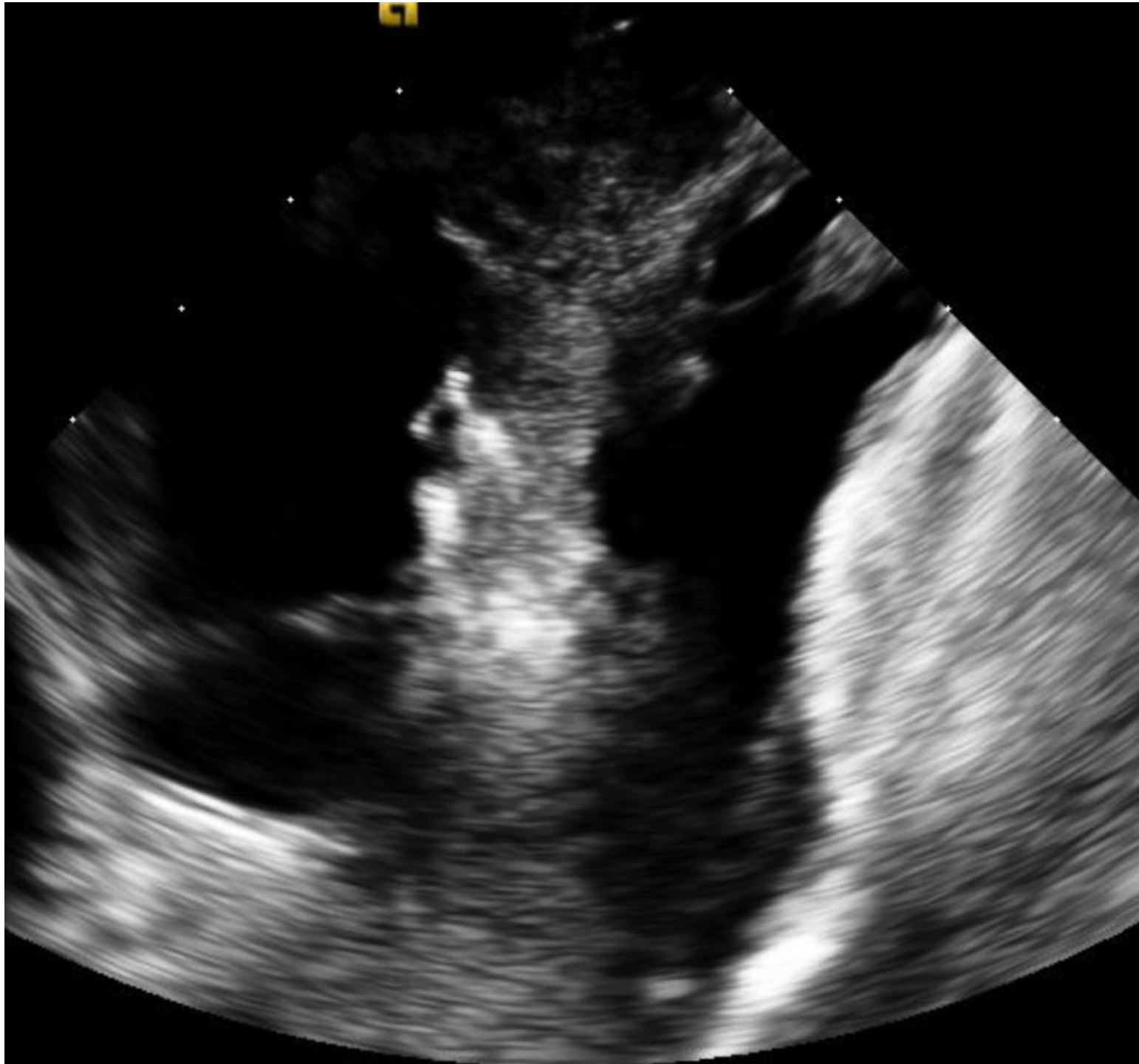




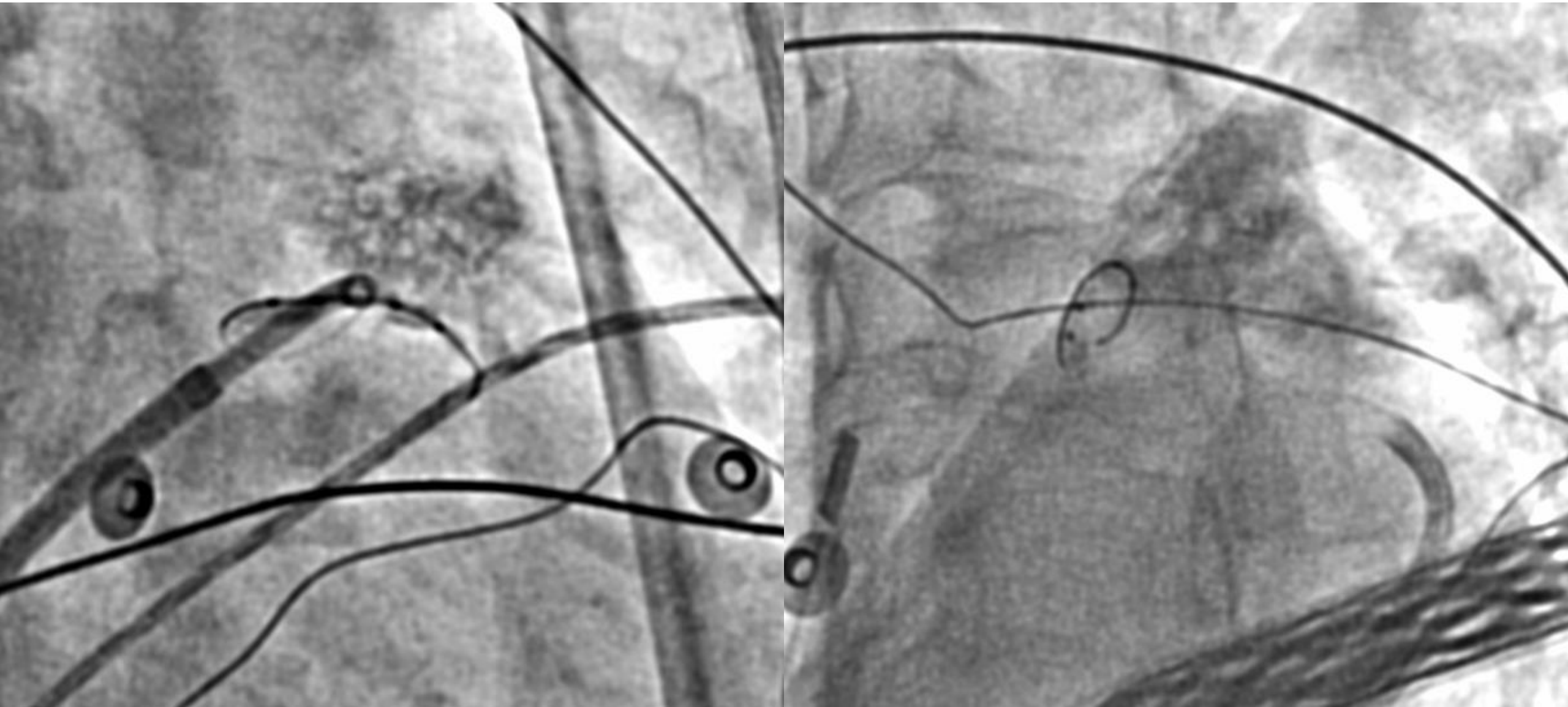


Ethanol injection

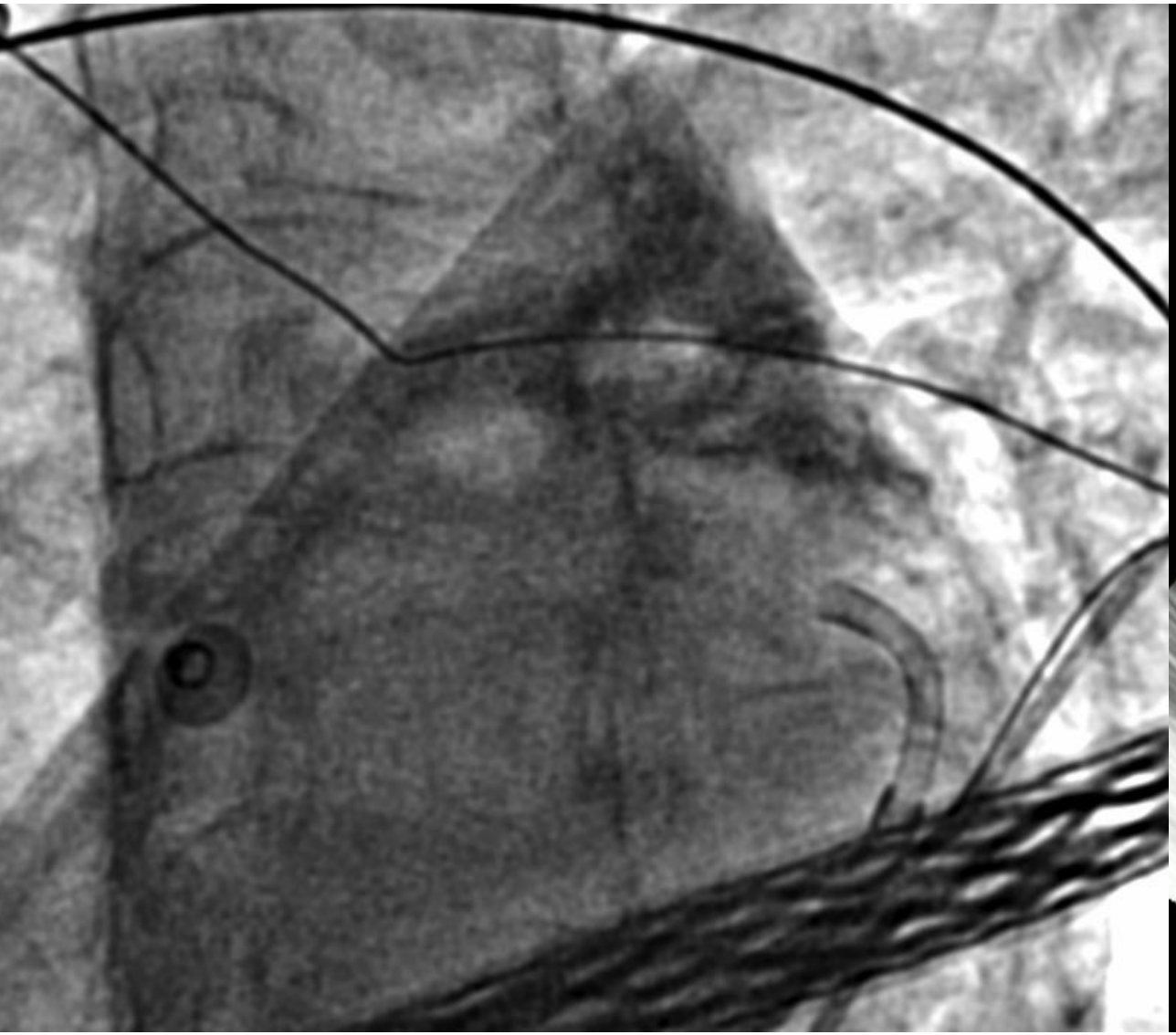


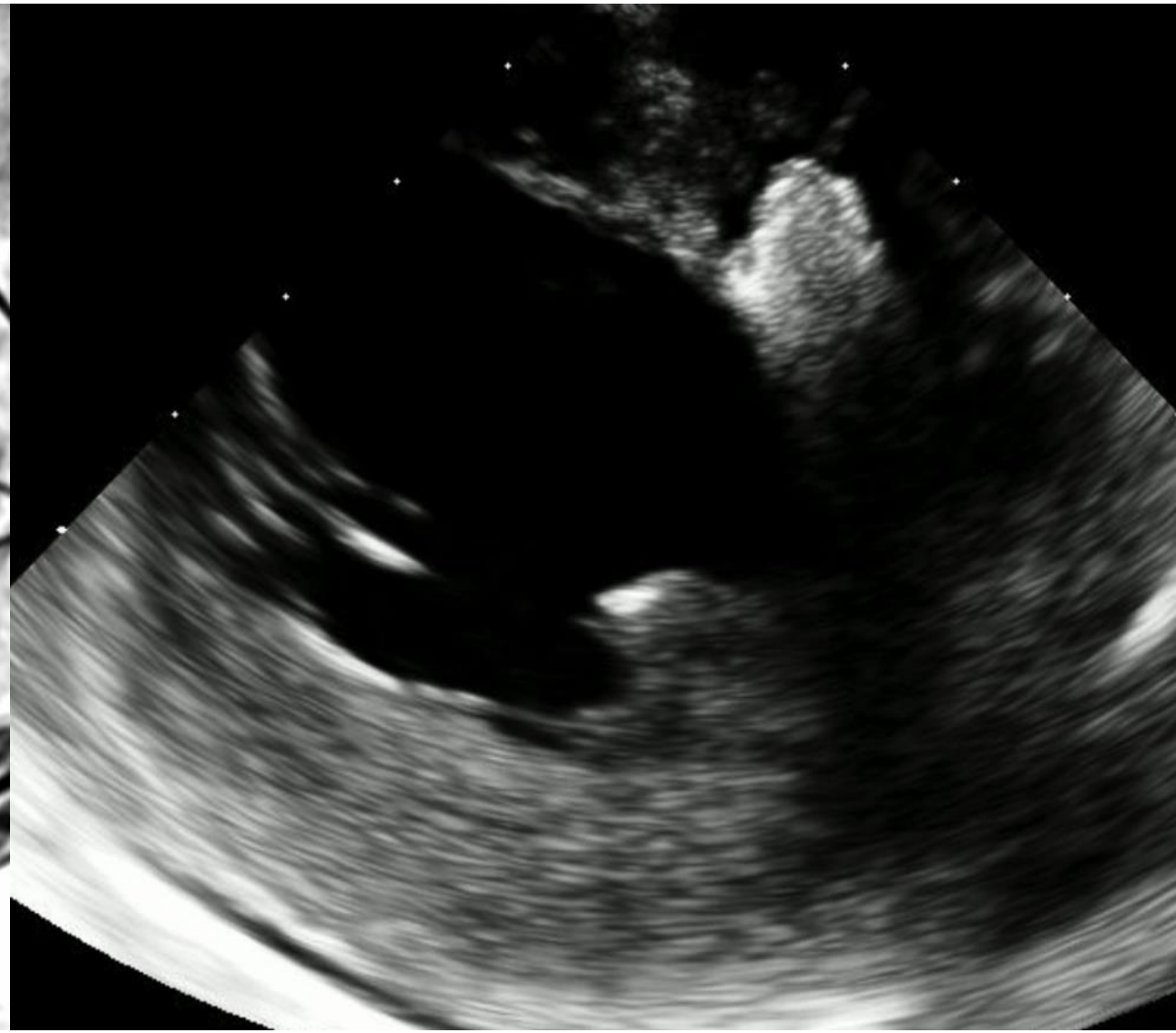


Ethanol injection

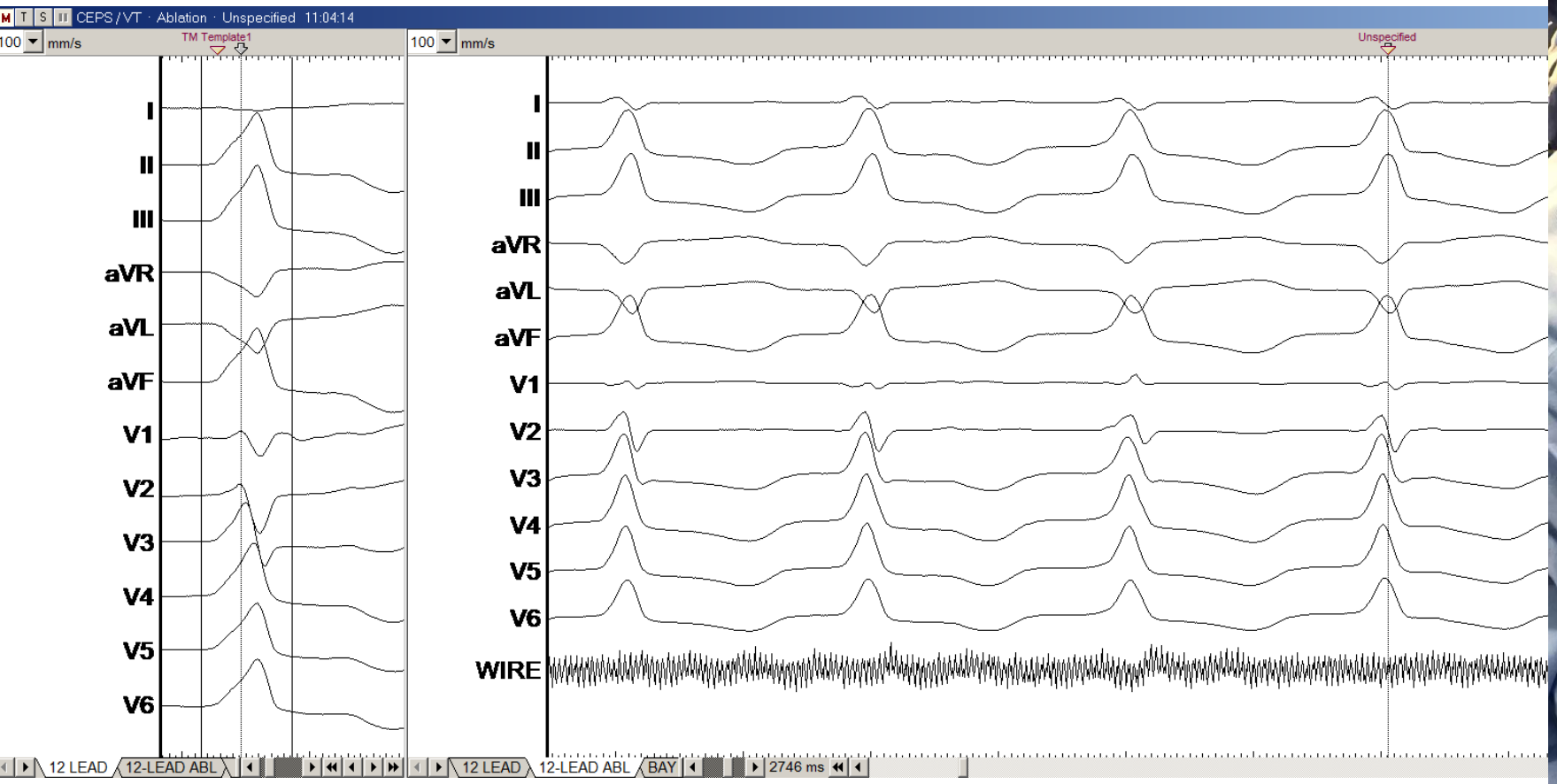


Ethanol injection

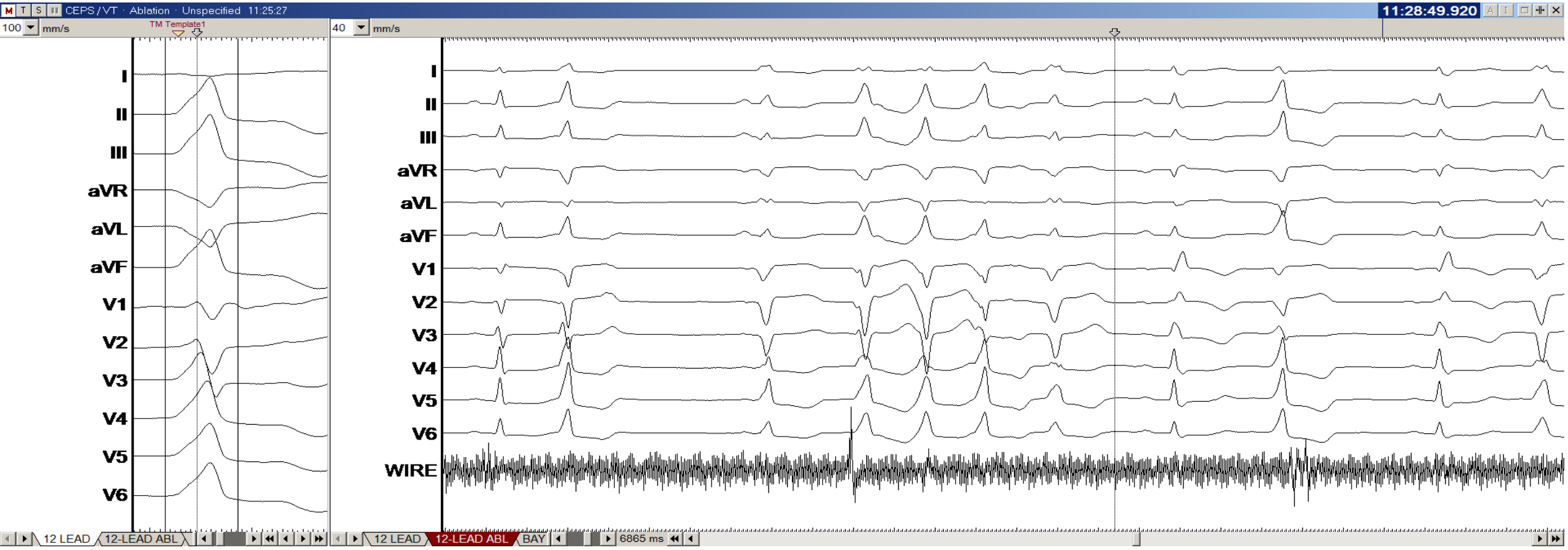




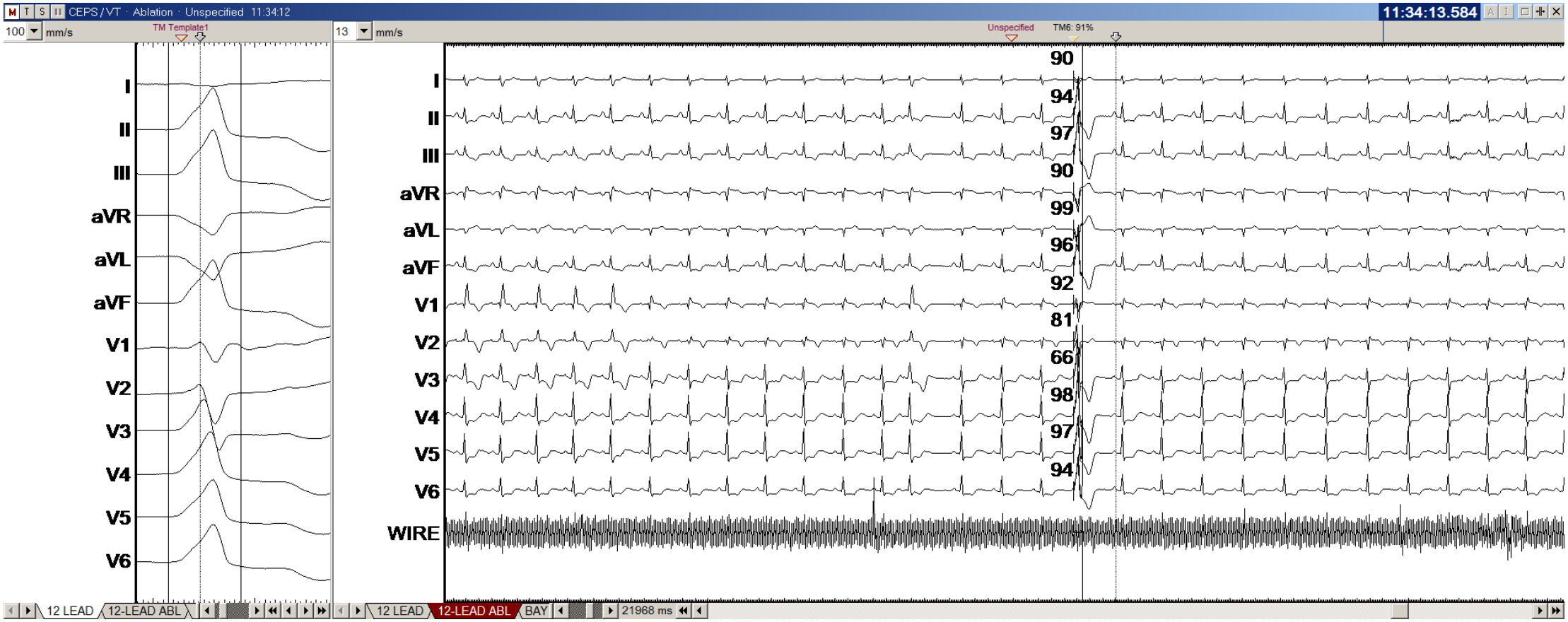
Ethanol-induced VT



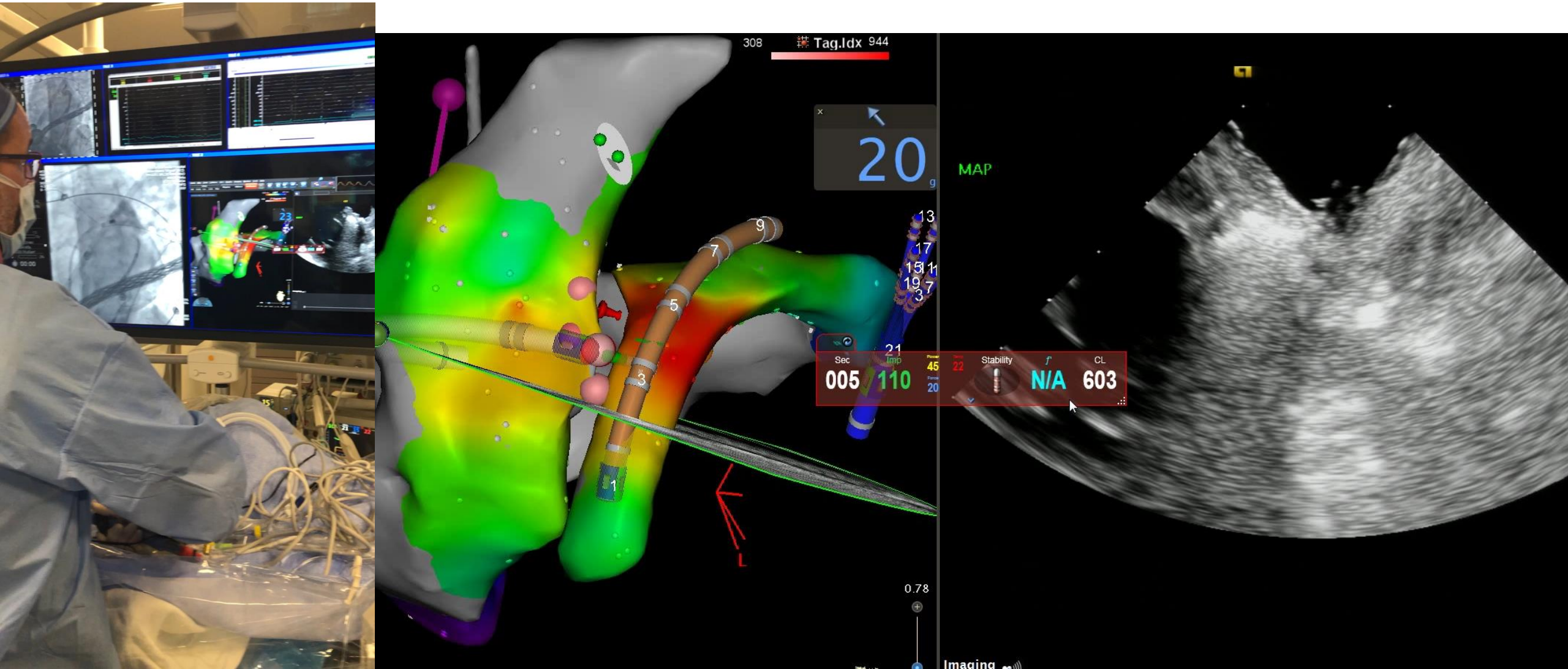
RBBB


CEPS / VT · Ablation · Unspecified 11:25:27
11:28:49.920
100 mm/s
TM Template1
40 mm/s
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
WIRE
12 LEAD
12-LEAD ABL
BAY
6865 ms

RBBB resolved



Reinforced in RV and LV sides



Reinforced in RV and LV sides

24h CMR: myocardial edema, microvascular obstruction