

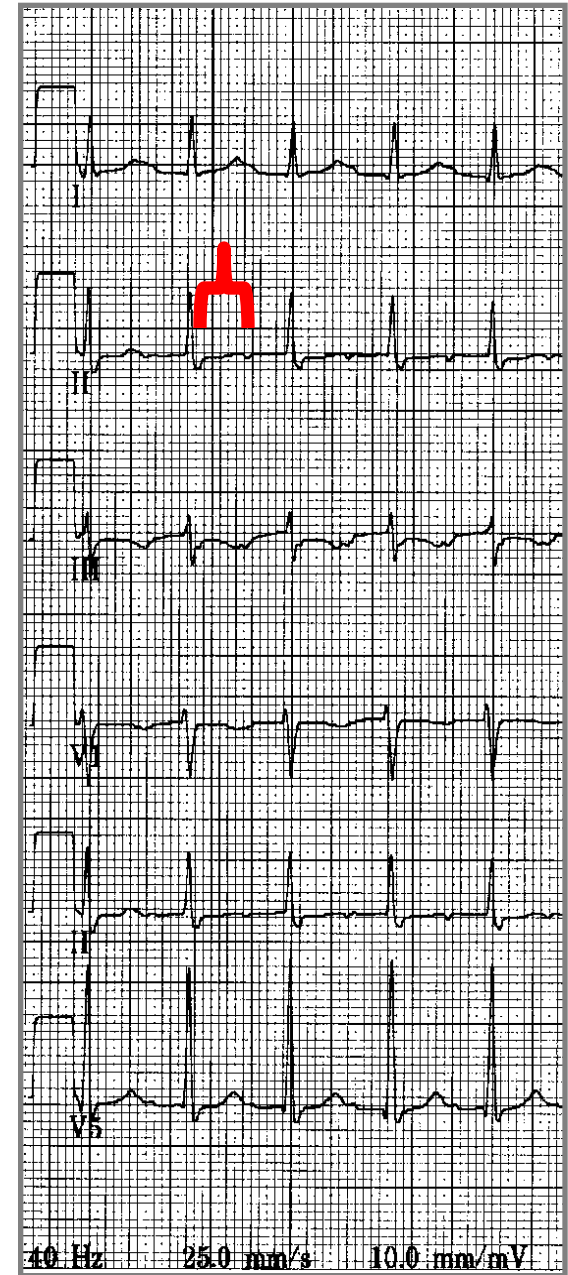
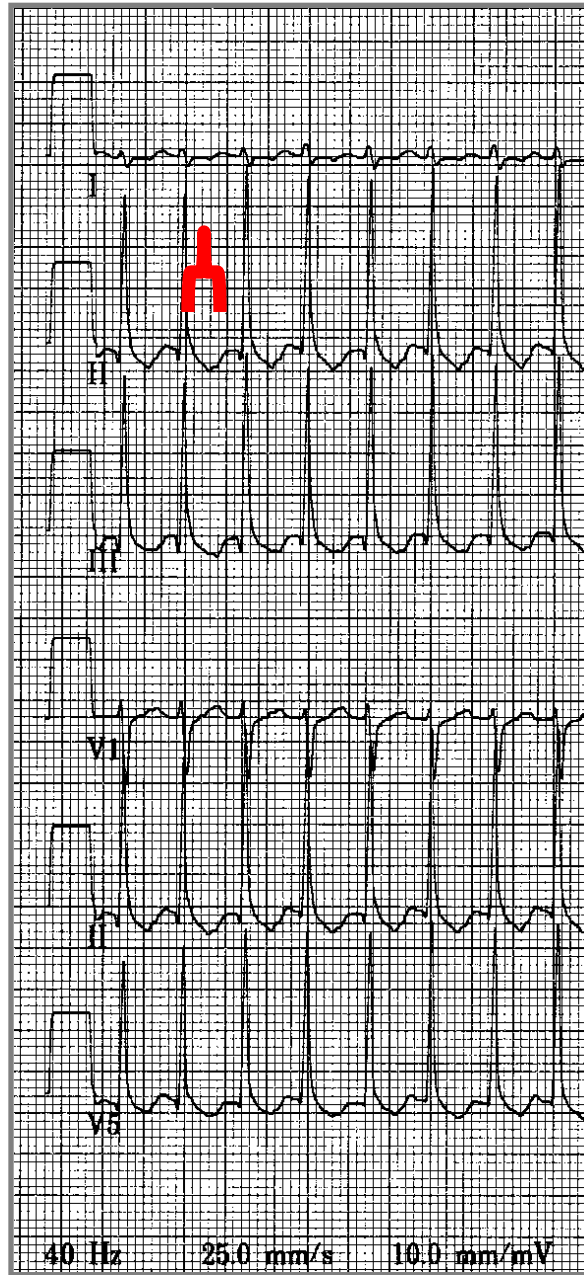
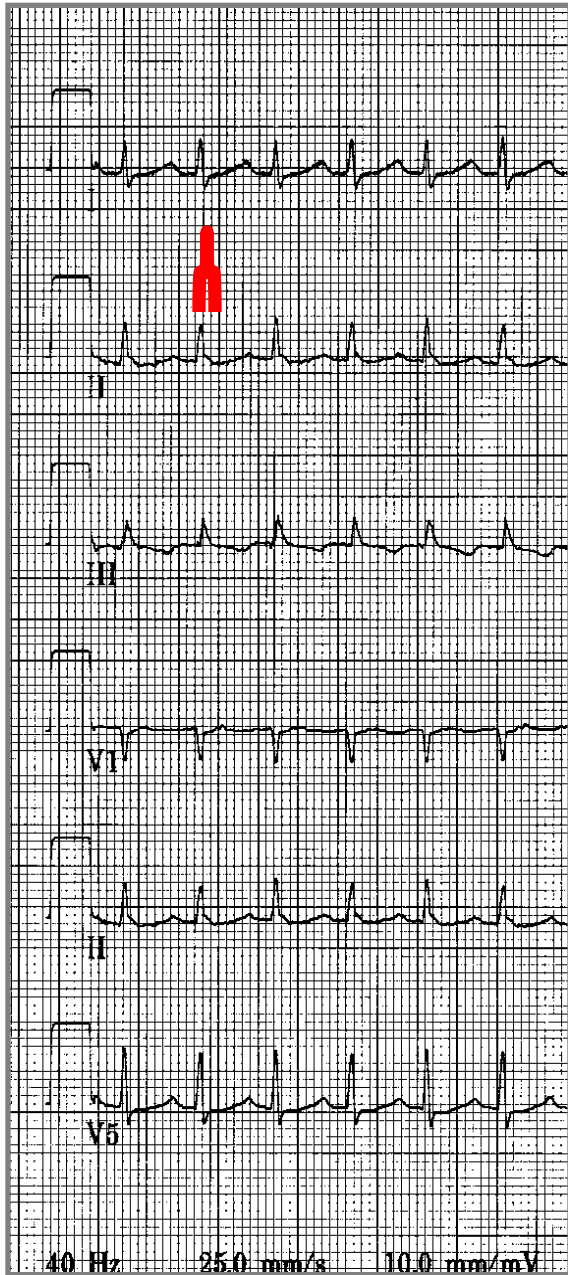
Supraventricular Tachycardia (SVT)

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Outline

- I. Classification/Clinical
- II. Circuits
- III. Pathophysiology
- IV. ECG Diagnosis

SVT

Narrow QRS

Wide QRS

Irregular
QRS

Regular QRS

Aberration

Pre-excitation

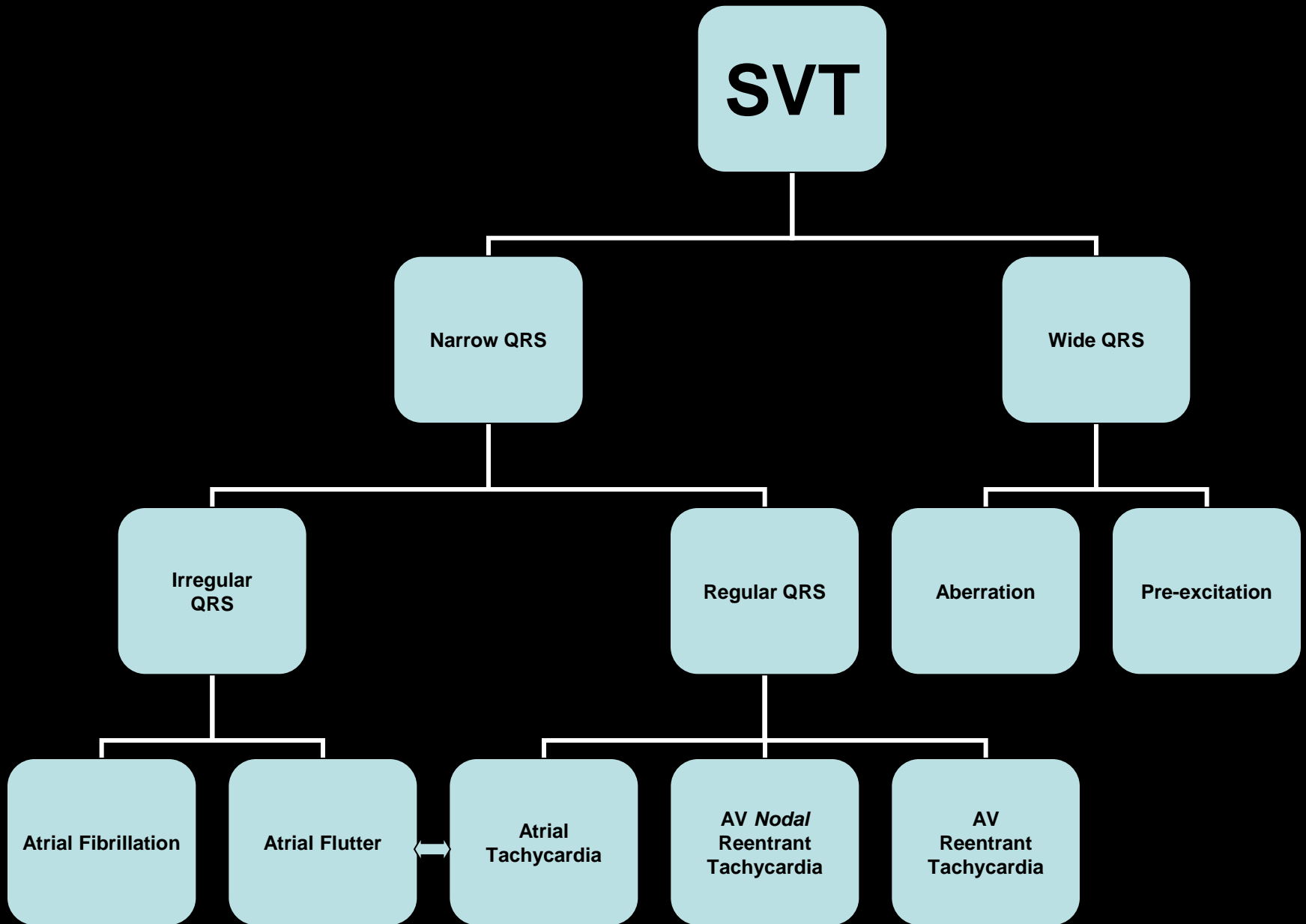
Atrial Fibrillation

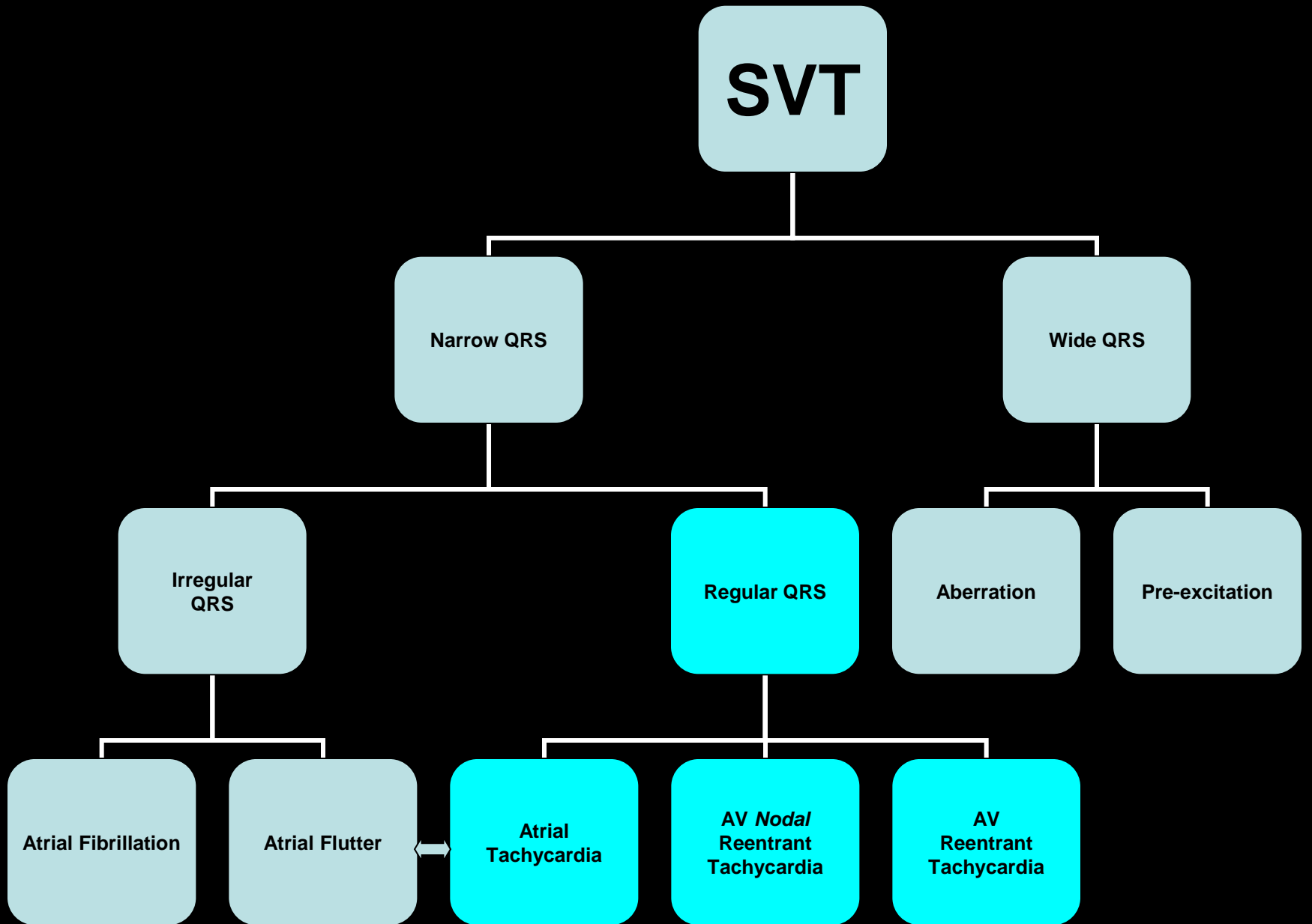
Atrial Flutter

Atrial
Tachycardia

AV Nodal
Reentrant
Tachycardia

AV
Reentrant
Tachycardia





Epidemiology of SVT

- **AF** and **AFL** are the most common arrhythmias affecting >2 million people in the US
- The most common SVT is **AVNRT** (60%), followed by **AVRT** (30%), and **AT** (10%)
- **AVNRT** is more common in women (70%)
 - Mean age of onset 32y
- **AVRT** is more common in men
 - Mean age of onset 23y
- **AT** is more common with older age and structural heart disease

Clinical History in SVT

- **Symptoms**

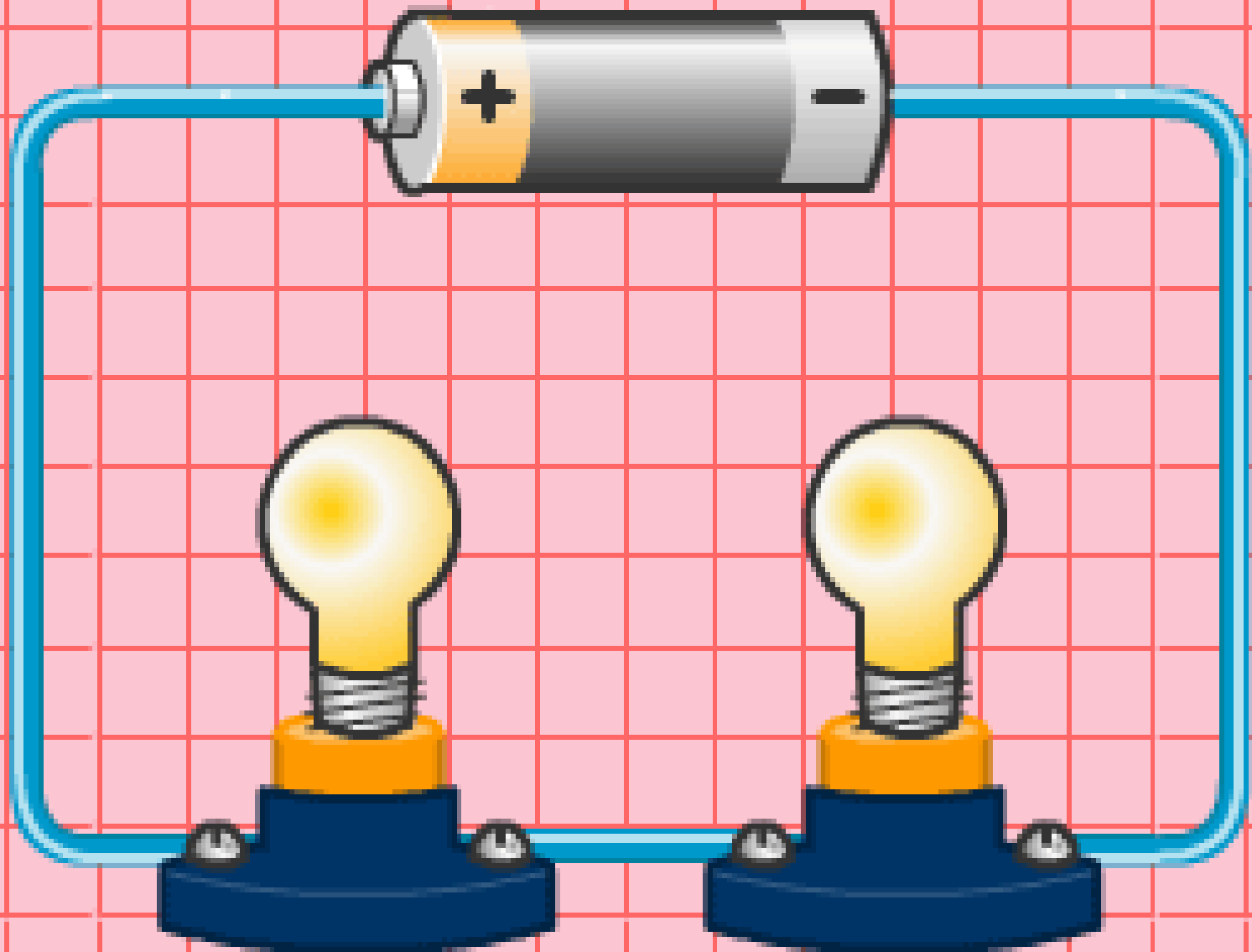
- Palpitations (“irregular” or “skipped” beats)
- Exertional fatigue/dyspnea
- Chest discomfort
- Near-syncope (rarely syncope)

- **Historical Features**

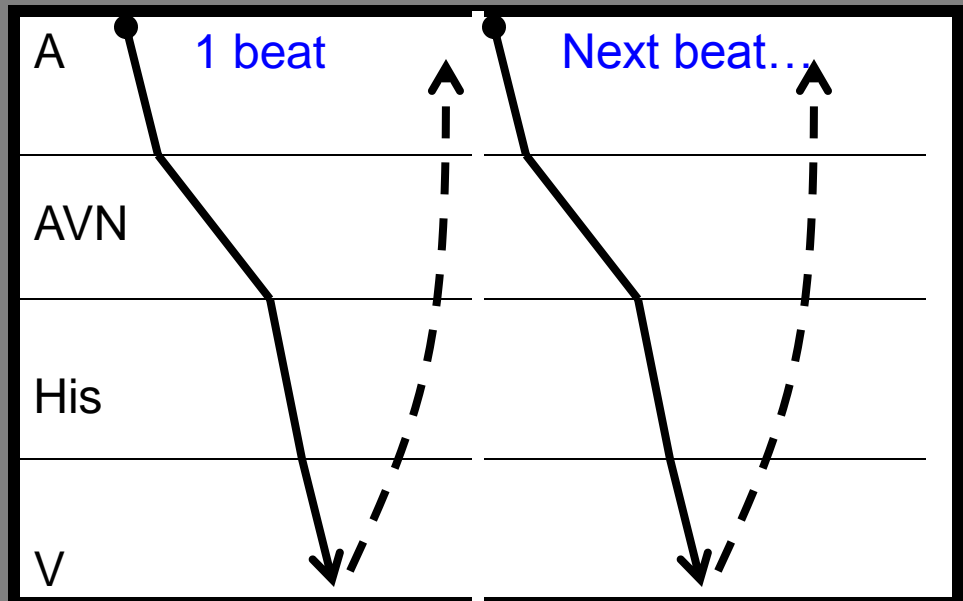
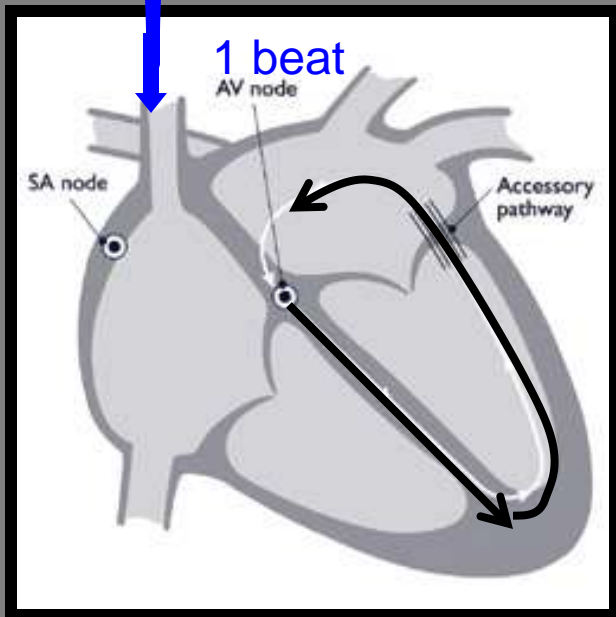
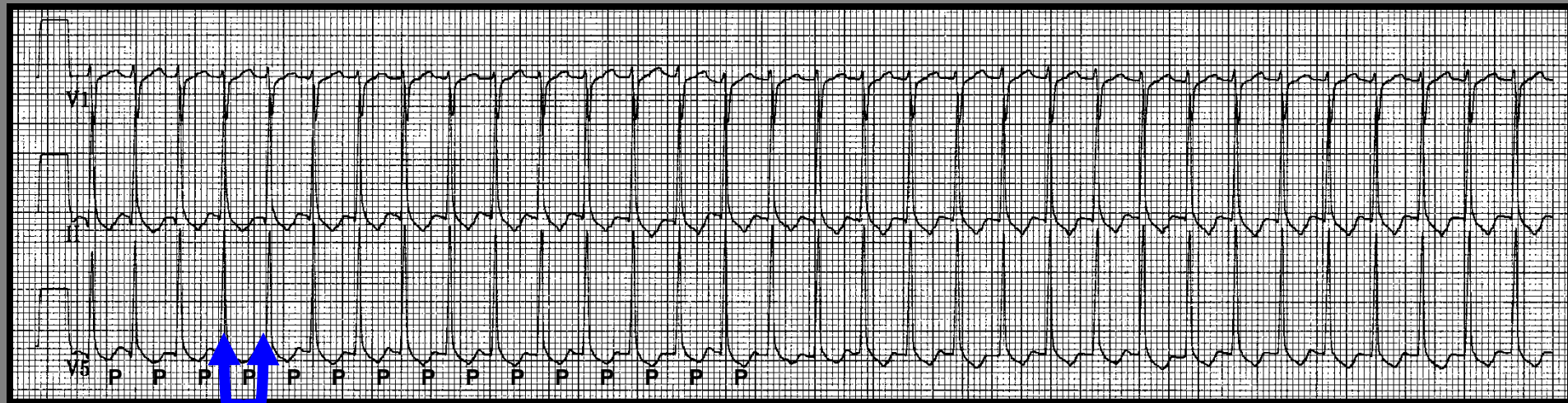
- Triggers
- Abruptness of onset and termination
 - *Common in AVRT and AVNRT*
- Frequency of episodes
 - *Incessant is often AT*
- Ability to stop symptoms
 - *Common in AVRT and AVNRT*

SVT	Possible Effect of CSM
Sinus tachycardia	Gradual, temporary slowing of HR
AT	AV block
AVNRT	Cessation
AVRT	Cessation

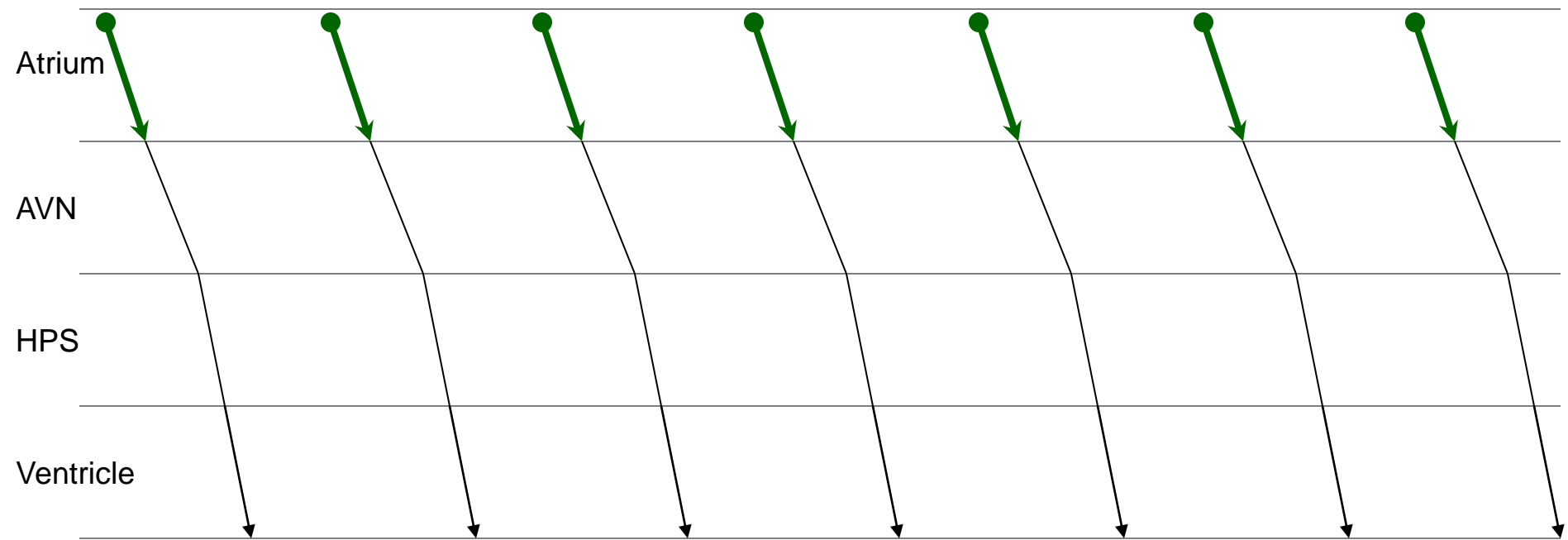
Circuits



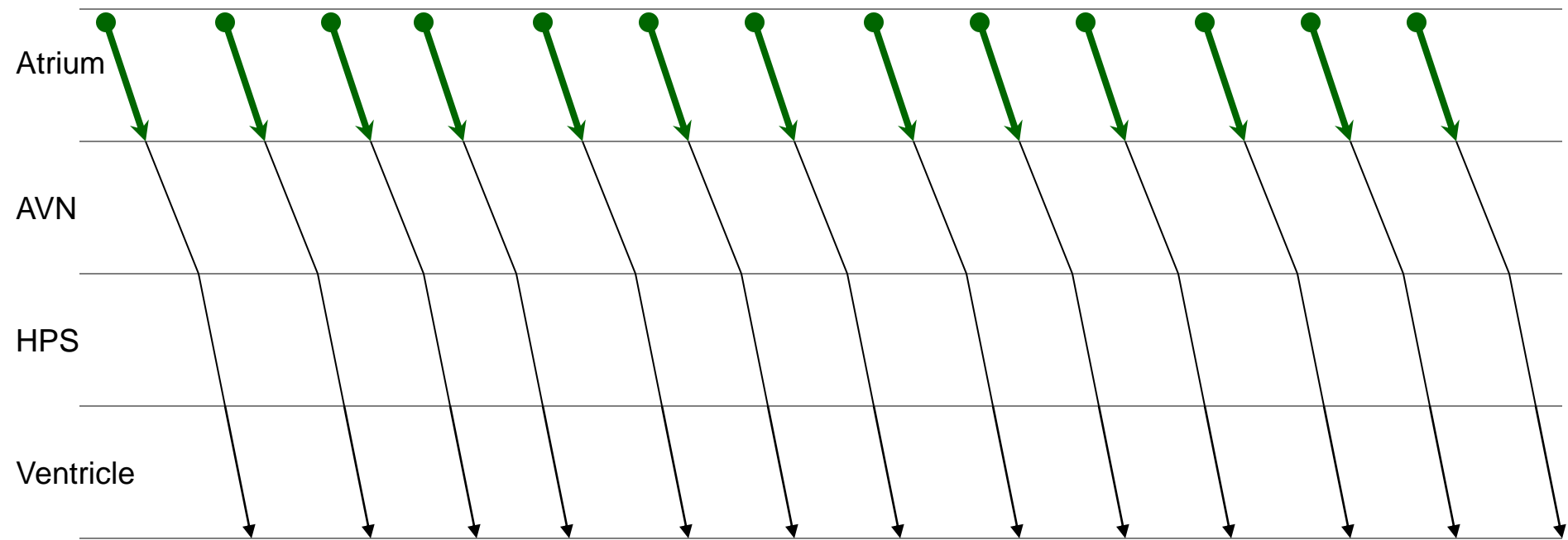
Diagramming SVT



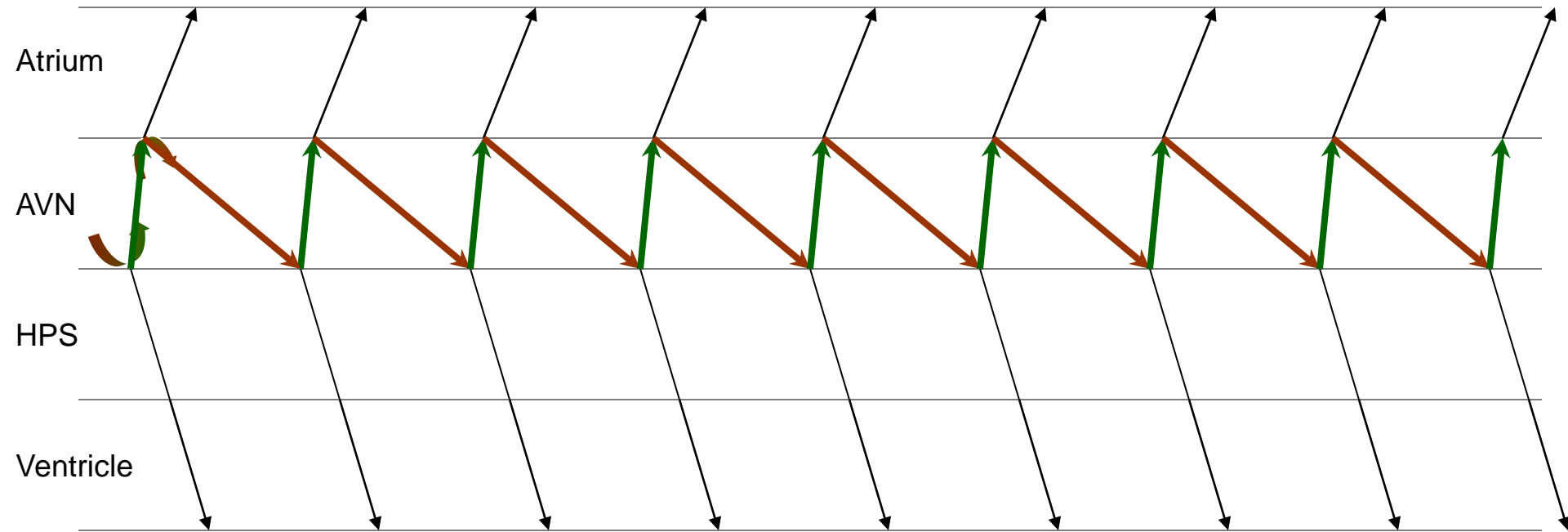
Sinus Rhythm






Atrial Tachycardia

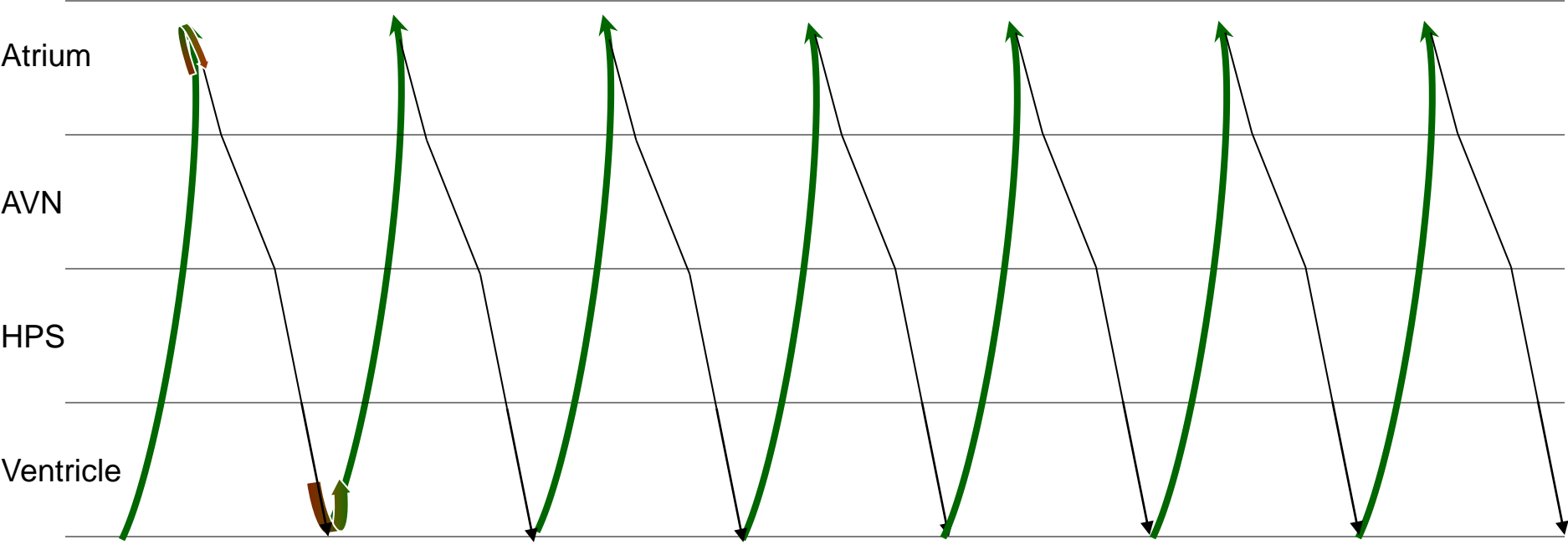


Typical AVNRT





-  Retrograde "fast" pathway
-  Antegrade "slow" pathway
-  Indicates reentrant mechanism

Orthodromic AVRT



- The curved lines depict extra-Hisian depolarization of the atrium due to conduction up an accessory pathway (AP)
- VA intervals are longer than VA intervals in AVNRT because of sequential activation

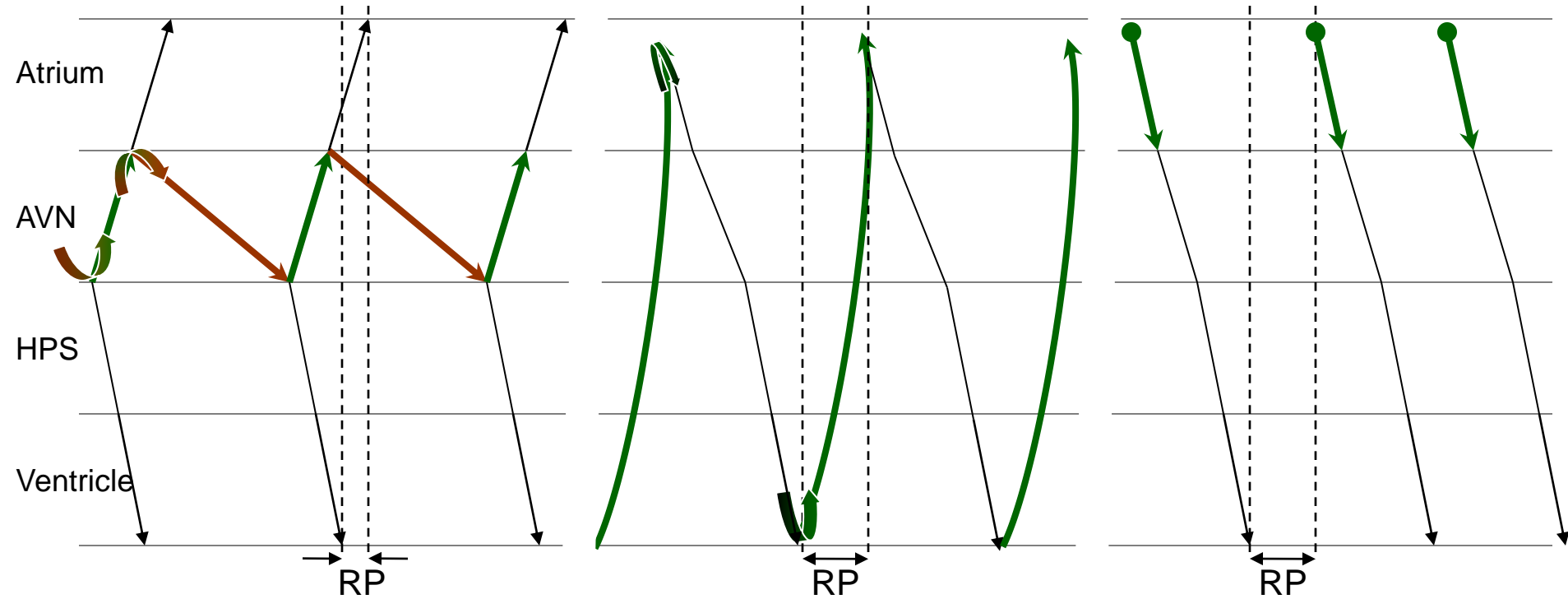
	Retrograde AP conduction
	Indicates reentrant mechanism

RP Intervals in AVNRT, AVRT, and AT

AVNRT

AVRT

AT

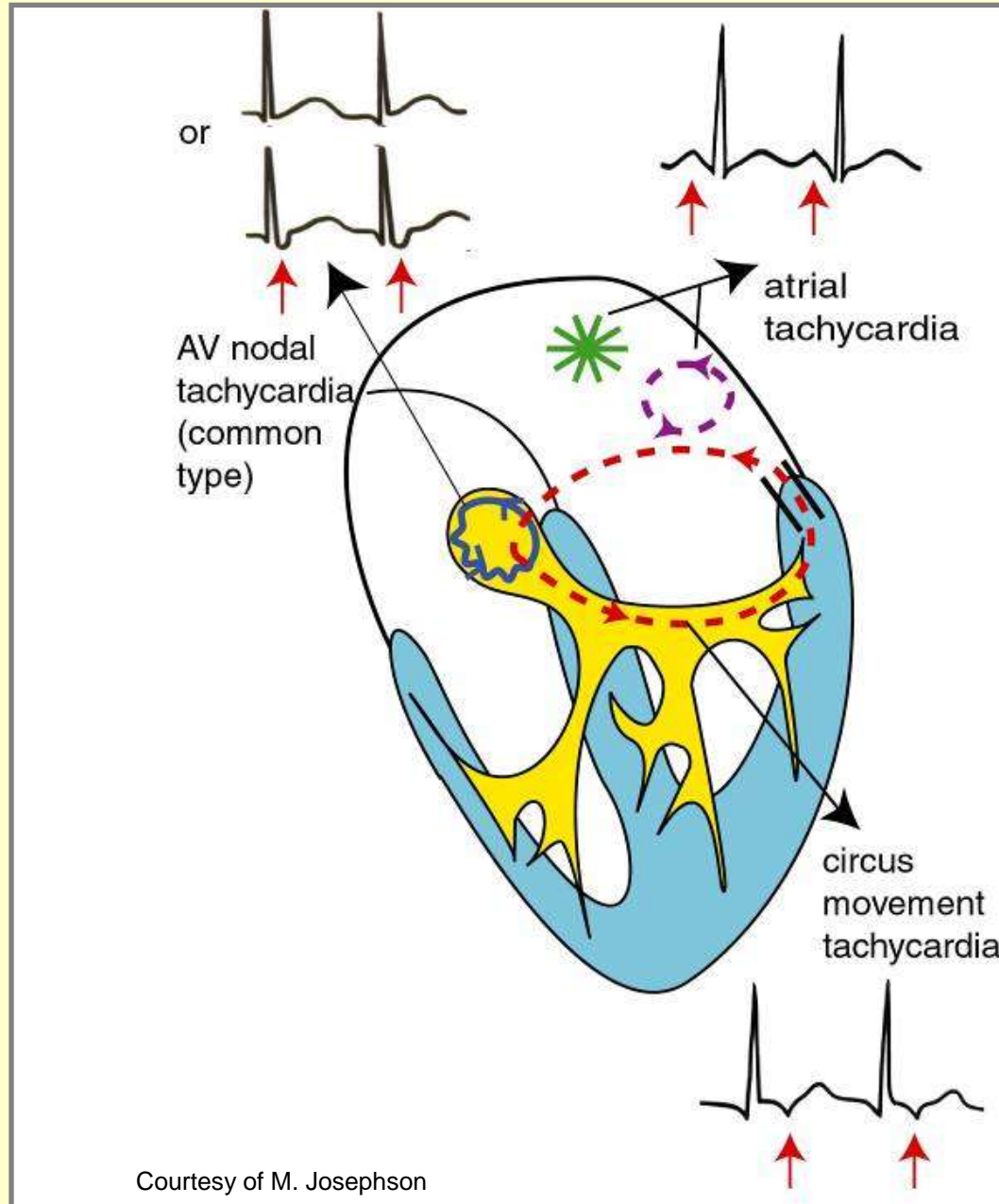


- Retrograde "fast" pathway
- Antegrade "slow" pathway
- Retrograde AP conduction
- AT Source
- Indicates reentry

*RP interval is shorter in AVNRT vs. AVRT and AT because of parallel rather than sequential activation of the atria and ventricles.

*Cycle length variation in AT is shown intentionally to demonstrate that A-A changes precede H-H or V-V changes.

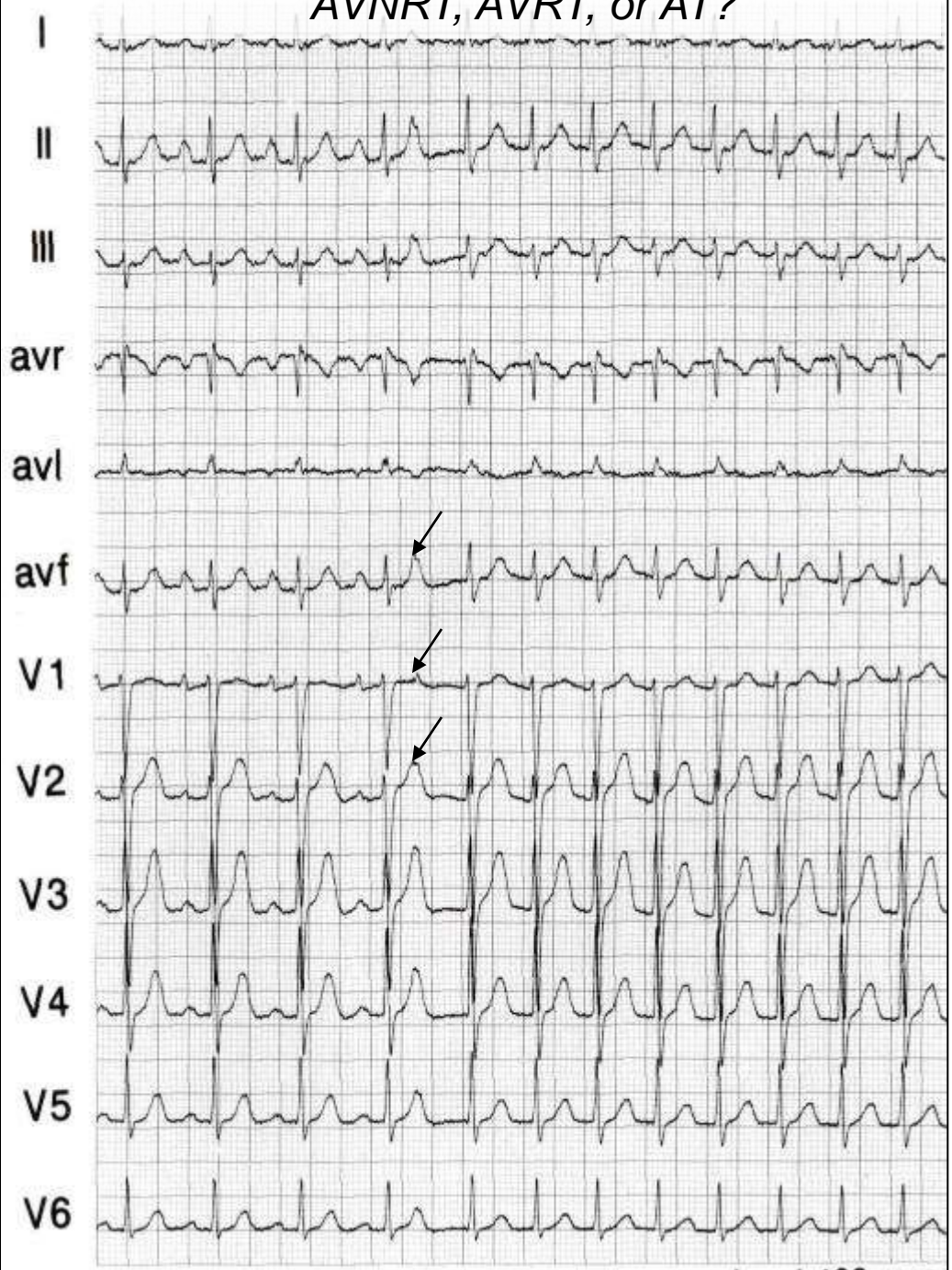
Pathophysiology



Courtesy of M. Josephson

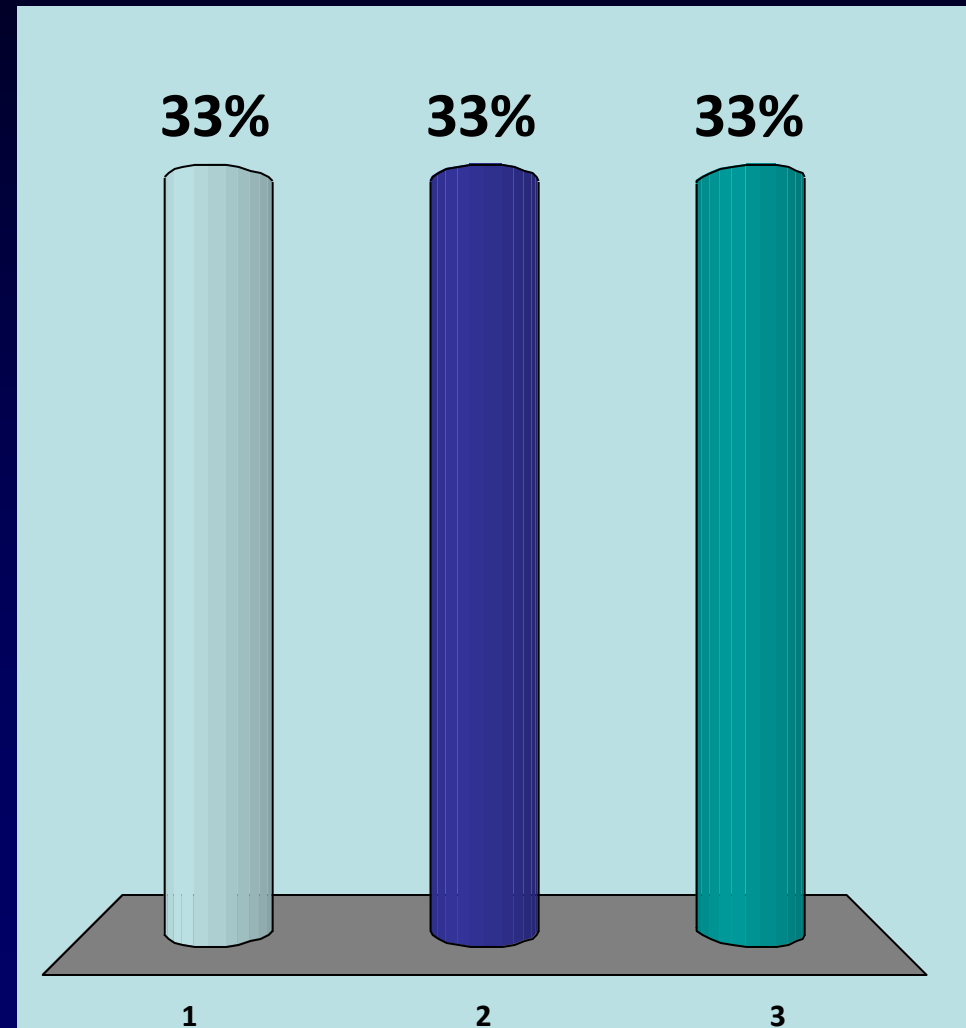
AVNRT, AVRT, or AT?

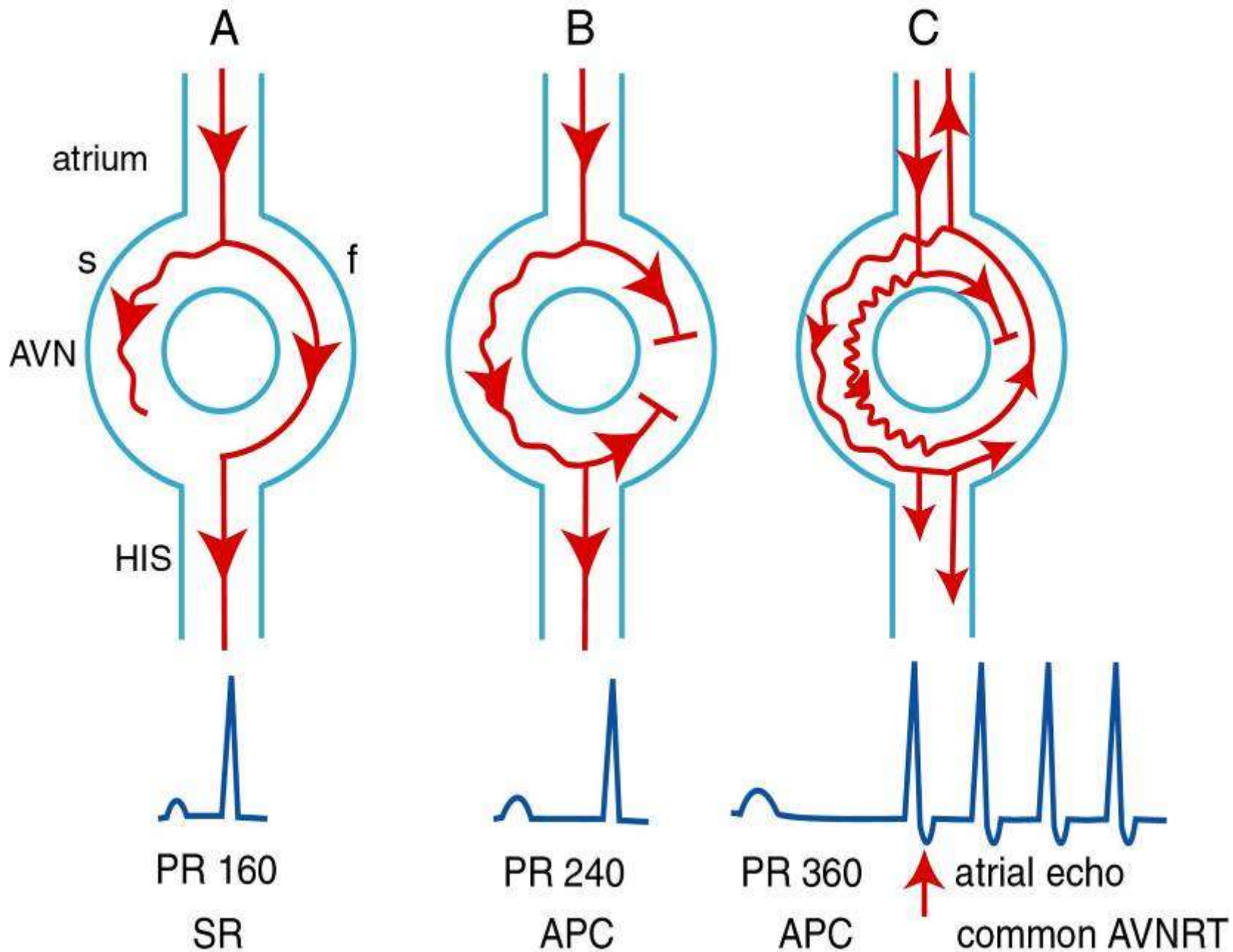
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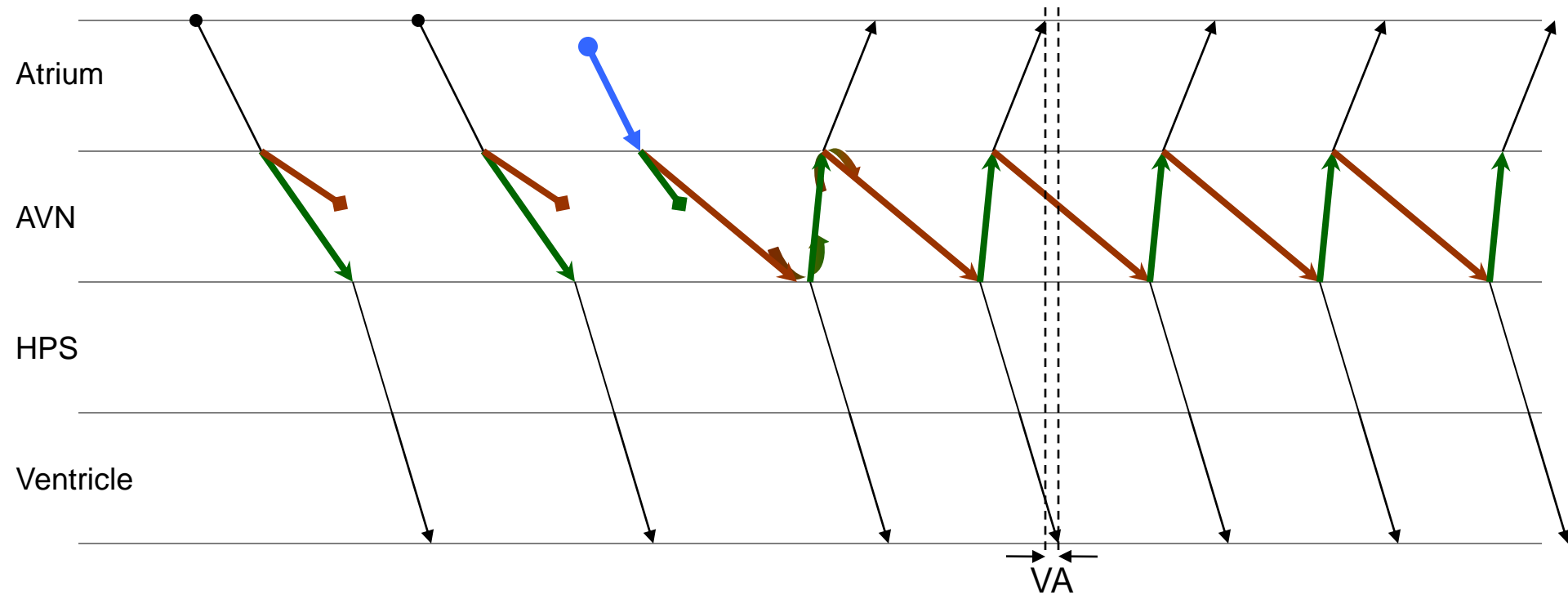
AVNRT, AVRT, or AT?

1. AVNRT
2. AVRT
3. AT

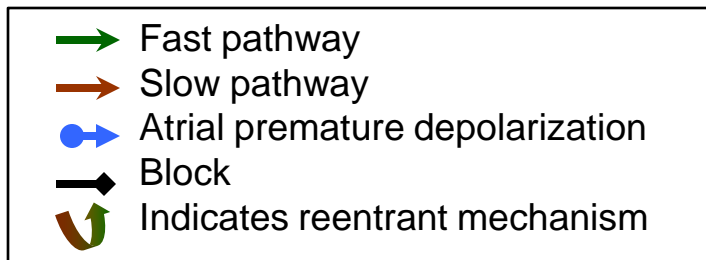


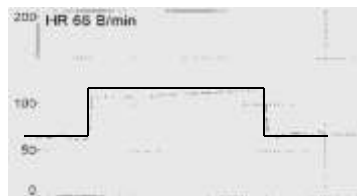
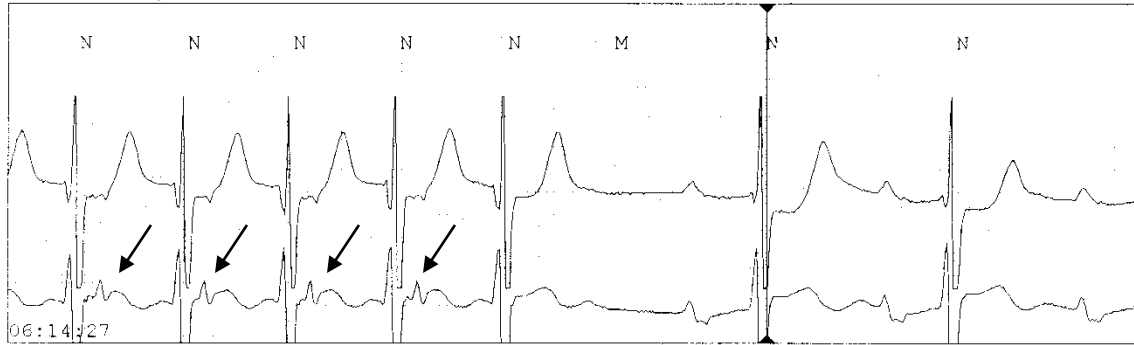
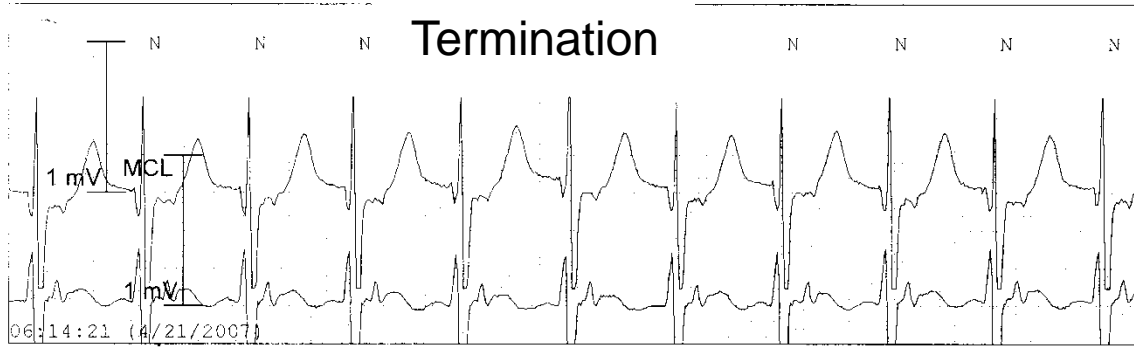
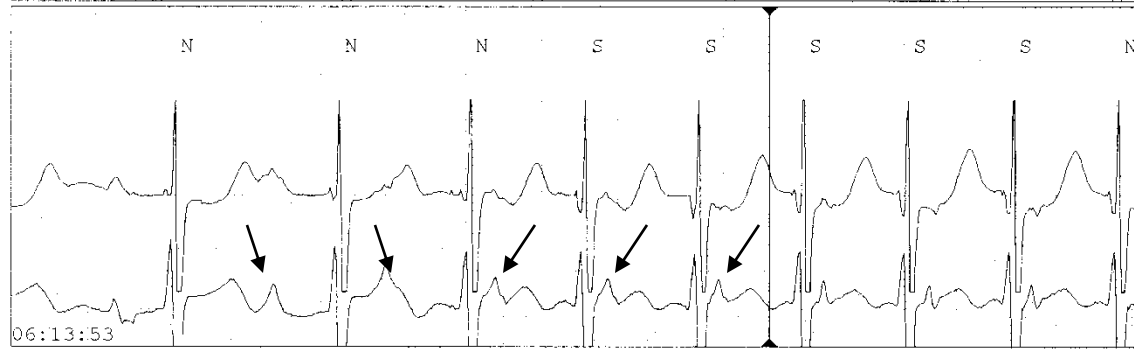
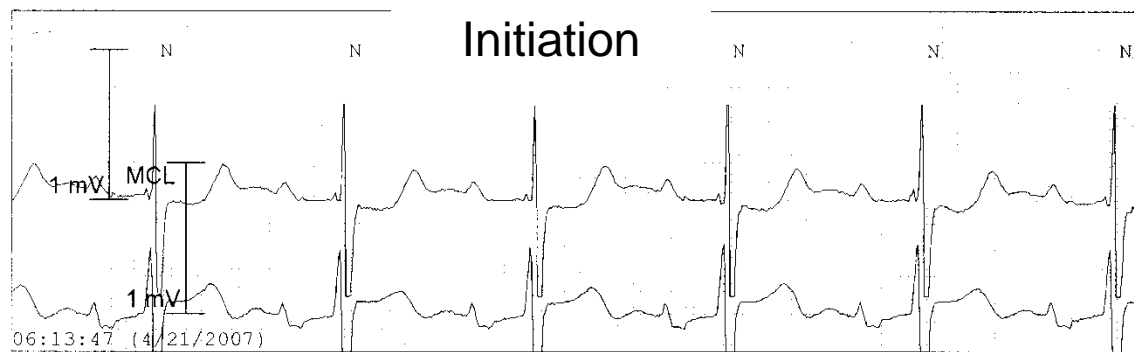


Initiation of Typical AVNRT with an APD



•An APD blocks in the fast pathway, conducts antegrade over the slow pathway, and then retrograde over the fast pathway

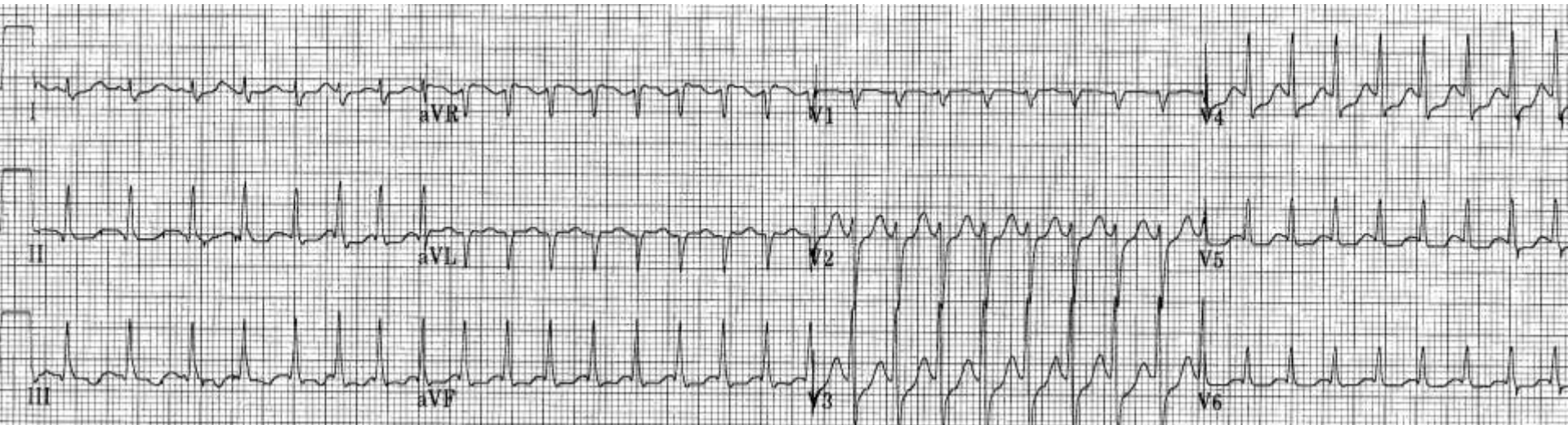




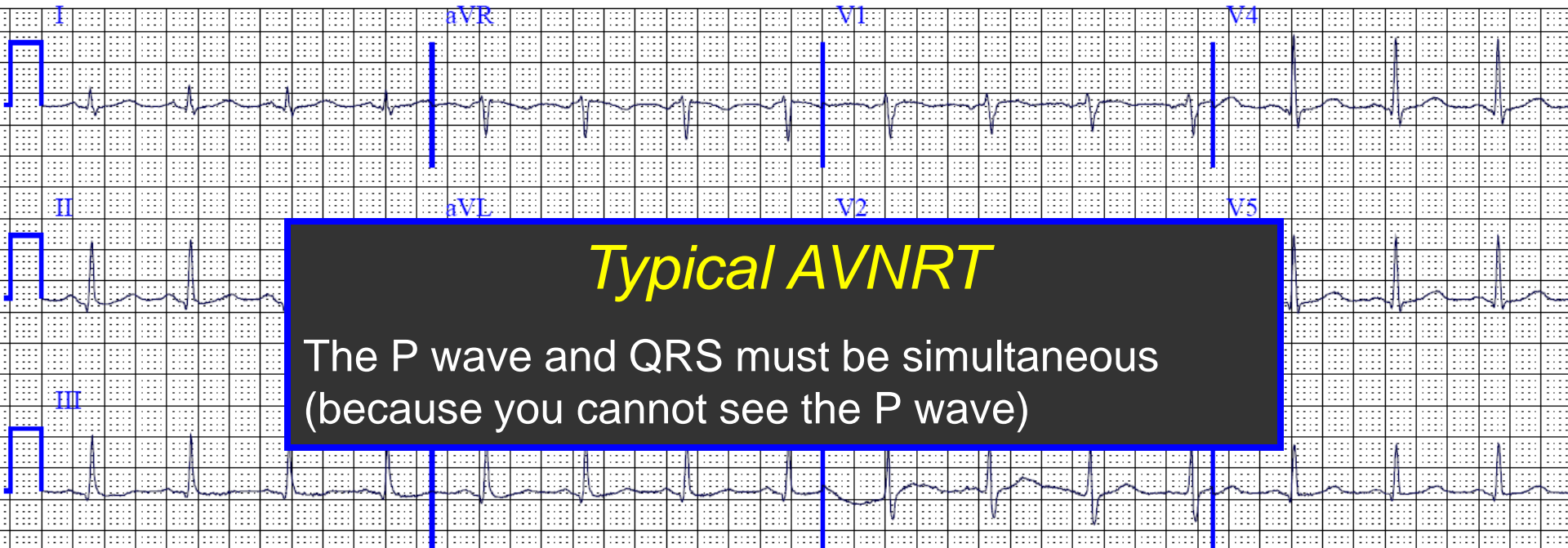
Trend review

48 M with palpitations

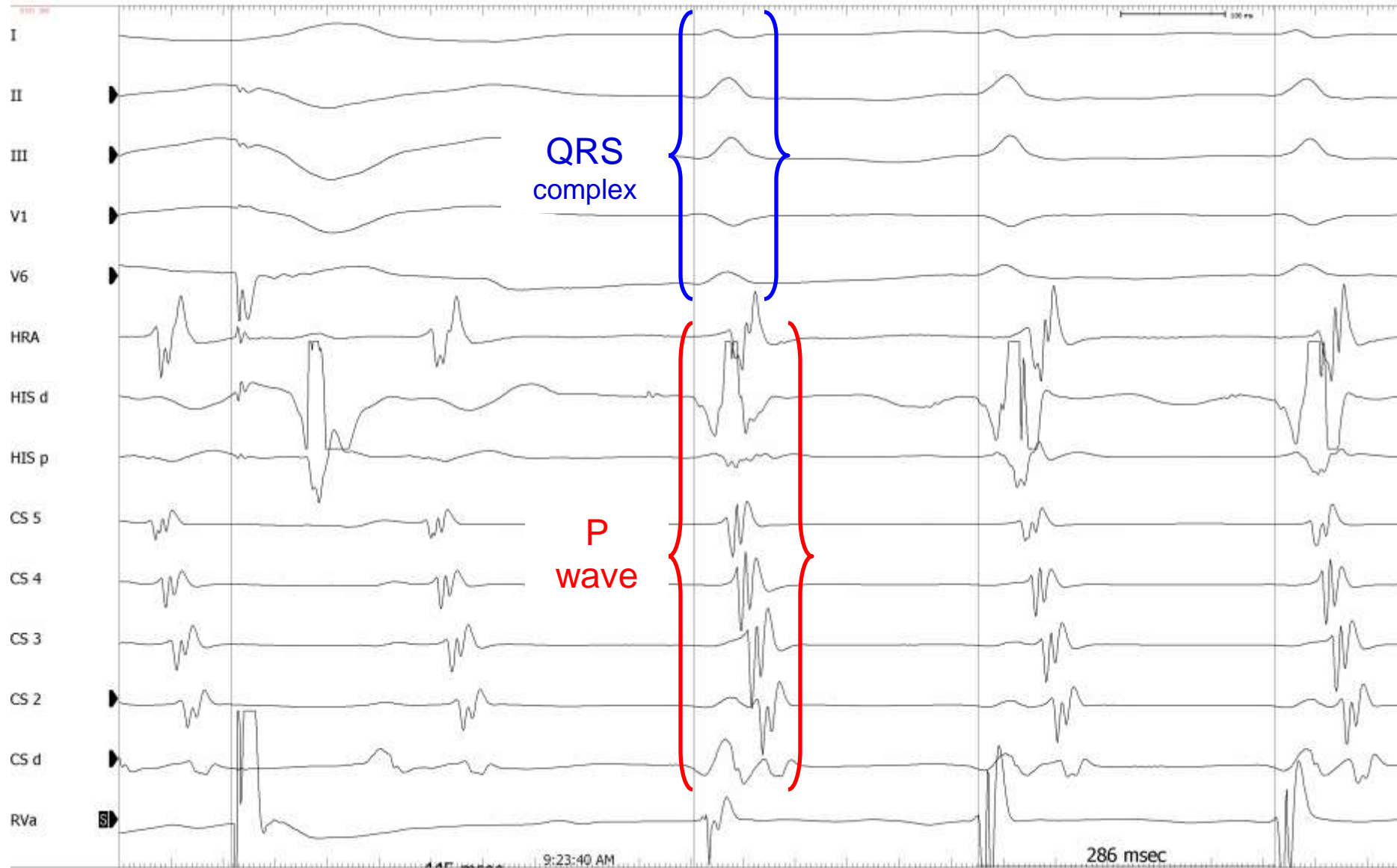
Typical or Atypical AVNRT?



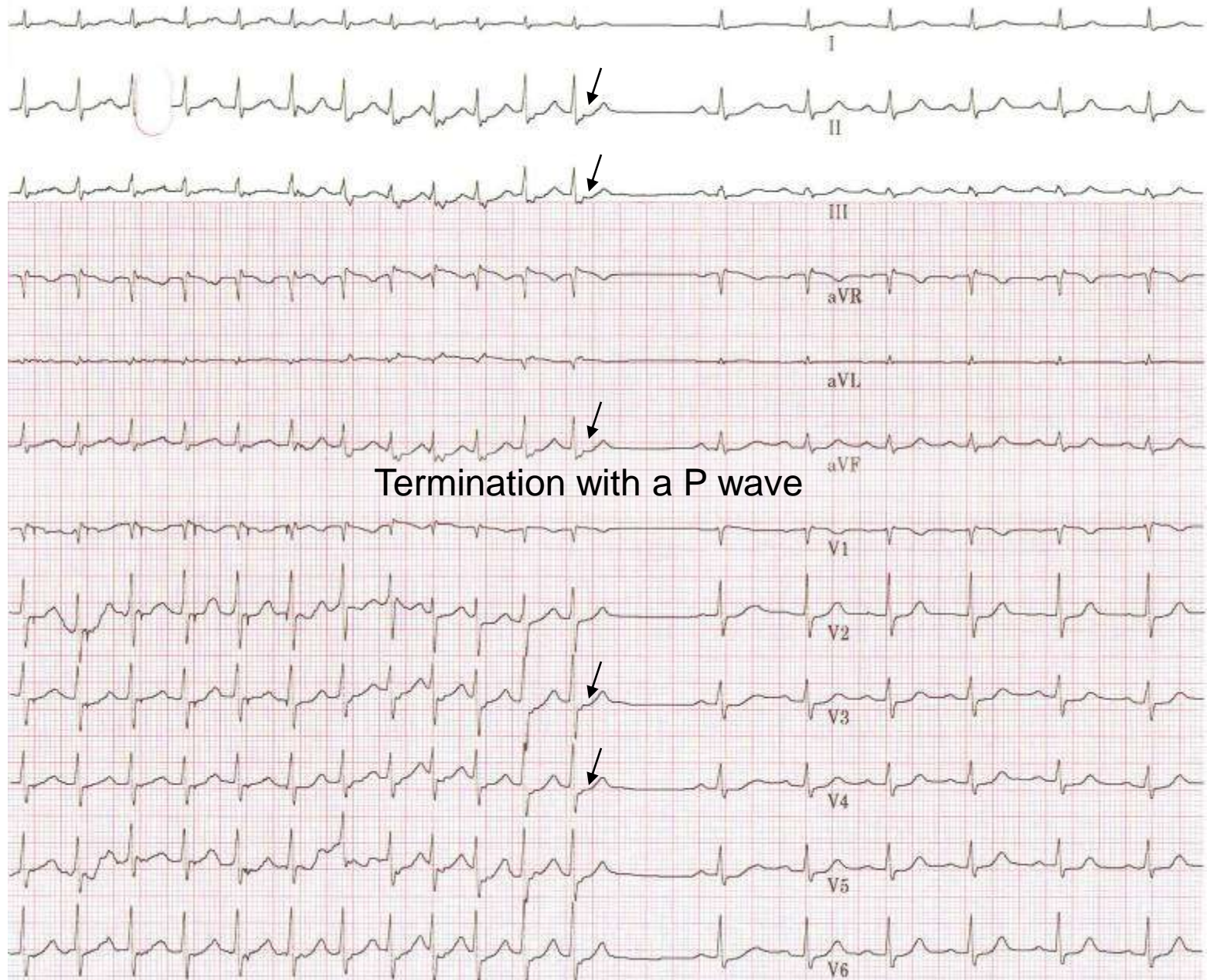
Baseline



Simultaneous QRS complexes and P waves



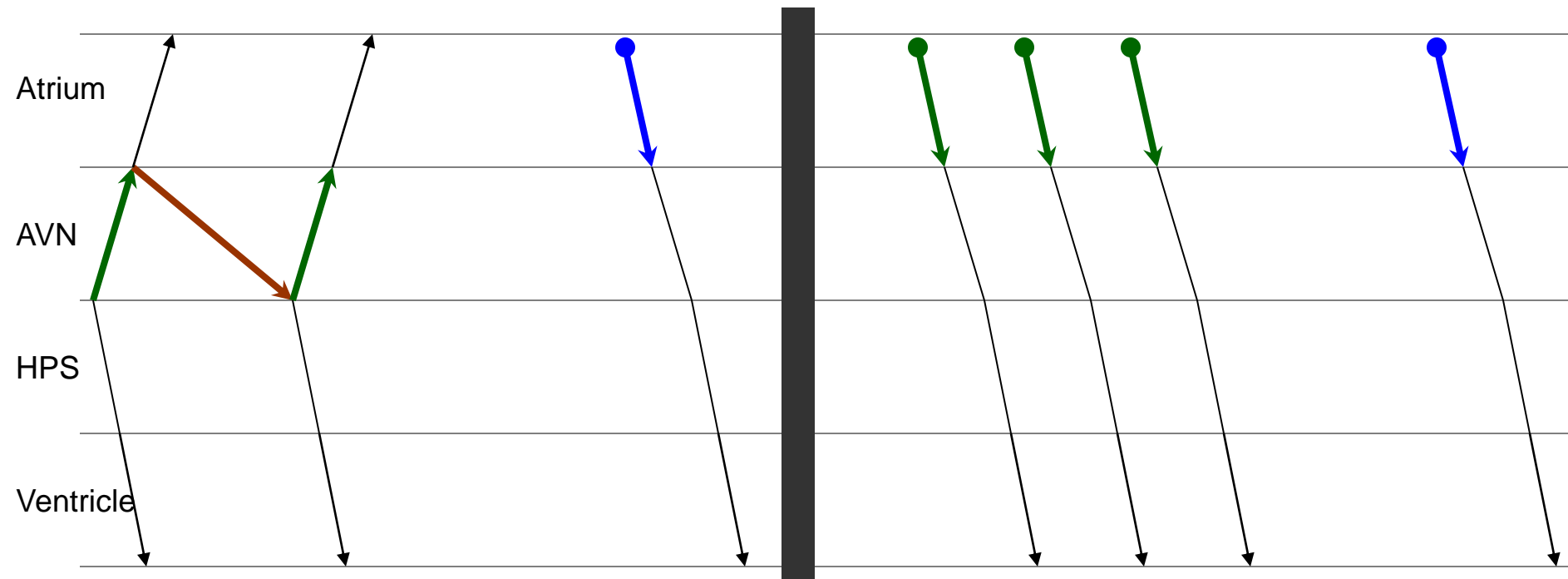
How Does the Termination of this SVT Help Determine the Mechanism?



Termination of AVNRT vs. AT

AVNRT

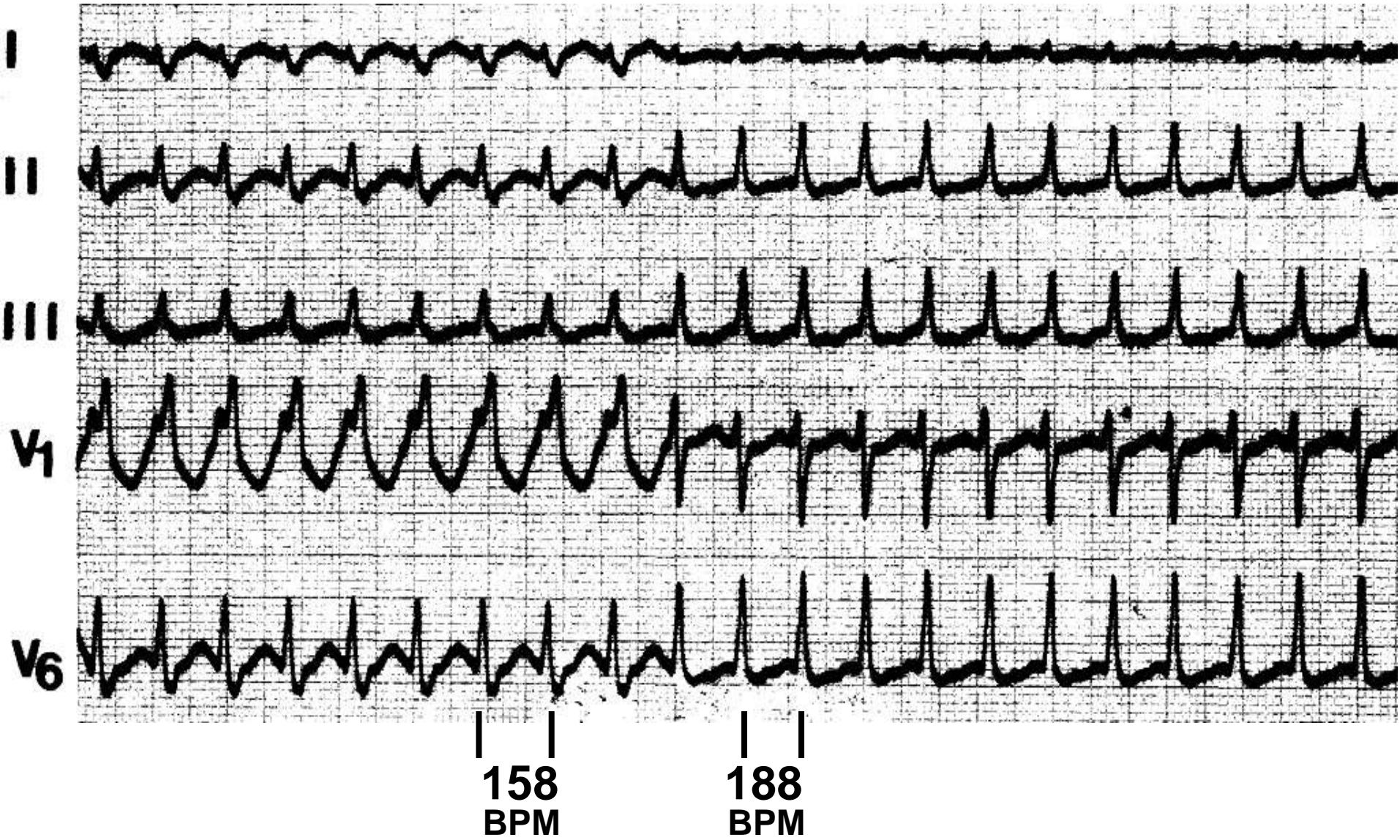
AT



- ↗ Retrograde "fast" pathway
- ↘ Antegrade "slow" pathway
- ↘ AT Source
- ↘ Sinus beat

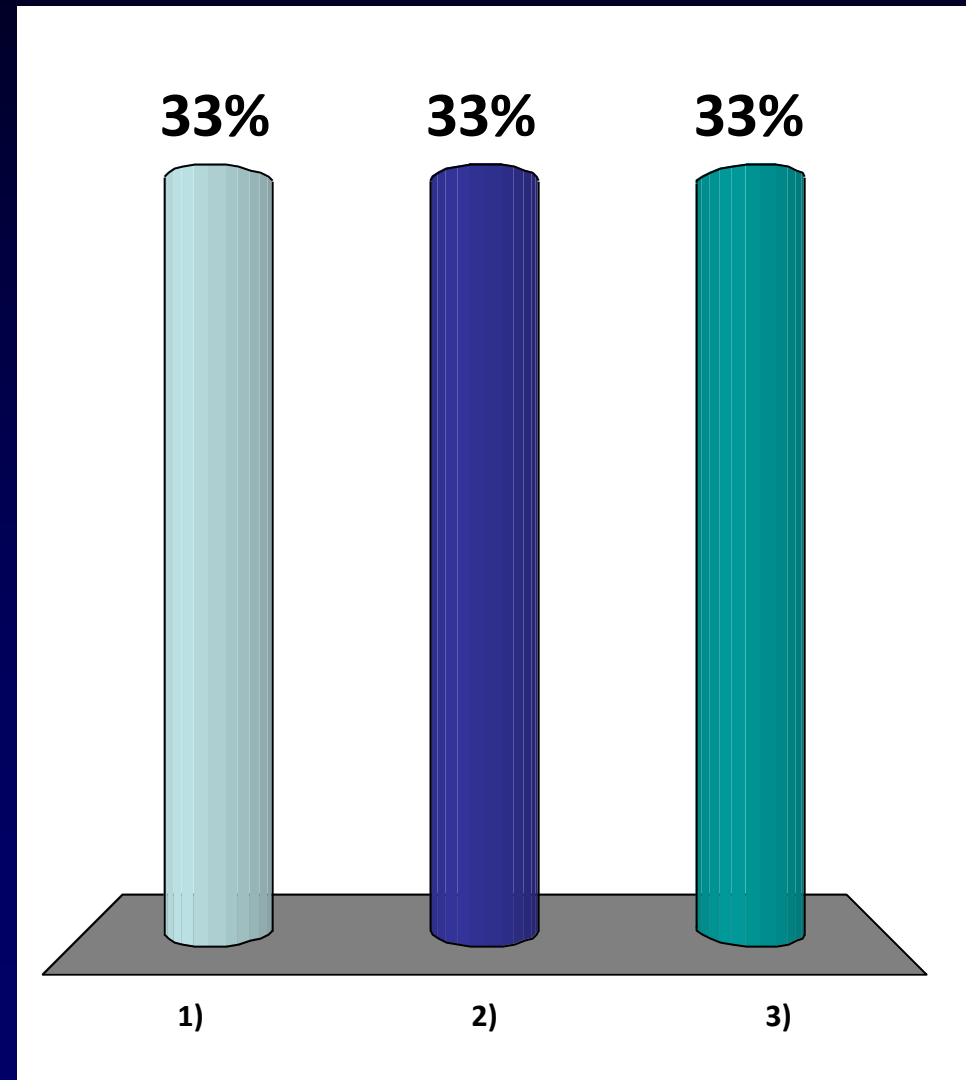
The last beat of AVNRT would be expected to depolarize **both** A & V
The last beat of AT would be expected to depolarize **only** the V

AVNRT, AVRT, or AT?



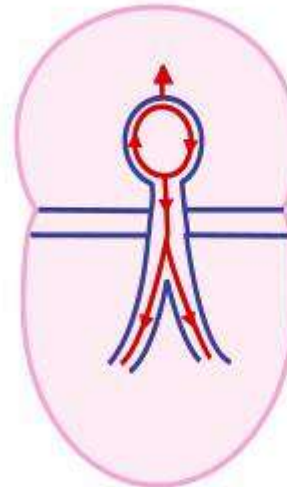
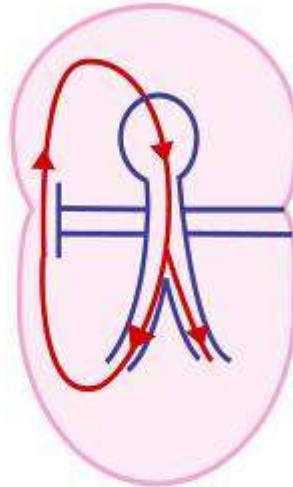
AVNRT, AVRT, or AT?

- 1) AVNRT
- 2) AVRT
- 3) AT



AVRT

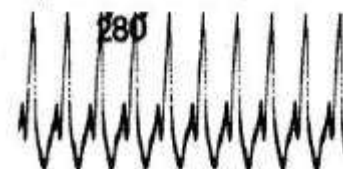
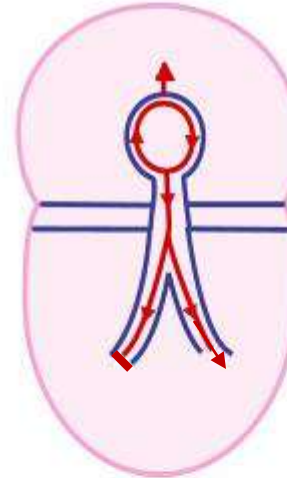
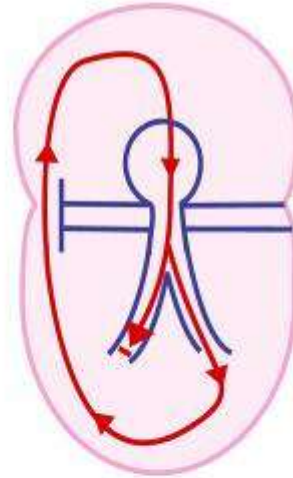
AVNRT



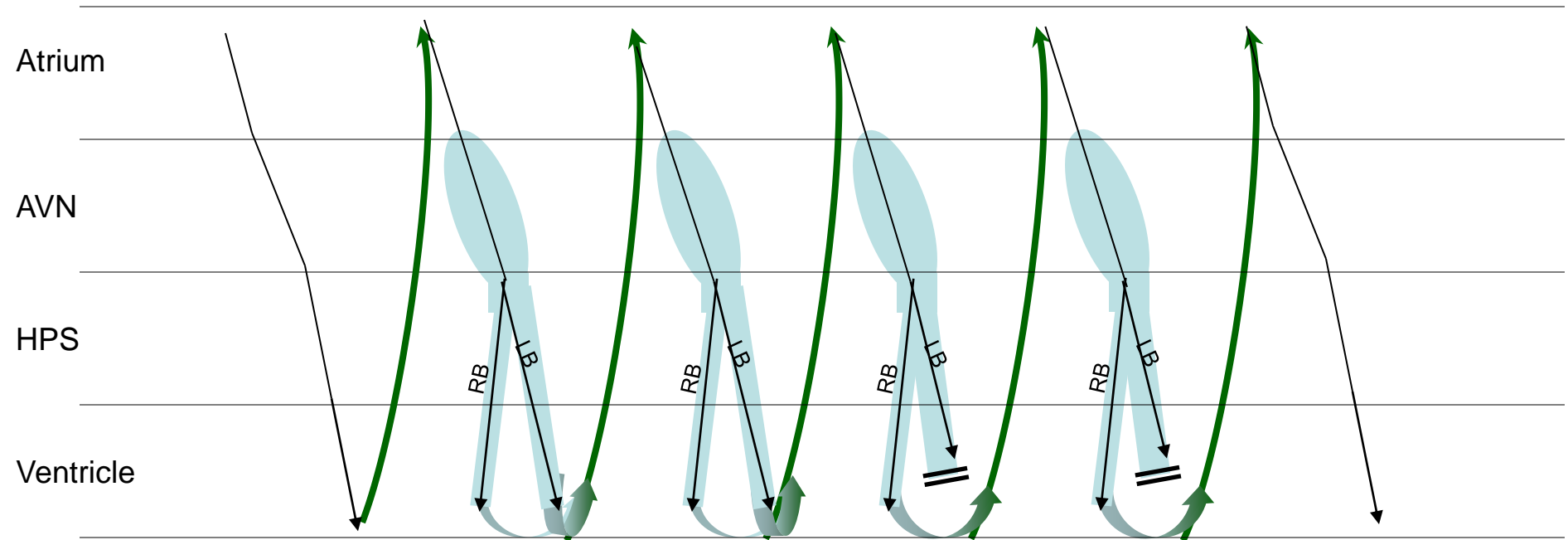
Coumel's Law

If Right AP and RBBB:
Then VA and TCL increase

If Left AP and LBBB
Then VA and TCL increase

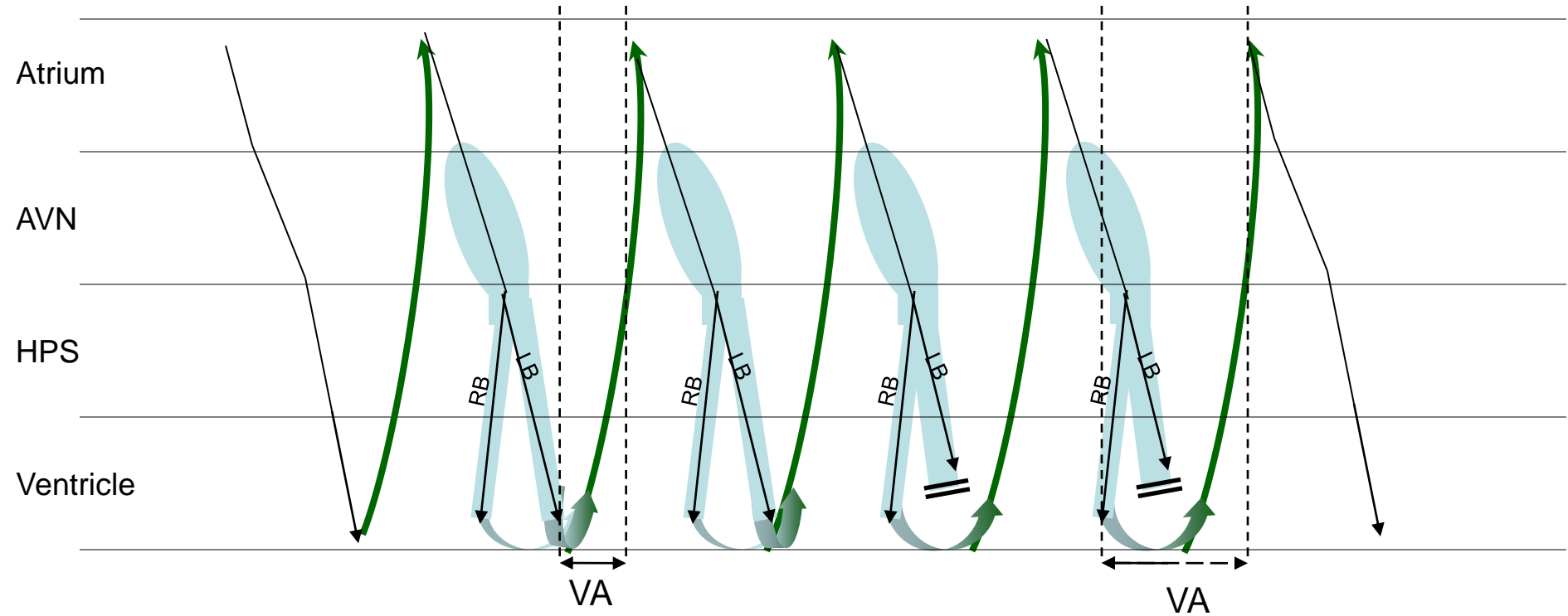


AVRT with Left-Sided AP and LBBB



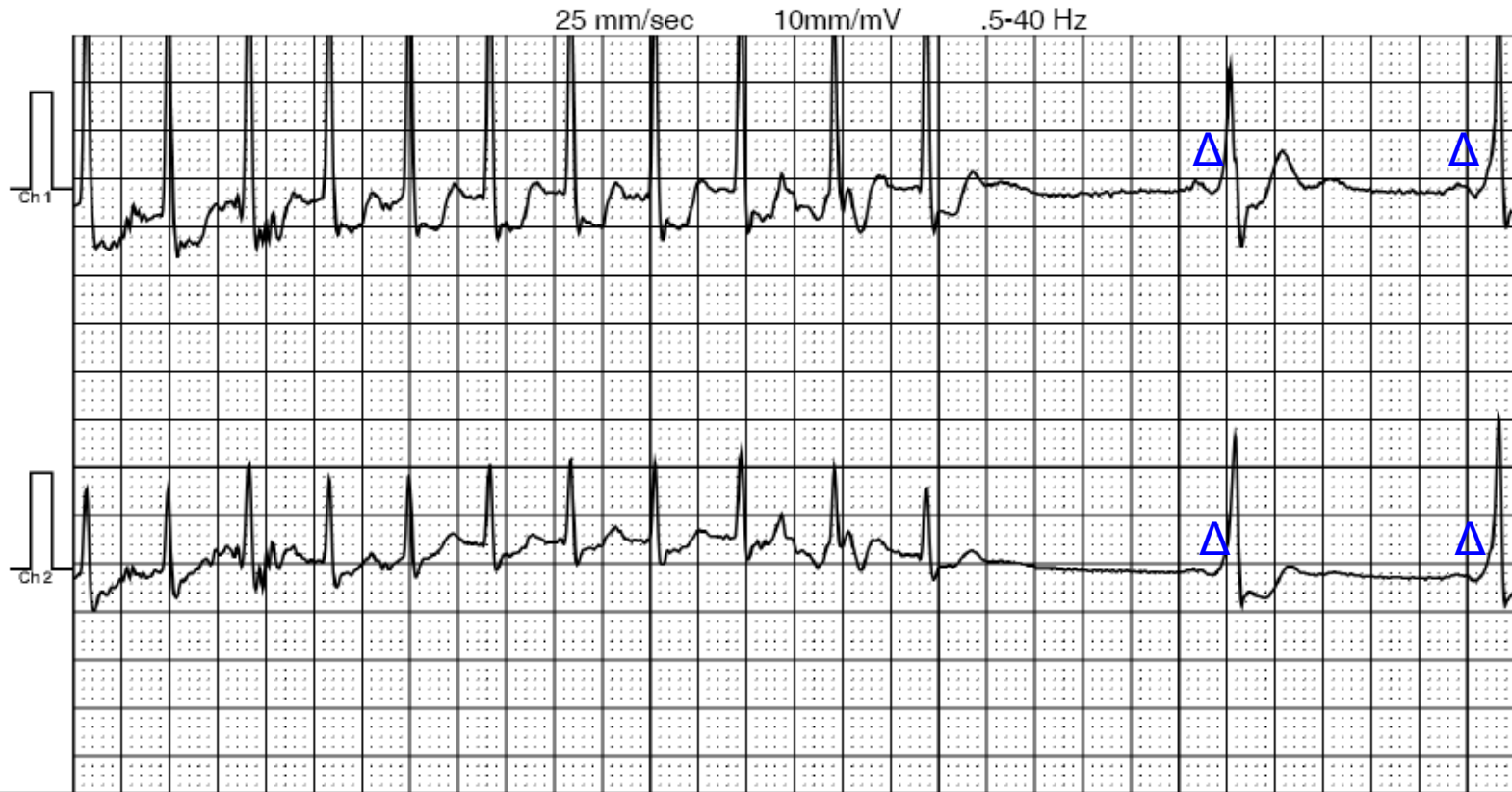
•When an a bundle branch block develops ipsilateral to the site of an AP (in this case a left bundle [LB] branch block in the presence of a left-sided AP) the VA interval increases with or without an increase in the SVT rate

Orthodromic AVRT with Ipsilateral BBB



- When an a bundle branch block develops ipsilateral to the site of an AP (in this case a left bundle [LB] branch block in the presence of a left-sided AP) the VA interval increases with or without an increase in the SVT rate

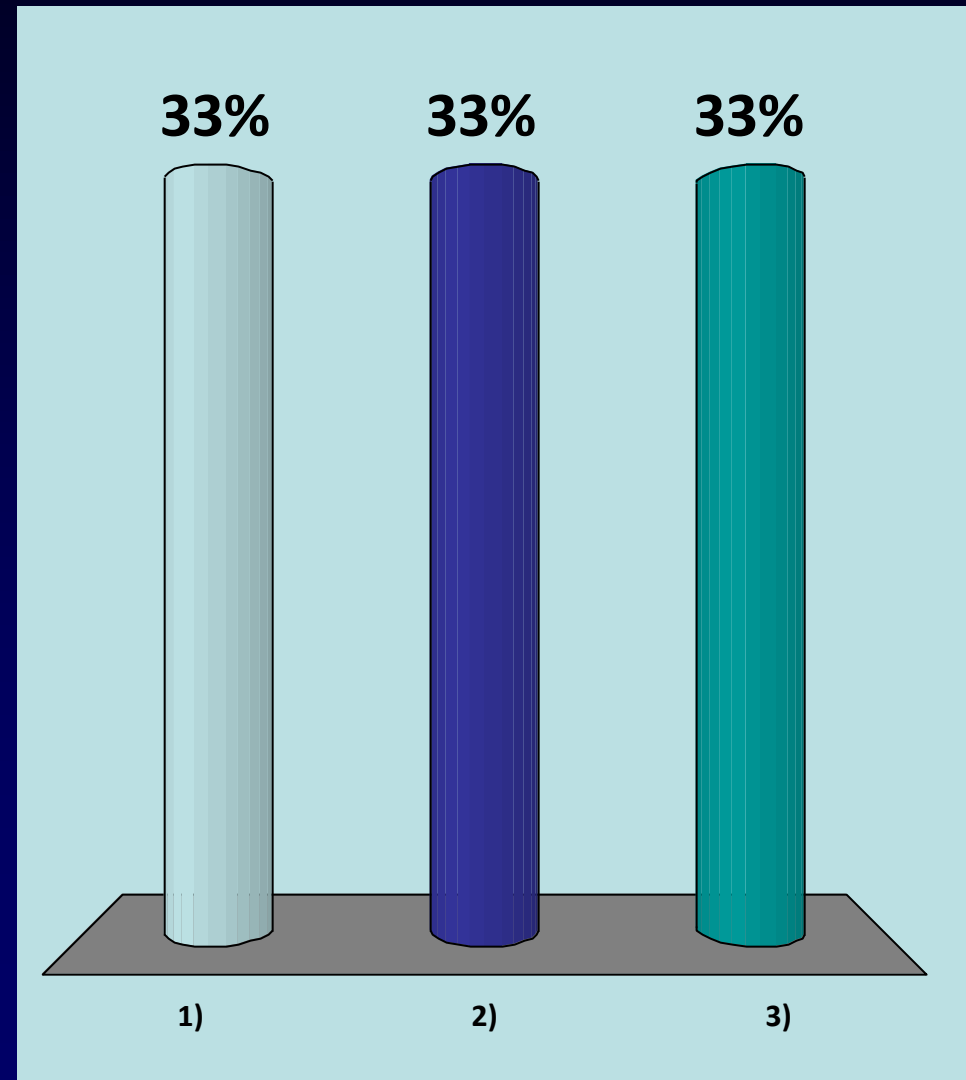
42 M with a history of palpitations since his teens
AVNRT, AVRT, or AT?



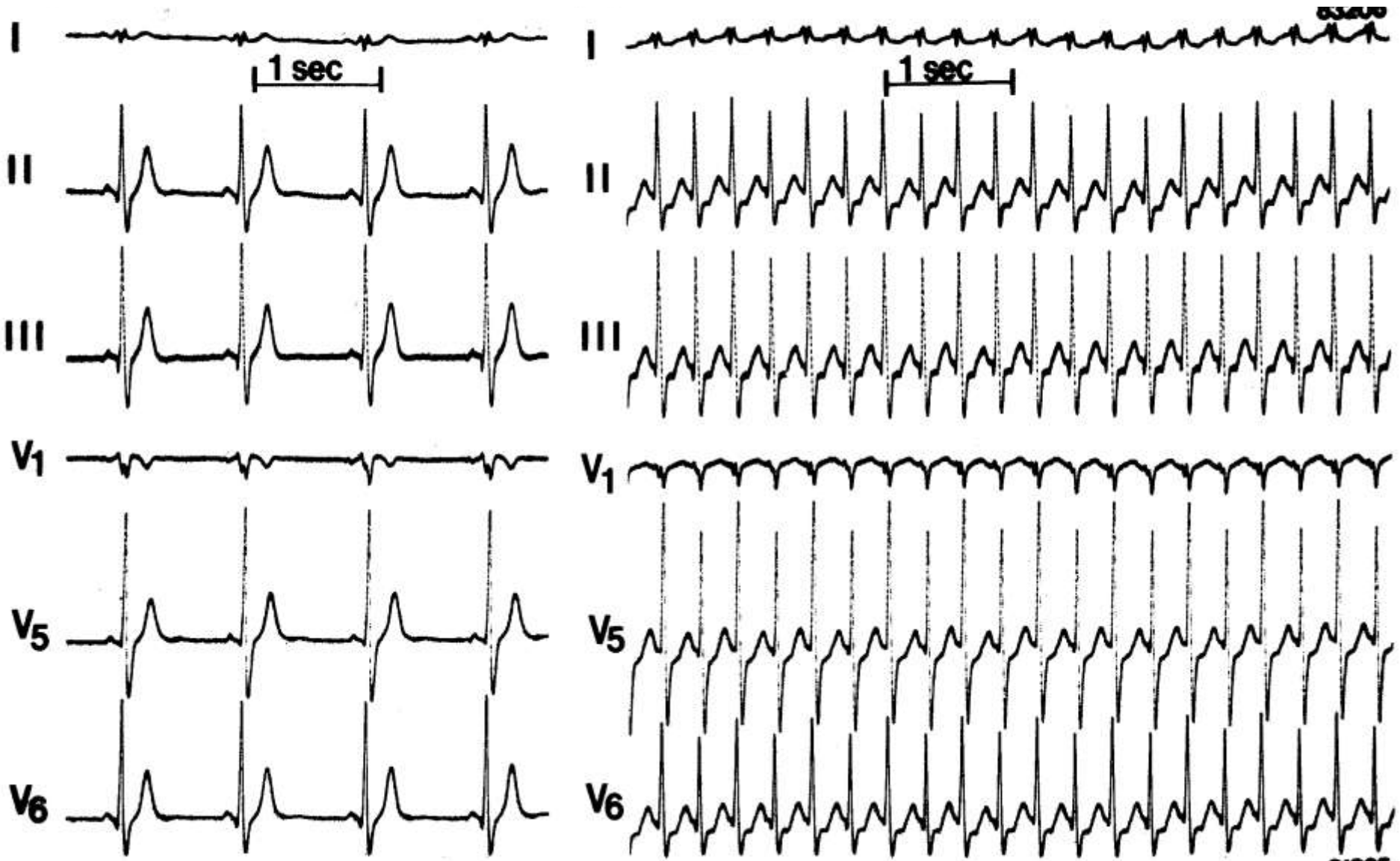
Note the Δ wave! An accessory pathway is the likely involved the SVT
(AVRT)

AVNRT, AVRT, or AT?

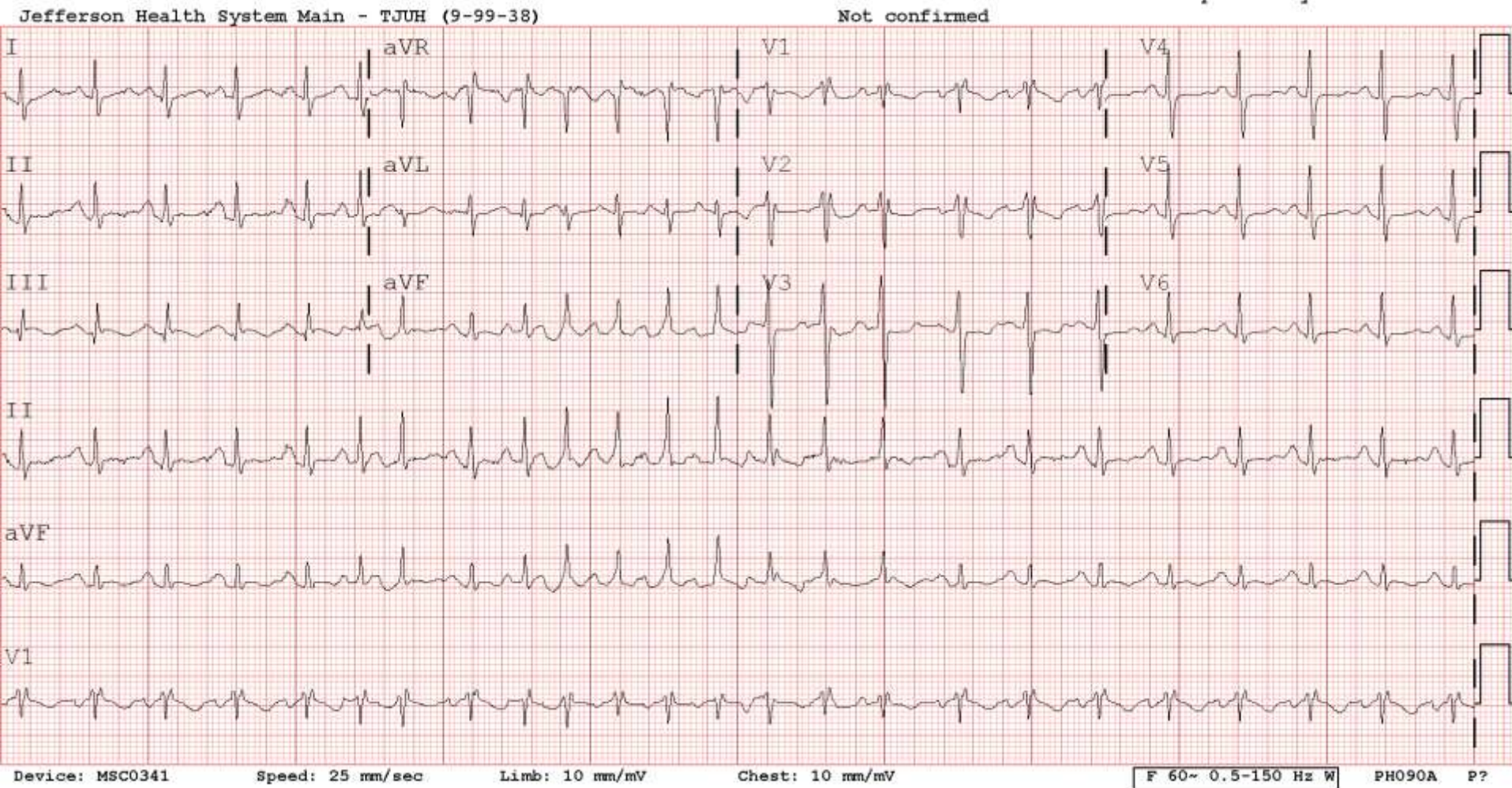
- 1) AVNRT
- 2) AVRT
- 3) AT



QRS Alternans (a feature of AVRT)

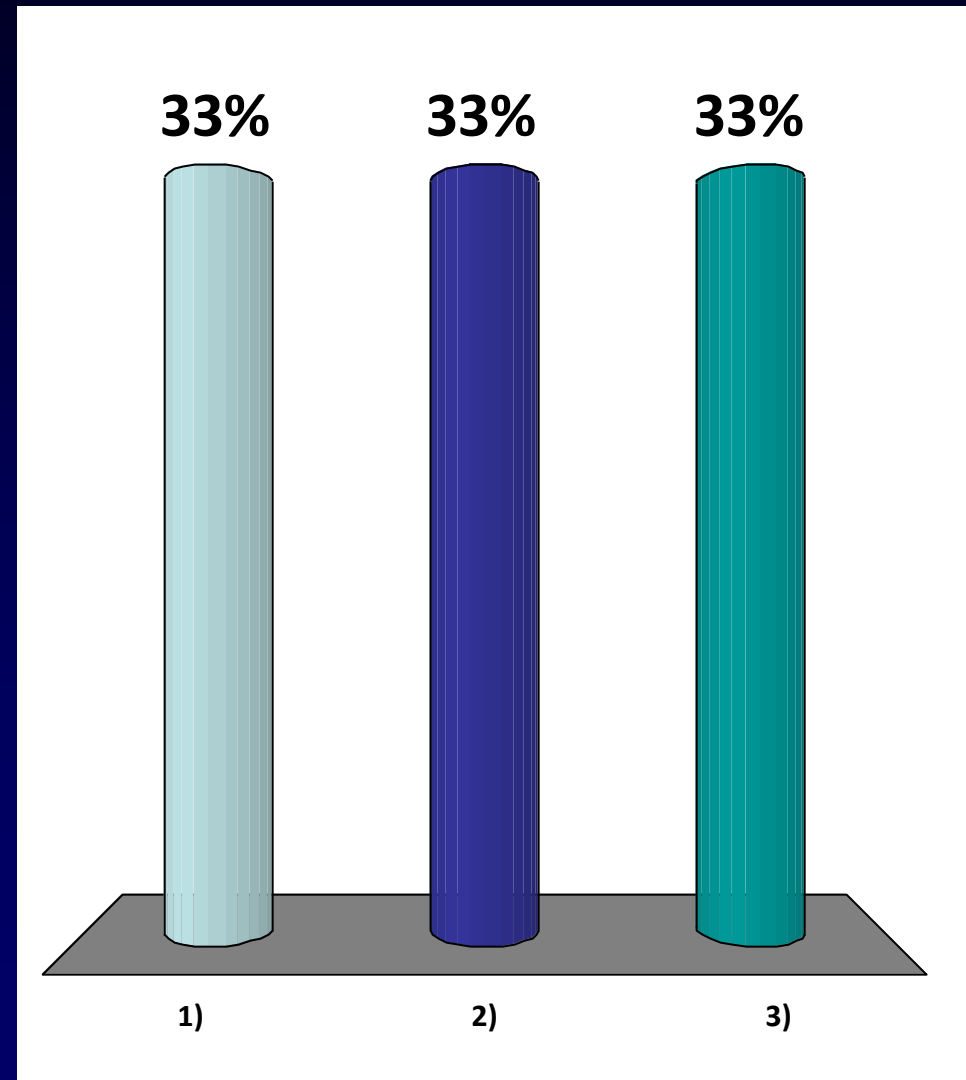


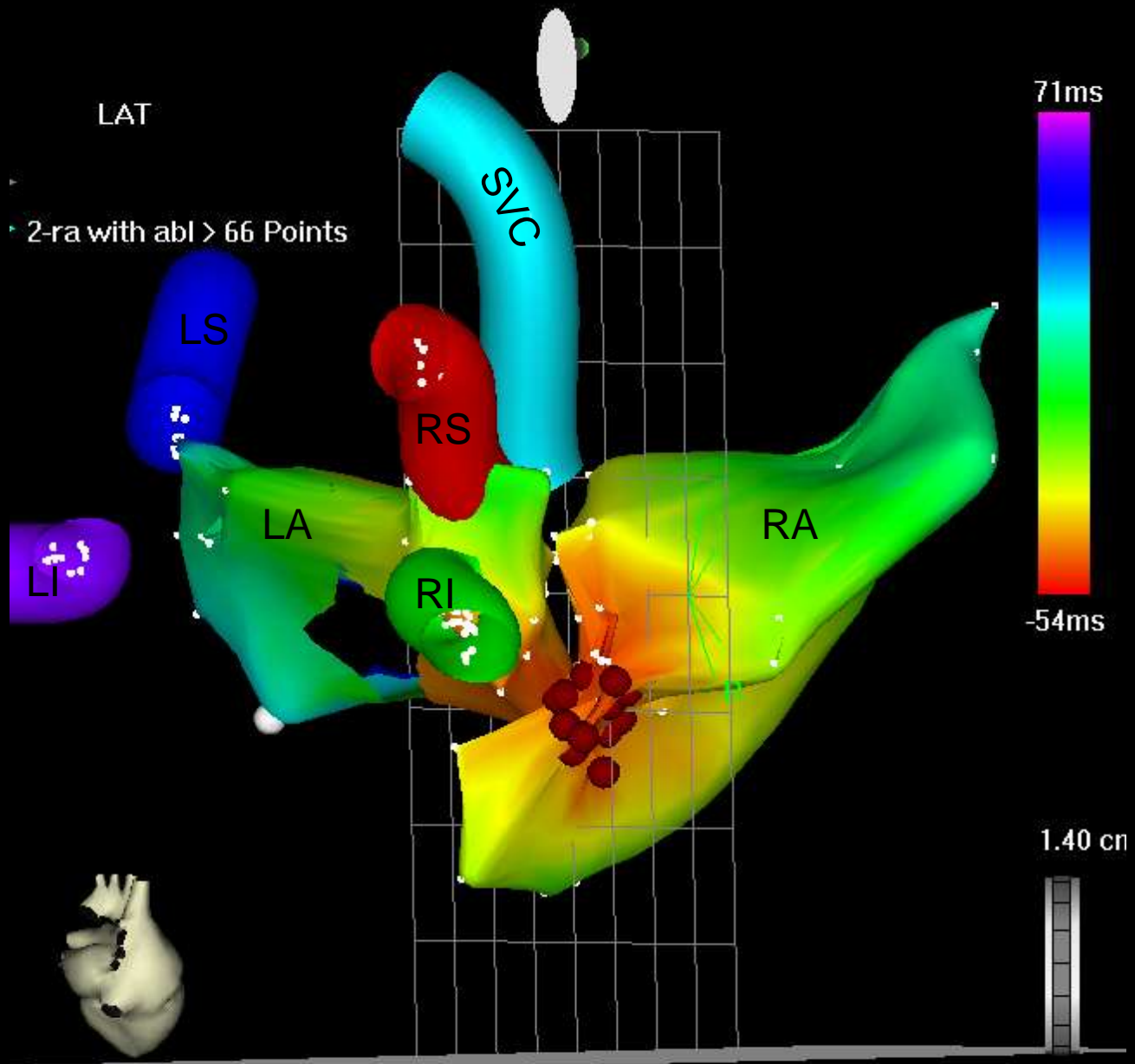
AVNRT, AVRT, or AT?



AVNRT, AVRT, or AT?

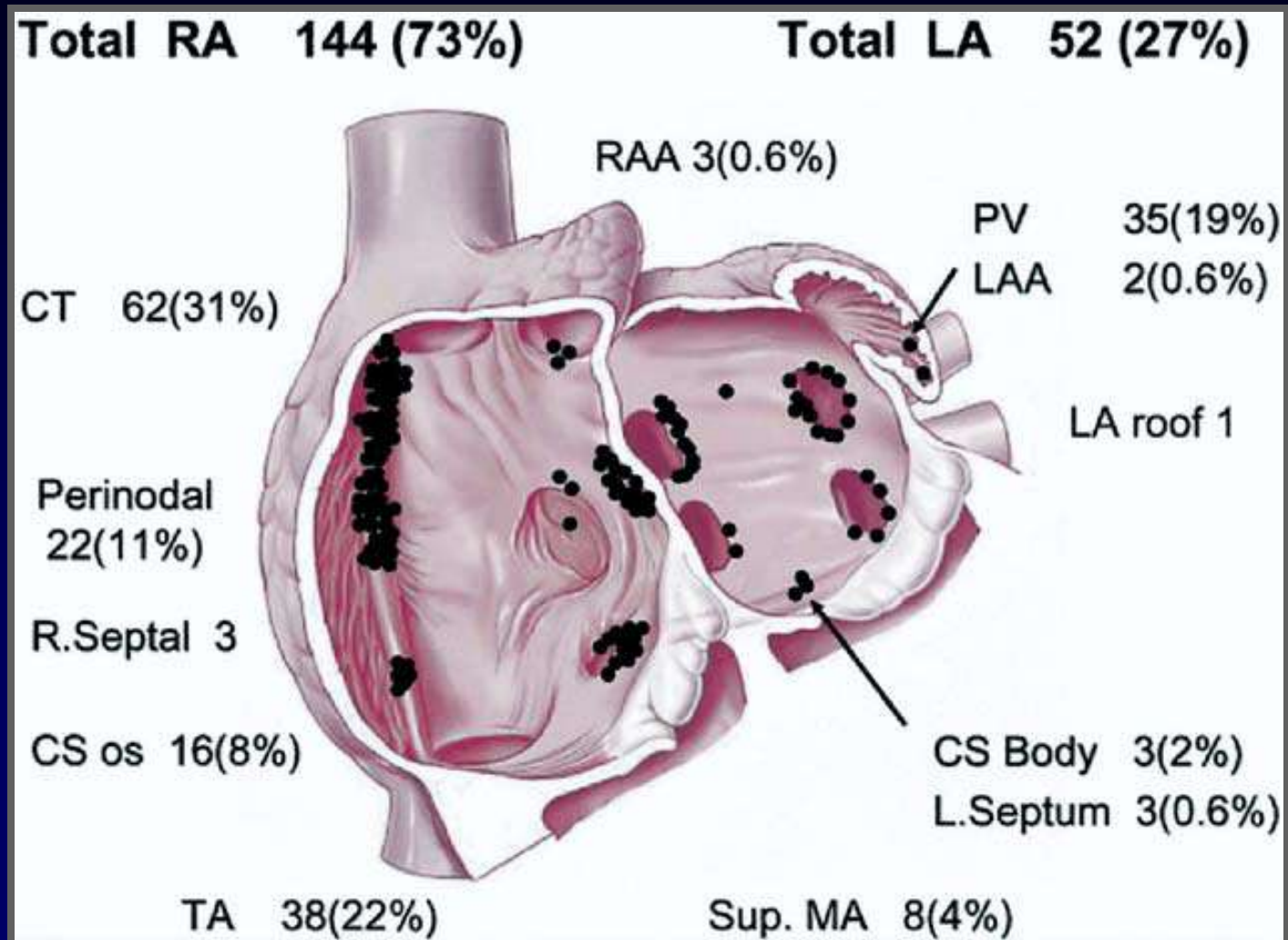
- 1) AVNRT
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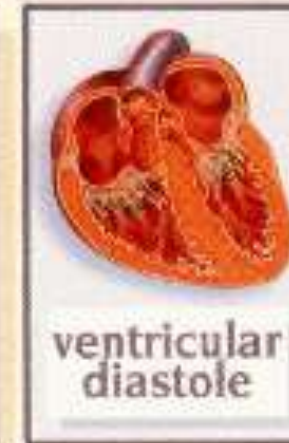
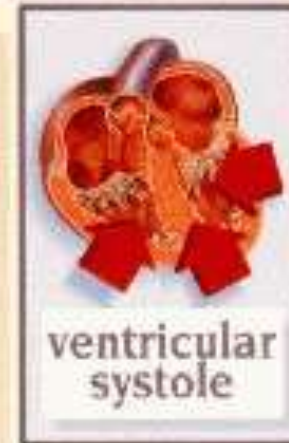
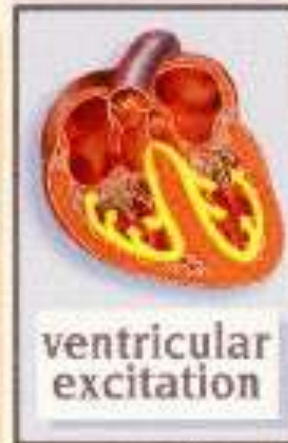
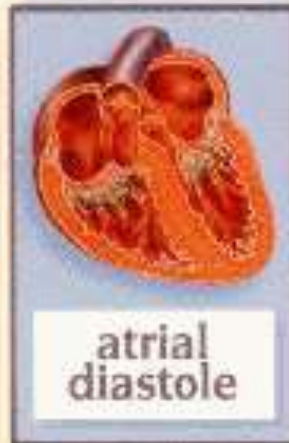
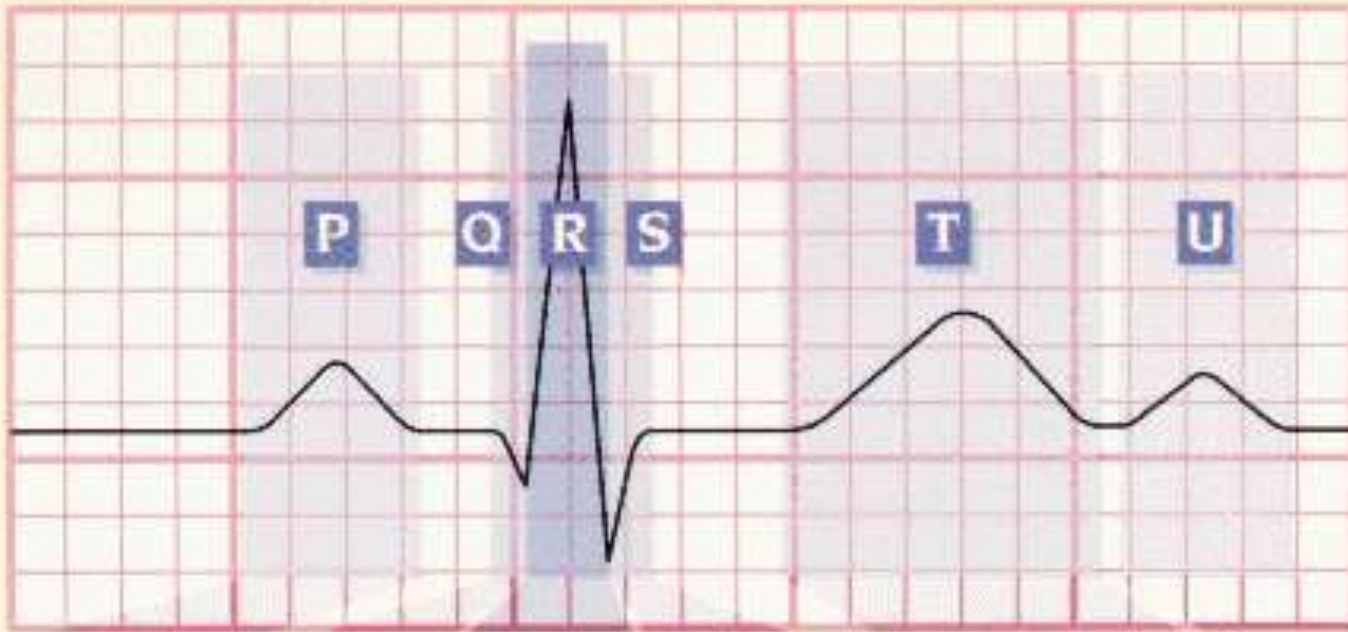


Right Lateral view showing Posteroinferior RA septal AT

ATs Tend to cluster



ECG Diagnosis:



Surface ECG Analysis of SVT

All cases:

1. Identify the P wave
2. Determine the P wave axis and morphology
3. Determine the P wave relationship to the QRS
4. Determine the RP and PR intervals
5. Determine the presence/absence of QRS alternans

Selected cases:

6. Note the influence of VPDs or BBB on the tachycardia
7. Note the initiation and termination of the tachycardia
8. Note the consequence of vagal maneuvers on the SVT

ECG Characteristics of SVT

ECG Sign	AVNRT	AVRT	AT
AV Block	Rare	Excluded if present	Possible
QRS Alternans	Rare	Common	Rare
P wave location	Within QRS	Between QRSs. Fixed RP	Between QRSs. RP varies
P wave polarity	Always (-) in II, III, aVF	Often (-) in II, III, aVF	Often (+) in II, III, aVF
P wave width	Narrow	Variable	Variable
Aberrancy	Rare	Common	Uncommon

ECG Diagnosis: Tips

1. Enhance the view

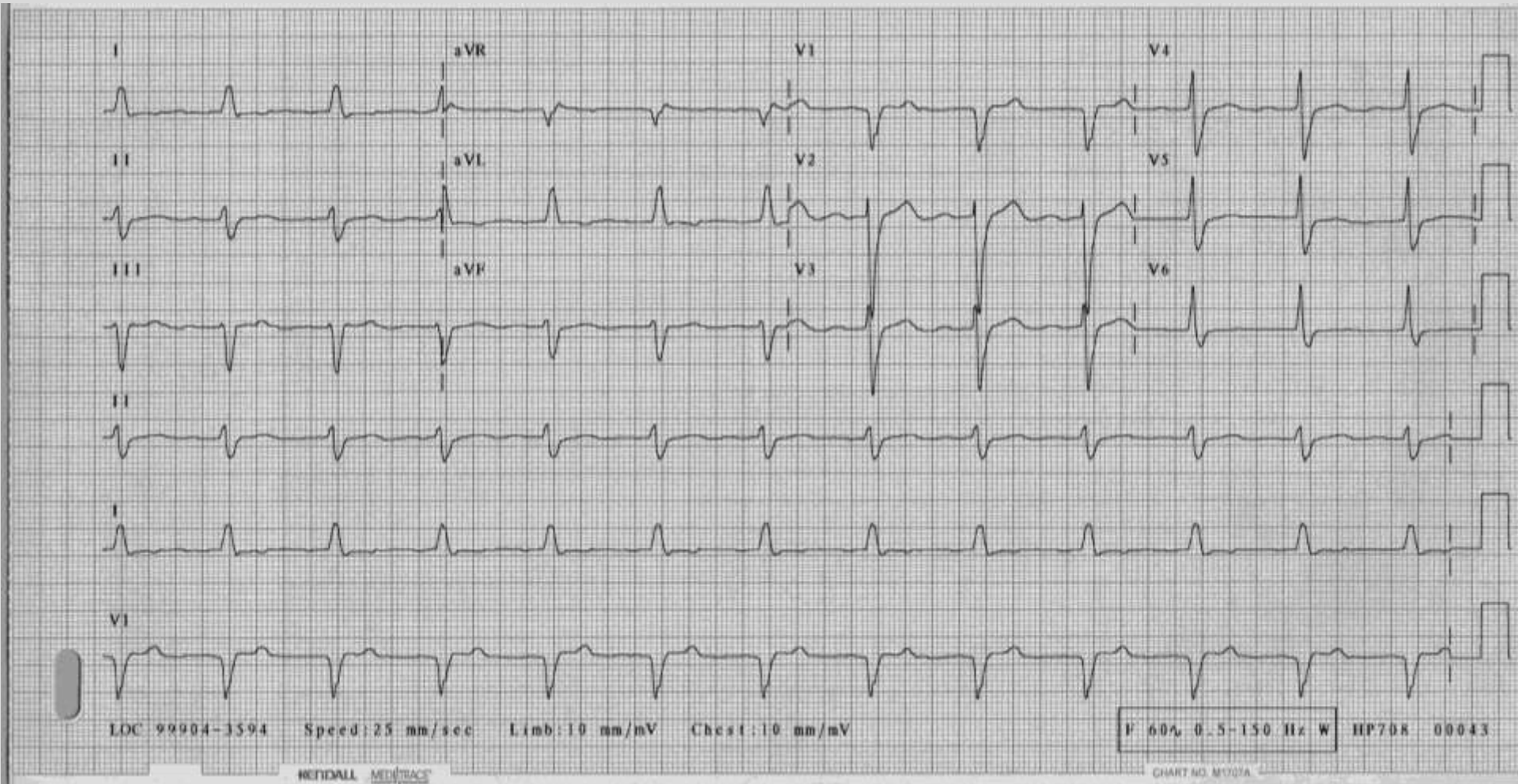
- Gain it up (2X or more)
- Speed it up (paper speed 25 → 50 mm/sec)

2. Remember CSM

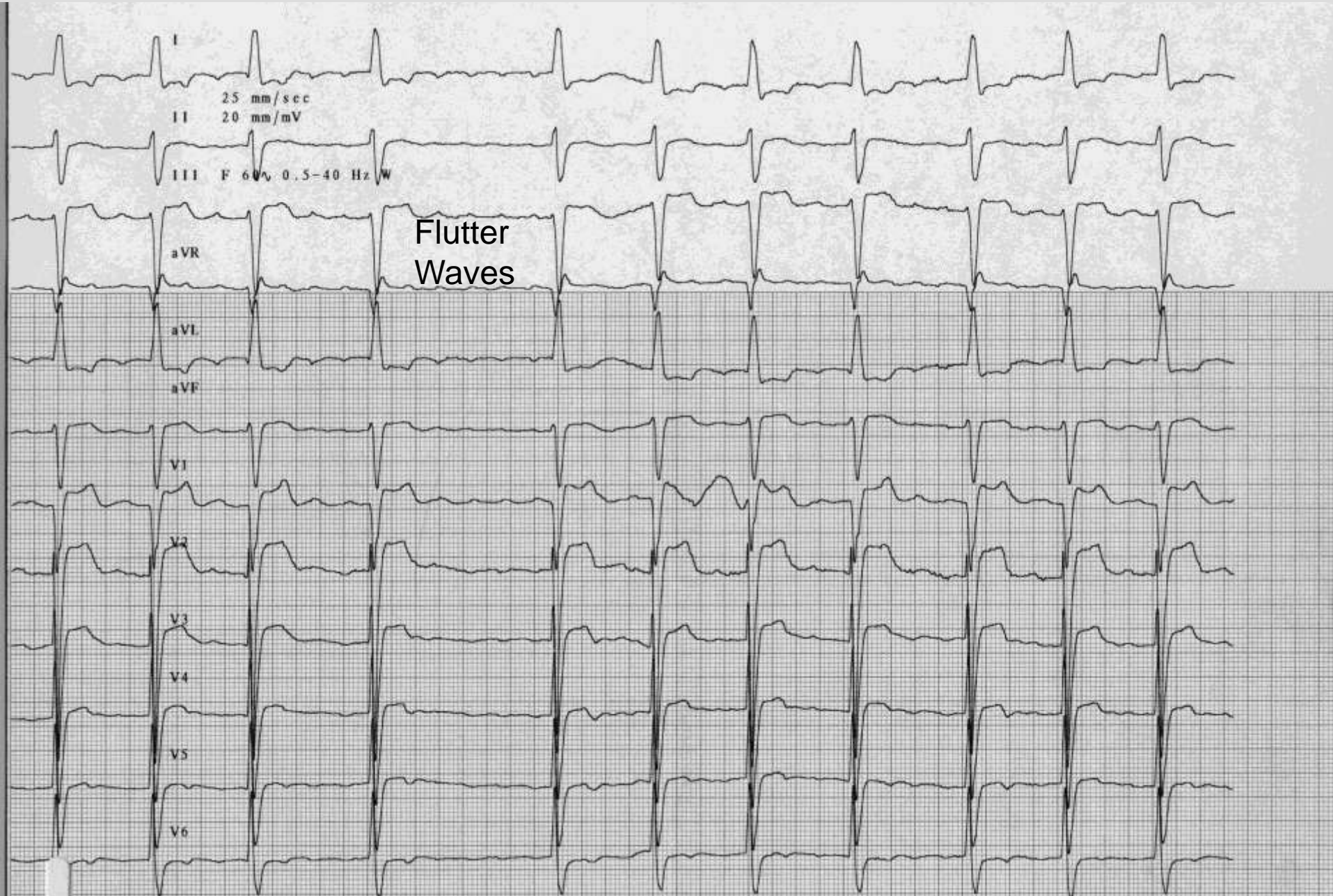
3. Compare to baseline

71M with Fatigue

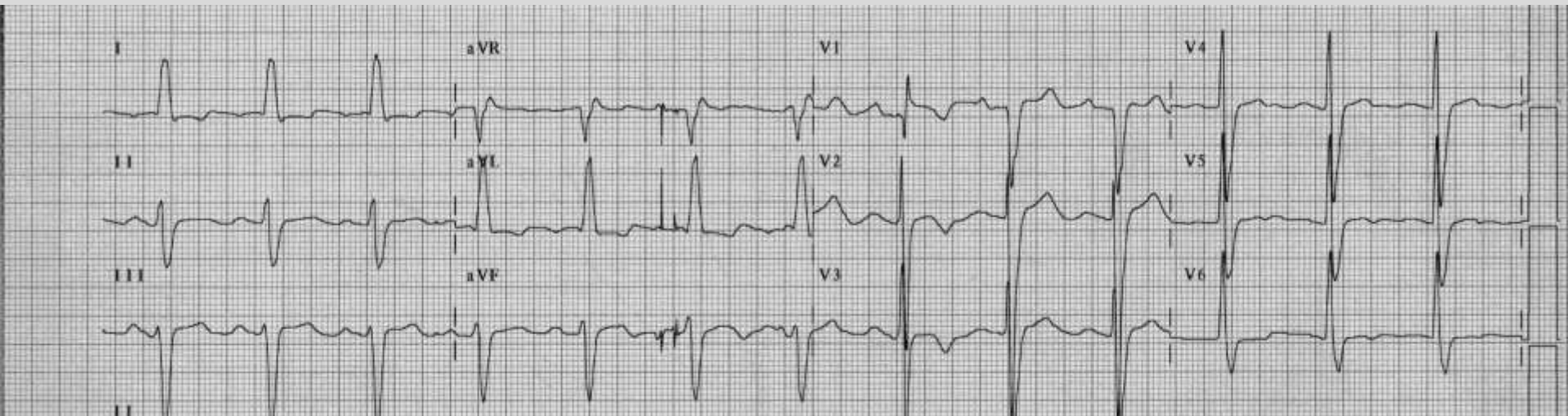
What is the Rhythm?



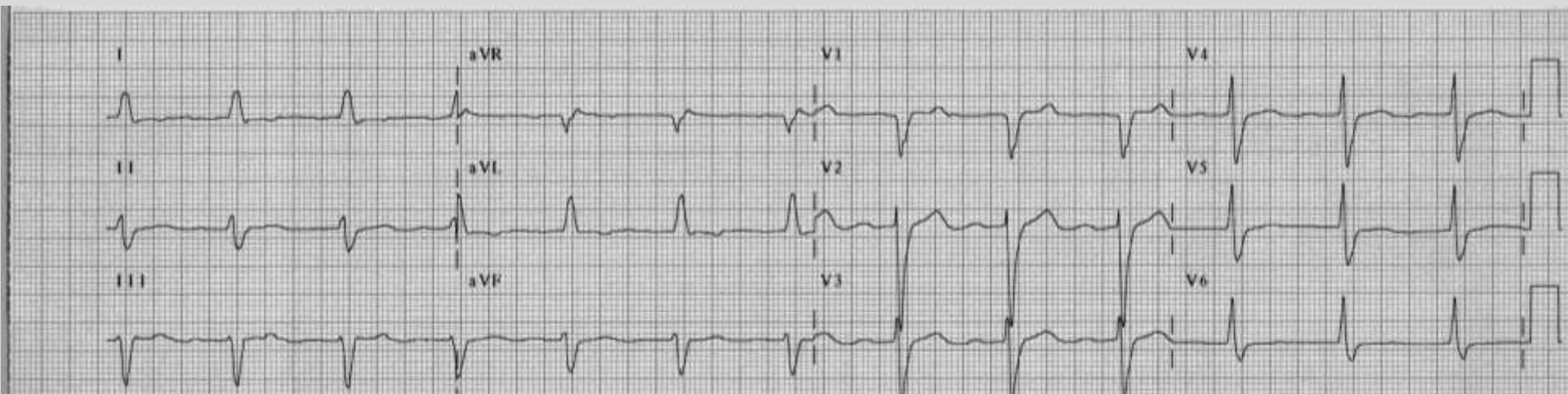
Carotid Sinus Massage (Left)



Post Cardioversion



Initial



Conclusions

Pre-Interpretation


1. Recall the pathophysiology of the different SVTs
2. Use all available information
 - Epidemiology
 - Response to Rx (adenosine)
3. Enhance the view on ECG
 - Gain it up (2X or more)
 - Speed it up (paper speed 25 → 50 mm/sec)
4. Remember CSM
5. Compare to baseline
 - Look for pre-excitation (WPW)

Interpretation

1. Find zones of transition
 - Initiation (APD with long PR?), termination (P wave?)
2. Look for perturbations
 - SVT with BBB, initiation and/or termination with VPD, change in RP interval or change in SVT rate with BBB should raise suspicion for AP
3. Persistence of SVT with AV block excludes AVRT
4. (+) P waves II,III,F suggest AT
5. QRS alternans suggests AVRT

Selected References

- Josephson ME and Wellens HJ. Differential diagnosis of supraventricular tachycardia. *Cardiol Clin.* 1990 Aug;8(3):411-42.
- Wellens HJJ, Conover MB. *The ECG in Emergency Decision Making.* Ed. 2. Philadelphia, Saunders, 2005.



Which of the following is the largest?

An Elephant

The Moon

Supraventricular Tachycardia (SVT)

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