

Case-Based Practical ECG Interpretation for the Generalist

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Disclosures

None

Overview

ECG Basics – Methodological Approach to Reading ECGs

Differentiation of Supraventricular Arrhythmias

- SVT classification

- Atrial Fibrillation vs. Atrial Flutter

- WPW Syndrome

Recognition and management of a long QT interval

Review

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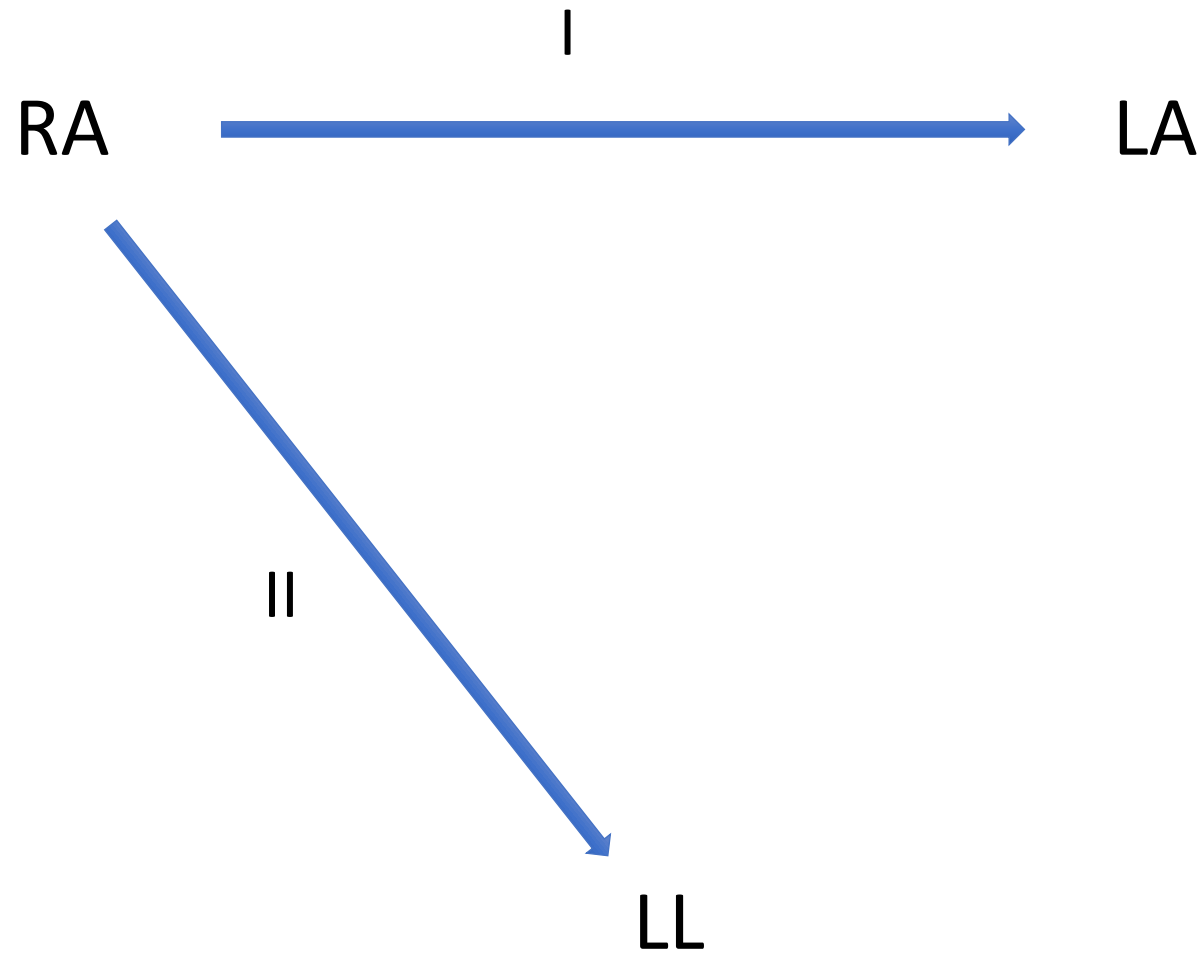
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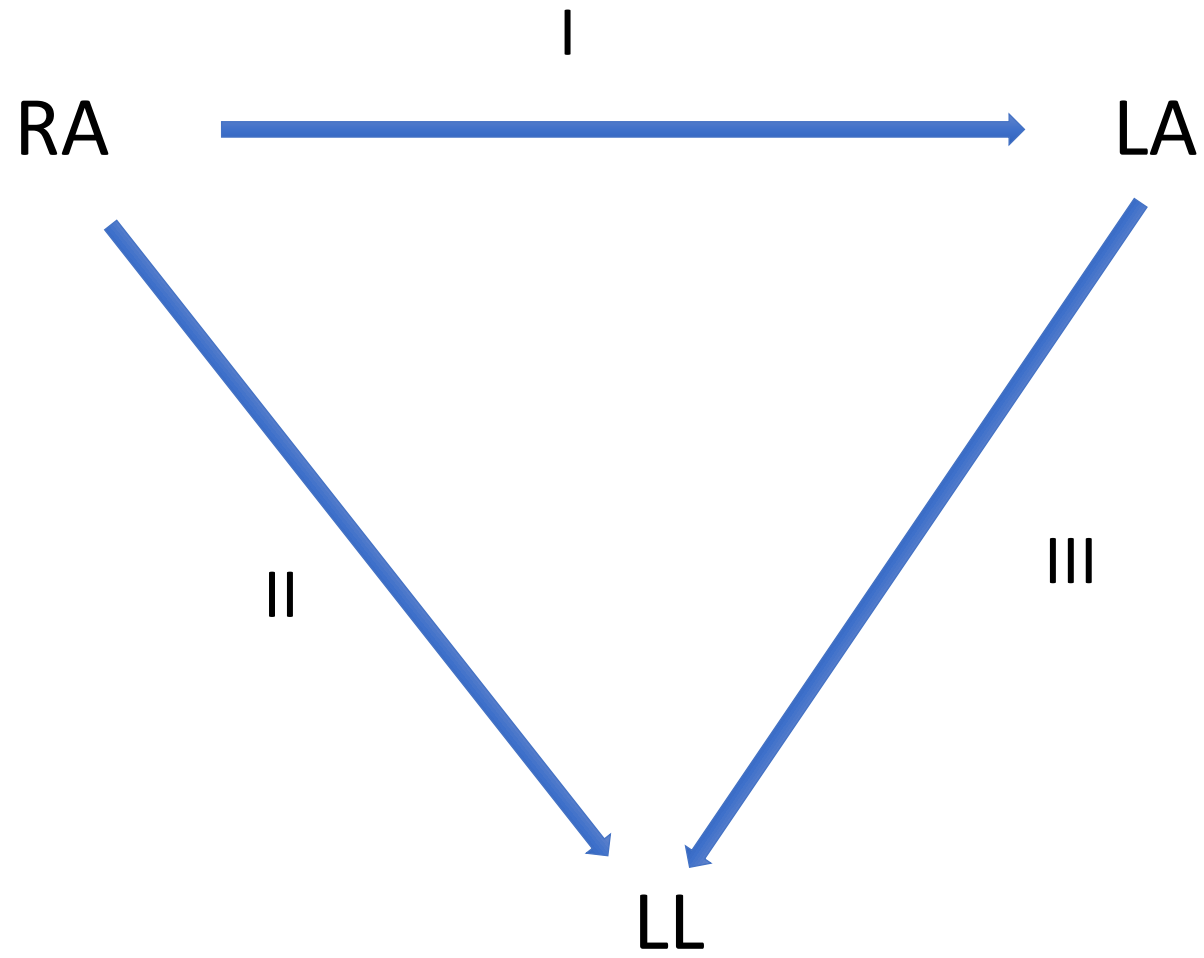
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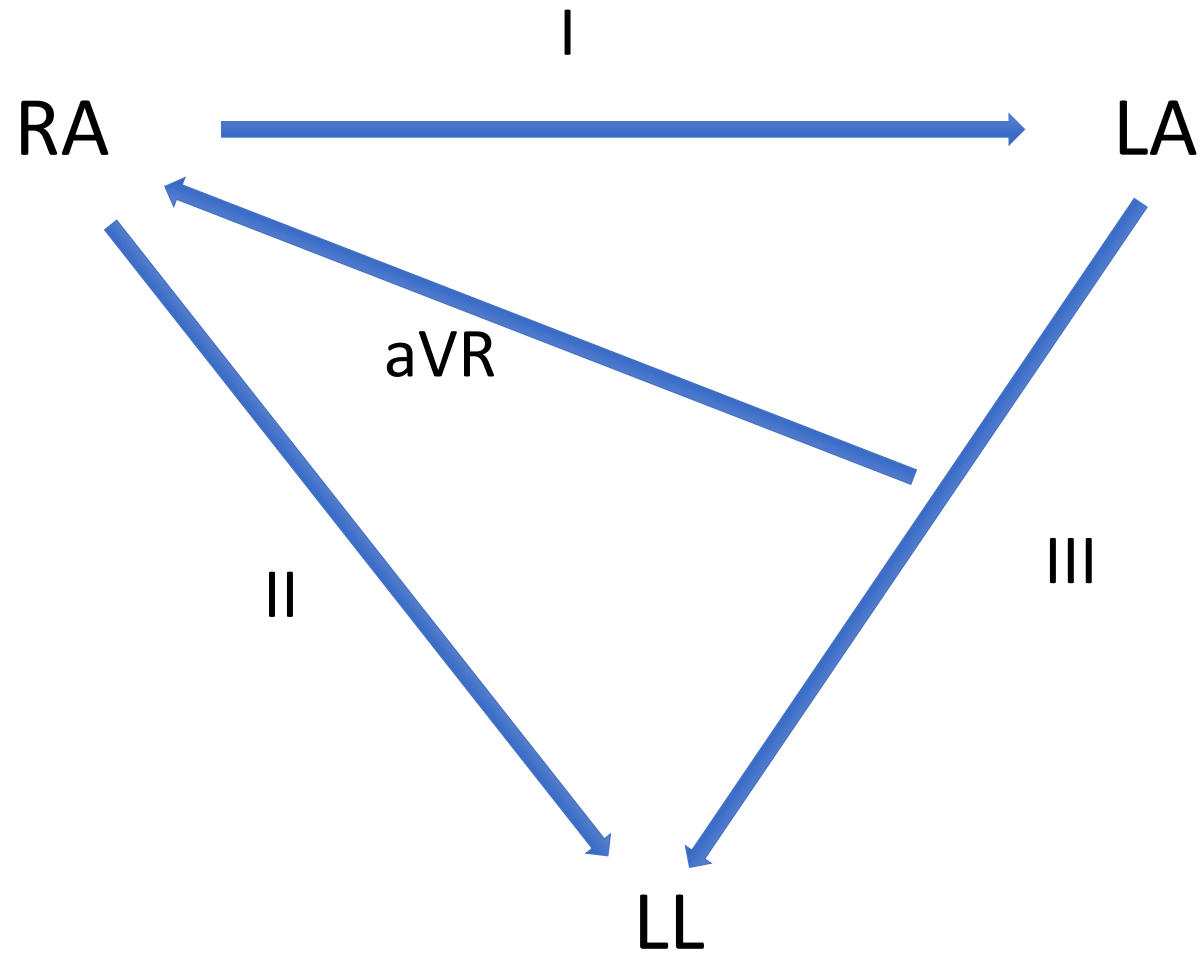
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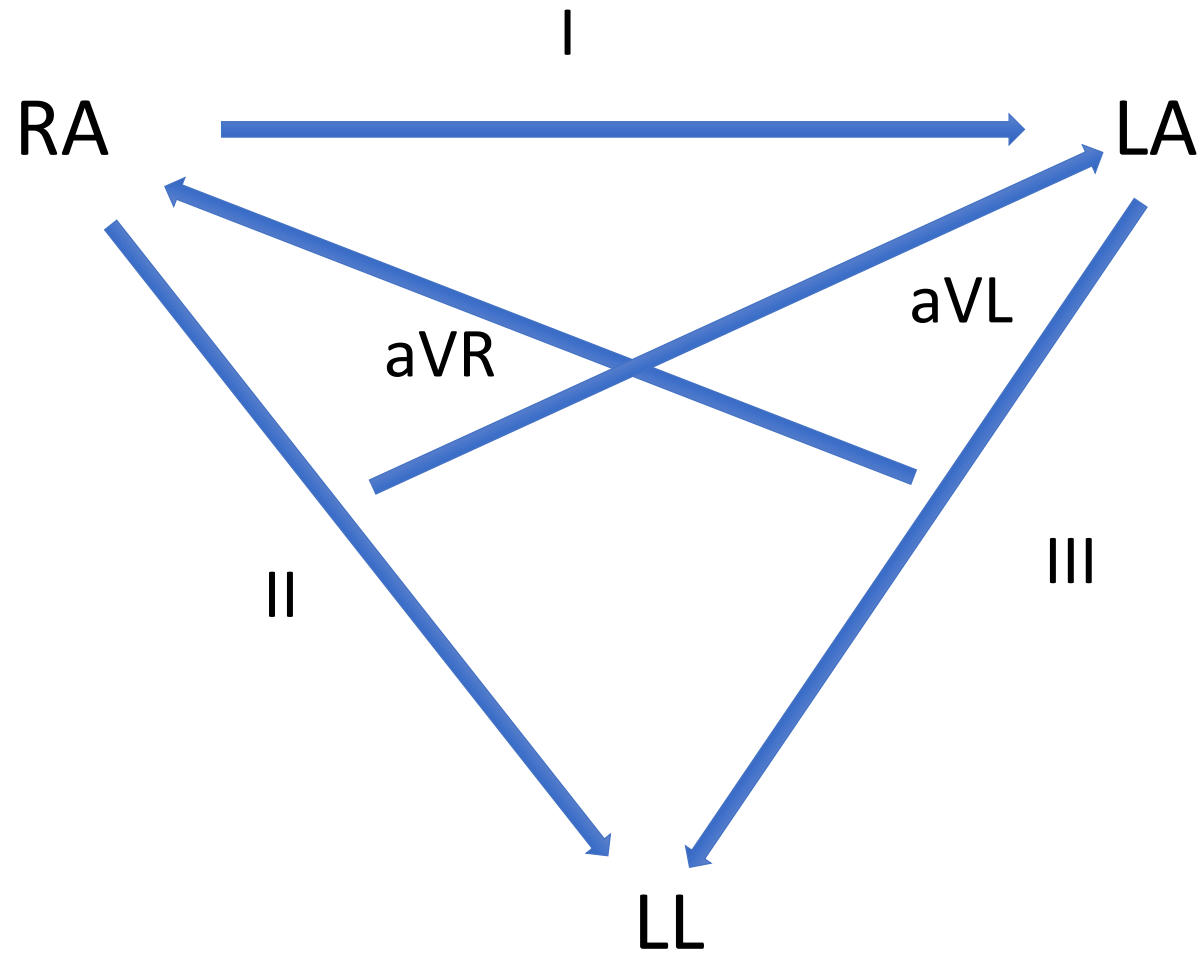


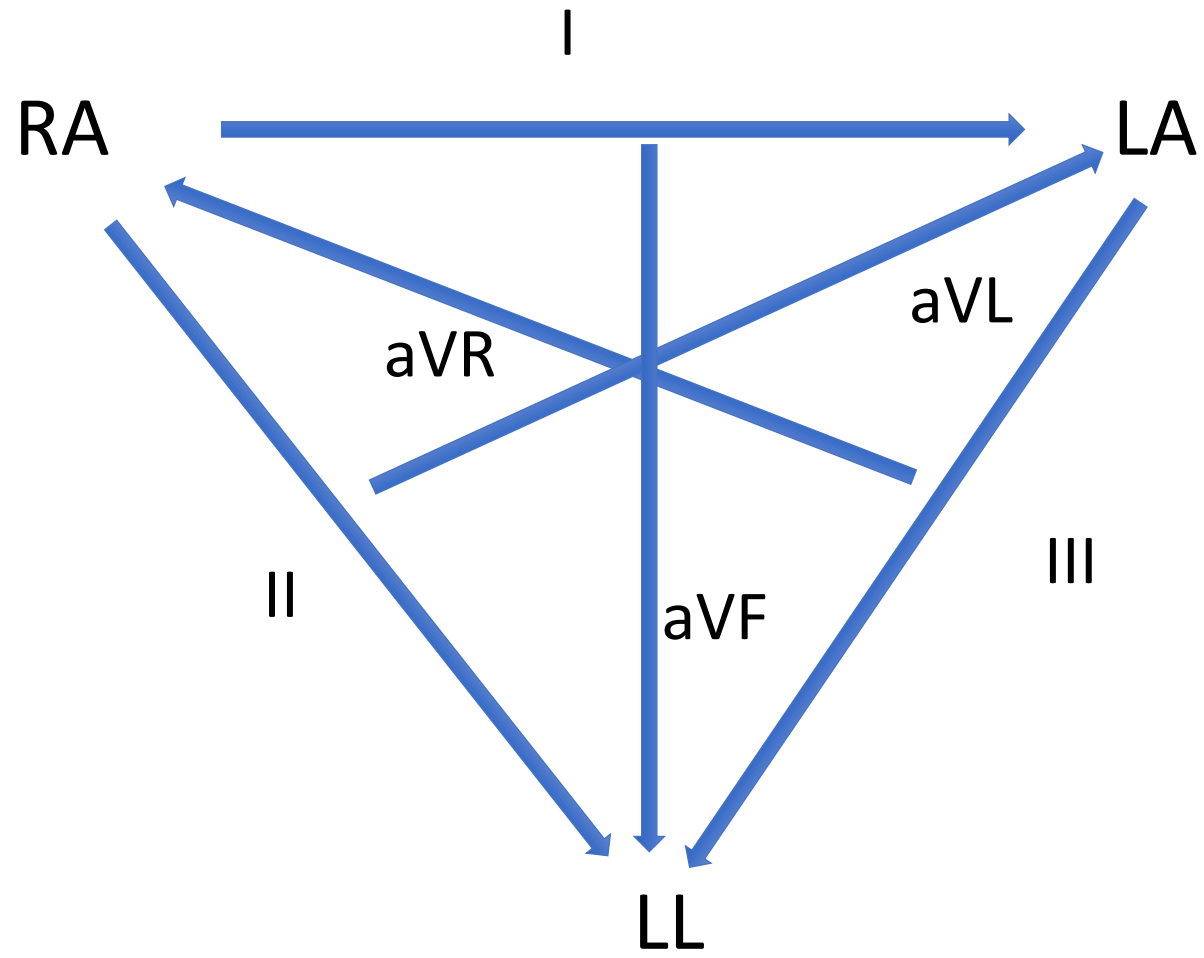
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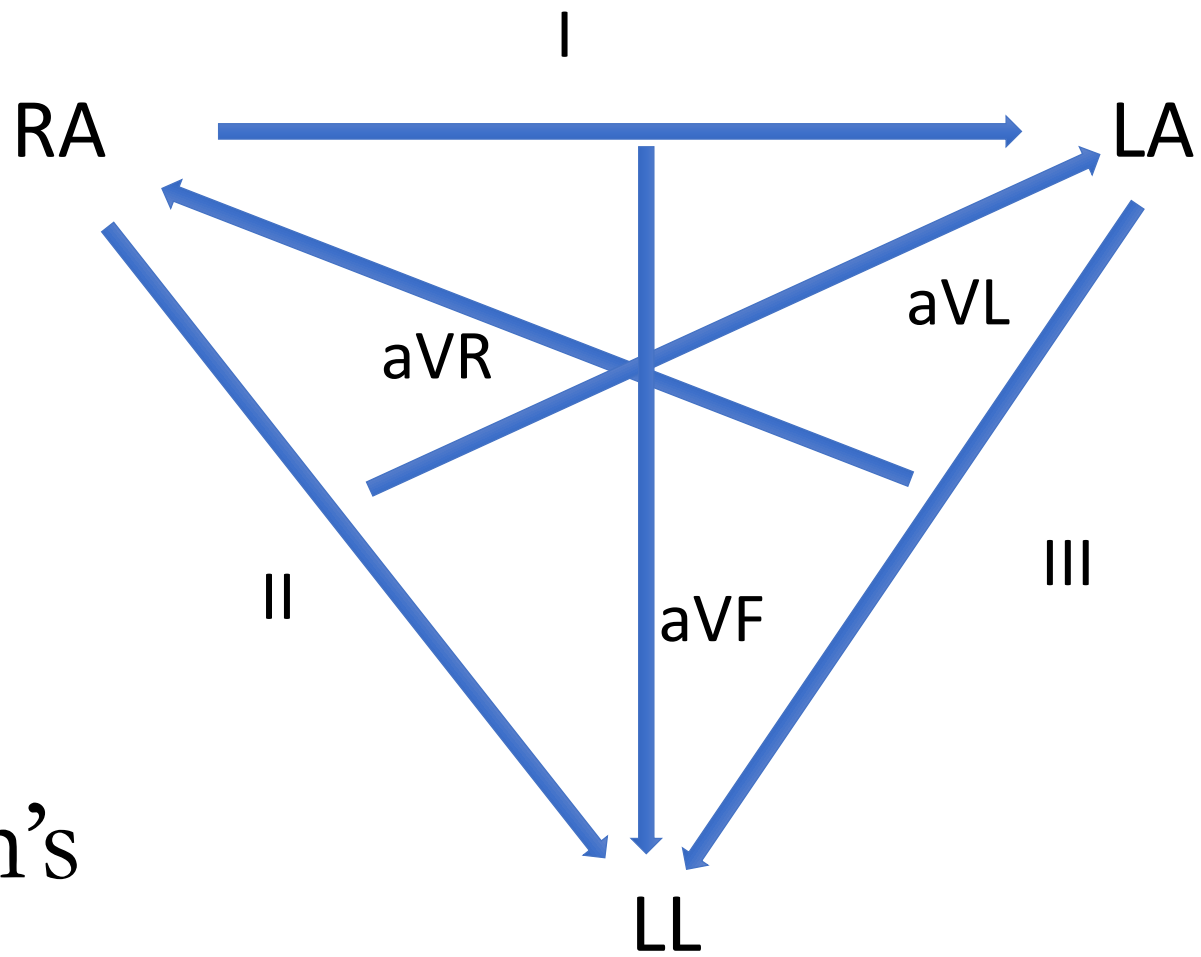












Einthoven's
Triangle

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The Modern 12-Lead ECG

The Modern 12-Lead ECG

One of the quintessential tools of Cardiology

Approach to the 12-Lead ECG

Rate

Rhythm

Intervals

Axis

QRS Morphology (Infarction, Hypertrophy)

ST Segment and T Waves

Measuring ECG Intervals

At 25 mm/sec paper speed:

Large boxes are 0.2 sec (200 msec)

Small boxes are 0.04 sec (40 msec)

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Supraventricular Tachycardia (SVT)

SVT is common

Prevalence of ~1/500

Incidence of ~90,000 new cases per year

AVNRT accounts for 50-60% of all SVT

Dual AV Node Physiology

Present in as many as 30-40%

Only a small percentage have clinical SVT

SVT: Differential Diagnosis

Sinus tachycardia

Atrial tachycardia

Atrial flutter

Atrioventricular nodal reentrant tachycardia (AVNRT)

Orthodromic atrioventricular reentrant tachycardia (AVRT)

Junctional tachycardia

Paroxysmal form of junctional reciprocating tachycardia (PJRT)

Subcategorizing SVT: P wave

No P or P-in-QRS

Short RP

Long RP

Subcategorizing SVT: P wave

No P or P-in-QRS

Short RP

Long RP

Helps to focus the differential diagnosis!!

No P or P in QRS



R



R

No P or P in QRS

Differential diagnosis:

AVNRT

Atrial flutter

AT with 1st degree AV block

JT

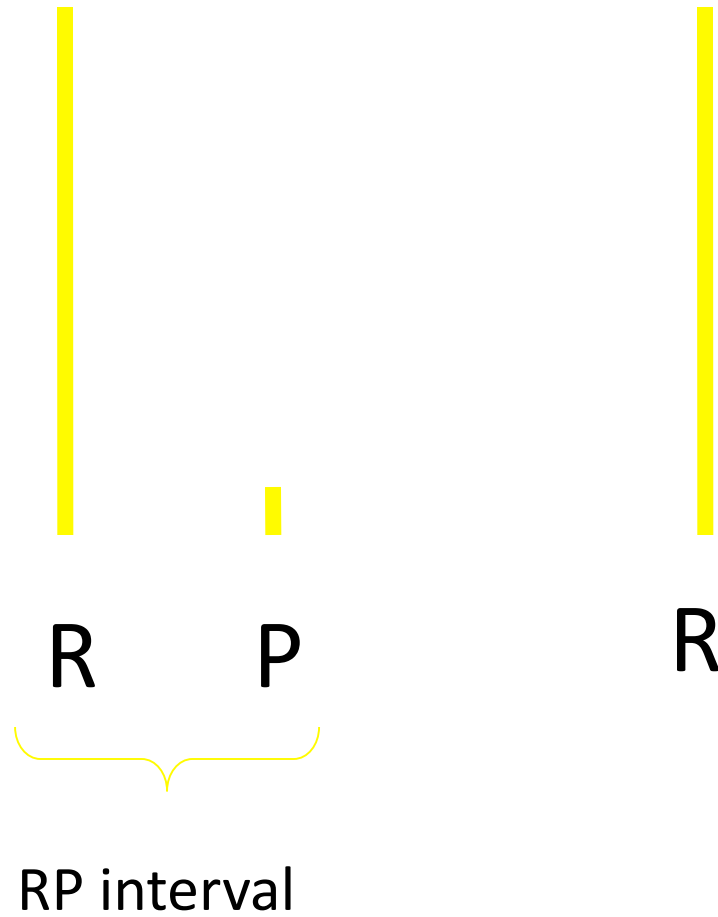
Much less likely AVRT

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AVNRT: Atrioventricular Nodal Reentrant
Tachycardia

Short RP



Short RP

Differential diagnosis:

AVRT

AVNRT

AT with 1st degree AV conduction delay

JT

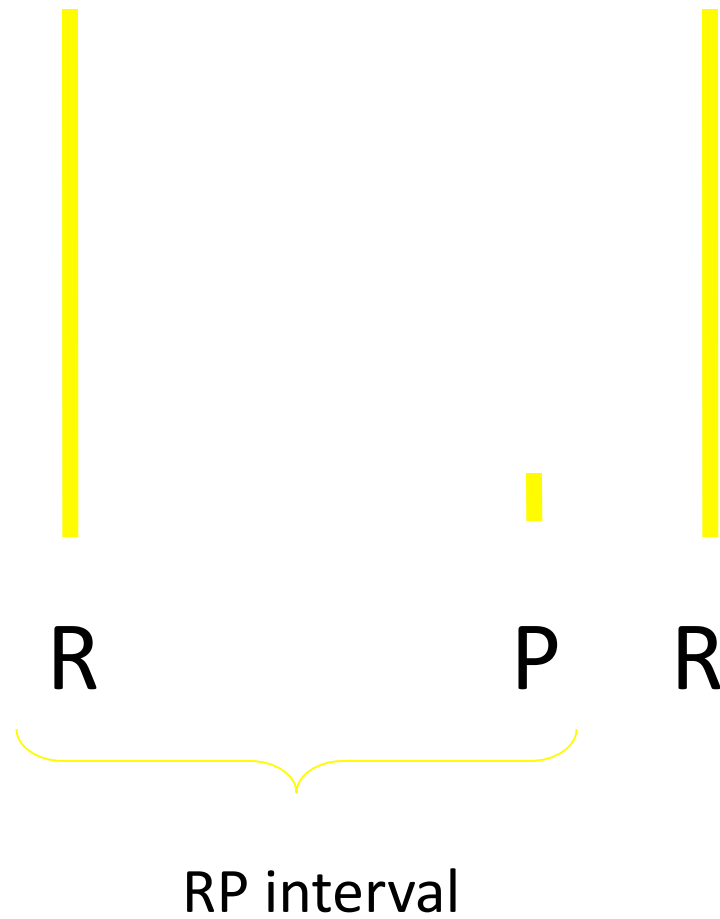
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AVRT: Atrioventricular Reentrant Tachycardia

- .

Long RP



Long RP

Differential diagnosis:

Sinus tachycardia

Atrial tachycardia

AVNRT (atypical form)

Junctional tachycardia

AVRT

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Atrial Tachycardia

Focal arrhythmia arising in either right or left atrium

Several arrhythmia mechanisms are possible

- Automatic

- Triggered

- Micro-reentrant

Most common site is the right atrial crista terminalis near the sinus node

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Differentiating Atrial Fibrillation from Flutter

Atrial Fibrillation

- Disorganized atrial activity
- Irregularly-irregular ventricular response

Atrial Flutter

- Organized atrial activity – intra-atrial macro-reentry
- Often regular rapid ventricular response (2:1 conduction ~150 bpm)

Differentiating Atrial Fibrillation from Flutter

Atrial Fibrillation

- Rate control generally possible
- Ablation is sometimes successful (improves symptoms in 50-60%)
- Moderate risk of complications (5-10%)

Atrial Flutter

- Rate is difficult to control
- Ablation is highly successful (>95% cure)
- Ablation is low risk (<2%)

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Case 1

30 yo man awoke on a Saturday morning with sudden onset palpitations, dyspnea, and presyncope.

This episode followed an evening of drinking substantially more than usual with friends.

No known medical problems.

Came to the ED for medical attention.

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Case 1

30 yo man awakened with palpitations, dyspnea, and presyncope

Tachycardic, irregular, but otherwise normal exam

Abnormal ECG

Normal Echocardiogram

Case 1

30 yo man awakened with palpitations, dyspnea, and presyncope

*Wolff-Parkinson-White Syndrome
with preexcited atrial fibrillation*

Accessory Pathway

Wolff-Parkinson-White Syndrome

Sinus ECG shows evidence of pre-excitation

Typical episodes of tachycardia

- Orthodromic AVRT

- Antidromic AVRT

- SVT with pre-excitation (most commonly atrial fibrillation with pre-excitation)

Tachycardias with Accessory Pathways

Atrioventricular Reentrant Tachycardia (AVRT)

A reentrant arrhythmia involving

Atrium

AV Node/His-Purkinje system

Ventricle

Accessory Pathway

Orthodromic: down the conduction system

(Narrow complex)

Antidromic: up the conduction system

(Wide complex)

SVT with pre-excitation

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Treatment of Accessory Pathway-Mediated Tachycardias

Medical:

AVRT:

AV nodal blockers (adenosine, etc)

Atrial fibrillation with pre-excitation:

NO AV BLOCKERS: Risk of V Fib!!!

Procainamide – slows conduction in pathway

Electrical: cardioversion if unstable

Radiofrequency ablation

Almost always curative!

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Case 1

30 yo man awakened with palpitations, dyspnea, and presyncope

*Underwent successful RF catheter ablation
of a posteroseptal accessory pathway*

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Case 2

60 yo man with multiple episodes of syncope, all occurring in the setting of urination.

Case 2

60 yo man with multiple episodes of syncope, all occurring in the setting of urination.

He has a history of IV drug use currently in remission on methadone therapy.

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ECG Recognition of a prolonged QT Interval

All 12 leads can be used, V2 and V3 may be best to exclude U waves

Rule of thumb: If the QT interval is more than half the RR, it's probably too long

QT correction – several approaches to account for changes with HR

$$\text{Bazett QTc} = \frac{QT}{\sqrt{RR}}$$

Fridericia

Nomogram

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Acquired Long QT

Prolonged QTc found in up to 1% of hospitalized patients

Risk Factors:

- Electrolyte disturbances (K, Mg, Ca)

- Hypothyroidism

- Anorexia

- Bradycardia

- Structural heart issues (LVH, reduced LVEF)

- Medications (antiarrhythmics, psychotropic drugs, antibiotics, etc.)

www.crediblemeds.org

Case 3

19 yo woman with palpitations and lightheadedness. Her mother died suddenly at age 25.

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Congenital Long QT Syndrome

Much less common than acquired QT prolongation – 1/2000

Clinical syndromes:

- Romano-Ward (Autosomal dominant, cardiac only)

- Jervell and Lange-Nielsen (Autosomal recessive, sensorineural deafness)

300+ mutations in ~20 genes identified

Phenotypes

- LQT1 – events with exercise (especially swimming) (35%)

- LQT2 – events with auditory stimuli (25%)

- LQT2 and LQT3 – events during sleep (10%)

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Congenital Long QT Syndrome - Management

Avoid exacerbating factors (medications, etc.)

Beta Blockers (especially LQT1) – propranolol, nadolol preferred

Pacing and/or ICD if symptoms/events on beta blocker

Sports – debate about restriction

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