Cardiac Imaging for VT Ablation

Intracardiac Echocardiography

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엄 재 선

Roles of ICE in EP Procedures

- Identification of endocardial anatomy
- Positioning of intracardiac catheters
- Confirmation of catheter contact
- Assessment of ablation lesion creation
- Guidance for transseptal puncture
- Identification & prevention of complications
- 3D reconstruction: CARTO Sound

Advantages & Disadvantages of ICE

Advantages

- Real-time image
- Superior image quality
- Hemodynamics
- No patient' discomfort
- Local anesthesia
- Less personnel
- No radiation

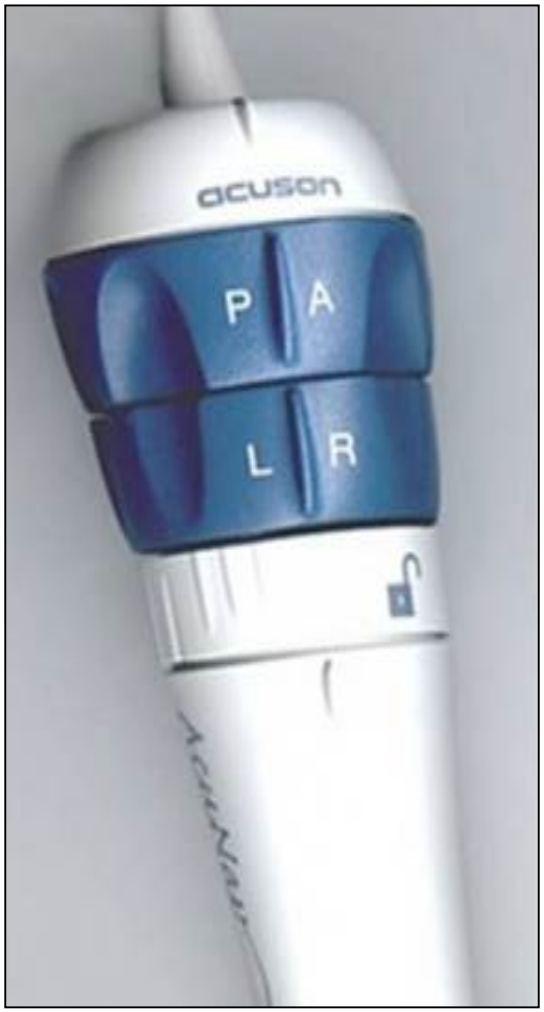
Disadvantages

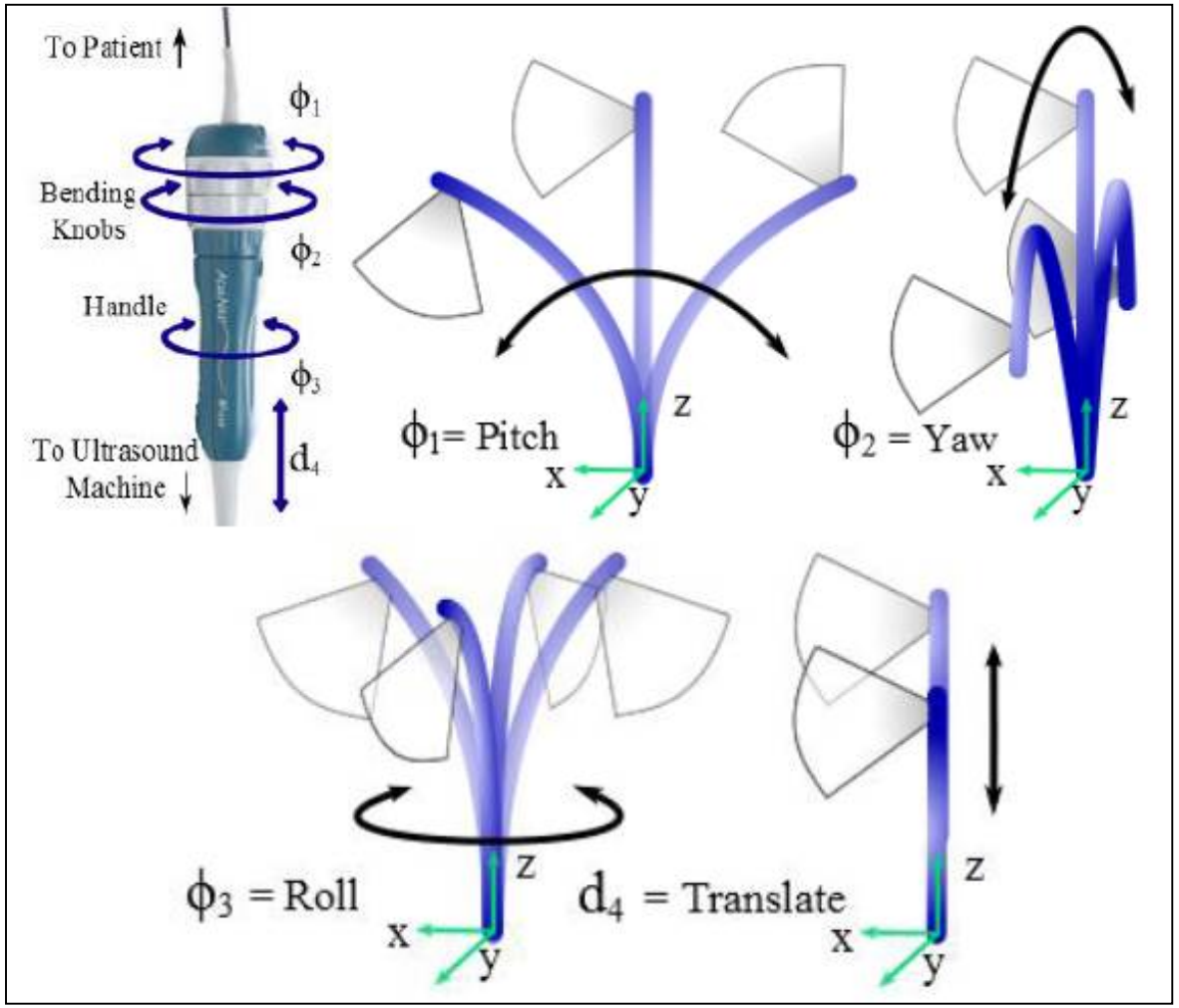
- Single-use catheter
- Additional cost
- Additional venous puncture
- Tomographic images
- Learning curve

Available ICE Devices

	AcuNav®	SoundStar®
Company	Siemens	Siemens/Biosense Webster
Diameter	8 Fr, 10 Fr	8 Fr, 10 Fr
Length	90 cm	90 cm
Steering	4-direction	4-direction
View	Side-looking	Side-looking
Frequency	5-10 MHz	5-10 MHz
Penetration	15cm	15cm
Sheath diameter	9 Fr, 11 Fr	9 Fr, 11 Fr
3D reconstruction	No	Yes

ICE Catheter Manipulation

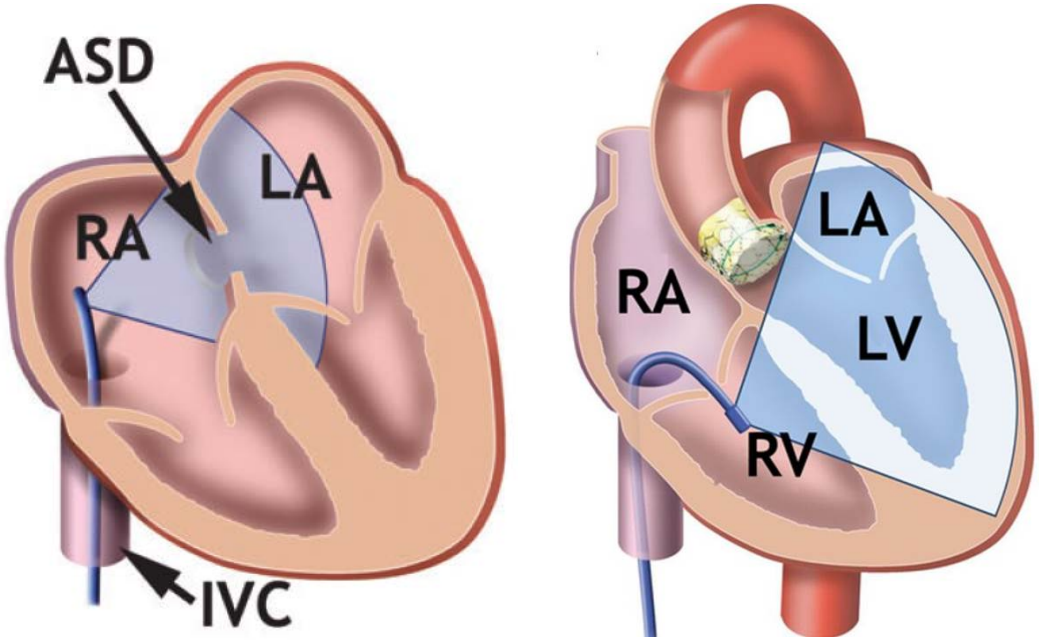




ICE Catheter Manipulation

Advancing ↔ withdrawing

- High RA view
- Mid RA view
- Mid low RA view
- RV view
- LA view



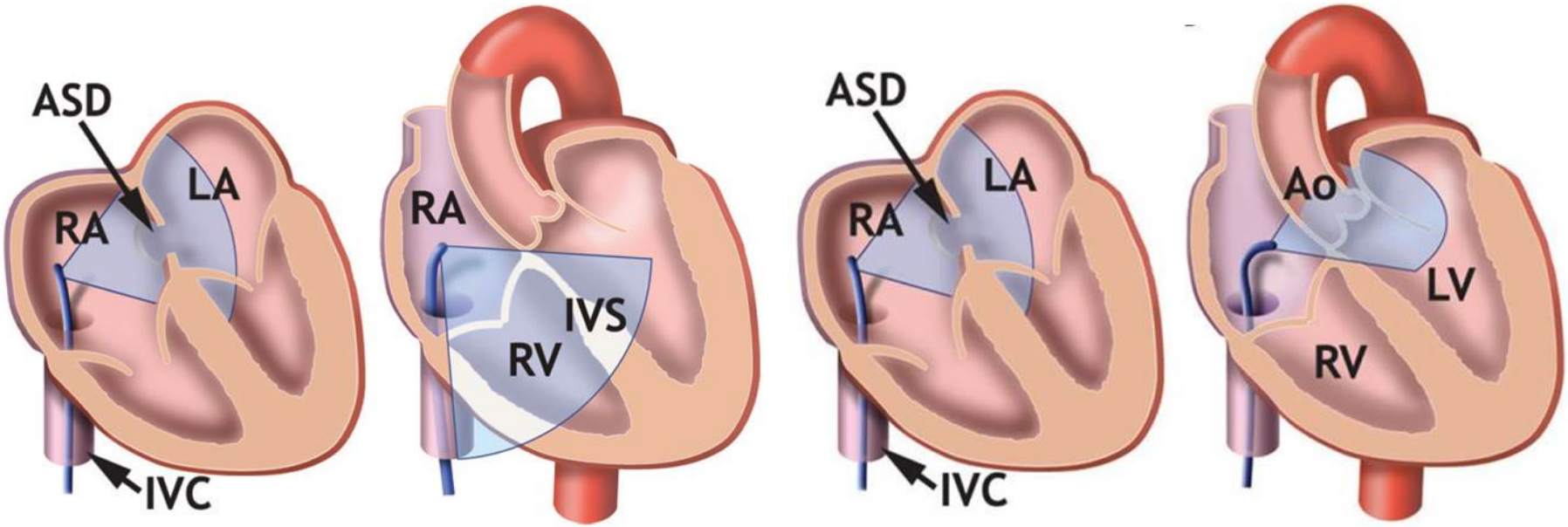
ICE Catheter Manipulation

Anterior ↔ posterior tilt

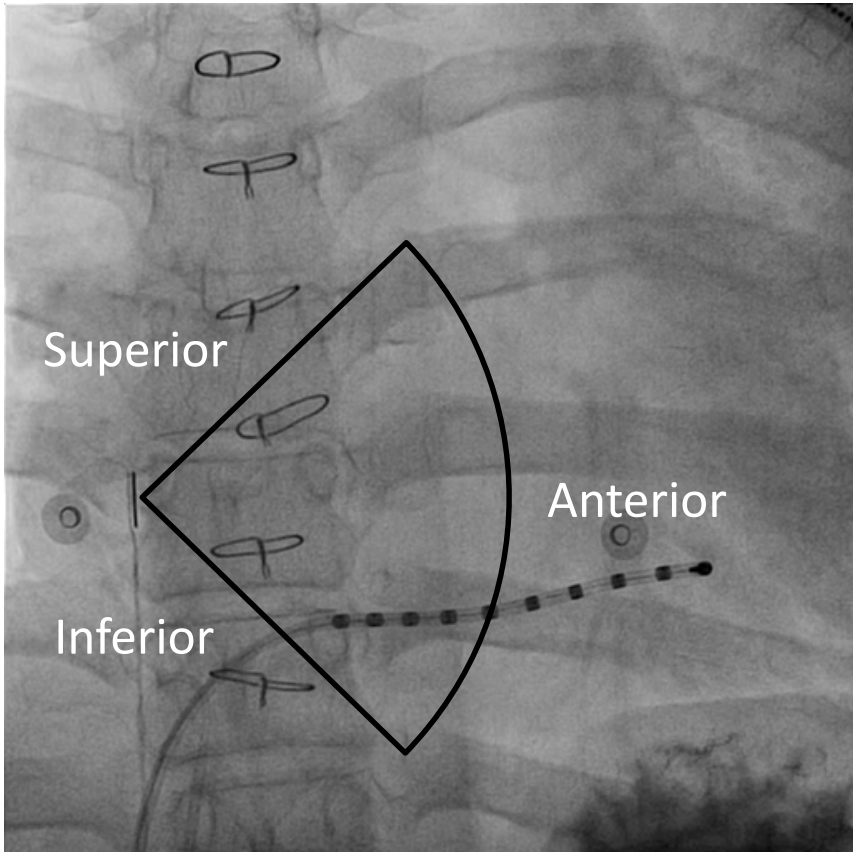
- Atrial view
- Ventricular view

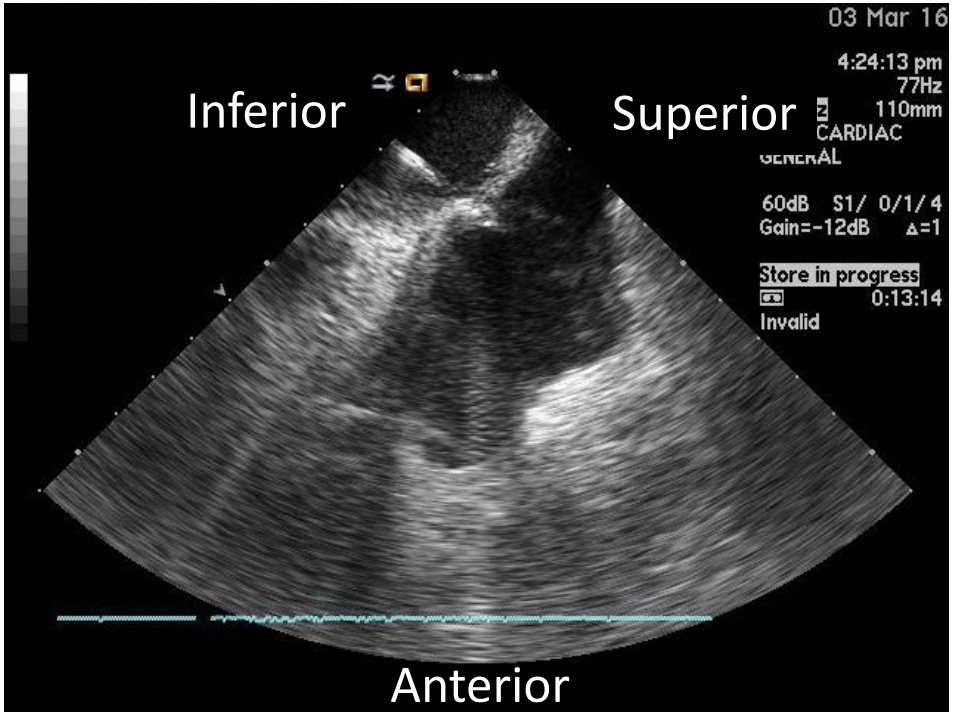
Right ↔ left steering

- Short axis view
- Long axis view

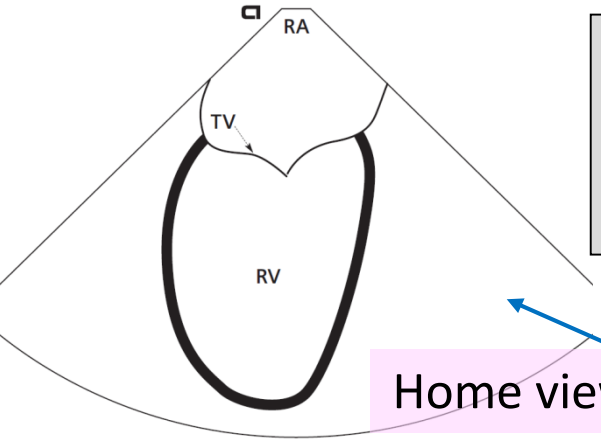


Orientation of ICE Images

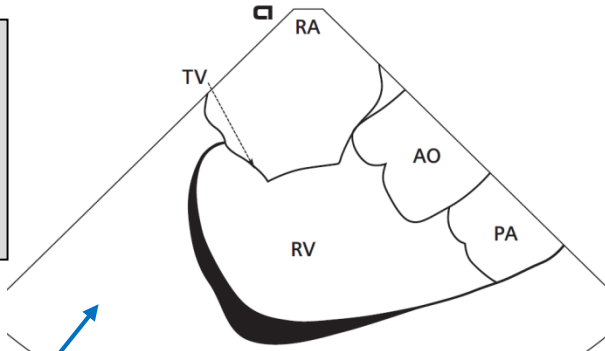




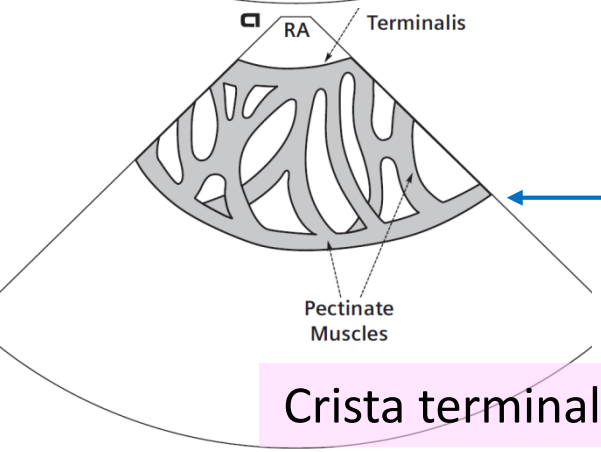
Basic Views



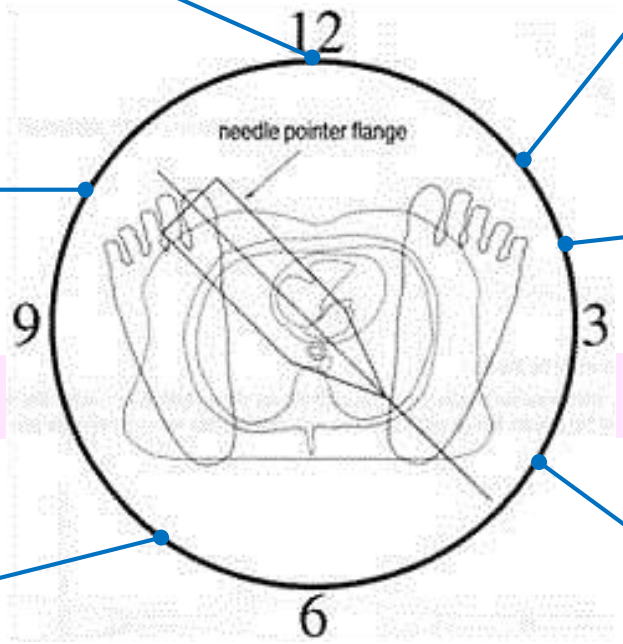
Home view

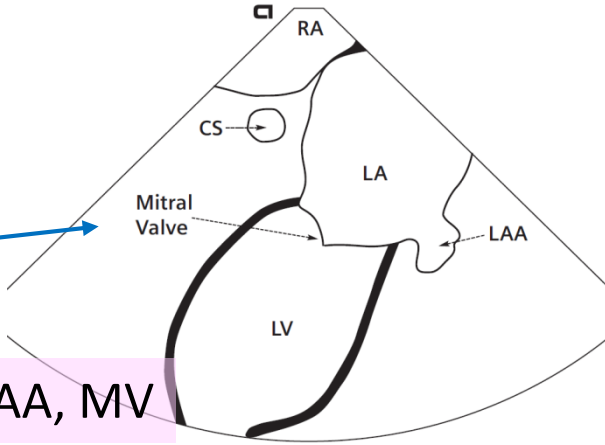


Aorta, PA

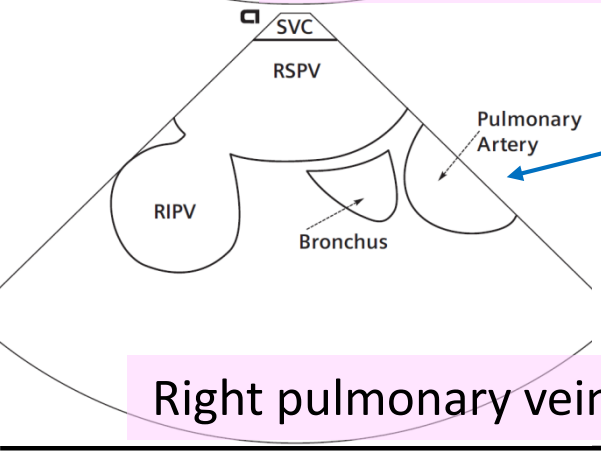


Crista terminalis

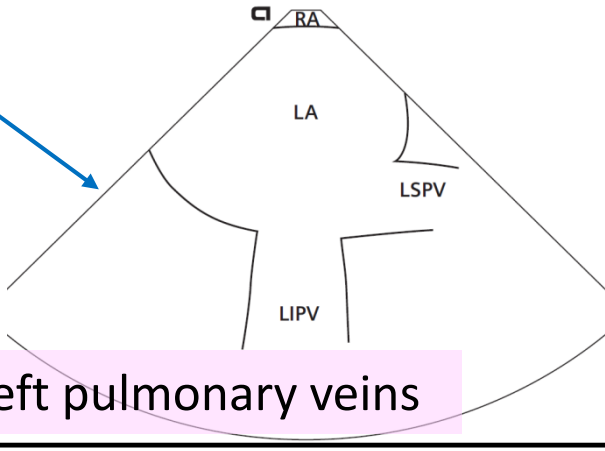




LAA, MV



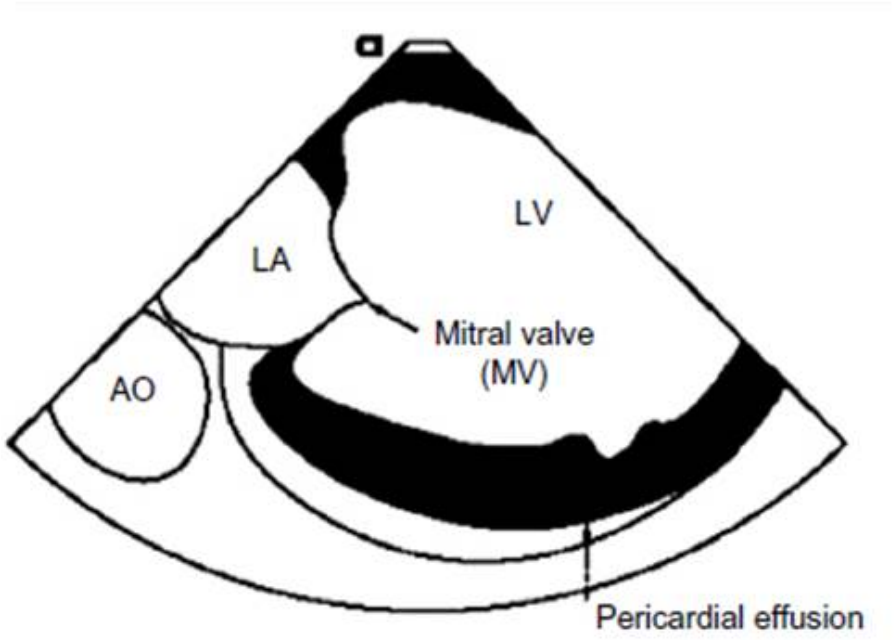
CCW ↔ CW rotating



Right pulmonary veins

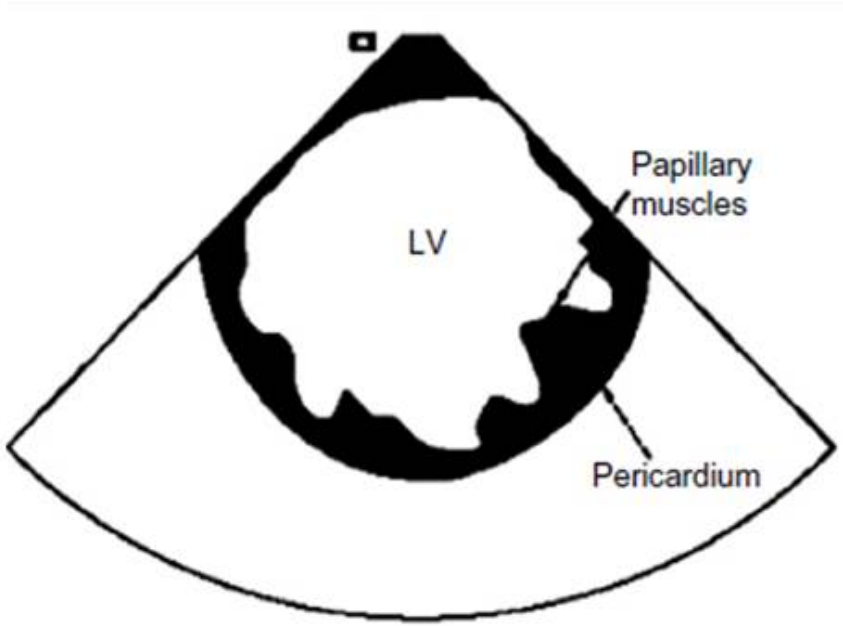
Left pulmonary veins

LV Views from RV



LV long axis view

Home view → RV → CW



LV short axis view

LV long axis view → right/left steering

VTs in which ICE is useful

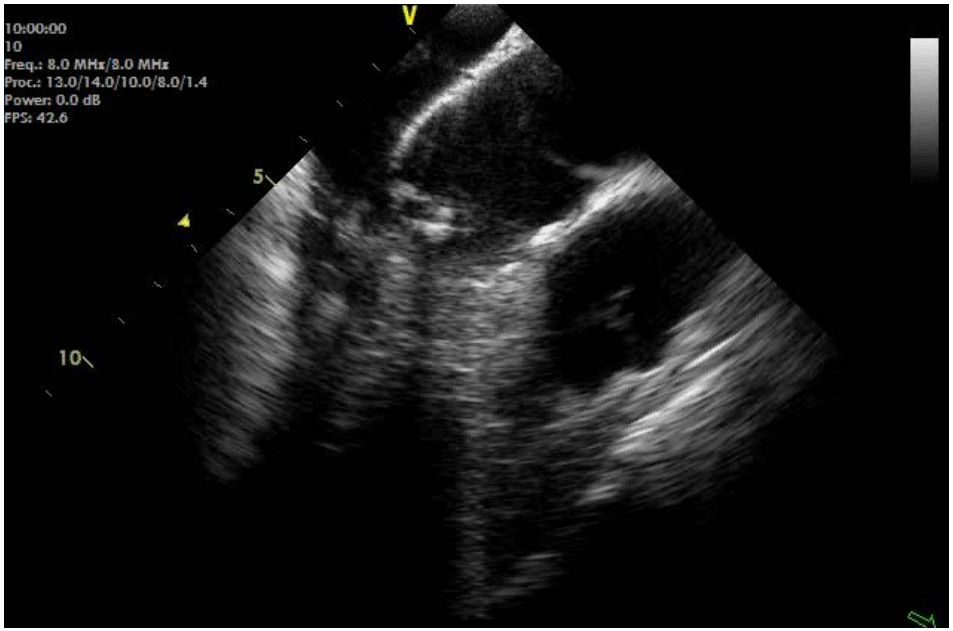
- LVOT VT
- Papillary muscle VT

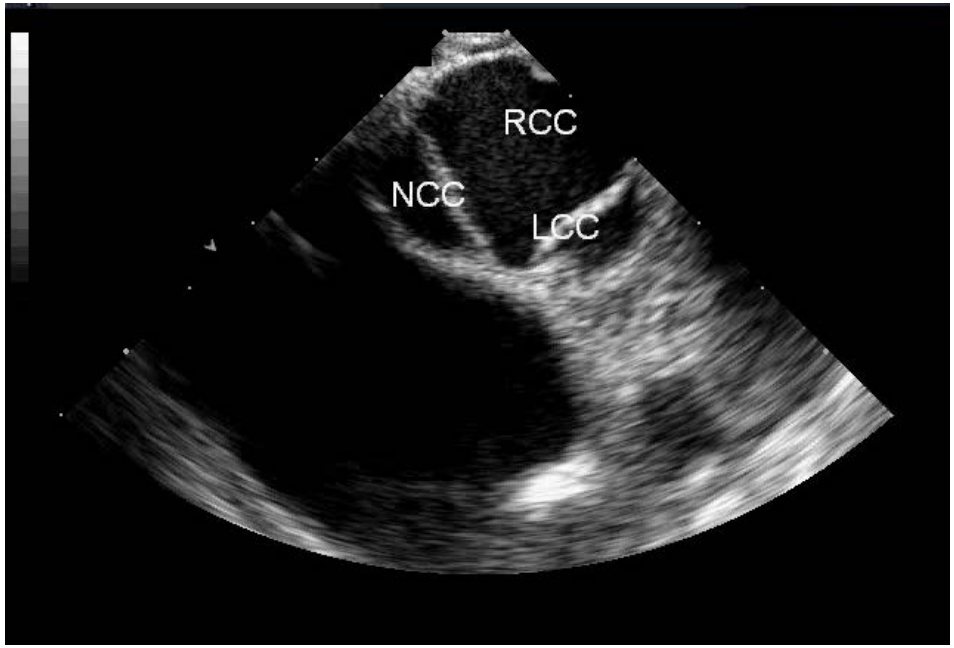
ICE for LVOT VT Ablation

- Visualized from RA or RV
  - Home view → 30^{o} CW rotation
  - Home view → RV → 180^{o} CW rotation
- Long axis: Aortic root, aortic valve
  - Above or below valve plane?
  - Distance from coronary arteries?
- Short axis: Aortic cusps
  - Which aortic cusp?
  - Single coronary sinus or between the sinuses

Lamberti, et al. J Cardiovasc Electrophysiol 2001;12:529-535

Aortic Valve; 3 Cusps





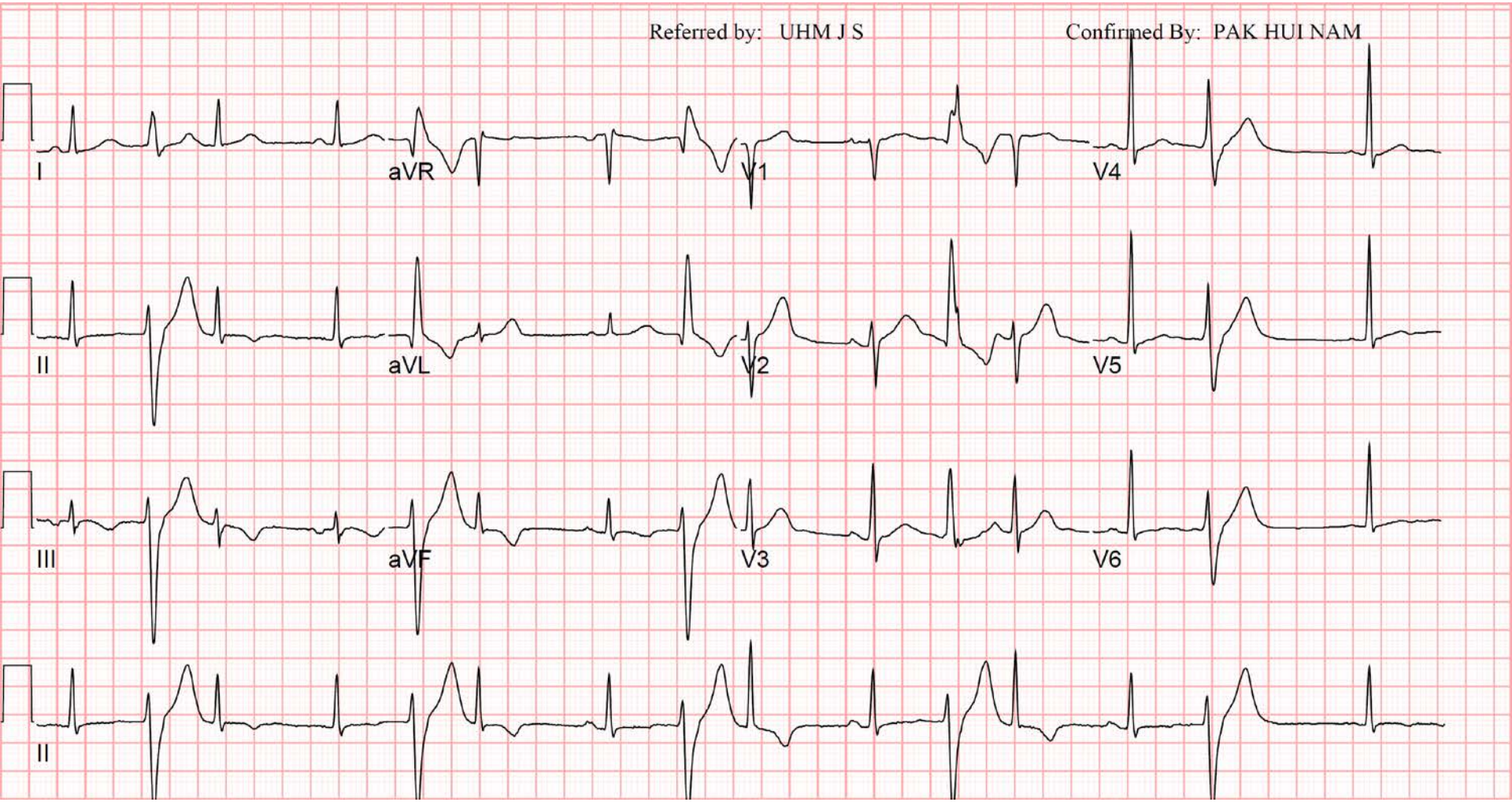
ICE for Papillary Muscle VT Ablation

- Visualized from RV or LA
  - Home view → anterior tilting → RV → RV PM
  - RV → slow CW rotation → LV anterolateral PM→ LV posteromedial PM
  - Transseptal puncture → LA → LV anterolateral & posteromedial PM
- Real-time assessment of the adequacy of catheter contact
- 3D reconstruction by CARTO Sound

Yamada T, et al. Circ Arrhythm Electrophysiol 2010;3:324-331
Good E, et al. Heart Rhythm 2008;5:1530-1537

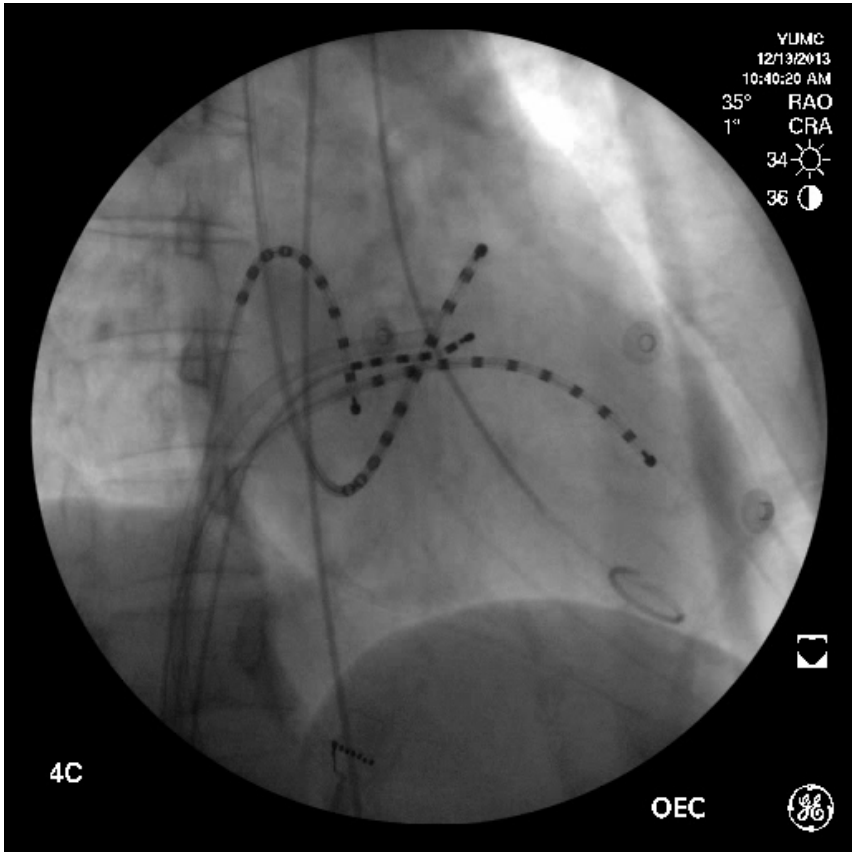
CASE 1; 55/F

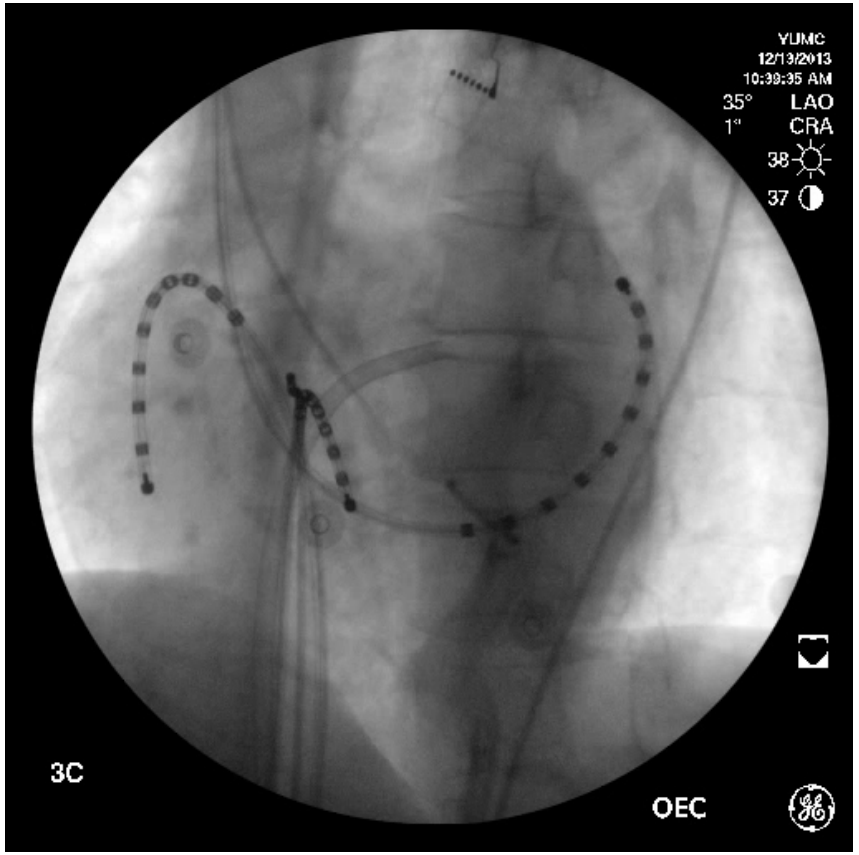
55/F, Palpitation all day long



CASE 1; 55/F

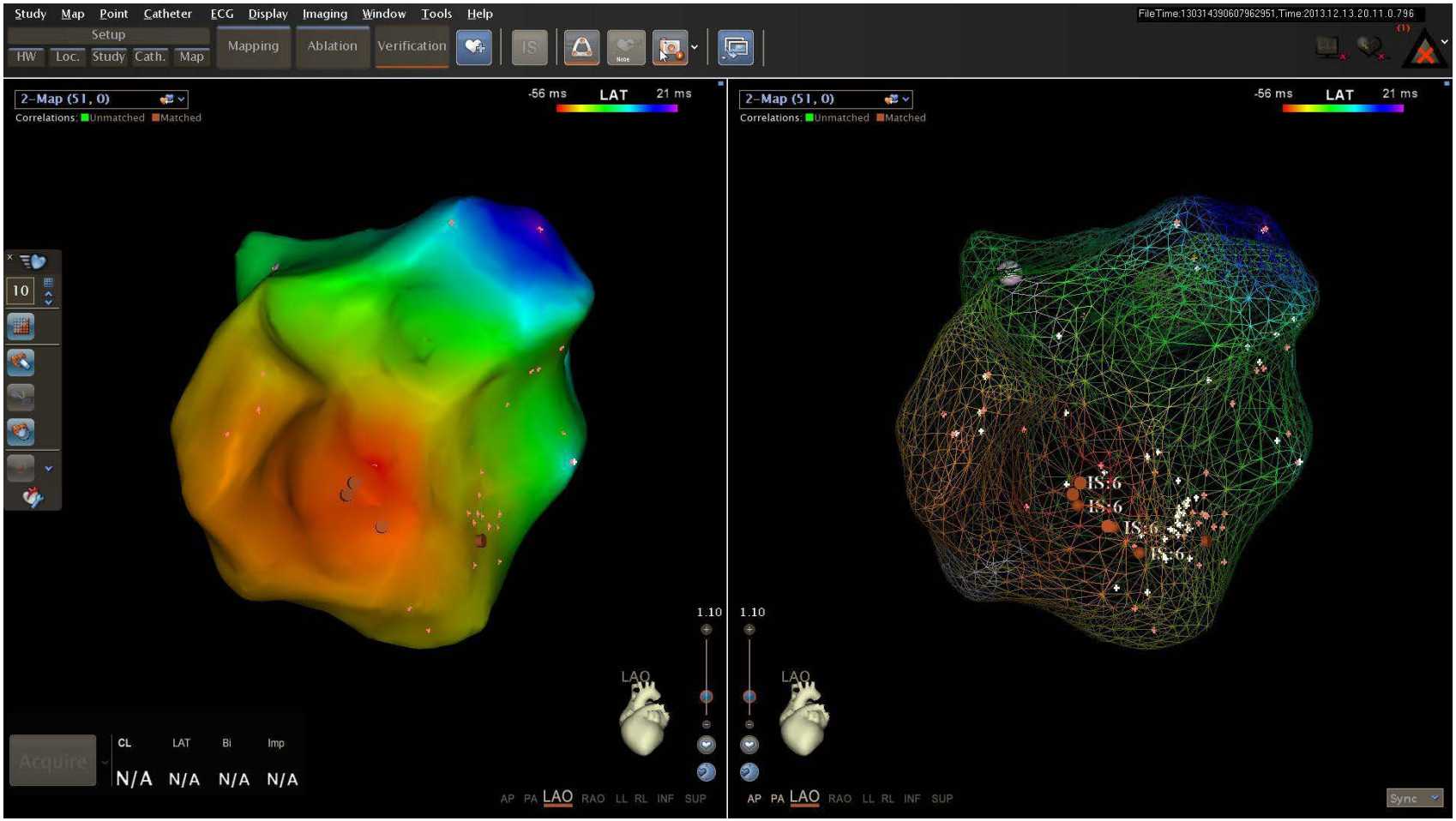
Left Ventriculography





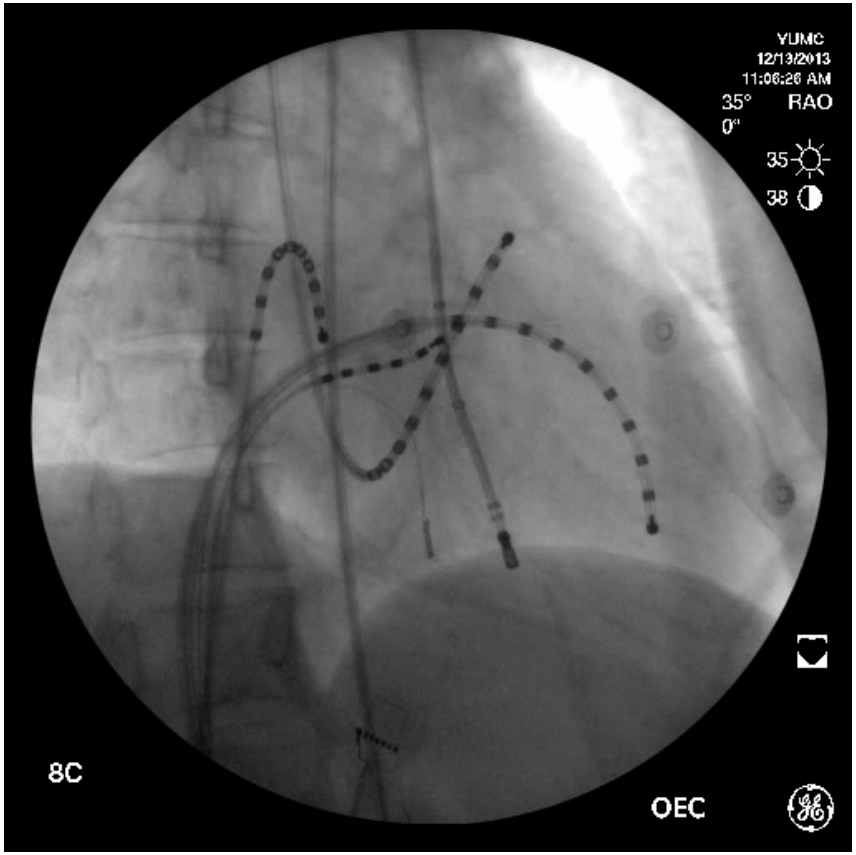
CASE 1; 55/F

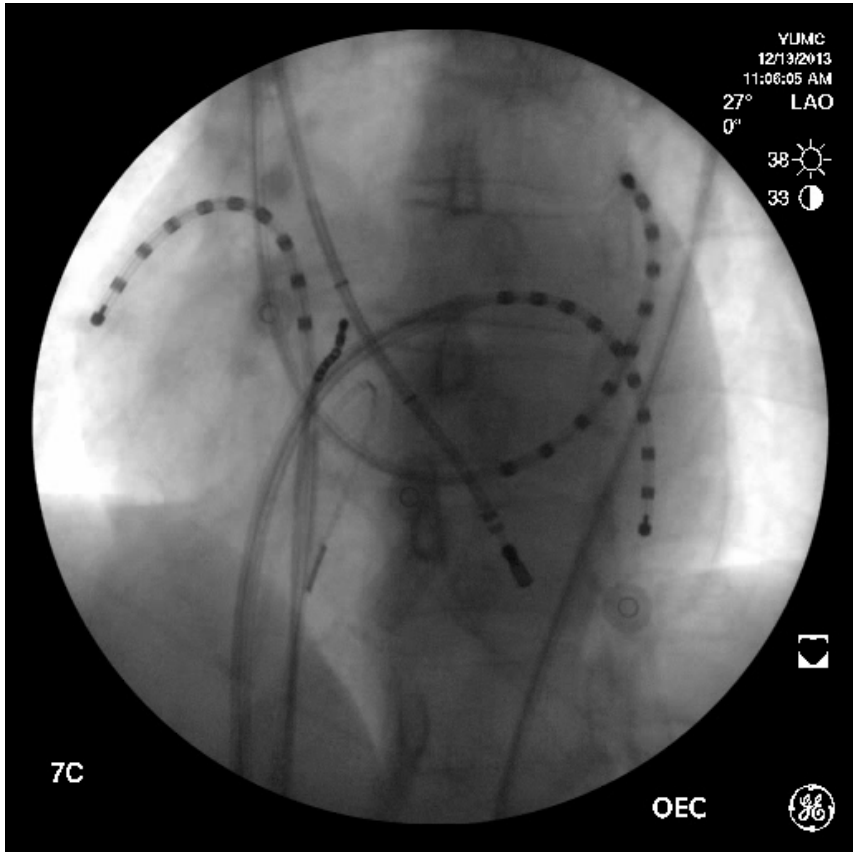
3D Activation Map



CASE 1; 55/F

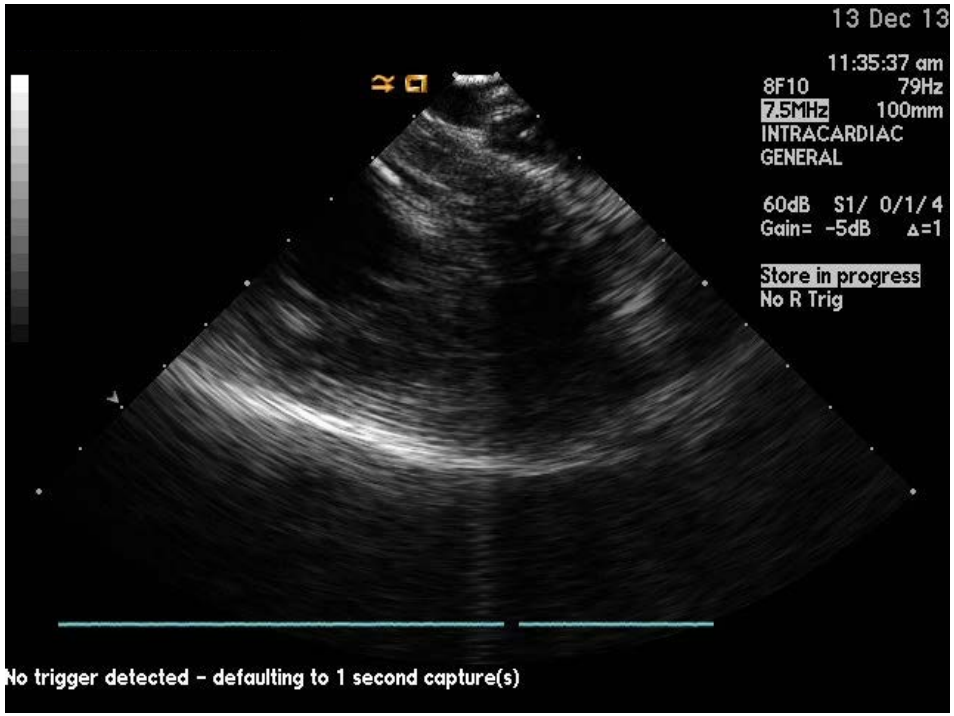
RFCA

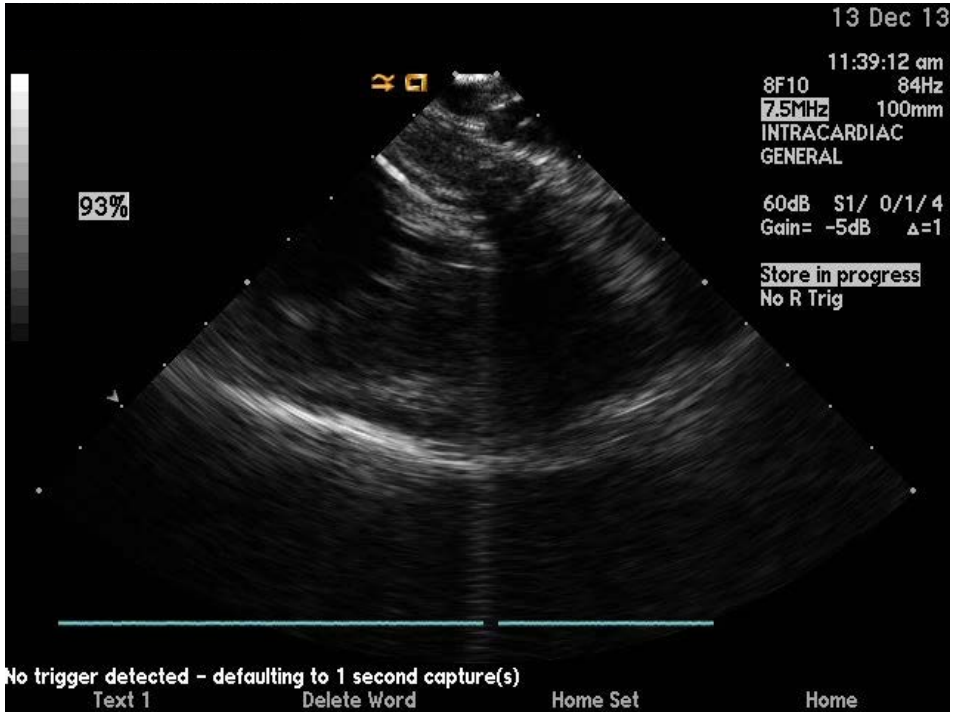




CASE 1; 55/F

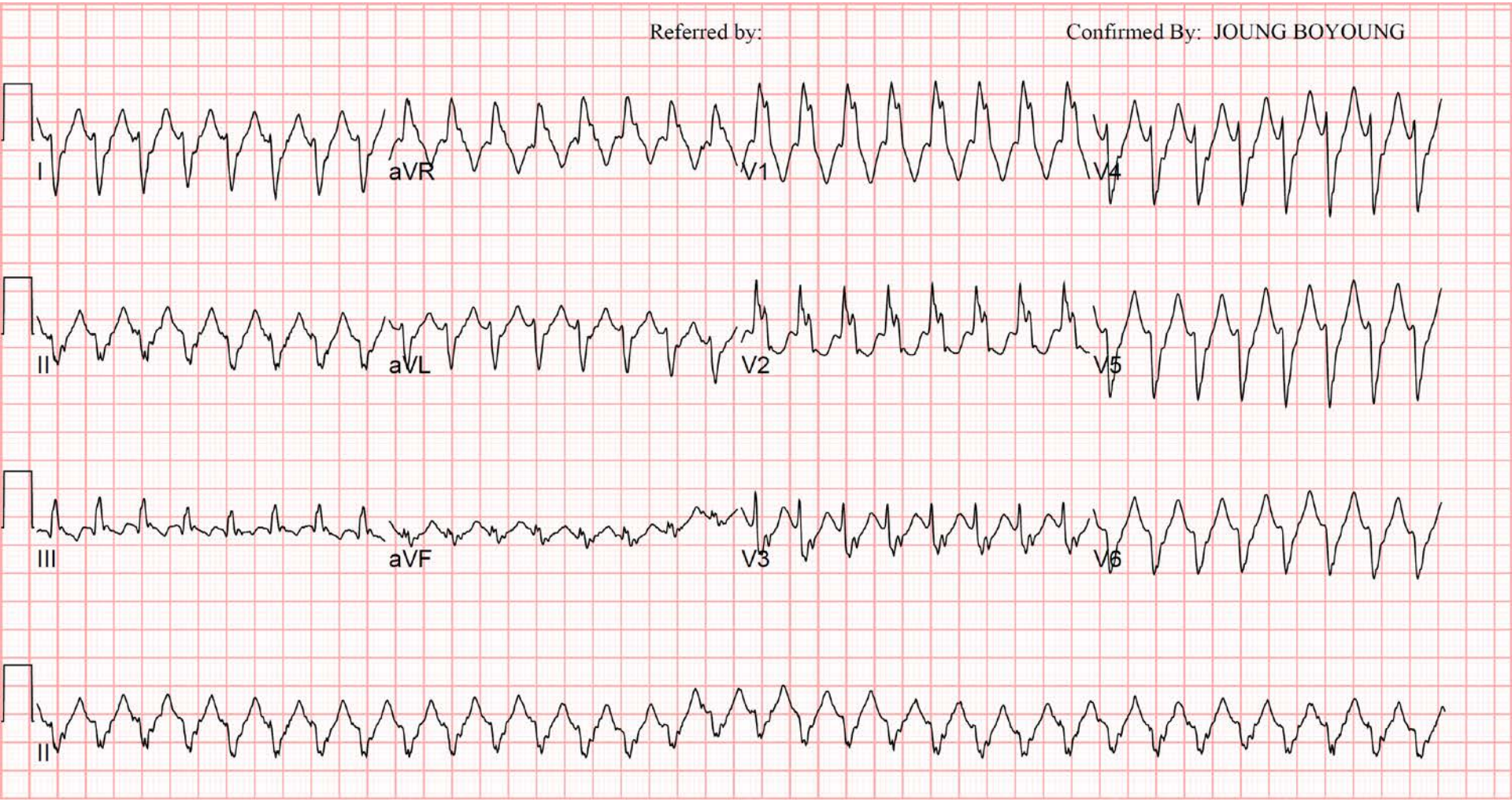
ICE; LV Views from RV





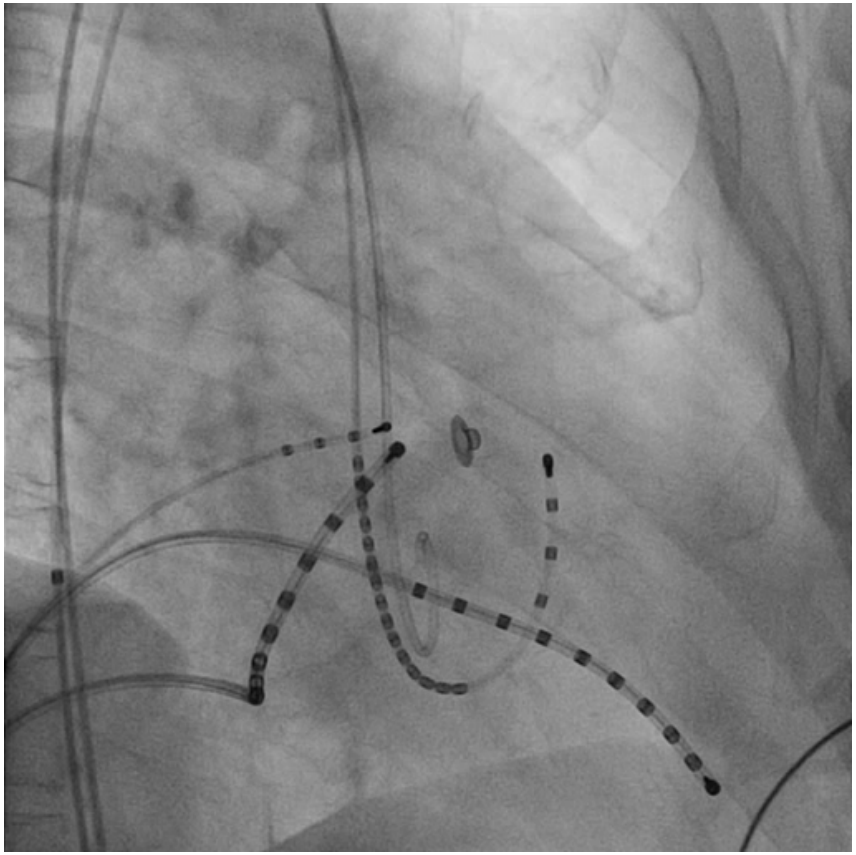
CASE 2; 59/F

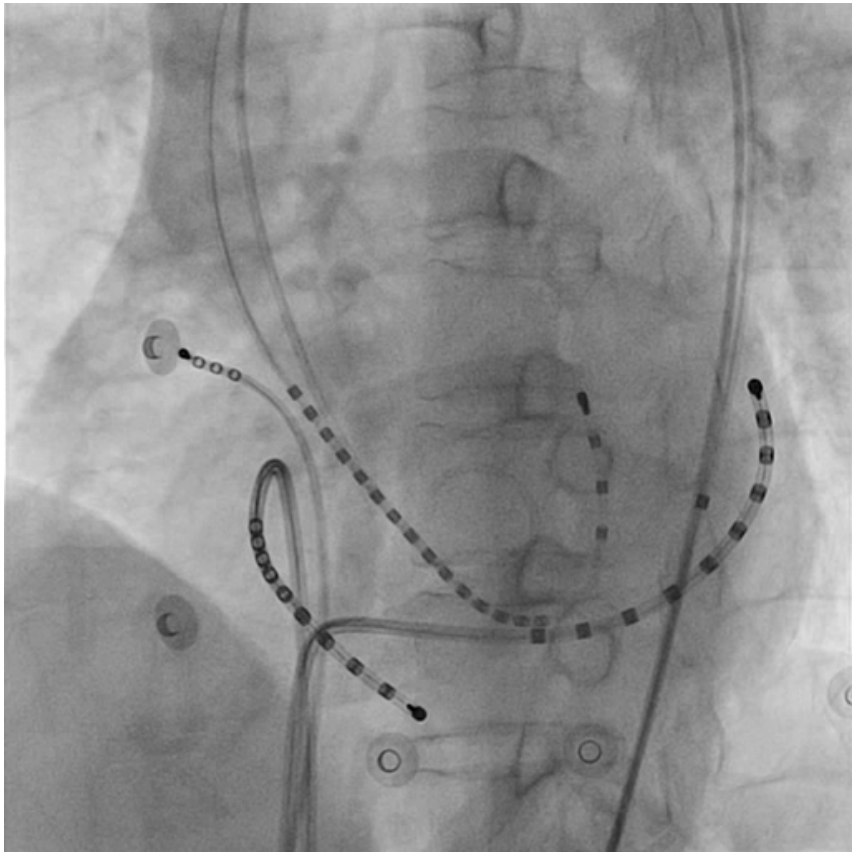
59/F, Recurrent palpitation



CASE 2; 59/F

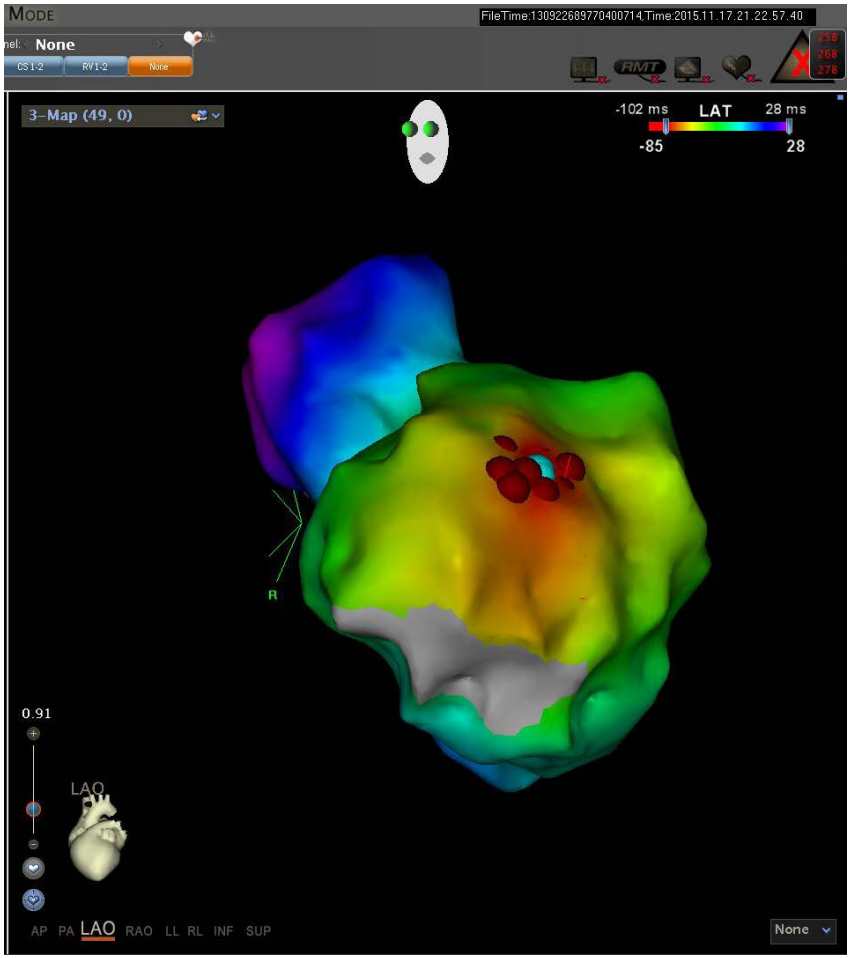
Left Ventriculography

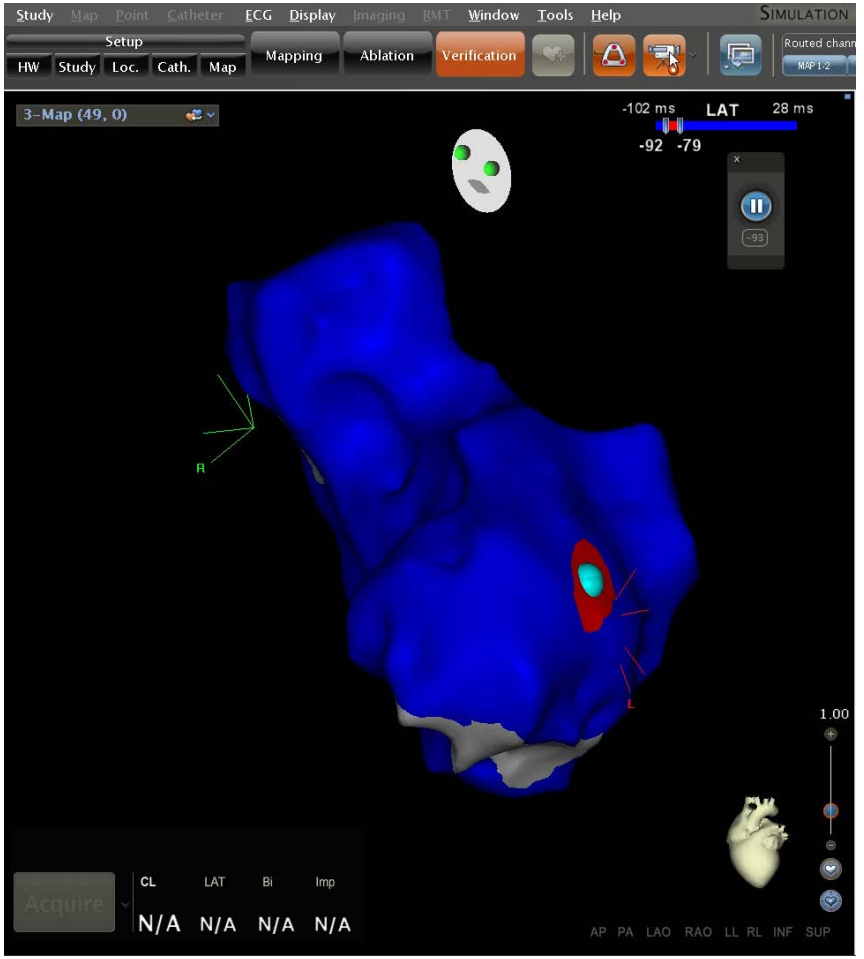




CASE 2; 59/F

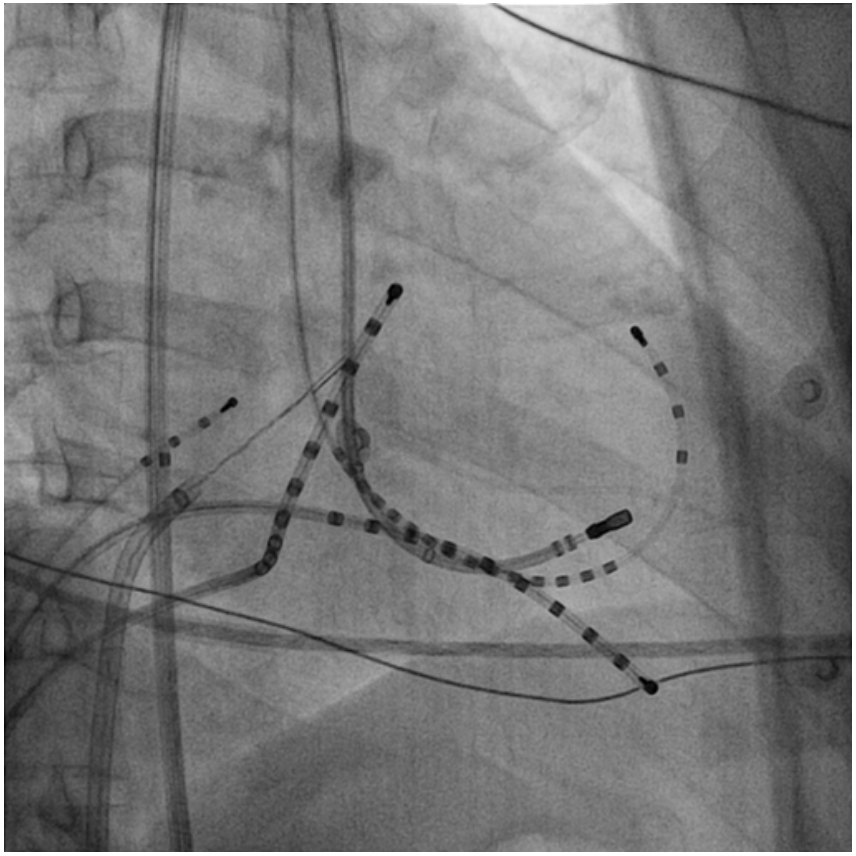
3D Activation & Propagation Map

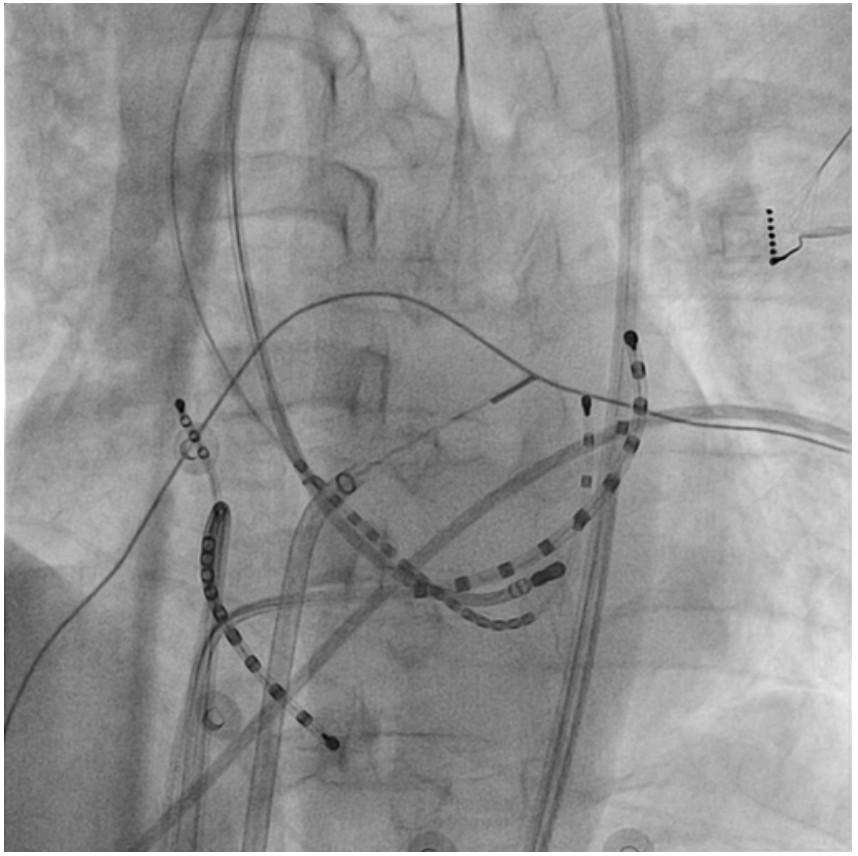




CASE 2; 59/F

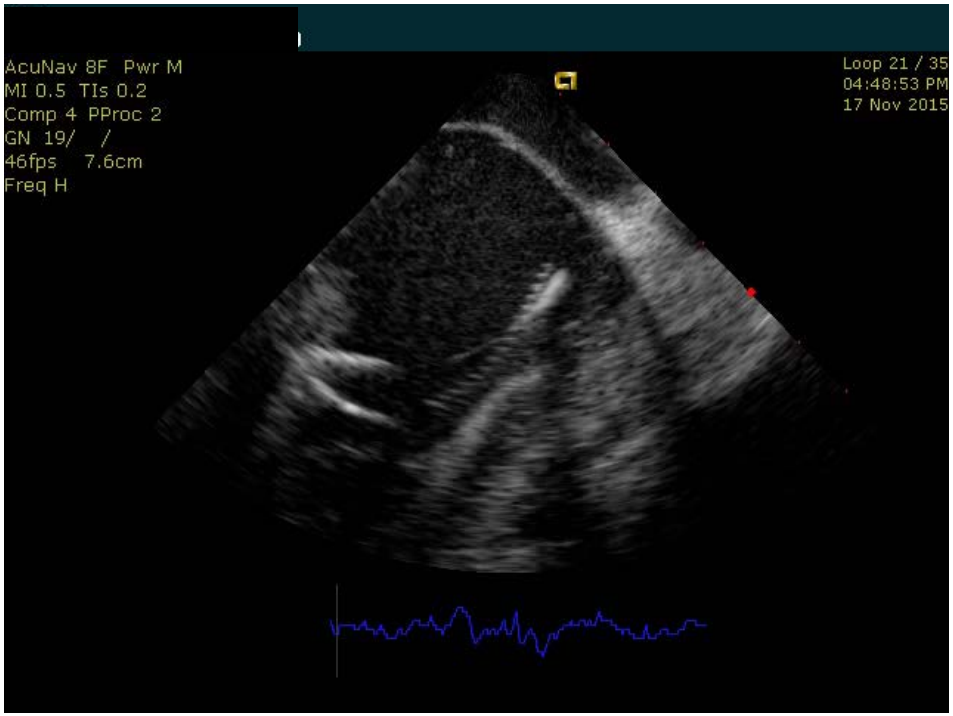
RFCA

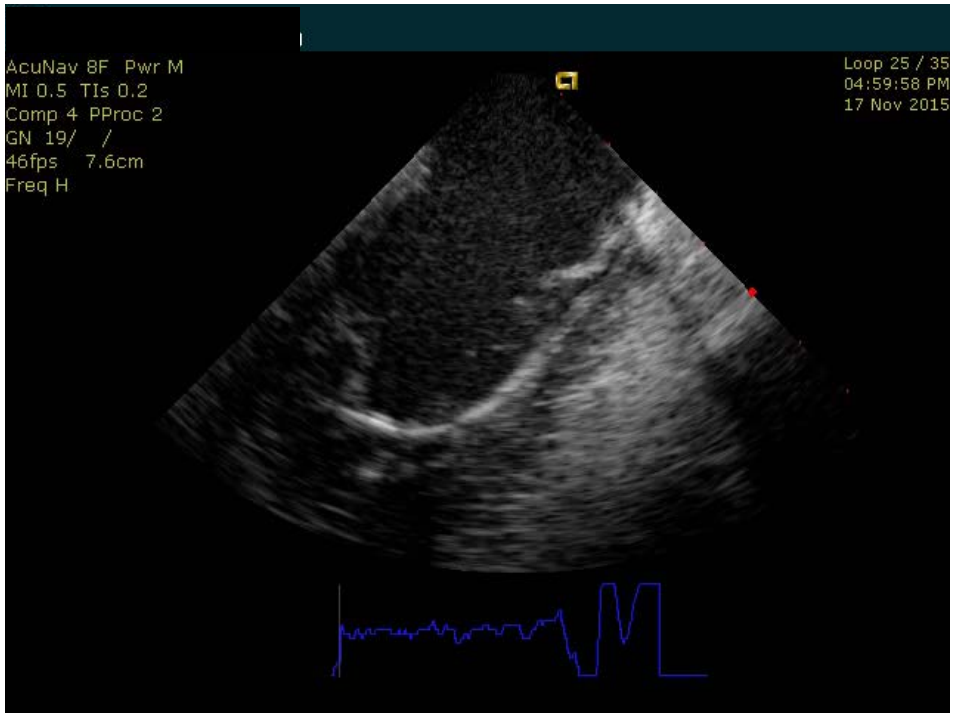




CASE 2; 59/F

ICE; LV Views from LA





Visualization of Arrhythmia Substrate

- Interstitial myocardial fibrosis
  - Echo-intense region
- Transmural infarction
  - Echo-intense region
  - Akinesia
  - Wall thinning
  - Aneurysm formation
- Differentiation between intramural & epicardial fibrosis

Chandraratna PA, et al. Am Heart J 1997;133:364-368
Khaykin Y, et al. Heart Rhythm 2008;5:1396-1402
Bogun FM, et al. J Am Coll Cardiol 2009;53:1138-1145

Visualization of Ablation Lesions

- Catheter-tissue contact during ablation
- Increase of tissue echo-intensity
- Increase of wall thickness
- Transient changes in contractile function adjacent to ablation lesions

Weerasooriya R, et al. Circulation 2003;108:e80

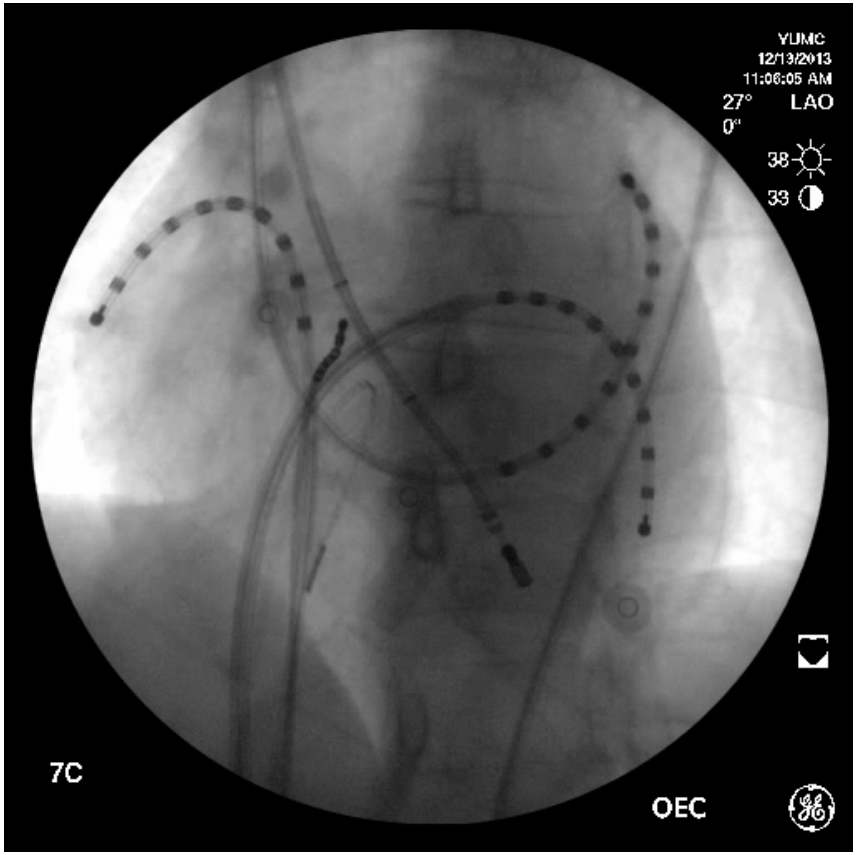
Visualization of Ablation Lesions

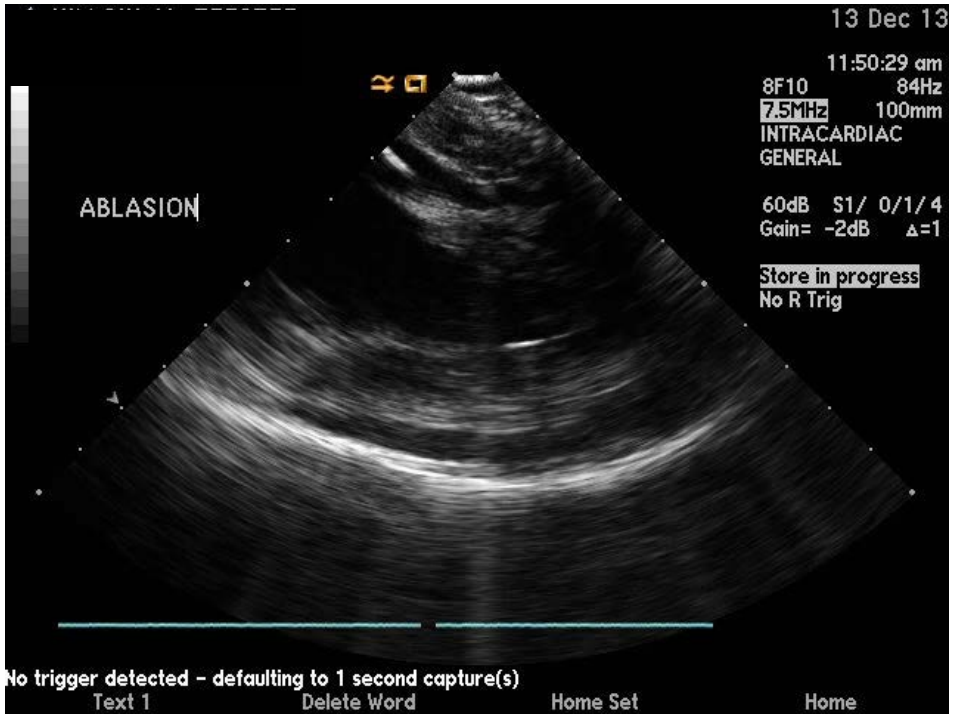
Detection & Prevention of Complications

- Pericardial effusion
- Tissue overheating
  - Microbubbles
- Intracardiac thrombus
- Coronary artery injury
  - Distance between ablation catheter & ostium of coronary artery
- Pulmonary vein stenosis

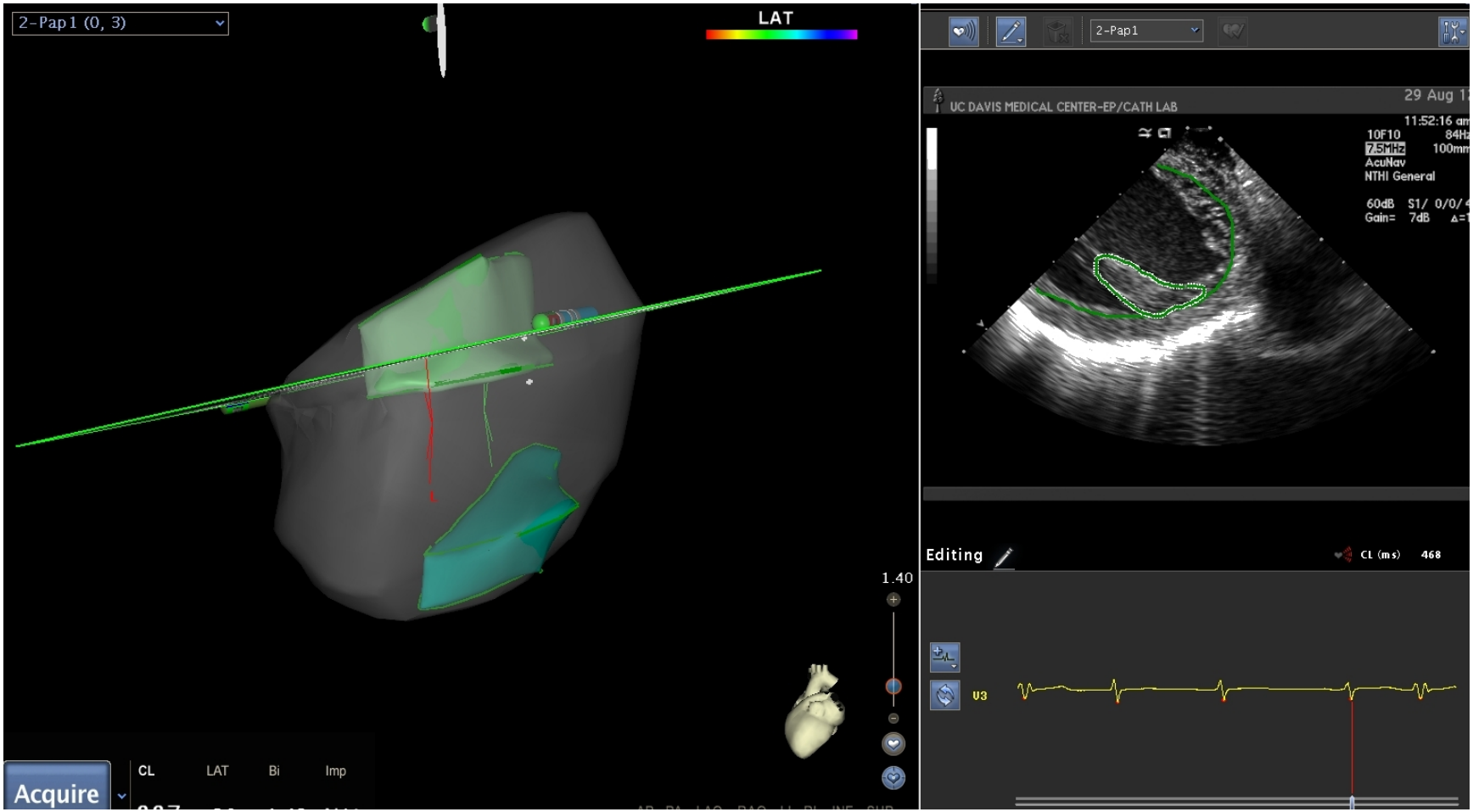
Supple GE, et al. Circulation 2011;124;772-778
Cappato R, et al. Circ Arrhythm Electrophysiol 2010;3:32-38

Pericardial Effusion





Future Perspectives; CARTO Sound



By courtesy of Biosense Webster

Thank you for your attention!