Epicardial VT Ablation: What We Have Learned – A U.S.A View (Pearls and Pitfalls)

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Presenter Disclosure Information

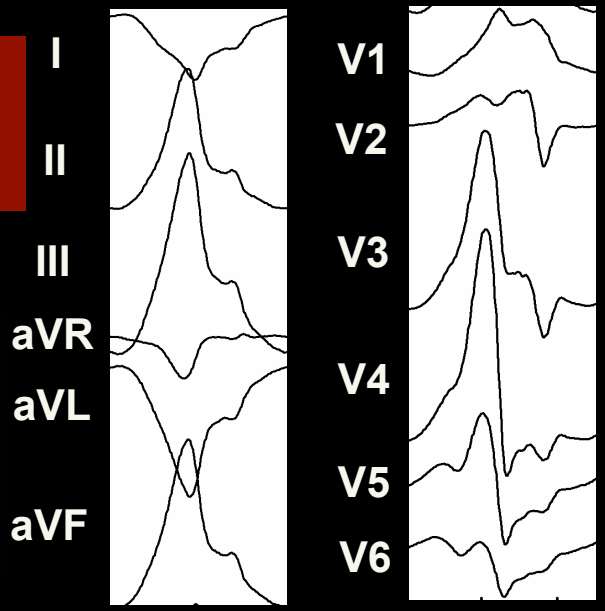
Within the past 12 months, the presenter has received financial support from the organizations identified below for the relationships listed.

Company Name:	Relationship:
Biosense Webster	Sponsored Research/Advisory Panel /Lecture Honorarium
Biotronik	Lecture Honorarium
Boston Scientific	Sponsored Research/Lecture Honorarium
Cardioinsight	Advisory Board
St. Jude Medical	Sponsored Research/ Lecture Honorarium
Medtronic	Sponsored Research/Advisory Panel/Lecture Honorarium

Epicardial VT Ablation: Pearls and Pitfalls

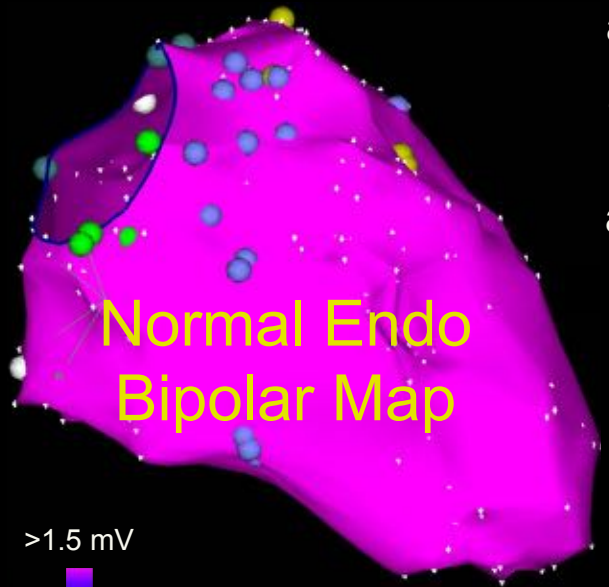
- Do not attempt epicardial access unless warranted
  - Think mid septal scar in NICM
  - Ablate from adjacent structures with LV summit EPI VT

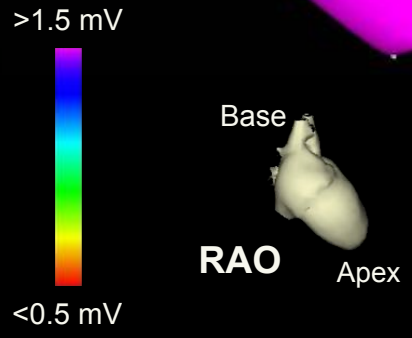
ECG suggesting EPI VT

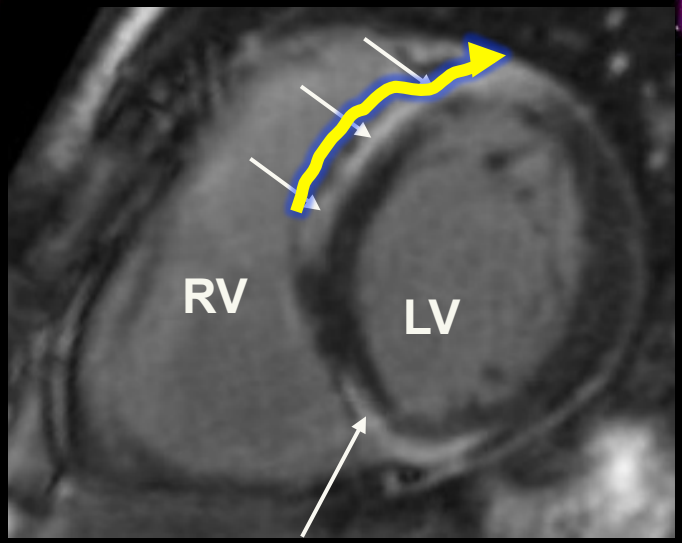


VT - RBRI 280ms

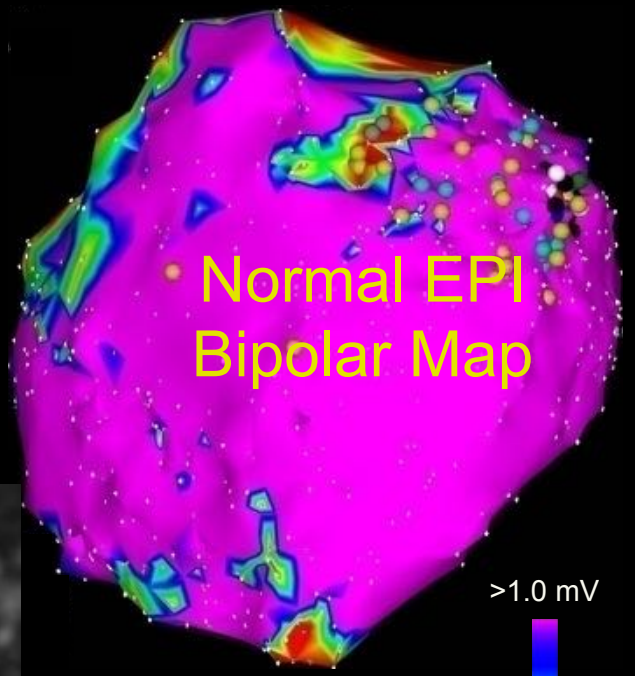
57 (27%)/209 pts with NICM) – only septal mid

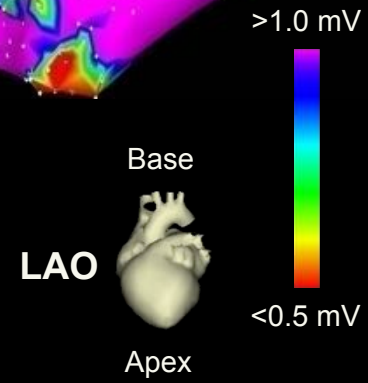




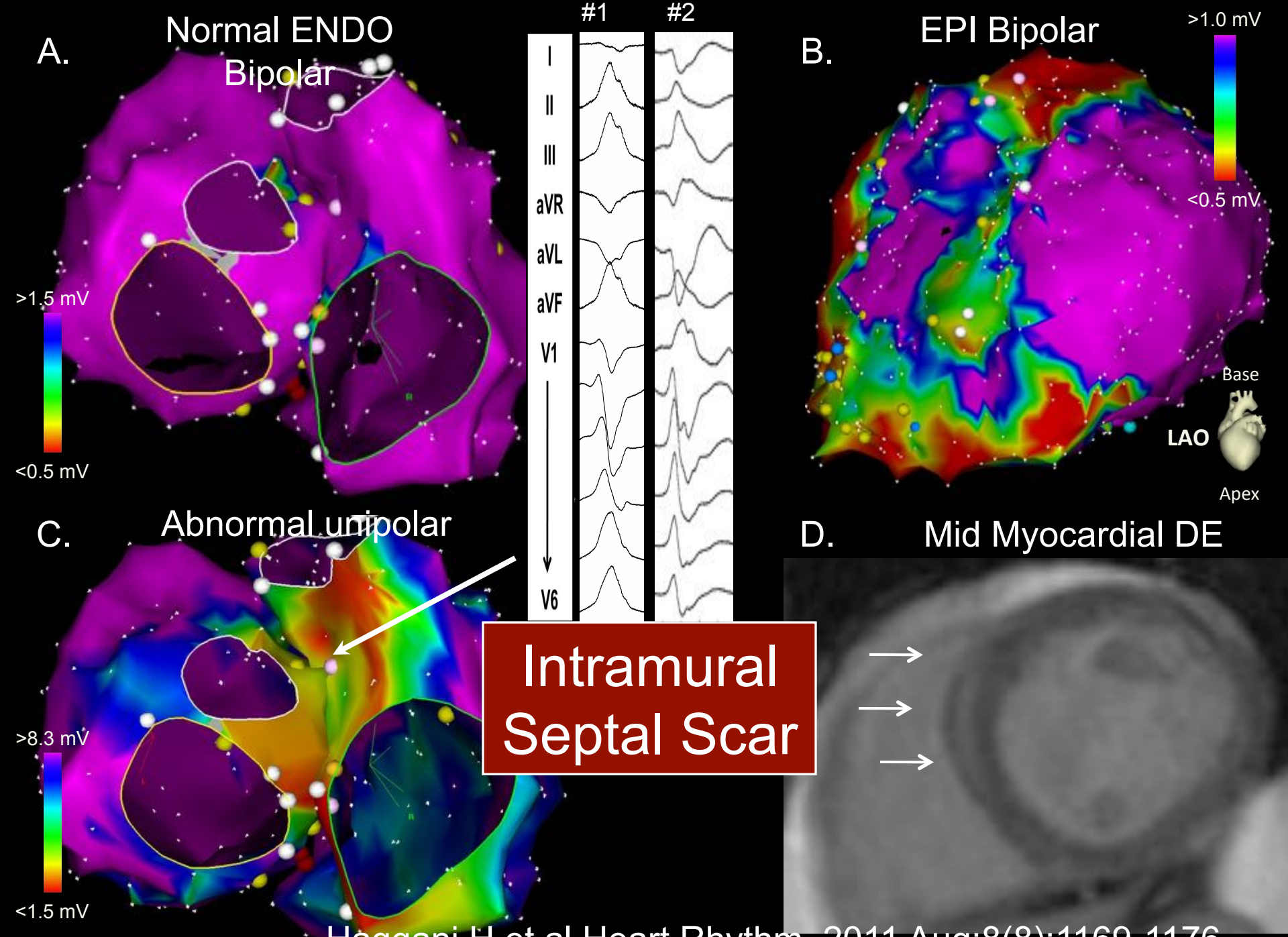


Mid-myocardial delayed enhancement

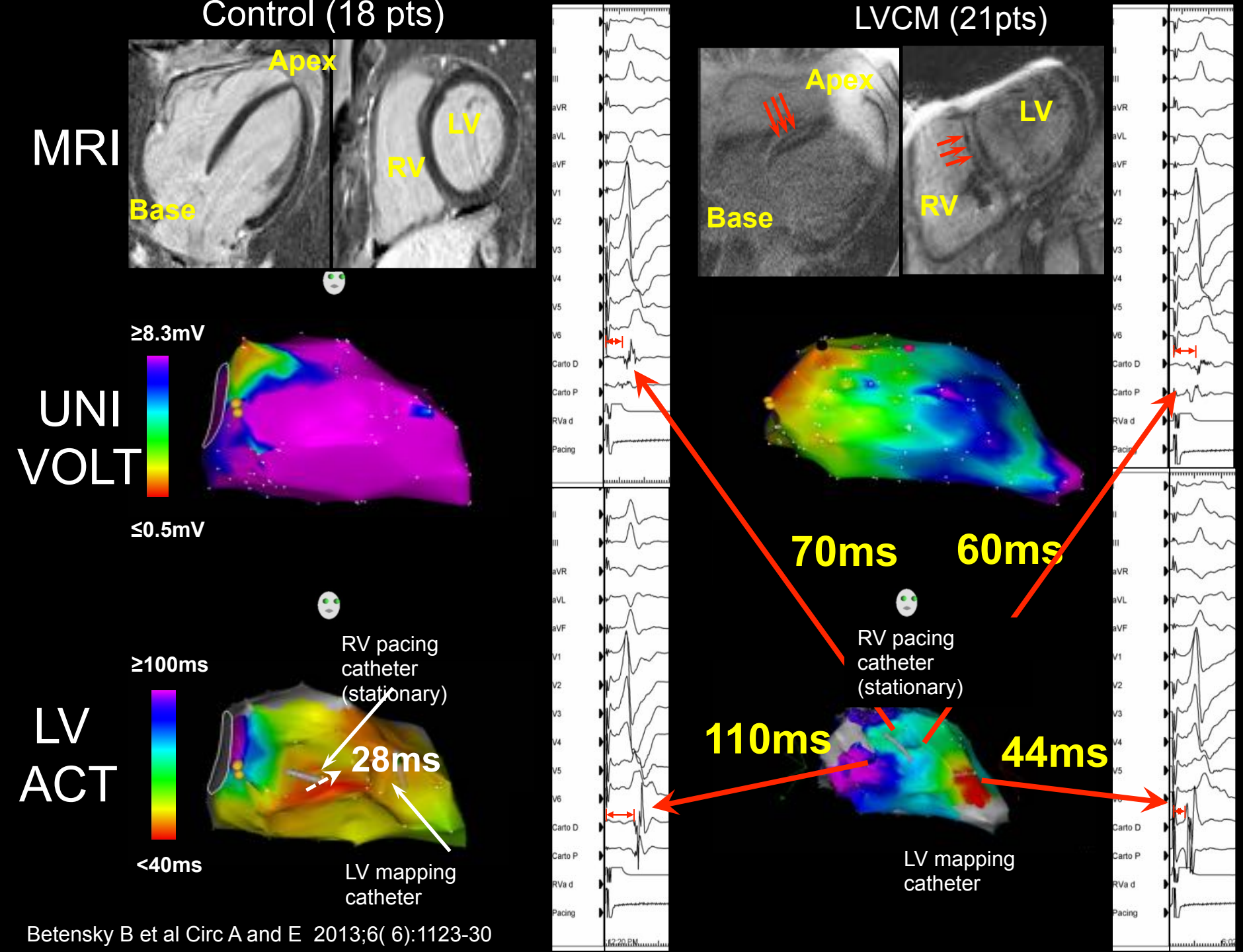




Haqqani H et al Heart Rhythm. 2011 Aug;8(8): 1169-1176.



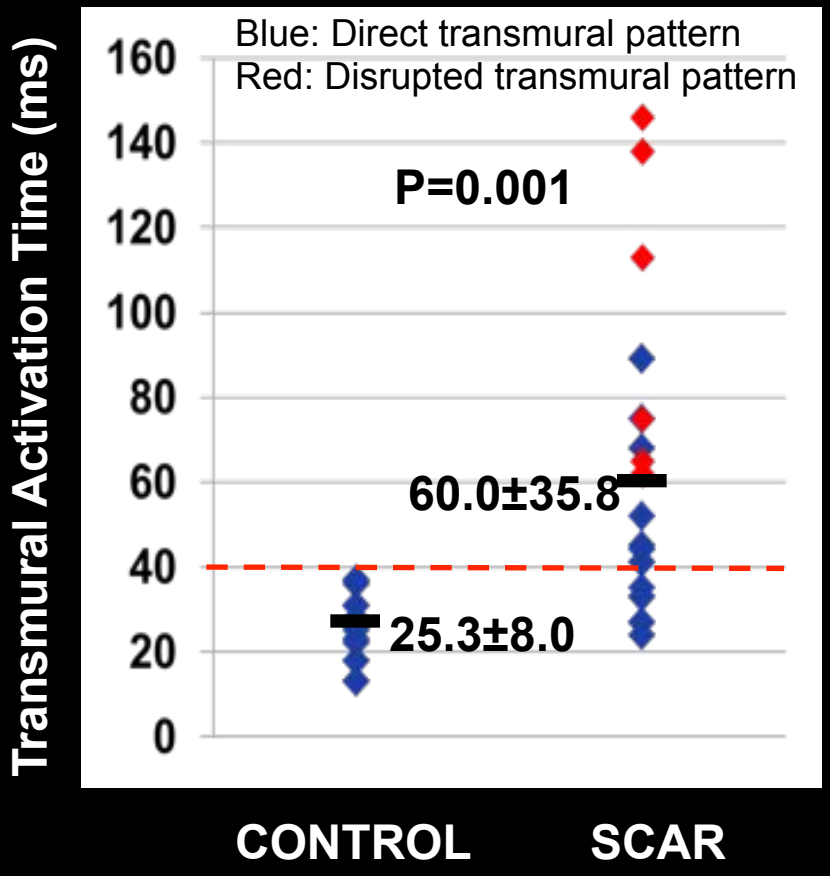
Haqqani H et al Heart Rhythm. 2011 Aug;8(8):1169-1176

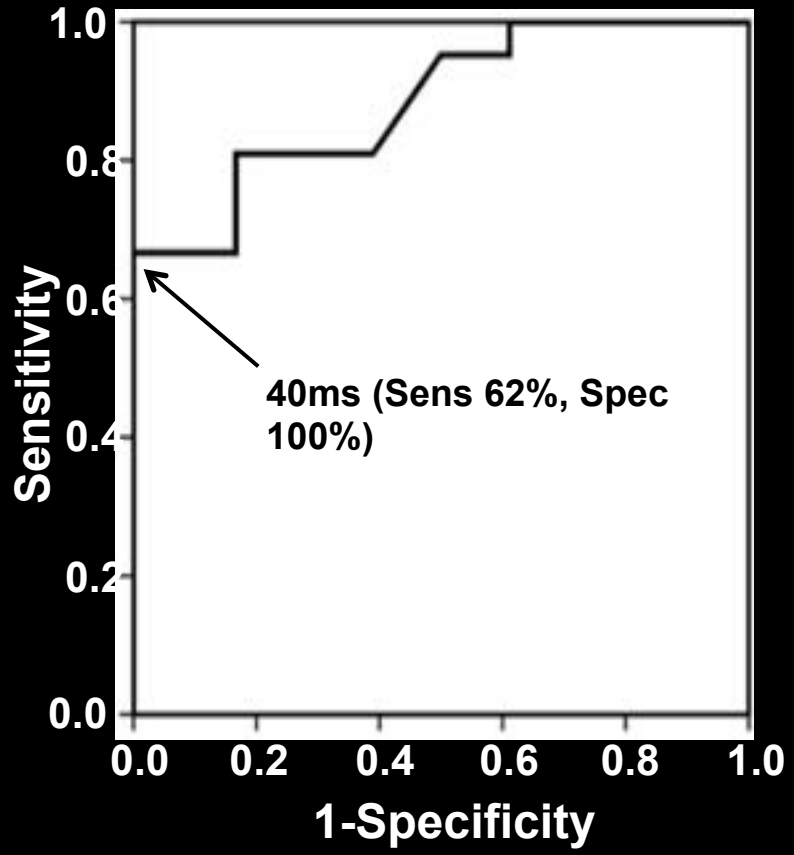


Betensky B et al Circ A and E 2013;6(6):1123-30

Transmural Activation Time During "Opposite" Pacing

N=39

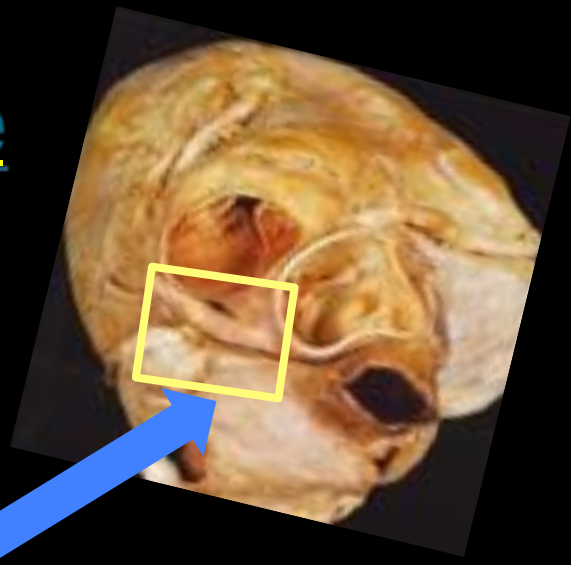




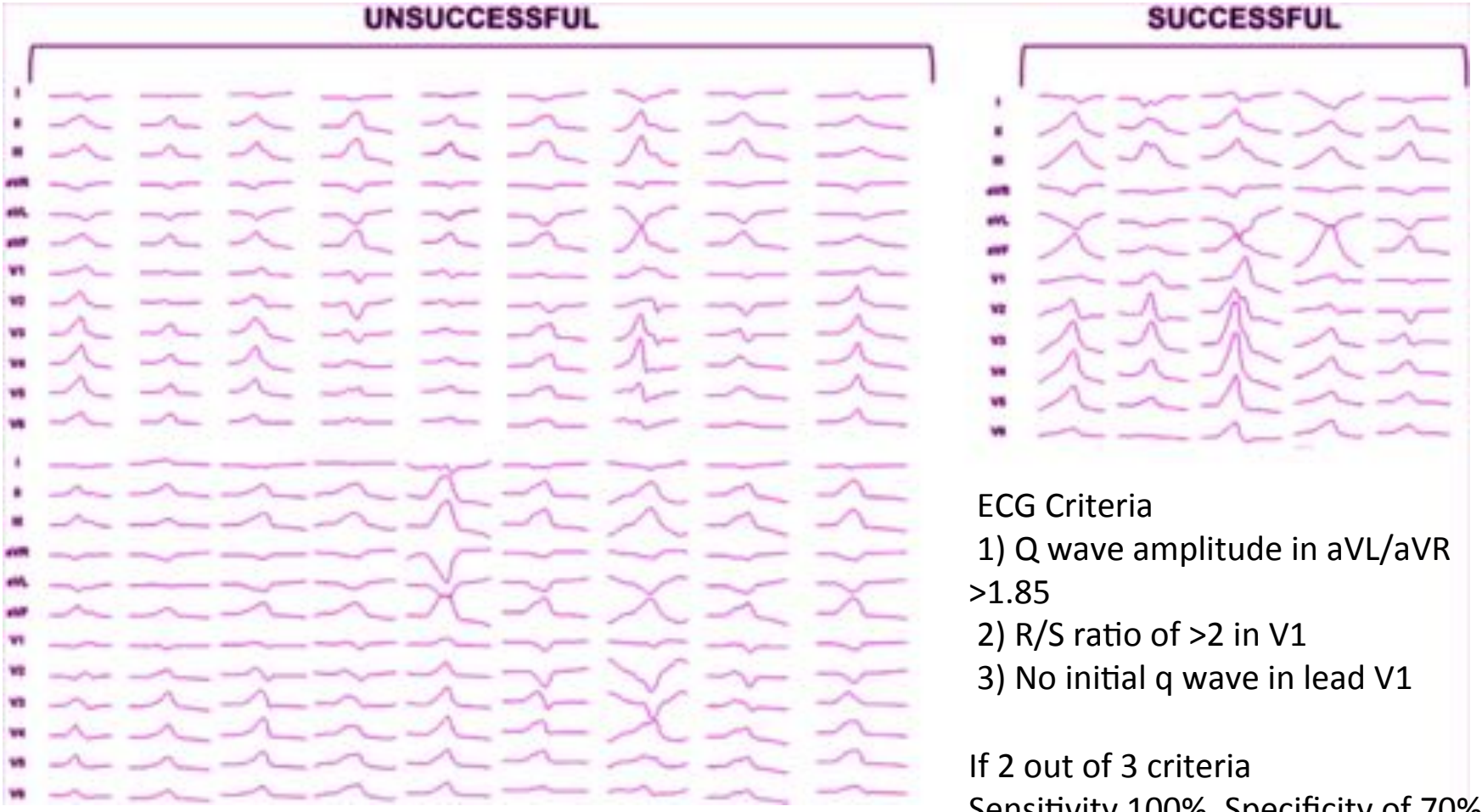
Betensky B et al Circ A and E 2013;6(6):1123-30

Best strategy for ablating EPI VT from LV Summit earliest in GCV or AIV vein but close to coronary or ineffective?

Successful Epi mapping and ablation in only 5/23 – all more lateral +/- distal



ECG Characteristics of Successful EPI Ablation (More Apical and Lateral)



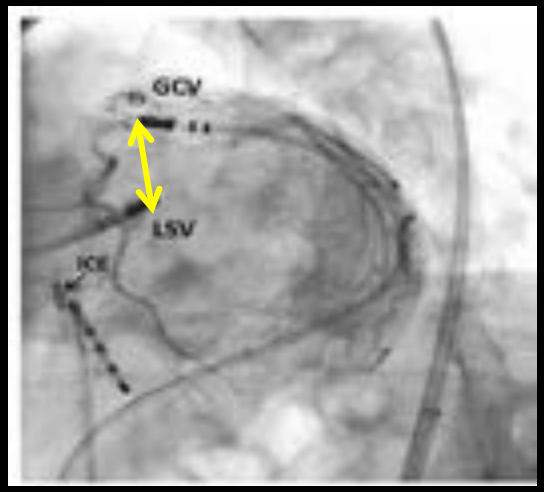
ECG Criteria
1) Q wave amplitude in aVL/aVR >1.85
2) R/S ratio of >2 in V1
3) No initial q wave in lead V1

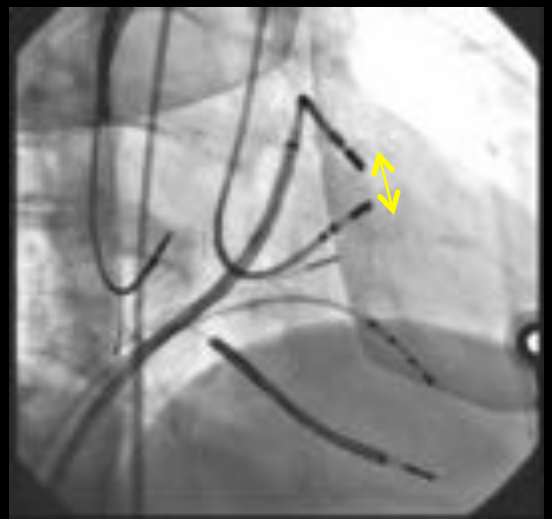
If 2 out of 3 criteria
Sensitivity 100%, Specificity of 70%

Santangelli P et al Circ A and E 2015;8:337-343.

Ablation from LCC or Adjacent Endocardium of VT Source Near the AIV (Earliest site/best PM) -16pts Clue for Successful ablation – proximity

Anatomic Distance <13.5mm

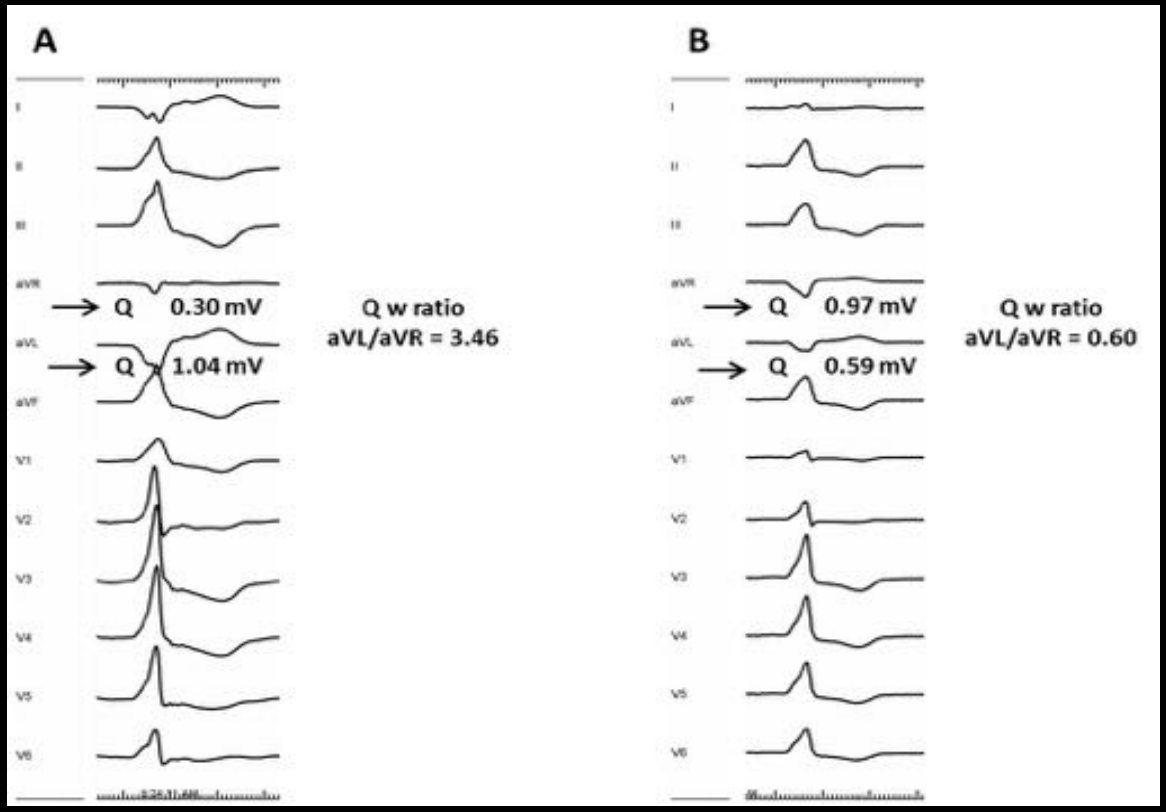




Unsuccessful

Successful

ECG clue - Q wave ratio aVL/aVR - <1.45



Abularach M et al Heart Rhythm. 2012. Jun;9(6):865-873.

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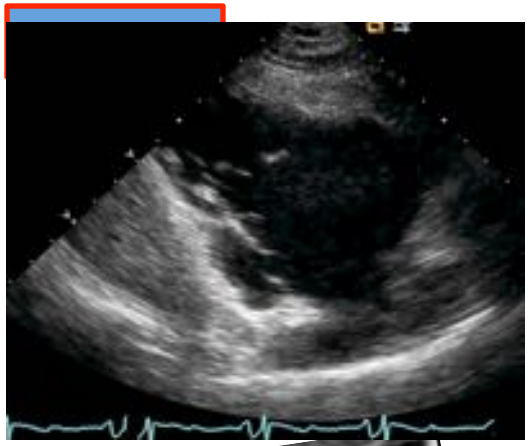
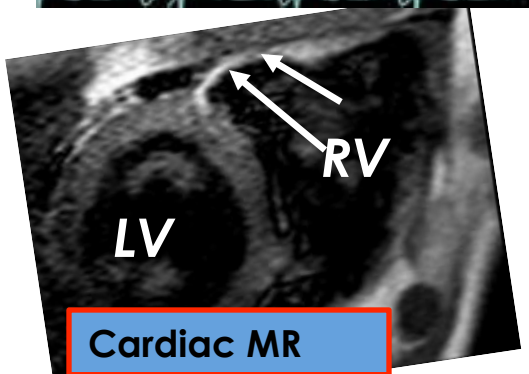
- Use imaging/ECG/Unipolar Egs to identify EPI substrate/VT exit

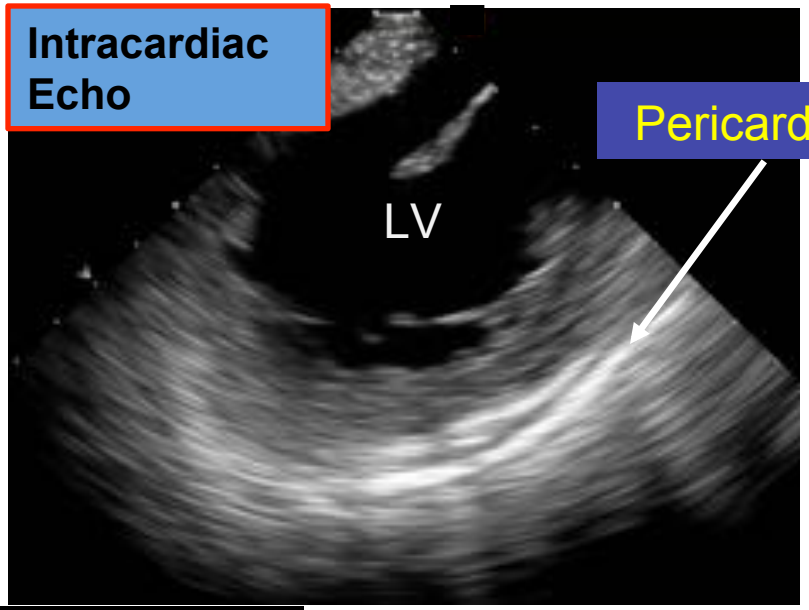
Epicardial/Intramyocardial Substrate – NICM Importance of Imaging

Basso, C. et al. Circulation 1996;94:983-991

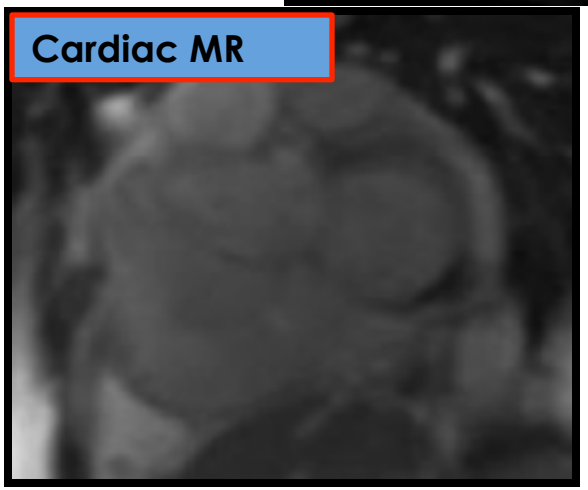




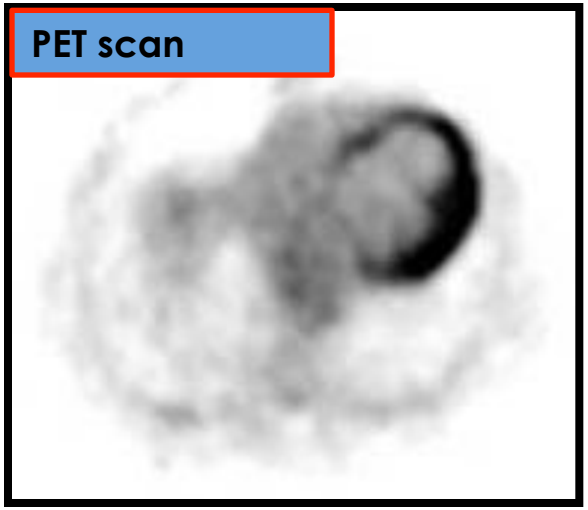
Intracardiac Echo



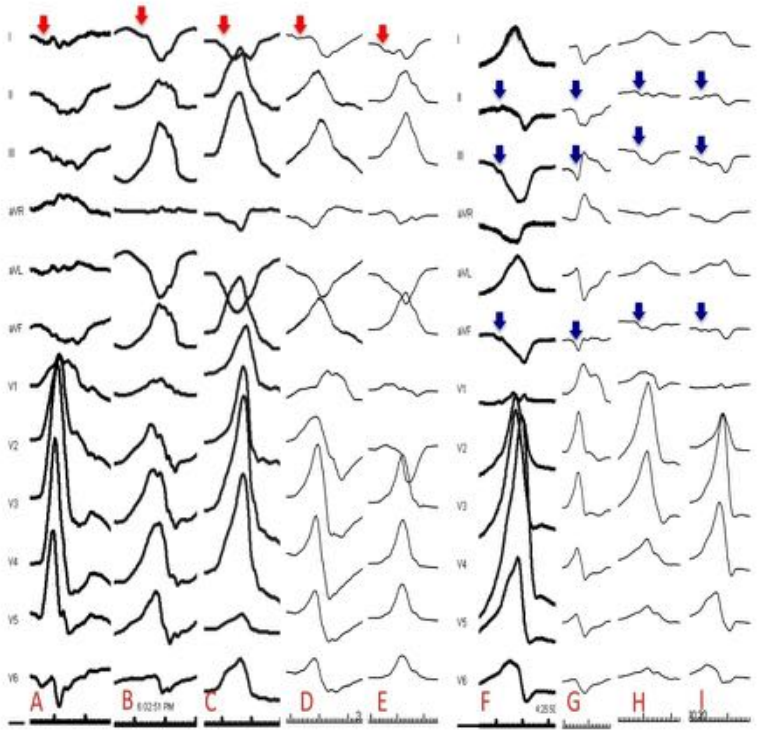
Cardiac MR



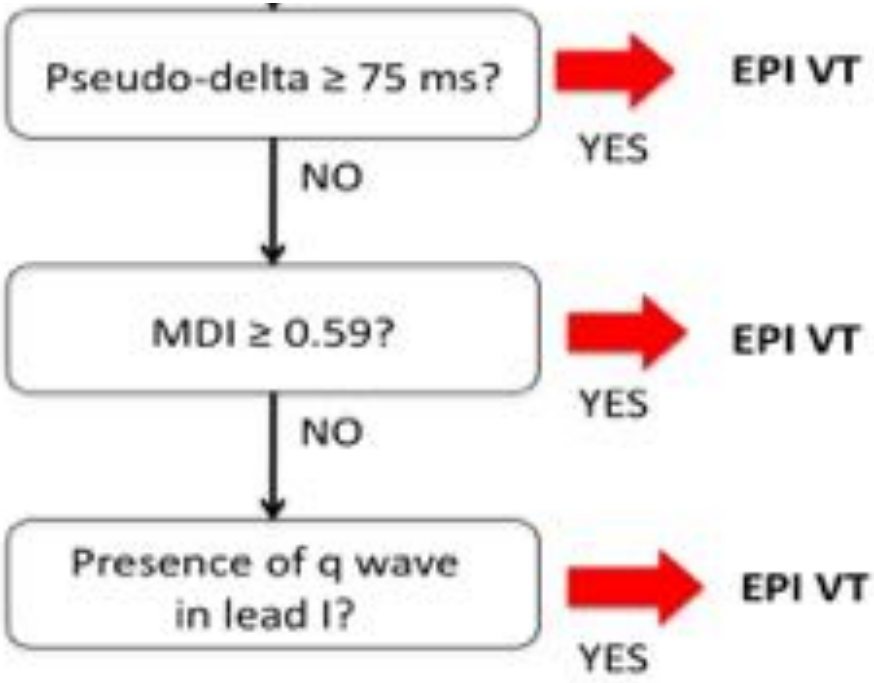
PET scan

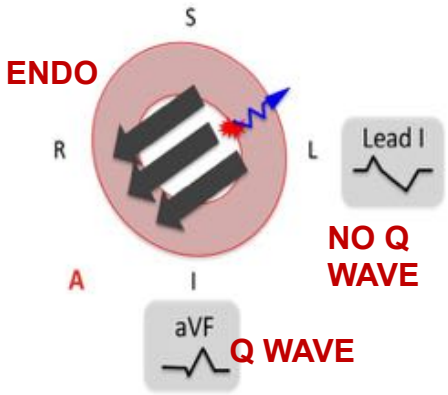


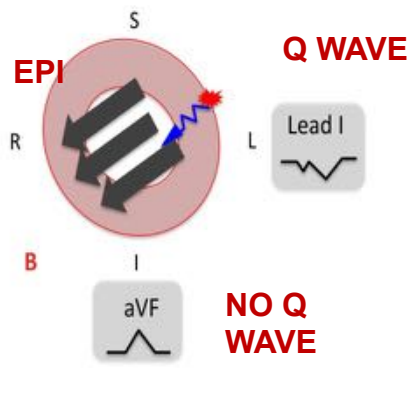
ECG Criteria Epicardial VT - Basal Lateral LV NICM



Modified Interval criteria / add Q wave in 1







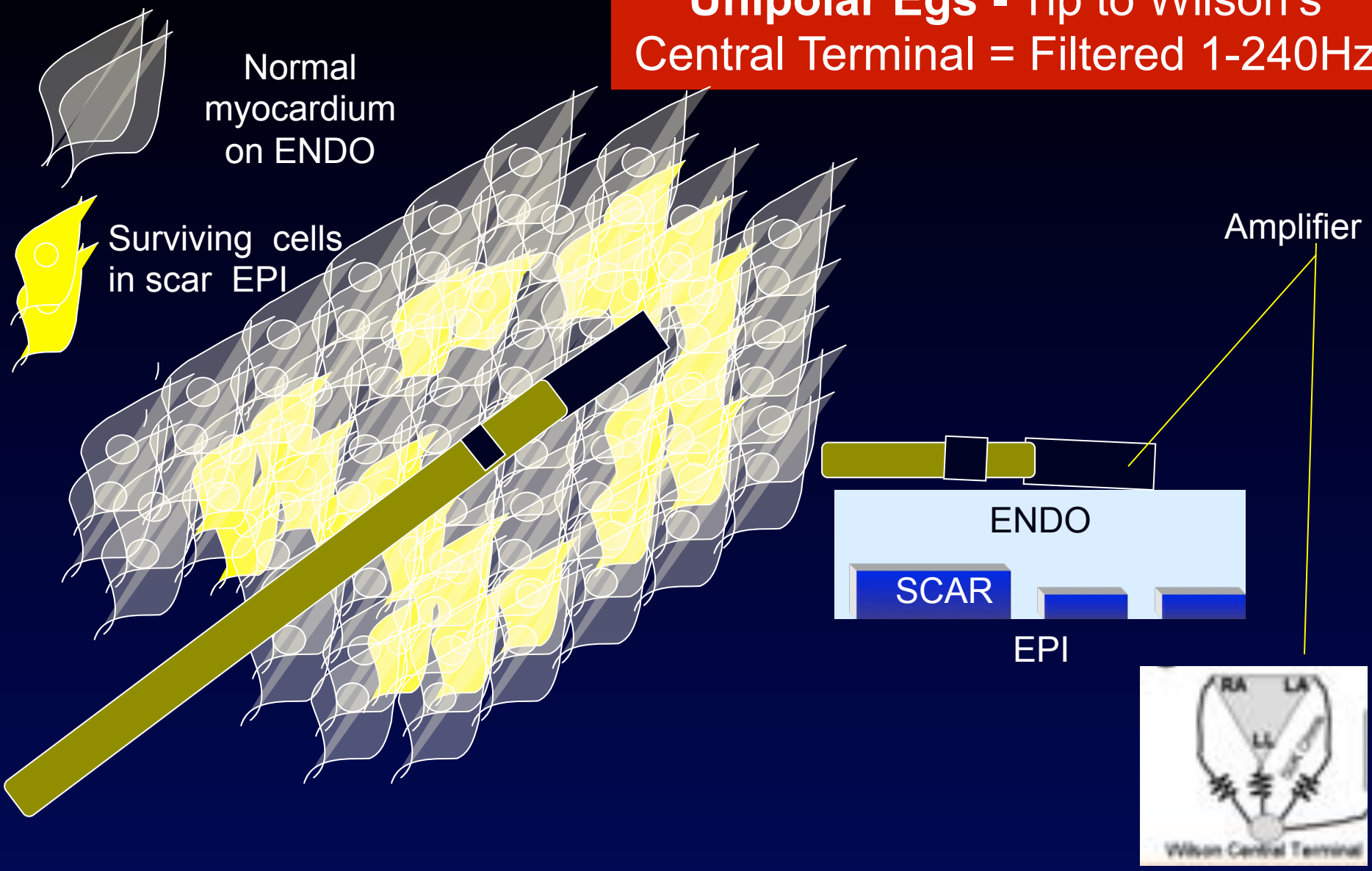
SN = 96% SP = 93%

Valles et al Circ Arrhythm Electrophysiol. 2010 Feb 1:3(1):63-71

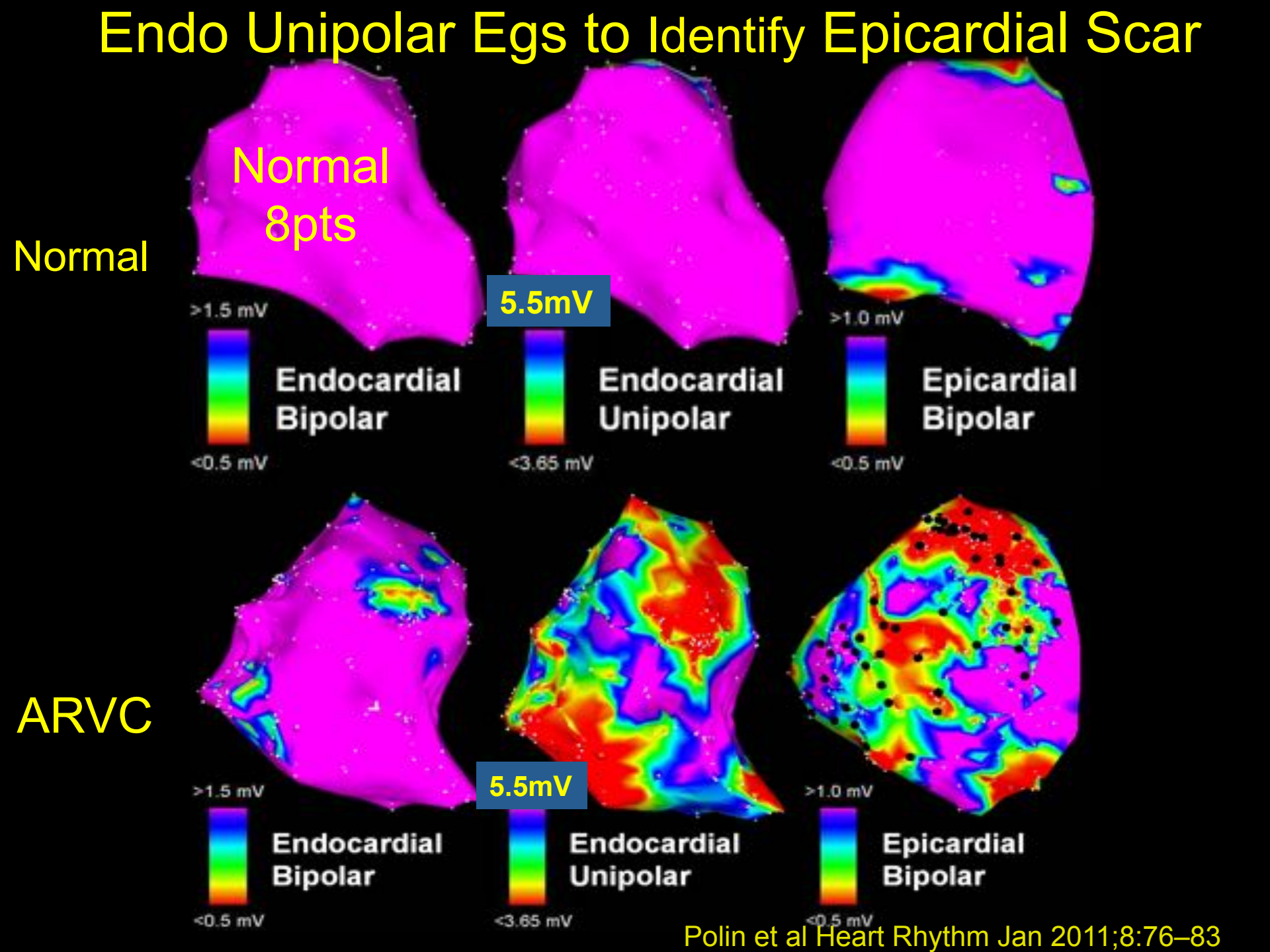
Unipolar Eg – Wide View – Through Normal?

NICM

Unipolar Egs - Tip to Wilson's Central Terminal = Filtered 1-240Hz



Endo Unipolar Egs to Identify Epicardial Scar



Polin et al Heart Rhythm Jan 2011;8:76–83

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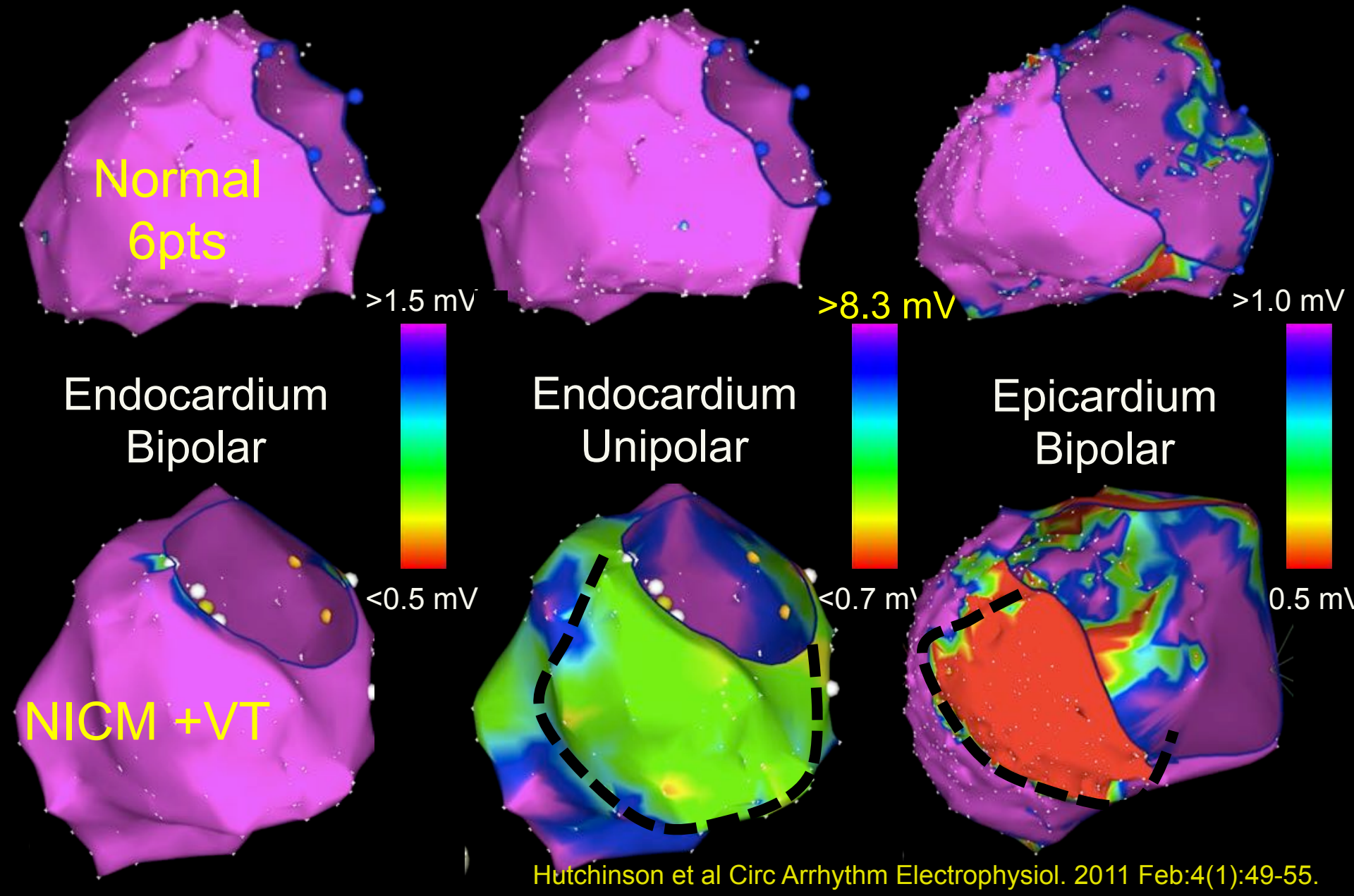

Hutchinson et al Circ Arrhythm Electrophysiol. 2011 Feb:4(1):49-55.

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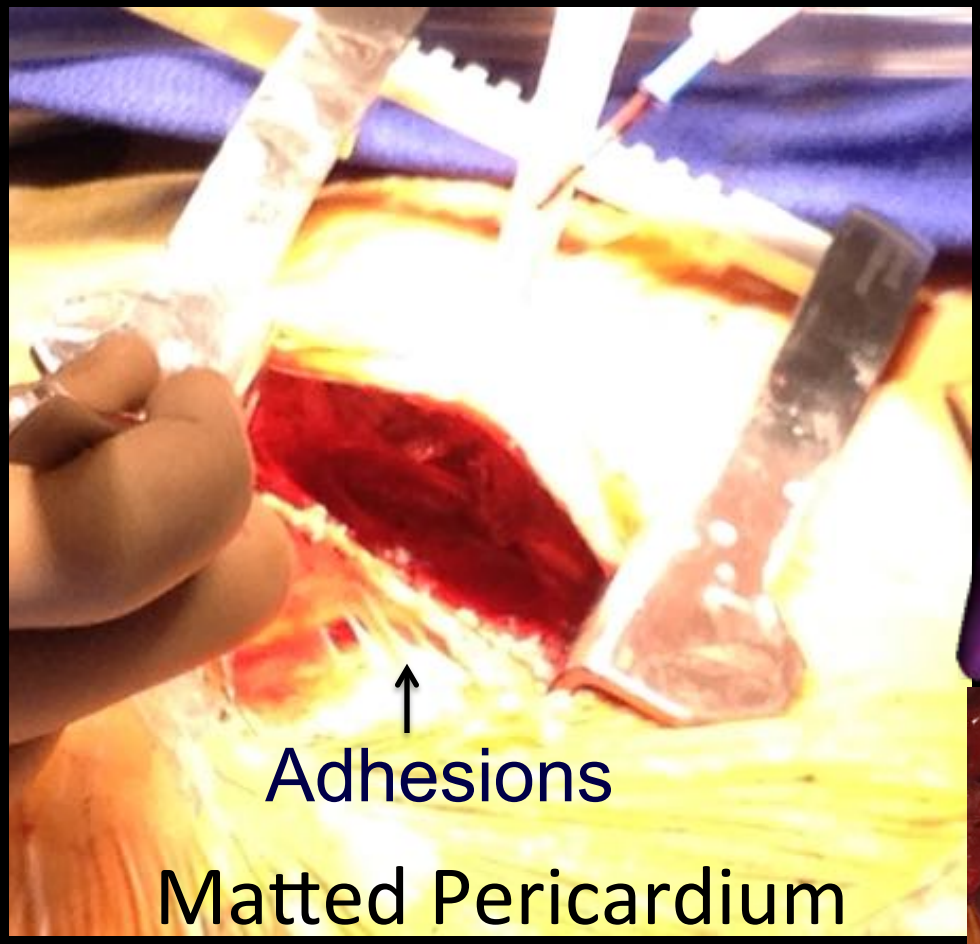
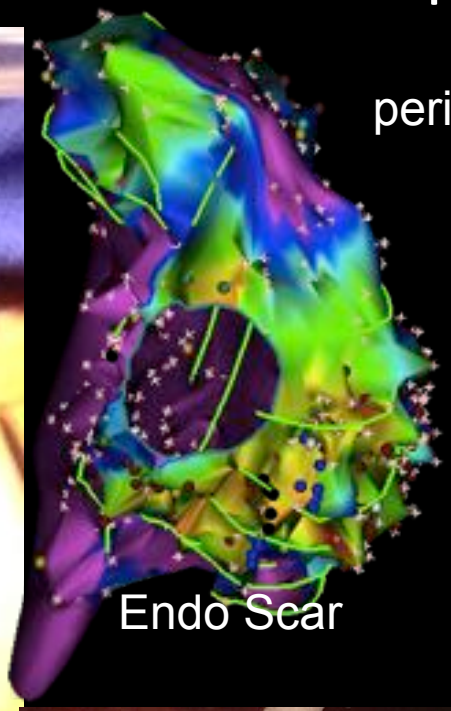
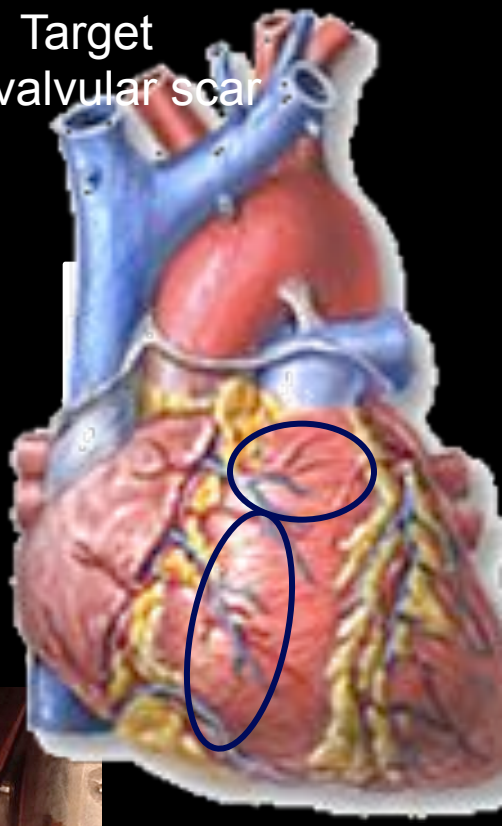
- Use Imaging/ECG/Unipolar Eg clues to identify EPI substrate /VT
- ? percutaneous EPI approach if prior hemopericardium/pericarditis
- Always have surgical backup when attempting epicardial

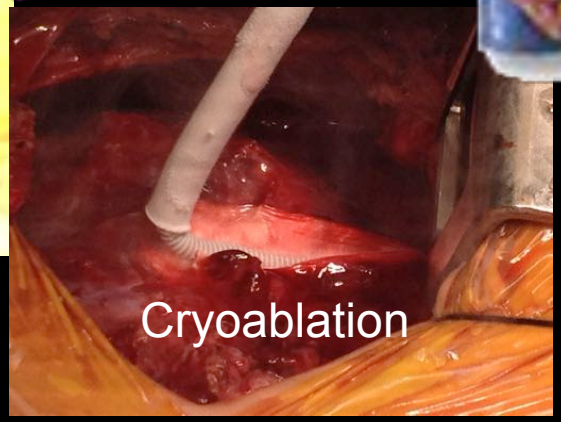
EPI Surgical CRYO Ablation after ENDO Catheter Ablation

History of Prior EPI Ablation with Hemopericardium







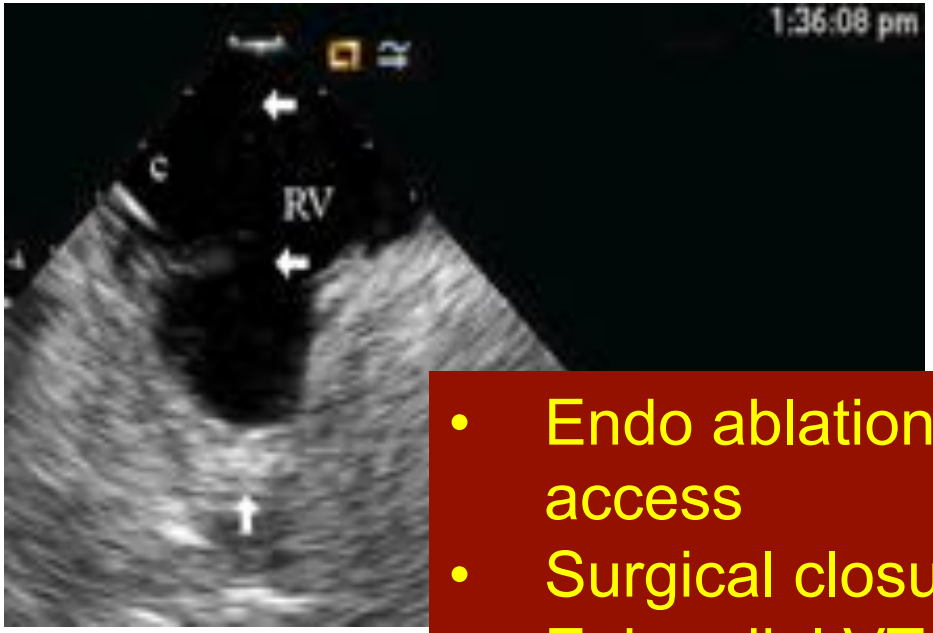


ARVC Ablation Strategy

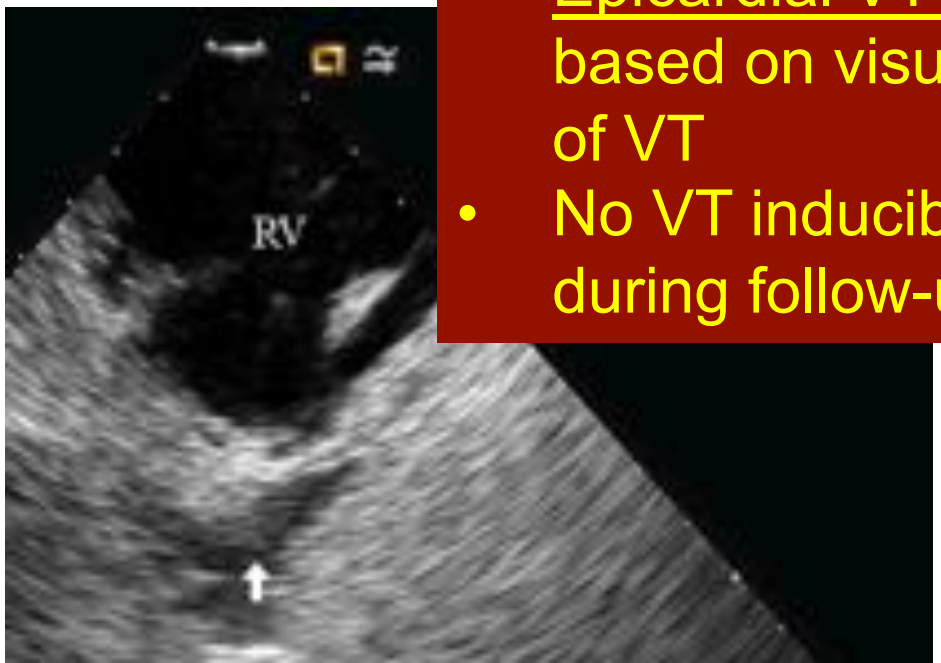
Cryoablaton targetting the RV free wall perivalvular Scar

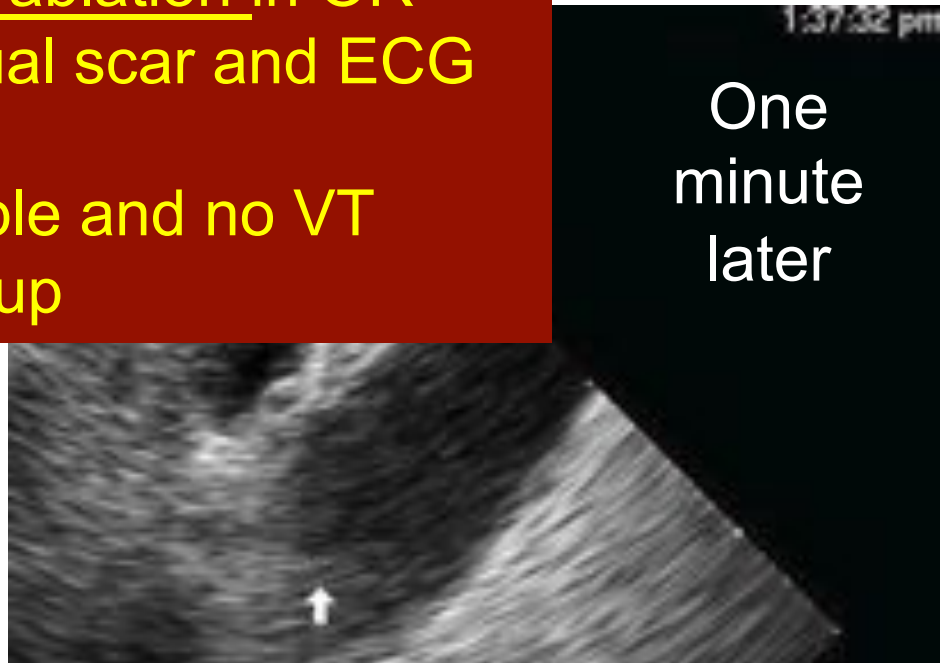
No inducible VT after surgery

Rapid Bleeding with Access – Surgical Backup



- Endo ablation before EPI access
- Surgical closure of laceration
- Epicardial VT ablation in OR based on visual scar and ECG of VT
- No VT inducible and no VT during follow-up





One minute later

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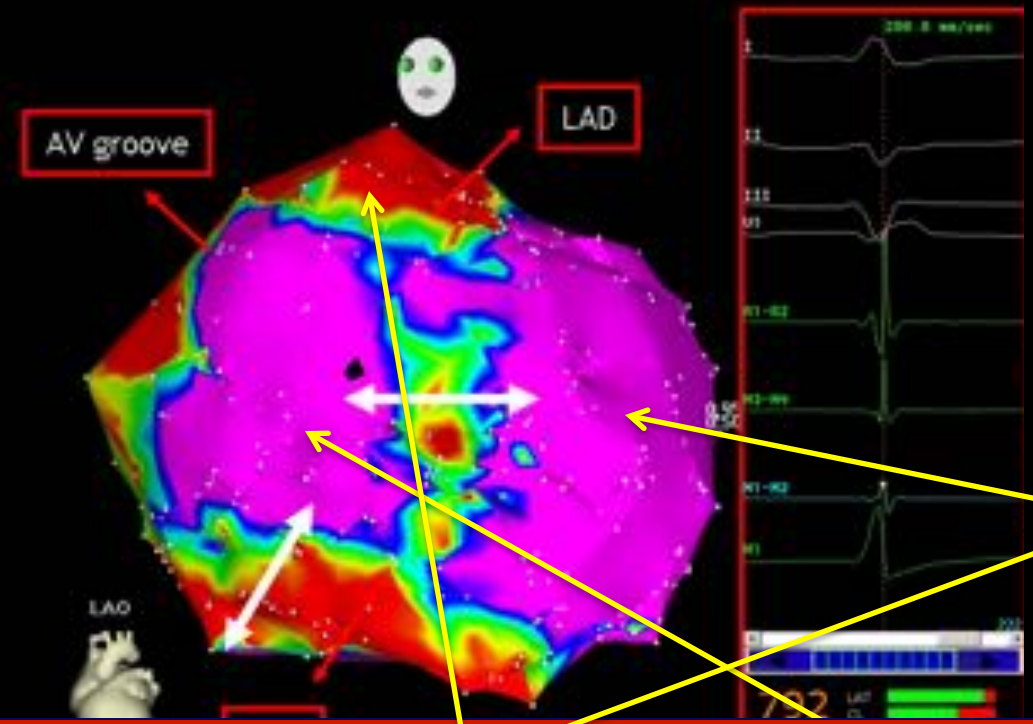
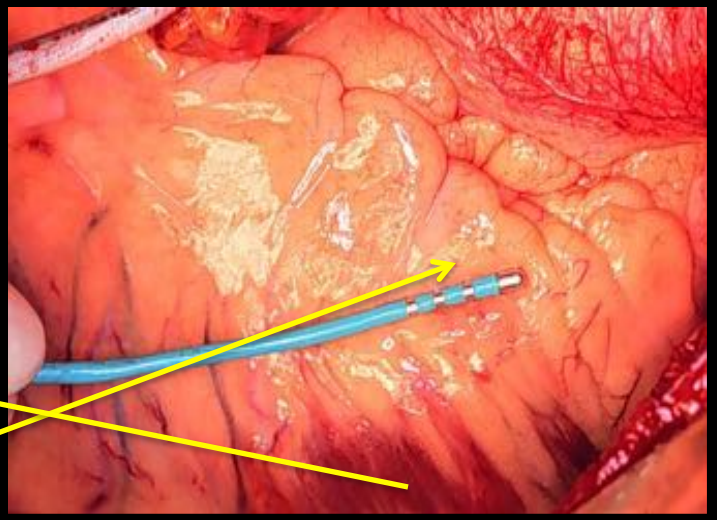
- ? percutaneous EPI approach if prior hemopericardium/pericarditis
- Always have surgical backup when attempting epicardial
- Pay attention to electrograms and not just voltage
- Make sure you identify and protect phrenic
- Prevent adhesions – if you need to revisit(steroids)

Epicardium Normal heart (8pts) – Low voltage (<1.0mV) – along coronaries and fat at acute angle of RV and LV apex





From Fat/Coronaries or Normal RV/LV

Low voltage (<1.0mV)common

Rare - Wide Egs > 80mS – 2.2%

Split Egs - 0.9%

Late Potentials – 0%

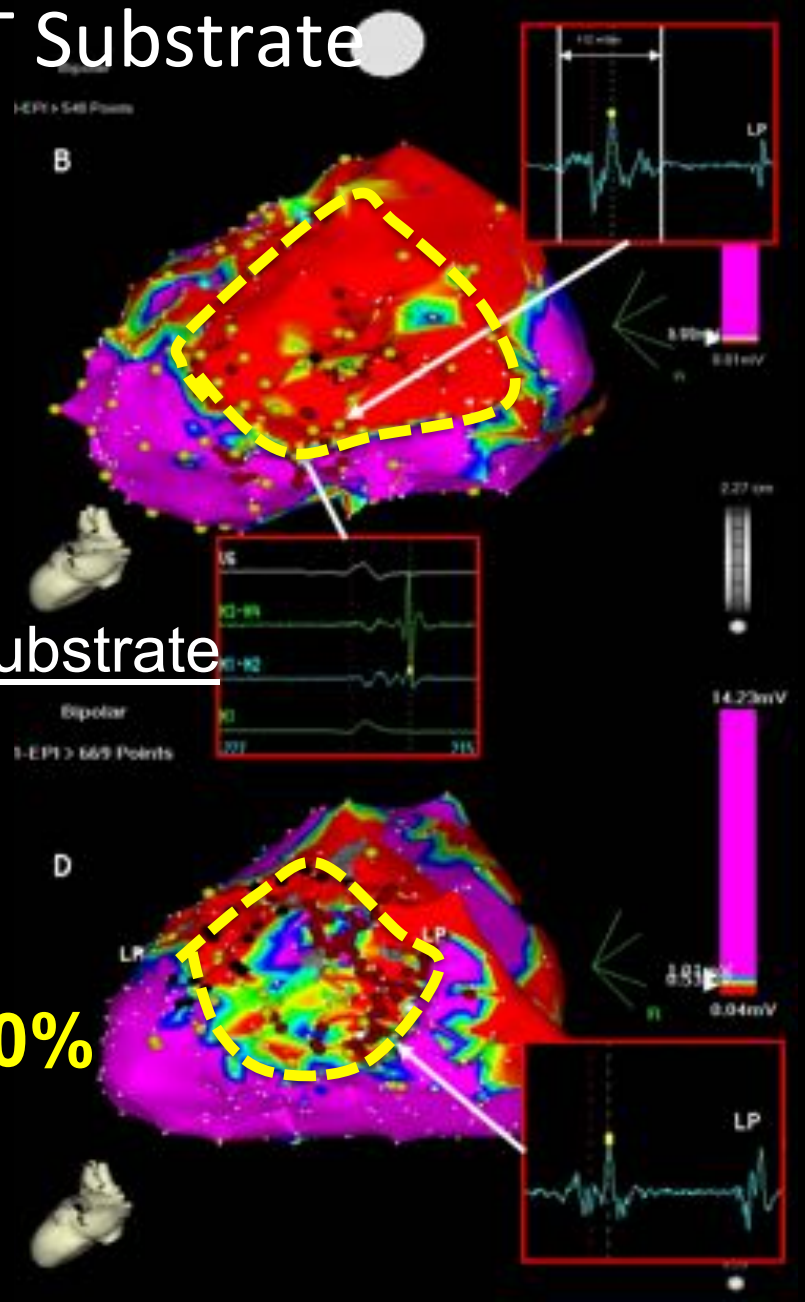
Wide, Split or Late - >2.3%

95% of signals ***>1.0mV*** from rest of EPI – voltage cutoff for normal RV/LV EPI

Cano et al JACC 2009;54:799-808

Epicardium LVCM and EPI VT ORIGIN (18pts)
Abnormal EPI = VT Substrate

Basal lateral sizable (56.7 ± 33.1 cm^2)confluent scar (< 1.0mV)
away from coronaries



Electrogram Characteristics in VT Substrate

- Wide Egs > 80ms - 27.5%
- Split Egs – 33.0%
- Late Potentials – 25.8%
- **Wide, Split or Late - 50% (minimum – 20%)**

Cano et al JACC 2009;54:799-808

Epicardial bipolar voltage (0.5-1.0 mV)

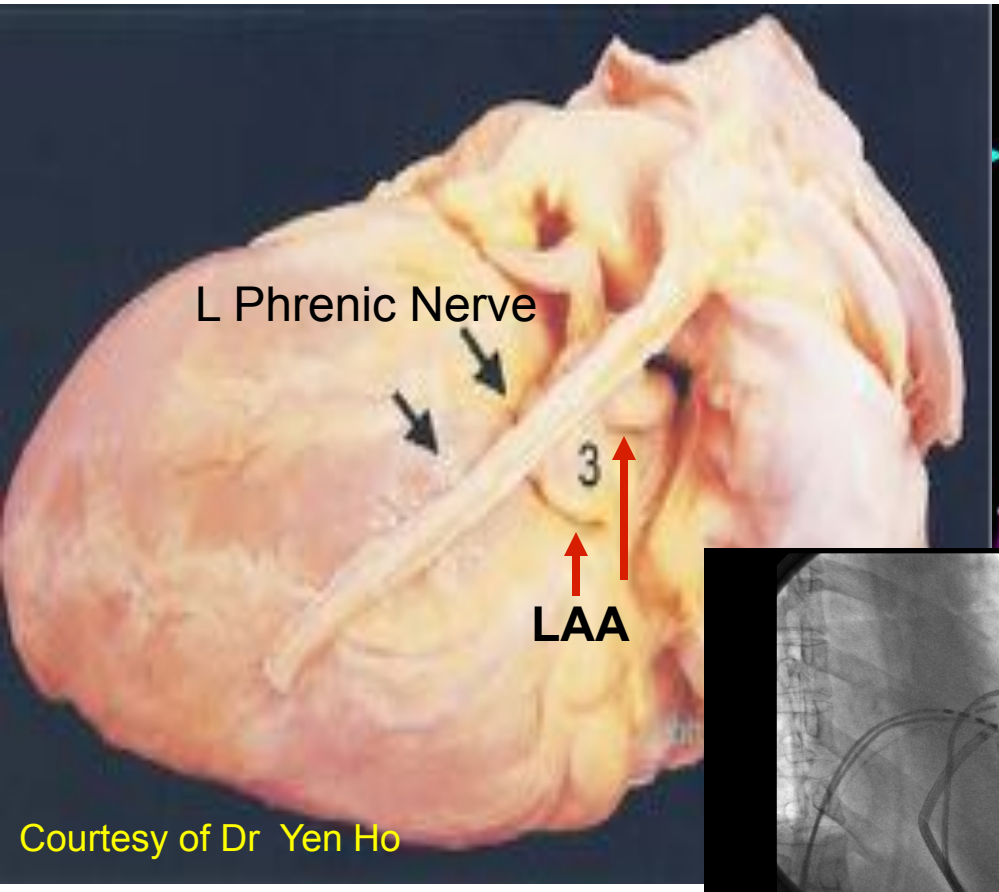
Epicardial bipolar voltage (0.5-2.9 mV)

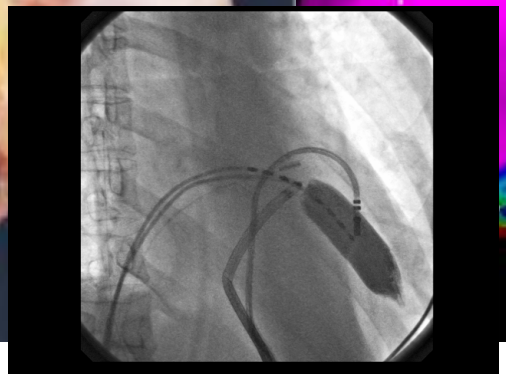
Patchy Scar – May create larger amplitude but still abnormal Egs

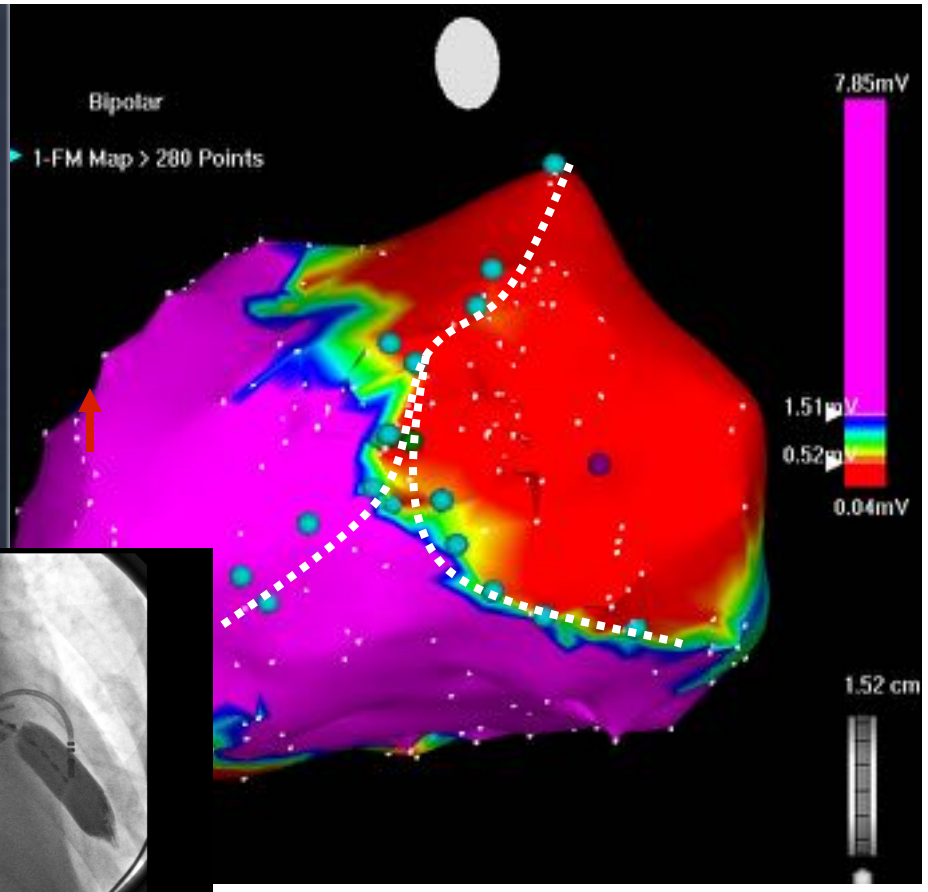
Patchy Scar

COURSE OF LEFT PHRENIC NERVE OVER LEFT VENTRICLE

EPICARDIAL VOLTAGE MAP



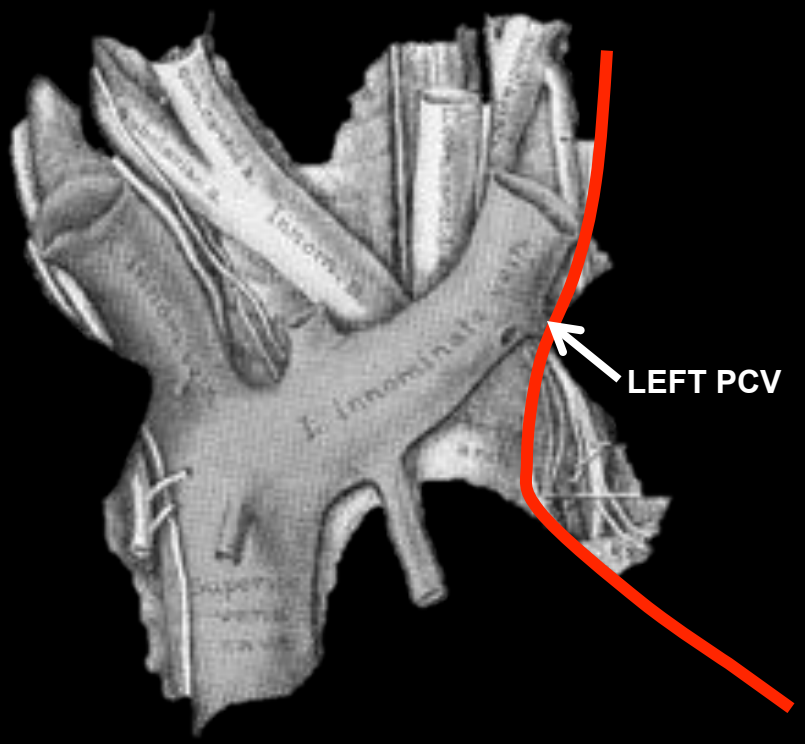




Fan et al Heart Rhythm 2009; 6(1): 59-64

Stimulation of phrenic nerve

Monitoring for Left PN injury During LV EPI Ablation by Pacing L Phrenic at L Subclavian



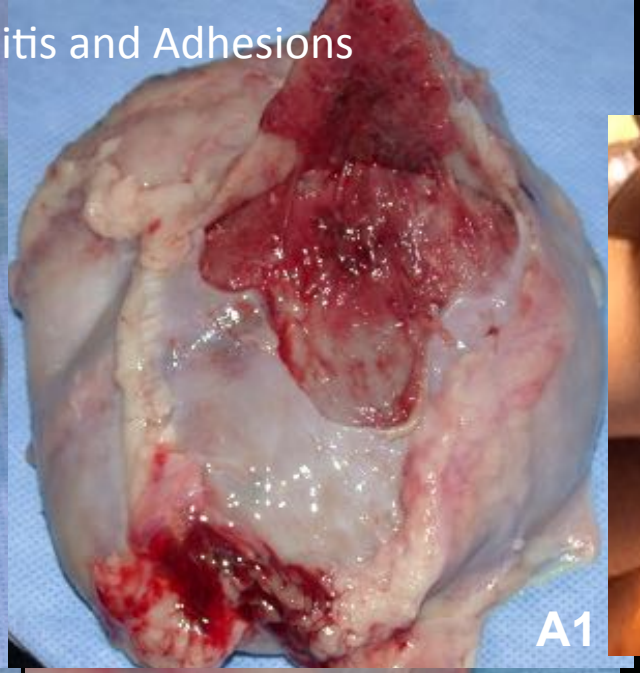
Santangeli P, MD; Marchlinski, F M D Circ Arrhythm Electrophysiol. 2015;8:241-242

Pericarditis and Adhesions

Adhesions in OR

Control

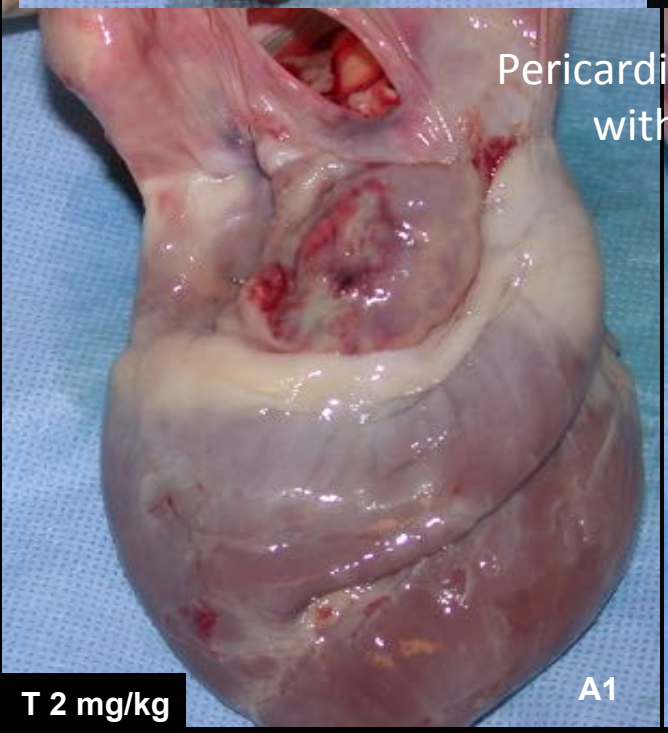
A



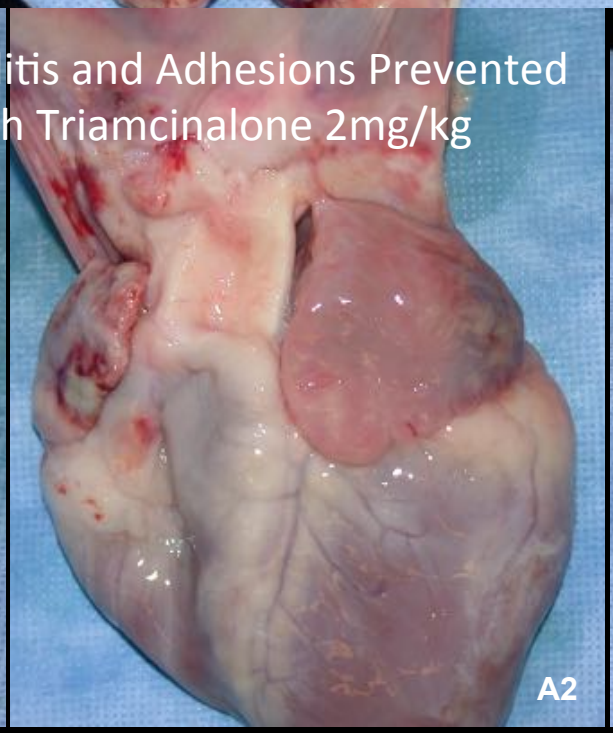
A1

Pericarditis and Adhesions Prevented with Triamcinalone 2mg/kg

T 2 mg/kg



A1



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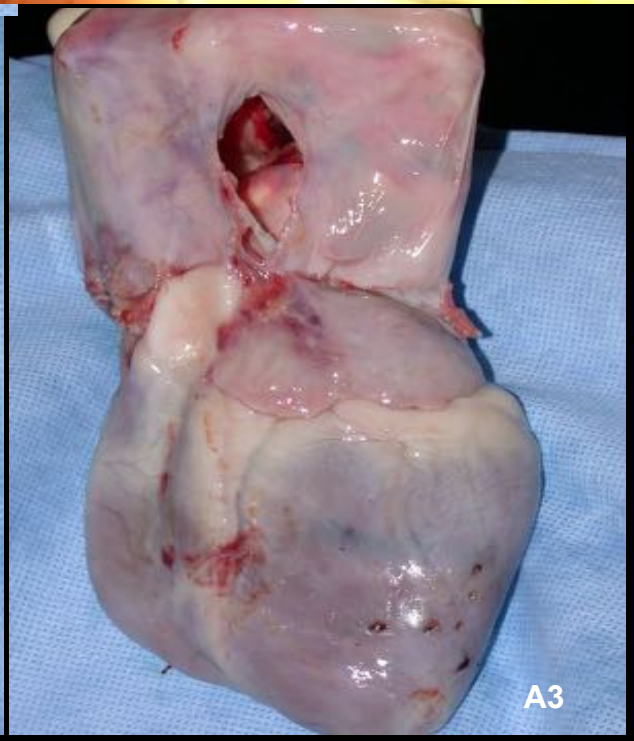

A3

Courtesy of Dr. Andre d 'Avilla

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