-Papillary muscle VT-

Localization of papillary muscle PVC foci: Tip or base?

Yae Min, Park, M.D.

Cardiology Division, Gachon University Gil Hospital, Incheon, Korea

Ventricular Tachycardia Originating From the Posterior Papillary Muscle in the Left Ventricle

A Distinct Clinical Syndrome

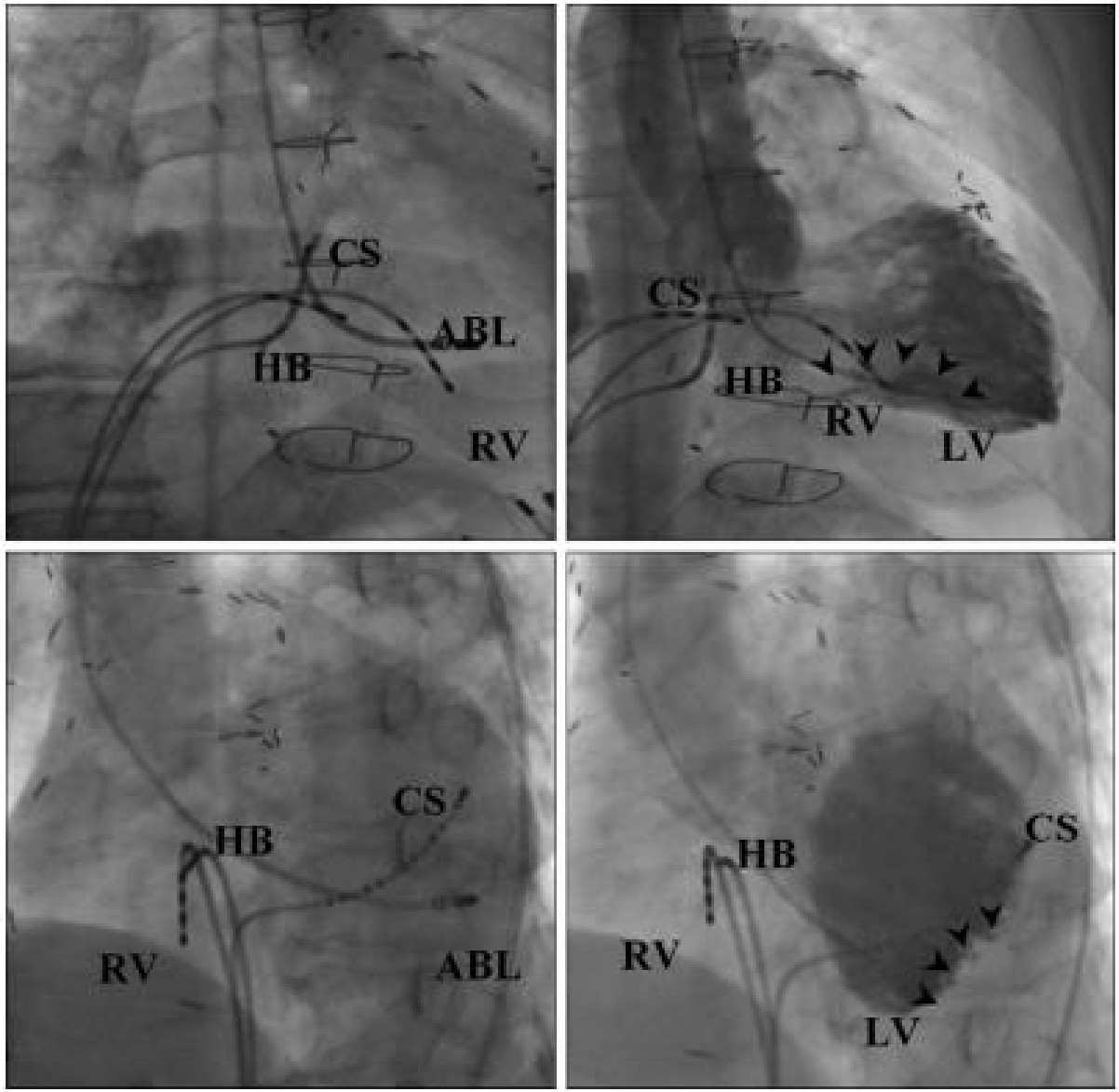
Harish Doppalapudi, MD; Takumi Yamada, MD; H. Thomas McElderry, MD; Vance J. Plumb, MD; Andrew E. Epstein, MD; G. Neal Kay, MD

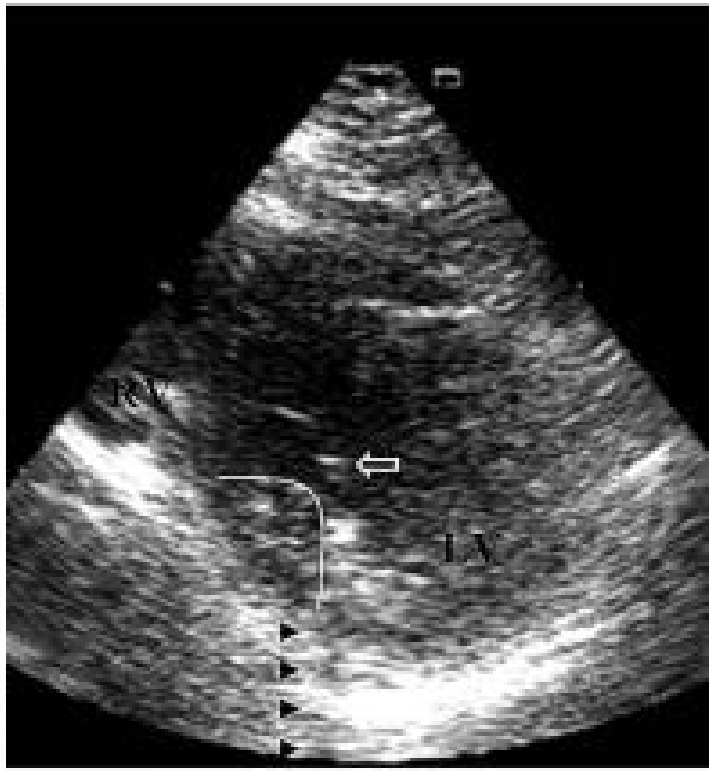
Background—Several distinct forms of focal ventricular tachycardia (VT) from the left ventricle (LV) have been described. We report a new syndrome of VT arising from the base of the posterior papillary muscle in the LV.

Methods and Results—Among 290 consecutive patients who underwent ablation for VT or symptomatic premature ventricular complexes (PVCs) based on a focal mechanism, 7 patients were found to have an ablation site at the base of the posterior papillary muscle in the LV. All patients had normal LV systolic function and a normal baseline electrocardiogram. The electrocardiogram during VT or PVCs demonstrated a right bundle-branch block and superior-axis QRS morphology in all patients. VT was not inducible by programmed atrial or ventricular stimulation. In 2 patients with sustained VT, overdrive pacing neither terminated VT nor demonstrated any criterion for transient entrainment. Activation mapping localized the earliest site of activation to the base of the posterior papillary muscle in all patients. When Purkinje potentials were recorded at the site of successful ablation, these potentials preceded local ventricular muscle potentials during sinus rhythm. During VT or PVCs, however, the ventricular muscle potential always preceded the Purkinje potentials. After recurrence of VT or PVCs with standard radiofrequency ablation, irrigated ablation was successful in eliminating the arrhythmia in all patients. Over a mean follow-up period of 9 months, all patients have been free of PVCs and VT.

Conclusion—We present a distinct syndrome of VT arising from the base of the posterior papillary muscle in the LV by a nonreentrant mechanism. Ablation can be challenging, and irrigated ablation may be necessary for long-term success.
(*Circ Arrhythmia Electrophysiol*. 2008;1:23-29.)

LVG & TTE



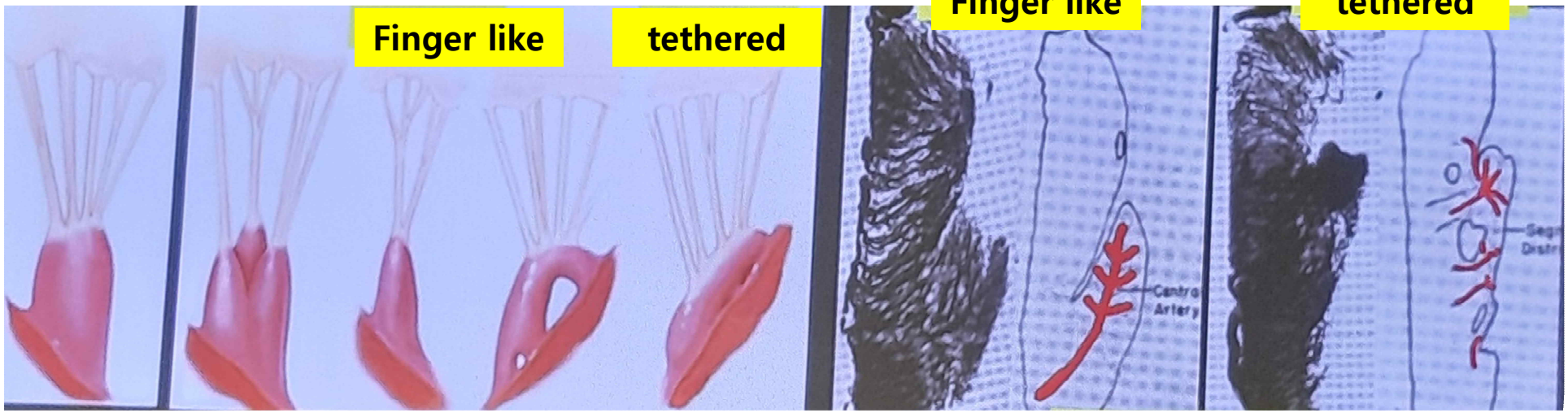


Doppalaqudi H, CircAEP 2008;1:23

Papillary muscle (PM) tip or base?

- Not simple
- PM anatomy is variable
- How can we visualize catheter tip?
- Is it true what we see?

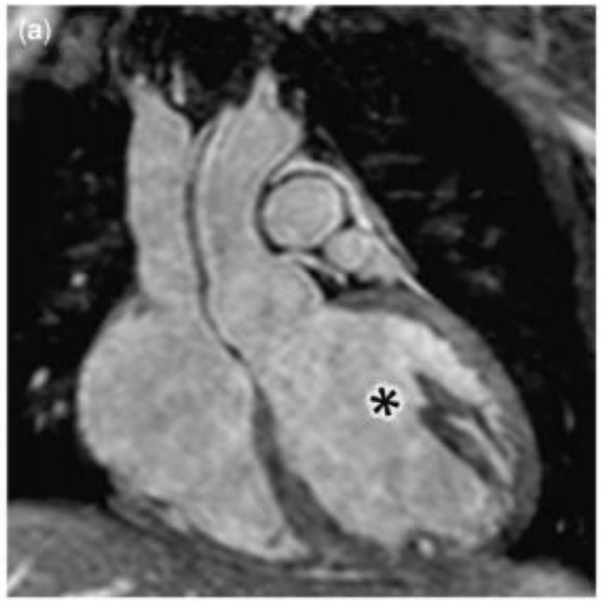
PM; complex intra-cavitary structure



Ranganathan et al, Am Heart J 1969;77(4):506

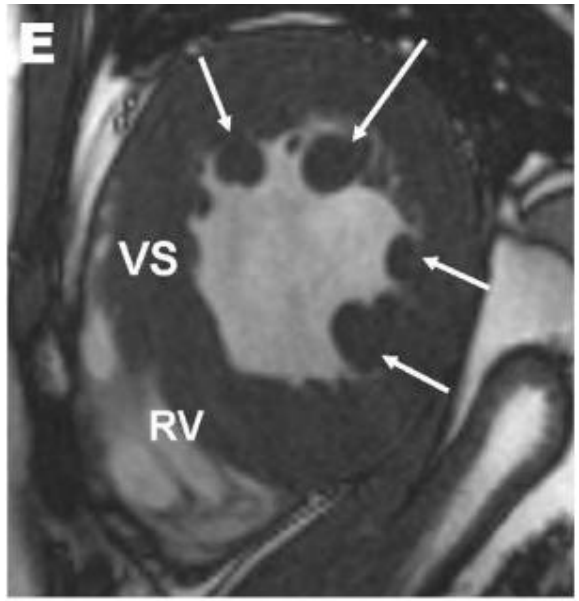
PM; anatomy is variable large/ small

PM variation



Narrow insertion vs. Broad insertion

Velasco Forte MN Cardiol Young 2017;27:1369

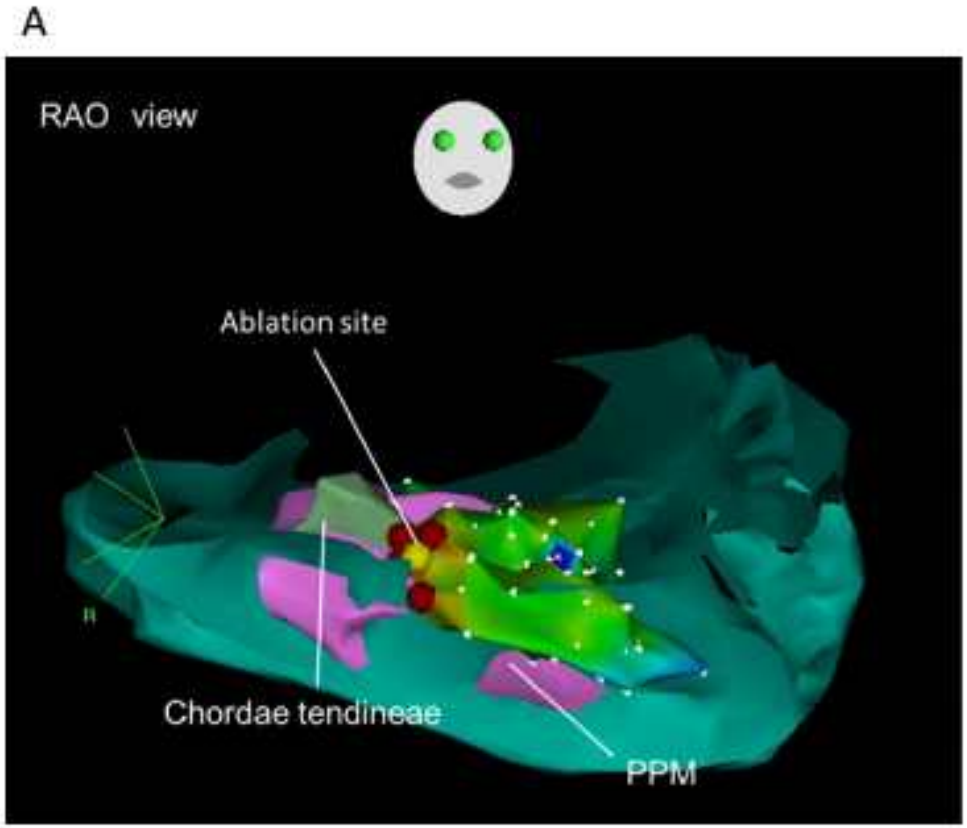


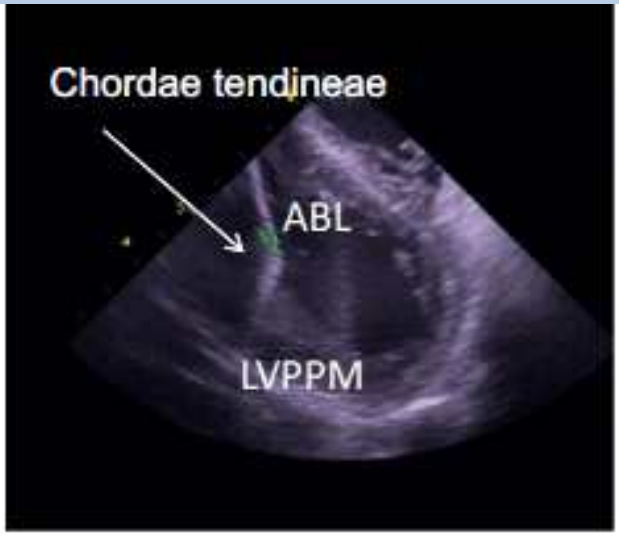
Multiple accessory PM in CMR

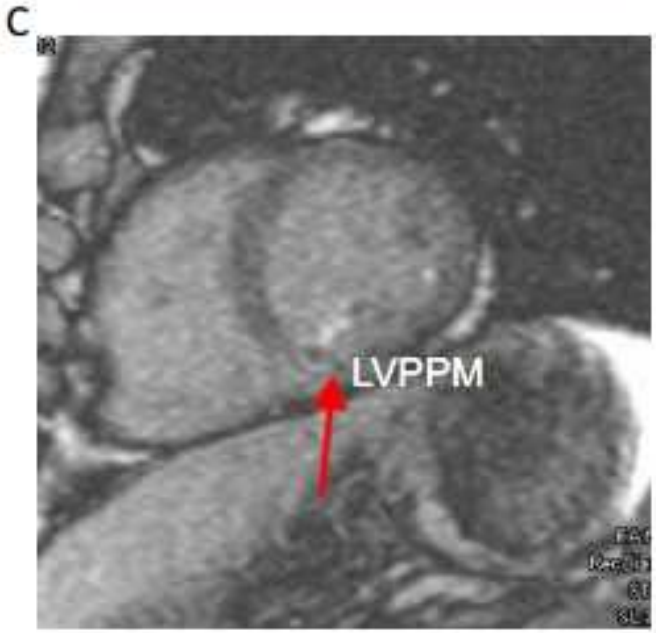
Maron MS, J Cardiovasc Magn Reson. 2012;14:13

가천대학교 Gachon University

3D mapping & ICE can demonstrate the tip of catheter ablation





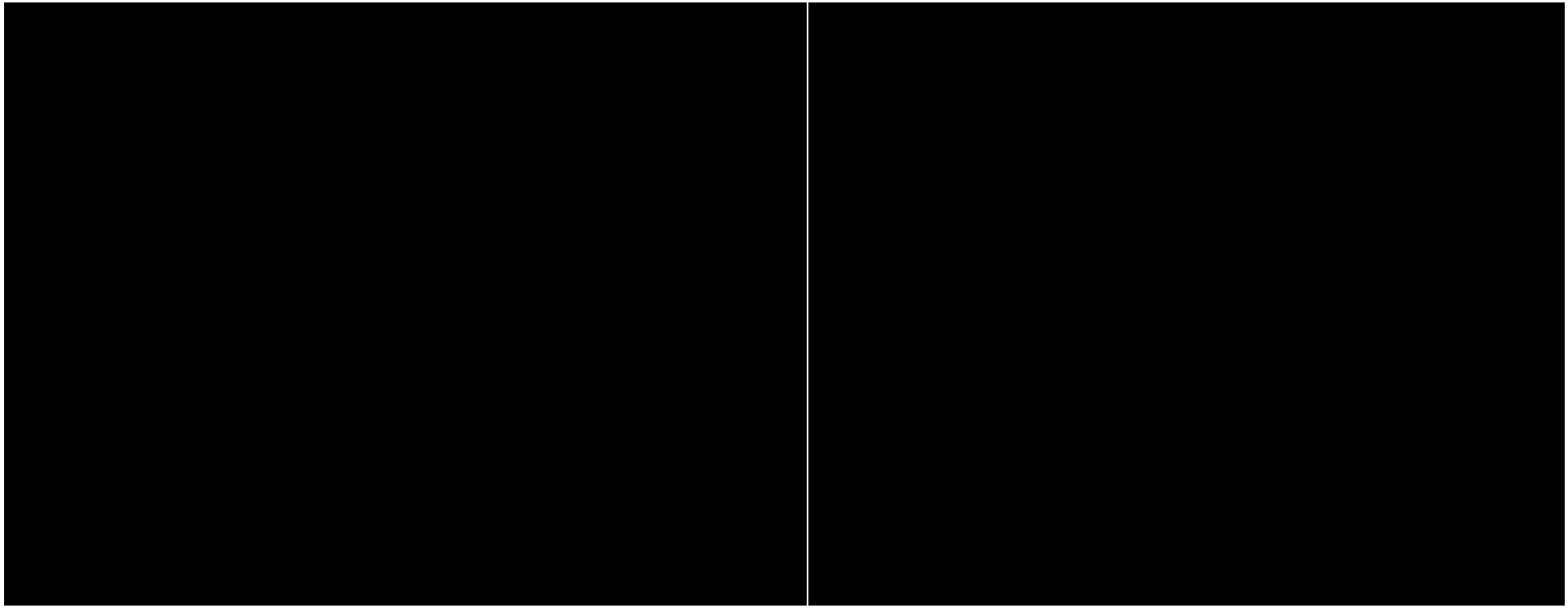


Kawakami H et al HR case reports 2015;1:110

ICE; PM anatomy

ICE during PM ablation
base vs. tip

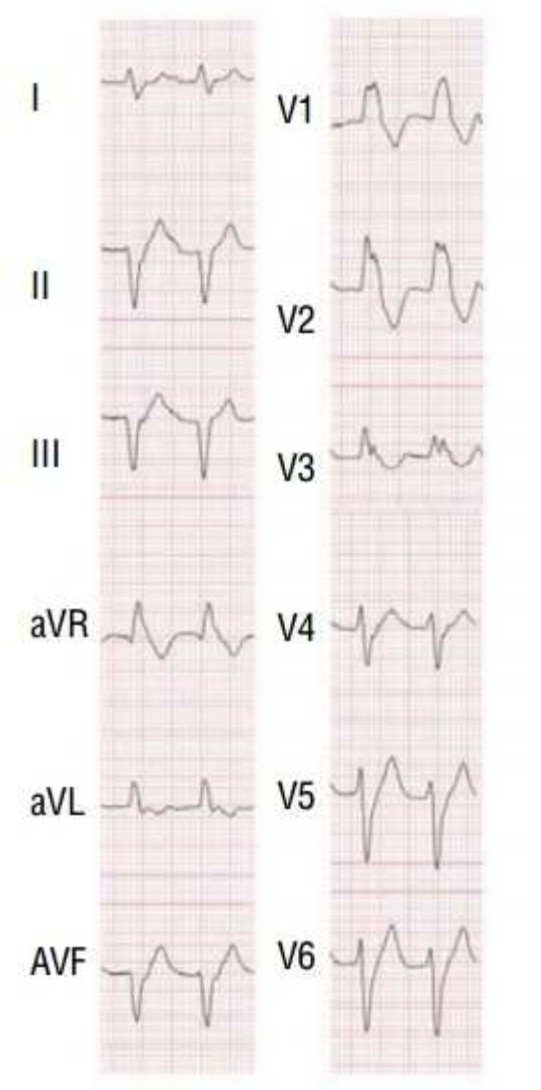
ICE during PM ablation
Trans-aortic vs. trans-septal approach



ICE; ablation effect

12-lead ECG pattern

Variable exit

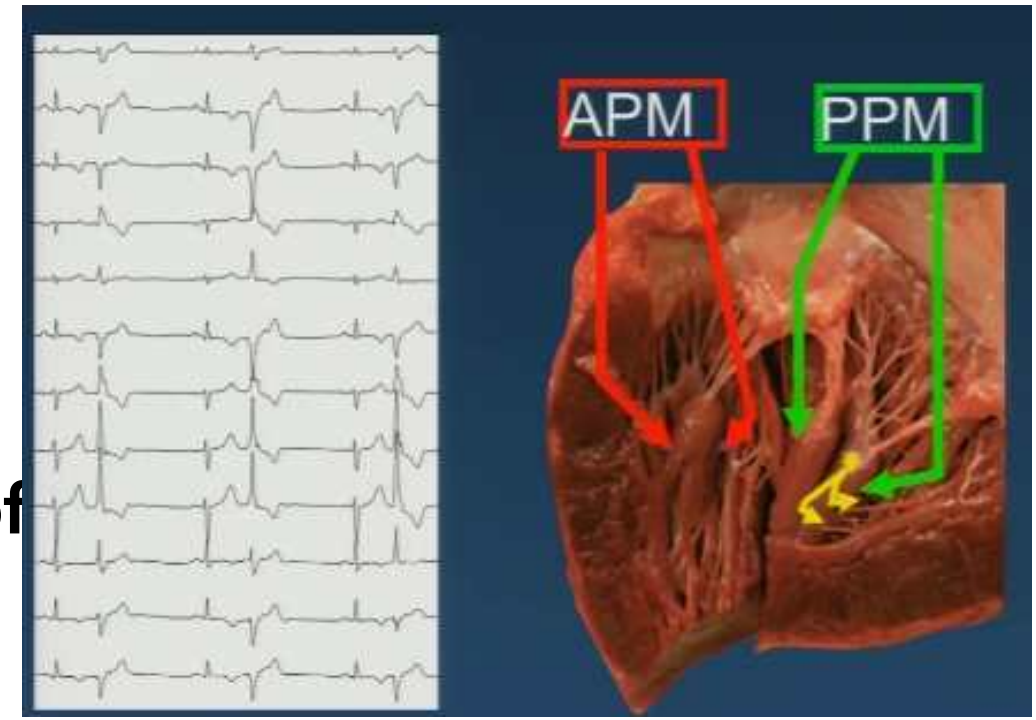


Variable coupling interval

Pacemapping

- Less useful due to catheter instability
- Adjacent tissue may be captured
- Ablation can be unsuccessful at site of excellent pacemap

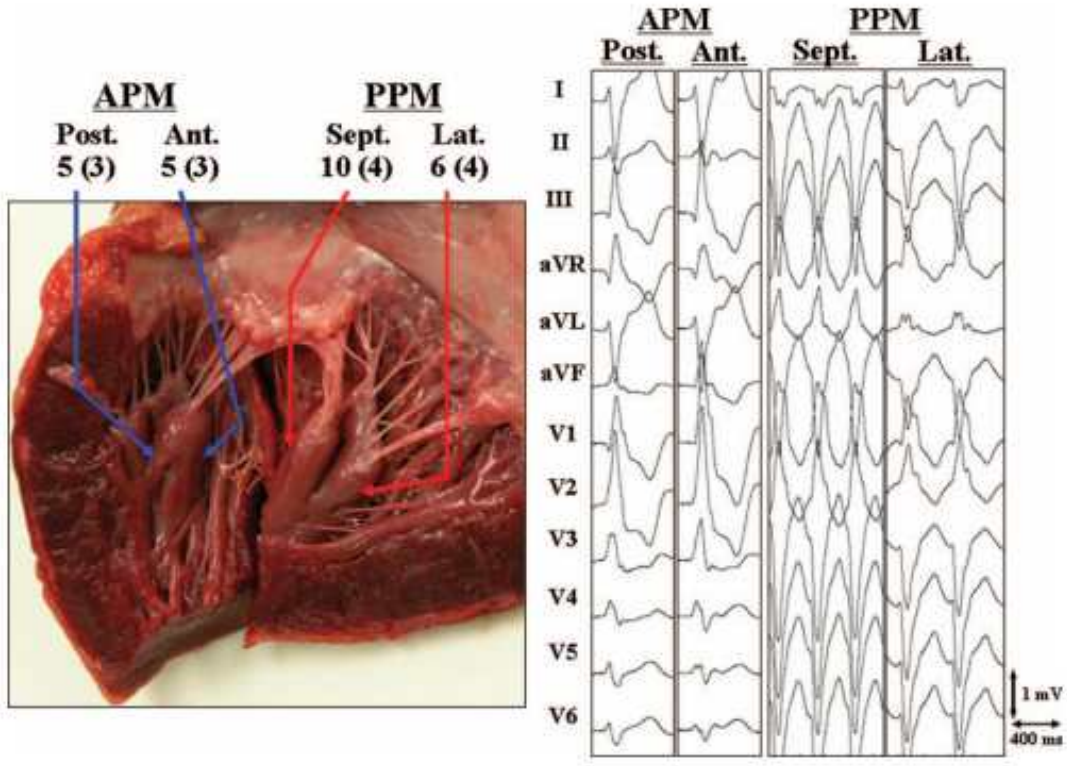
Varying QRS morphology



Yamada T. Circ AE 2010;3:324-331

Pacemapping

Ablation at site with excellent PM changed ECG morphology suggesting source higher or deeper in PM

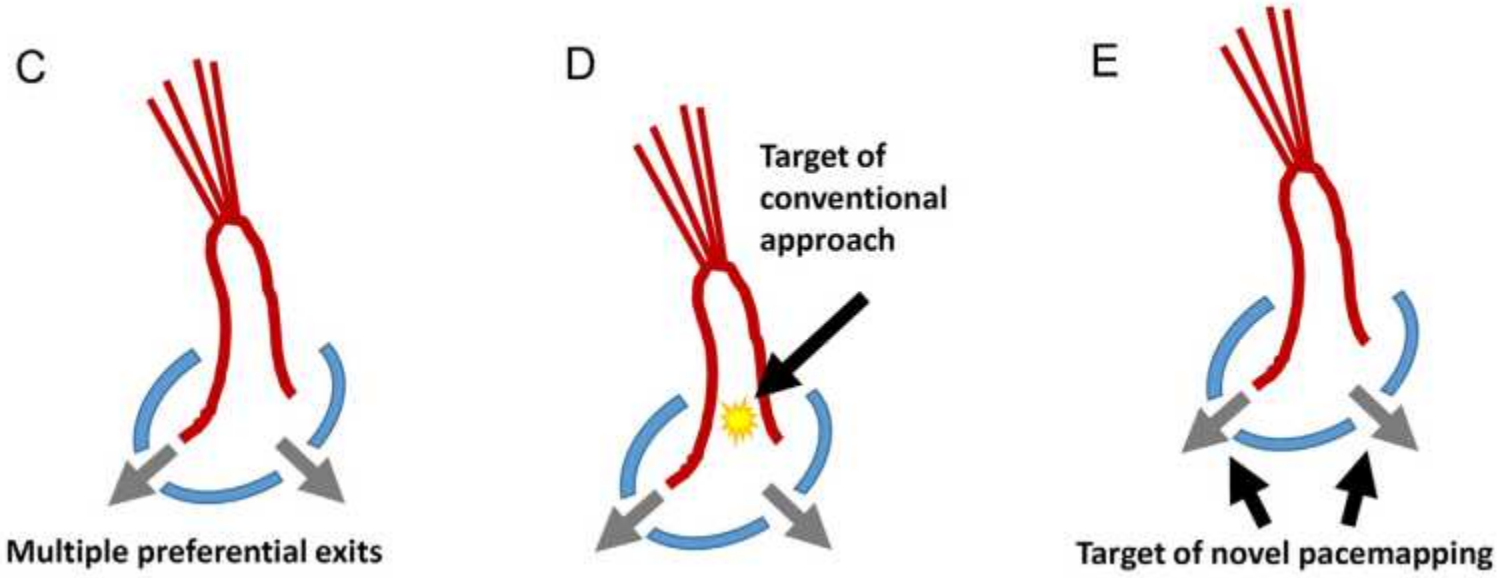


- **7 patients RFCA on both sides of the PAM was required to completely eliminate the VAs.**

Variouis exit

Yamada T. Circ AE 2010;3:324-331

Pacemapping is able to detect exits from PM



- 13 pts with PM VA, 3D activation mapping, automatic pacemapping module
- Mean inter-exit distance; 15.1 ± 5.9 mm
- Acute success rate; 100%.

Chang Y-T HR 2016;13:1431–1440

Tip or base?

Results of Cryoenergy and Radiofrequency-Based Catheter Ablation for Treating Ventricular Arrhythmias Arising From the Papillary Muscles of the Left Ventricle, Guided by Intracardiac Echocardiography and Image Integration

Santiago Rivera, MD; Maria de la Paz Ricapito, MD; Leandro Tomas, MD; Josefina Parodi, MD; Guillermo Bardera Molina, ENG; Rodrigo Banega, ENG; Pablo Bueti, TEC; Agustin Orosco, MD; Marcelo Reinoso, MD; Milagros Caro, MD; Diego Belardi, MD; Gaston Albina, MD; Alberto Giniger, MD; Fernando Scazzuso, MD

Characteristics	ALPM (n=3)	PMPM (n=18)	*P* Value
Location			
Apex	2 (66.7%)	1 (5.5%)	0.01
Base	0	12 (66.7%)	
Body	1 (33.3%)	5 (27.8%)	

Rivera S. Circ Arrhythm Electrophysiol 2016;9:e003874

Tip or base?

Intracardiac echo-facilitated 3D electroanatomical mapping of ventricular arrhythmias from the papillary muscles: assessing the 'fourth dimension' during ablation

Riccardo Proietti[1,2], Santiago Rivera[3], Charles Dussault[4], Vidal Essebag[1,5], Martin L. Bernier[1], Felix Ayala-Paredes[4], Mariano Badra-Verdu[4], and Jean-François Roux[4,6]*

[1]McGill University Health Center, Montreal, QC, Canada; [2]Cardiology Department, Luigi Sacco Hospital, Milan, Italy; [3]Cardiology Division, Instituto Cardiovascular de Buenos Aires, Buenos Aires, Argentina; [4]Cardiology Division, Centre Hospitalier Universitaire de Sherbrooke, Sherbrooke, Canada; [5]Hôpital Sacré-Coeur de Montréal, Montreal, QC, Canada; and [6]CHUS - Hôpital Fleurimont, 3001, 12e Avenue Nord, Sherbrooke, QC, Canada J1H N4

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- **16 pts, 24 procedure**

	AL PM	PM PM
Tip (%)		2 (7.1)
Body (%)	4 (14.3)	9 (32.1)
Base (%)	3 (10.7)	10 (35.7)

Proietti R. 2017;19:21 Europace

Tip or base?

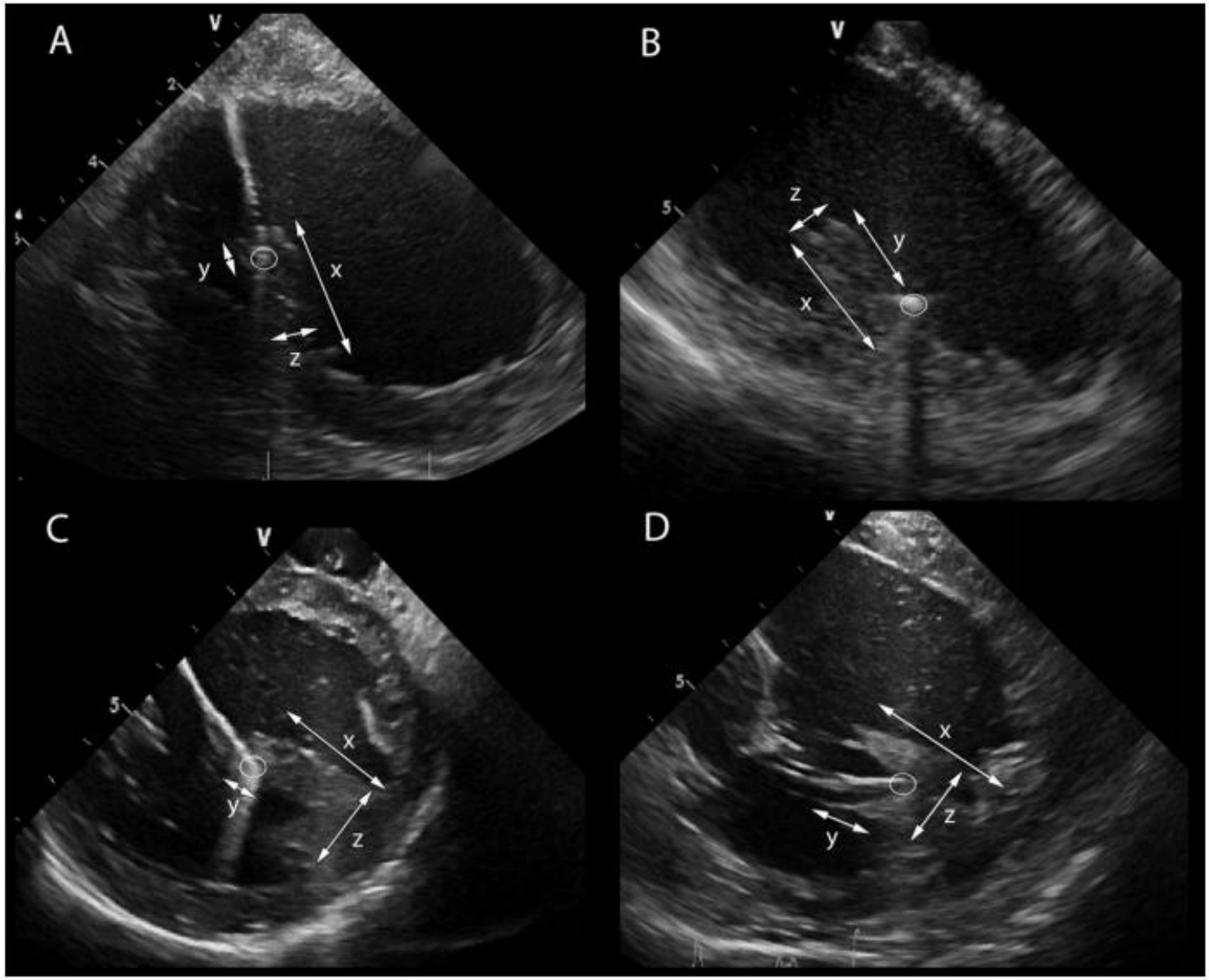
The tip of the muscle is a dominant location of ventricular ectopy originating from papillary muscles in the left ventricle

Petr Peichl MD, PhD[1] | Jakub Baran MD, PhD[2] | Dan Wichterle MD, PhD[1] | Robert Čihák MD, PhD[1] | Tomáš Skála MD, PhD[3] | Bashar Aldhoon MD, PhD[1] | Matevž Jan MD[4] | Bor Antolič MD, PhD[4] | Josef Kautzner MD, PhD[1]

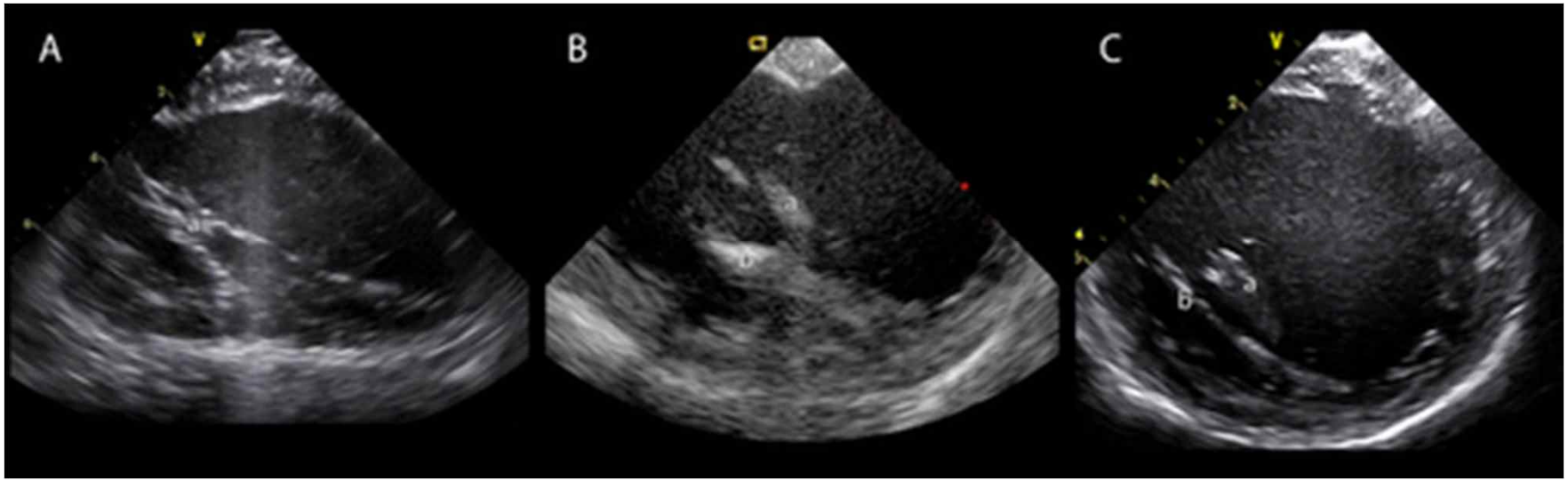
- 34 pts, PM PM 56%, AL PM 35%, both 9%
- Distal; 67%, mid; 19%, proximal (basal) third of PM; 14%
- Acute success; 86%, long-term success; 65%

Peichl P. JCE 2018;29:64

PM morphology



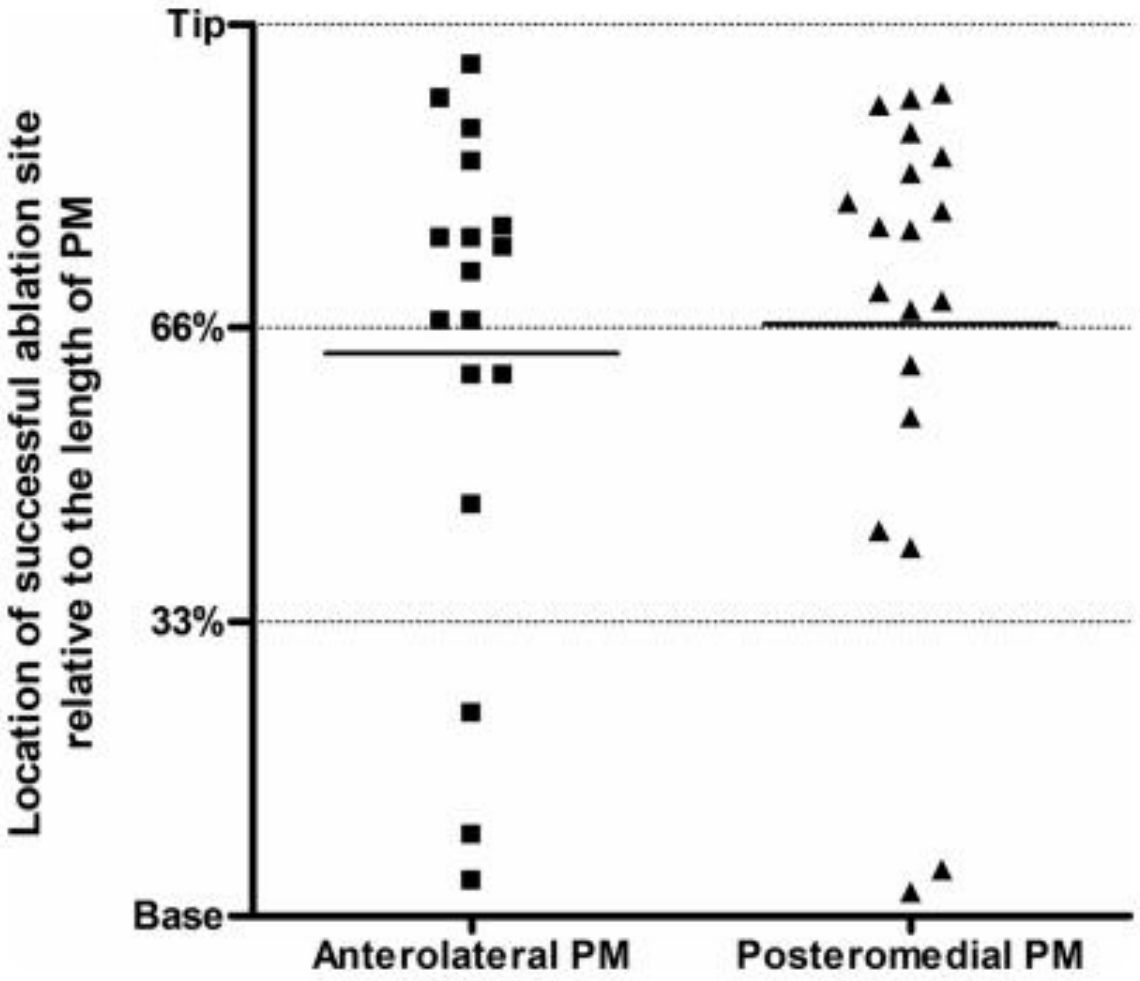
PM morphology; AL vs. PM



	Anterolateral PM (N = 15)	Posteromedial PM (N = 22)	P
Mean length, mm (range)	23 ± 4 (13–28)	28 ± 7 (19–43)	0.02
Mean width, mm (range)	16 ± 5 (7–26)	13 ± 4 (9–21)	0.03
Compact mass structure, n (%)	4 (27)	10 (45)	NS
Midportion separation of heads, n (%)	7 (47)	5 (23)	NS
Distinct separate heads from base, n (%)	4 (27)	7 (32)	NS

Peichl P. JCE 2018;29:64

PM tip (distal third) was the most frequent success site



Peichl P. JCE 2018;29:64

Conclusions

- Morphology of PM is highly variable
- Pre-procedural CMR and in–vivo ICE are helpful to visualize endocavitary structure
- Often deep site of origin with multiple QRS morphologies due to preferential conduction
- Ablation remains challenging because origin may be located deep beneath the endocardium of PM, PM targeting preferential exit or deep site of origin
- Predominant site of PM is not consistently reported.

Gachon University Gil Medical Center
Cardiovascular Center