Narrow Complex Tachycardia: Approach to Diagnosis and Localization of Pathway with ECG

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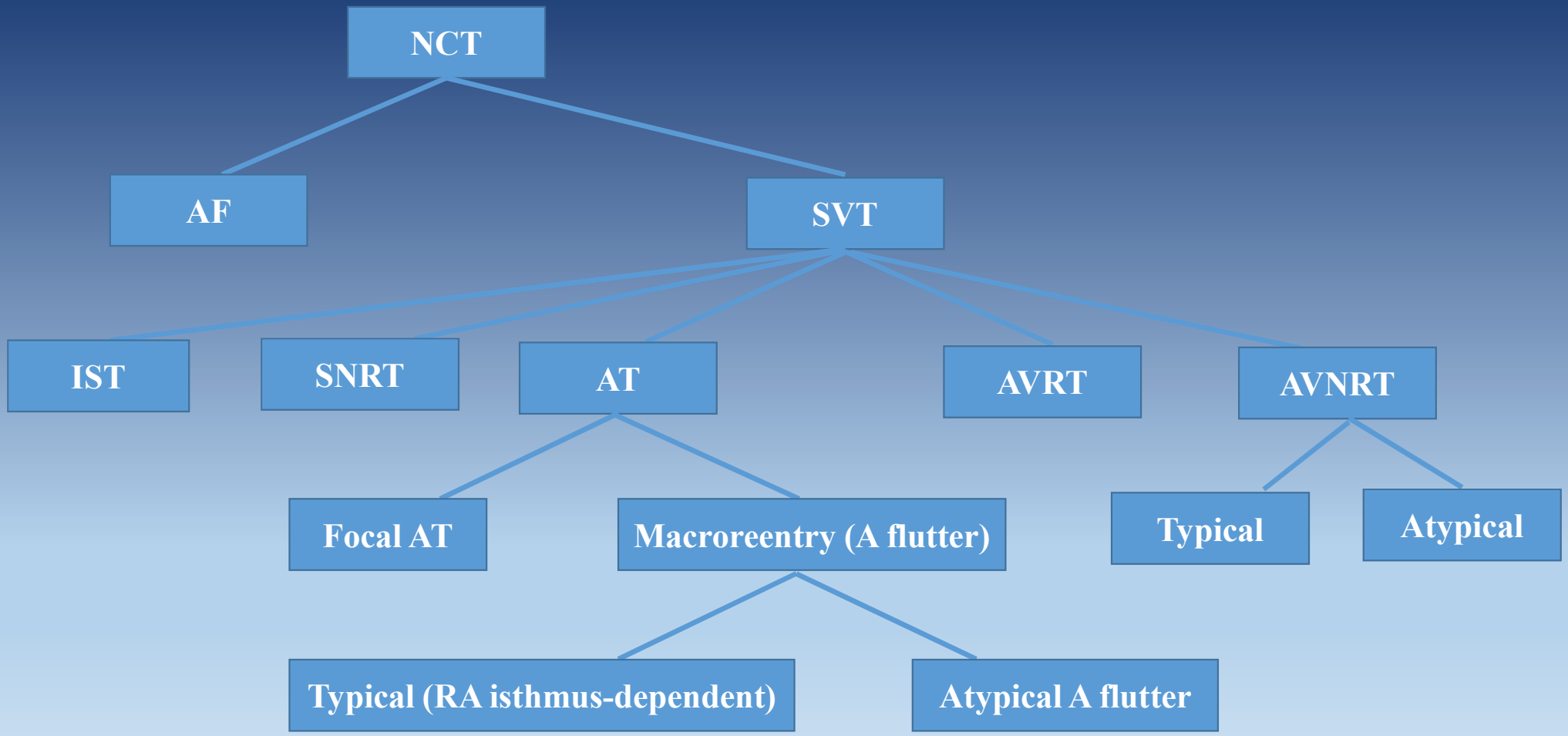
Lecture Outline

- Classification of narrow complex tachycardia
- Epidemiology and clinical presentations of SVT
- ECG features of different types of SVT
- Clinical features of inappropriate sinus tachycardia and sinus nodal reentry
- Localization of accessory pathway by ECG algorithm

Terminology

- Narrow complex tachycardia
- Supraventricular tachycardia
- Supraventricular arrhythmia
- Atrial tachycardia
- Atrial flutter
- Atrial fibrillation
- Sinus nodal re-entrant tachycardia
- Multifocal atrial tachycardia

Classification of Narrow Complex Tachycardia



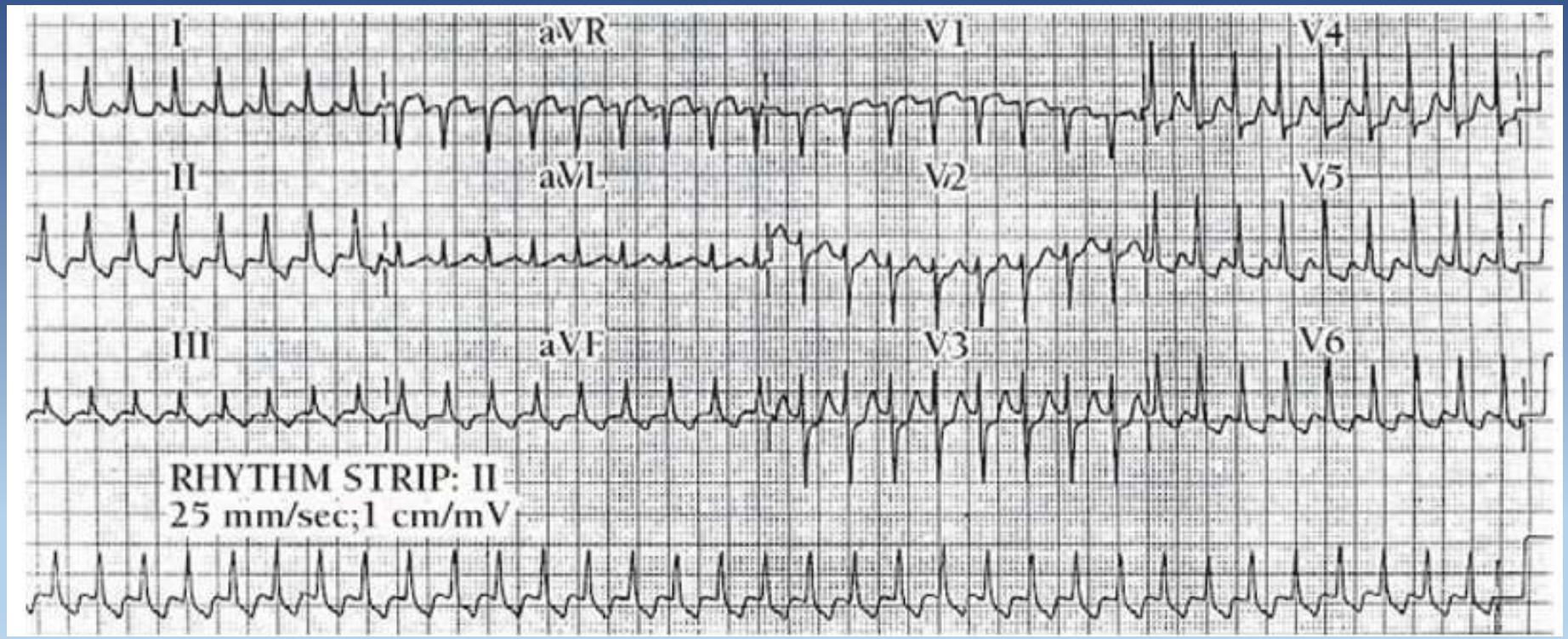
Epidemiology of SVT

- Incomplete data and imprecisely defined
- Prevalence: 2.29 per 1,000 persons (around 16,000 in Hong Kong)
- Incidence: 36 per 100,000 persons per year (around 2,500/year in Hong Kong)
- Women twice the risk of men in developing SVT
- Individuals >65 years of age >5 times risk of developing SVT
- Patients with SVT but without CV diseases are younger (37 vs 69 years of age) and have faster SVT (186 vs 155bpm)

Clinical Presentation of SVT

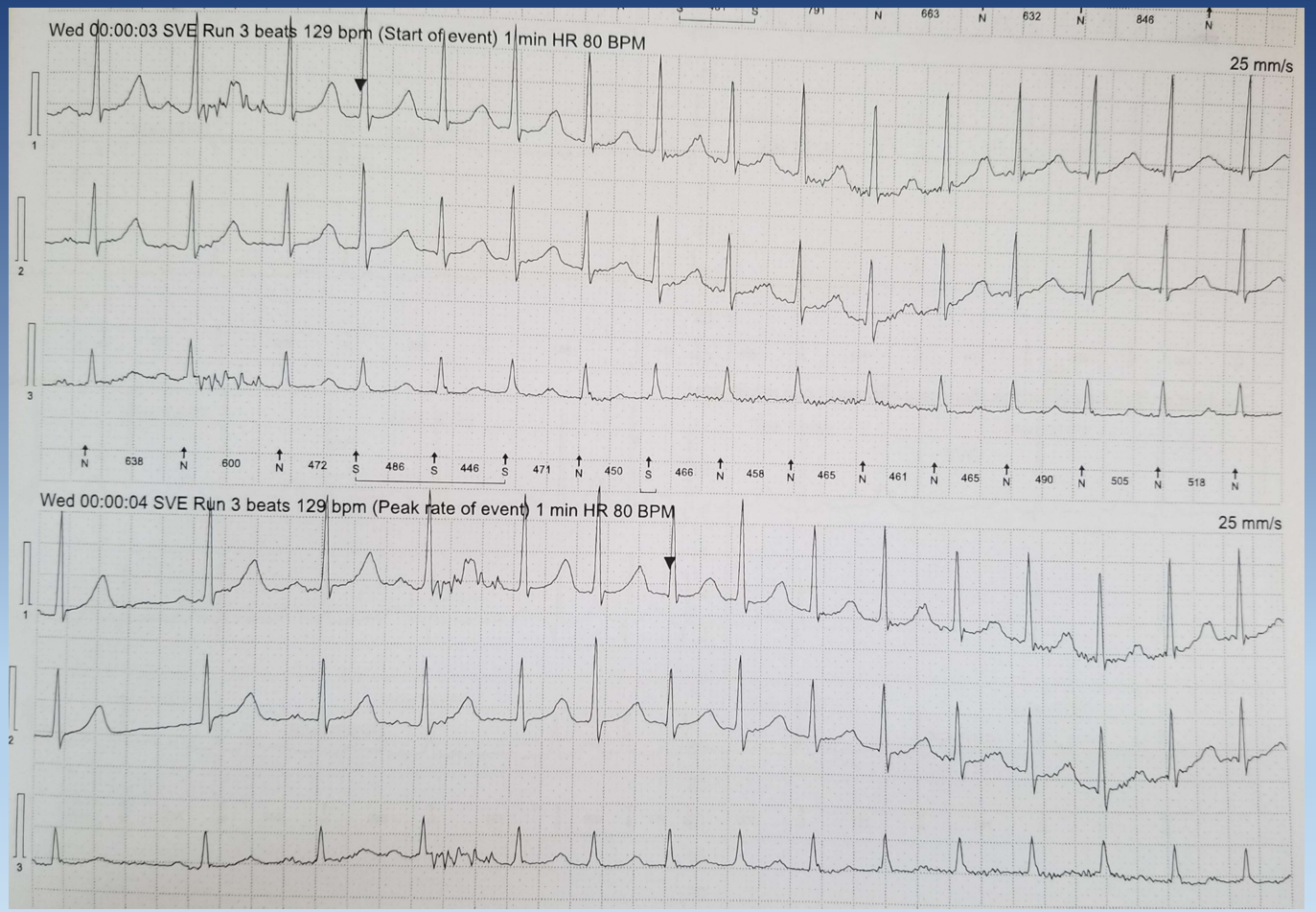
- Episodic fast palpitations, sudden onset and offset
- Light-headedness, true syncope uncommon
- Shortness of breath, generalized weakness, chest pain
- Polyuria
- Mimic panic and anxiety disorders

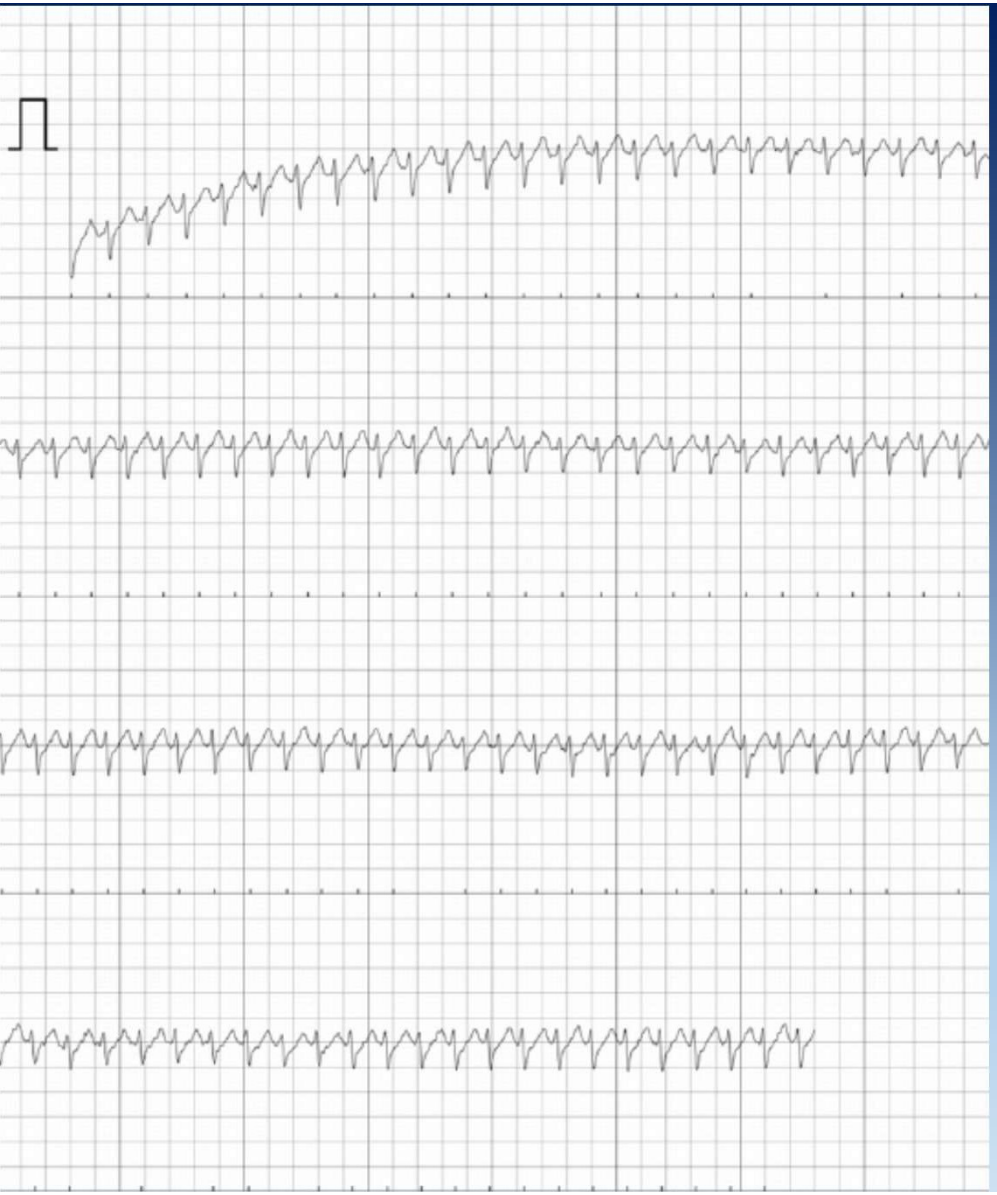
12-lead ECG



Medi C et al. Supraventricular tachycardia. MJA 2009;190:255-60.

Holter Monitoring

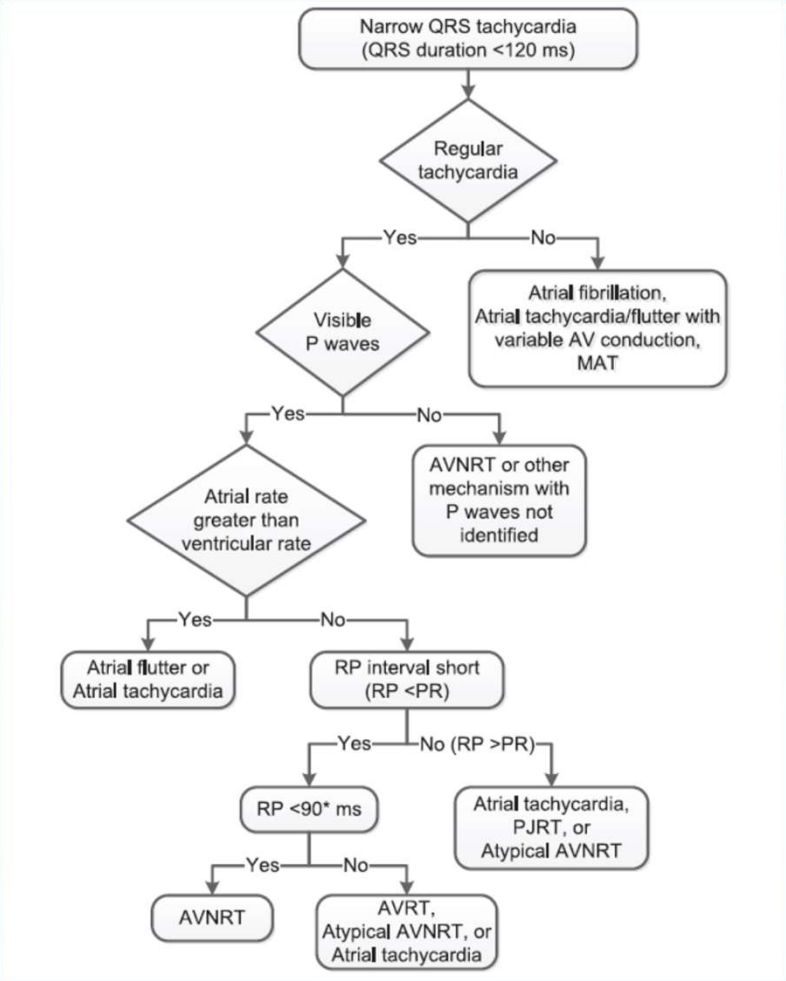




Smartphone ECG

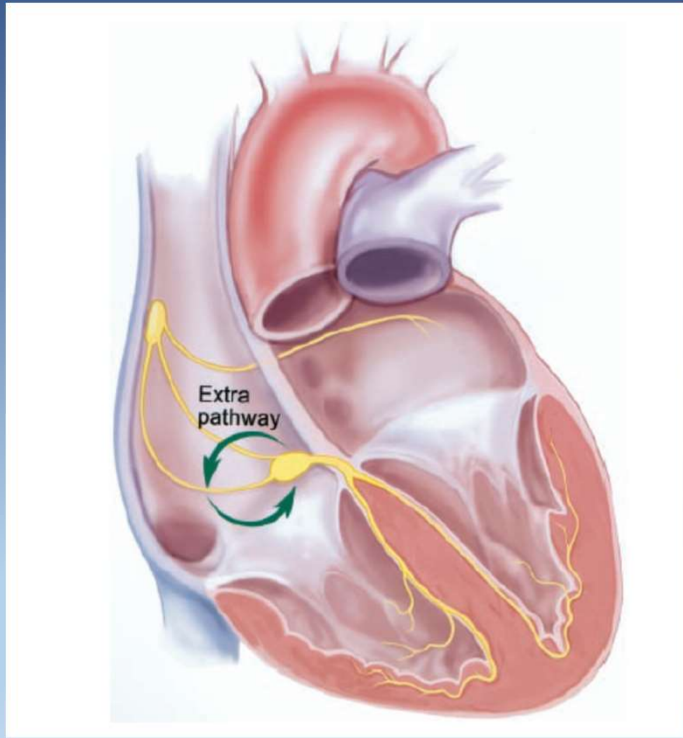
Tabing A, et al. Supraventricular tachycardia diagnosed by smartphone ECG. BMJ Case Rep 2017. doi:10.1136/bcr-2016-217197.

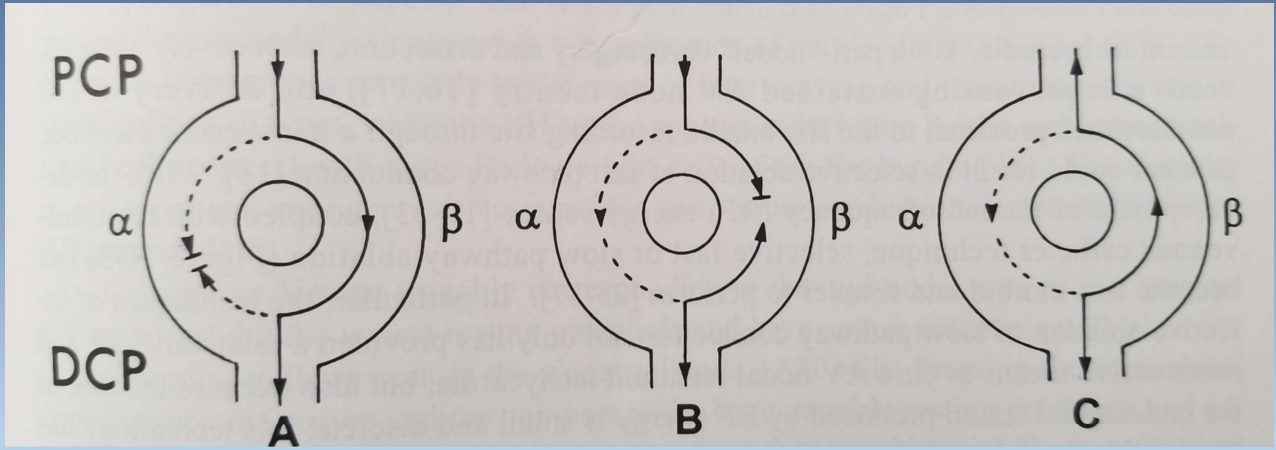
Differential Diagnosis Algorithm for NCT



Page RL et al. 2015 ACC/AHA/HRS guideline for the management of adult patients with supraventricular tachycardia. J Am Coll Cardiol 2016;67(13):e27-115.

Atrioventricular Nodal Reentrant Tachycardia





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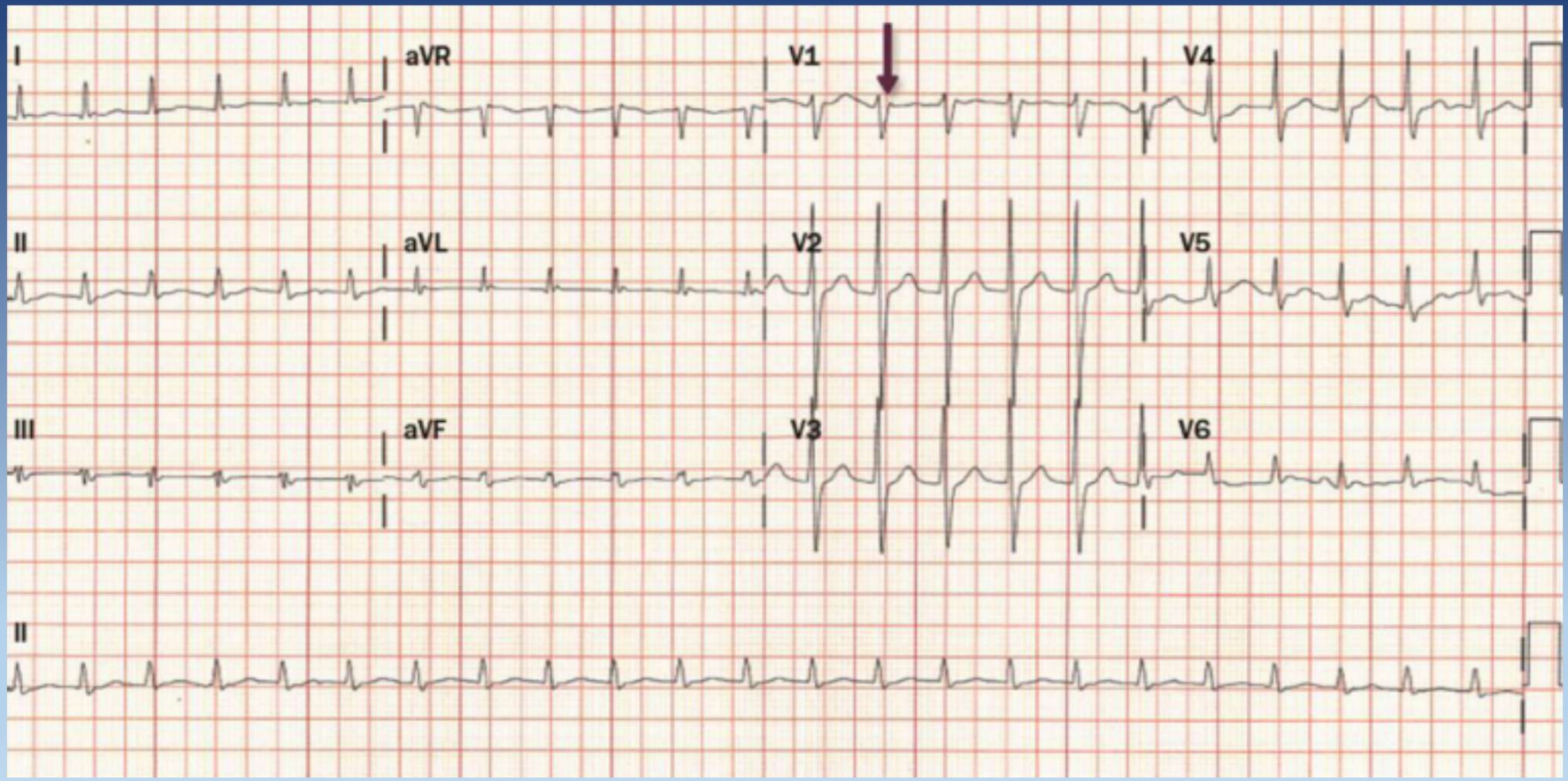
Typical AVNRT



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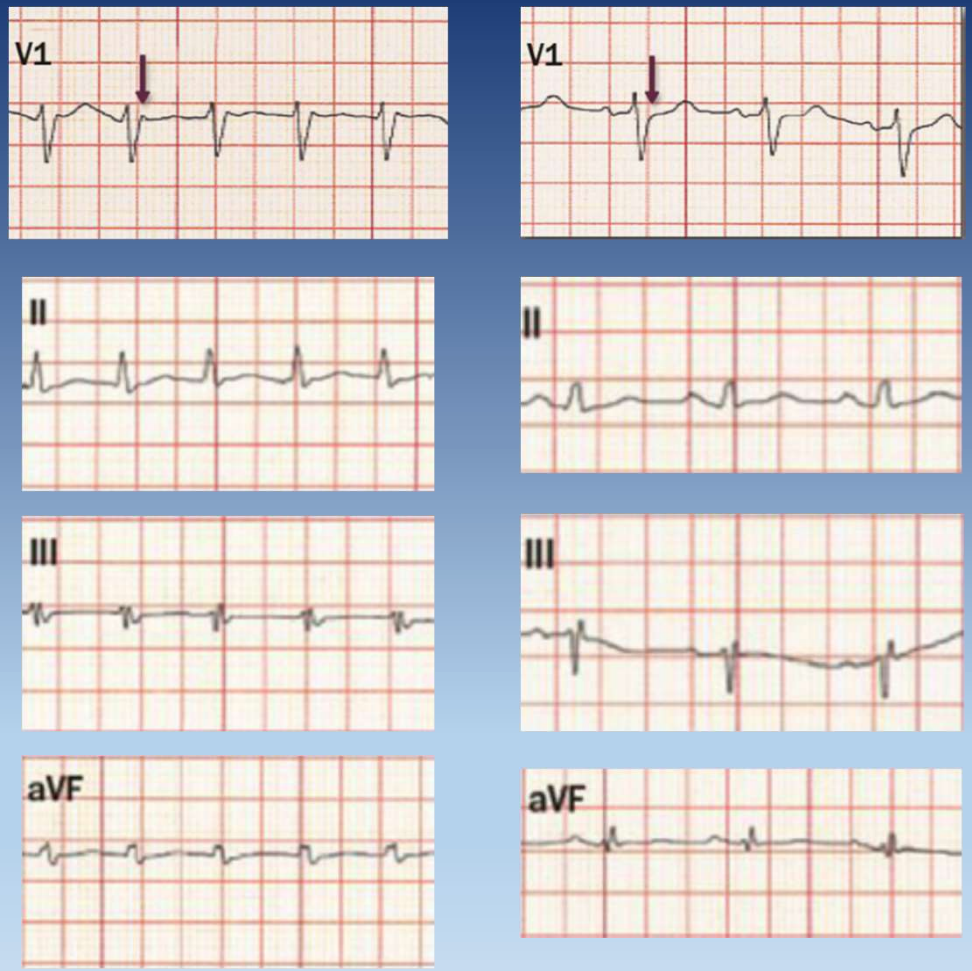

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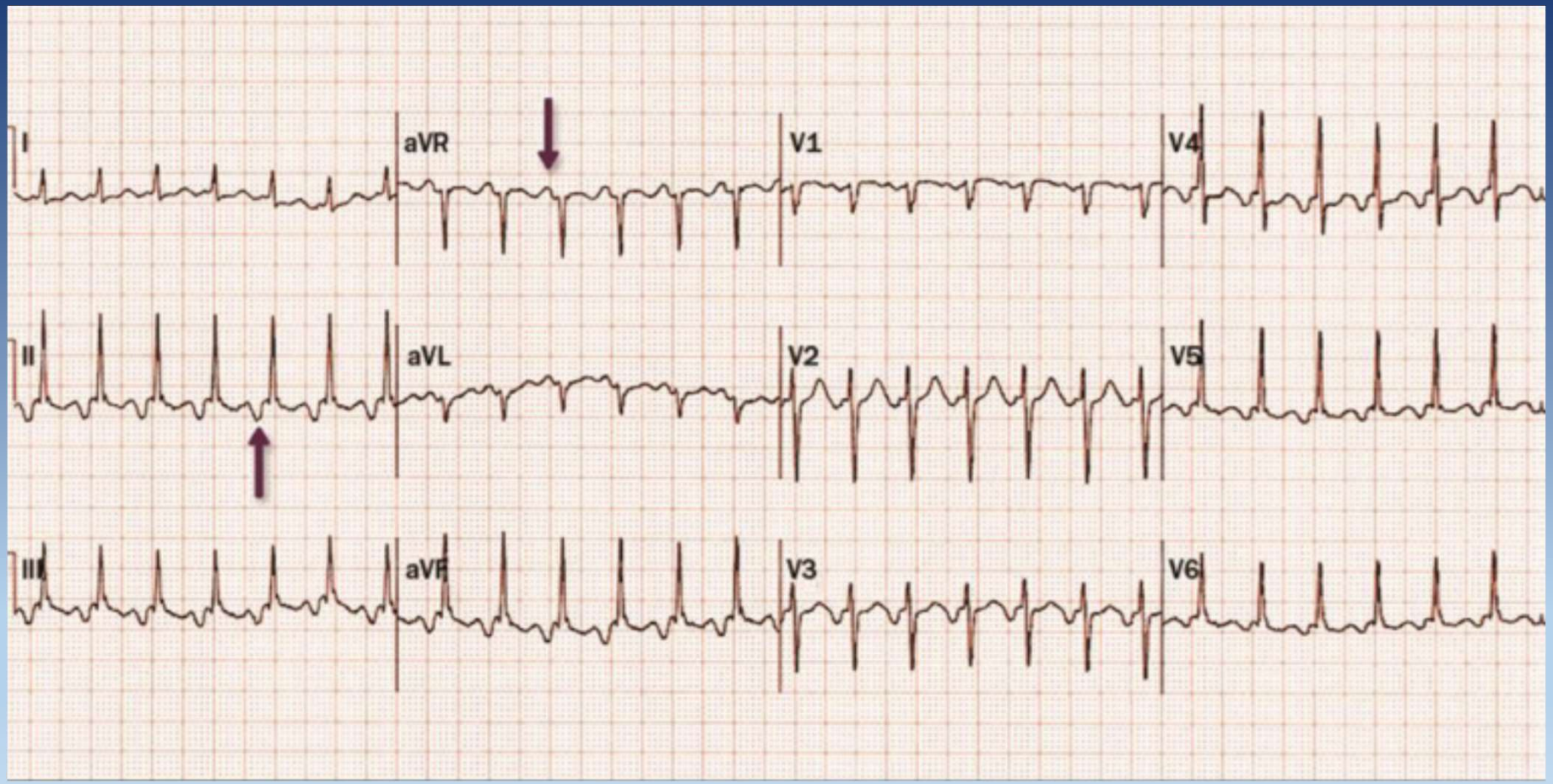
Atypical AVNRT



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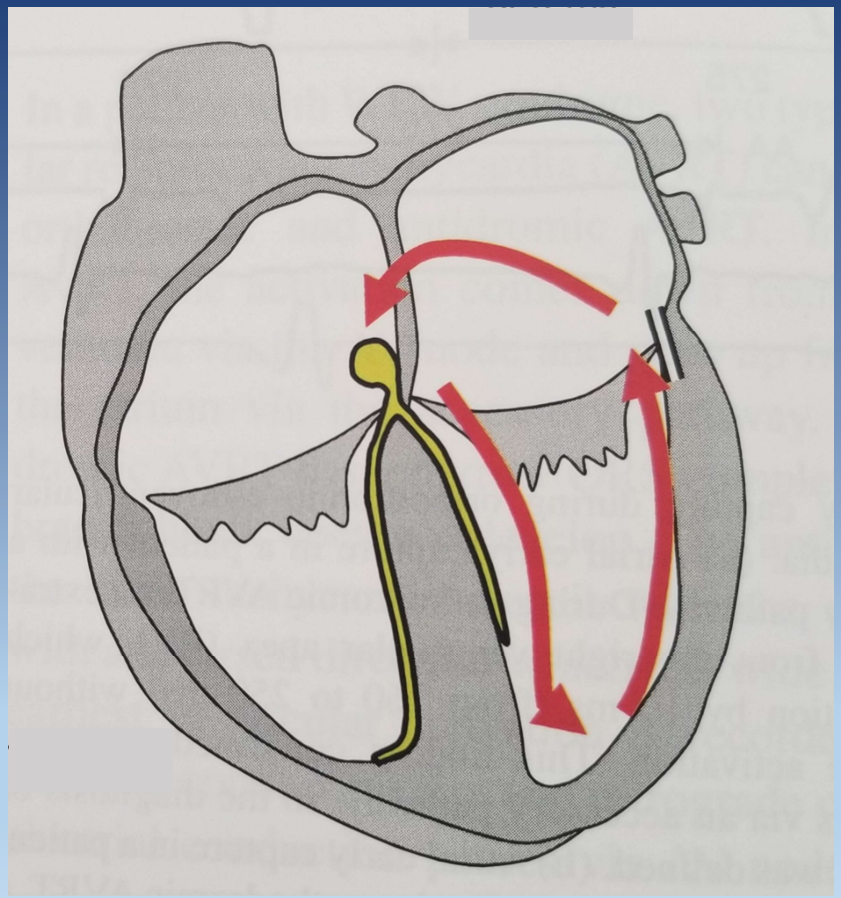
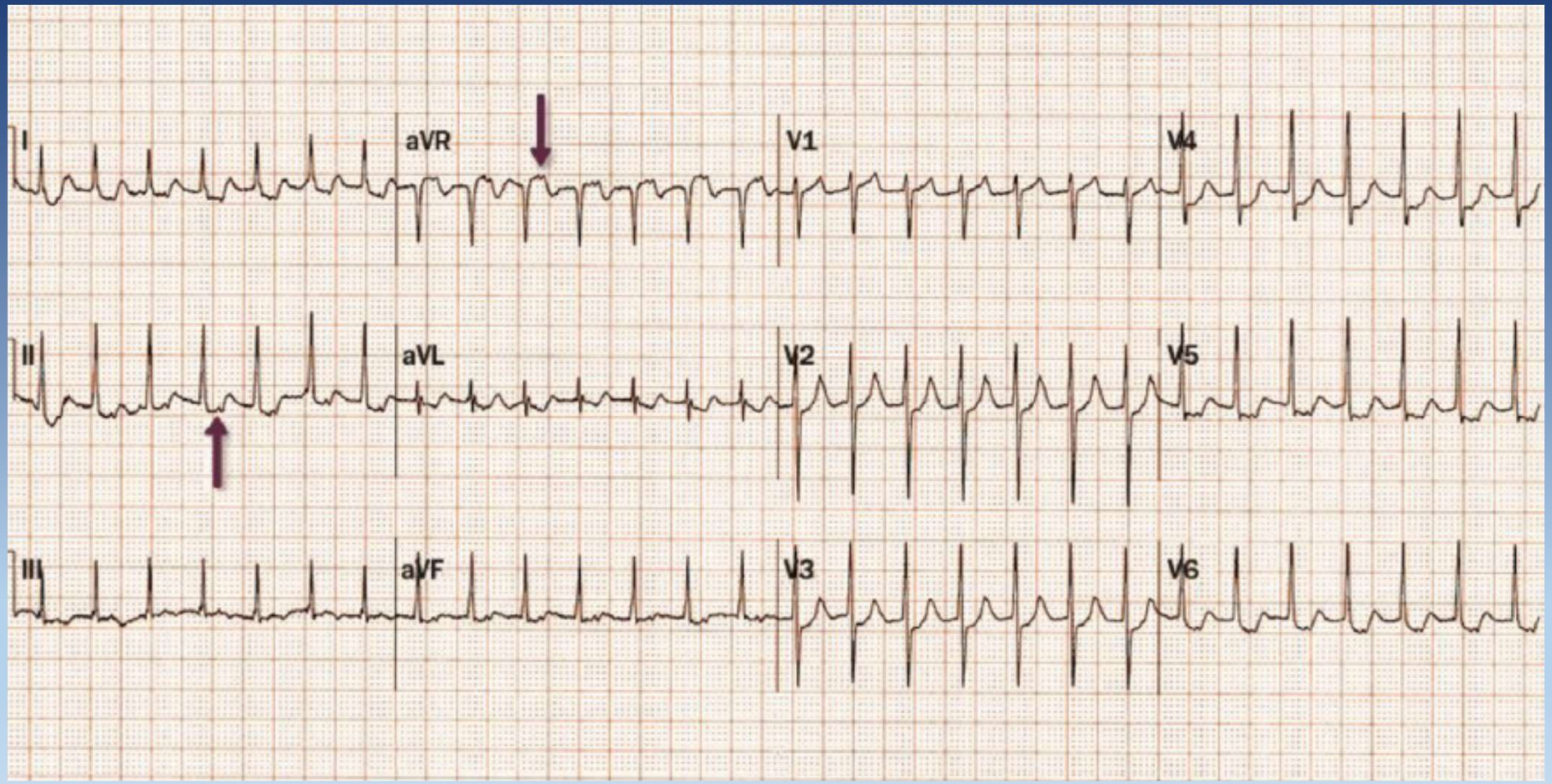
Atrioventricular Reentrant Tachycardia



Hirao K. Catheter ablation. A current approach on cardiac arrhythmias. 2018 Springer

Orthodromic AVRT



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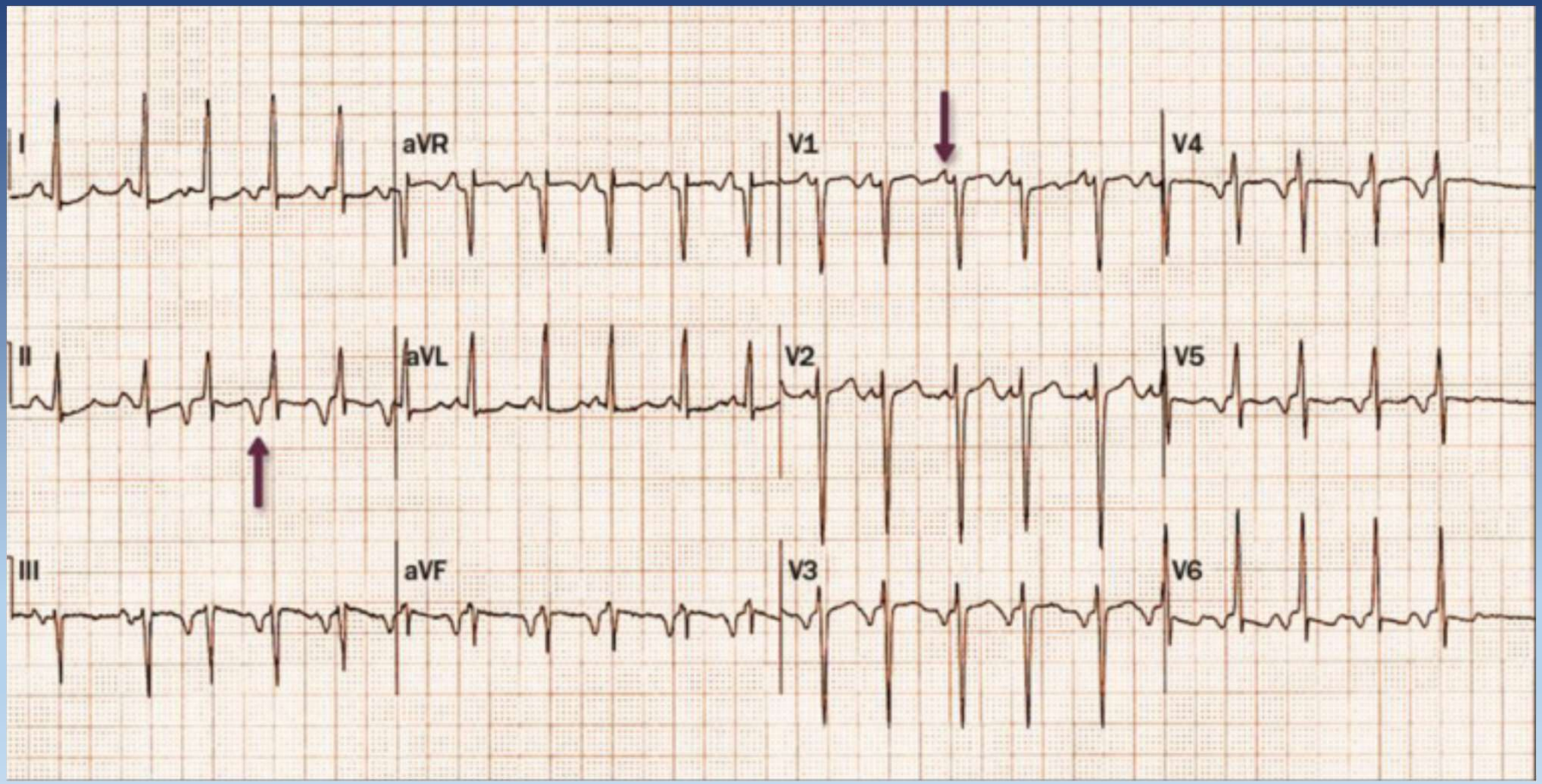
Permanent Form of Junctional Reciprocating Tachycardia (PJRT)



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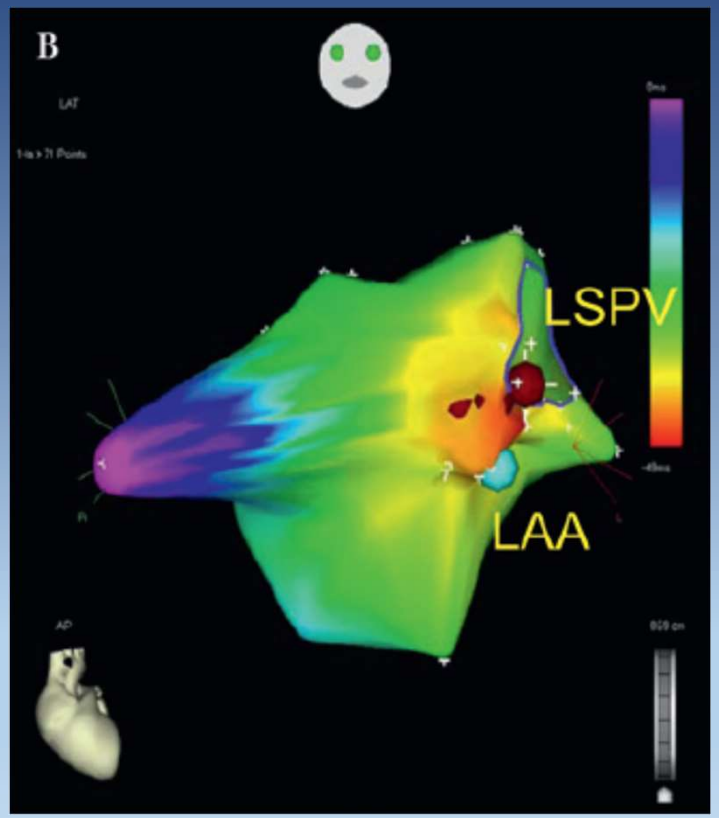
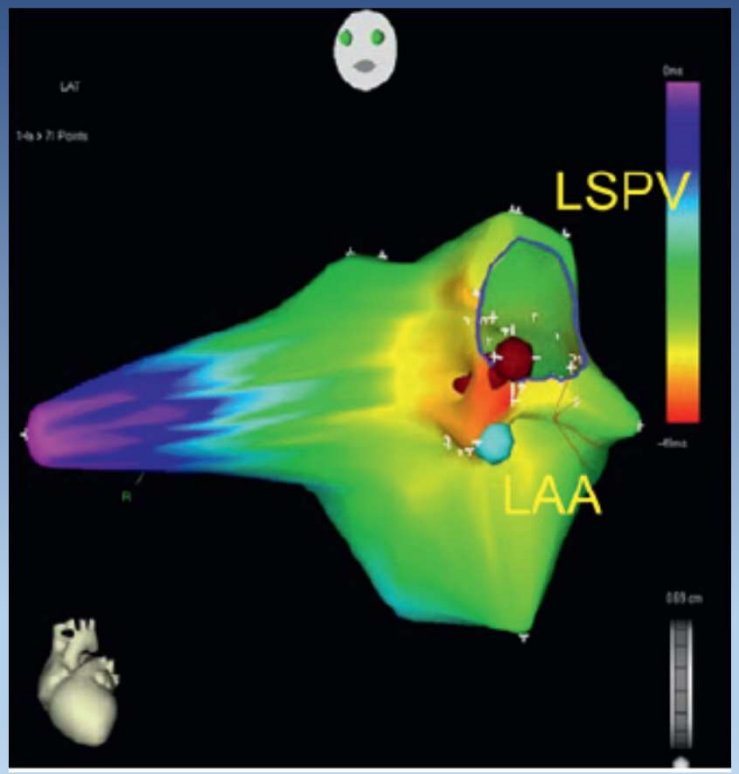
Focal Atrial Tachycardia





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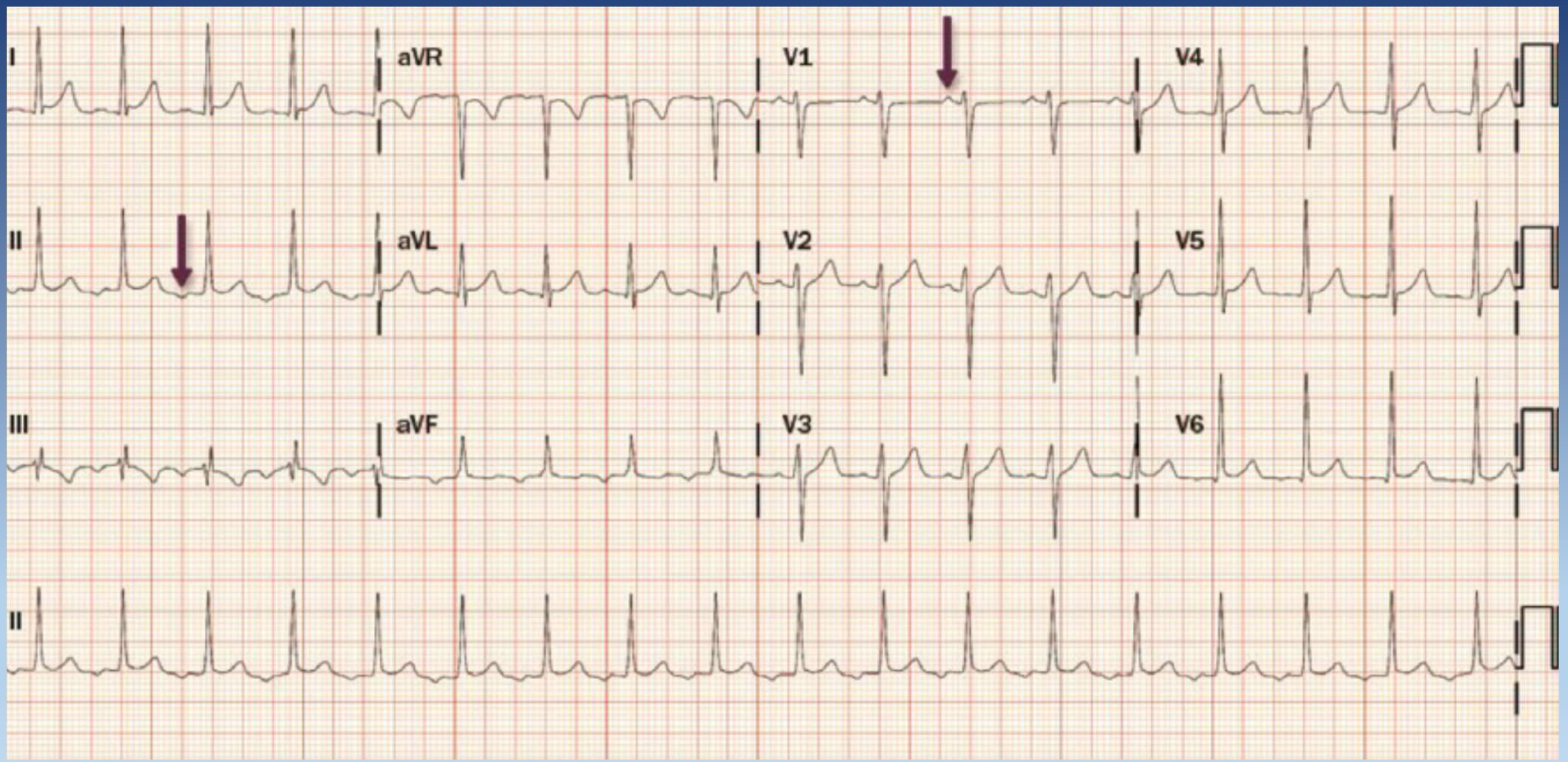
Atrial Tachycardia



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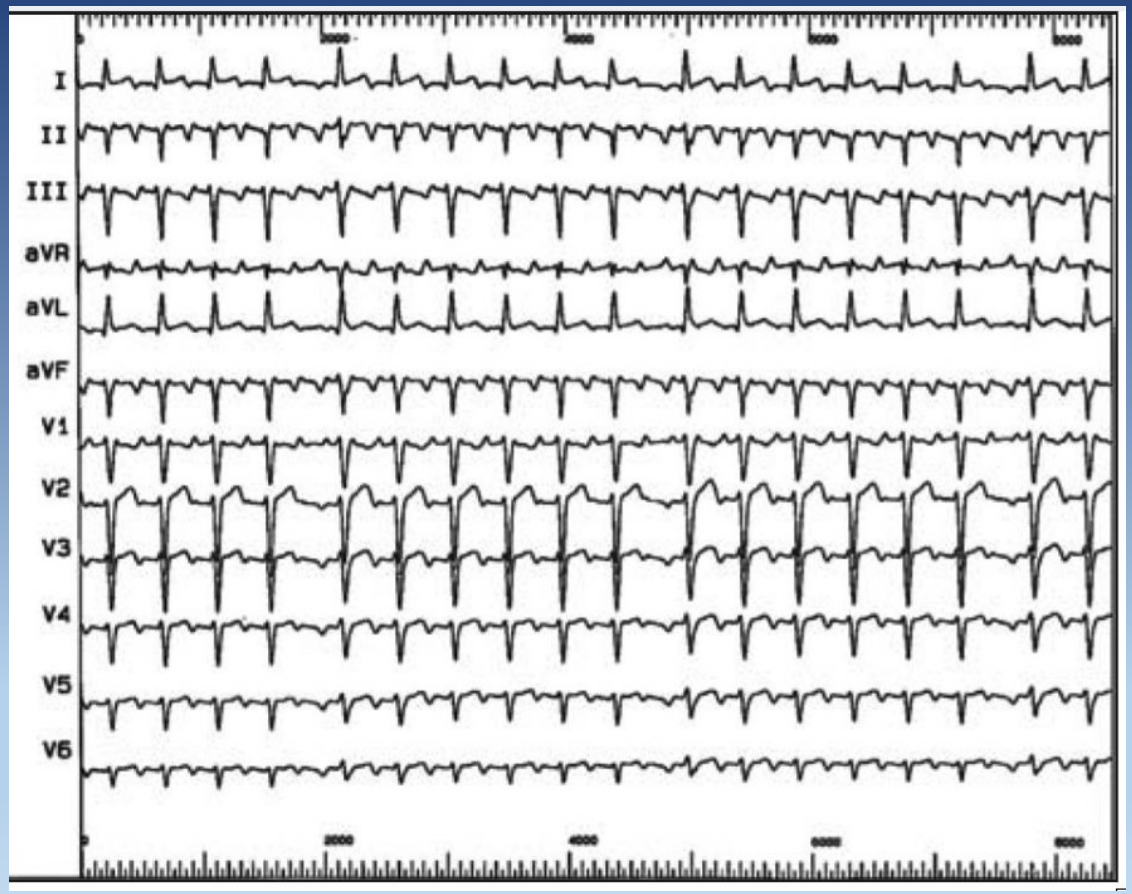
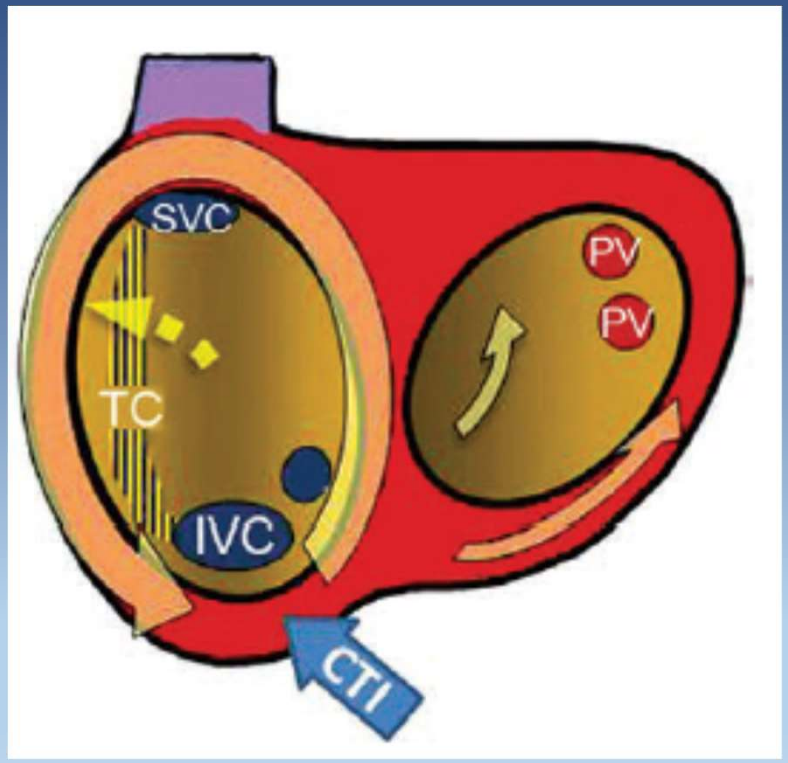
Multifocal Atrial Tachycardia

UpToDate: Supraventricular tachycardia. Accessed on December 1 2018

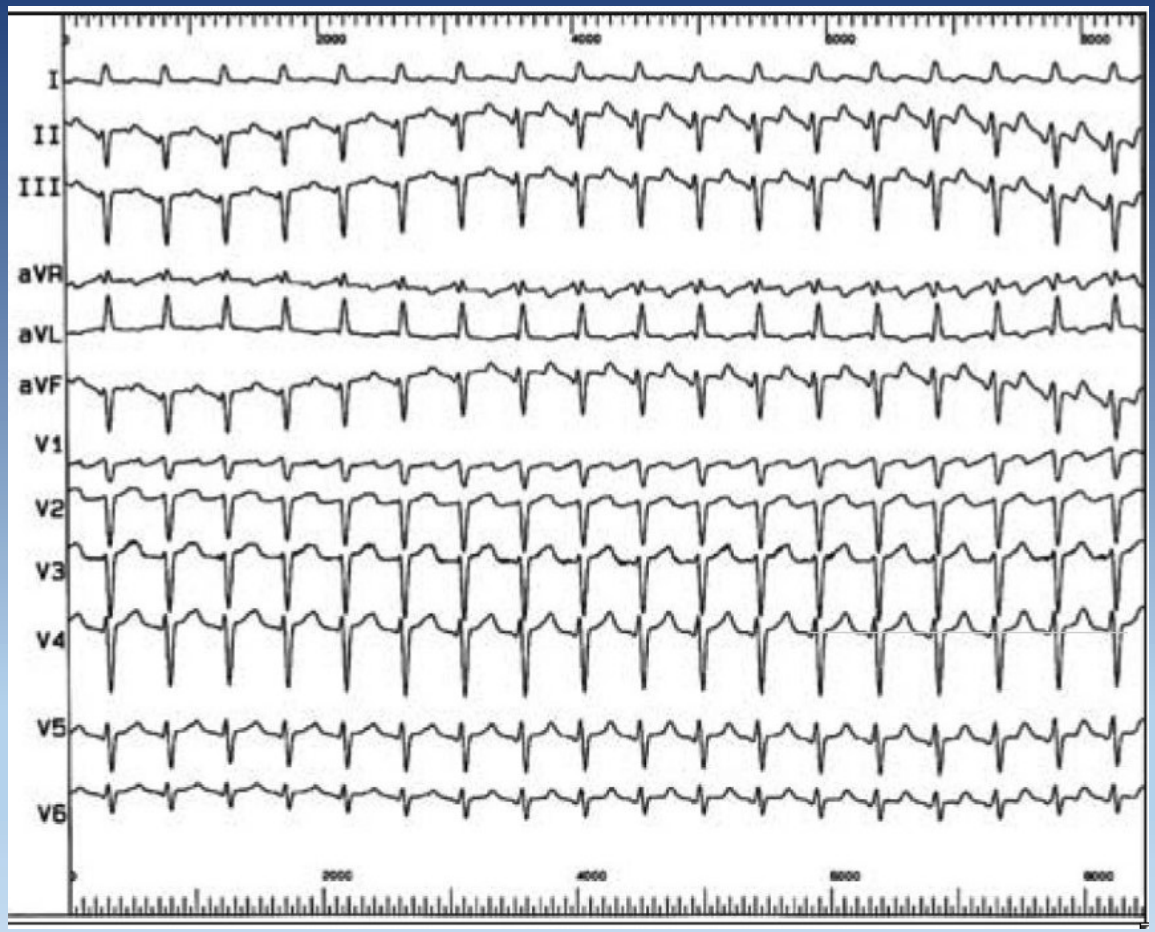
Cavo-tricuspid Isthmus-dependent Atrial Flutter (CCW)

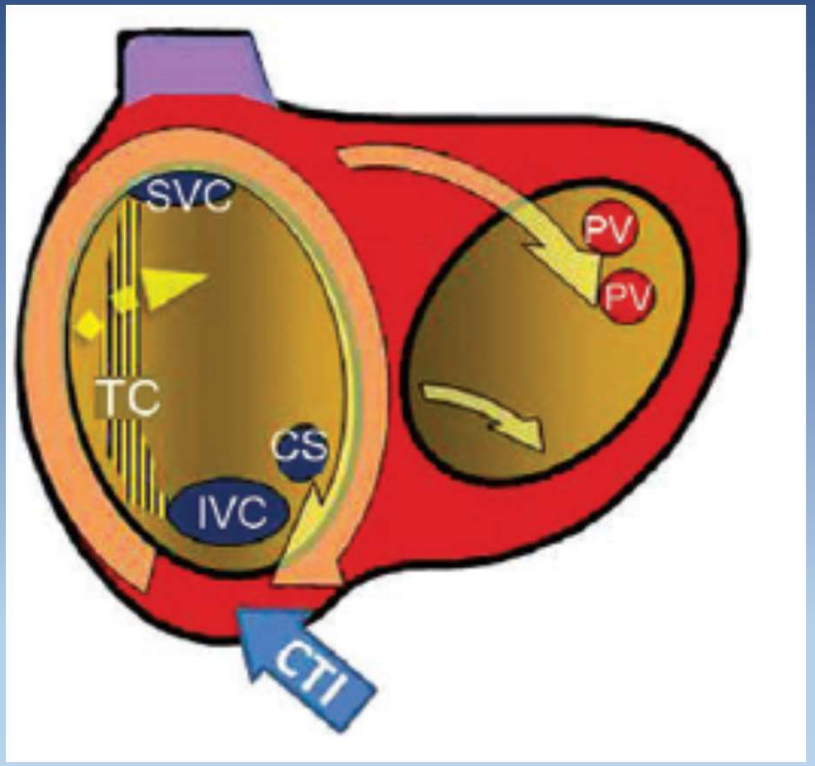




Cosio FG et al. Atrial flutter, typical and atypical: a review. Arrhythmia & Electrophysiology Review 2017;6(2):55-62
Pedrinazzi C, et al. Atrial flutter: from ECG to electroanatomical 3D mapping. Heart Int 2006;2(3-4):161.

Cavo-tricuspid Isthmus-dependent Atrial Flutter (CW)





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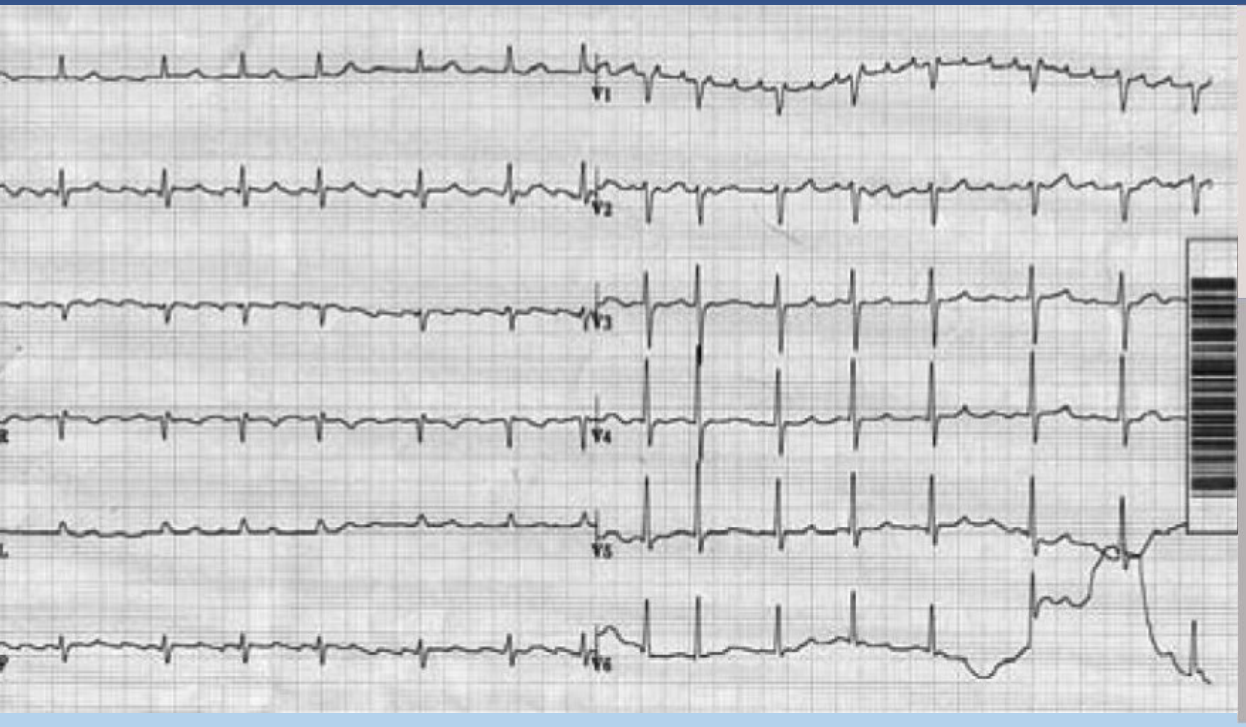
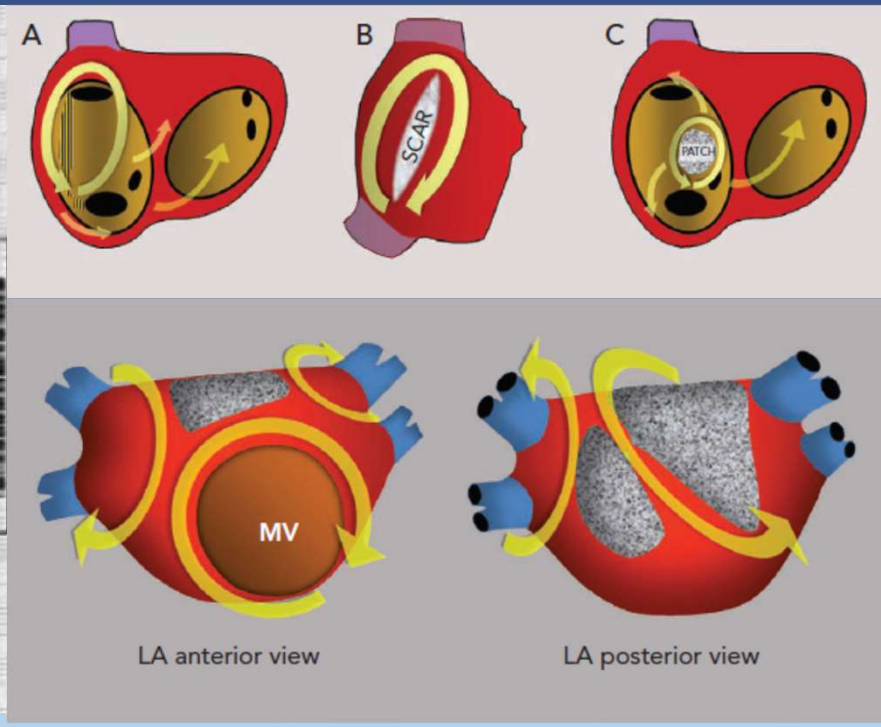
Atypical Atrial Flutter





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Inappropriate Sinus Tachycardia

- Sinus tachycardia that is unexplained by physiological demands at rest, with minimal exertion or during recovery from exercise
- Associated symptoms like weakness, fatigue, lightheadedness, syncope and uncomfortable sensations
- Resting HR>100 bpm, average HR>90 bpm over 24-hour period
- Cause unclear, may be related to dysautonomia, neurohormonal dysregulation and intrinsic sinus node hyperactivity
- Diagnosis by exclusion of secondary causes of tachycardia

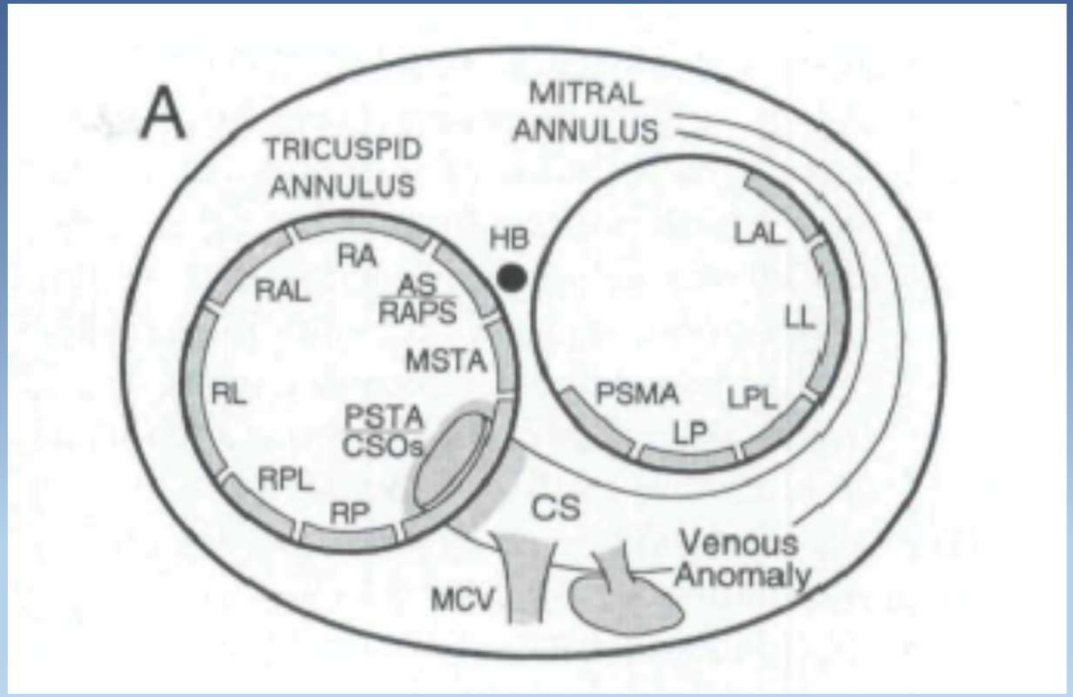
Treatment of Inappropriate Sinus Tachycardia

- Benign prognosis, treatment for symptom reduction
- Ivabradine: I_f channel (responsible for SN automaticity) inhibitor
- Radiofrequency ablation: 45% recurrence, significant complications including sinus or junctional bradycardia, phrenic nerve injury and narrowing of SVC/RA junction

Sinus Nodal Reentrant Tachycardia

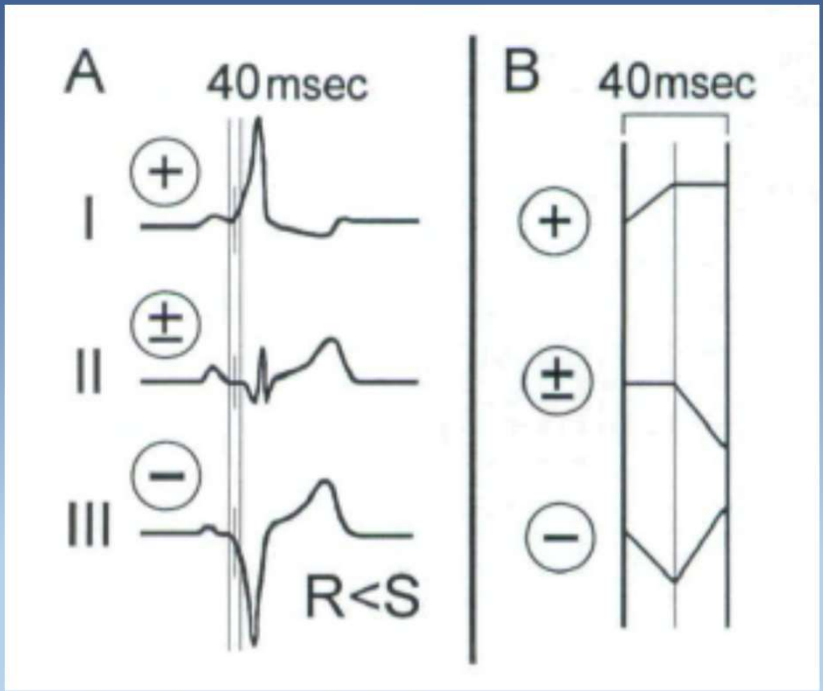
- SNRT is a microreentrant tachycardia involving the SA node and/or perinodal tissue
- Occurs most commonly in patients who have structural heart disease and is estimated to account for 2-17% of SVT
- Most patients are asymptomatic, some have palpitations and lightheadedness. Rarely, patients have syncope and tachycardia-induced CMP
- ECG shows a pattern indistinguishable from sinus tachycardia, rate between 100-150 bpm, definitive diagnosis requires cardiac EPS
- Acute termination: vagal maneuvers or iv adenosine
- Chronic therapy: verapamil, digoxin, amiodarone, catheter ablation

Anatomical Locations of Accessory Pathways



Arruda MS et al. Development and validation of an ECG algorithm for identifying accessory pathway ablation site in Wolff-Parkinson-White syndrome. J Cardiovasc Electrophysiol 1998;9:2-12.

Polarity of Delta Wave



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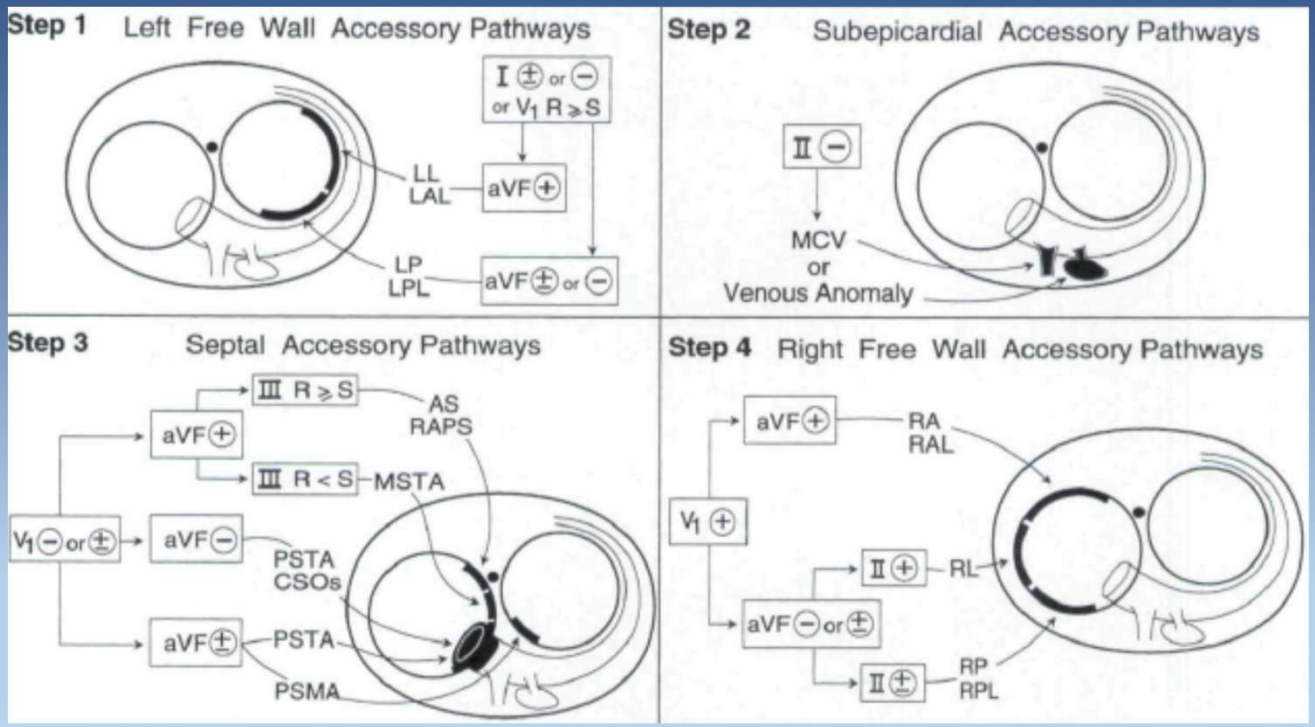
ECG Algorithm for Accessory Pathway Locations



Sensitivity 90%
Specificity 99%

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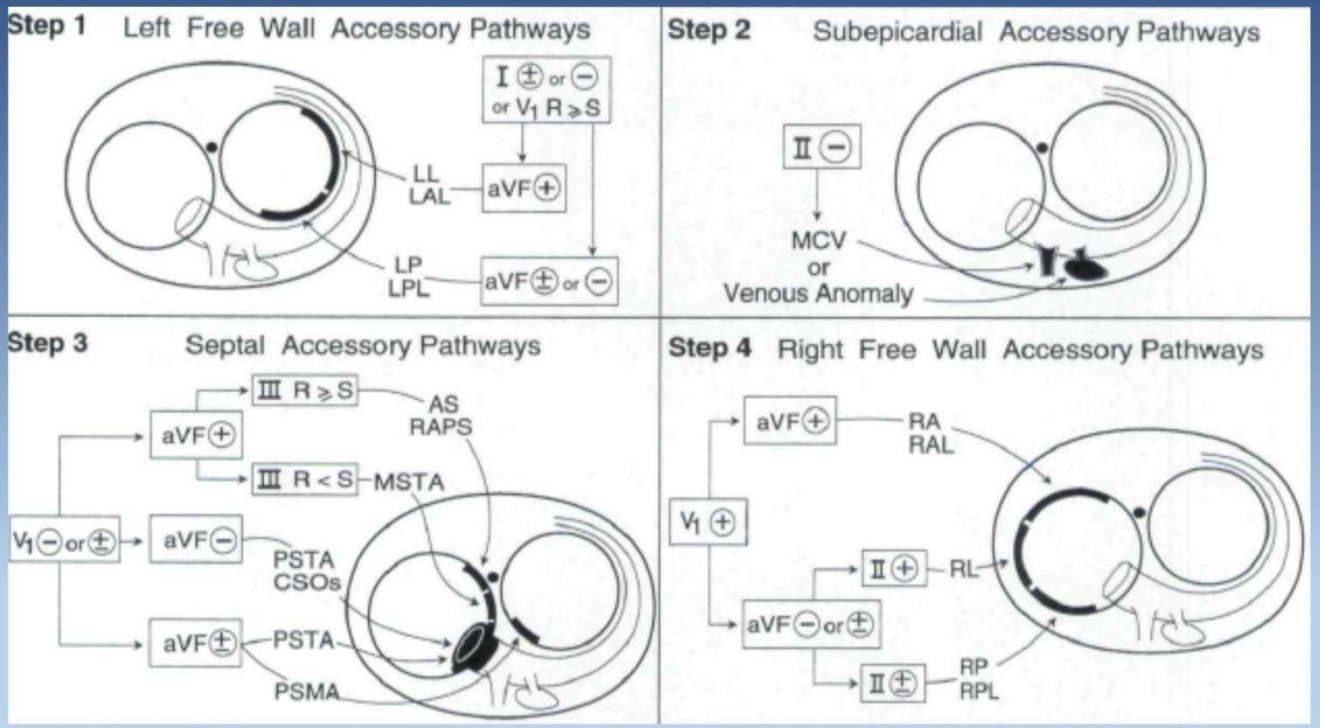
Left Lateral/Anterolateral Pathway



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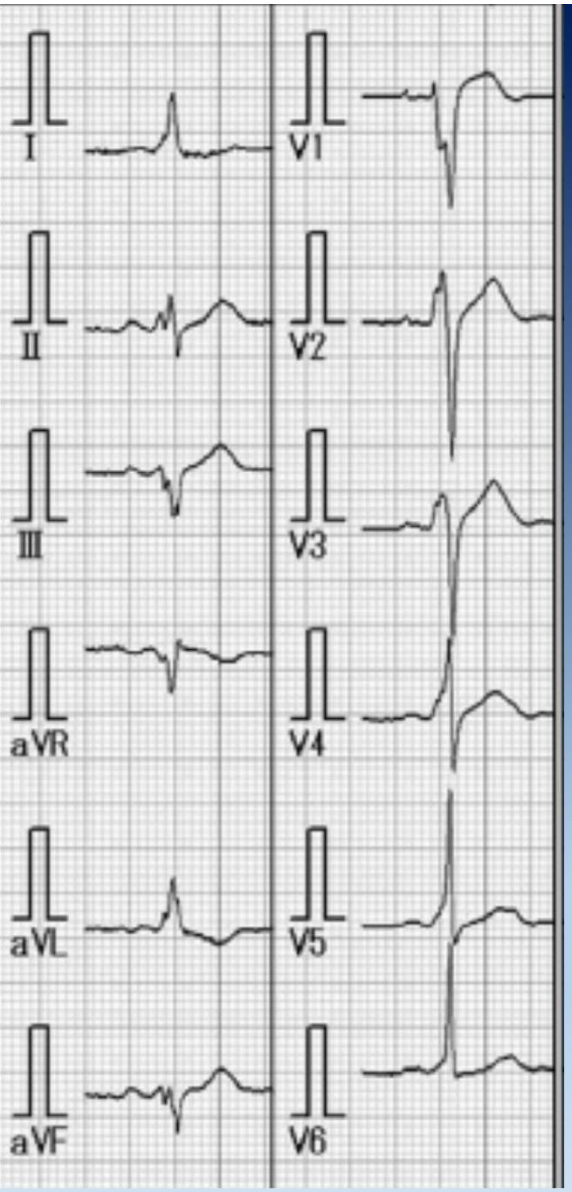
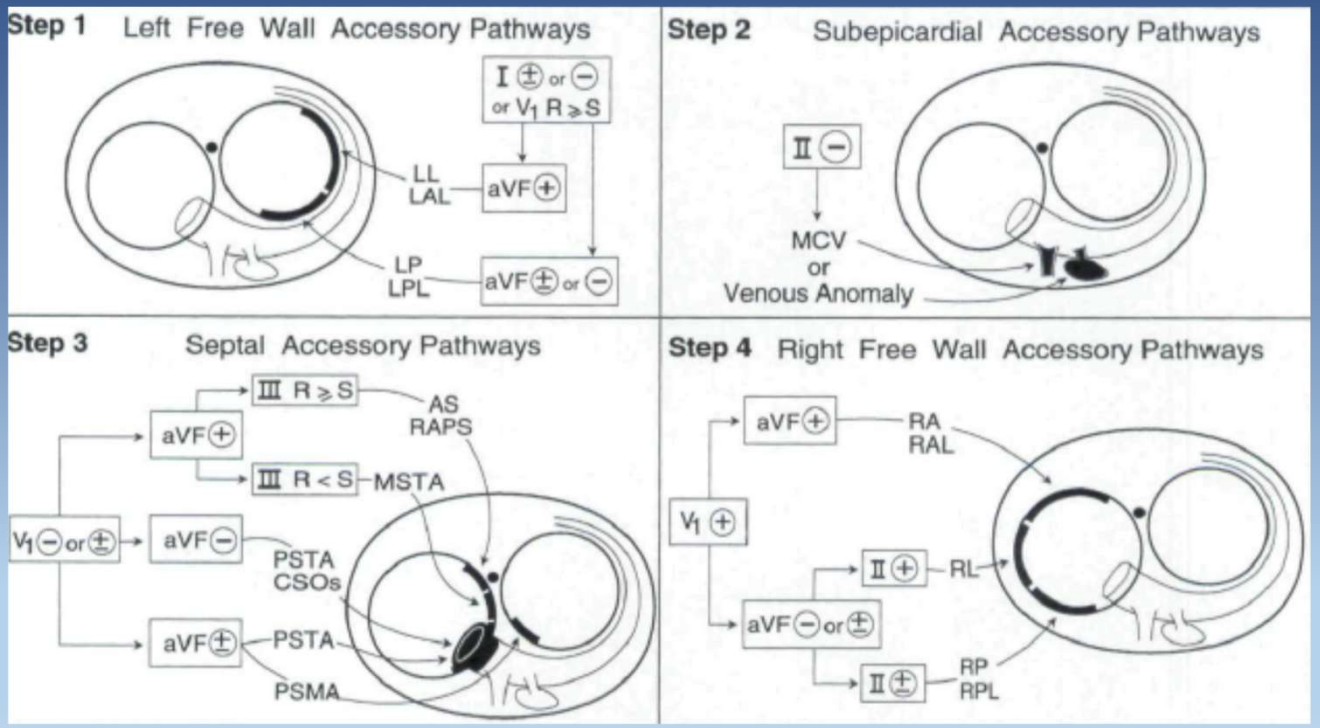


Right Anterior/Anterolateral Pathway



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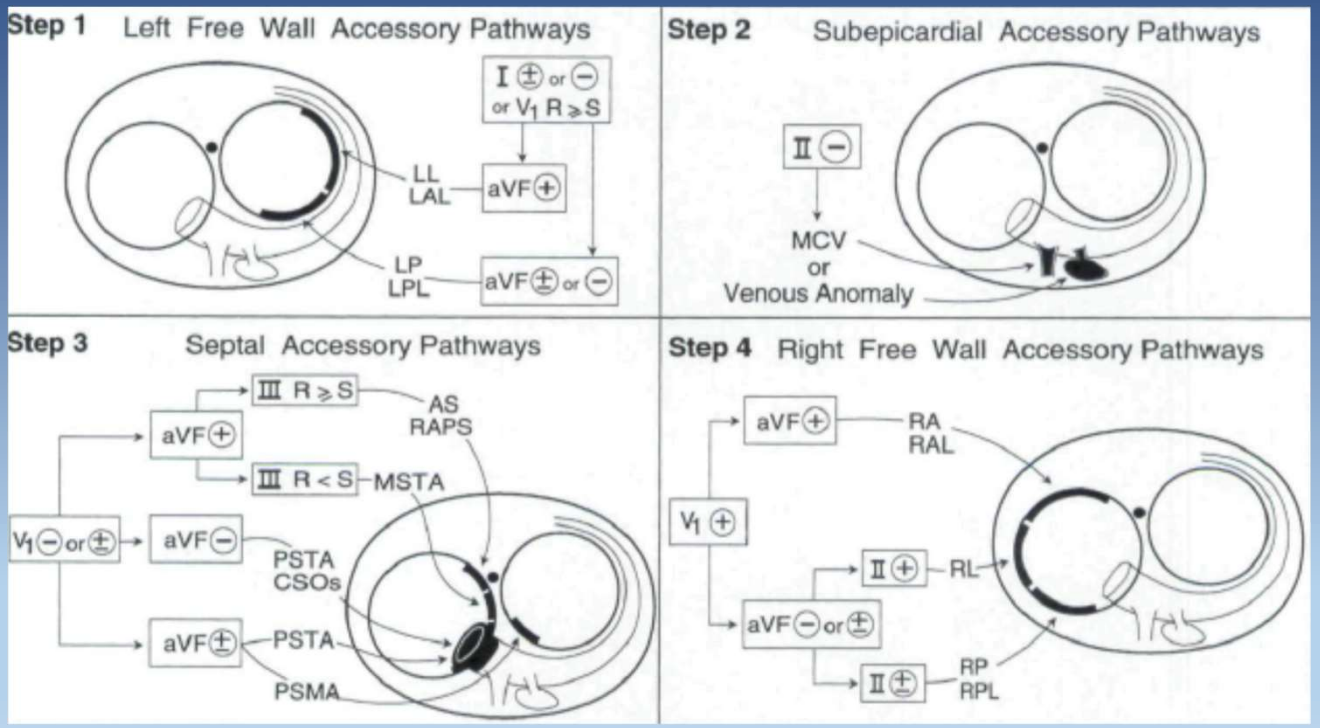
Posteroseptal Pathway



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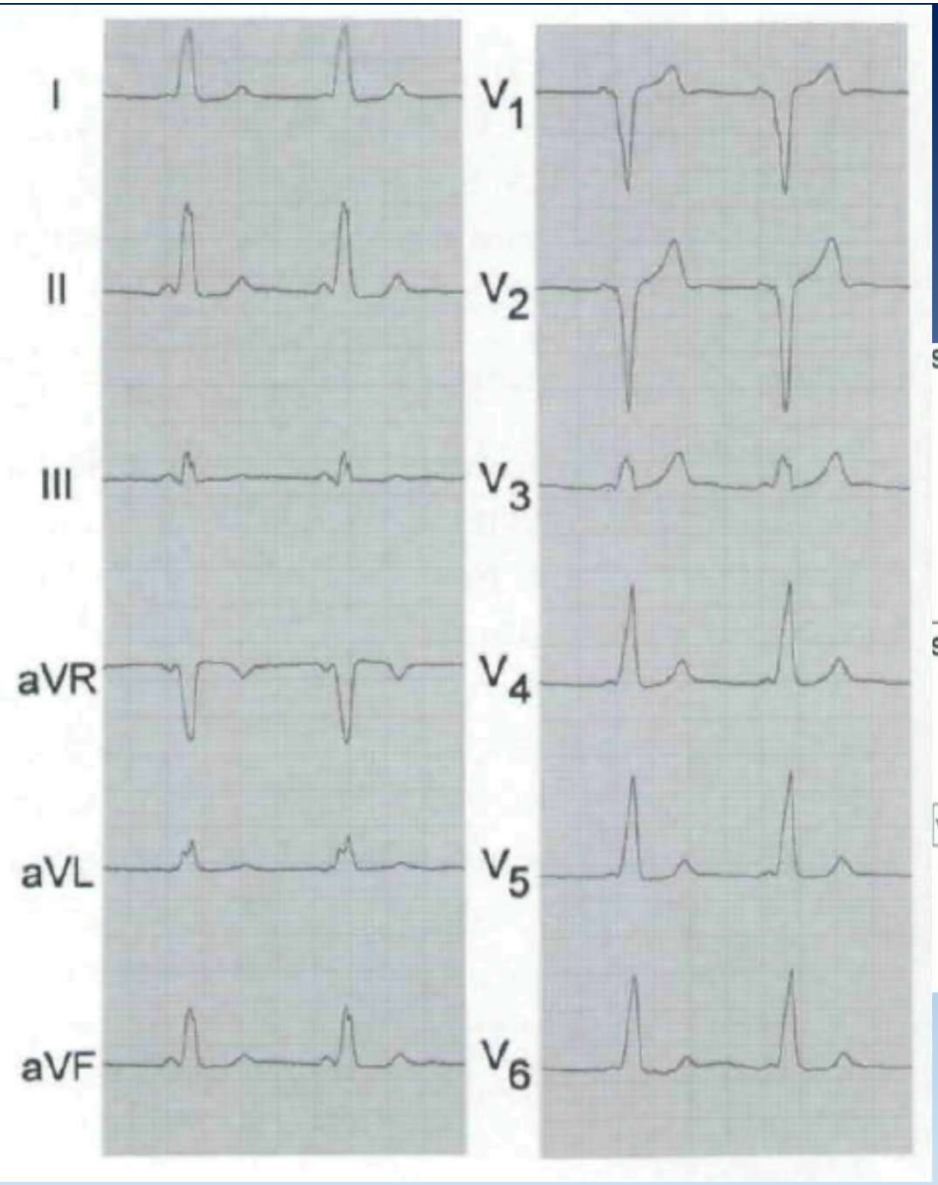
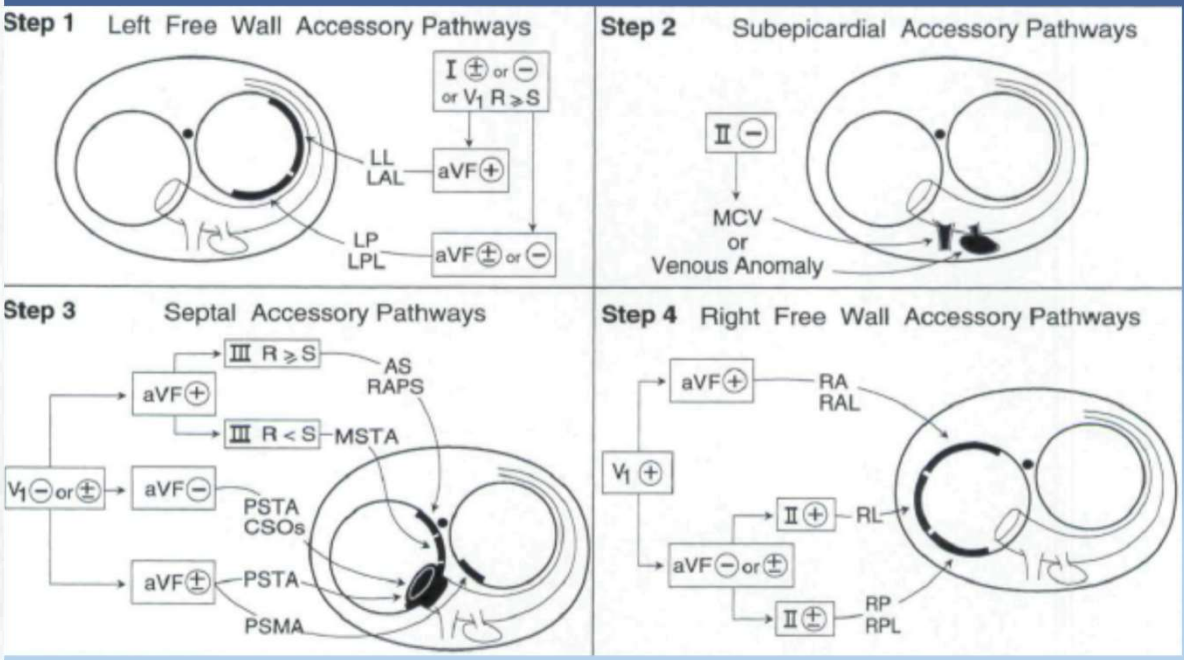


Anteroseptal Pathway



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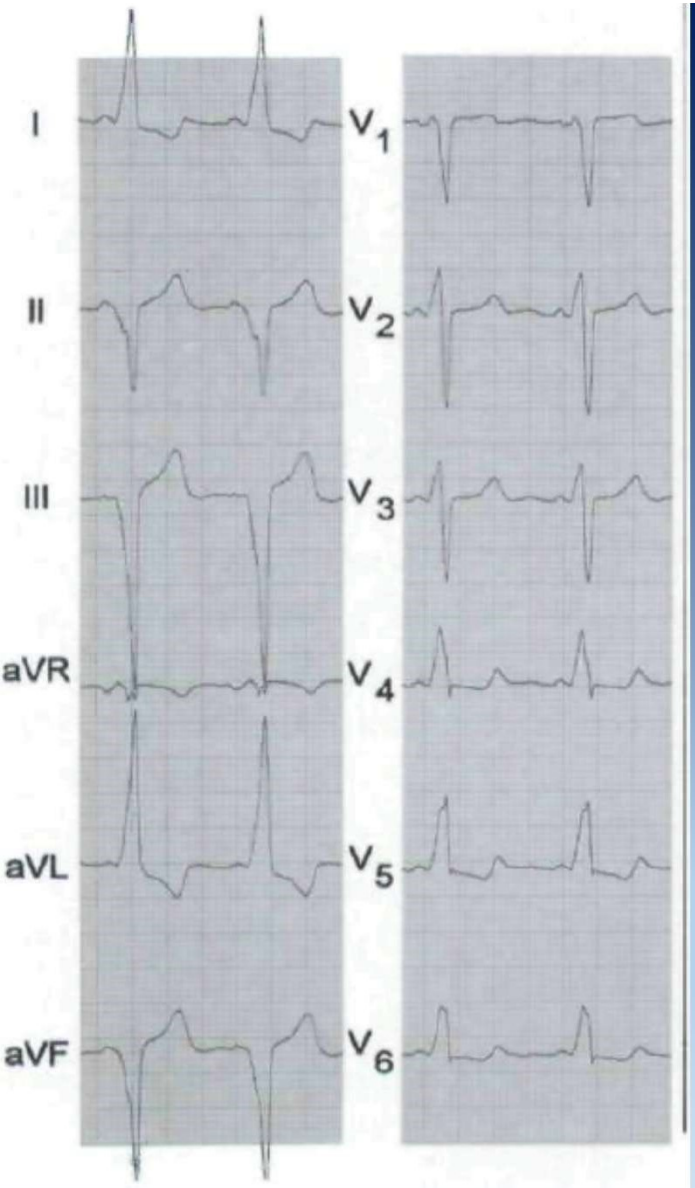
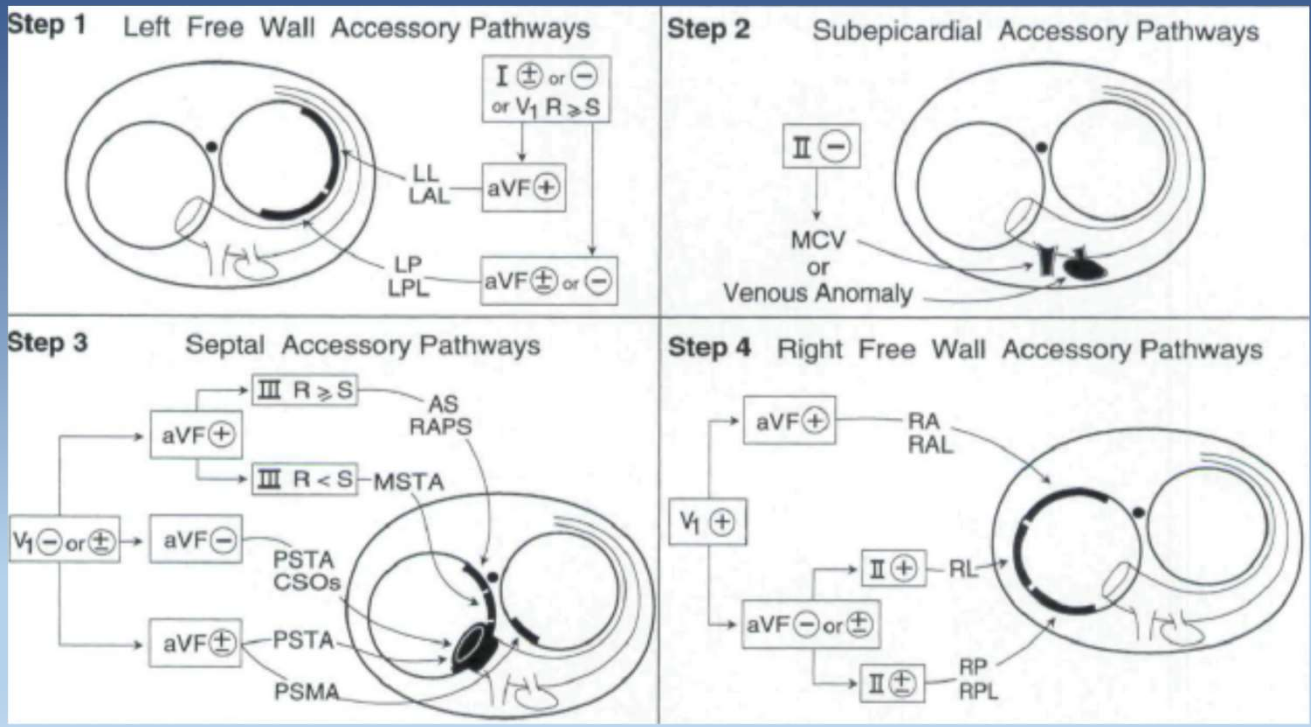


Epicardial CS Diverticulum Pathway



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Conclusions

- Narrow complex tachycardia can be classified into AF and SVT; SVT can be classified into AVNRT, AVRT, AT, IST and SNRT according to mechanisms
- Symptom-rhythm correlation is crucial in approaching patients suspected of having SVT
- ECG is powerful in diagnosing the mechanisms of SVT
- Localization of accessory pathway can be achieved with high accuracy by ECG algorithm