

# Ablation of idiopathic VT/VPB using trans-aortic cusp and coronary sinus approach

Takumi Yamada, MD, PhD.

*University of Alabama at Birmingham*

*Division of Cardiovascular Disease*



# **Disclosures.**

**None.**

**ABSTRACT SESSION 27: ABLATION V: CATHETER ABLATION OF VENTRICULAR ARRHYTHMIAS**  
Friday, May 9, 1997, 4:30 p.m.-6:00 p.m.

160

**Idiopathic Ventricular Tachycardia Originating from the Left Sinus of Valsalva: Implications for Radiofrequency Catheter Ablation**

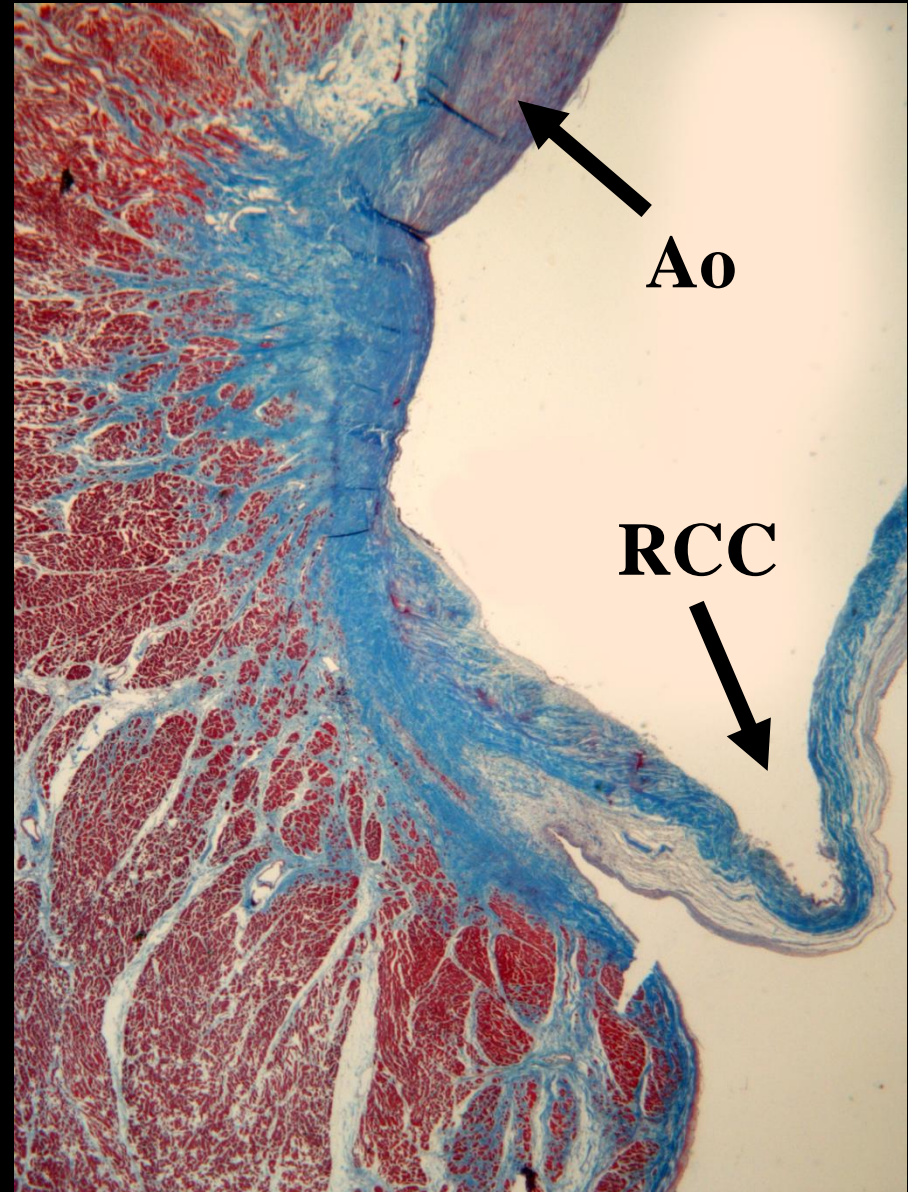
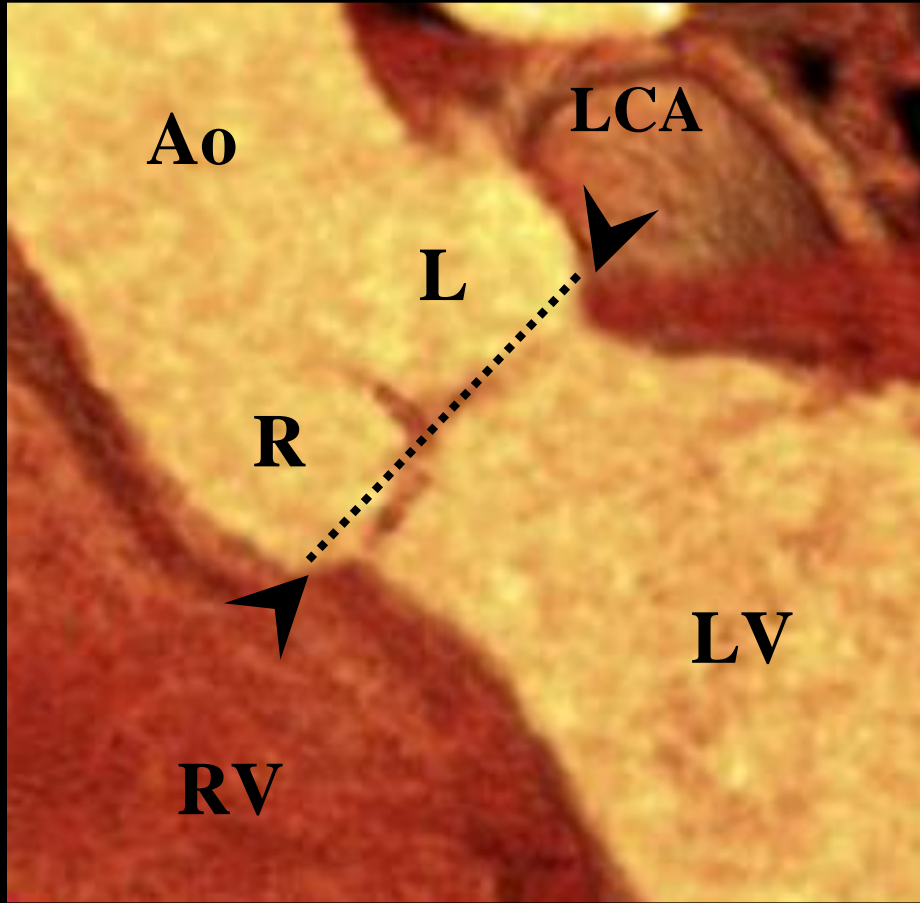
Naoya Tsuboi MD, Teruo Ito MD, Takumi Yamada MD, Yukiomi Tsuji MD, Haruo Hirayama MD, Yukihiko Yoshida MD, Yasuya Inden MD, Toshiyuki Osaka MD and Kazuo Kato MD. Nagoya Daini Red Cross Hospital, Fujita Health University, Owari Hospital and Shizuoka Saiseikai Hospital, Nagoya, Japan

We report 4 patients who had ventricular tachycardia (VT) originating from the left sinus of Valsalva. Four patients (3 females, 1 male), age ranging from 16-62 years, presented with repetitive nonsustained VT. In all patients the QRS morphology during VT exhibited a positive QRS in leads II, III and aVF, and a negative QRS in lead aVL. In 2 patients the QRS during VT showed a tall R wave across the precordial leads, whereas the VT morphology in the other 2 patients exhibited a rS or QS pattern in lead V1 with rightward shift of the transition zone in the precordial leads. Endocardial right and left ventricular mapping did not identify early ventricular activation. Endocardial pace mapping produced a poor QRS match. An excellent pace map was obtained in the left sinus of Valsalva in all patients, and the earliest ventricular activation (30-60 ms before the QRS) was obtained from the left sinus of Valsalva in 3 patients. In 2 patients catheter ablation was attempted from the left sinus of Valsalva using a conventional 4 mm tip electrode with a temperature-controlled ablation system. The temperature of the electrode tip was adjusted to 50-55° C. Delivery of radiofrequency energy in the left sinus of Valsalva eliminated the VT in those 2 patients. Coronary angiography was normal after ablation in both patients.

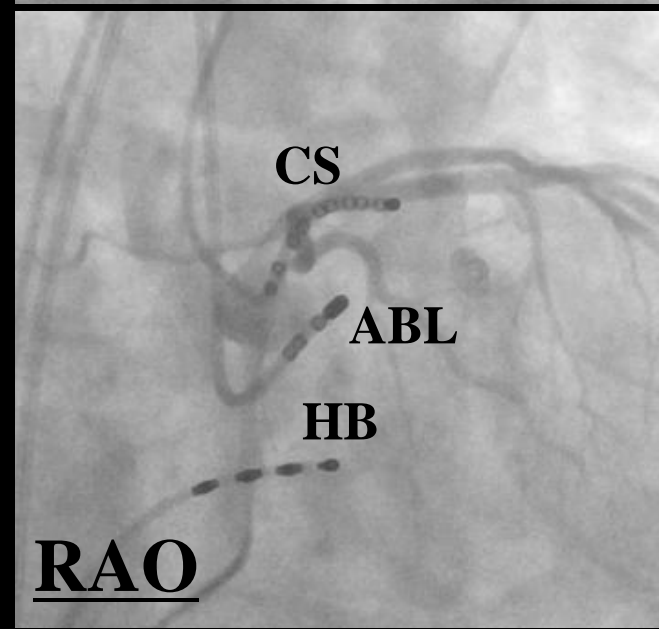
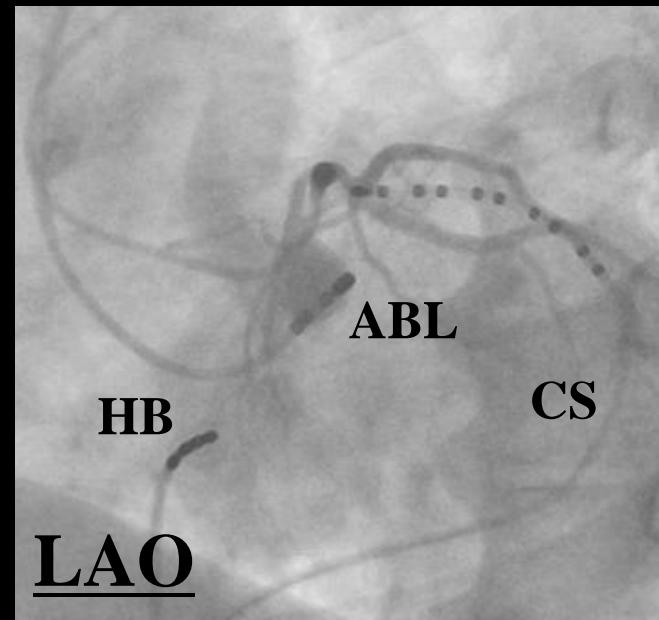
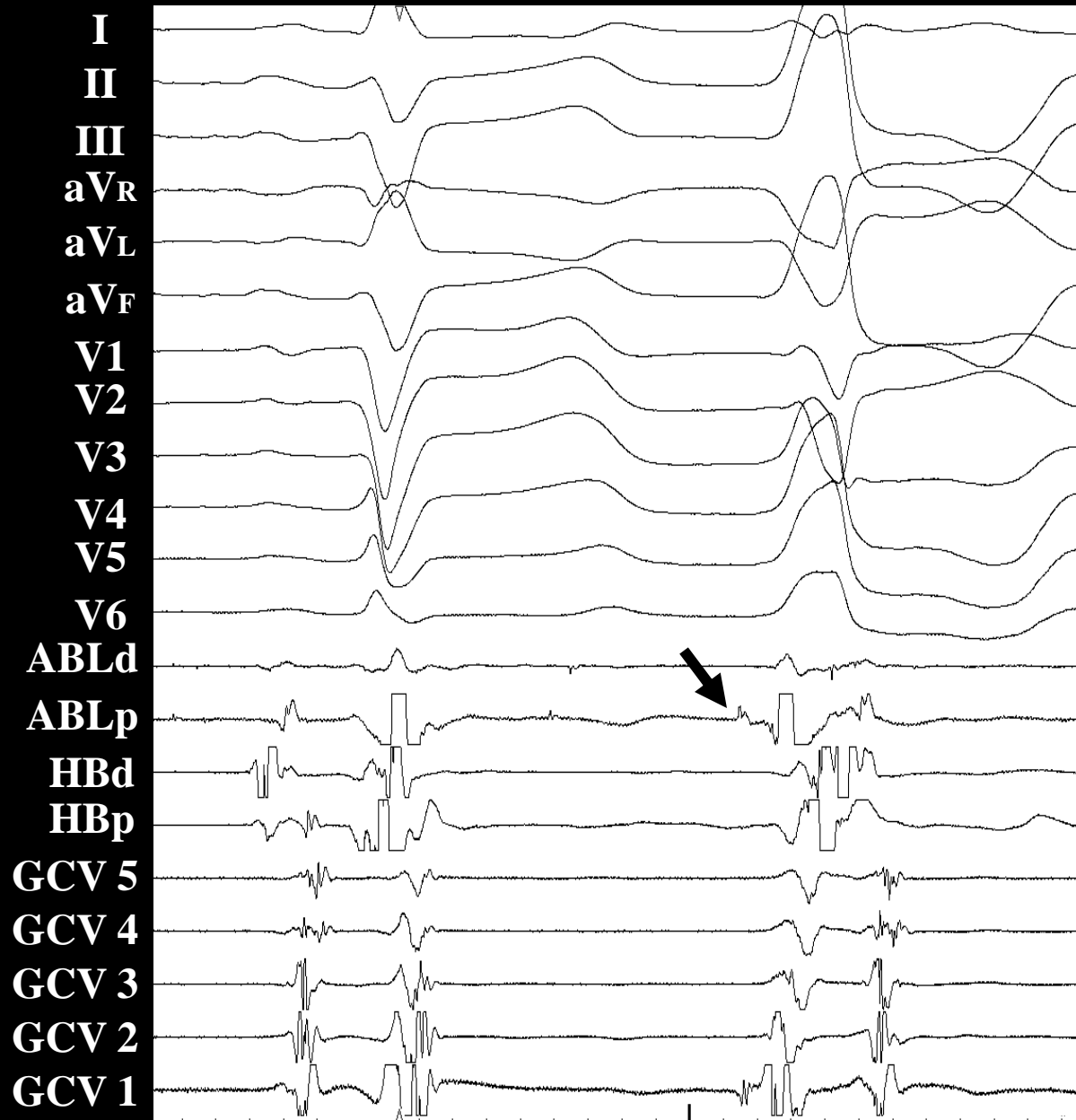
**Conclusion:** Some outflow tract ventricular tachycardias originate from the left sinus of Valsalva. Catheter ablation in the left sinus of Valsalva is feasible with a temperature-controlled ablation system.



# Anatomy of the ASCs

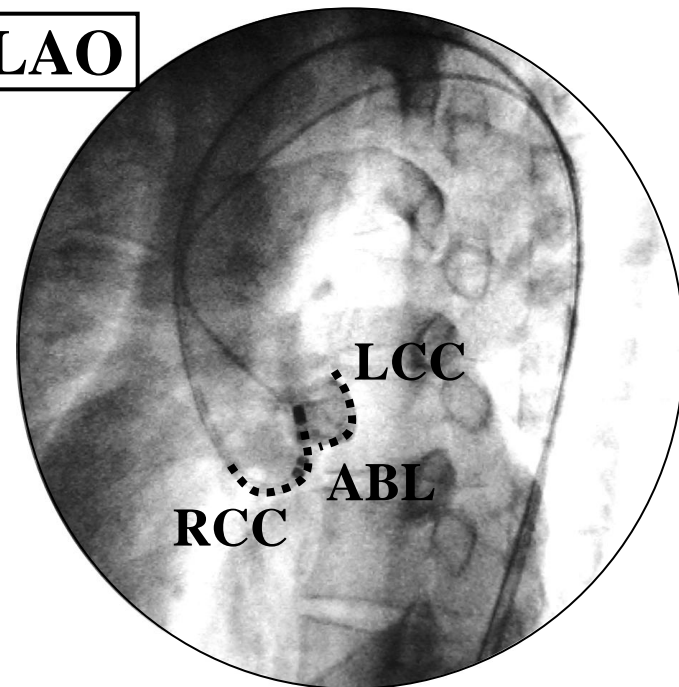


# Successful ABL site of LCC VT

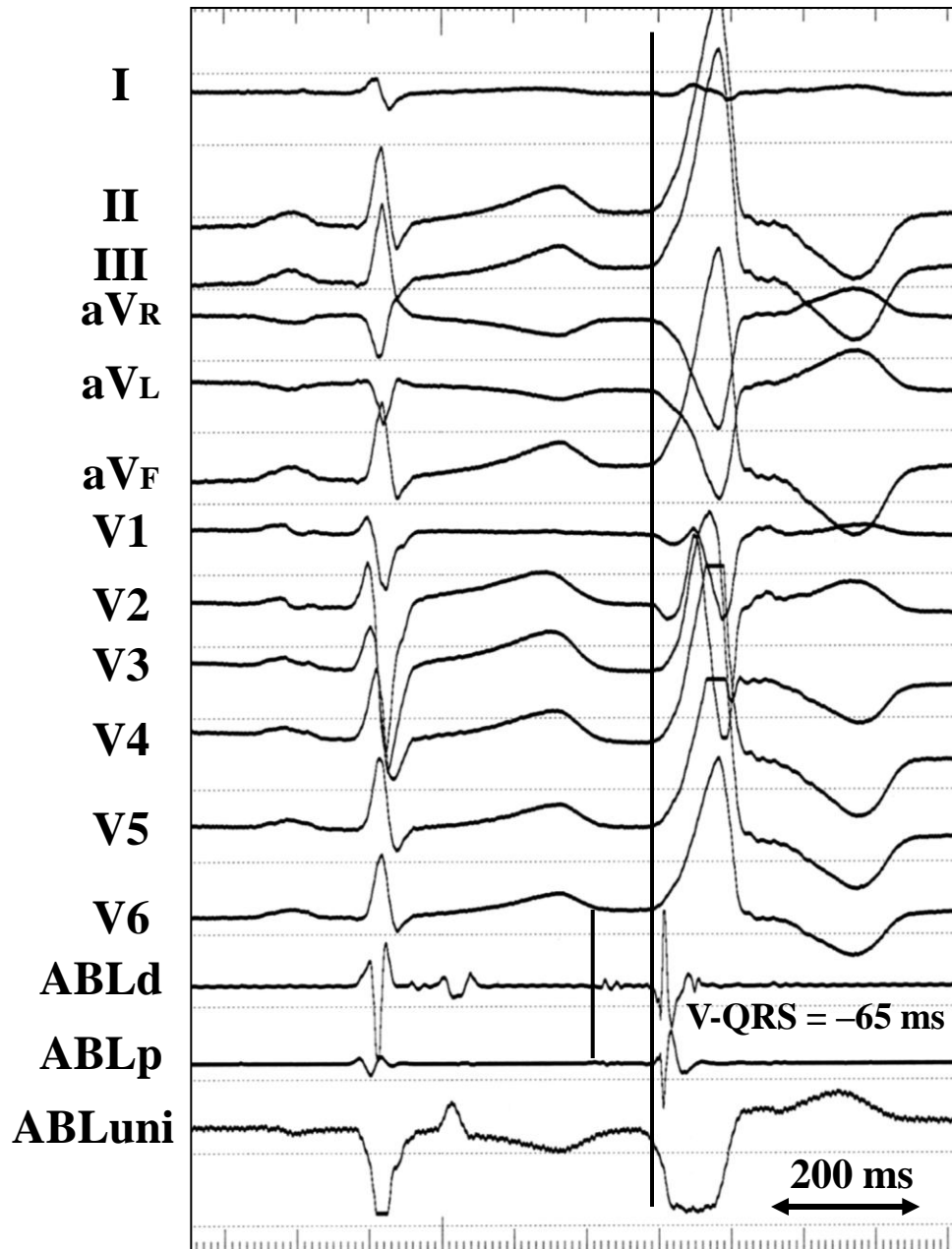
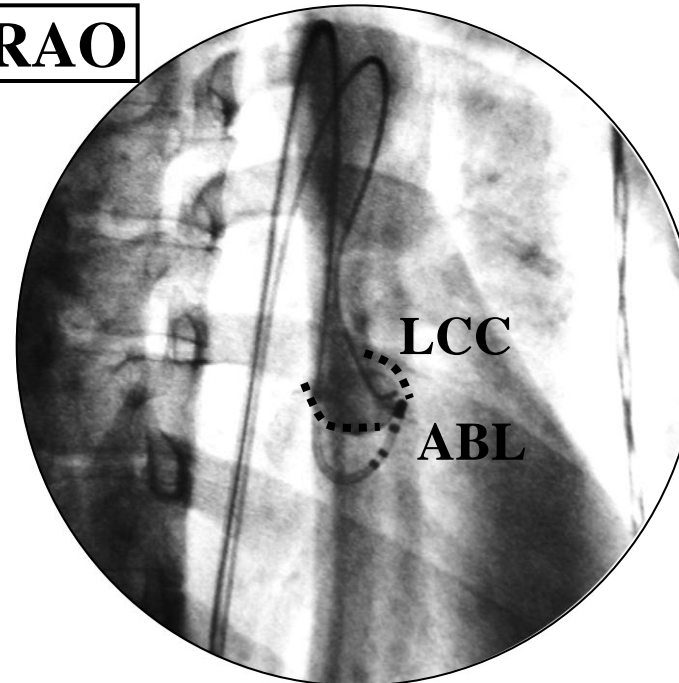


# Successful ABL site of L-RCC VT

**LAO**

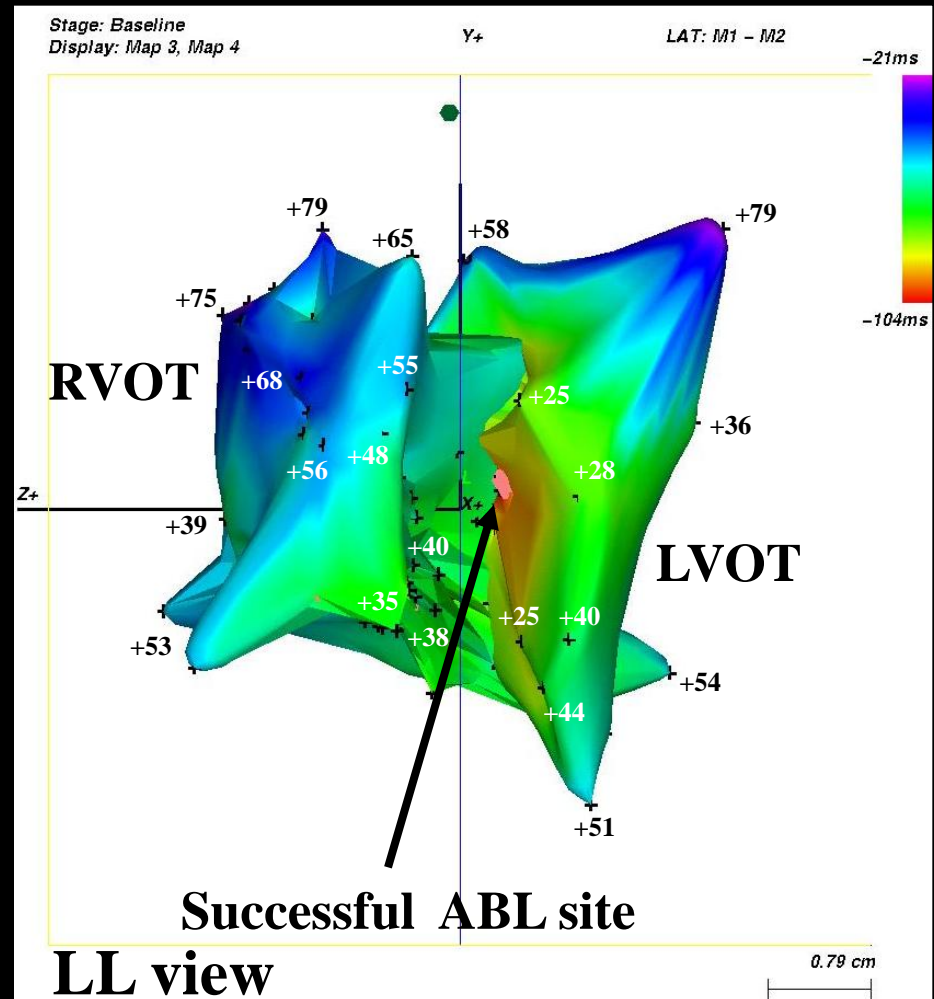
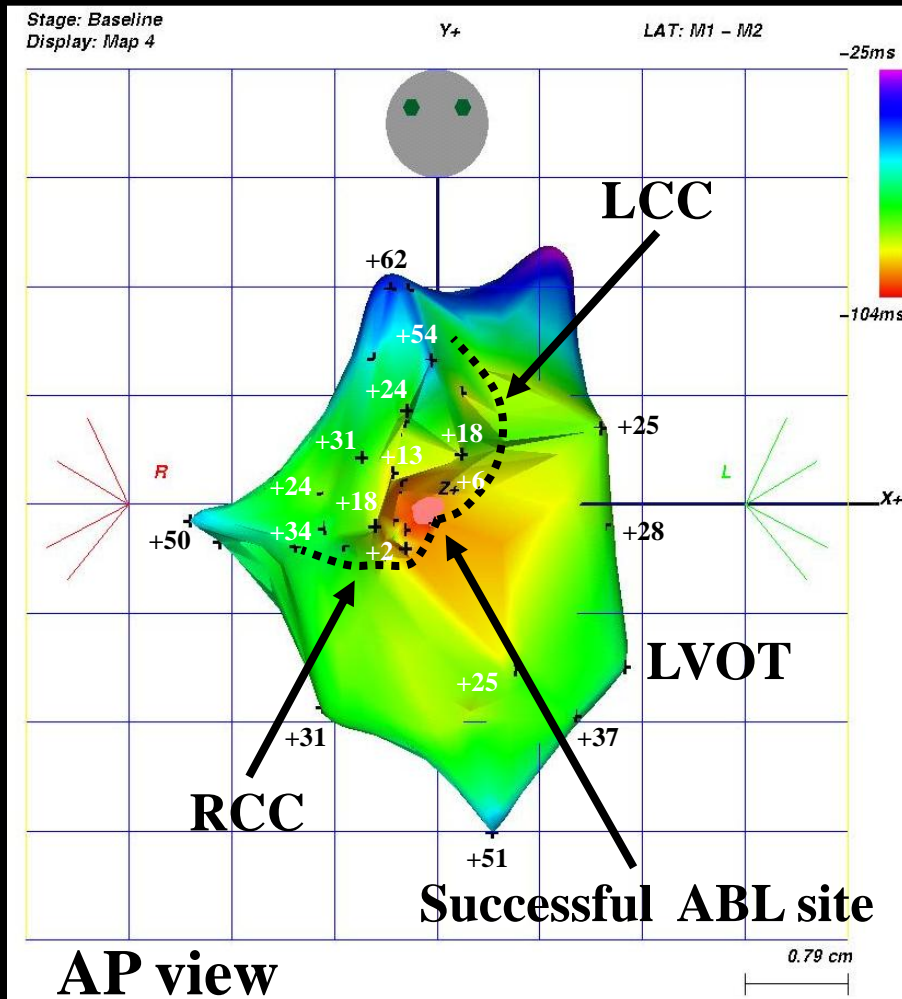


**RAO**



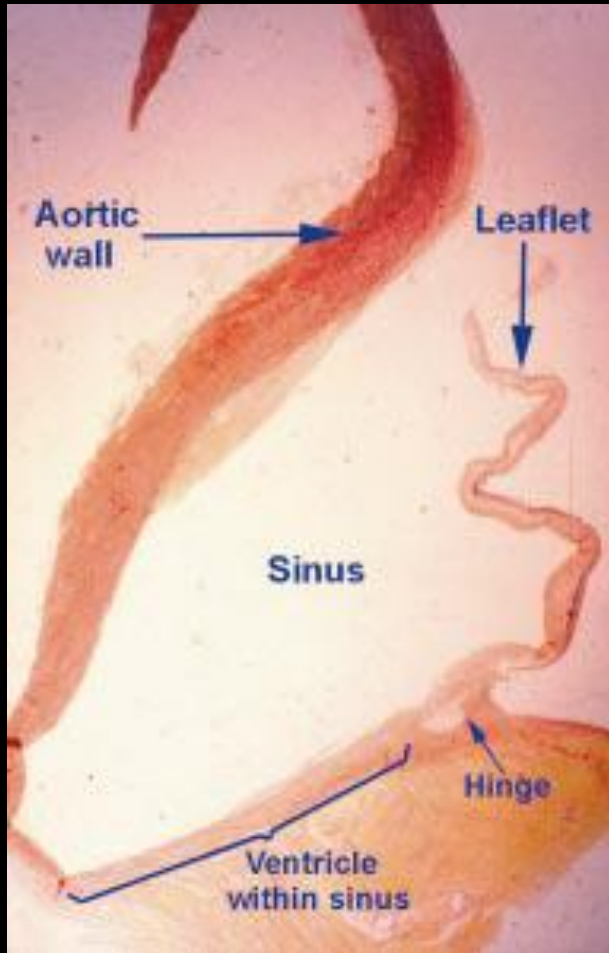


# Successful ABL site at the L-RCC

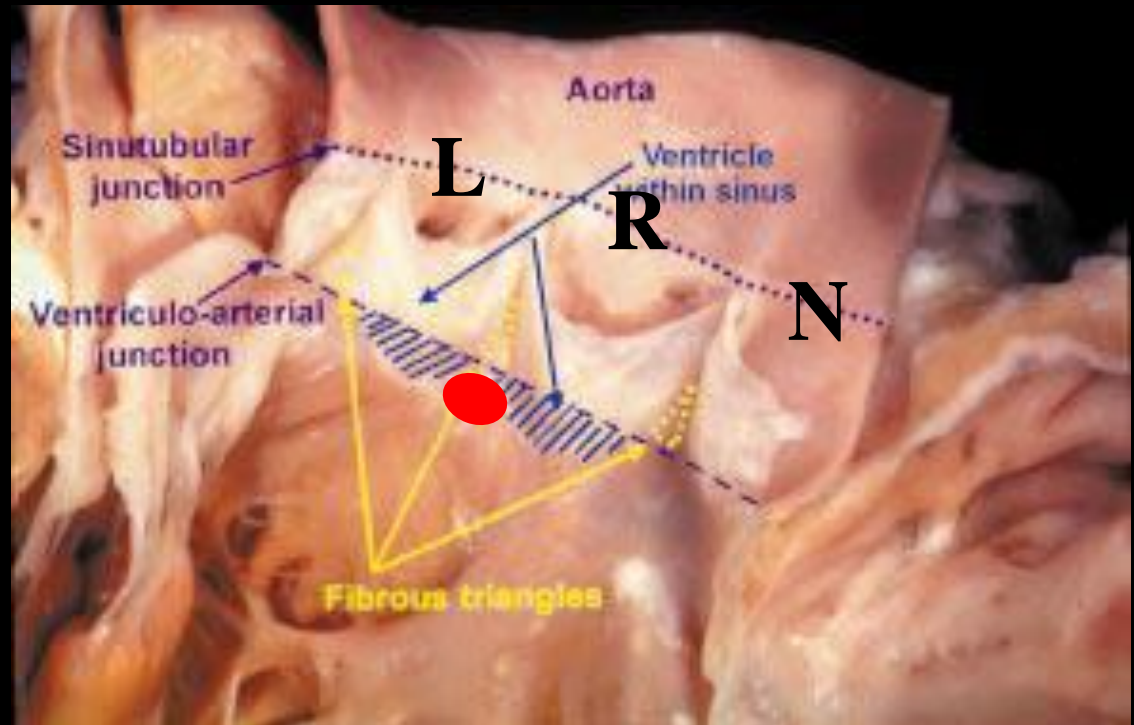


# Anatomy of Aortic root

**A**



**B**





# Idiopathic Ventricular Arrhythmias Originating From the Aortic Root

## Prevalence, Electrocardiographic and Electrophysiologic Characteristics, and Results of Radiofrequency Catheter Ablation

Takumi Yamada, MD,\* H. Thomas McElderry, MD,\* Harish Doppalapudi, MD,\* Yoshimasa Murakami, MD,‡ Yukihiro Yoshida, MD,§ Naoki Yoshida, MD,‡ Taro Okada, MD,‡ Naoya Tsuboi, MD,§ Yasuya Inden, MD,# Toyoaki Murohara, MD,# Andrew E. Epstein, MD,\* Vance J. Plumb, MD,\* Satinder P. Singh, MD,† G. Neal Kay, MD\*

*Birmingham, Alabama; and Ichinomiya and Nagoya, Japan*

### Objectives

This study investigated the prevalence and electrocardiographic and electrophysiologic characteristics of aortic root ventricular arrhythmias (VAs).

### Background

Idiopathic VAs originating from the ostium of the left ventricle may be ablated at the base of the aortic cusps.

### Methods

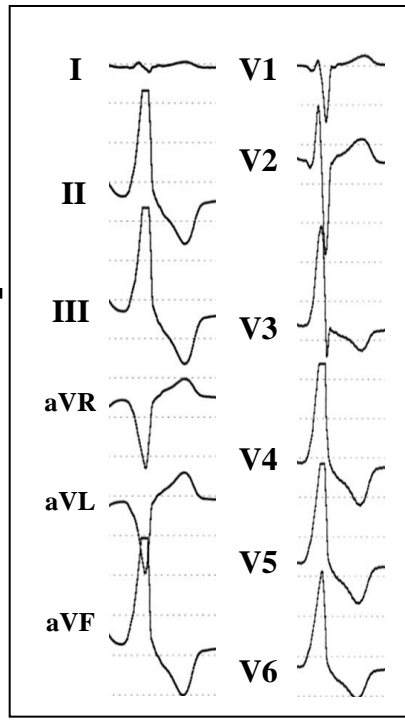
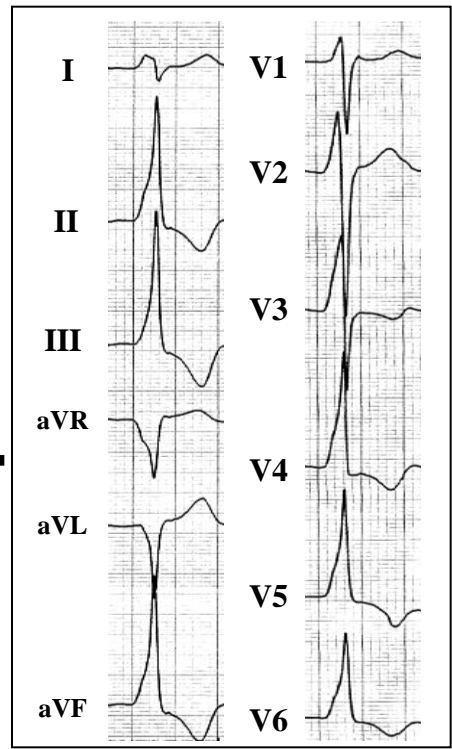
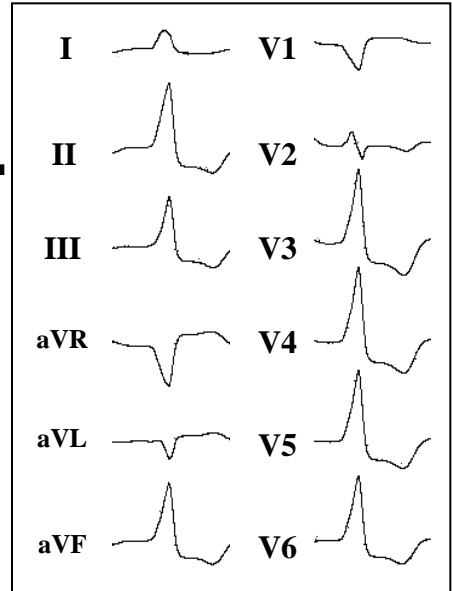
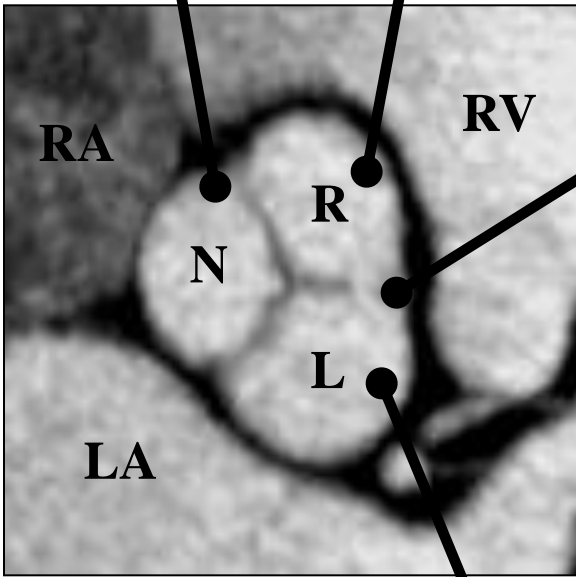
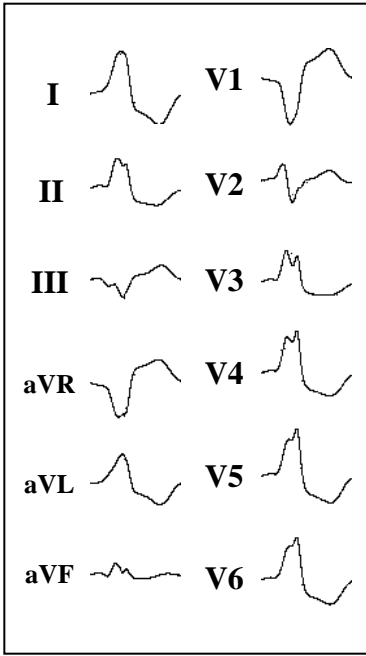
We studied 265 patients with idiopathic VAs with an inferior QRS-axis morphology.

### Results

The successful ablation site was within (or below) the aortic cusps in 44 patients (16.6%). The site of the origin was the left coronary cusp (LCC) in 24 (54.5%), the right coronary cusp (RCC) in 14 (31.8%), the noncoronary cusp (NCC) in 1 (2.3%), and at the junction between the LCC and RCC (L-RCC) in 5 (11.4%) cases. The maximum amplitude of the R-wave in the inferior leads was significantly greater with an LCC than with an RCC origin ( $p < 0.05$ ). The ratio of the R-wave amplitude in leads II and III was significantly greater with an LCC than with an RCC origin ( $p < 0.01$ ) and was significantly smaller in the NCC than in the other sites ( $p < 0.0001$ ). The ventricular deflection in the His bundle electrogram was significantly later relative to the surface QRS with an LCC or L-RCC origin than with an RCC or NCC origin ( $p < 0.0001$ ). The ratio of the atrial-to-ventricular deflection amplitude was significantly greater in the NCC than in the other sites ( $p < 0.0001$ ). No other factors predicted the site of origin.

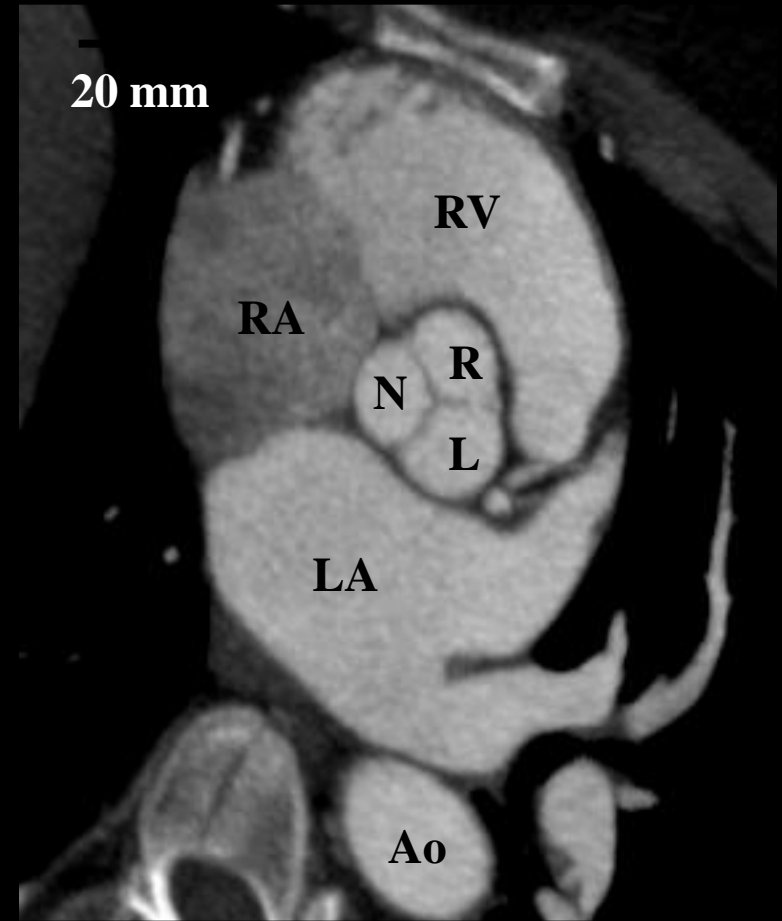
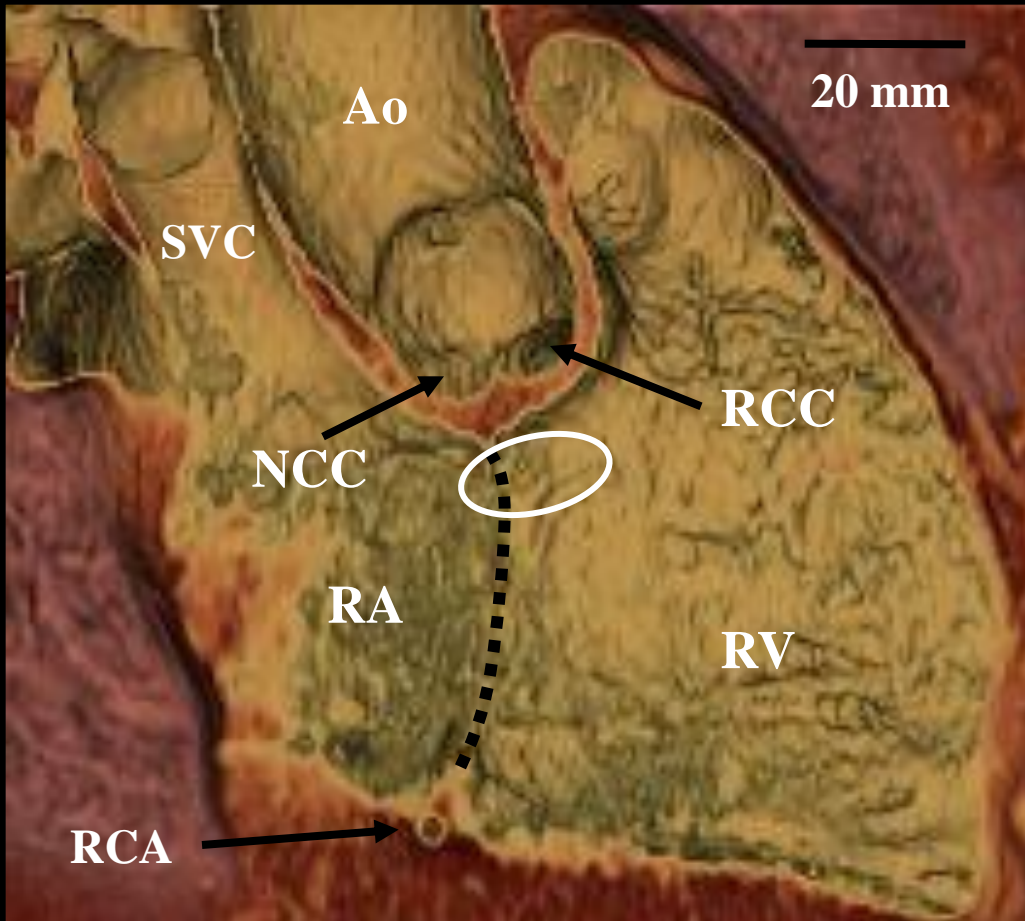
### Conclusions

Idiopathic VAs are more common in the LCC than in the RCC and rarely arise from the NCC. The electrocardiogram is useful for differentiating the site of origin. (J Am Coll Cardiol 2008;52:139-47) © 2008 by the American College of Cardiology Foundation

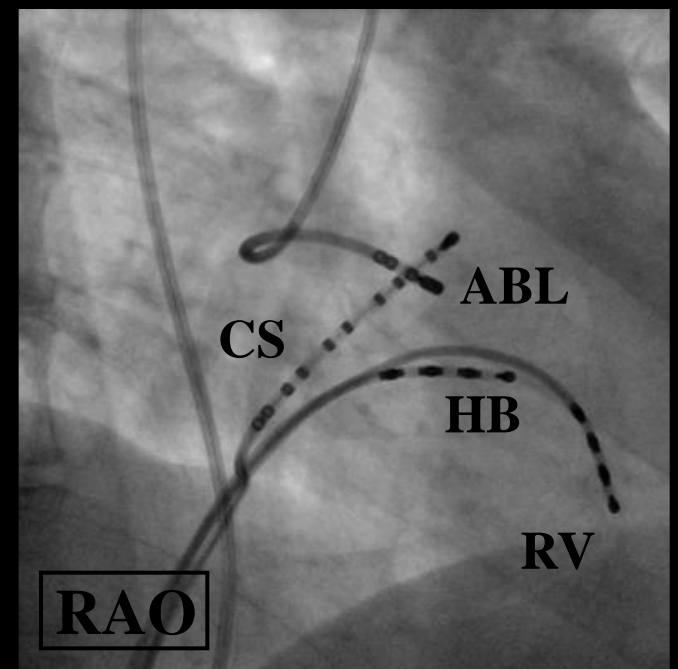
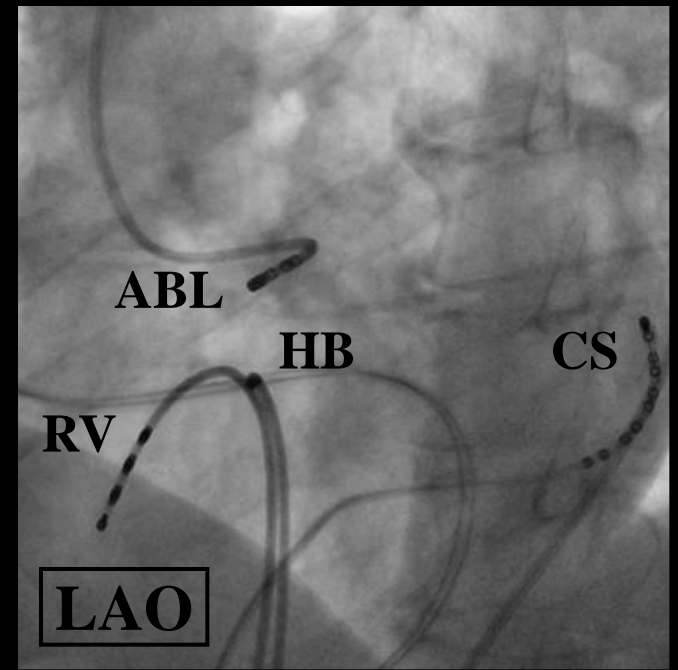
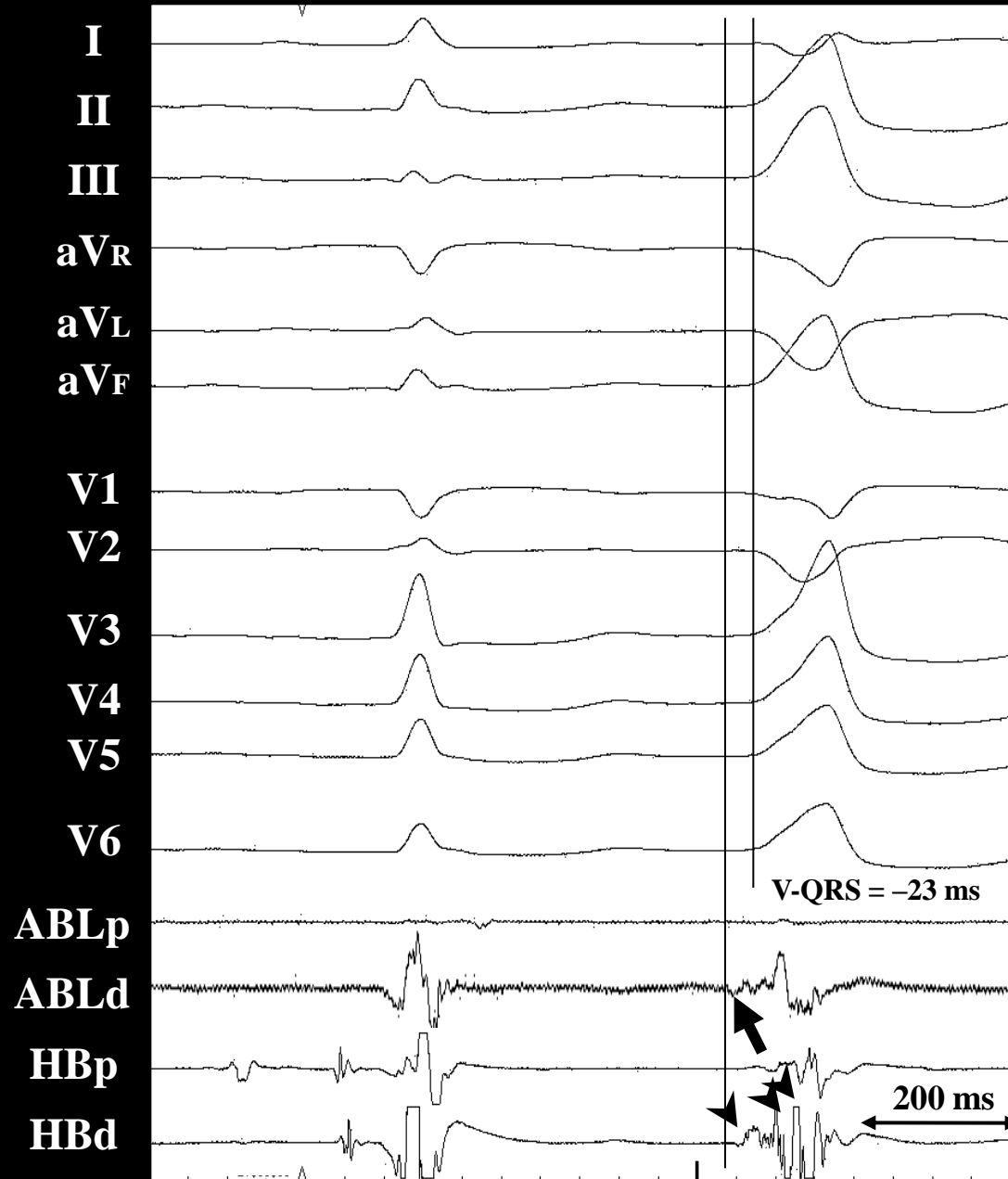


2 mV
   
 200 ms

# Anatomy around the RCC and NCC

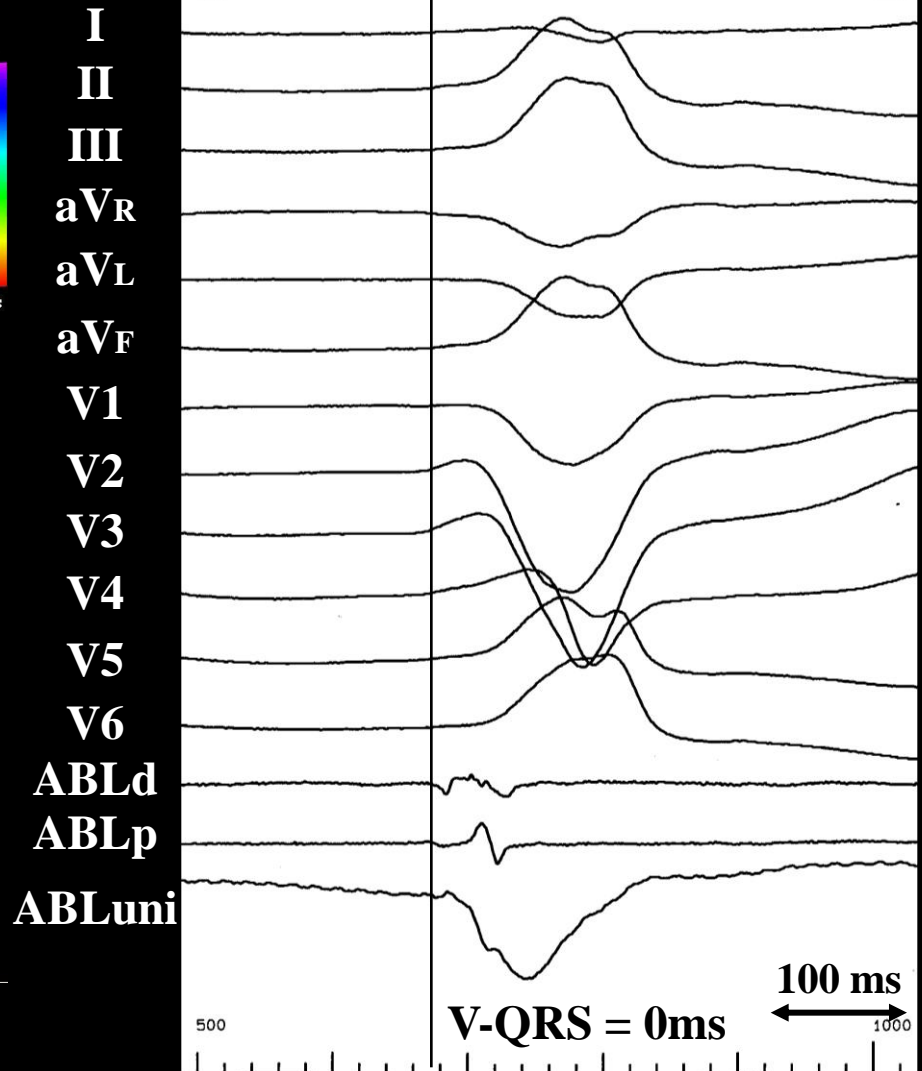
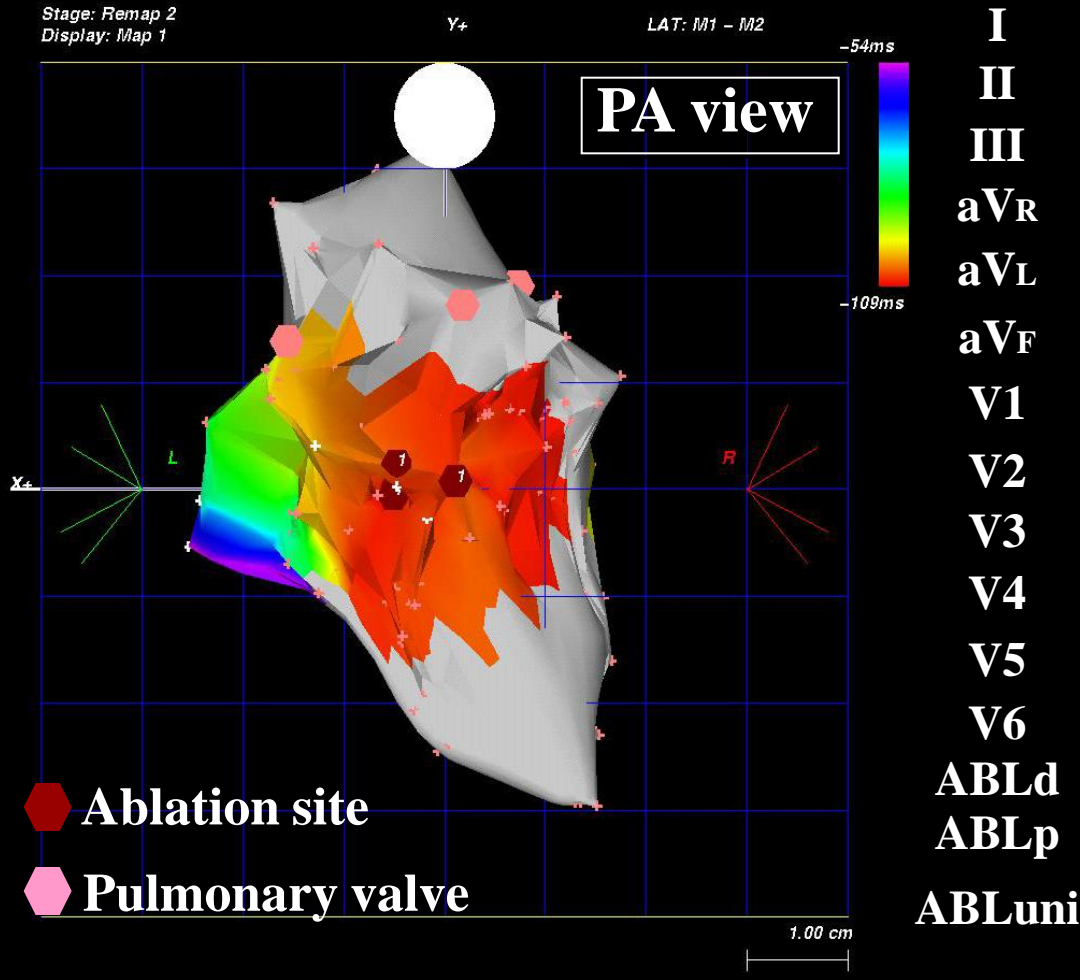


# Successful ABL site of RCC VT



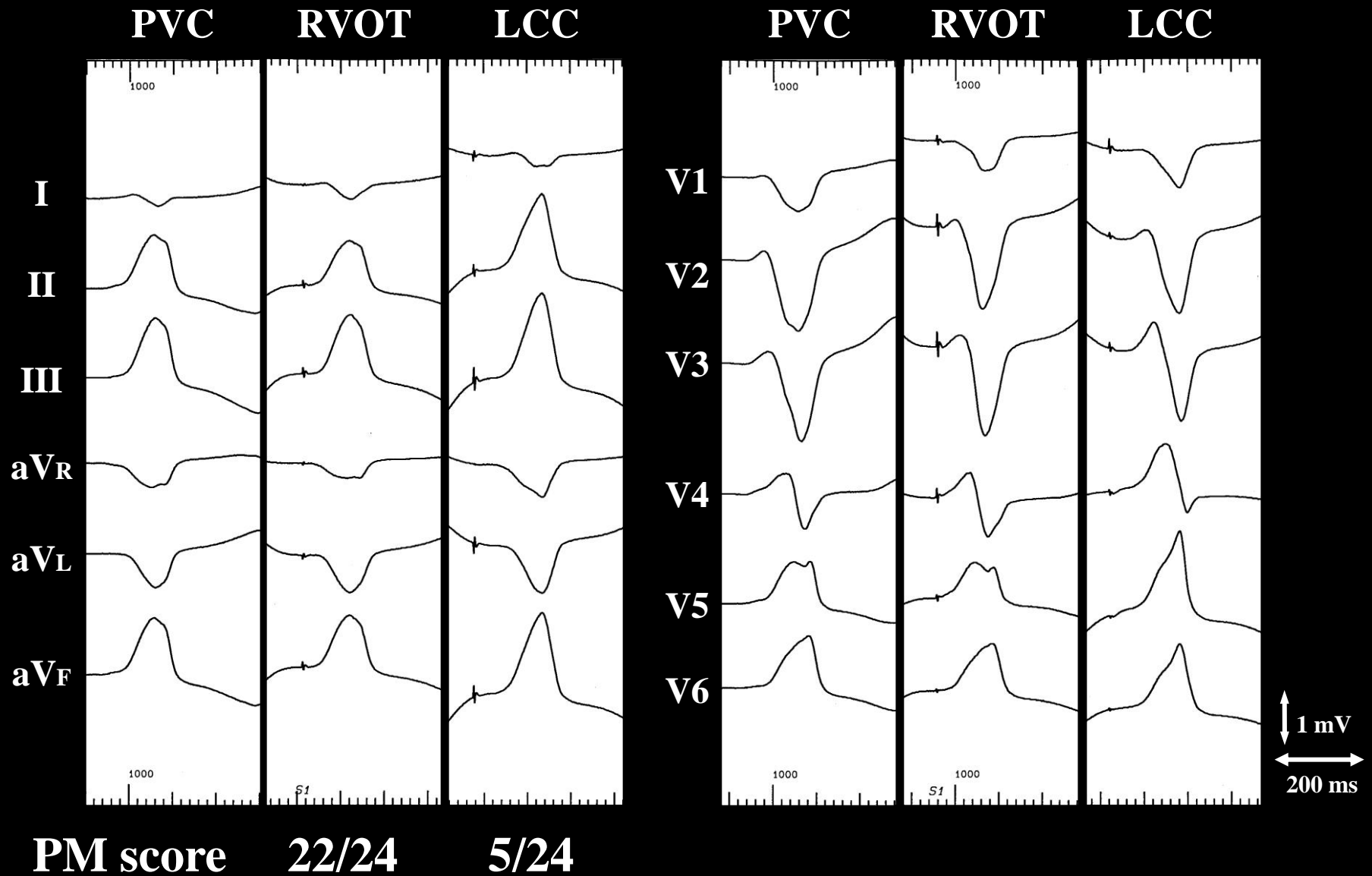


# Preferential conduction in the VOT

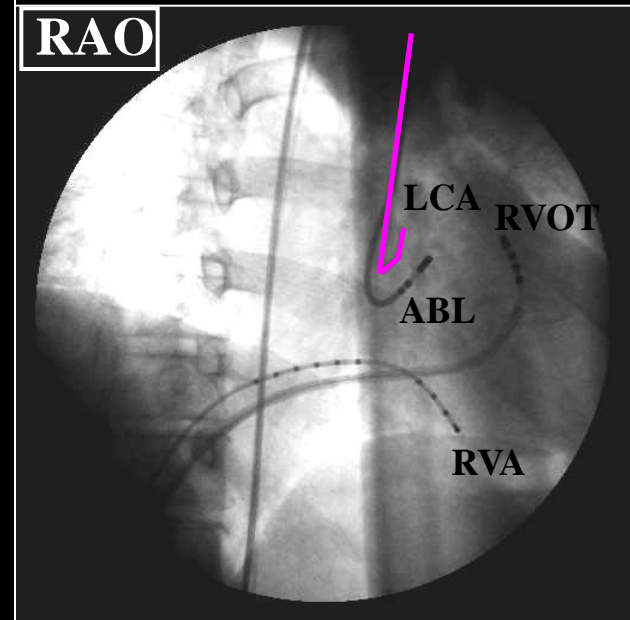
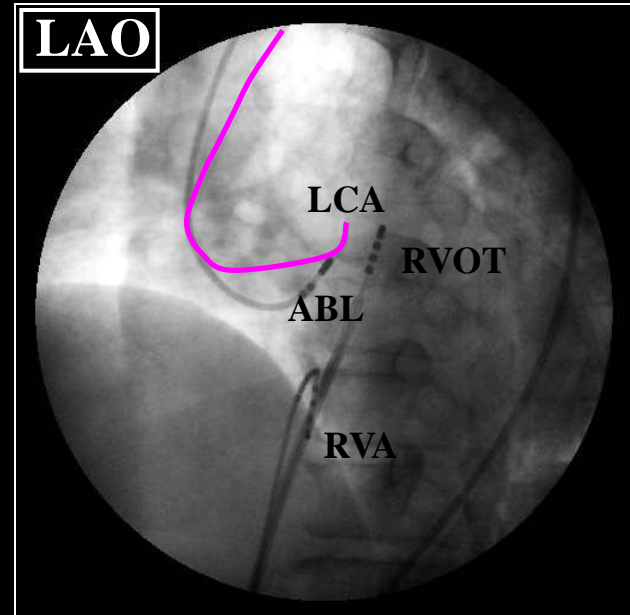
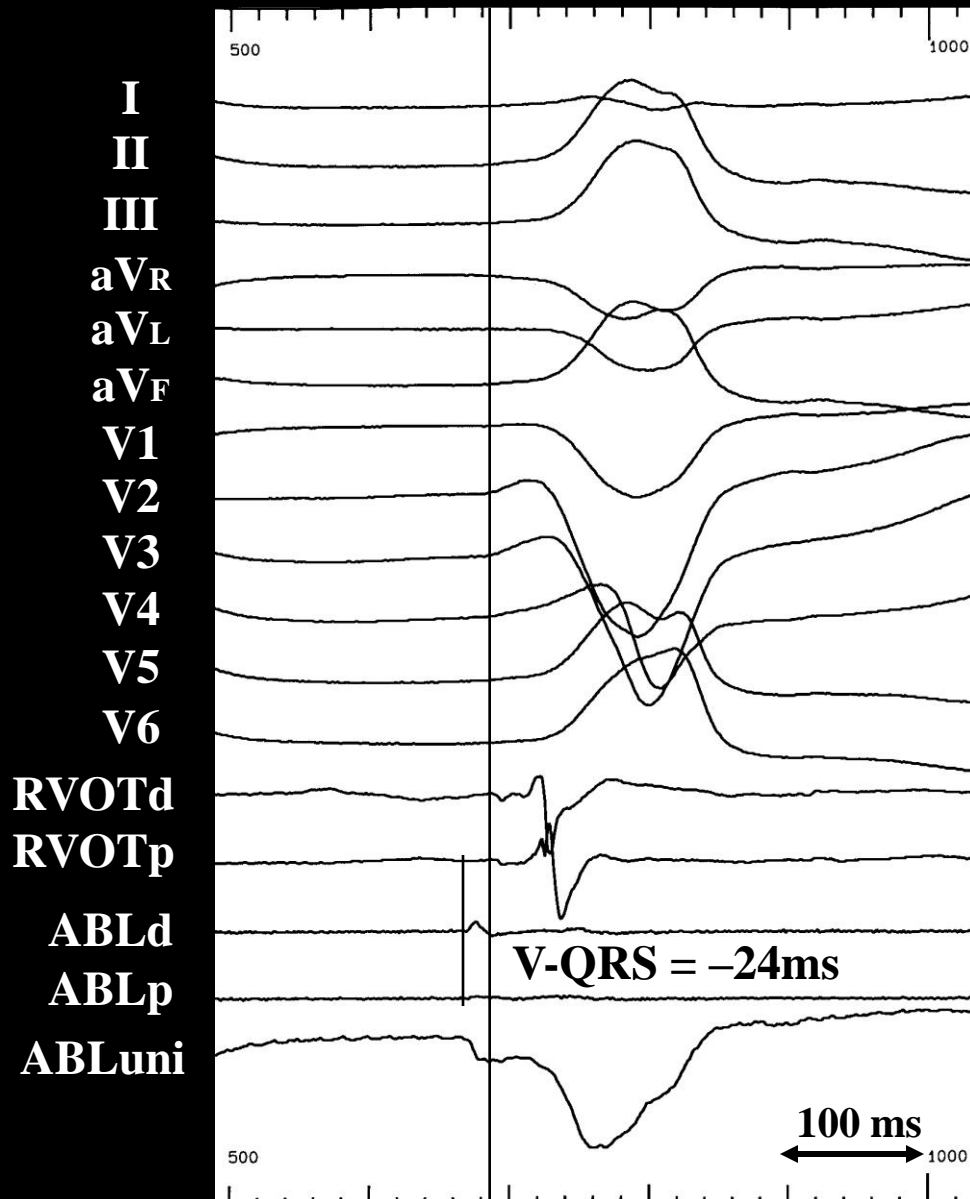


Yamada T, et al. J Am Coll Cardiol  
2007;50:884-891.

# Preferential conduction in the VOT



# Preferential conduction in the VOT



# Characteristics of aortic root VTs

- LCC VTs > RCC VTs. NCC VTs are very rare.
- A right bundle branch block QRS morphology during the VAs may suggest that the VAs never originate from the RCC, NCC, or L-RCC.
- QRS polarity in lead I and R wave amplitude ratio in leads II and III may be helpful for differentiating between LCC and RCC VTs.
- Comparing activation times between the GCV and HB region is helpful for predicting a site of an aortic root VA origin.



# Characteristics of aortic root VTs

- During VAs originating from the RCC and NCC, a far-field electrogram preceding the QRS onset is recorded in the HB region.
- Pace map - A long interval from the pacing stimulus to QRS onset.
- Preferential conduction – may limit reliability of pace mapping in this region.

# Catheter ABL of aortic root VTs

- A pre-potential during VTs may be a good predictor of successful ABL in this region.
- Non-irrigated RF ABL is usually effective and safe.
- Catheter ABL with an angiographic catheter within the coronary artery is strongly recommended to prevent complications associated with the coronary arteries.
- ICE may also be helpful for identifying which cusp is mapped and ablated.

# Idiopathic Ventricular Arrhythmias Originating From the Left Ventricular Summit

## Anatomic Concepts Relevant to Ablation

Takumi Yamada, MD; H. Thomas McElderry, MD; Harish Doppalapudi, MD; Taro Okada, MD; Yoshimasa Murakami, MD; Yukihiko Yoshida, MD; Naoki Yoshida, MD; Yasuya Inden, MD; Toyooki Murohara, MD; Vance J. Plumb, MD; G. Neal Kay, MD

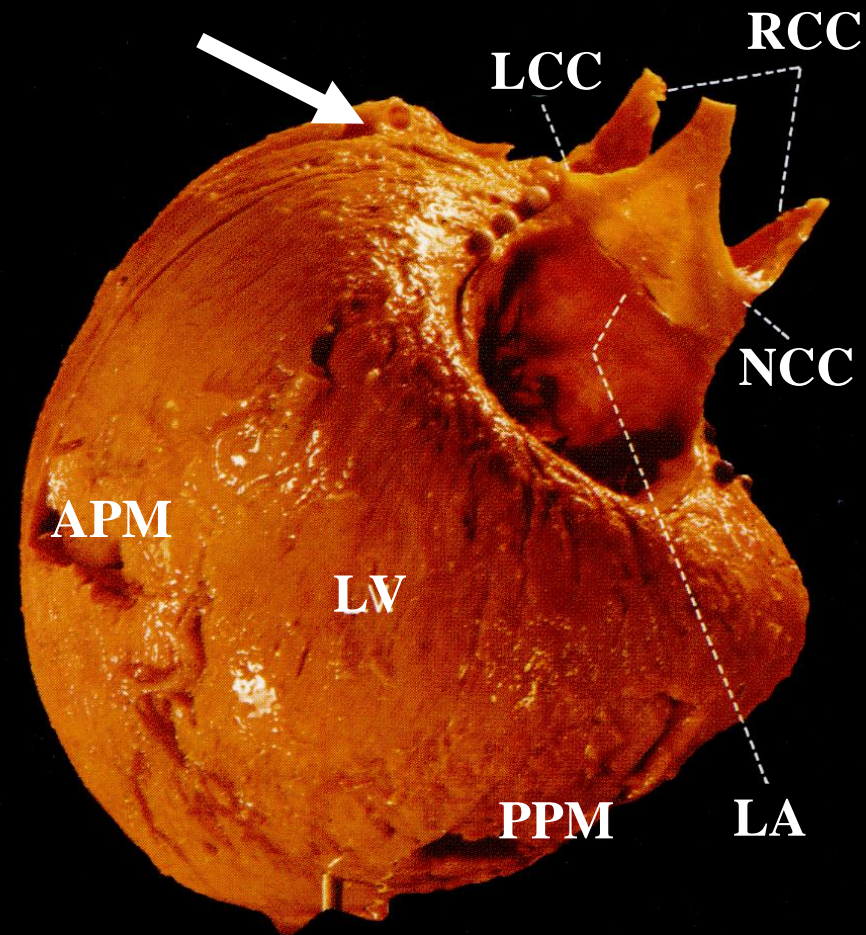
**Background**—The summit of the left ventricle (LV) is the most superior portion of the epicardial LV bounded by an arc from the left anterior descending coronary artery, superior to the first septal perforating branch to the left circumflex coronary artery. Ventricular arrhythmias (VAs) originating from this region may present challenges for catheter ablation.

**Methods and Results**—We studied 27 consecutive patients with VAs originating from the LV summit. The great cardiac vein (GCV) divides this region between an inferior area accessible to ablation and a superior, inaccessible area. Successful ablation was achieved within the GCV in 14 patients and on the epicardial surface in 4. Ventricular prepotentials were recorded at the successful ablation site in 80% of these patients. In 5 patients, ablation was abandoned because of inaccessibility of the catheter to the myocardium or high impedance with radiofrequency application within the GCV. In the remaining 4 patients, epicardial mapping suggested VA origins in a region of low voltage that was located superior to the GCV (inaccessible area), and ablation was abandoned because of close proximity to the coronary arteries or high impedance. A right bundle-branch block, transition zone, R-wave amplitude ratio in leads III to II, Q-wave amplitude ratio in leads aVL to aVR, and S waves in lead V<sub>6</sub> accurately predicted the site of origin.

**Conclusions**—LV summit VAs may be ablated within the GCV or inferior to the GCV on the epicardial surface, though sites superior to the GCV are usually inaccessible to ablation. (*Circ Arrhythm Electrophysiol.* 2010;3:616-623.)

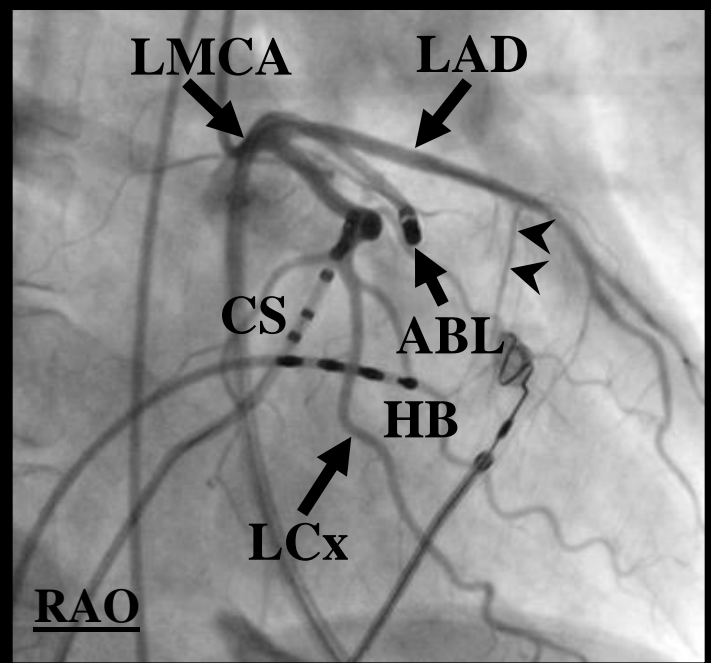
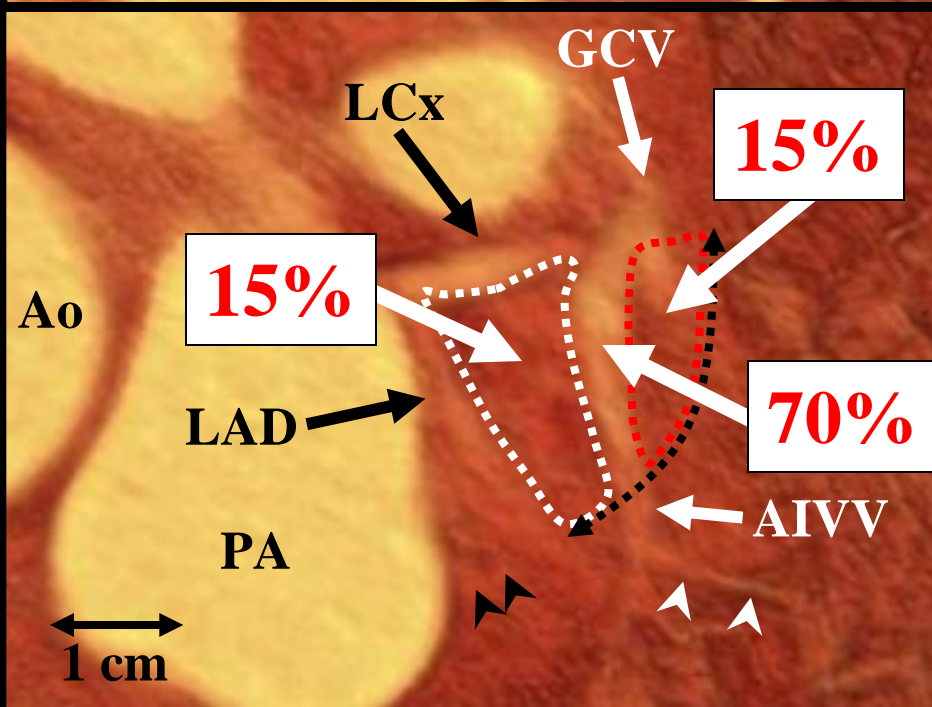
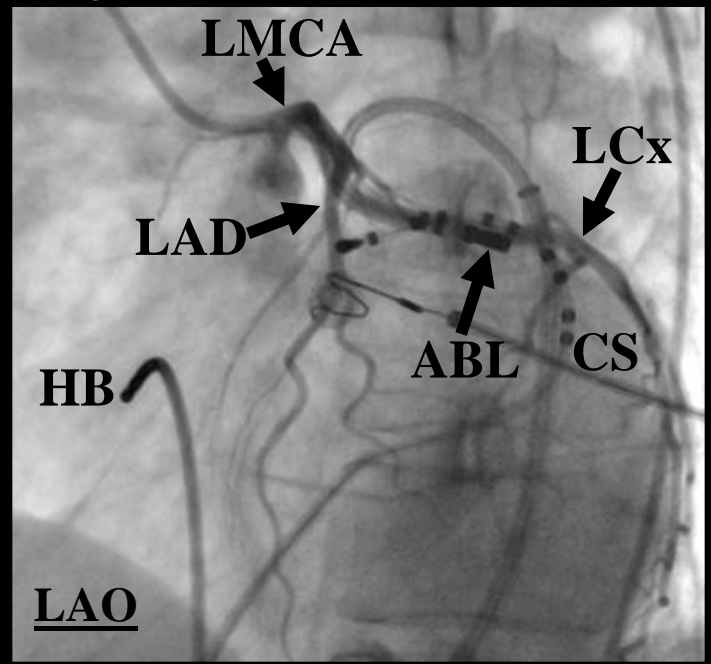
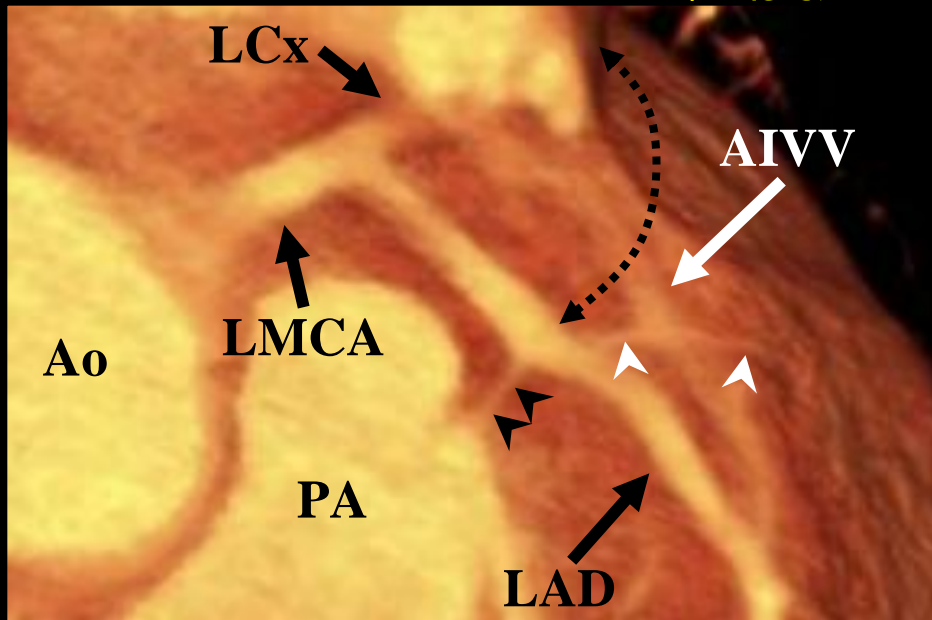
# Where is the LV summit?

- A region of the LV epicardial surface bounded by the left anterior descending coronary artery (LAD) and left circumflex coronary artery (LCx) that lies superior to the aortic portion of the LV ostium occupies the most superior portion of the LV and has been termed the LV summit by McAlpine.





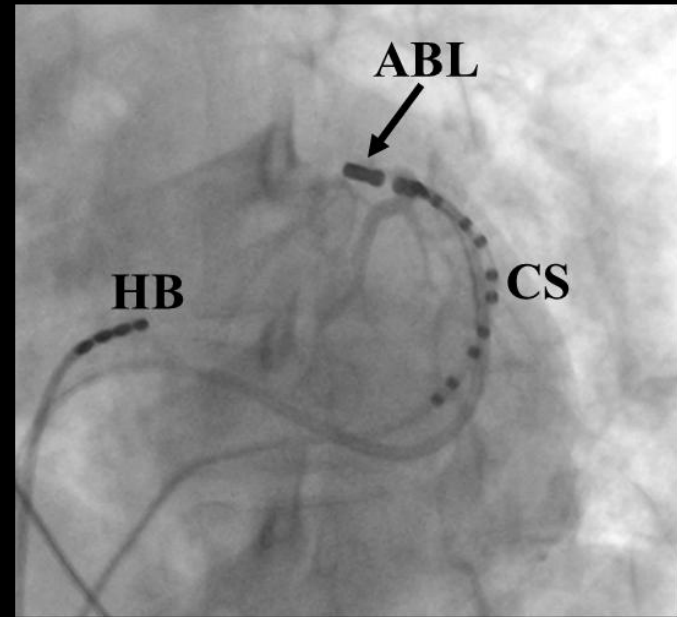
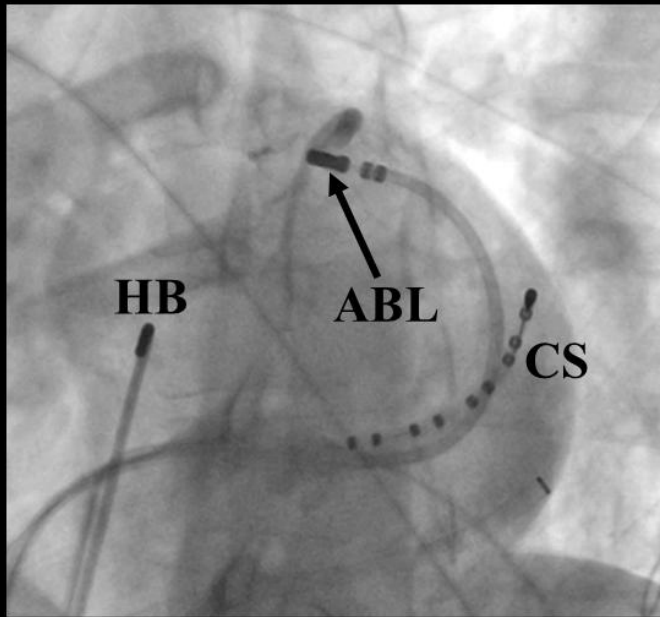
# LV summit



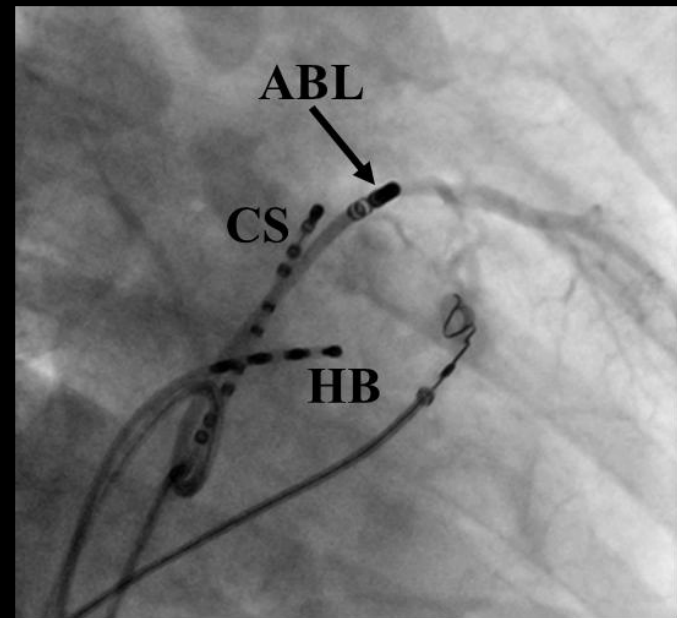
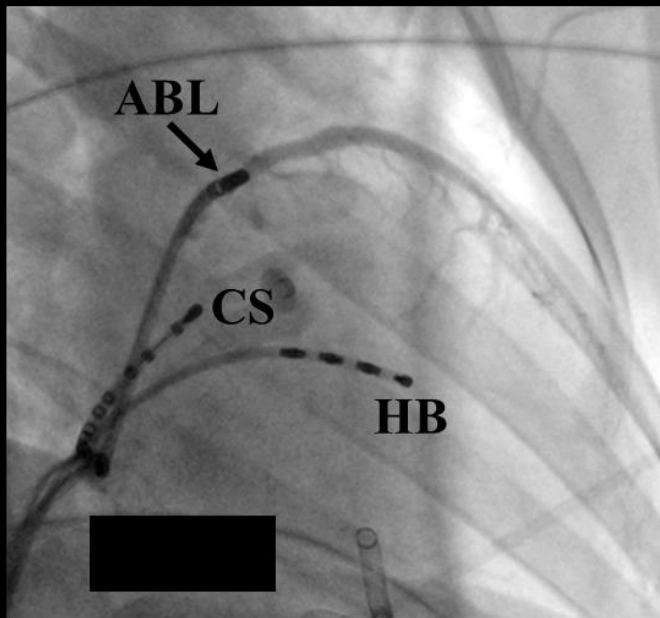
Case 1

Case 2

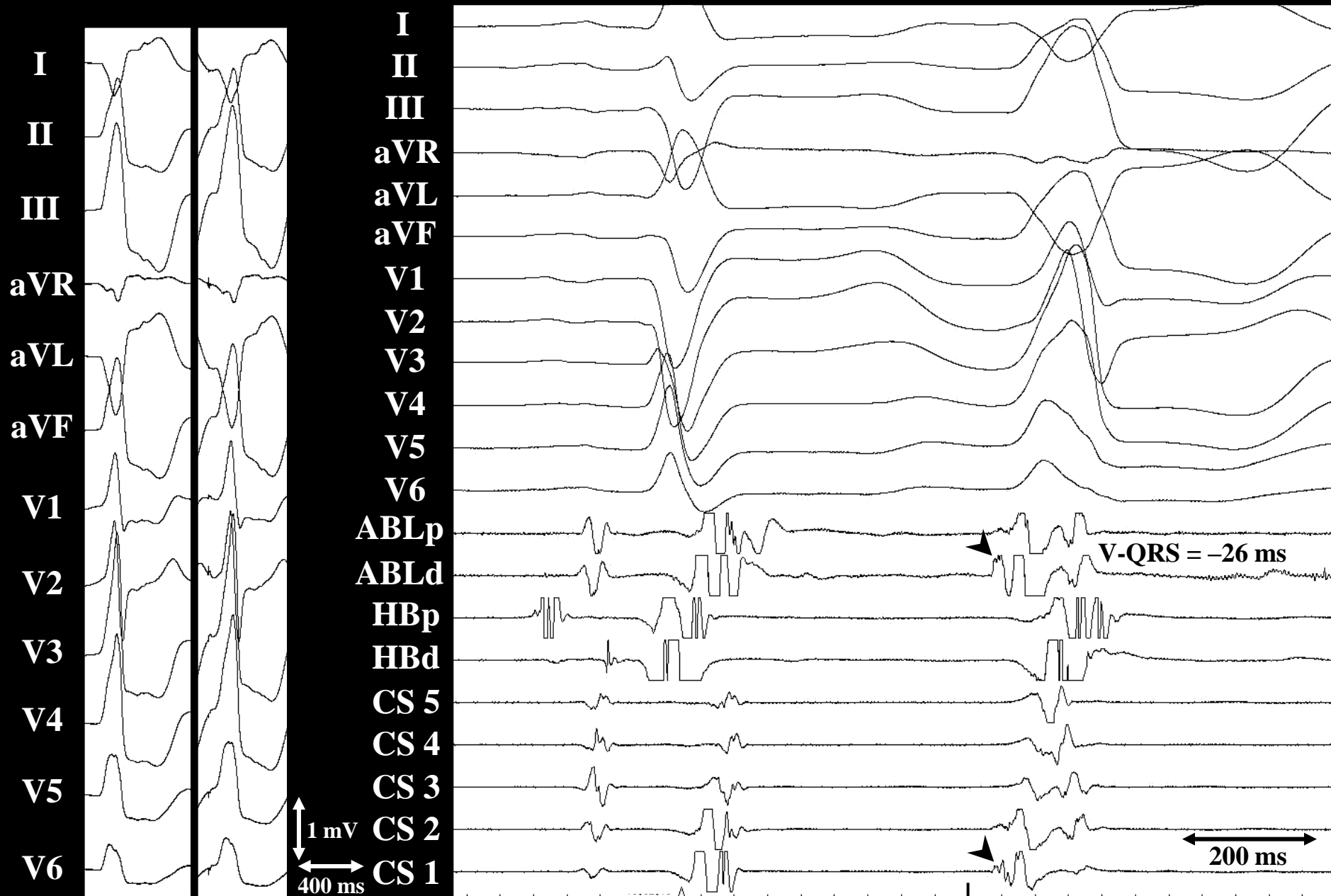
LAO



RAO



# Successful ABL site of GCV VT



# Catheter ABL within the GCV

## When?

- The activation time within the GCV precedes the QRS onset by  $> 20$  ms and is also earlier than that in any endocardial site.
- A ventricular pre-potential.
- An excellent pace map.

# Catheter ABL within the GCV

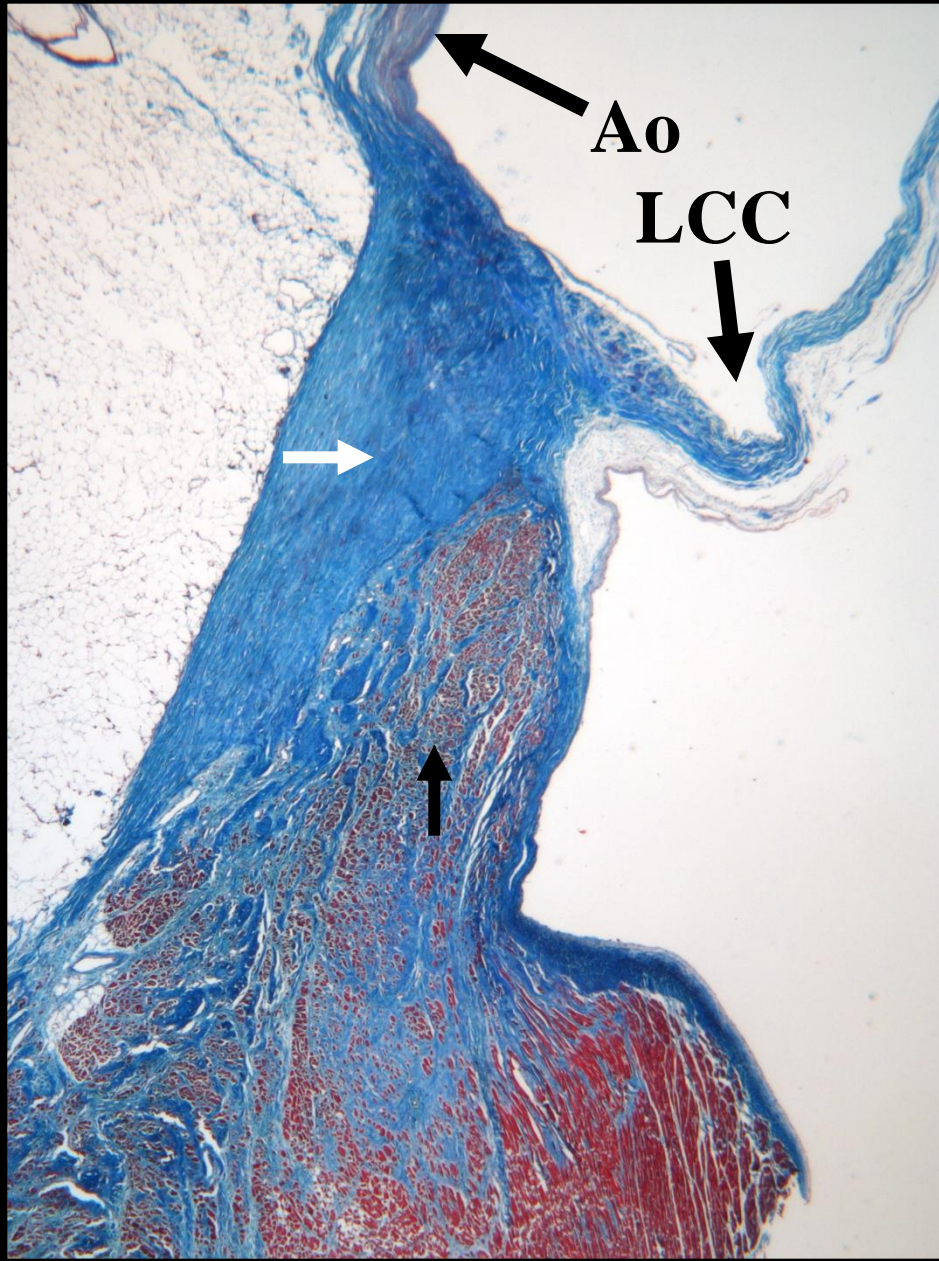
## How?

- Irrigated RF ABL starting at 20 W should be the first choice.
- Left coronary angiography should be performed during the ABL to prevent complications.
- Contrast injection through an external irrigation catheter may be helpful as a guide during mapping in the GCV.
- Cryo ABL may be helpful when RF ABL is impossible because of high impedance and close proximity to the coronary artery.



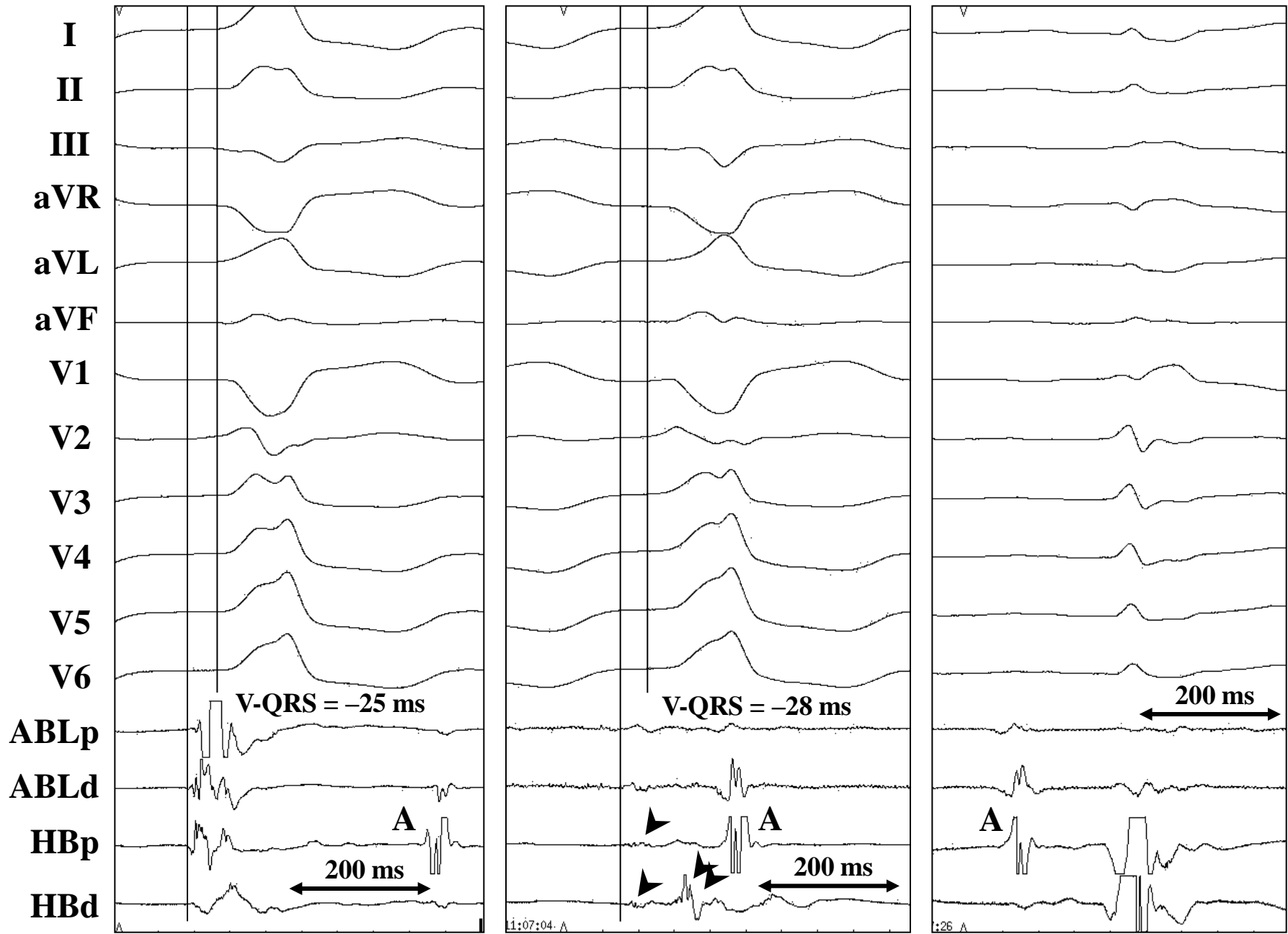
**Thank you so much  
for your attention.**





# Near His

# NCC



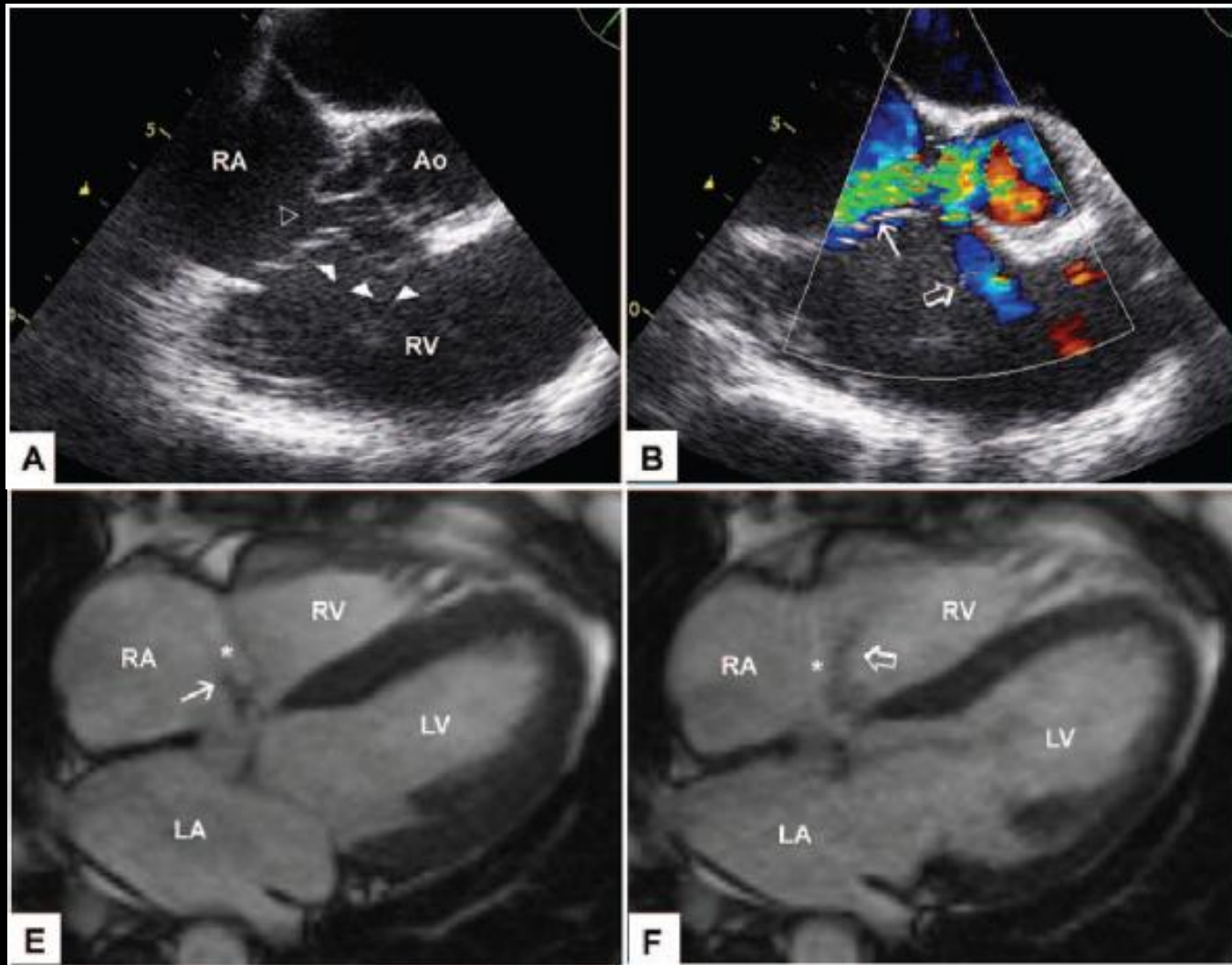


# Images in Cardiovascular Medicine

## Newly Discovered Heart Murmur

### Noncoronary Sinus of Valsalva Aneurysm With Rupture Into the Right Atrium and Right Ventricle

Tobias Hoevelborn, MD; Joerg Doering, MD; Stephan Lindemann, MD; Christian S. Haas, MD



# Preferential conduction in the VOT

- Efficacy of pace mapping is sometimes limited because of preferential conduction.
- Activation mapping is most reliable to identify a site of IVT origin.



# Where is the crux of the heart?

- The crux of the heart is formed by the junction of the AV groove and the posterior interventricular groove and corresponds roughly to the junction of the middle cardiac vein and the CS, near the origin of the posterior descending coronary artery.

# **Intramural foci in the IVS and LVOT**

# **Intramural foci in the IVS and LVOT**

# **Intramural foci in the IVS and LVOT**

Irrigated needle ABL catheter and  
transcoronary ethanol ABL may be  
helpful to treat the intramural origin.

**SAPP JL, STEVENSON WG, et al.  
JCE 2006;17:657-661**

# Conclusions

- Catheter ablation of IVT is safe and highly effective if it is performed appropriately.
- Currently, catheter ablation could be the first-line treatment of symptomatic IVTs with a patient's preference.