

Ventricular Arrhythmias Arising From Cardiac Crux

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Nothing to Disclose



보낸 사람: VT Symposium Secretariat <smc-vt@on-comm.kr>
받는 사람: 박희남(내과학교실)
참조: "SAMSUNG-VT"
제목: RE: 2018 VT Symposium 에 초대합니다.

보낸 날짜: 2018-04-19 (목) 오후 5:00

< Idiopathic VT; complex cases >

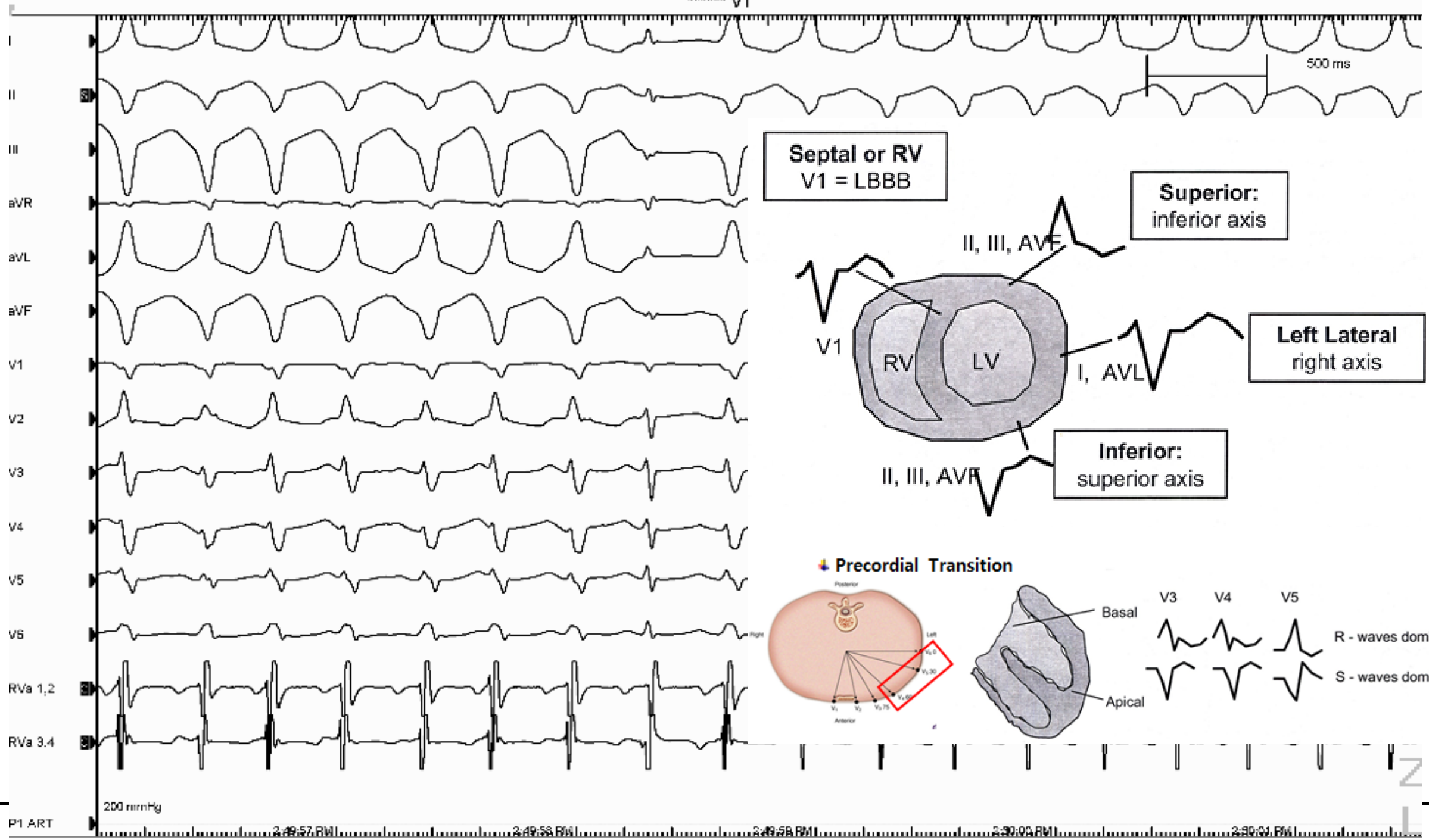
- 일 자: 2018년 11월 3일(토) | 세션시간: 13:30~14:30

- 주 제:

Ventricular arrhythmia arising from the crux

- 발표시간: 14:10~14:20

- 역 할: Lecturer

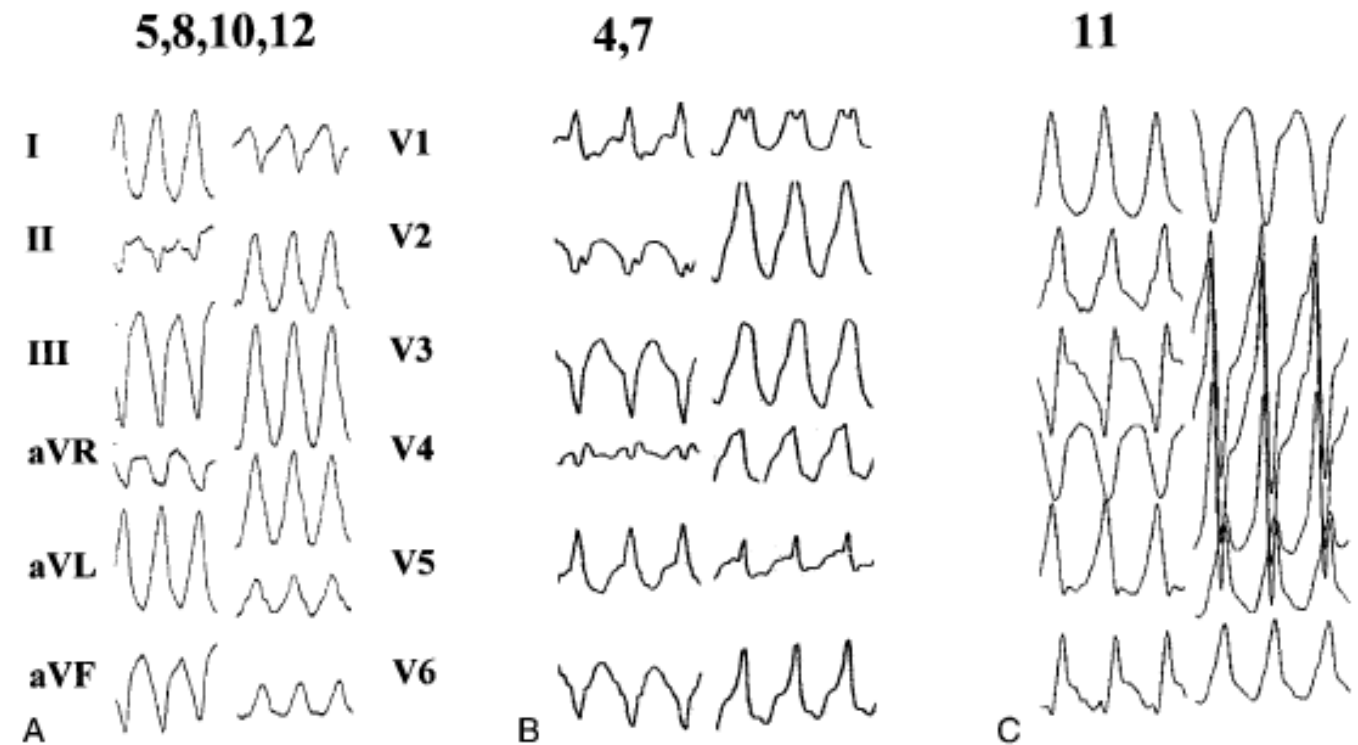


Ventricular Tachycardia Originating from the Posteroseptal Process of the Left Ventricle With Inferior Wall Healed Myocardial Infarction

Dominique Lacroix, MD, Didier Klug, MD, Daniel Grandmougin, MD, Mustapha Jarwe, MD, Claude Kouakam, MD, and Salem Kacet, MD

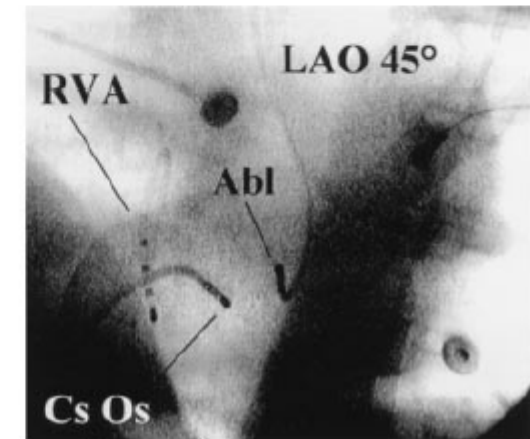
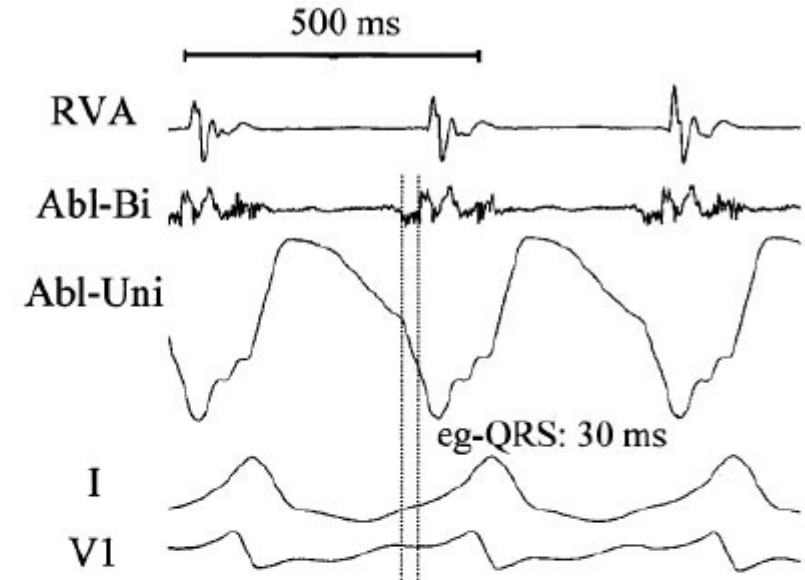
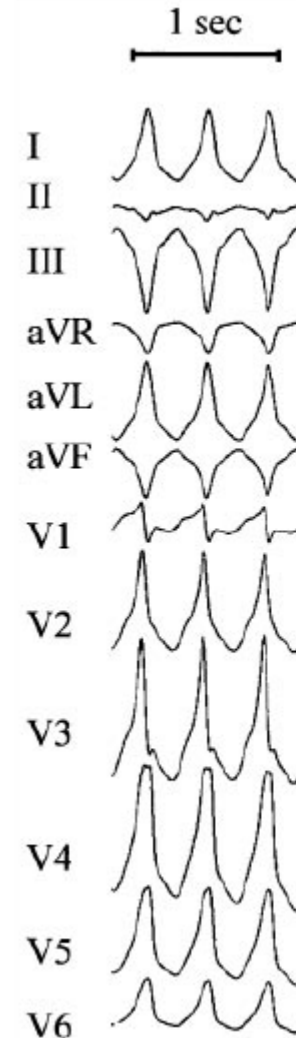
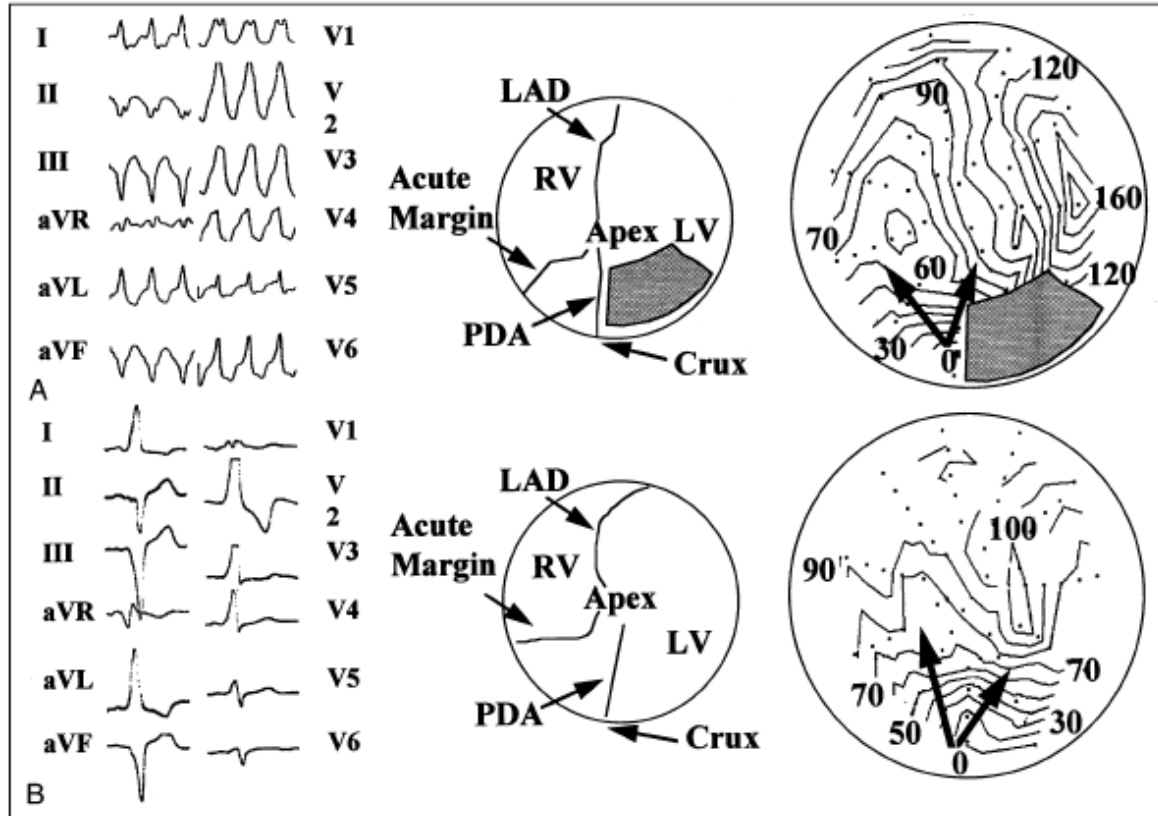
Am J Cardiol. 1994;84:181-186

7 VTs from posterior septal process
6 surgical cryoablation
1 catheter ablation



LV Posteroseptal Process VT

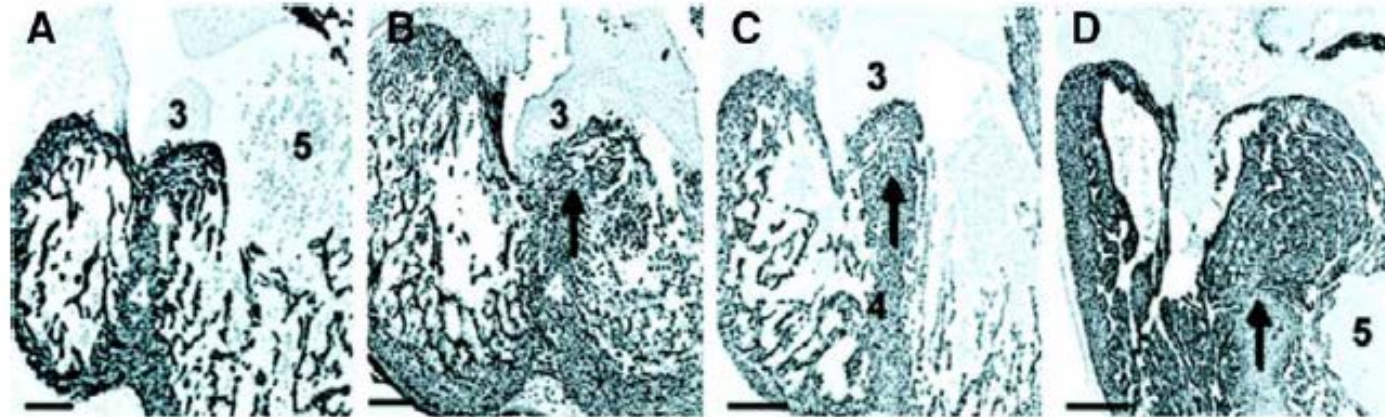
Lacroix et al. Am J Cardiol. 1994;84:181-186



Embryology of Cardiac Crux

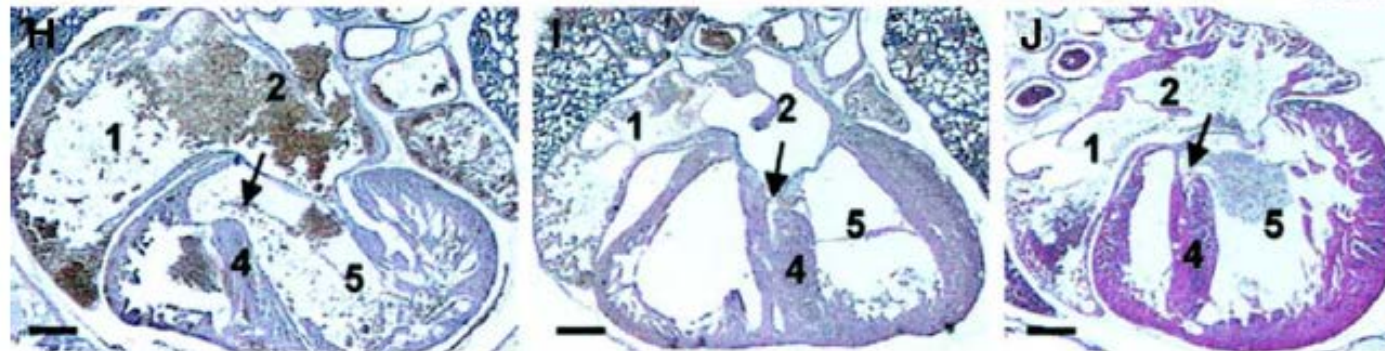
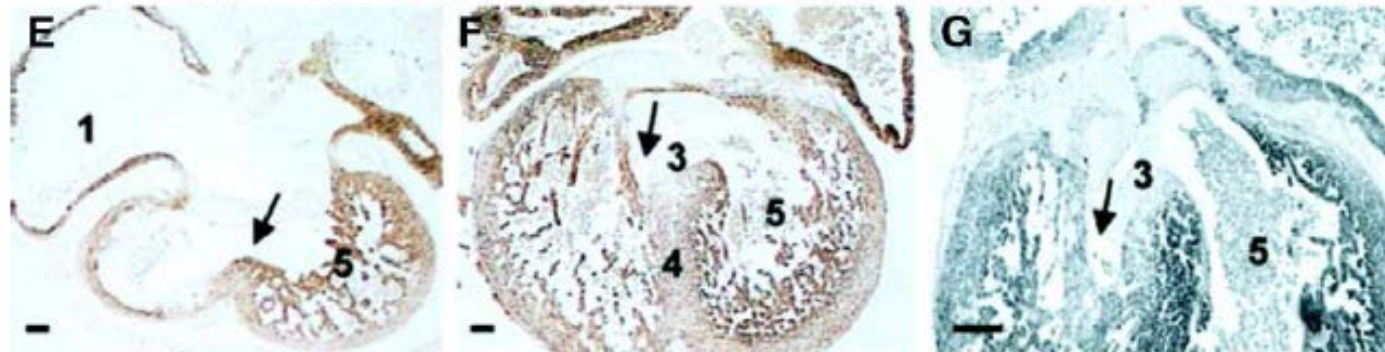
LV posterior superior process (Human Embryo 6.5 wk)

Lamers et al. Circ Res. 2002;91:93-103.



Crest of muscular ventricular septum

Tricuspid Gully
Embryo RV septation

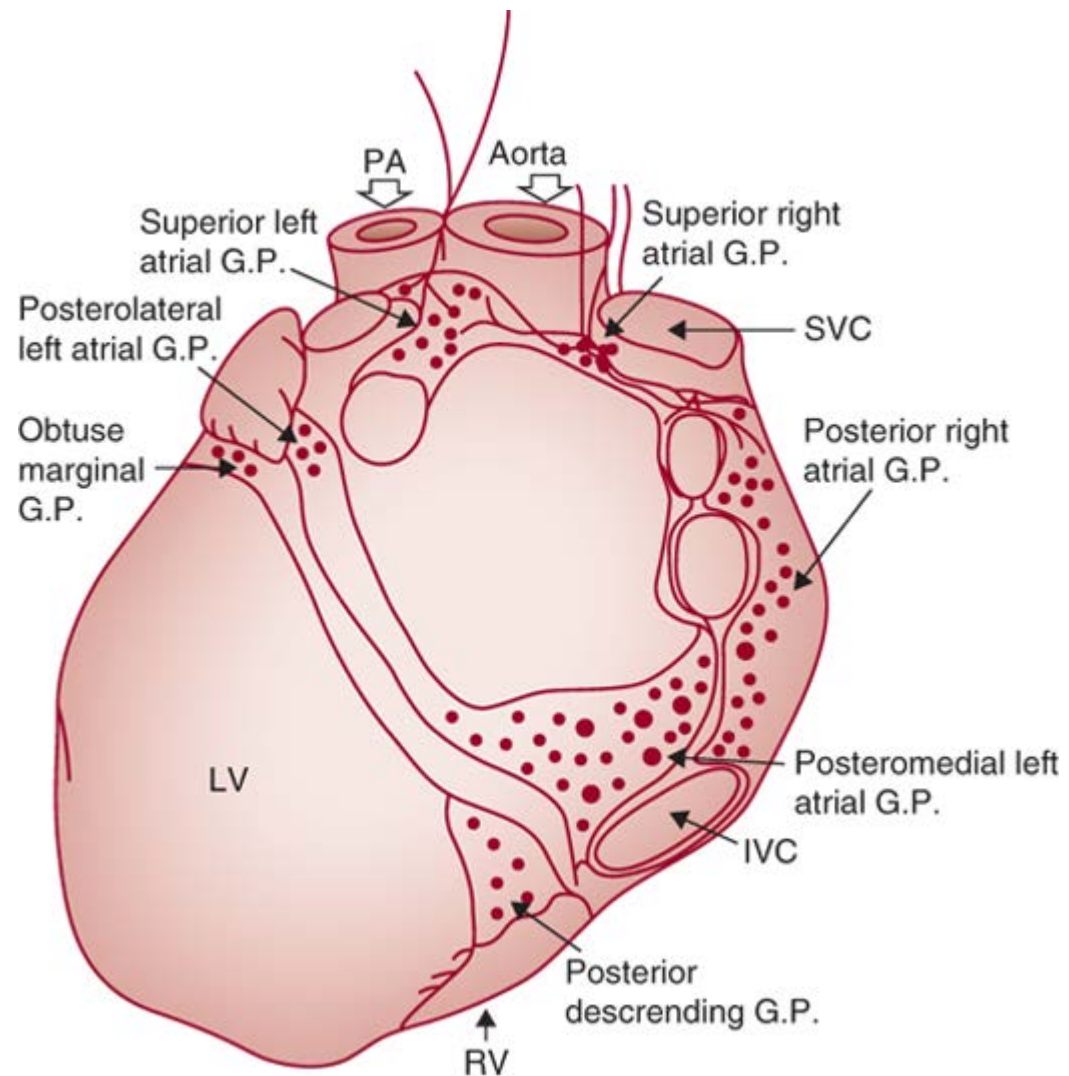
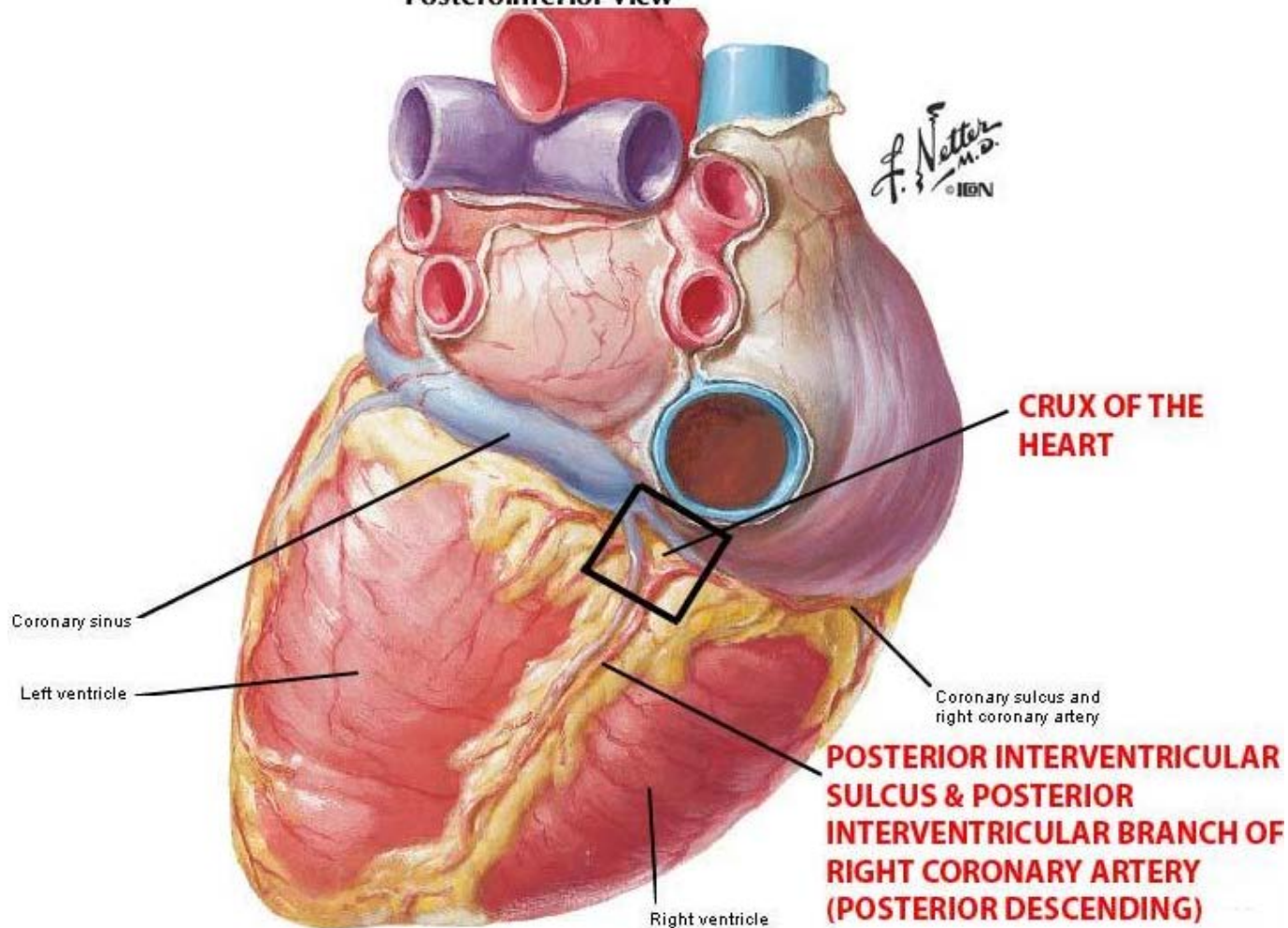


Development of AV junction
& Endocardial cushion

Anatomy of Cardiac Crux

Adjacent Structures

Heart - Diaphragmatic Surface
Posteroinferior View

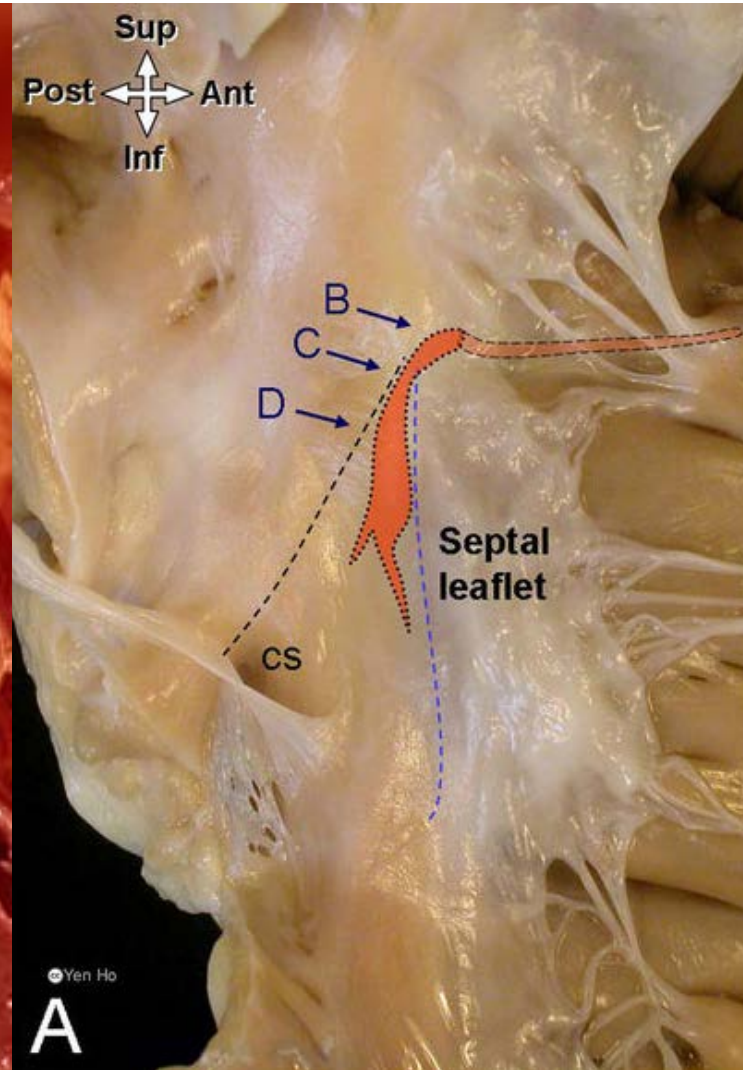
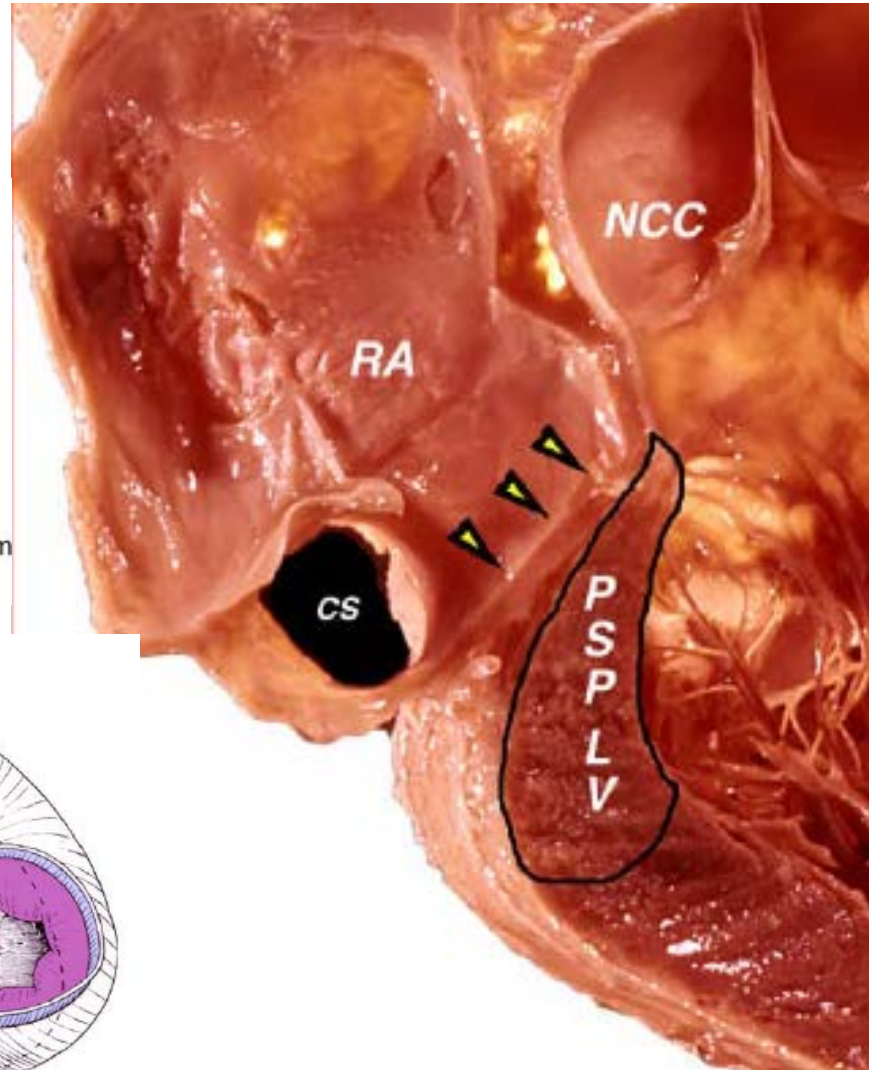
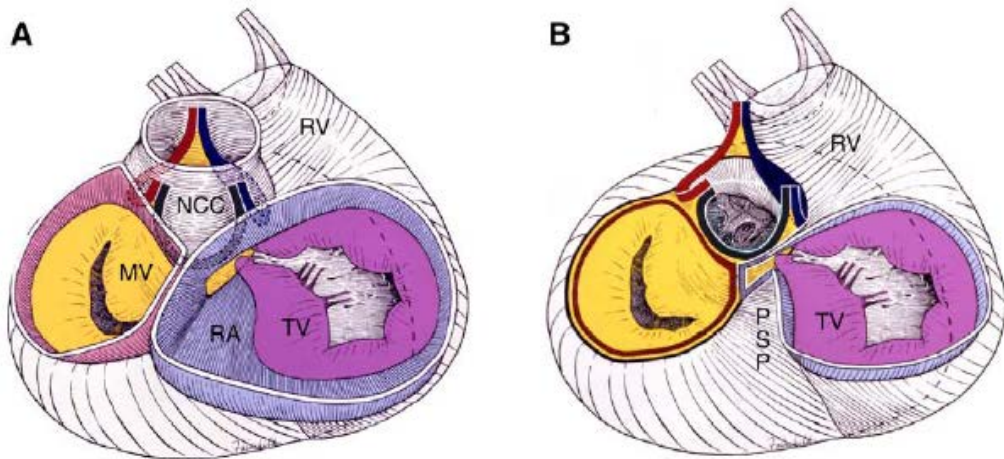
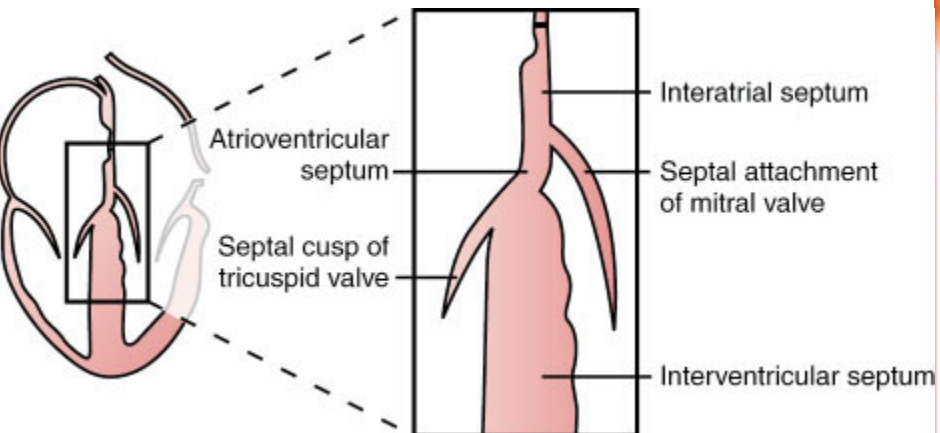


Anatomy of Cardiac Crux

LV posterior process

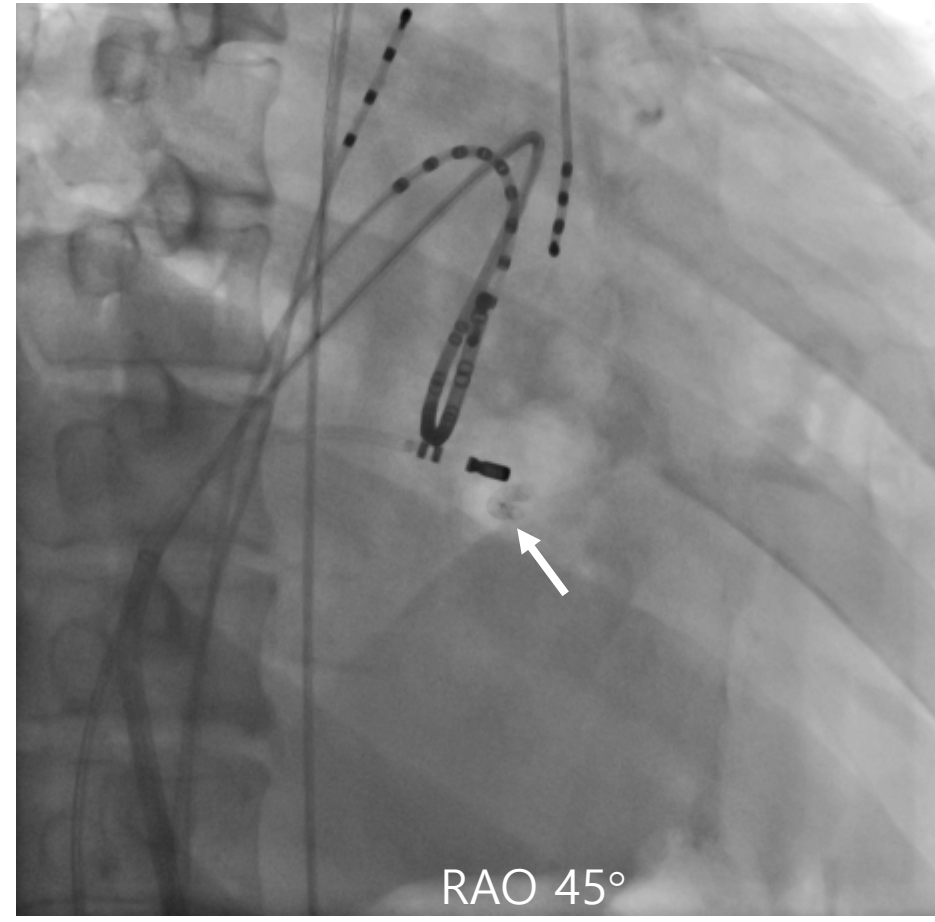
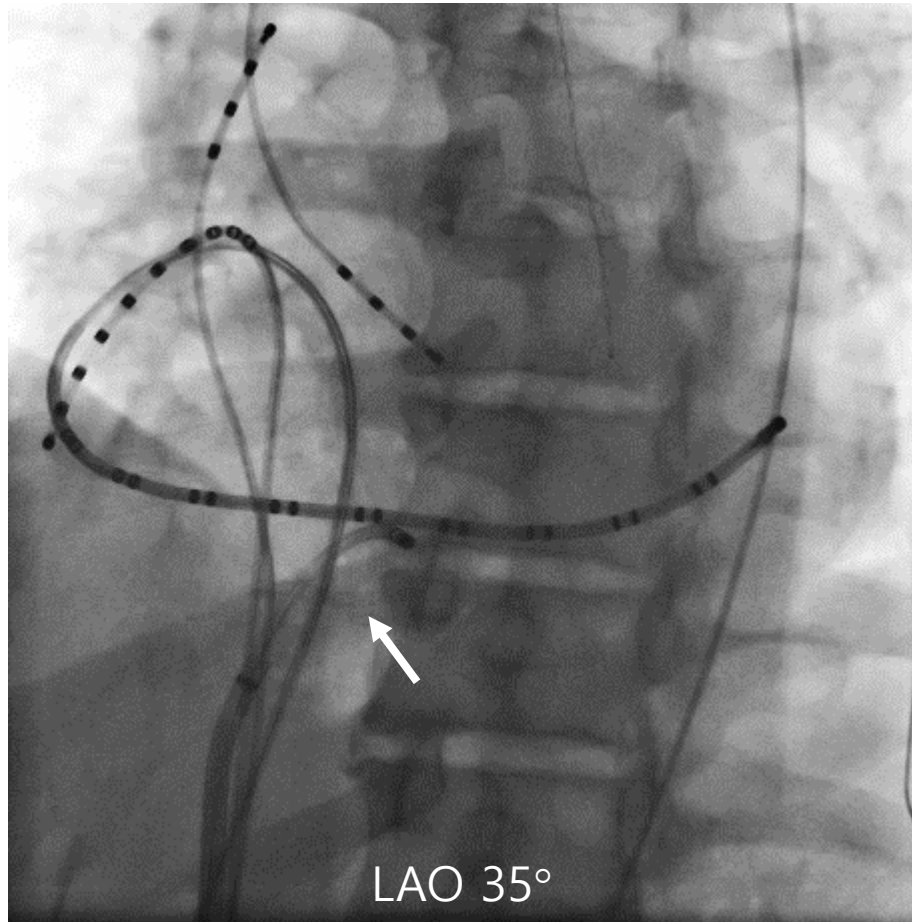
Santangeli et al. Circ Arrhy EP. 2016;9:e004048.

Conjunction of LA-LV, RA-RV, CS, PDA,
& post-interventricular groove.
Cardiac autonomic fat pad



RCA-PD vs. CTI

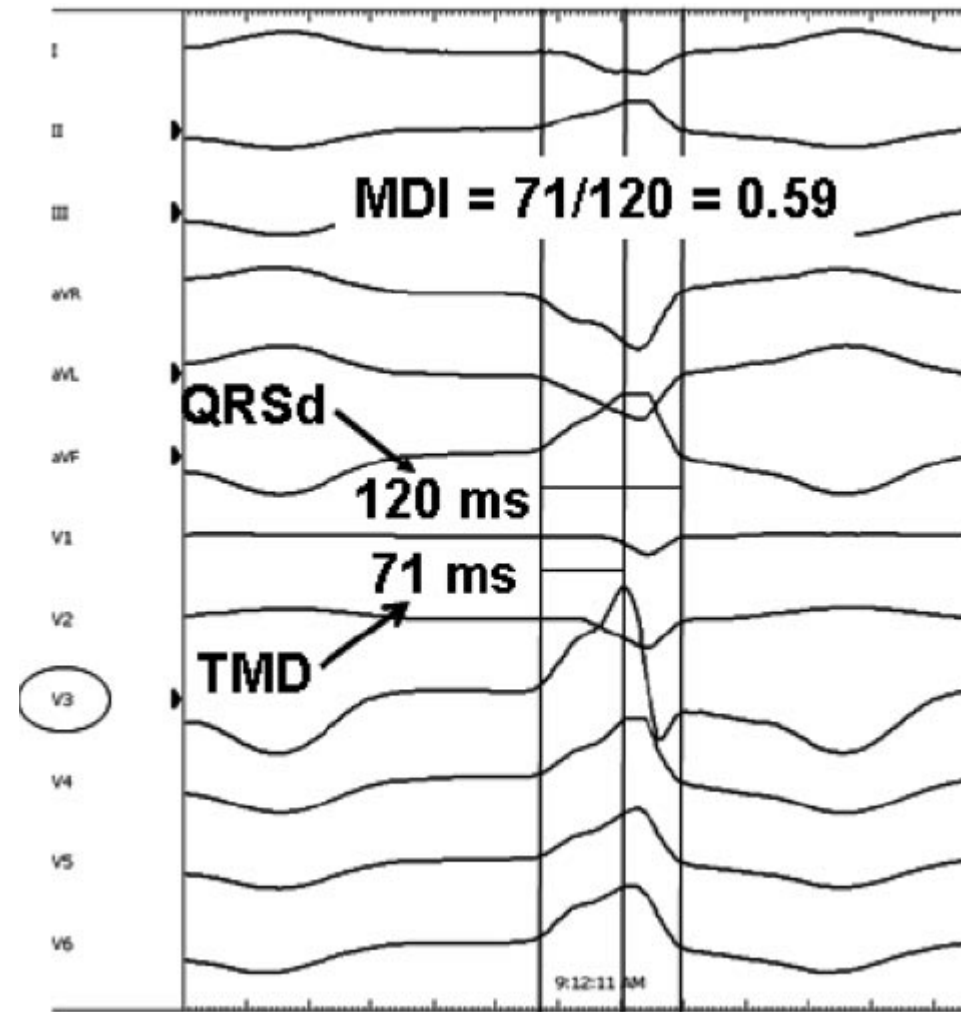
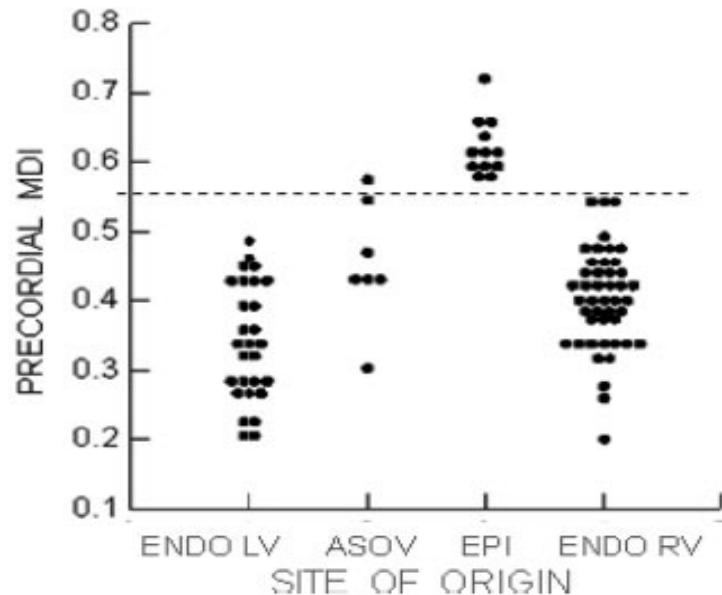
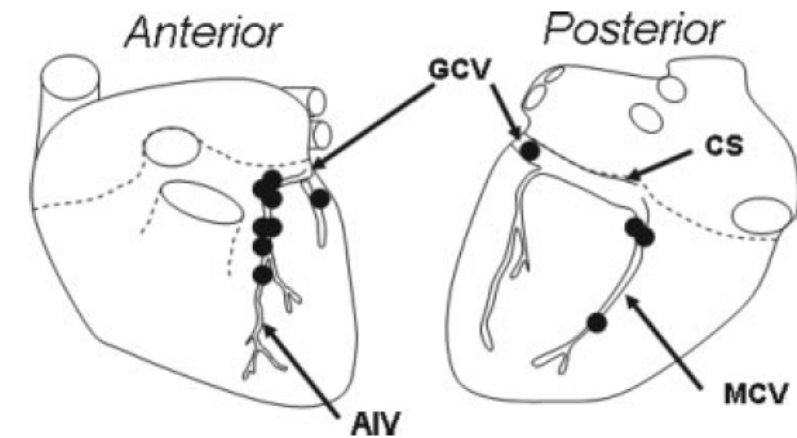
Adjacent Structures



Idiopathic Epicardial LV-VT Remote from Sinus of Valsalva

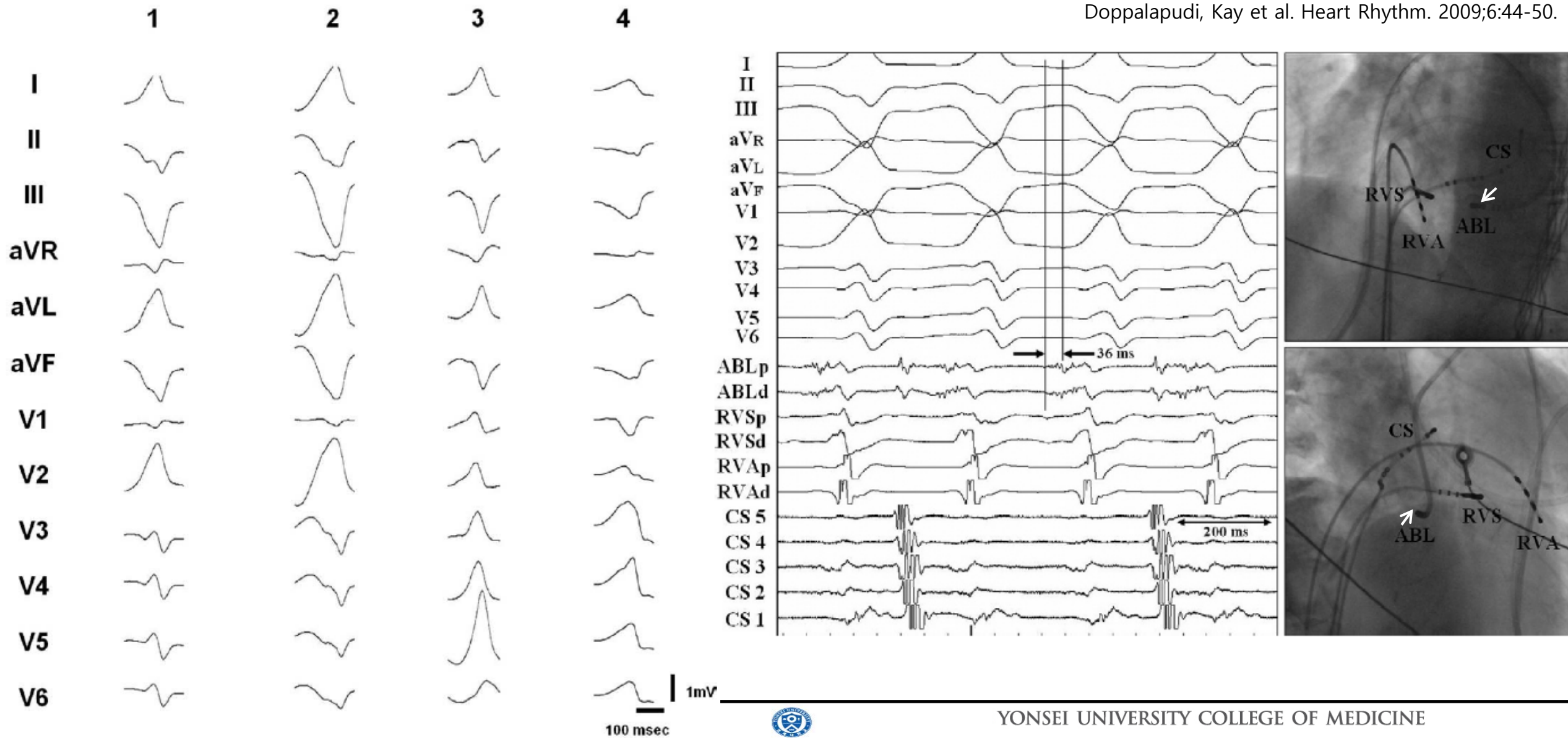
Daniel, Wilber et al. Circulation. 2006;113:1659-1666.

3/12 Cases



Idiopathic Focal Epicardial VT from Crux

Doppalapudi, Kay et al. Heart Rhythm. 2009;6:44-50.



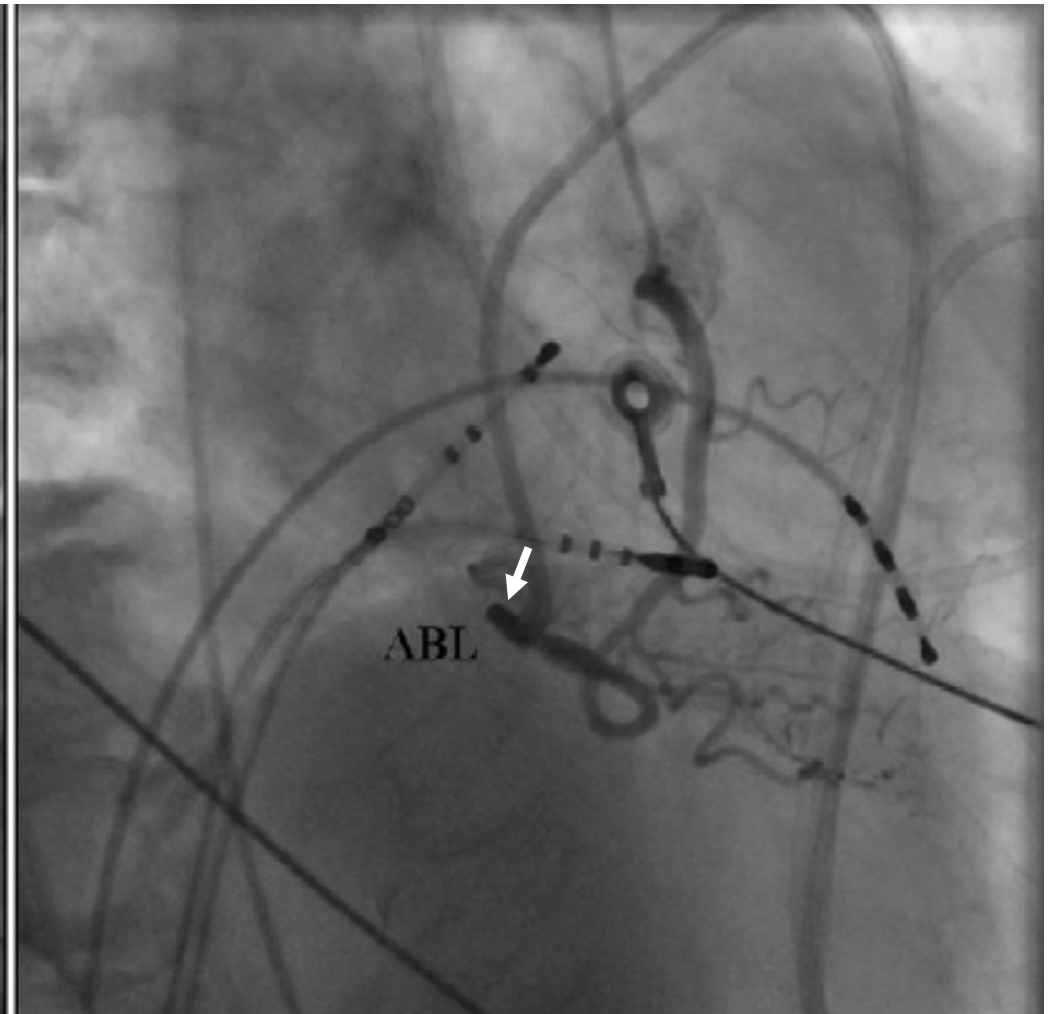
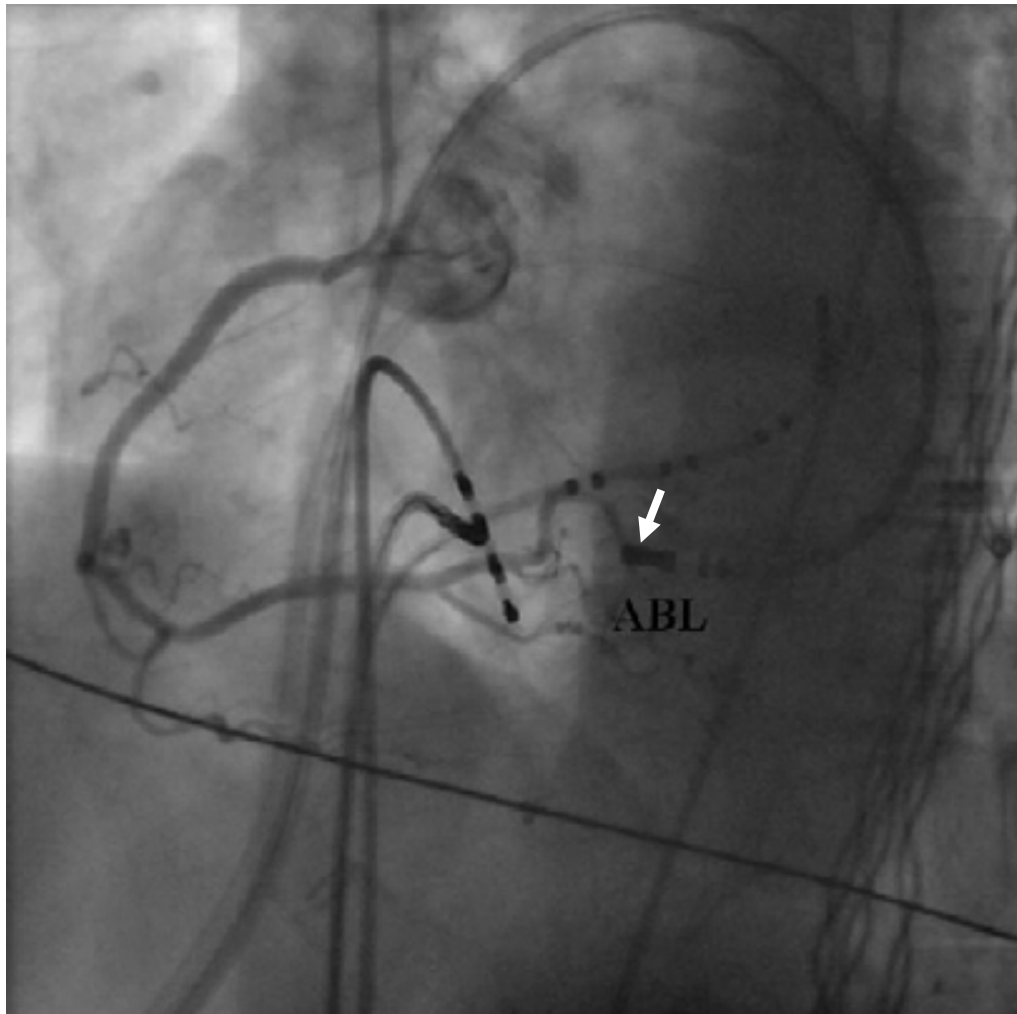
Idiopathic Focal Epicardial VT from Crux

Doppalapudi, Kay et al. Heart Rhythm. 2009;6:44-50.

	Patient 1	Patient 2	Patient 3	Patient 4
Electrophysiologic study				
Induction of arrhythmia	S1S2	Rapid pacing	S1S2S3S4	Rapid pacing
Isoproterenol for induction	No	Yes	Yes	Yes
Cycle length of VT (ms)	240	250	208	360
Response to pacing				
Termination	Yes	No	Yes	No
Entrainment	No	No	No	No
Mapping/ablation				
LAT-QRS onset				
Coronary vein (ms)	28 (pCS)	30 (pCS)	35 (pCS)	20 (pMVC)
Epicardium (ms)	36	30	N/A	N/A
Ablation				
Coronary vein	pCS (unsuccessful)	pCS (unsuccessful)	pCS (unsuccessful)	pMVC (successful)
Epicardium	Crux (successful)	Crux (successful)	N/A	N/A
Follow-up duration (months)	6	3	12	4

Idiopathic Focal Epicardial VT from Crux

Doppalapudi, Kay et al. Heart Rhythm. 2009;6:44-50.

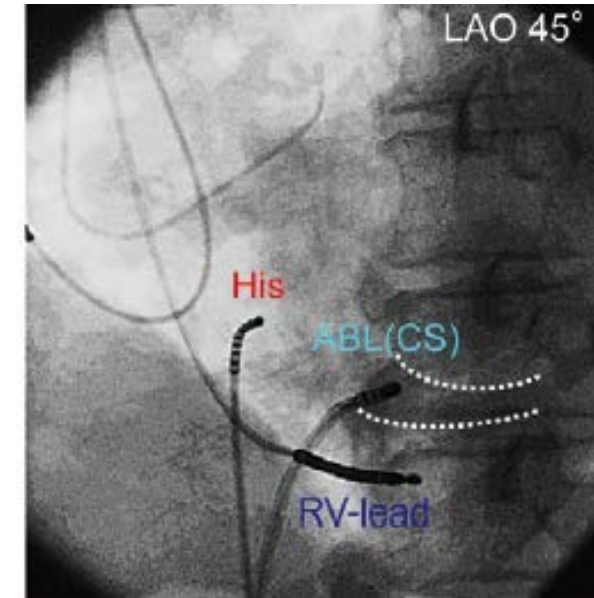
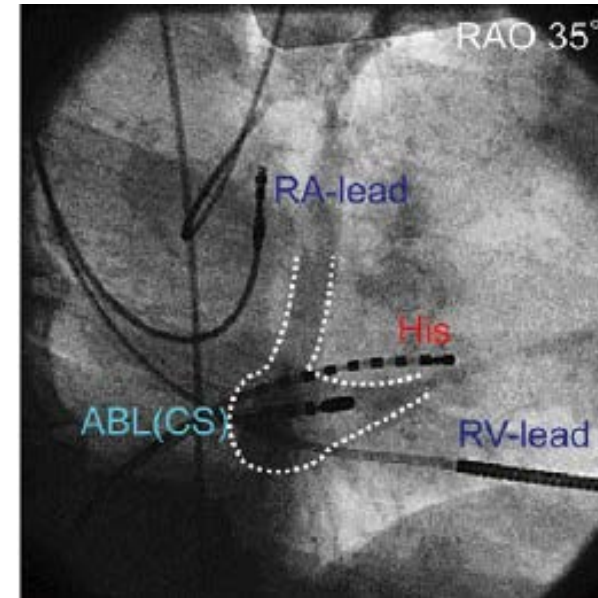
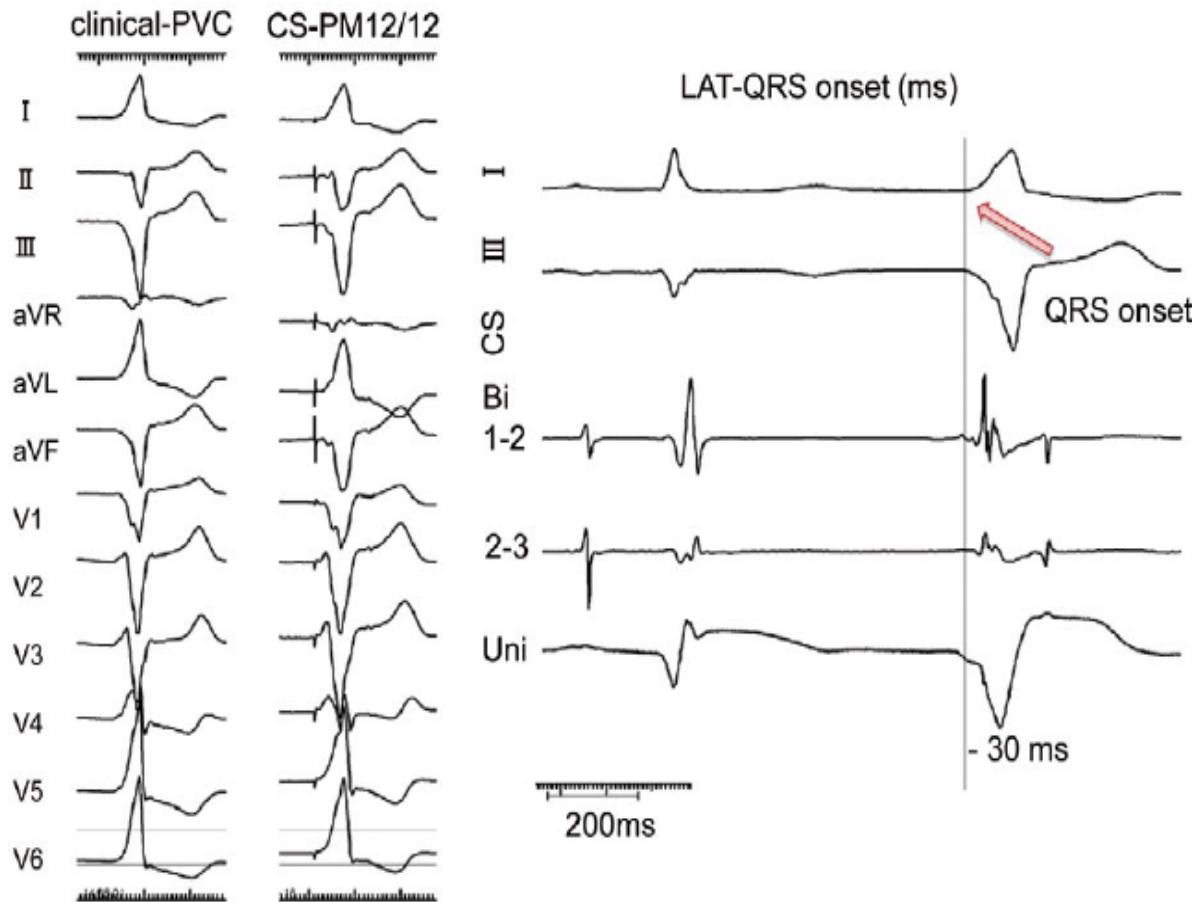


CS Ostial VT

(n=6/309)

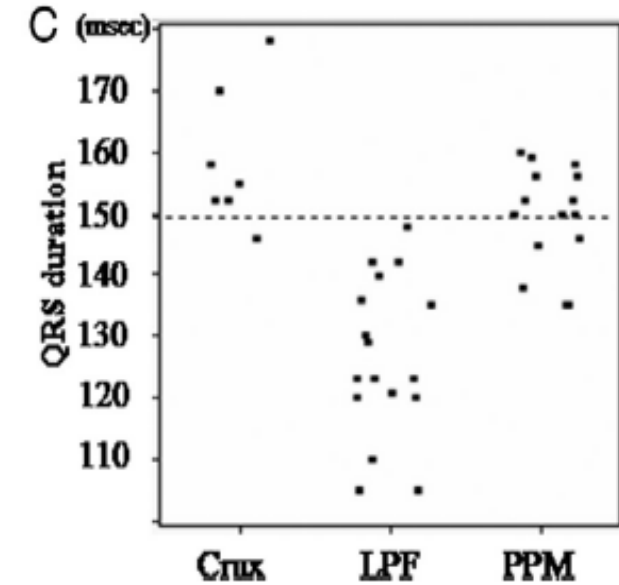
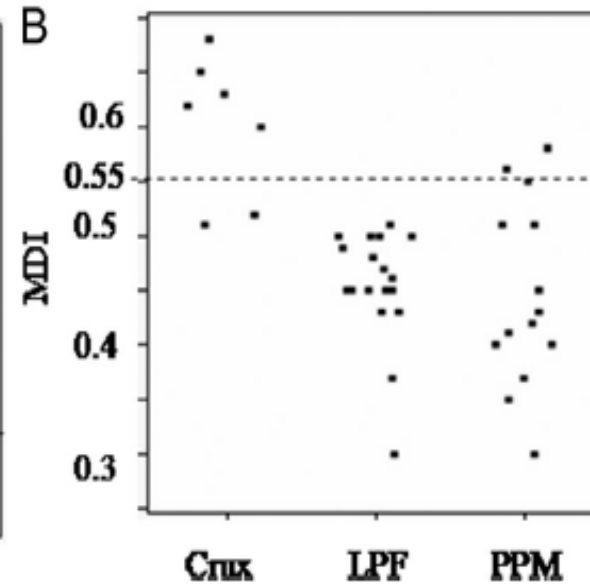
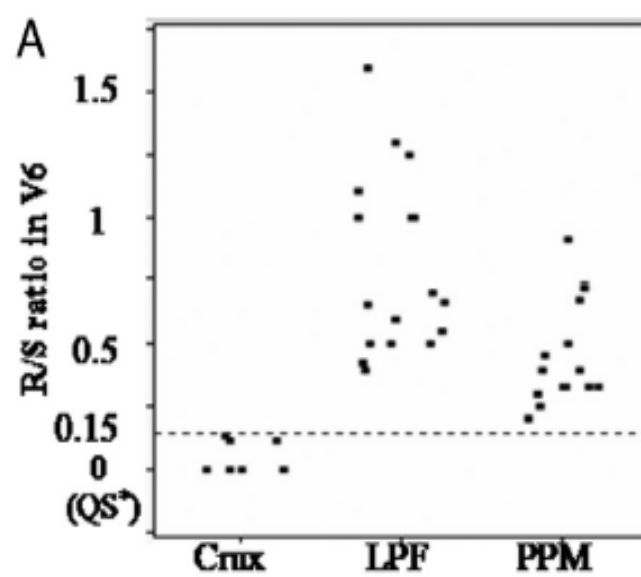
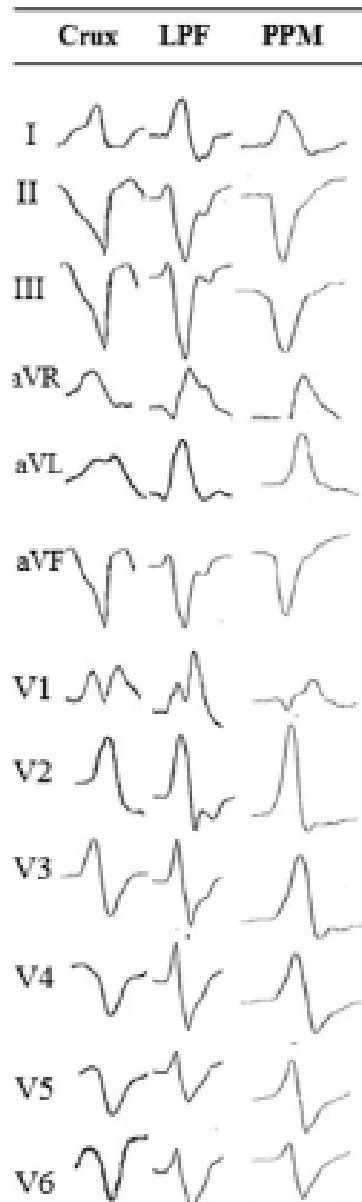
Yui, Nogami et al. CircJ 2017;81:1807-15.

4 from CSOs, 2 from MCV os



ECG Characteristics of Apical Crux VT (7/40 ILVTs)

Kawamura et al. Heart Rhythm. 2015;12:1137-44.



D/Dx of Apical Crux VT

Kawamura et al. Heart Rhythm. 2015;12:1137-44.

	All patients	LFP	LV PPM	Apical crux
No. of patients	40	18	15	7
<u>Age (years)</u>	49 ± 10	41 ± 12 [†]	52 ± 11 [†]	<u>57 ± 9[†]</u>
Gender, male	21 (52%)	10 (56%)	8 (53%)	3 (43%)
Ejection fraction (%)	58 ± 8	57 ± 12	60 ± 5	62 ± 3
History of <u>ventricular tachycardia</u>	22 (55%)	12 (67%)	4 (27%)*	<u>6 (86%)*</u>
History of <u>syncope/cardiac arrest</u>	6 (15%)	1 (6%) [†]	1 (7%) [†]	<u>4 (57%)[†]</u>
Successful ablation				
Endocardium	29 (73%)	16 (89%)*	12 (80%)*	1 (14%)*
<u>Epicardium</u>	2 (5%)	N/A	N/A	<u>2 (29%)</u>
Medical therapy [n (%)]				
Amiodarone/sotalol	5 (13%)	3 (17%)	2 (13%)	0 (0%)
Flecainide	2 (5%)	0 (0%)	1 (7%)	1 (14%)
Beta-blocker	12 (30%)	4 (22%)*	4 (27%)	4 (57%)*
Calcium blocker	14 (35%)	10 (56%)	3 (20%)	0 (0%)
Electrocardiography				
<u>QRS duration (ms)</u>	141 ± 18	124 ± 15 [†]	142 ± 13 [†]	<u>155 ± 22[†]</u>
<u>MDI > 0.55</u>	7 (17%)	0 (0%) [†]	2 (13%)*	<u>5 (71%)[†]</u>
QS in II	18 (45%)	6 (33%)	5 (33%)	7 (100%)
Monophasic R in aVR	9 (23%)	2 (11%) [†]	1 (7%) [†]	6 (86%) [†]
qR in V ₁	13 (32%)	3 (17%)	9 (60%)	1 (14%)
<u>QS or r/S < 0.15 in V₆</u>	9 (23%)	1 (5%) [†]	1 (7%) [†]	<u>7 (100%)[†]</u>

LFP = left ventricular posterior fascicle; LV PPM = left ventricular posterior papillary muscle; MDI = precordial maximal deflection index; N/A = not applicable.

*P < .05 †P < .01.

Crux VT

(9 apical crux VT, 9 basal crux VT)

Kawamura et al. CircAE. 2014;7:1152-58.

	Crux VA (n=18)	Idiopathic VA (n=251)	P Value
Age, y	53±12	48±21	0.07
Men	8 (44%)	115 (46%)	0.81
History of syncope	8 (44%)	50 (20%)	0.01
History of VT	15 (83%)	83 (33%)	0.0001
QRS duration, ms	150±27	138±19	0.04
LV ejection fraction, %	60±5	58±8	0.26
ICD implantation	3 (17%)	7 (3%)	0.02

ICD indicates implantable cardioverter defibrillator; LV, left ventricular; VA, ventricular arrhythmia; and VT, ventricular tachycardia.

Basal Crux VT (within 2cm of MCV os)

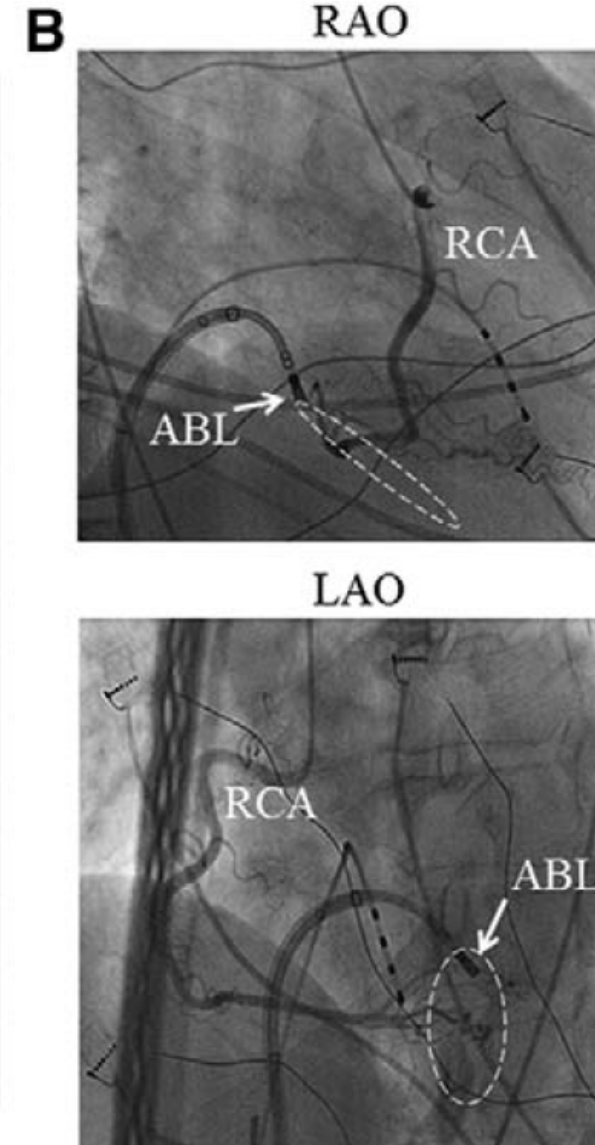
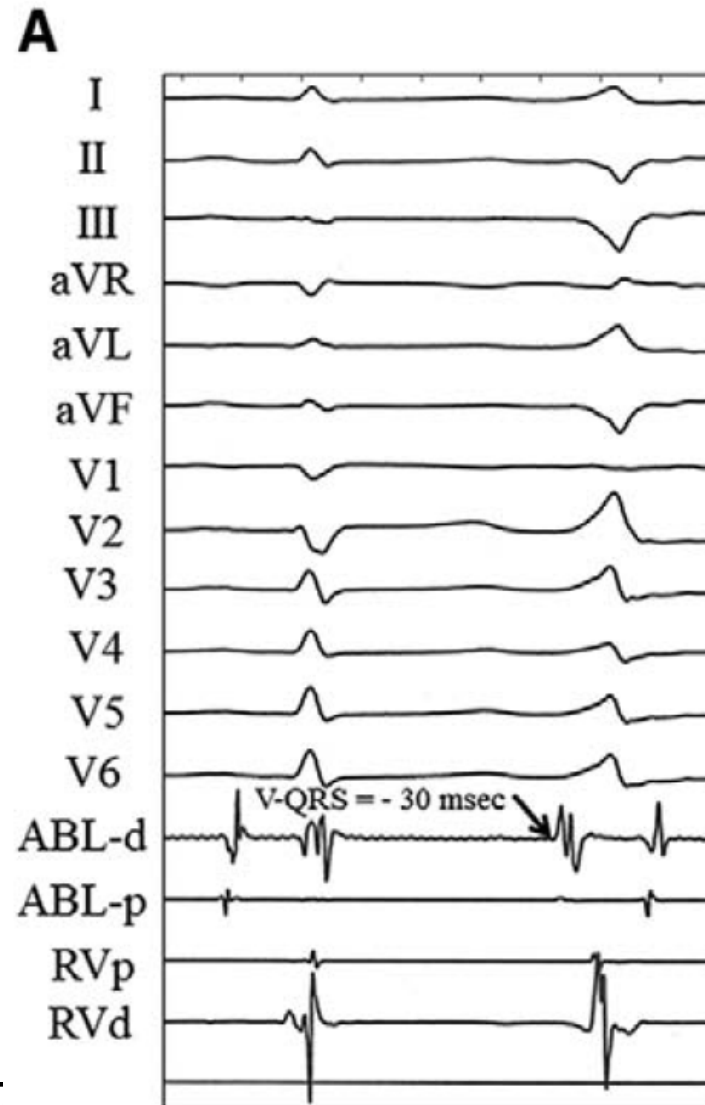
Kawamura et al. CircAE. 2014;7:1152-58.

Basal Crux VA (n=9)

33% syncope, 0% ICD
positive V6
9/9 MCV ablation success,
1 case recur

D/Dx from Tricuspid VA

QS pattern in II
Taller R in V2
Longer QRS duration

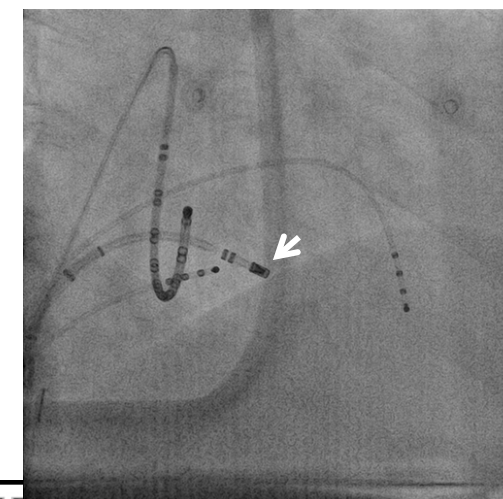
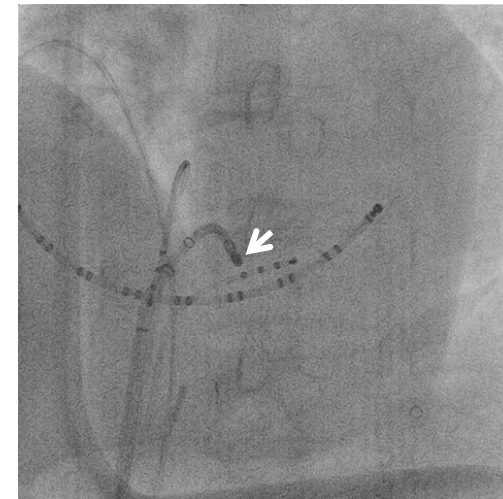
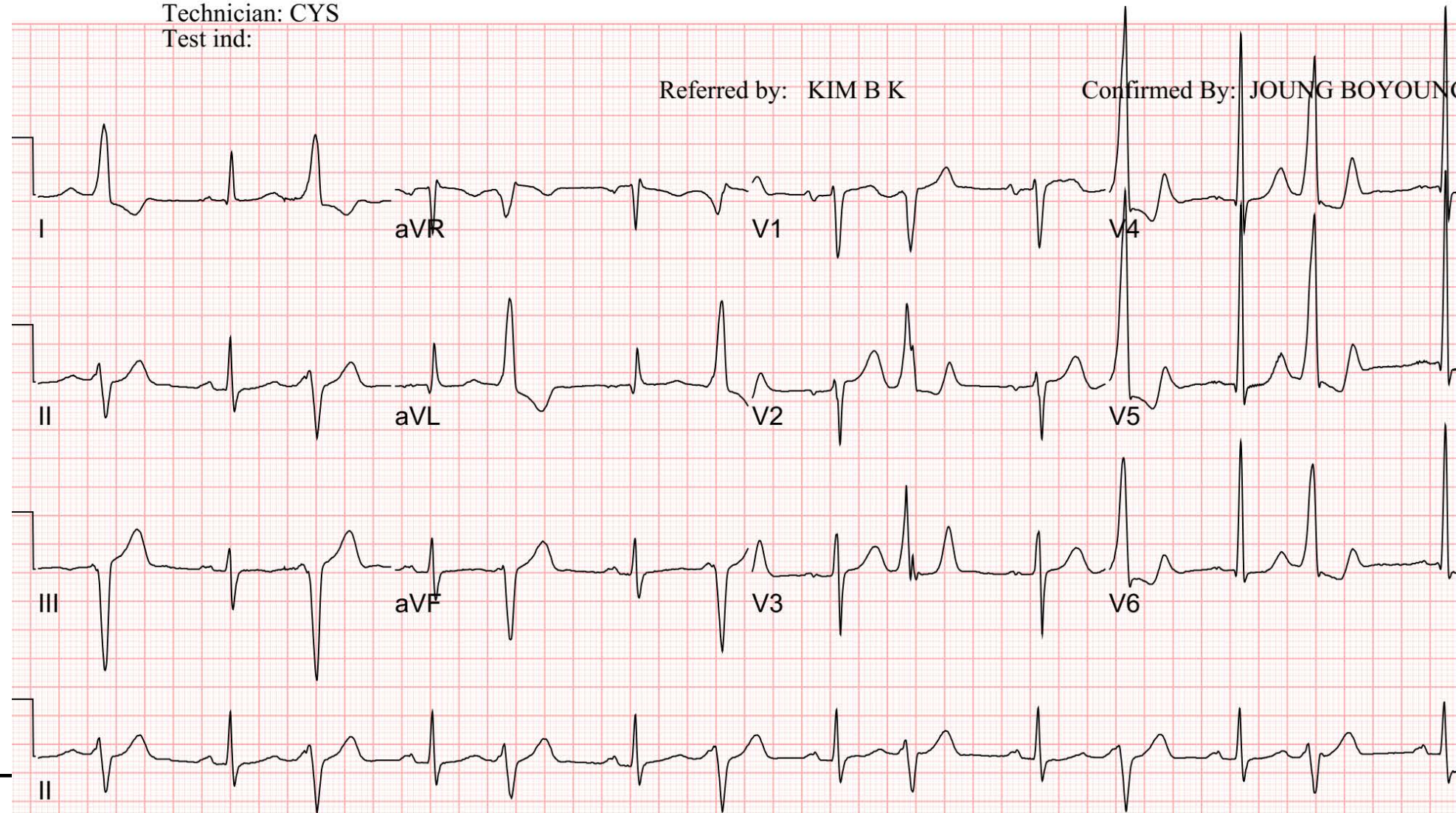


Tricuspid Annular PVC

Technician: CYS
Test ind:

Referred by: KIM B K

Confirmed By: JOUNG BOYOUNG



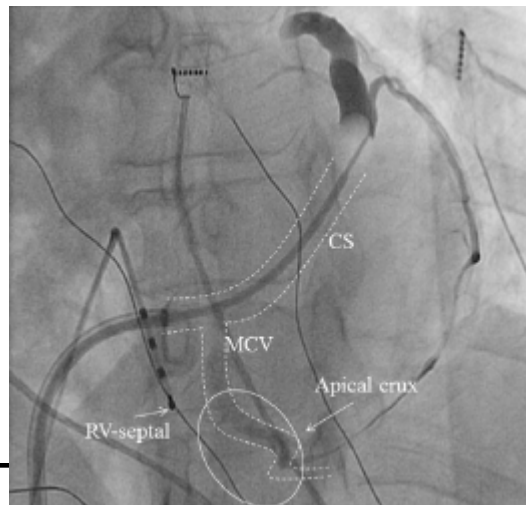
Apical Crux VT

(distal to 2cm of MCV os)

Kawamura et al. CircAE. 2014;7:1152-58.

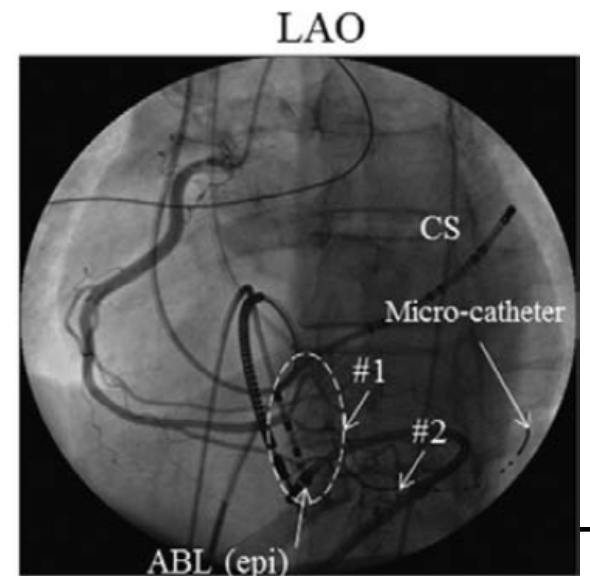
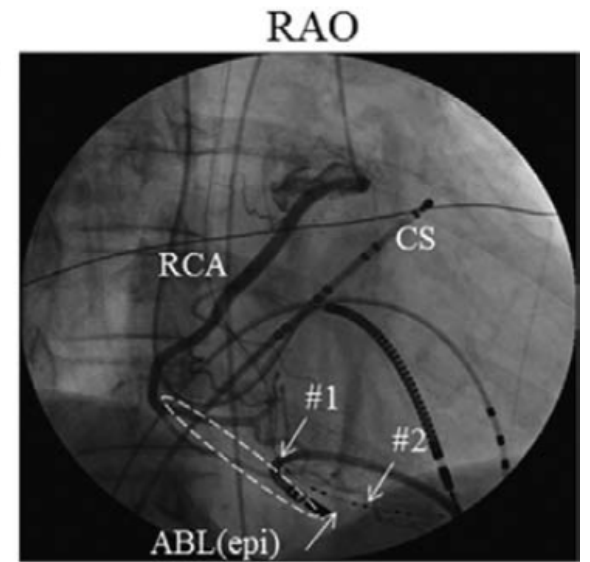
Apical Crux VA (n=9)

55% syncope, 33% ICD
 TCL 261 ± 28 vs. 391 ± 45 ms, $p=0.047$
 deep S in V6
 QRS change from LBBB to RBBB
MCV > 2cm from MCV ostium
 2/9 MCV ablation success
 (All recur within 24hrs.)
 4/4 success by epicardial ablation
 -52 ± 18ms activation map



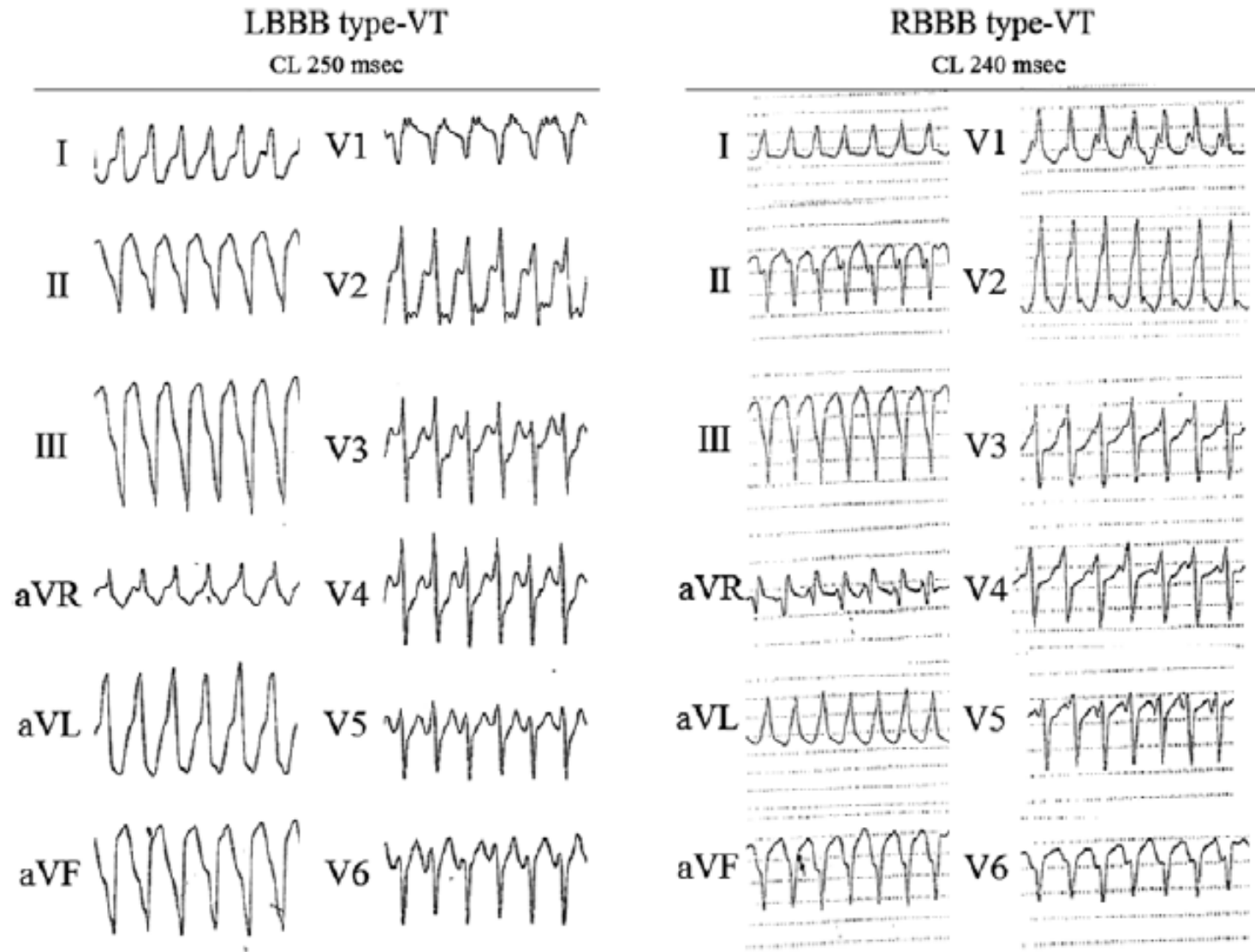
CULAR HOSPI

	Apical-VT	Epicardial site pacing	Pro-MCV pacing (#1)	Distal-MCV pacing (#2)	Distal-MCV pacing (another patient)
I					
II					
III					
aVR					
aVL					
aVF					
V1					
V2					
V3					
V4					
V5					
V6					



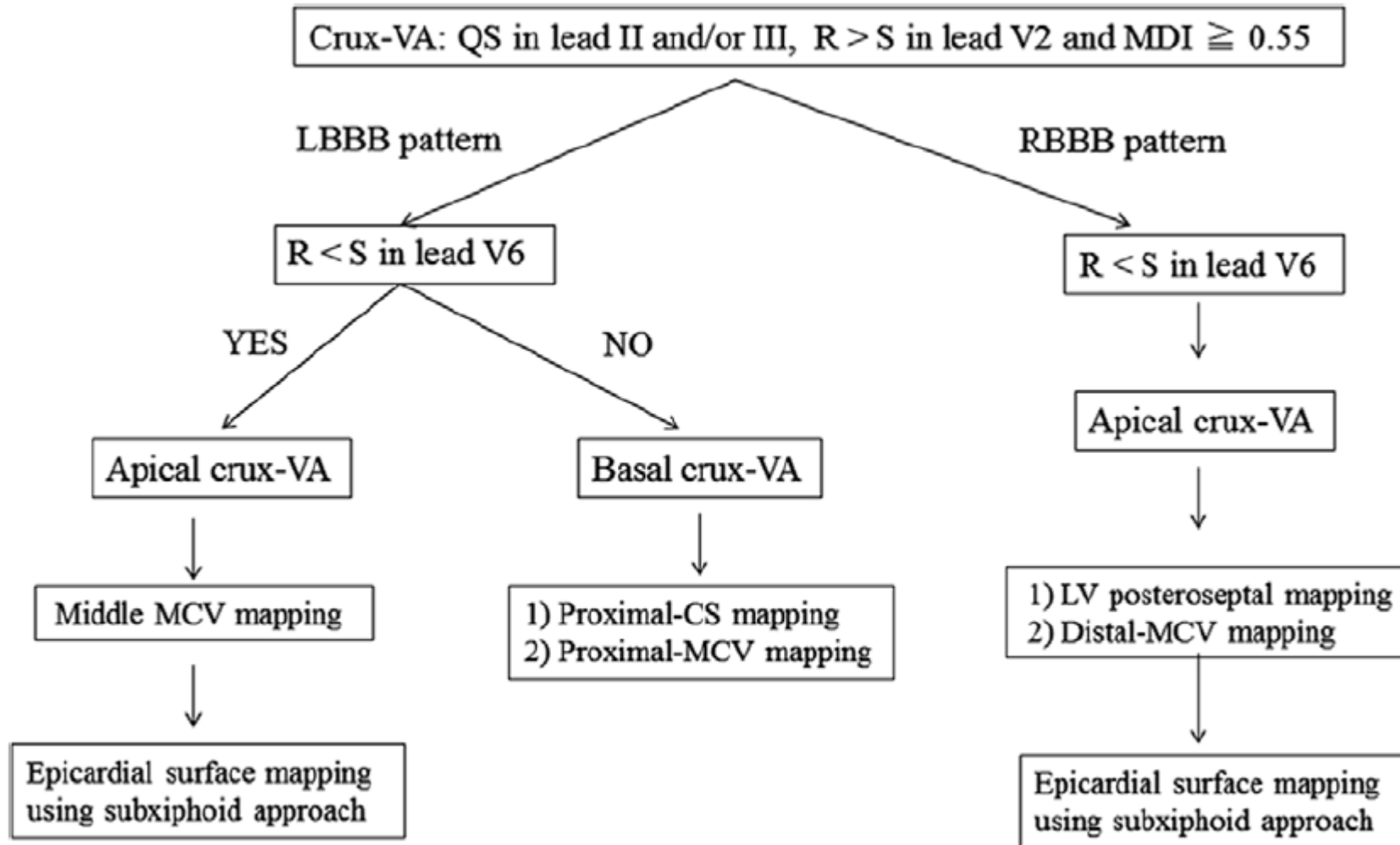
Apical Crux VT

Kawamura et al. CircAE. 2014;7:1152-58.



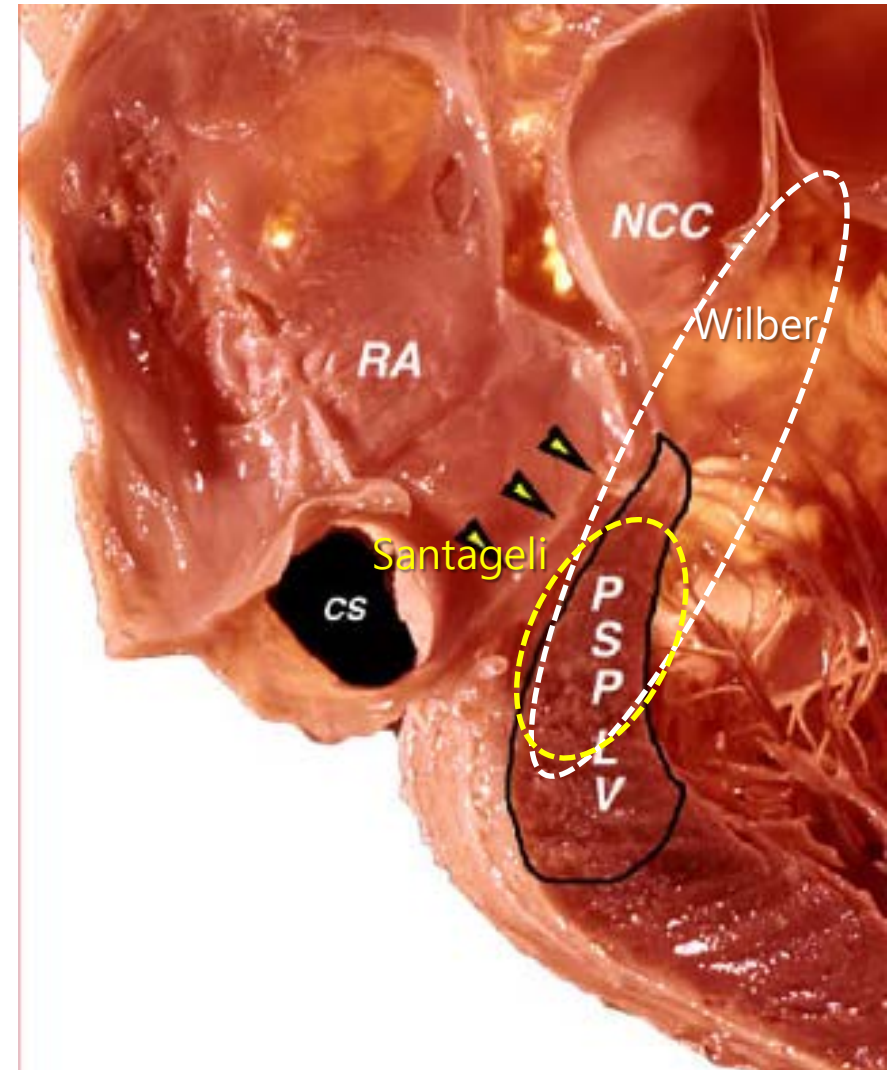
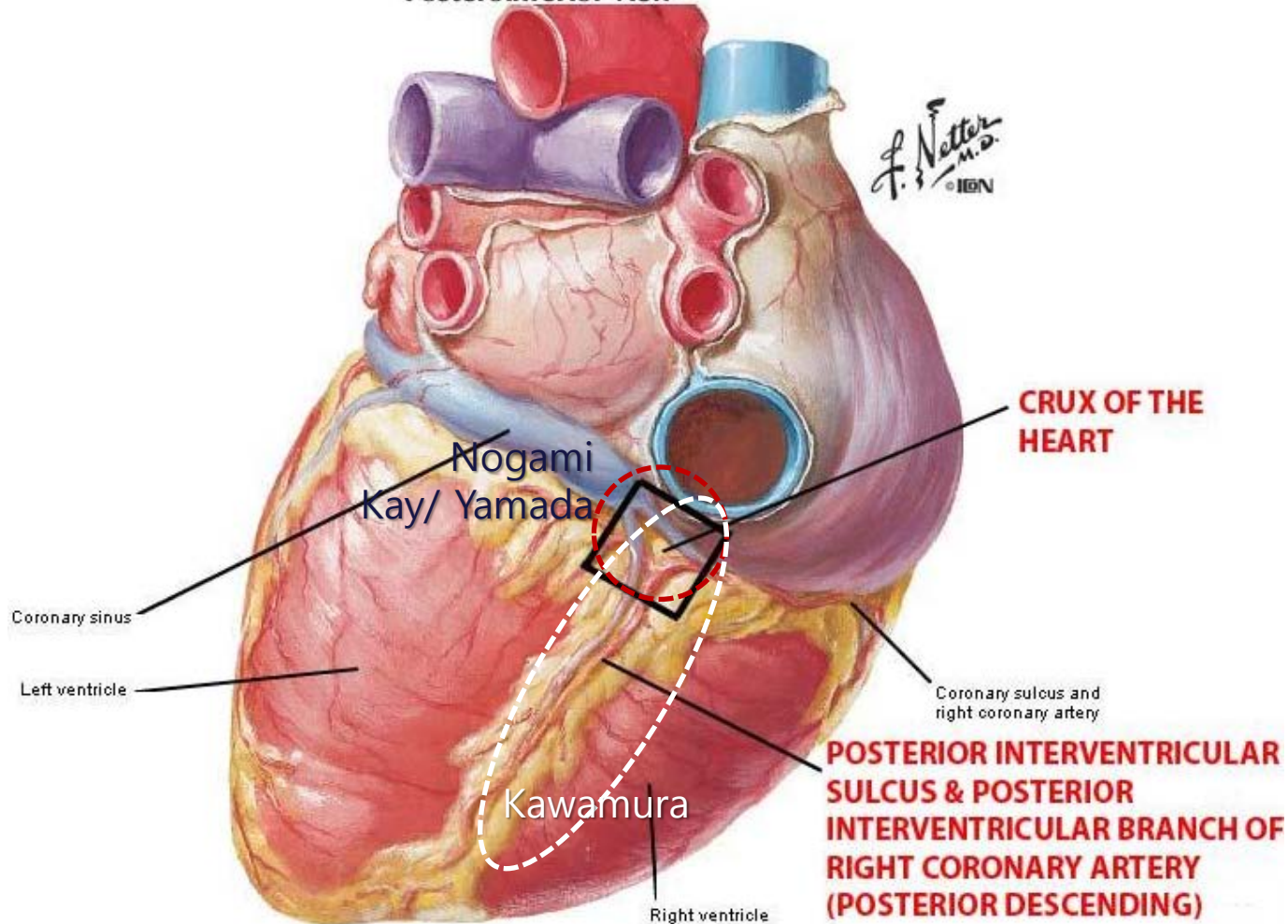
Approach to Crux VT

Kawamura et al. CircAE. 2014;7:1152-58.



Crux VT: Same Name Different Definitions

Heart - Diaphragmatic Surface
Posteroinferior View



Conclusion

- The cardiac crux is the posteroseptal region formed by the A-V annulus and interventricular groove.
- Cardiac crux is a pyramidal space, which presents the confluence of all 4 cardiac chambers, CS, RCA, as well as autonomic fat pad in their nearest proximity.
- ECG characteristics of Crux VT
- Crux VT is a focal type VT, commonly associated with syncope and fast VT.
- Apical crux VT should be managed by epicardial approach.
- There are overlapping zone of crux VT from posterior inferior process to apical posterior interventricular groove.

