




October 16 - 18  
14<sup>th</sup> EDITION 2015

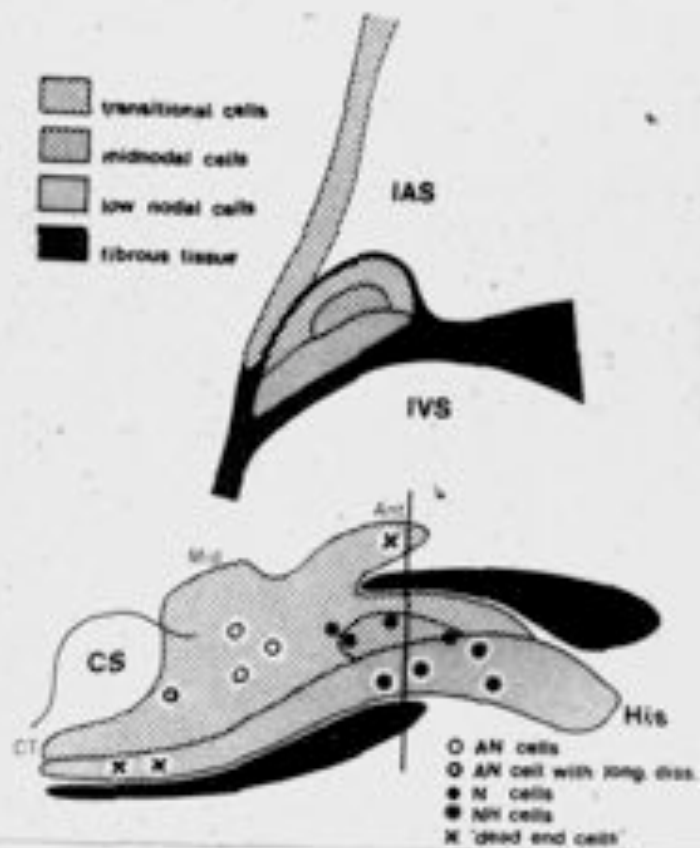
# MY CONFLICTS OF INTEREST ARE

**Honoraria from St. Jude, Medtronic, Boston  
Scientific, Biotronik for lectures**

 The image cannot be displayed. Your computer may not have enough memory to open the image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.

# VARIANTS OF AV JUNCTIONAL RHYTHMS

1. Typical AVNRT
2. Atypical AVNRT
3. Septal A.P.
4. Nodo-fascicular pathway
5. Para-hisian AT
6. Focal junctional tachycardia  
(J.E.T., A.J.T.)



CHILDERS, R. Prog. CV Dis. 19:361, 1977.

Fast-slow AVNRT

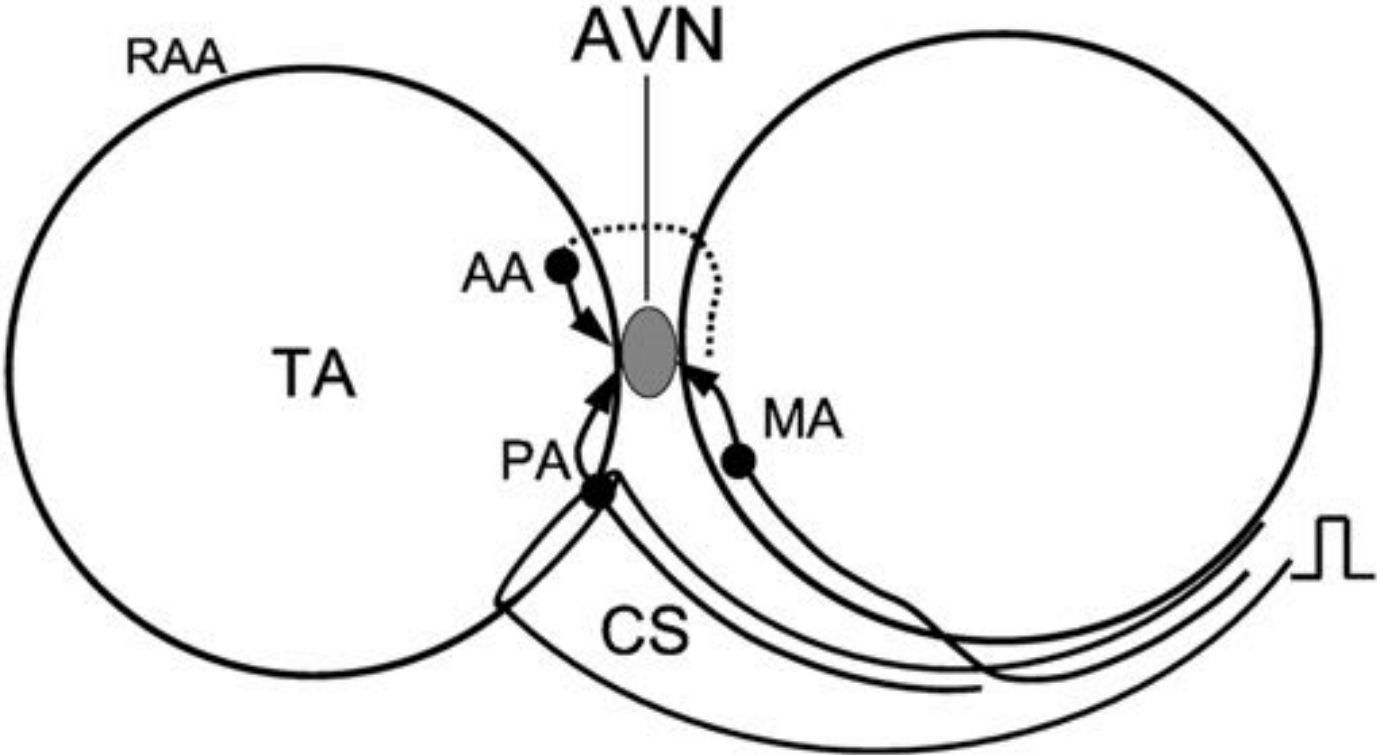
FO

CS

TV



**Schematic representation in the left anterior oblique projection of 3 potential inputs (dots) to the AV node (AVN) during distal coronary sinus stimulation**



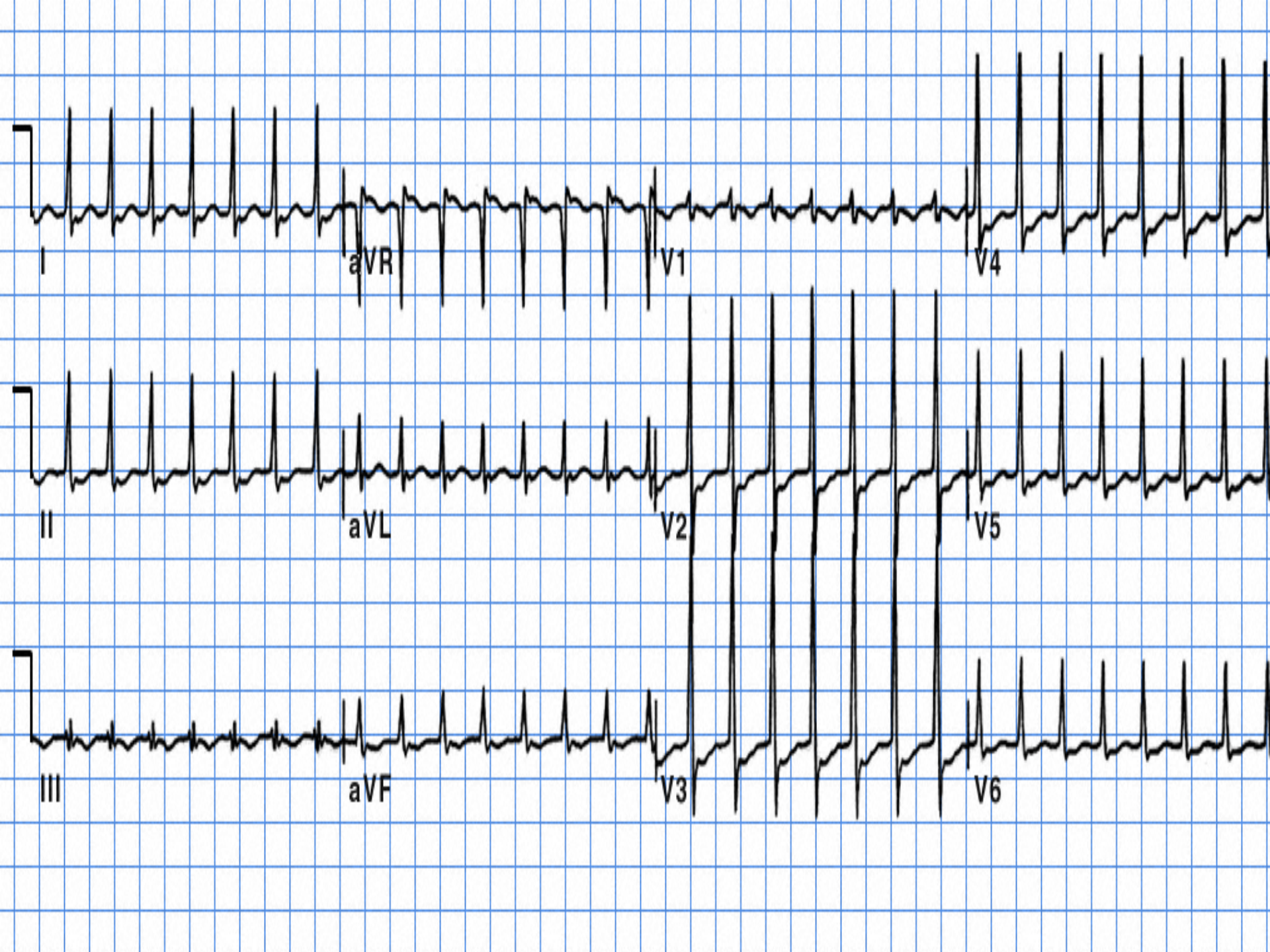
Gonzalez, M. D. et al. *Circulation* 2002;106:2930-2934

# AVNRT Possible Circuits

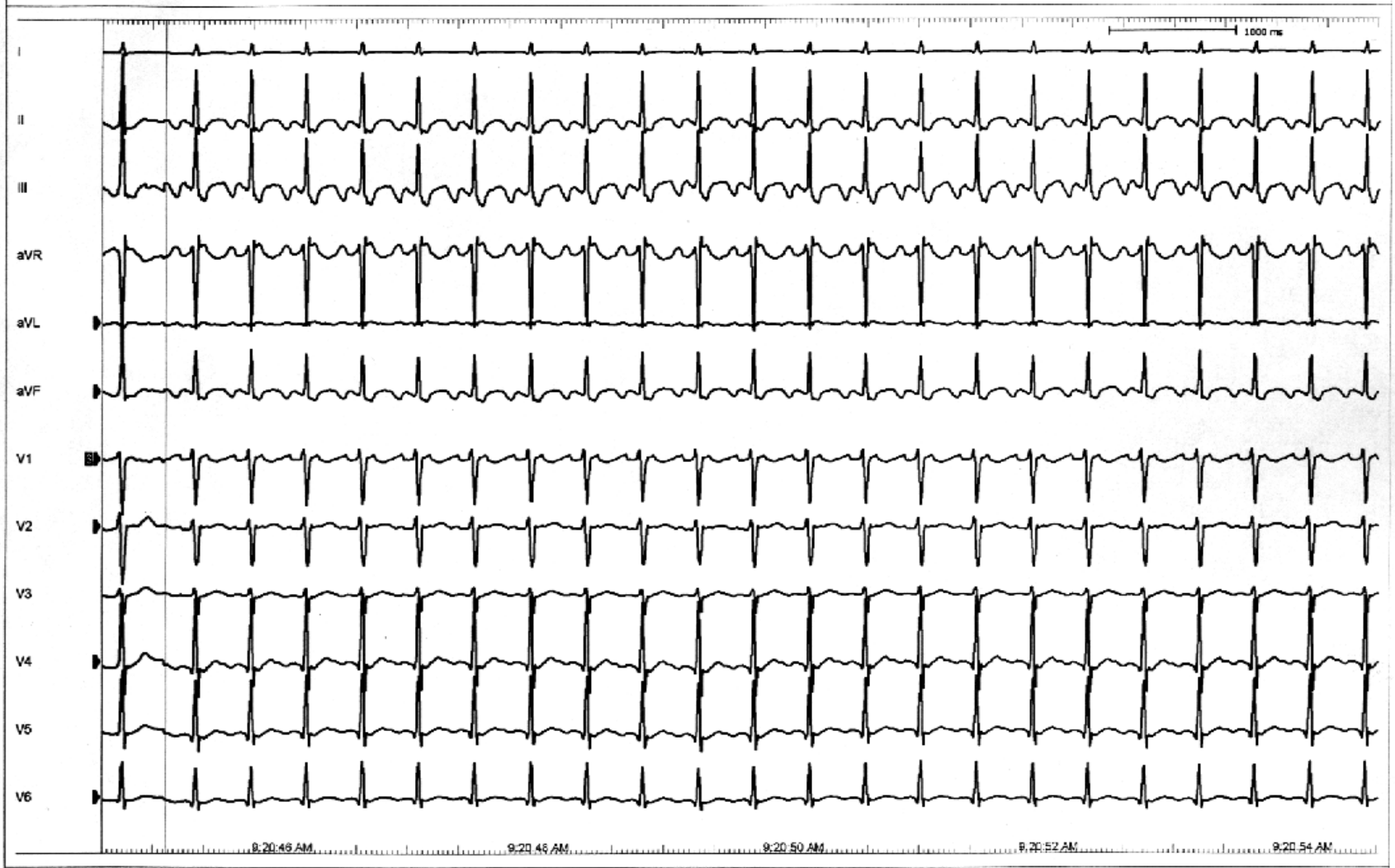
1. Solely RA
2. LA with typical SP involvement
5. LA involving LA or CS muscle without involvement of SP
6. H-A fibers
7. Involves both inferior extensions

# Types of AVNRT

1. Classic slow-fast
2. Atypical fast-slow
3. Slow-slow

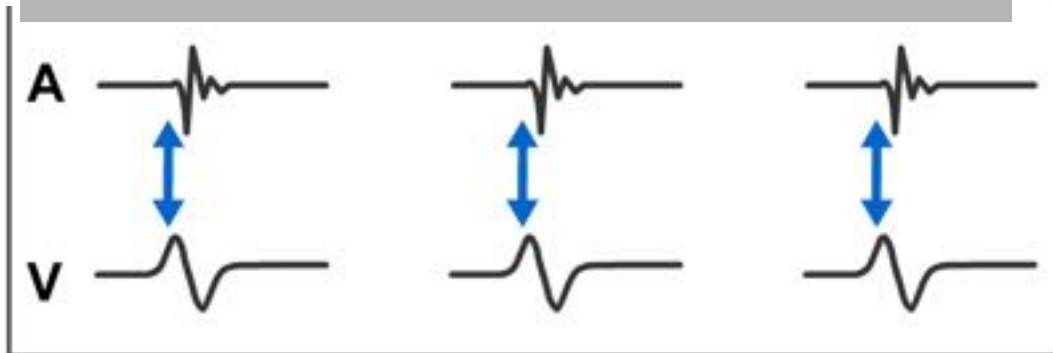
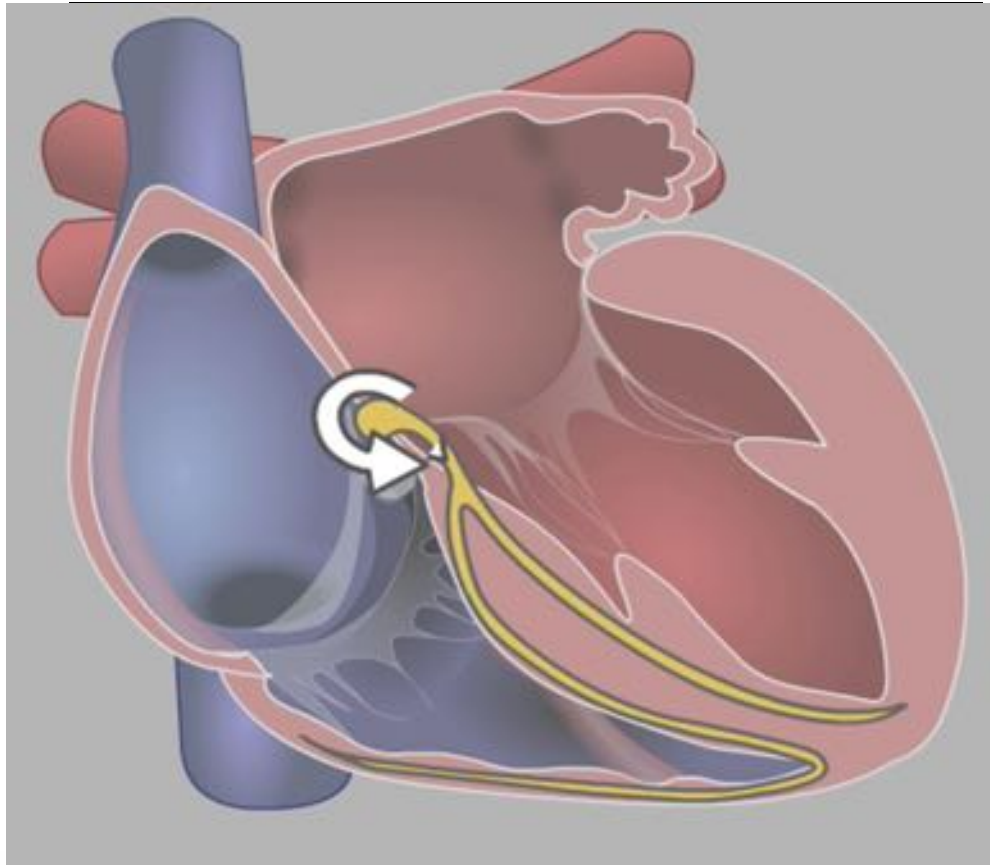




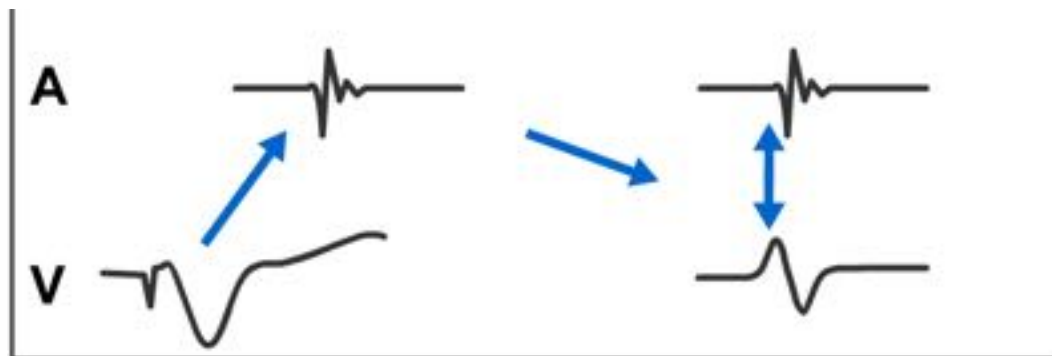
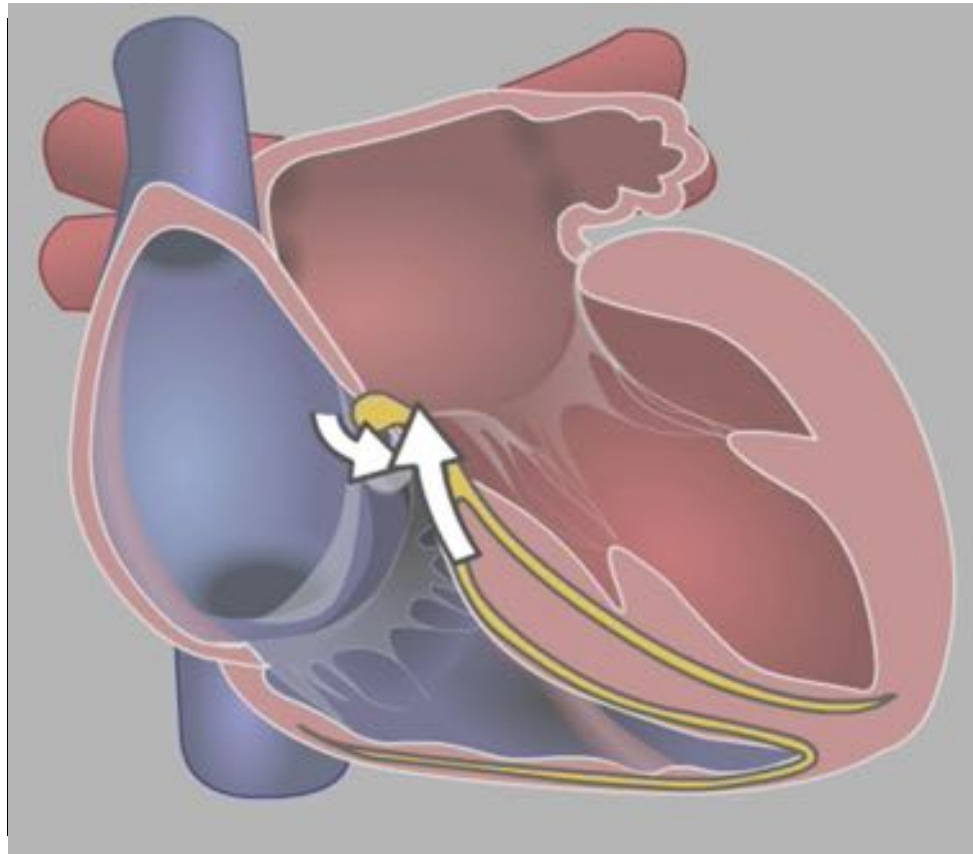


(2)

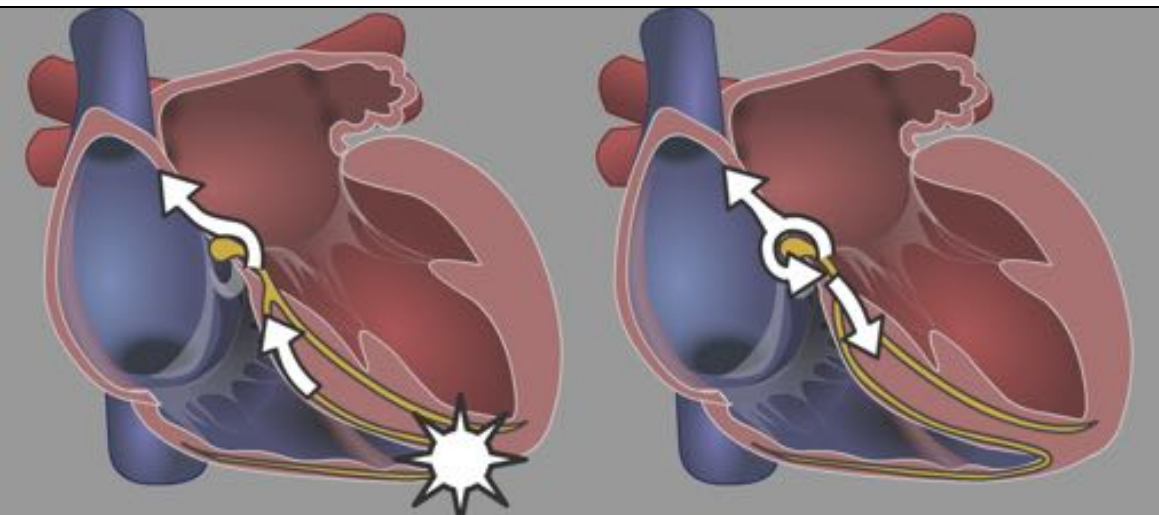
# AVNRT



# AVNRT - Pacing Termination



# Stim-A minus V-A in tachycardia

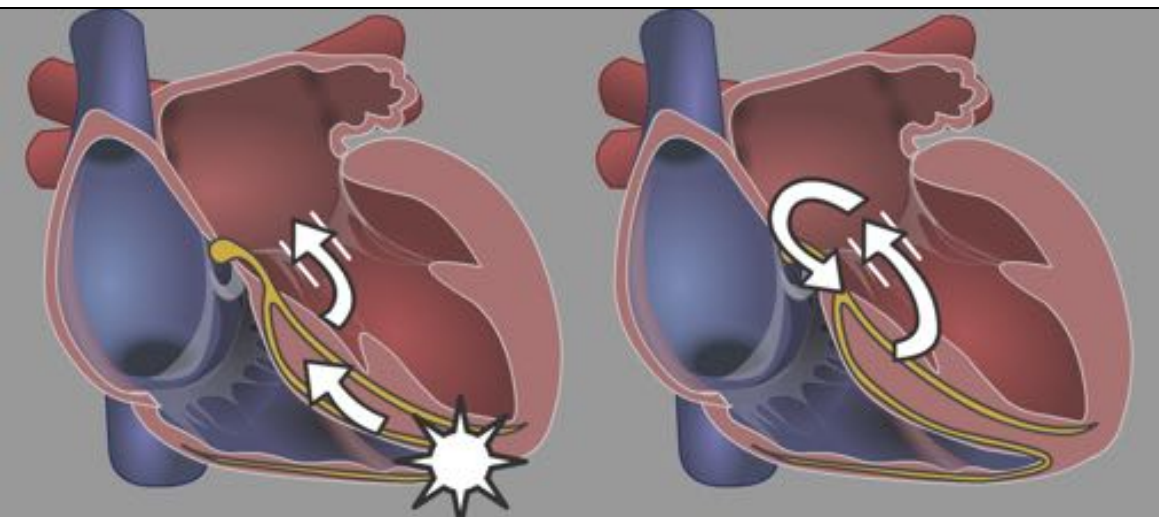


AVNRT: V Stim

Tachycardia

$$\begin{array}{r} \text{AVNRT} \\ \hline \underline{\text{V Stim}} \quad \underline{\text{Tach}} \\ \text{V-A} \quad > \quad \text{V-A} \\ \hline \end{array}$$

Stim-A minus V-A  
**> 85 msec**



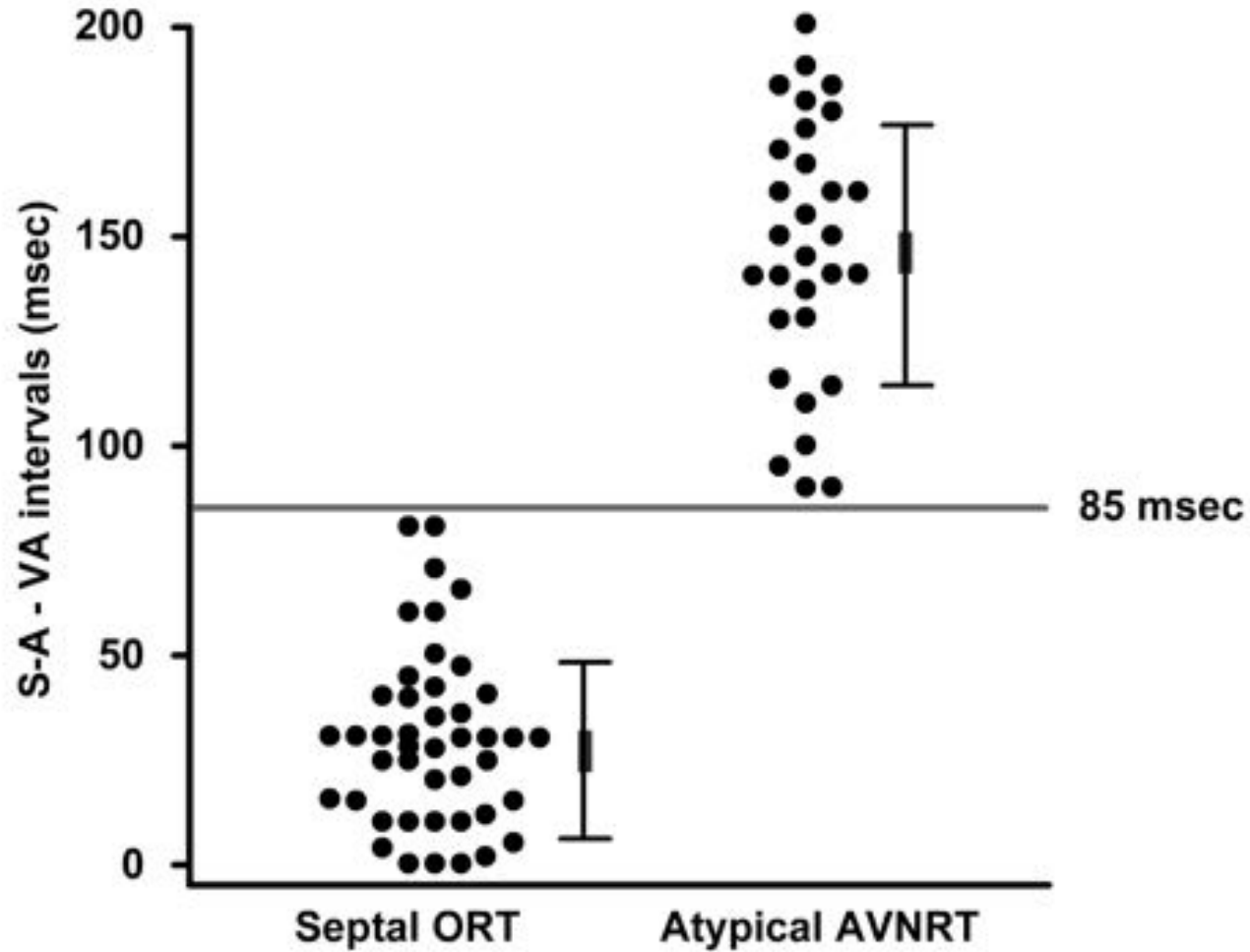
AVRT: V Stim

Tachycardia

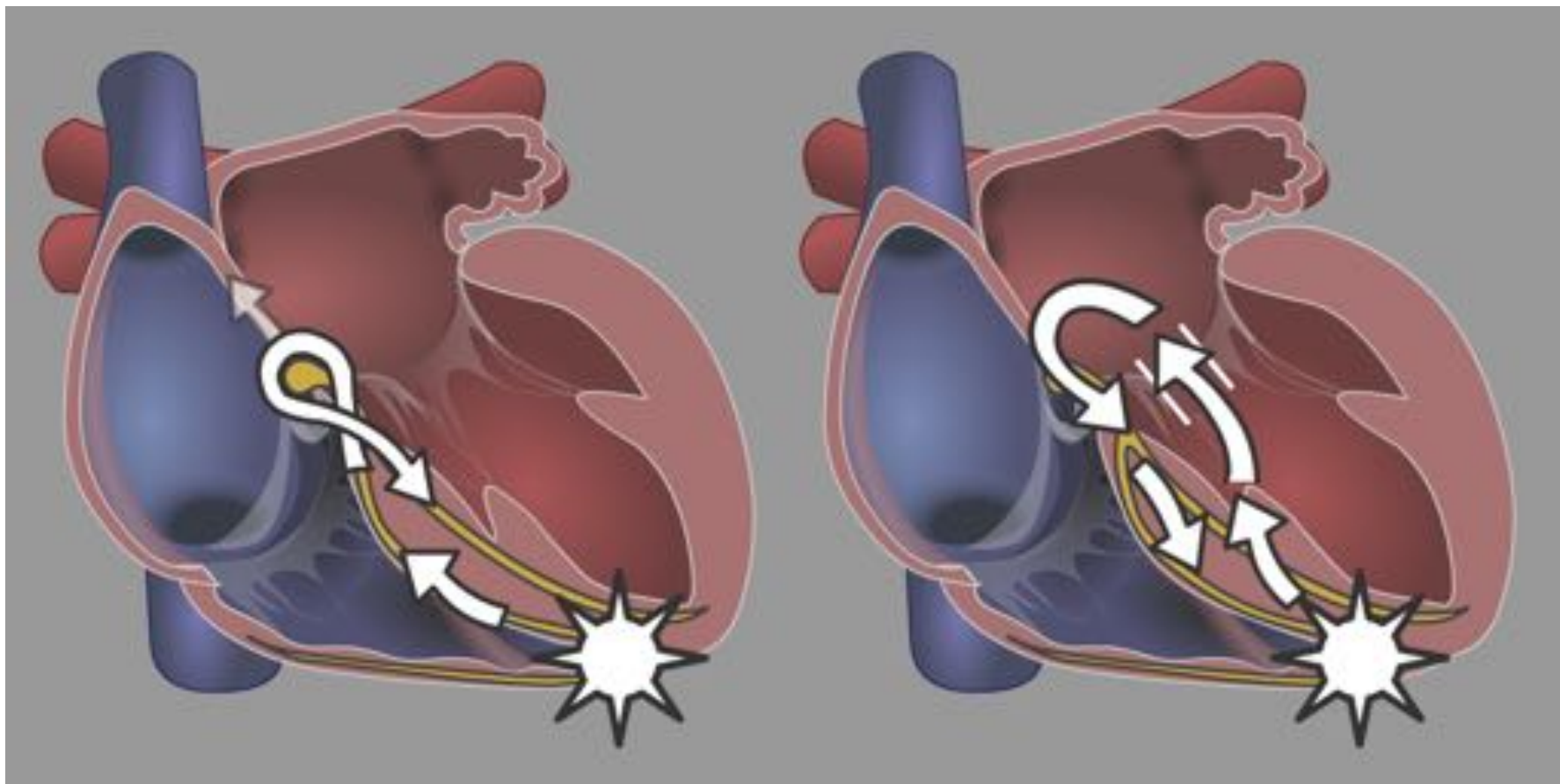
$$\begin{array}{r} \text{AVRT} \\ \hline \underline{\text{V Stim}} \quad \underline{\text{Tach}} \\ \text{V-A} \quad < \quad \text{V-A} \\ \hline \end{array}$$

Stim-A minus V-A  
**< 85 msec**

# Stim-A minus V-A



# Post Pacing Interval (PPI) minus TCL



## AVNRT

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- RV apex farther from circuit
- PPI minus TCL > **115 msec**

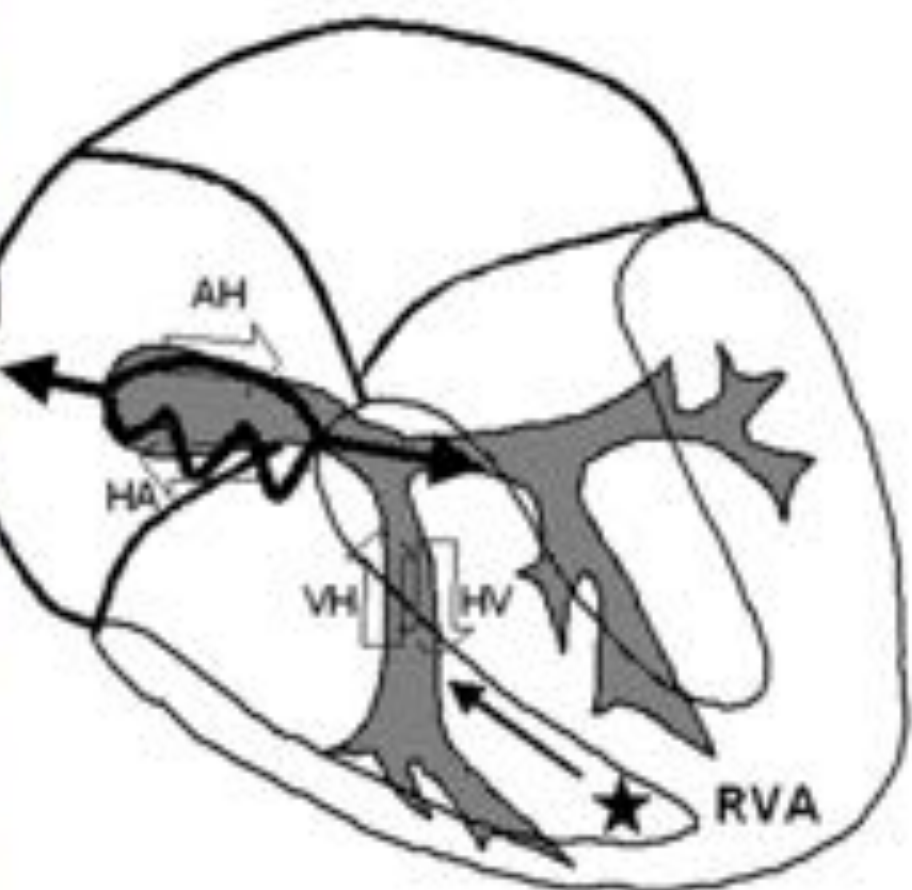
## AVRT

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- RV apex closer to circuit
- PPI minus TCL < **115 msec**



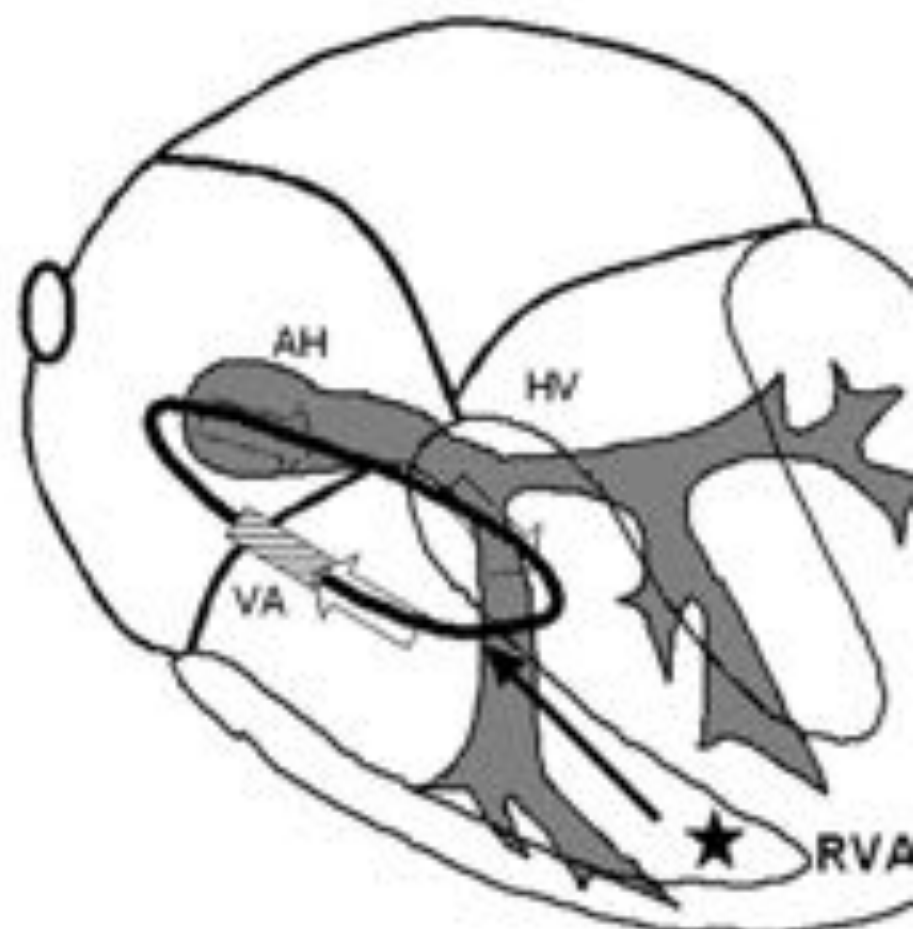
### AVNRT



CL (Ent)=AH+HV+VH+HA

PPI-TCL > 110 ms

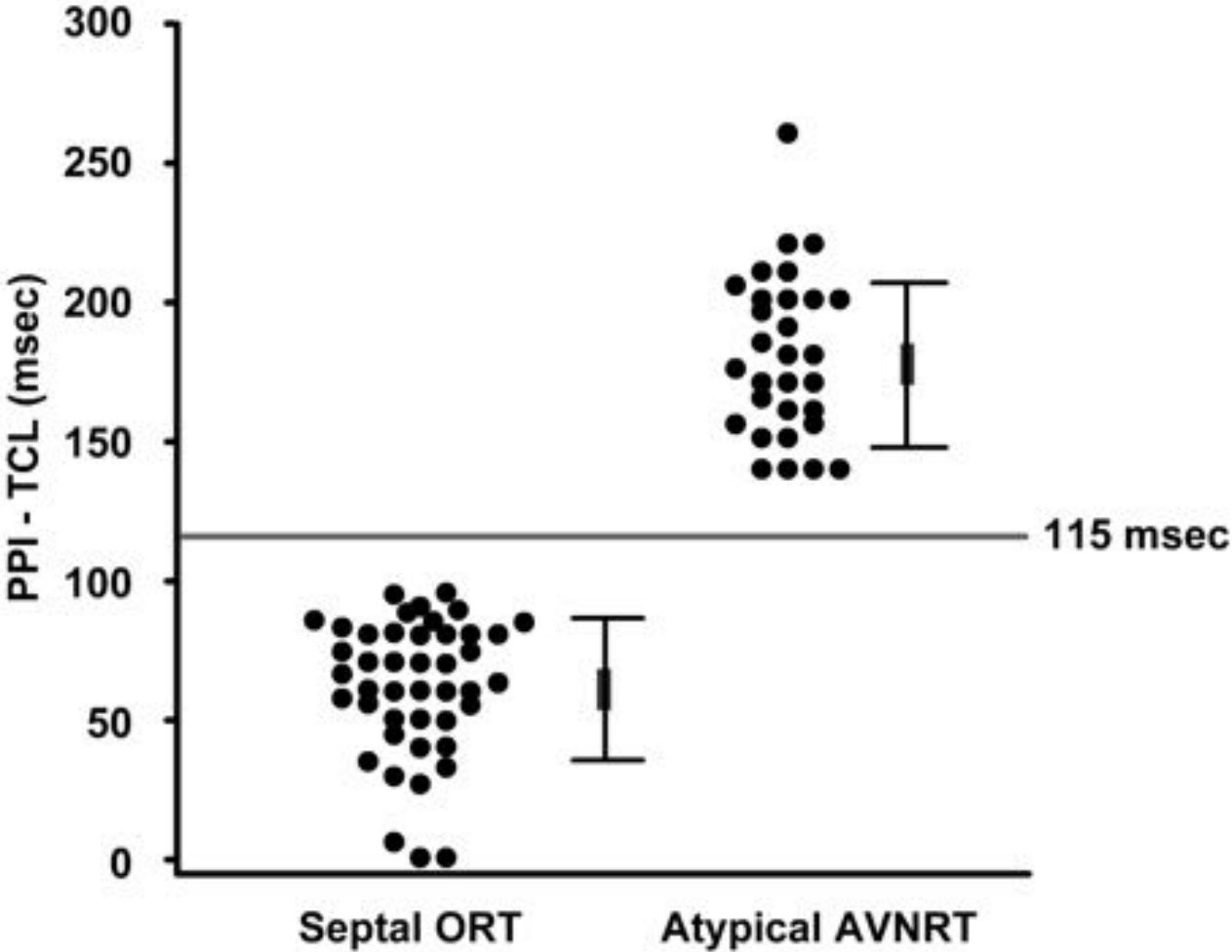
### ORT



CL (Ent)=AH+HV+VA

PPI-TCL < 110 ms

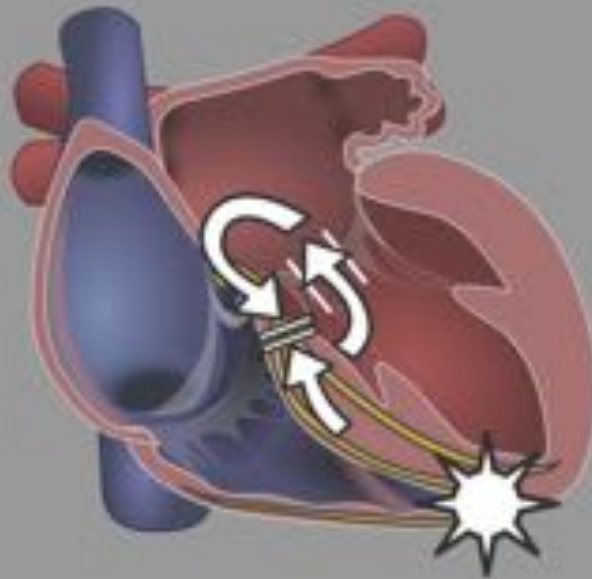
# PPI minus TCL





# “V on His” = His-refractory PVC

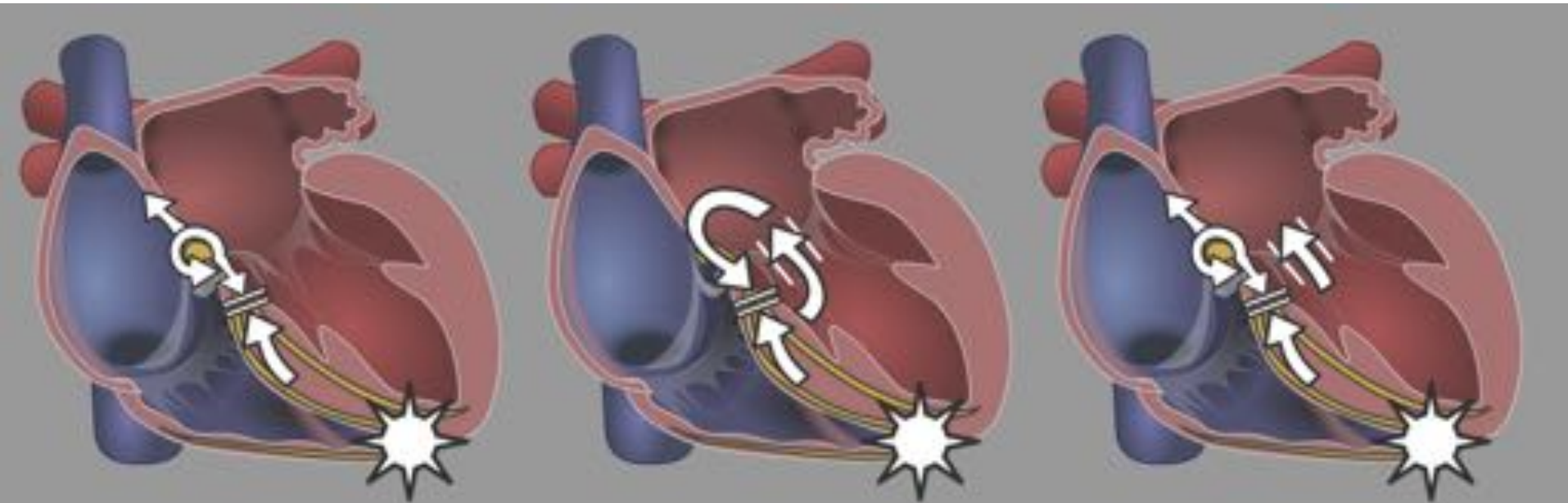
AVNRT	AVRT	AVNRT w/ bystander
→ No change in next A	→ Advances <b>or</b> delays next A	→ Advances next A



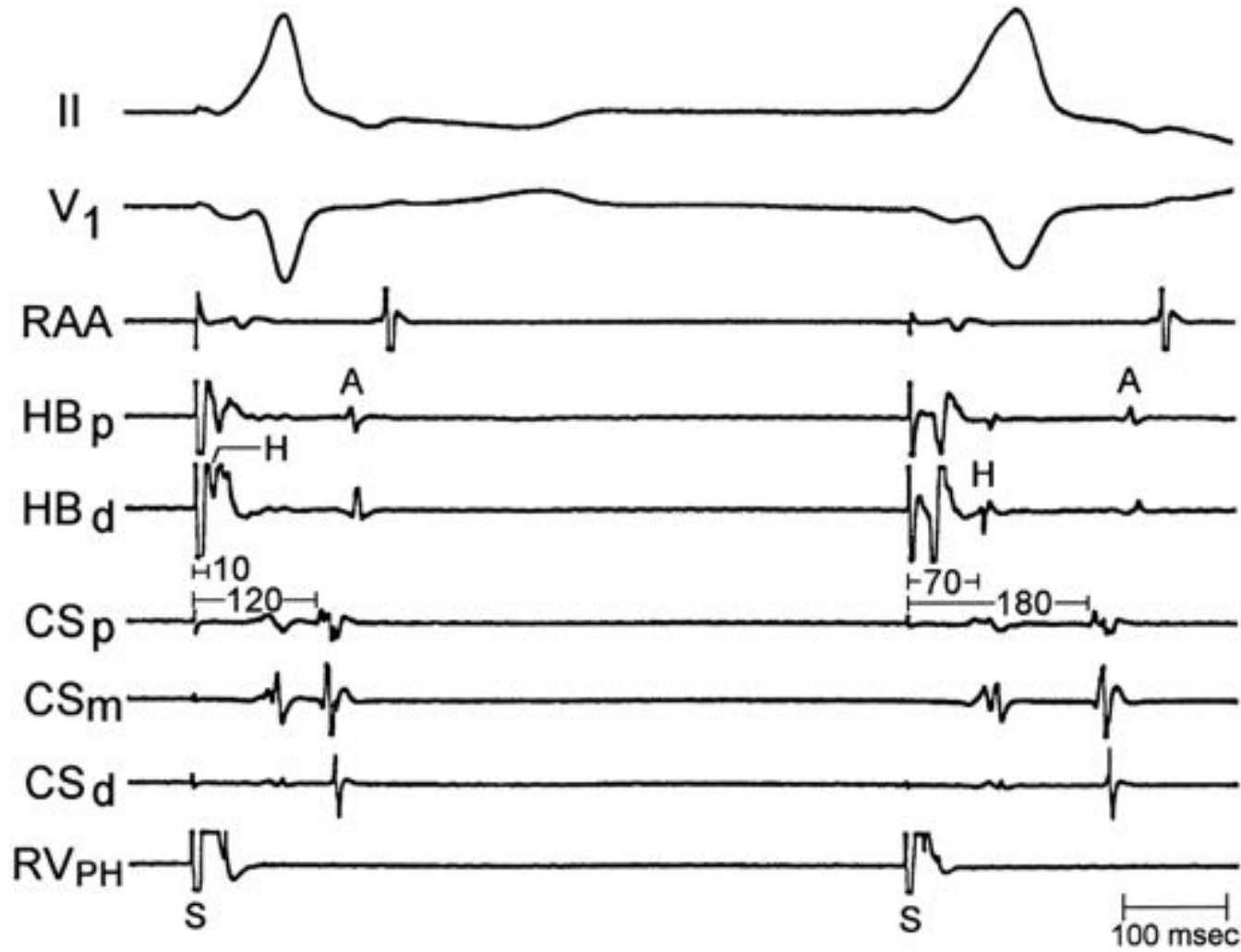
# “V on His” = His-refractory PVC

## Possible observations regarding the timing of the next A:

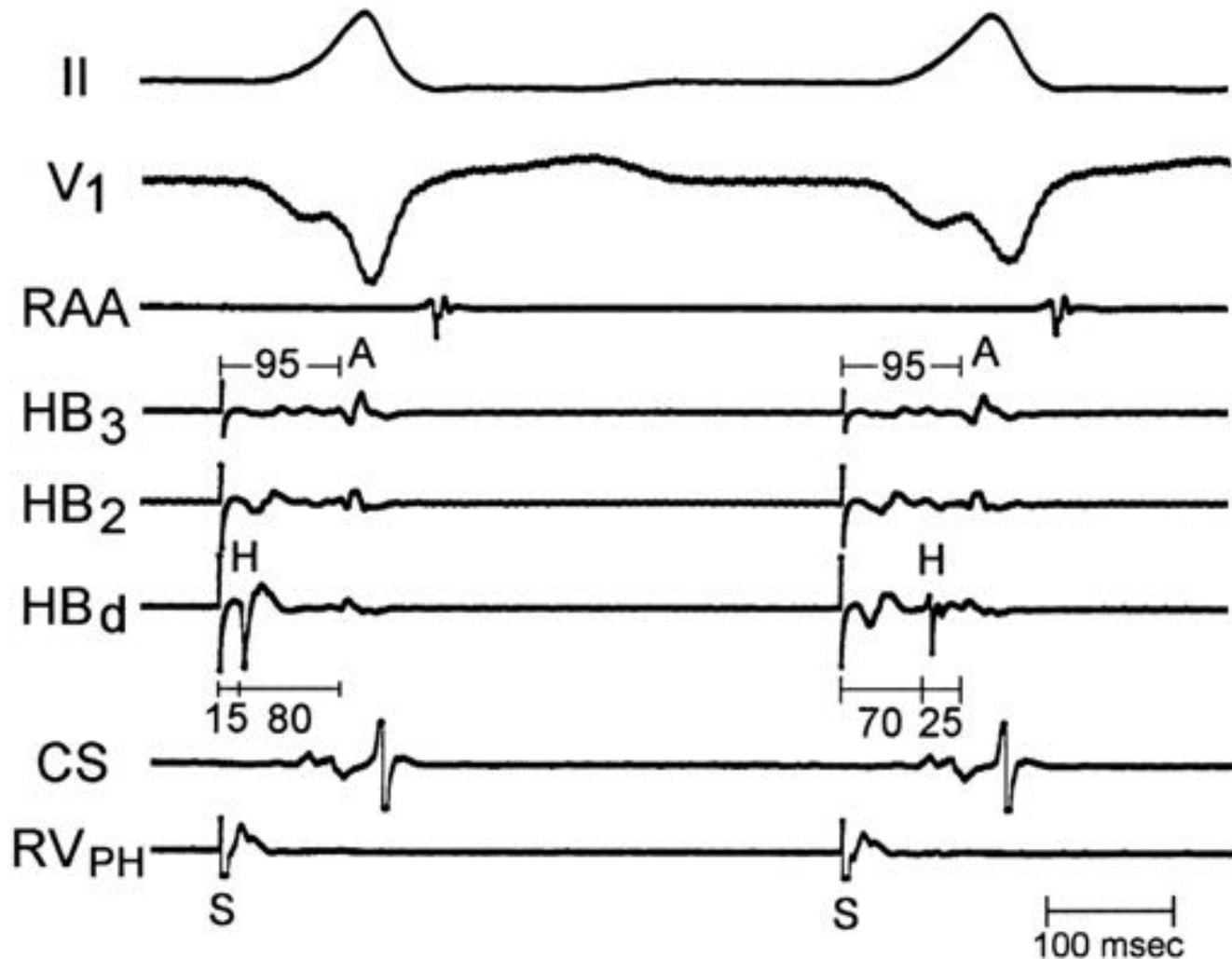
1. No change → doesn't help you
2. Advances next A → confirms presence of pathway, not AVRT
3. Terminates tachycardia without ensuing A → confirms AVRT
4. Delays next A → confirms AVRT



# Para-Hisian pacing demonstrating retrograde conduction over the slow AV nodal pathway



# Para-Hisian pacing demonstrating retrograde conduction over Anteroseptal AP



# **A on V Tachycardia**

1. Slow-fast AVNRT
2. Atrial tachycardia
3. Focal junctional tachycardia
4. Concealed nodofascicular
5. Excludes AV reentry pathway

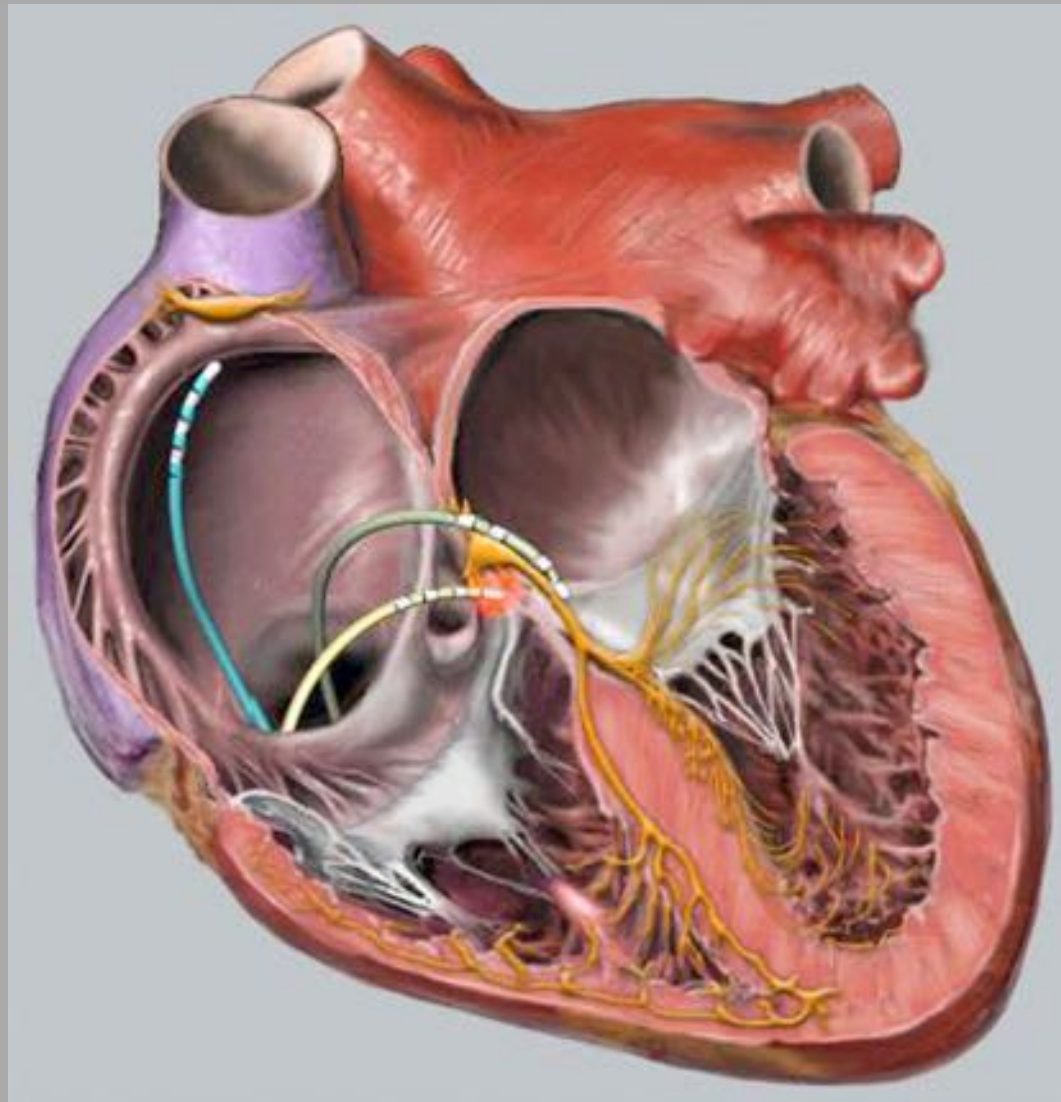
# Characteristics of S-F AVNRT

1. Dual pathways with critical AH for echo beats
2. Usually induced by atrial pacing
3. VA is hooked,  $\Delta H-H$  drives  $\Delta AA$
4. Spontaneous termination with A block in slow pathway
5. VAV response after entrainment
6. ( PPI- TCL >115 ms)
7. Premature V terminates tachycardia without affecting A

# Characteristics of Atypical AVNRT

1. Negative P waves in 2,3,F and V<sub>6</sub>, positive in V<sub>1</sub> (short duration)
2. Usually initiated by ventricular pacing
3. PPI-TCL > 115 ms, S-VA-VAT => 85 ms
4. V on His no effect on succeeding A
5. Parahisian pacing (SVT) to exclude septal AP

# Ablation of Slow Pathway



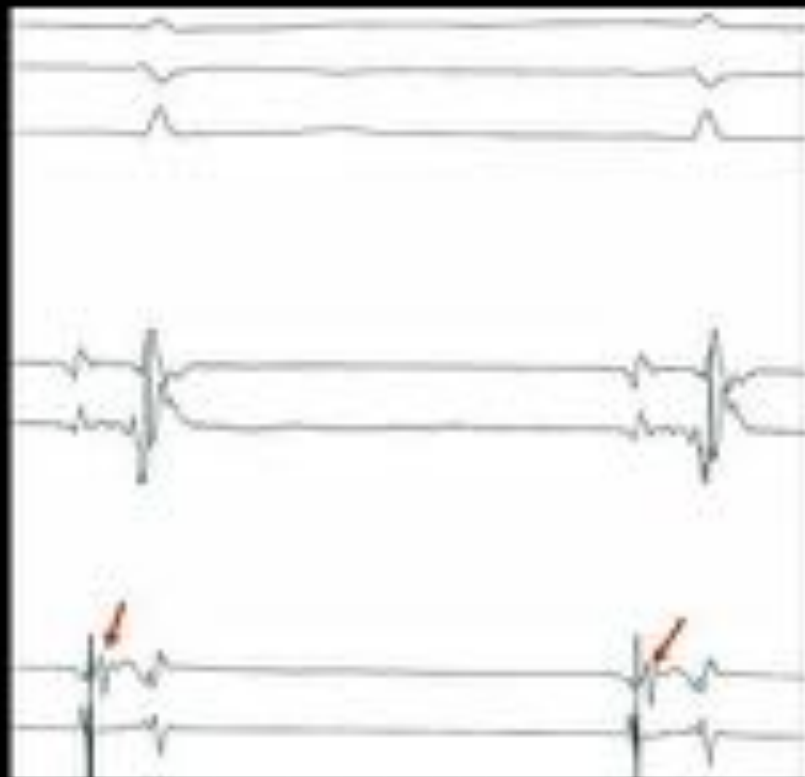


# DIFFICULT AVNRT ABLATION

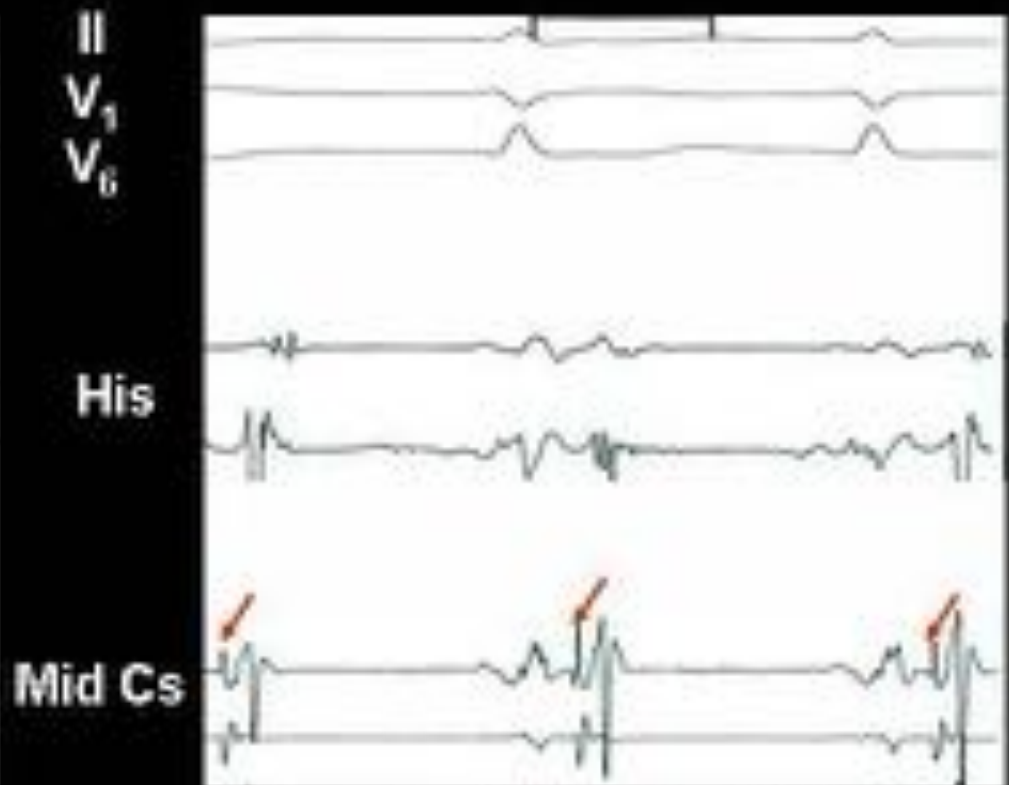
Start low ( level of CS os/stay septal!

1. Ablation dangerously close to His bundle. Use cryoablation
2. .Slow Pathway only  
(retrograde fast pathway ablation)
3. Look for potentials in the CS.
4. Look for eccentric CS atrial activation.

# CS potential

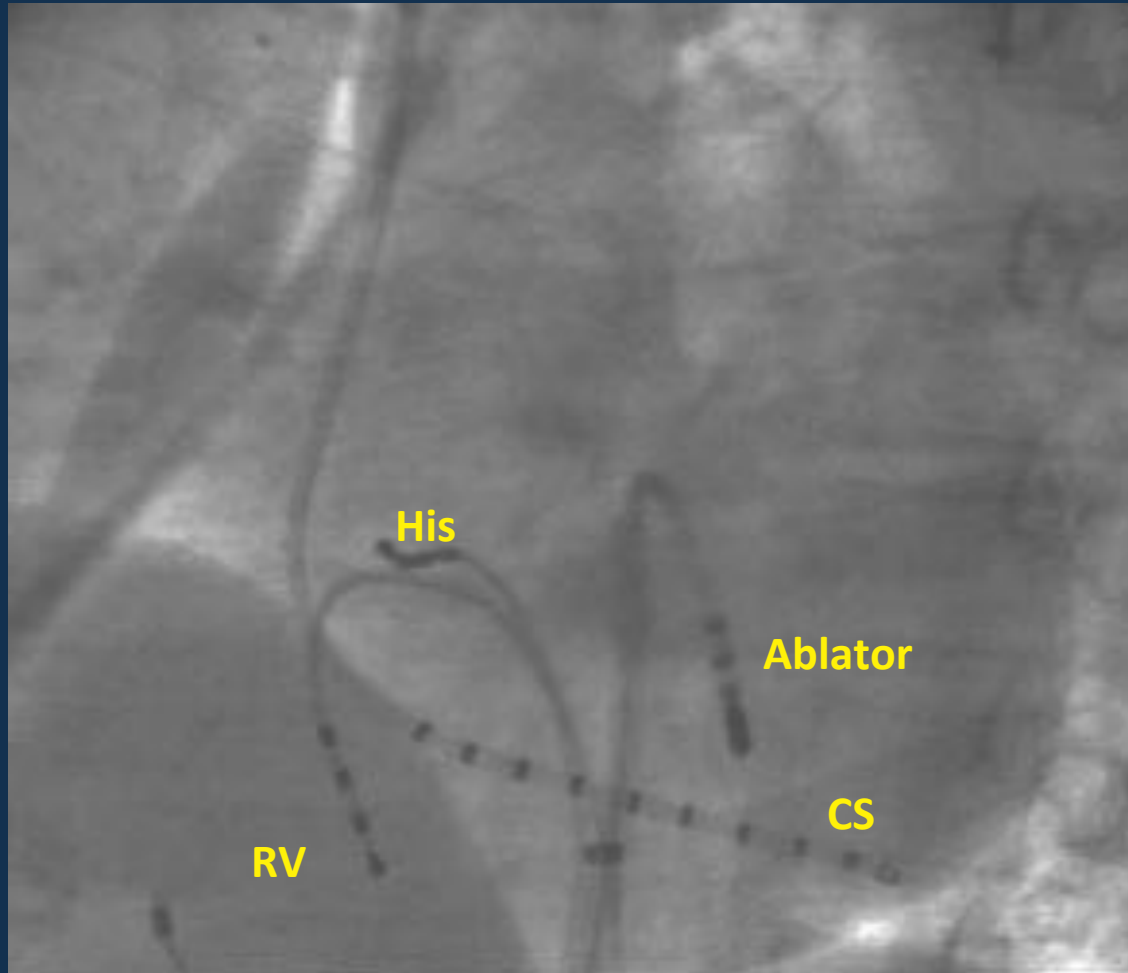


Cs potential in sinus rhythm

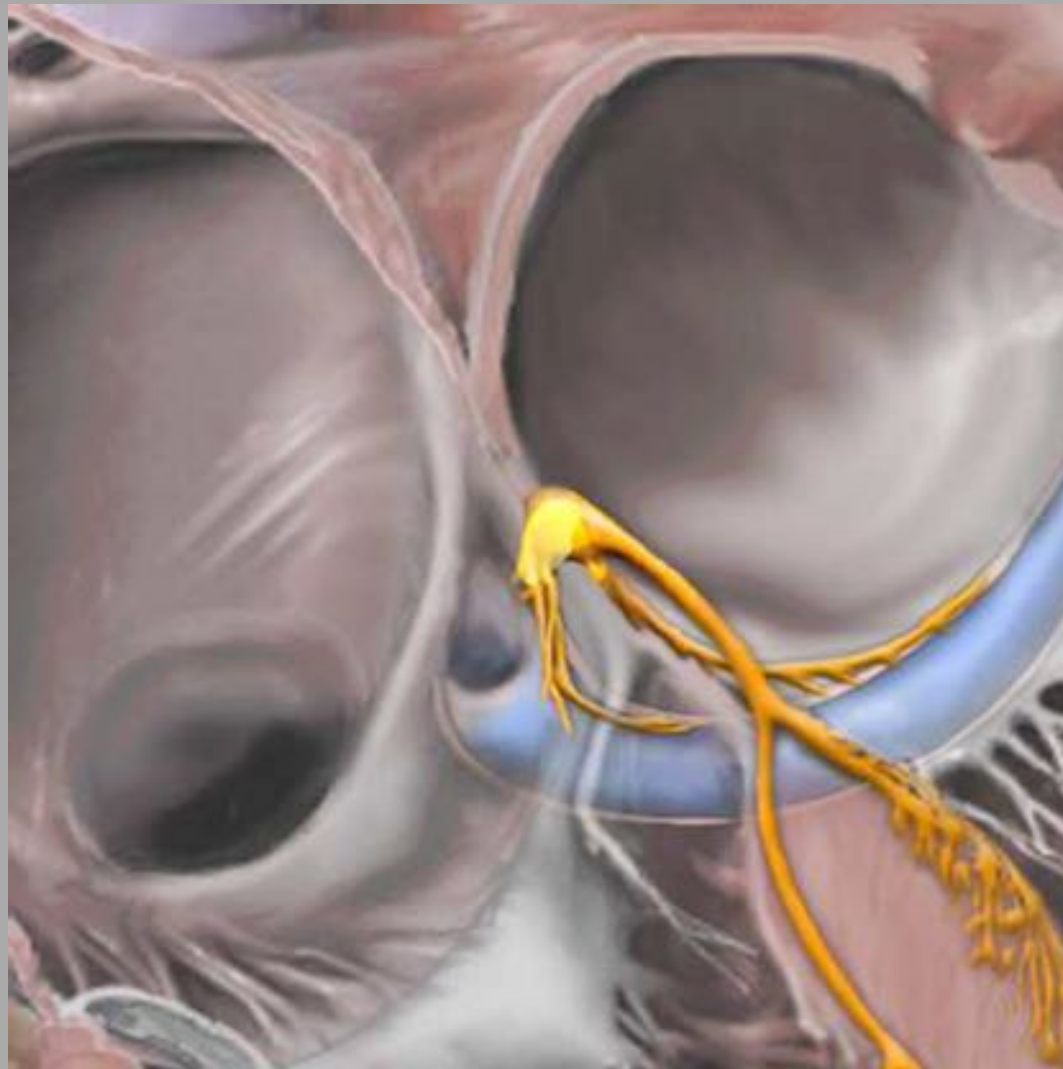


Cs potential during AVNRT

# Successful ablation site at the Mitral Annulus (transeptal)



# AVNRT via Left Posterior Extension



# Narrow complex tachycardia with VA block



AV nodal reentrant tachycardia

Junctional tachycardia

Concealed nodofascicular tachycardia

# Concealed nodofascicular tachycardia

- SVT initiated with atrial programmed stimulation (often with dual response) or ventricular extrastimuli
- Evidence of AV dissociation during SVT or A on V TACH. SVT (rules out extranodal AP)
- PVC on His during SVT advances the next His / V or terminates SVT
- Bundle branch block leads to prolongation of VA interval or tachycardia cycle length

# Spontaneous PVC

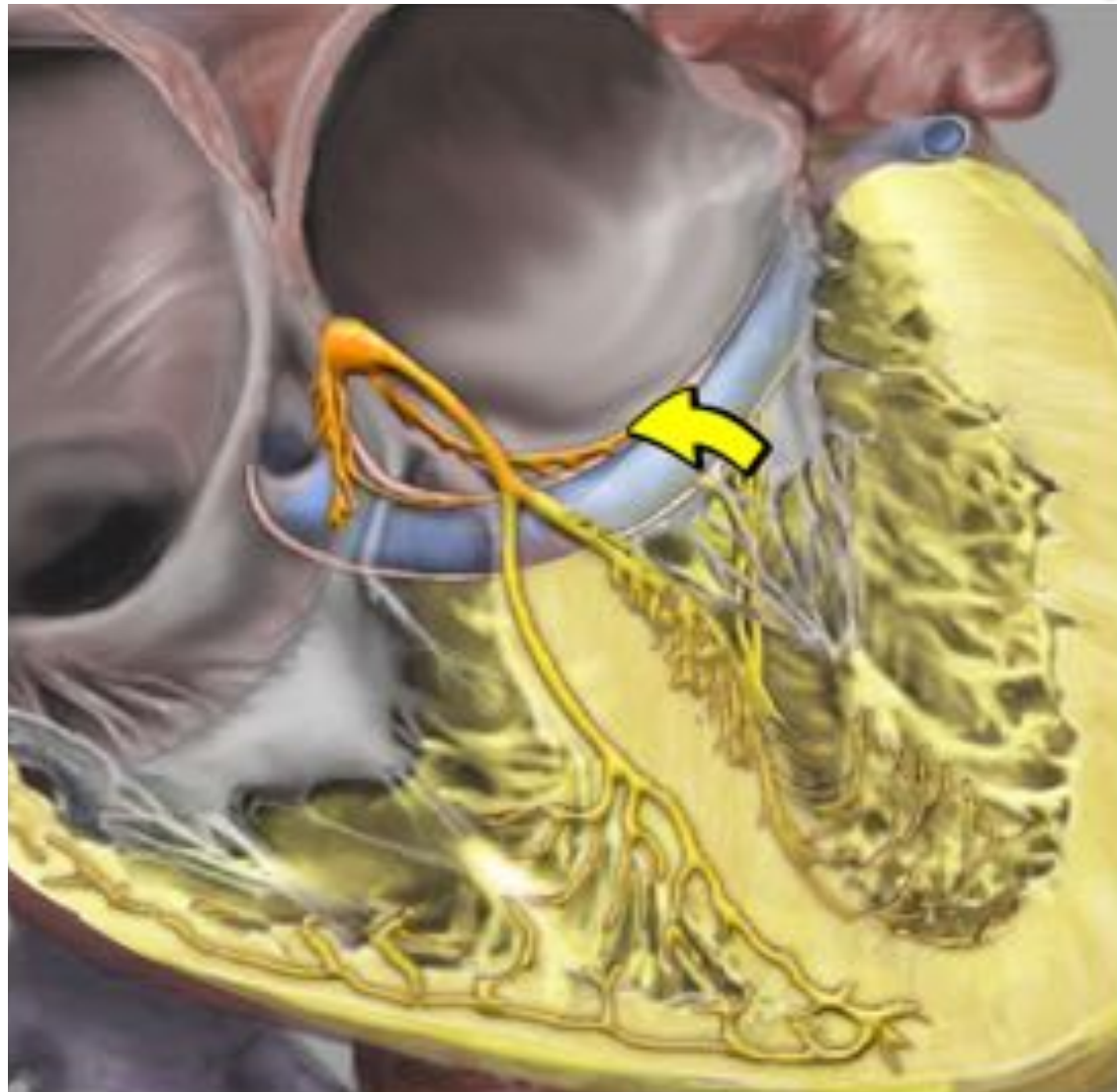


# Ablator signal within CS in sinus rhythm





# Proposed circuit for left sided concealed nodofascicular tachycardia



# Conclusions

- Parahisian AT has characteristic P wave morphology (narrower than NSR)
- Electrophysiological characteristics are similar to other annular ATs and most consistent with cyclic AMP-mediated triggered activity
- Catheter ablation guided by 3D mapping is safe and effective in majority of the patients

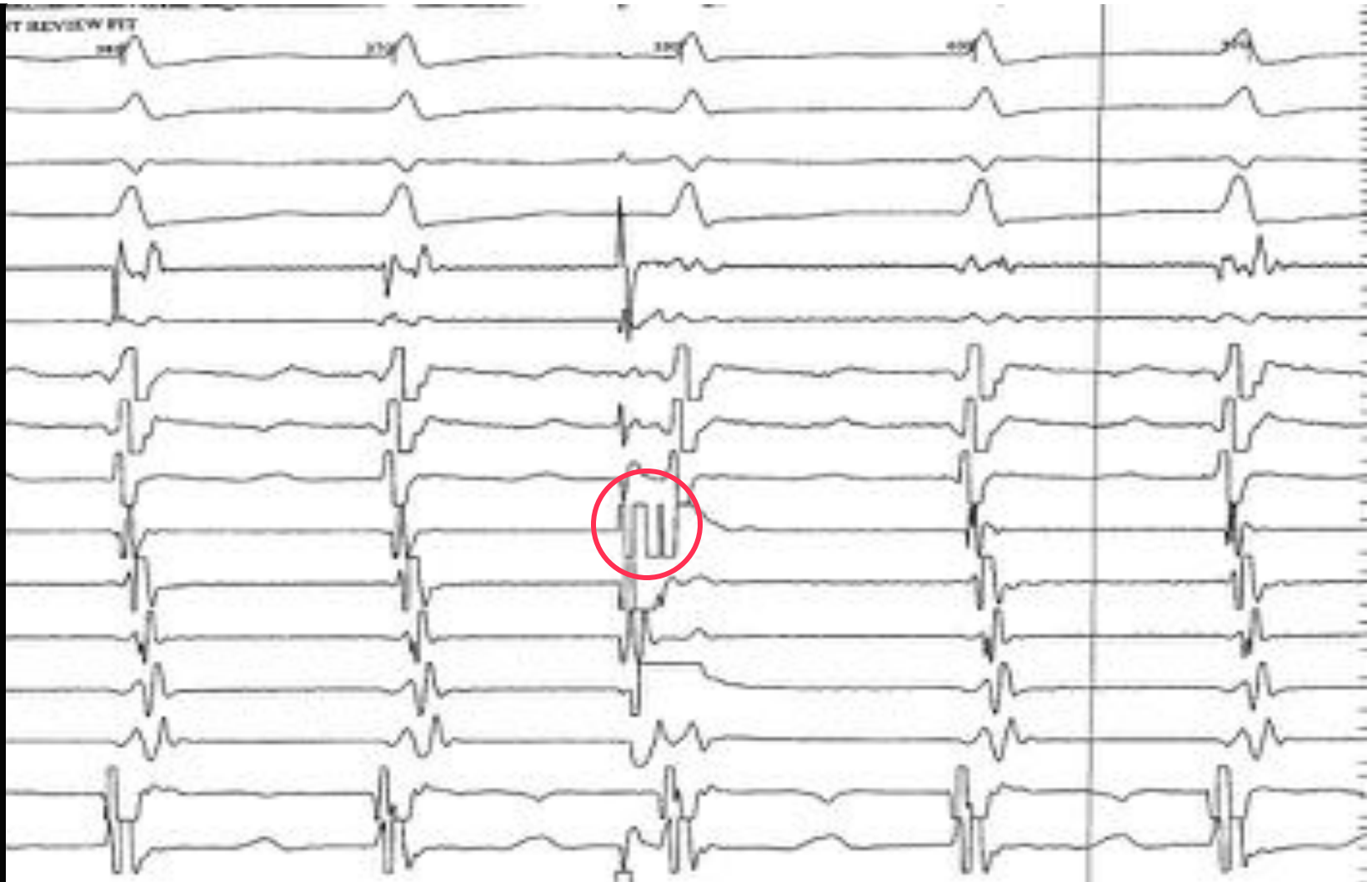
# Focal Junctional Tachycardia

- Narrow complex tachycardia at times associated with AV dissociation often irregular
- Catecholamine stimulation (abnormal automaticity)
- Initiation with atrial and ventricular overdrive pacing (triggered)
- Termination with adenosine (triggered)
- Earliest retrograde A preceded or buried in the QRS
- Late APD after His is committed does not affect tachycardia

# Tachycardia initiation



# Late PAC delays the next His

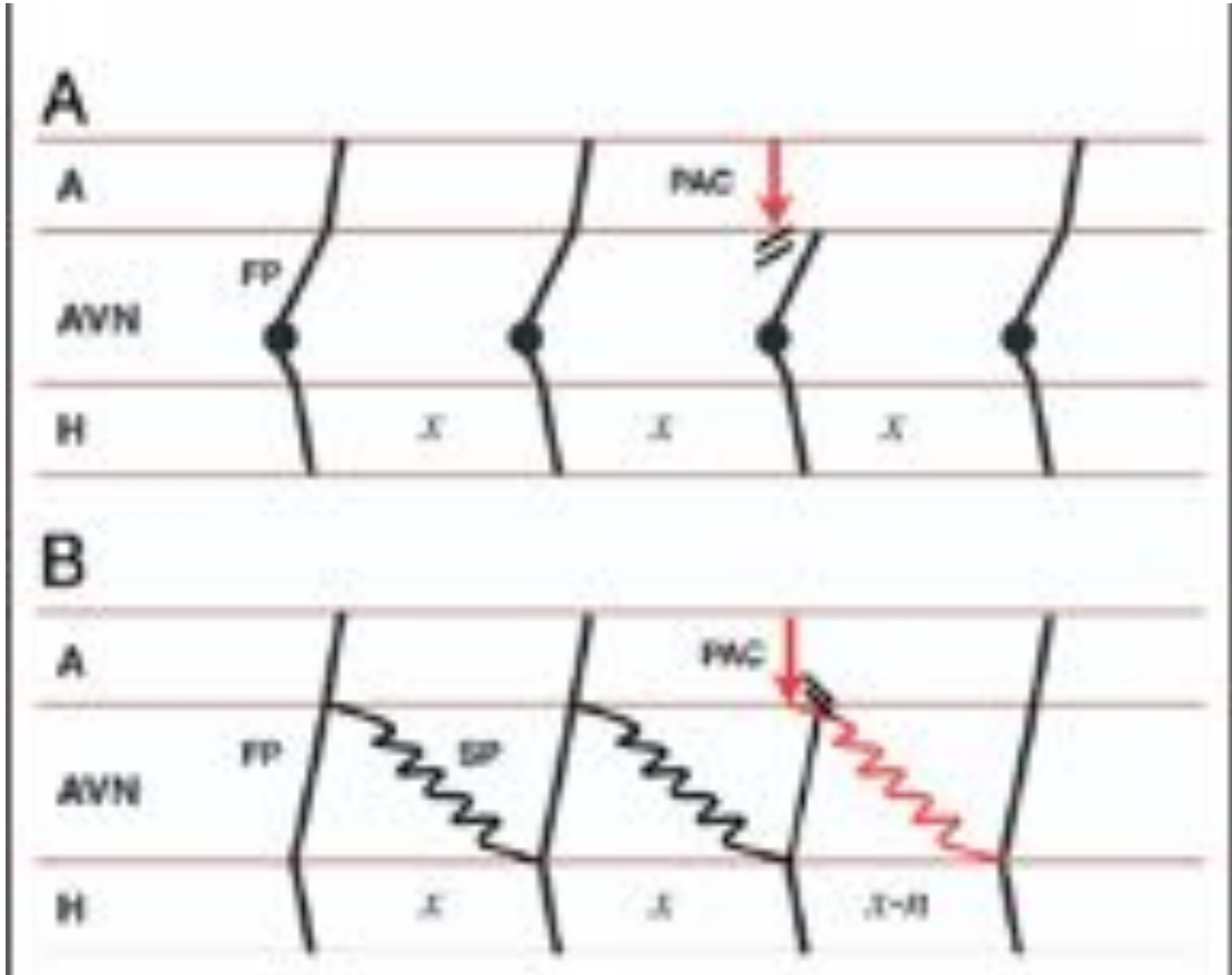


*Poster presentation, HRS 2007*

# Late PAC terminates SVT without affecting the V

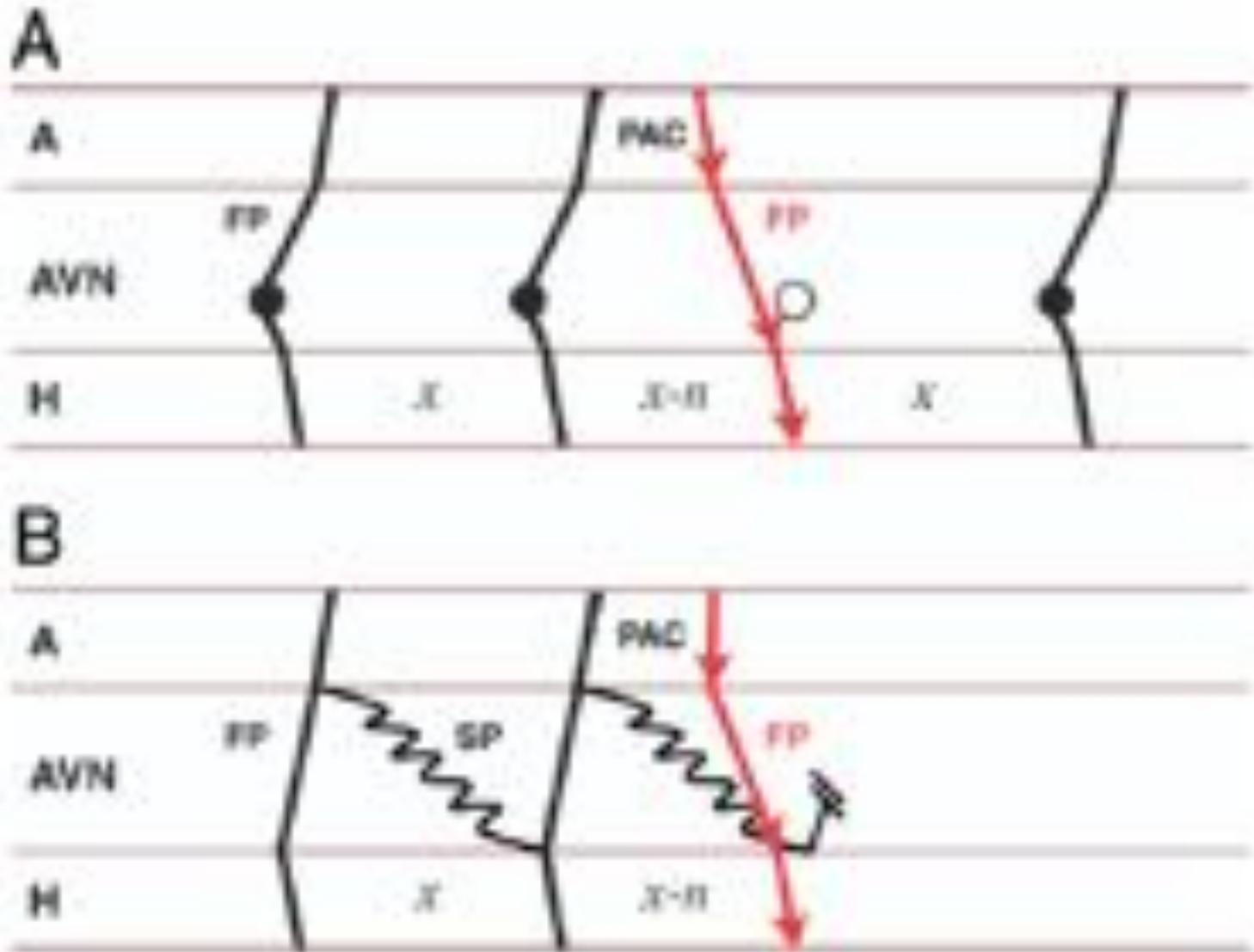


# Late PAC





# Early PAC





# conclusions

Proper Diagnoses and ablation depends on using techniques for differentiating

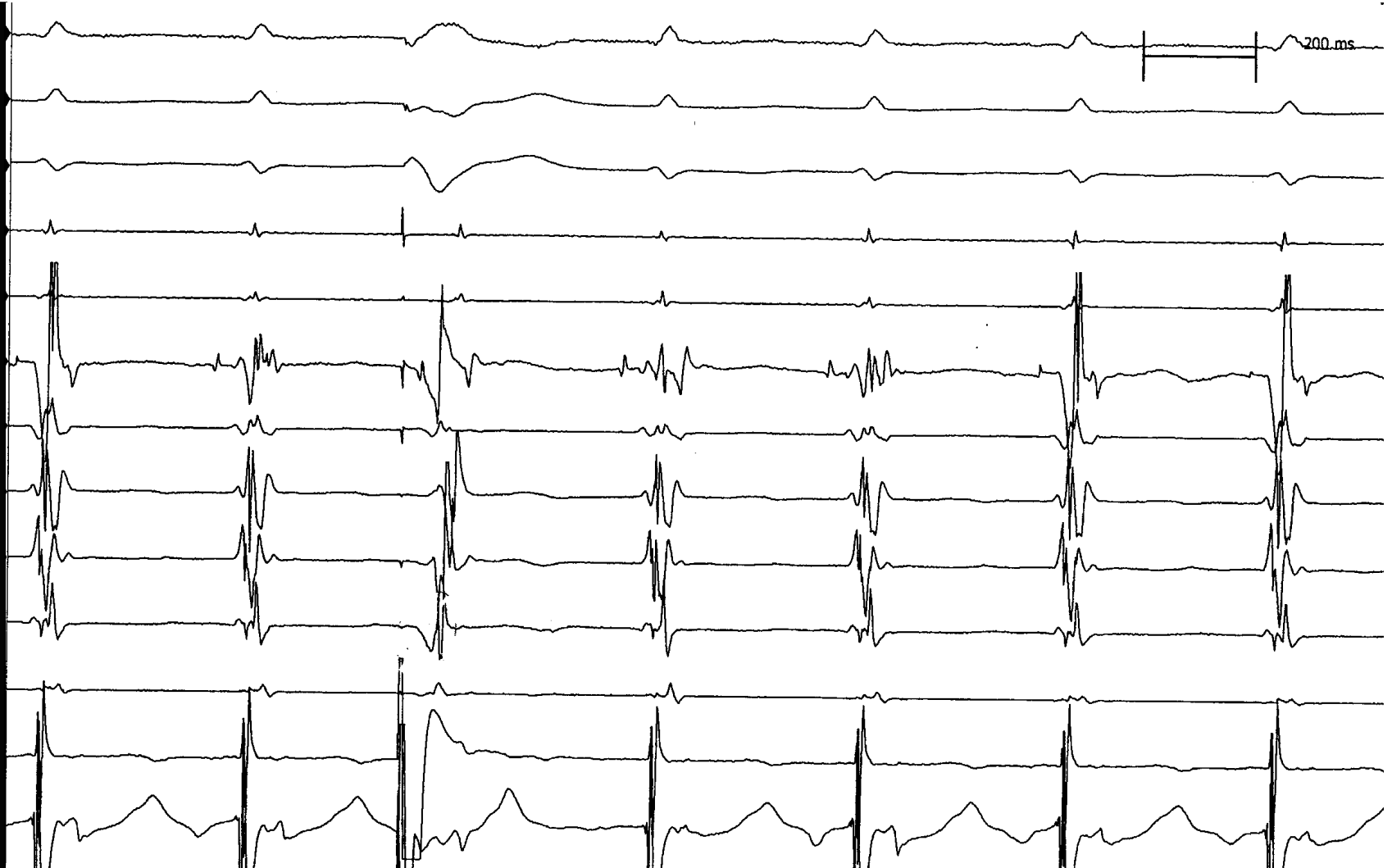
Types of AVNRT

Concealed N-V pathways

Junctional tachycardia

Para hisian A.T.

# Single PVC to reveal the site of earliest retrograde atrial activation



# AT: Diagnosis

- Surface P wave & intracardiac atrial activation sequence during AT was different from that in sinus rhythm
- AH interval with atrial pacing same as AH during AT
- Initiation independent of a critical AV nodal or AV conduction delay
- Lack of VA linking with programmed atrial pacing
- AV dissociation
  - Spontaneous /drug induced / pacing induced
  - V-A-A-V response after ventricular overdrive pacing

# Parahisian AT: ECG findings

- Narrower P waves during AT than in sinus rhythm
- P waves in II, III, avF variable morphology
- Positive P waves in avR, avL and I
- Biphasic in  $V_1$  (initial isoelectric/negative followed by positive)
- Usually terminated with Adenosine (CAMP trigger)
- Catheter ablation with mapping system very effective may require cryo or ablation in non coronary cusp

