



Cardiac Arrhythmias Beyond Atrial Fibrillation

Mahmoud Houmsse, MD, FACP, FACC, FHRS.

*Professor of Clinical Internal Medicine.
Director, OSUMC Anti-arrhythmic Clinic
Division of Cardiovascular Medicine*

The Ohio State Wexner University Medical Center

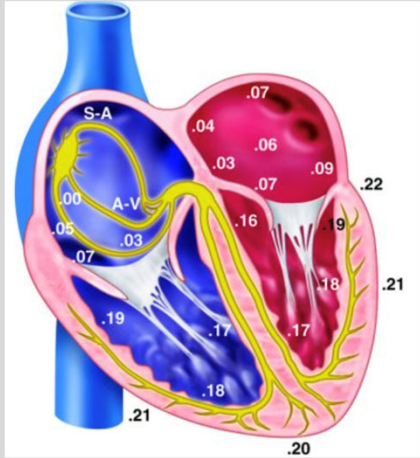
MedNet21
Center for Continuing Medical Education

 **THE OHIO STATE UNIVERSITY**
WEXNER MEDICAL CENTER

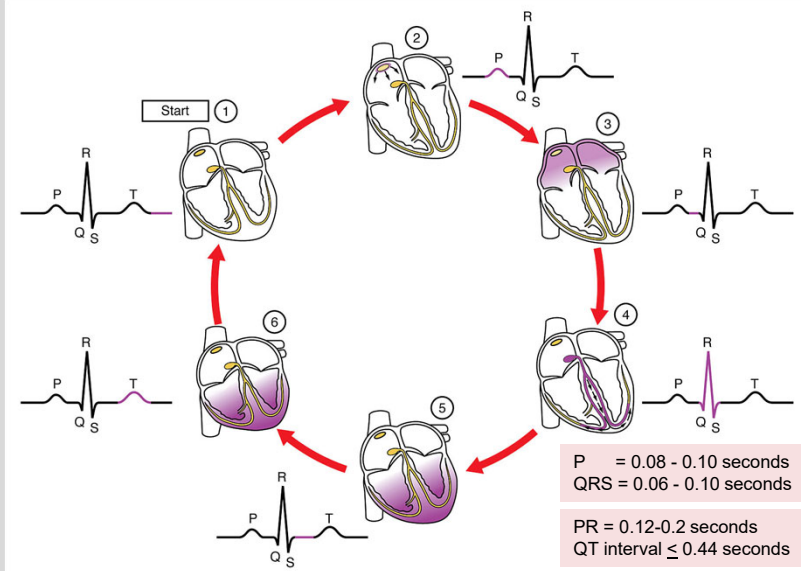
Objectives

- Normal Rhythm
- Ventricular ectopic beats
- Ventricular tachycardia
- Supraventricular tachycardia
- Work up and management of cardiac arrhythmia

ECG Tracing with Heart Contraction

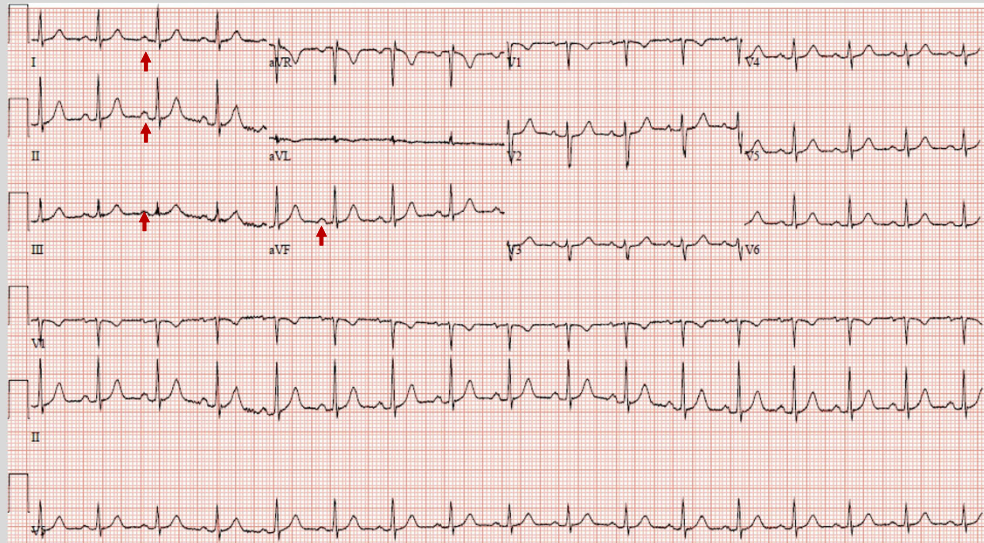


Internal Electrical Conduction System of the Heart
Lab X change

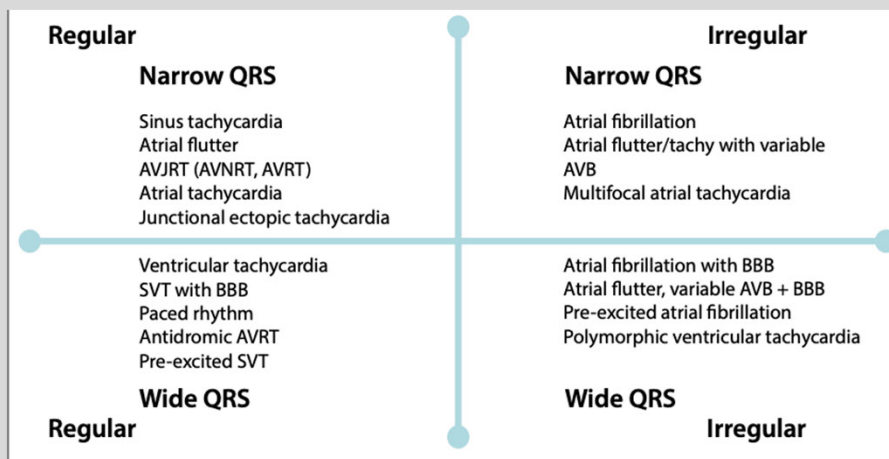


Wikimedia Commons

Normal ECG (Heart rate 60-100 bpm)



Classification of Tachycardia



S Afr Med J 2016;106(3):246-250

Unstable Tachyarrhythmia

Tachycardia >150 bpm
 +
 Systolic BP < 90 mmHg
 +
 Impairment of consciousness,
 chest pain, heart failure

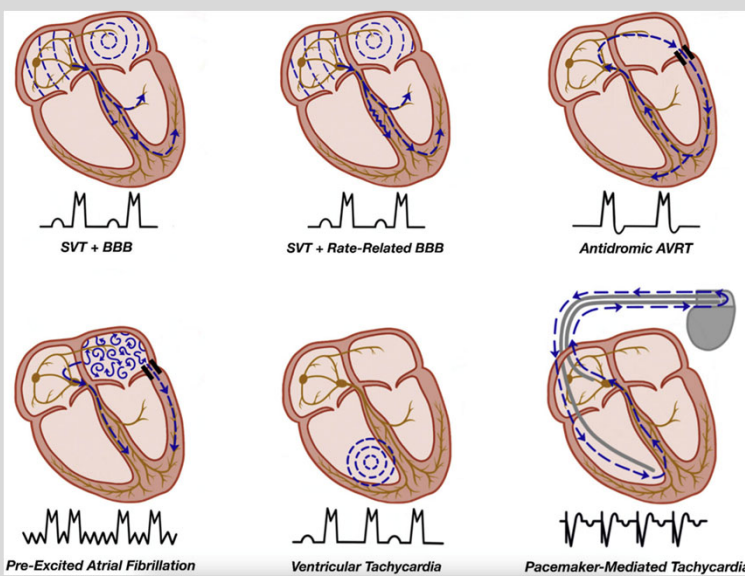


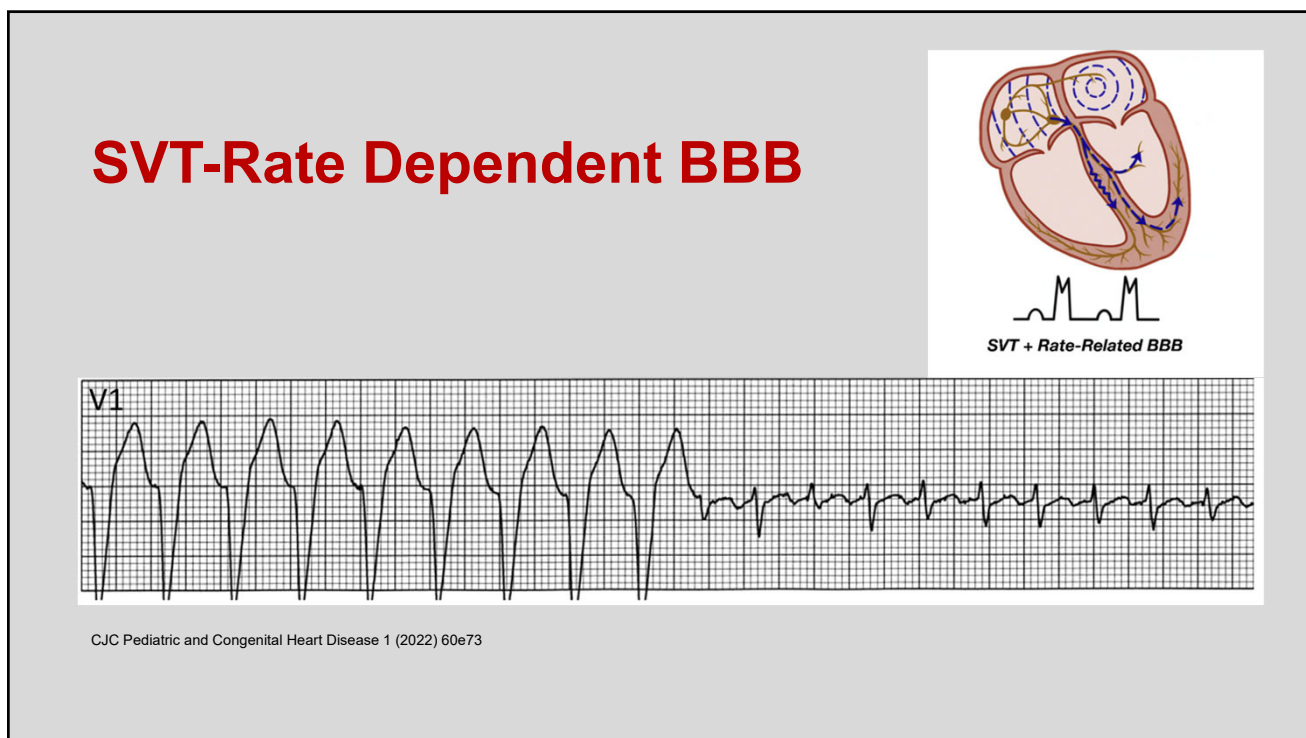
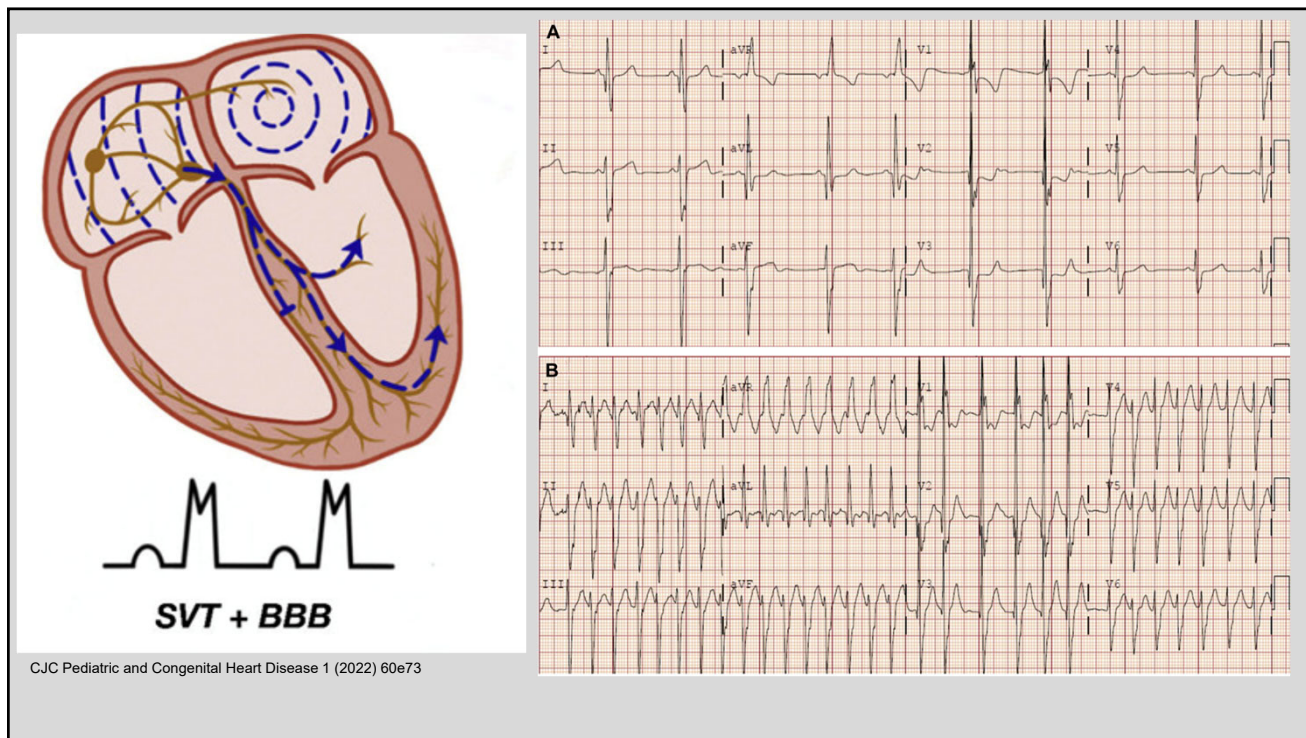
Electrical Cardioversion

Synchronized SVT, VT, AF, AFL
Unsynchronized Ventricular fibrillation

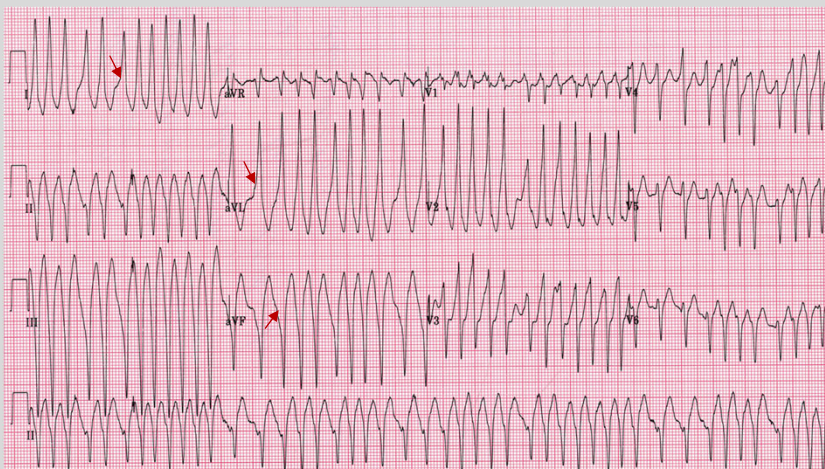
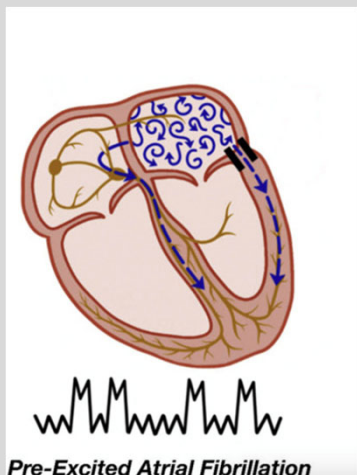
Wide QRS Tachycardia

Wide Complex Tachycardia





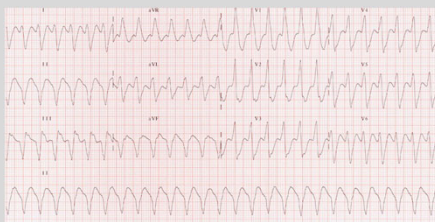
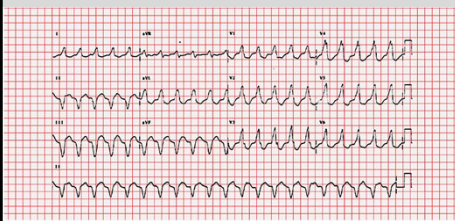
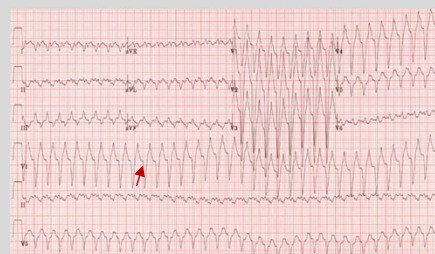
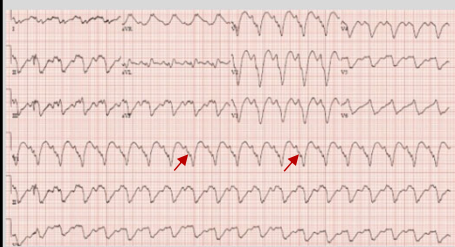
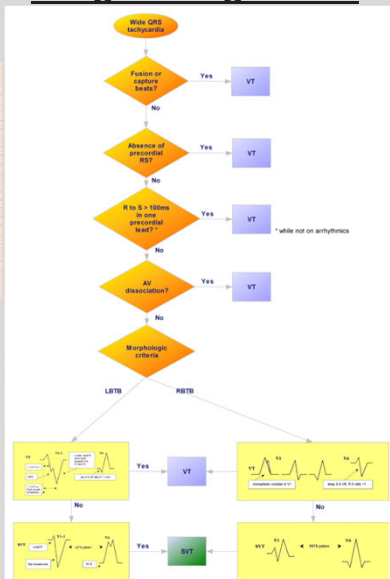
Pre-Excited Atrial Fibrillation



CJC Pediatric and Congenital Heart Disease 1 (2022) 60e73

Ventricular Tachycardia Vs. Supraventricular Complex Tachycardia with BBB

Brugada Algorithm



Courtesy of Michael Rosenqvist, BEing, MD, McGill University

ECG-PEDIA.ORG

<https://www.flickr.com/photos/nihgov/>

Wikimedia Commons

PVC and VT

Premature Ventricular Contractions (PVCS)

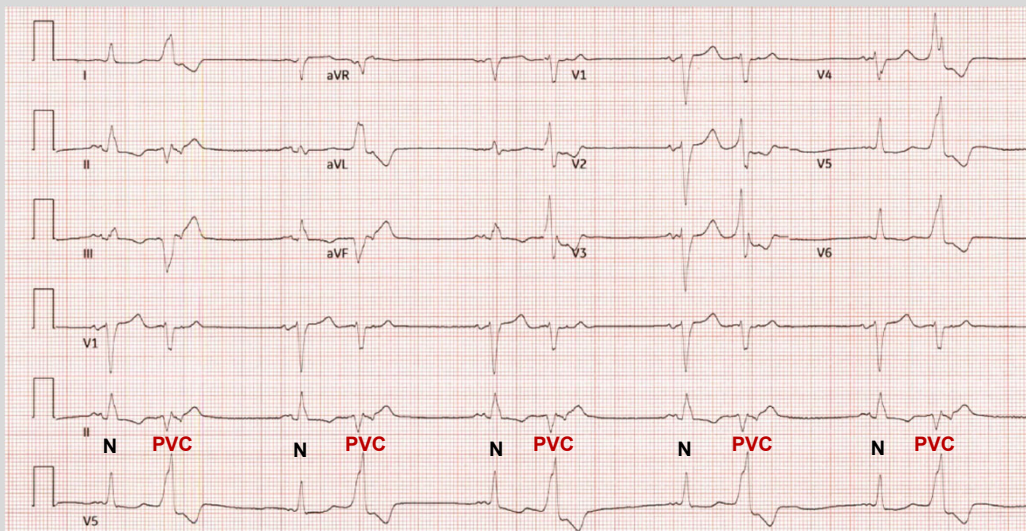
PVC's

- Earlier than next expected beat, wide QRS complex, No P wave before
- Monomorphic: PVC's look the same
- Polymorphic: PVC's look different o
- Bigeminy: PVC every other beat
- Trigeminy: PVC every 3rd beat
- Quadrigeminy: PVC every 4th beat

VT

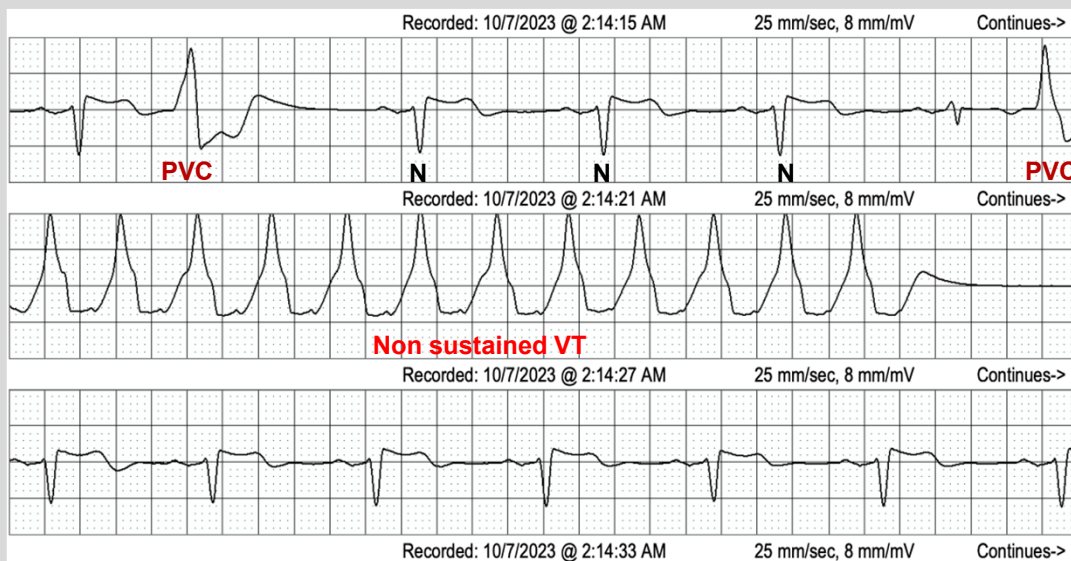
- Non-sustained (< 30 seconds)
- Sustained (> 30 seconds and / or <30 seconds with hemodynamic instability)

Premature Ventricular Contraction (PVCs)



Earlier than next expected beat, Wide and Bizarre QRS complex, No P wave before

Ventricular Tachycardia



Benign vs Malignant Ventricular Arrhythmias

Presence/Absence of Structural Disease

Degree of Symptomatology

Severity of Daily Burden

- **History:** Syncope, Palpitations with near syncope, CHF Symptom's, Chest pain, Progression, Toxins: Drugs, Chemotherapy (anthracyclines, TKI)
- **Family Hx:** Premature SCD or CM
- **EKG:** T-wave Morphology, BBB, Prior MI, PVC RB or LB?
- **Holter:** >10,000 PVC's/24 hours?
- **Echo:** Assure normal LV, RV size and function, Exclude: HOCM, LVH without HTN: Amyloid, Fabry's

Ventricular Arrhythmia Evaluation

Further Evaluation:

- **Nuclear Stress Test:**
 - Active Ischemia, Infarct without prior history of ischemia
- **Cardiac MRI:** to eval for scar or infiltrative disease
- **Cardiac PET:** for myocarditis/Sarcoid
- **Serologies:**
 - Free light chains, Ferritin, Genetic Eval, ACE level

Therapy Options

Do Nothing

- No Symptoms
- Benign Prognosis

Anti-arrhythmic Medication

- Tolerance
- Risk
- Efficacy

Catheter Ablation

- Frequency
- Inducibility

Implantable Defibrillator

PVC's Often Cause Cardiomyopathy

Predictors of PVC Induced Cardiomyopathy

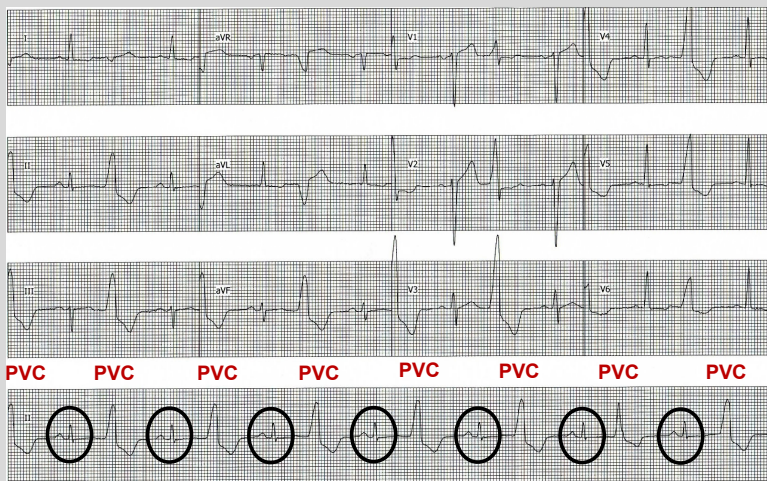
- Very frequent PVCs (>10,000/day)
- Longer duration of PVC exposure (years)
- Asymptomatic status (longer duration)
- PVCs with longer QRS duration (150 msec)
- Epicardial origin of PVCs
- Interpolated PVCs
- Lack of diurnal variation of PVC frequency
- Male gender

51 year old, Long History of “Benign” PVCs

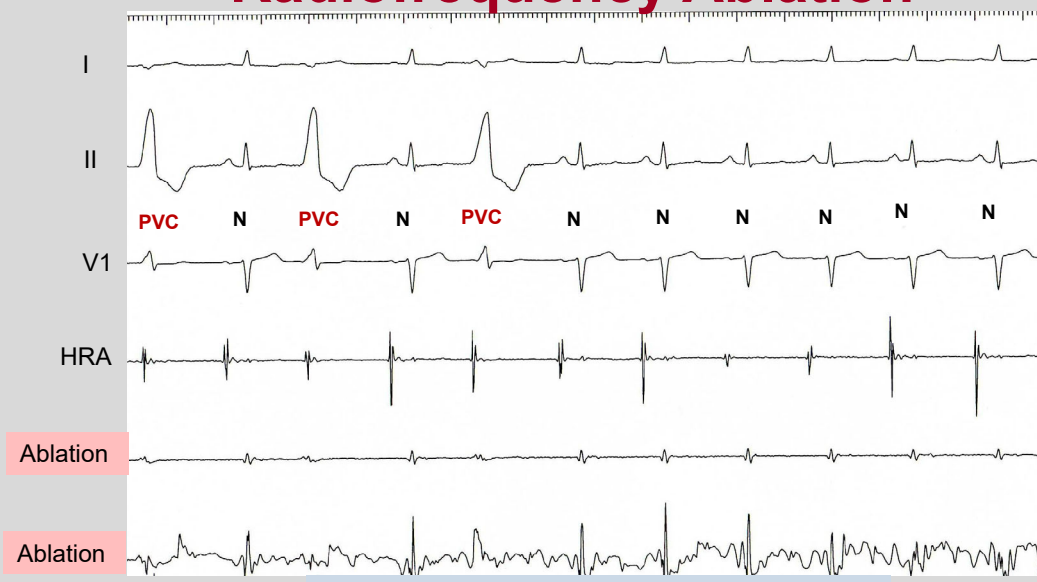
NICM New Dx (**LVEF = 20%**). Meds = ACEI, Coreg, Aldactone

Holter: **PVCs = 28%** of QRS complexes

Referred for ICD Implant

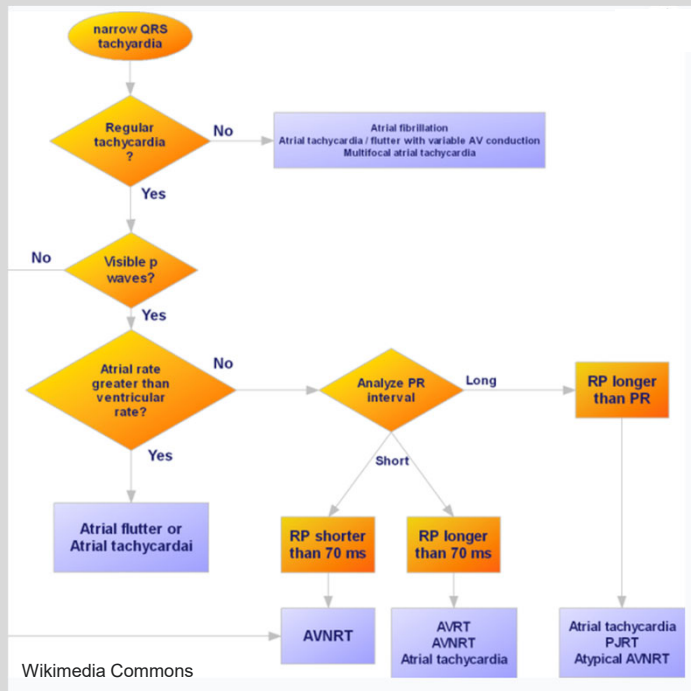


Radiofrequency Ablation

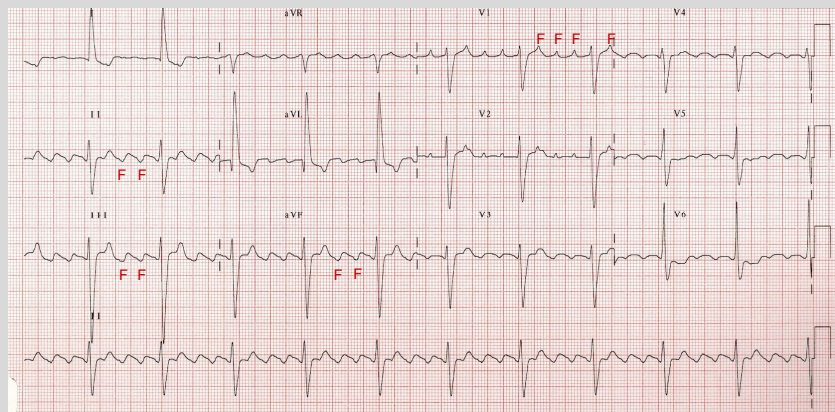


2 months Follow up LVEF = 45%

Narrow QRS Tachycardia



Cavo-tricuspid isthmus (CTI) dependent atrial flutter

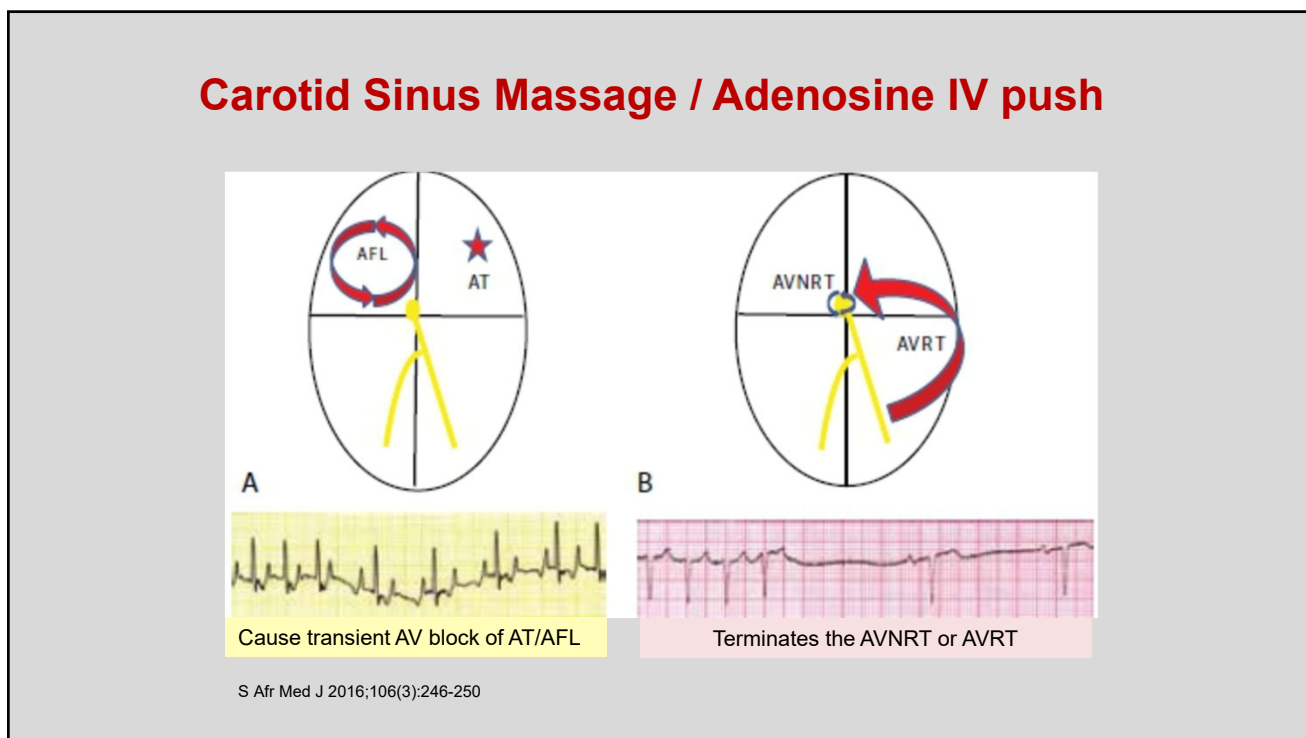
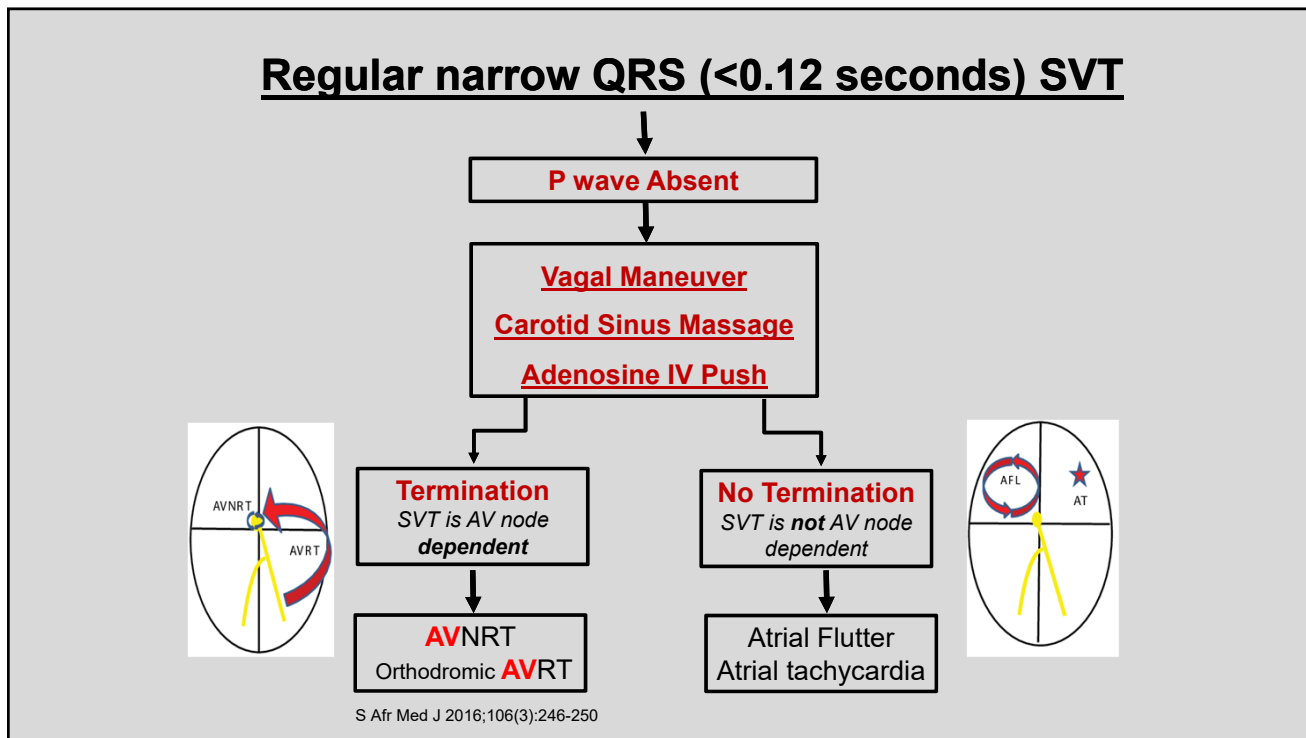


F Sawtooth flutter waves pattern negative in II, III and aVF / positive in V1

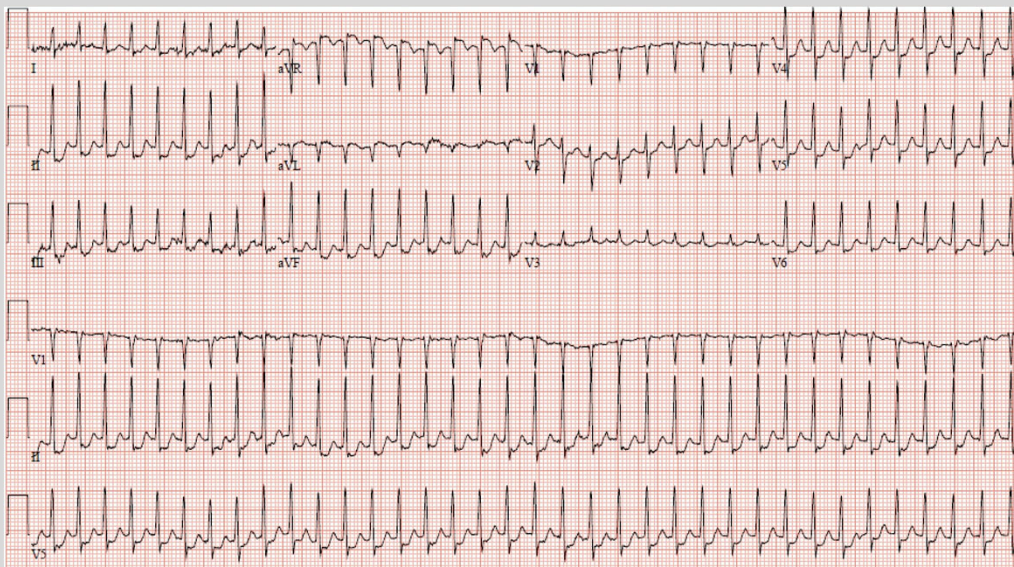
Other names: Counter-clock atrial flutter / Common atrial flutter

Cavo-Tricuspid Isthmus (CTI) dependent atrial flutter

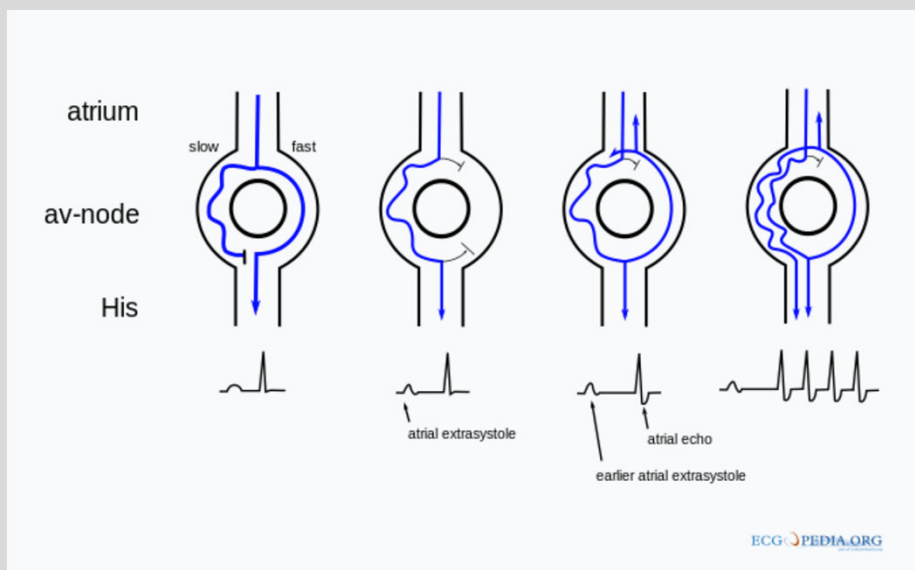
- ✓ Reentrant circuit commonly localized to the right atrium
- ✓ 250-350 bpm with 2:1 AV block
 - ✓ Heart rate at 150 bpm
- ✓ Medical therapy is **not successful**
- ✓ **Catheter ablation Successful up to 96%**
- ✓ Anticoagulation Rx is the same like AF



34 year old female with sudden onset palpitation [SVT 216 bpm]

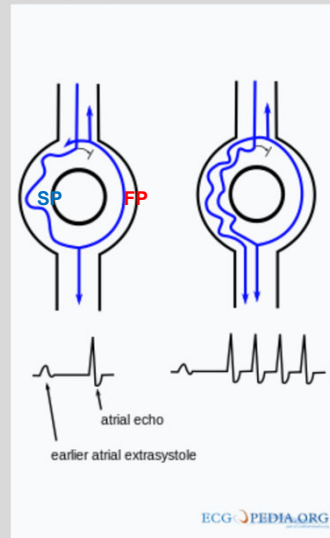
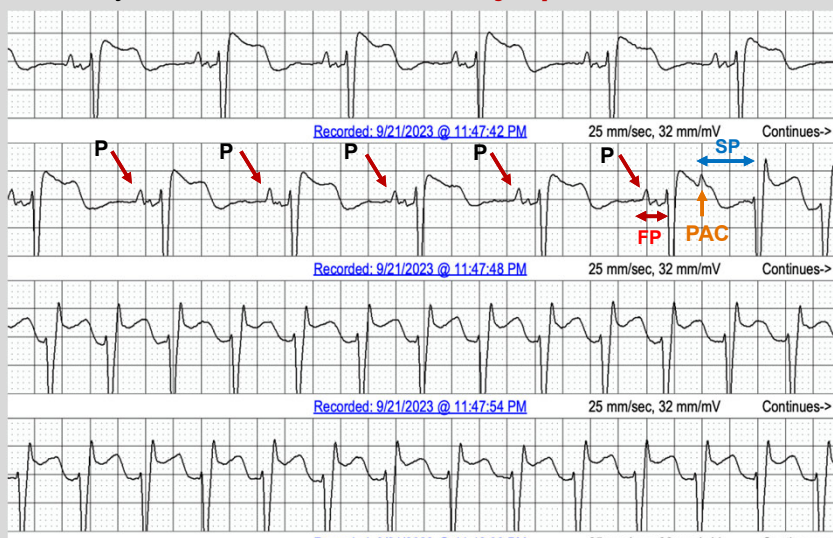


AV Node Re-entrant Tachycardia [AVNRT]



AV Node Re-entrant Tachycardia [AVNRT]

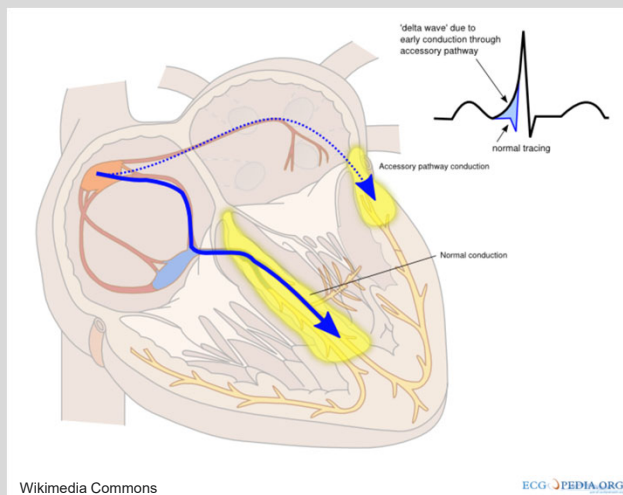
72 year old female who has **symptomatic sudden onset of palpitation**



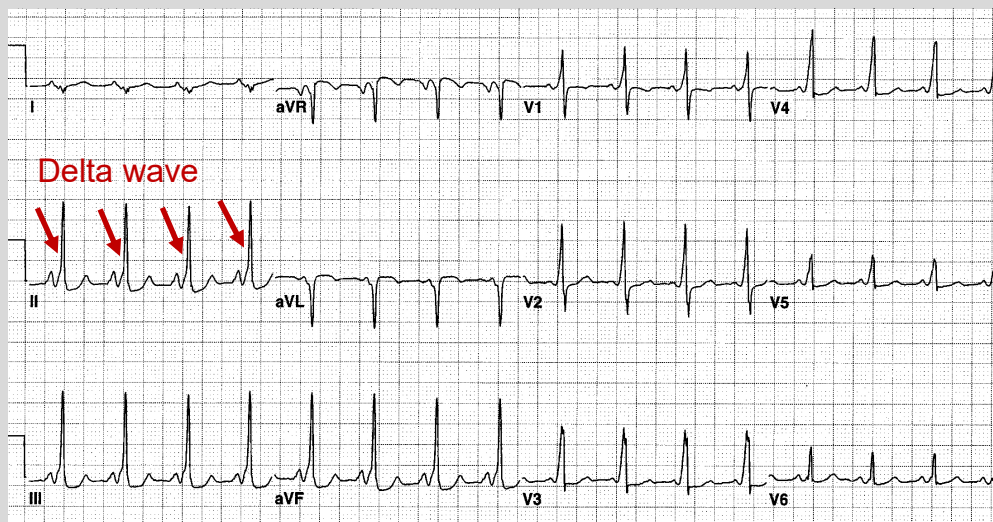
AV Node Re-entrant Tachycardia [AVNRT]

- ✓ 50-60% of SVT
- ✓ All ages affected
- ✓ **Female** slightly higher
- ✓ Heart rate is around 170
- ✓ Treatment
 - ✓ Vagal maneuvers
 - ✓ Medical therapy (BB, CCB,..)
 - ✓ **Catheter ablation (SP) is highly successful (96%)**

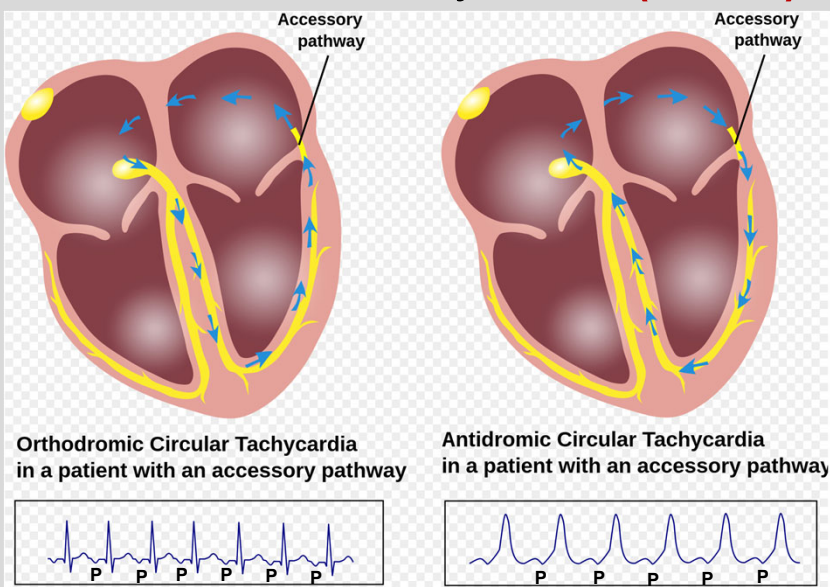
Wolfe-Parkinson-White (WPW)



Wolff-Parkinson-White ECG



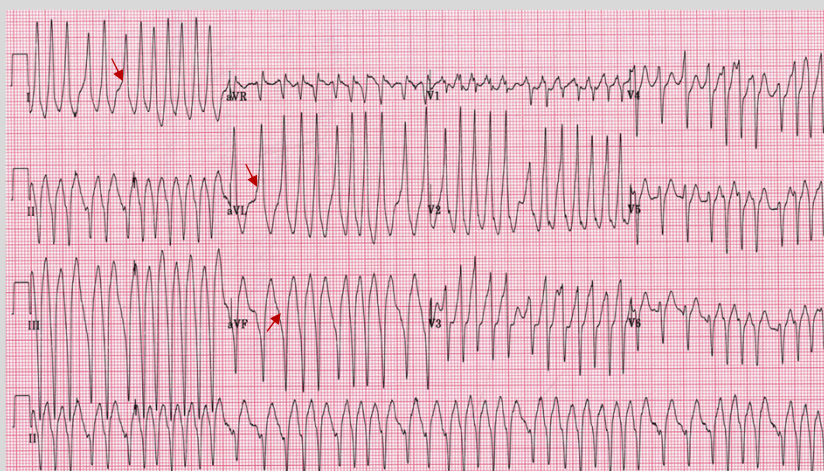
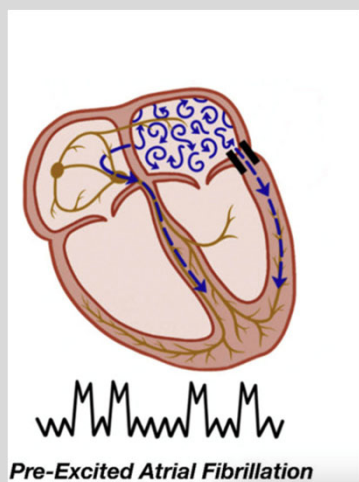
AV Reentrant Tachycardia (AVRT)



Wikimedia Commons

Pre-Excited Atrial Fibrillation

Don't use any **AV node slowing / blocking Agents**
 Beta Blocker, Calcium Channel Blocker, Digoxin or Adenosine



CJC Pediatric and Congenital Heart Disease 1 (2022) 60e73

Cardioversion Or **Procainamide** (block AP and AV node)

AVRT Treatment

✓ Acute Therapy:

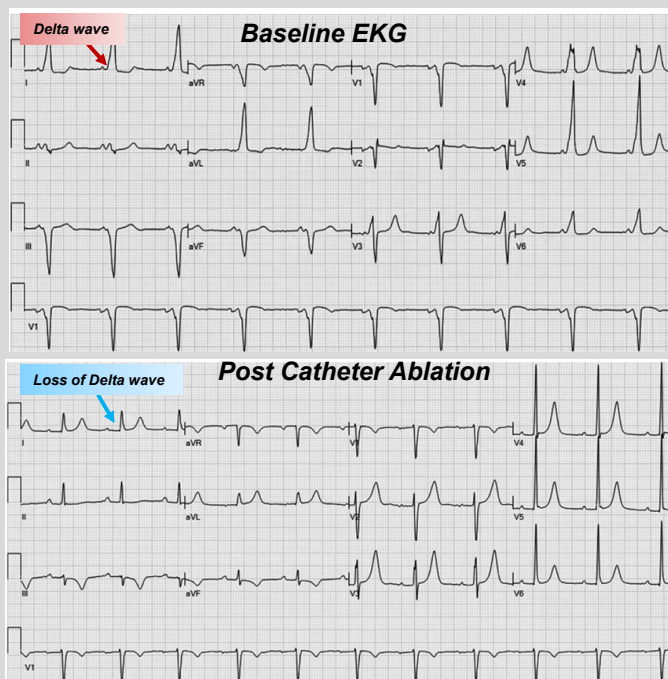
- ✓ Vagal Maneuver
- ✓ Carotid sinus massage
- ✓ Adenosine

✓ Chronic therapy in patient *without syncope*:

- ✓ Flecainide, Propafenone & Procainamide:
 - ✓ Pro-arrhythmia
 - ✓ Need regular ECG and lab testing
- ✓ Accessory pathway **Catheter ablation highly successful (95%)**

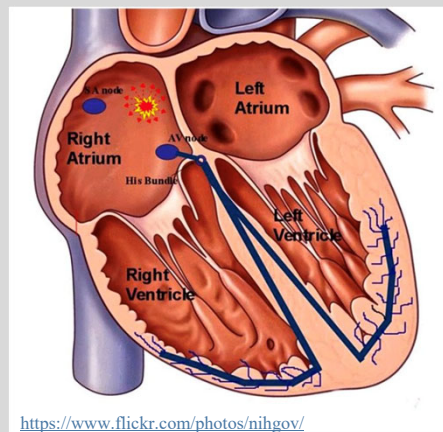
✓ Chronic therapy in patient *with syncope*:

- ✓ Accessory pathway **Catheter ablation highly successful (95%)**

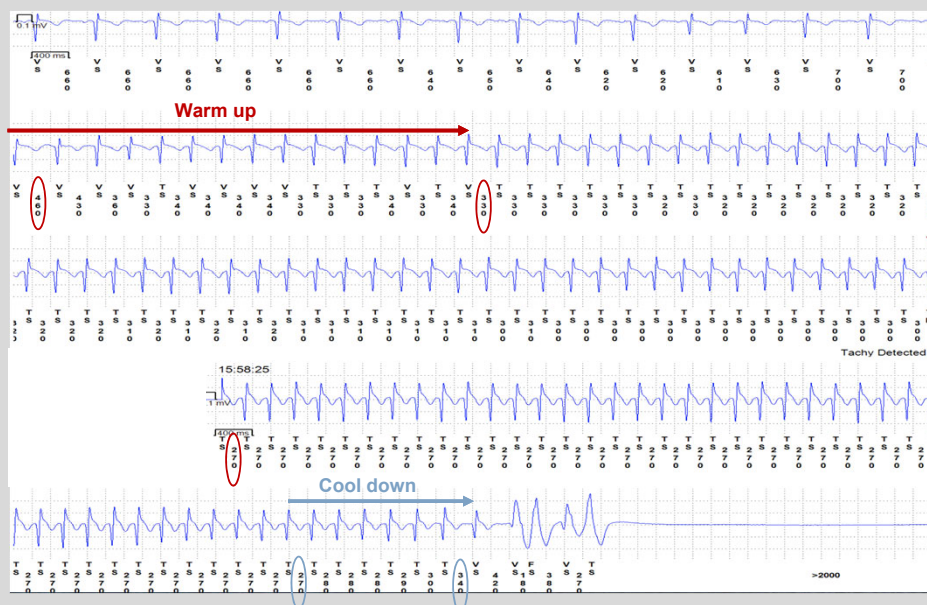


Focal Atrial Tachycardia

- 5 -15 % of SVT
- 150 – 250 bpm / tachycardia mediated cardiomyopathy
- 1:1 AV conduction
- Warm up and cool down in heart rate
- P wave morphology depends on origin
- Rate control Strategy:
 - Beta Blocker
 - Calcium Channel Blocker
- Rhythm control strategy:
 - Catheter ablation (86% success rate),
 - Flecainide, Propafenone, Sotalolol, or Amiodarone.



Focal Atrial Tachycardia



Inappropriate Sinus Tachycardia

- Abnormally high resting heart rate (>100 bpm) and disproportionate heart rate increase in *response to minimal activity*
- Must exclude **secondary** causes of sinus tachycardia
- **Rule out POTS**
- Treatment:
 - Beta blocker, calcium channel blocker
 - Ivabradine
 - **Sinus node modification using catheter ablation**

Multifocal Atrial tachycardia (MAT)

- Characteristics:
 - Multiple morphologies of P wave
 - Based on location of P waves
 - Variable PR intervals



CJC Pediatric and Congenital Heart Disease 1 (2022) 60e73

- Treatment:
 - Underlying pathophysiologic process
 - **Usually pulmonary disease**
 - Maintain serum potassium > 4 and magnesium > 2 .
 - Antiarrhythmic drugs:
 - beta blockers vs. calcium channel blocker therapy.
 - DC cardioversion is not effective

Conclusion

- Cardiac arrhythmia *demands an investigation*
- Baseline History, EKG, Holter, Echocardiogram are often sufficient to establish whether benign or serious arrhythmia
- Treatment determined by symptoms and whether heart structurally normal or not.
- If observation recommended, *don't forget to observe*