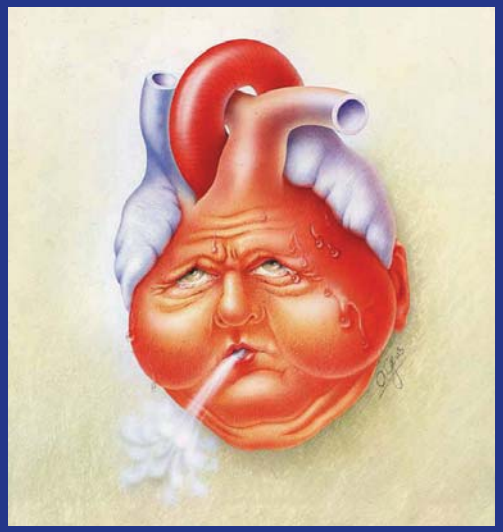
Common Arrhythmias



Jon Tardiff, BS, PA-C
OHSU Affiliate Associate Professor

Disclosures

Virginia Garcia Memorial FOUNDATION

- I work for Virginia Garcia Memorial Health Center.
- And I am a medical editor for Jones & Bartlett Publishing.

11 clinics: 45,000+ patients from all over the World!

55 Languages spoken at VG–Beaverton: English, Spanish, Arabic, Somali, Mai Mai, Russian, Cantonese, Mandarin, Vietnamese, Korean, Swahili, Kirundi, Farsi, Aramaic, Pashtu, Urdu, ASL, and more!

What a 12-Lead ECG can help you do

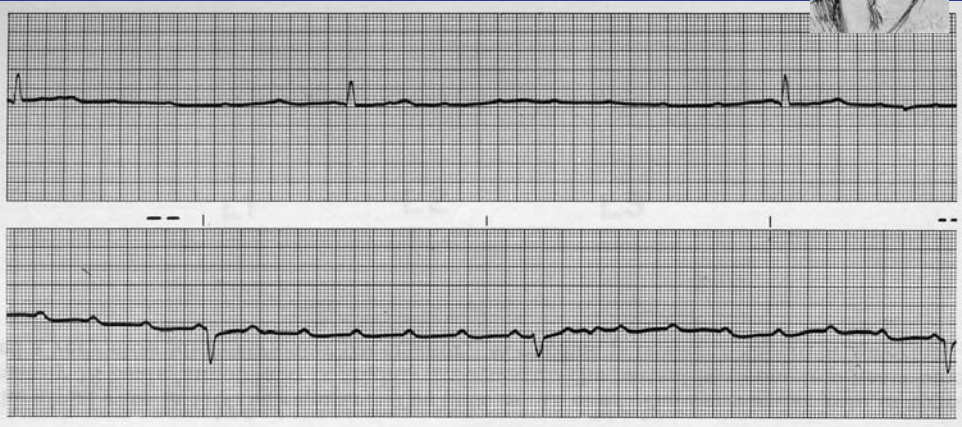
- Diagnose ACS / AMI
- Interpret arrhythmias
- Identify life-threatening syndromes (WPW, LGL, Long QT synd., Wellens synd., etc)
- Infer electrolyte imbalances
- Infer hypertrophy of any chamber
- Infer COPD, pericarditis, drug effects, and more!

For example:

71 y.o. man with syncope

This patient is conscious and alert!

Dr. William Stokes—1800s



Third Degree Block

Treatment: permanent pacemaker

Limitations of a 12-Lead ECG

- Truly useful only ~40% of the time
- Each ECG is only a 10 sec. snapshot
- Serial ECGs are necessary, especially for ACS
- Other labs help corroborate ECG findings (cardiac markers, Cx X-ray)
- Confounders must be ruled out (**LBBB**, dissecting aneurysm, pericarditis, WPW, digoxin, LVH, RVH)

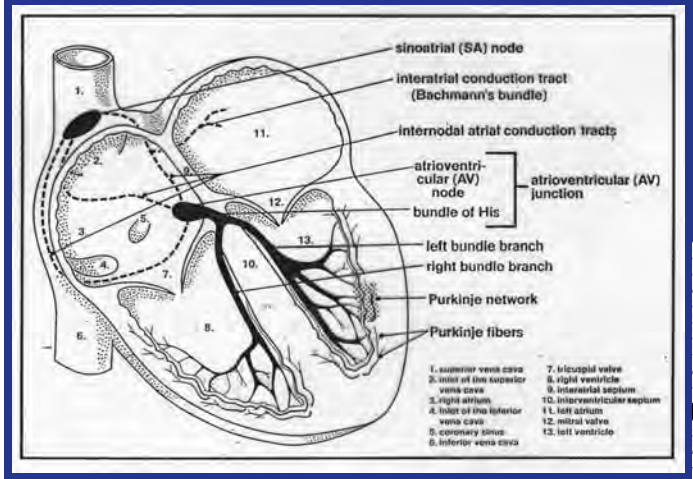
Lots of ways to read ECGs…

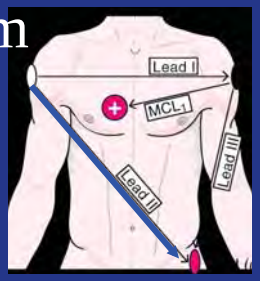
- **QRSs wide or narrow?**
- **Regular or irregular?**
- **Fast or slow?**
- **P waves?**
- **Is it sinus rhythm or not?**
- **If not, is it atrial fibrillation?**
- **BBB?**
- **MI?**

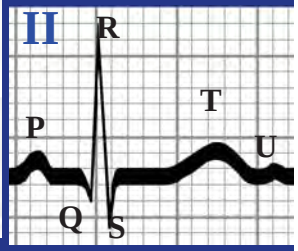
Symptoms:

- **<u>Syncope</u> is bradycardia, heart blocks, or VT**
- **<u>Rapid heart beat</u> is AF, SVT, or VT**

Conduction System

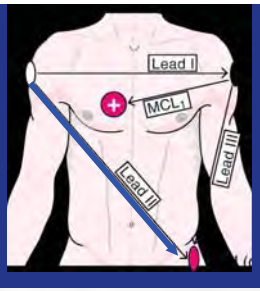


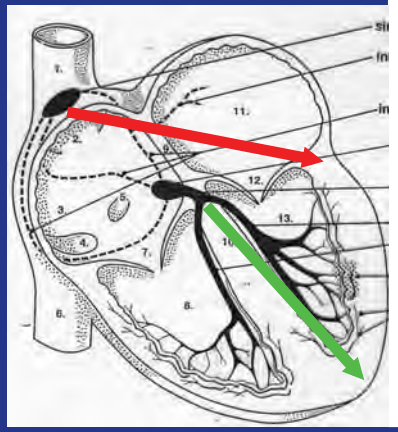




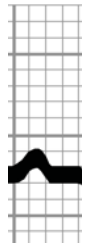
SA Node → AV Node → His Bundle → BBs → Purkinje Fibers

Lead II



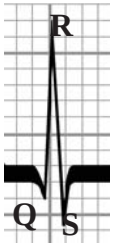


P wave axis



…upright in L II

R wave axis



…upright in L II

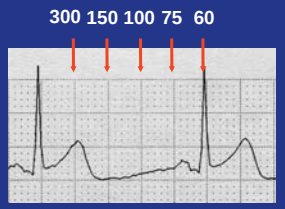
Heart Rate Calculations

Triplicate Method:

- 300, 150, 100,
- 75, 60, 50
- Quick, easy, sufficient

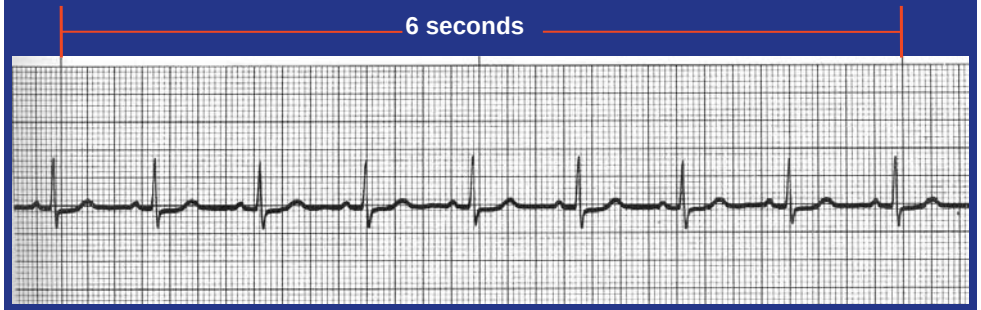
6-second strip:

- Count PQRST cycles in a 6 second strip & multiply x 10
- Easy, & more accurate



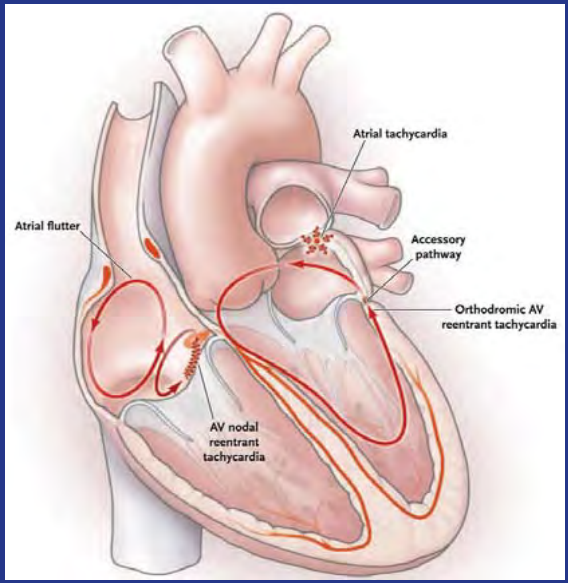
Horizontal axis is *time* (mS); vertical axis is electrical *energy* (mV)

Normal Sinus Rhythm



- What is the heart rate?

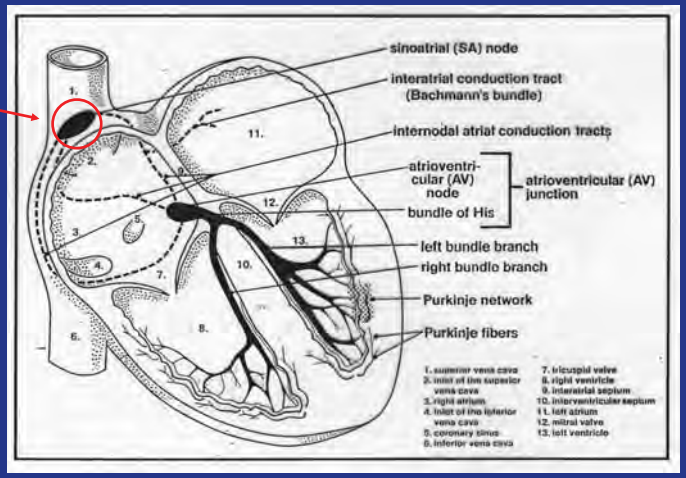
Supraventricular Rhythms



Supraventricular Rhythms—
(most common to least common)

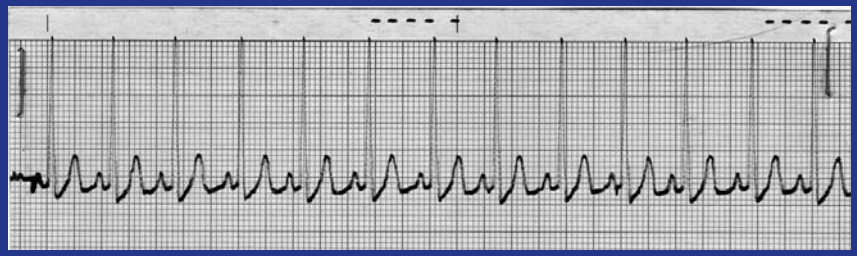
1. Sinus Tachycardia
2. Atrial Fibrillation / Atrial Flutter
3. AV Nodal Reentry Tachycardia
4. Accessory Pathway / AVRT (WPW)
5. Atrial Tachycardia
6. Multifocal Atrial Tachycardia
7. Junctional Tachycardia

Sinus Tachycardia



Originates in the sinus node. Usually a compensatory rhythm: "fight or flight" response.

Sinus Tachycardia



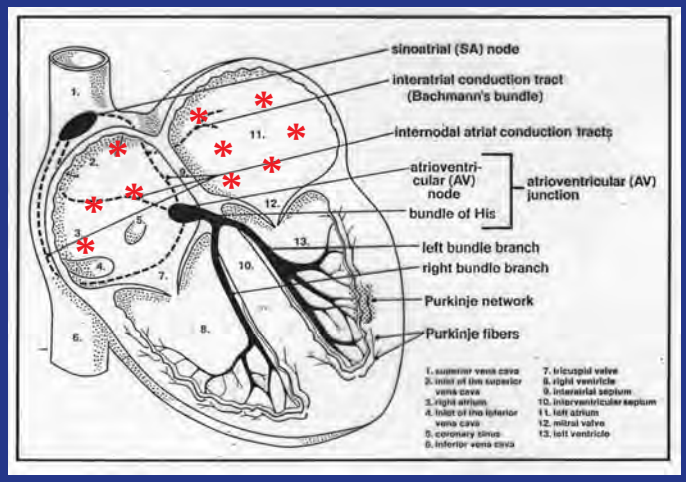
Treat the <u>cause</u> of the tachycardia—not the rhythm itself

Unless…

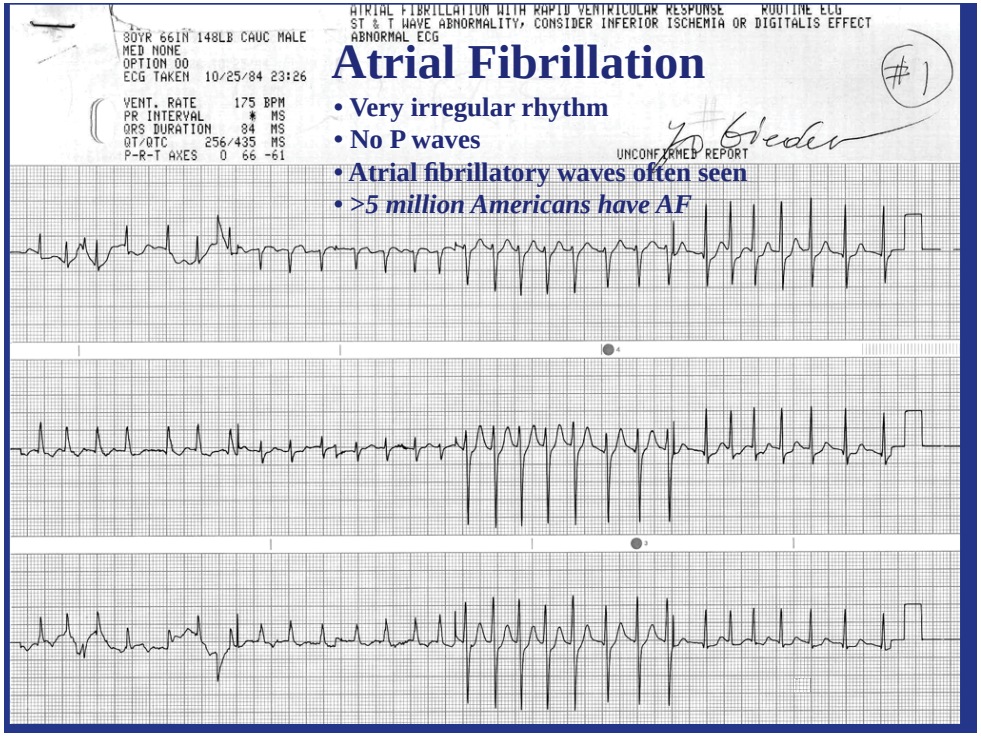
The patient is having an MI!

- Slow the heart rate with a Beta-blocker
- MONA (morphine, oxygen, NTG, aspirin)
- Stat cath lab for percutaneous coronary intervention (PCI)
- or fibrinolytic

Atrial Fibrillation



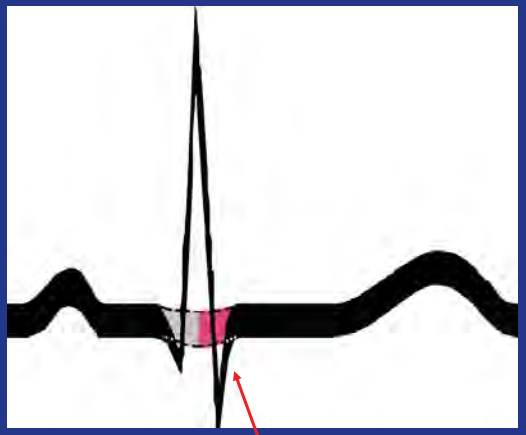
Multiple reentry circuits within the atria generate multiple impulses. Suppresses SA node. Atrial rate 320 – 450. 18



Atrial Fibrillation

- **Very irregular rhythm**
- **No P waves**
- **Atrial fibrillatory waves often seen**
- ***>5 million Americans have AF***

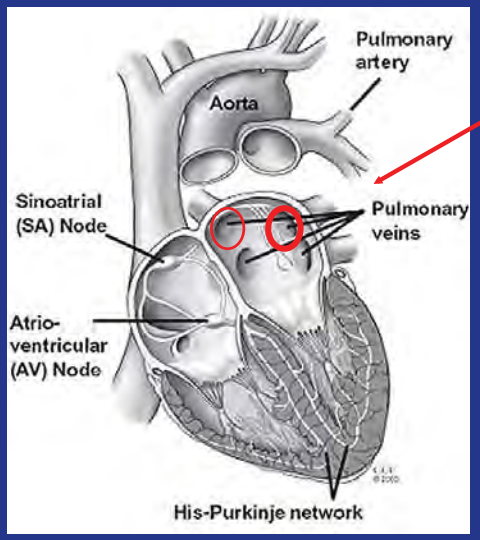
Atrial refractory period



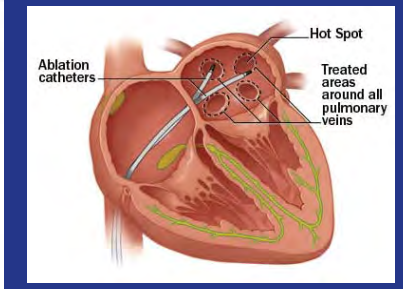
Relative Refractory Period (vulnerable period)

Sinus Rhythm with PACs… becoming Atrial Fibrillation

Atrial Fibrillation



R & L superior pulmonary veins, (especially the left)



Pulmonary vein isolation (ablation therapy) may cure AF

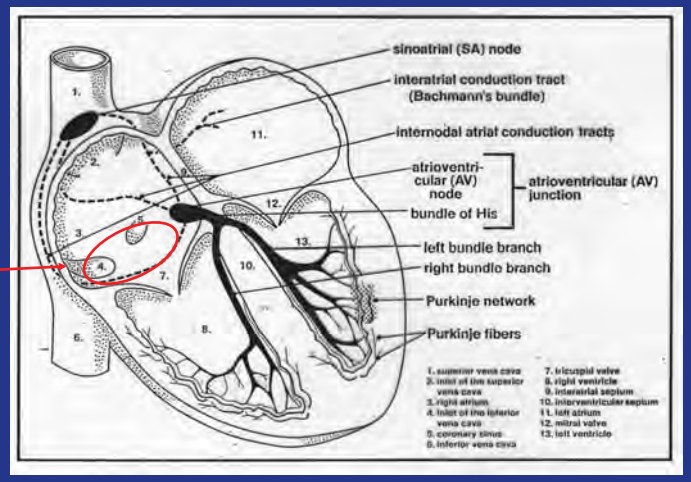
Case report:

60-ish male, jogging with friends, becomes short of breath and has to sit down. Is transported to Walter Reed Medical Center, and is diagnosed with paroxysmal atrial fibrillation.

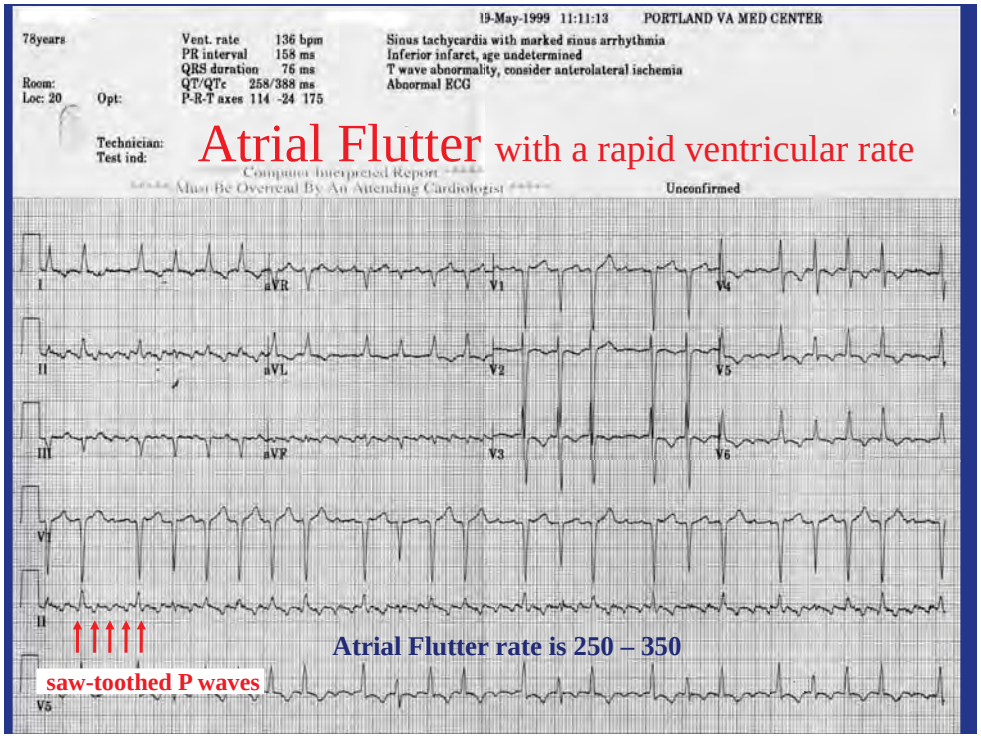
Cause: hyperthyroidism

Treatment: thyroid gland is irradiated. Patient makes full recovery and continues an exceptionally active and productive life.

Atrial Flutter

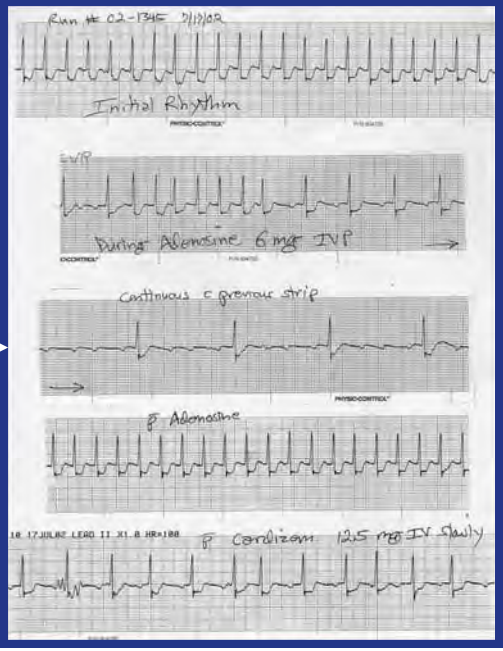


Rentry circuit in one of the atria.
Makes "Saw-toothed" P waves,

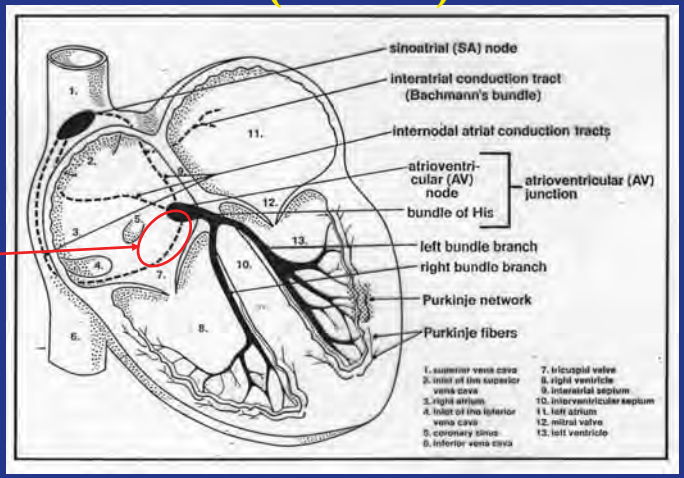


Adenosine revealing Atrial Flutter

Flutter waves



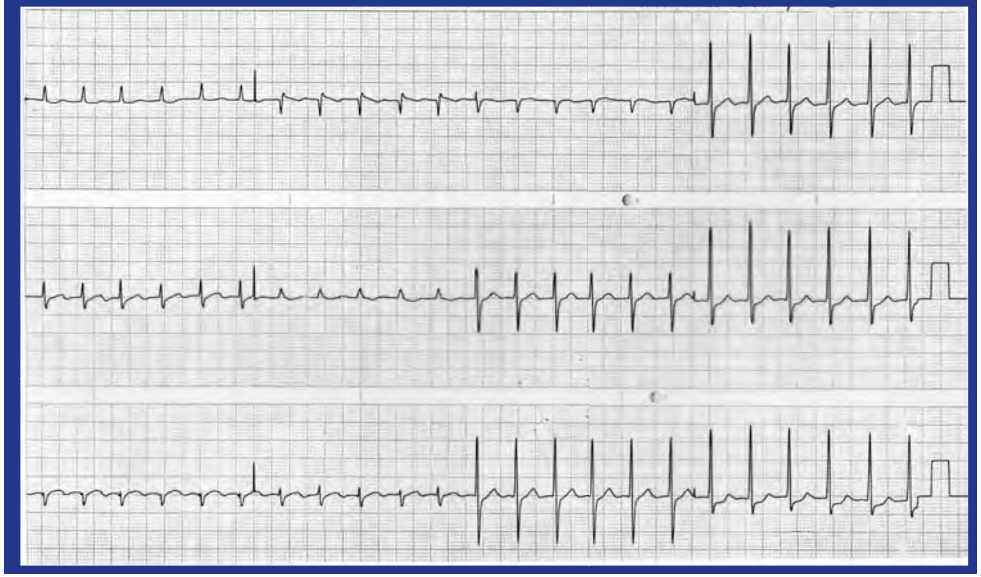
AV Nodal Reentry Tachycardia (AVNRT)



Rentry circuit in the right atrium near AV Junction
Incidence: ~60% of all paroxysmal supraventricular tachycardias (excluding atrial fibrillation / flutter).

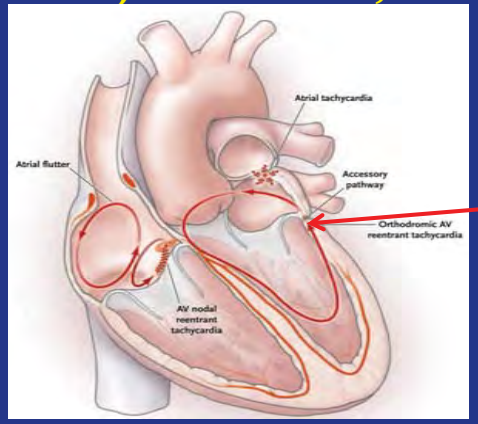
AV Nodal Reentry Tachycardia

(no P waves)



Accessory Pathway: AV Reentry Tachycardia

(AVRT) AKA: WPW, LGL

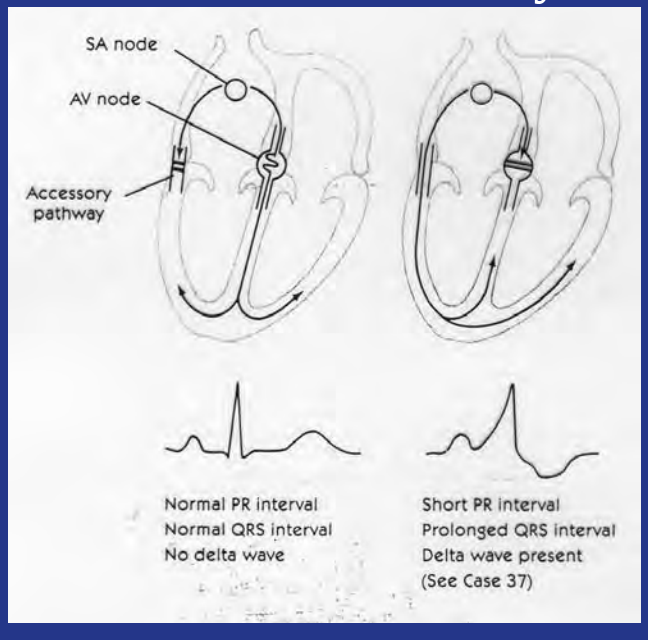


Accessory pathway

Drs. Wolff, Parkinson, & White

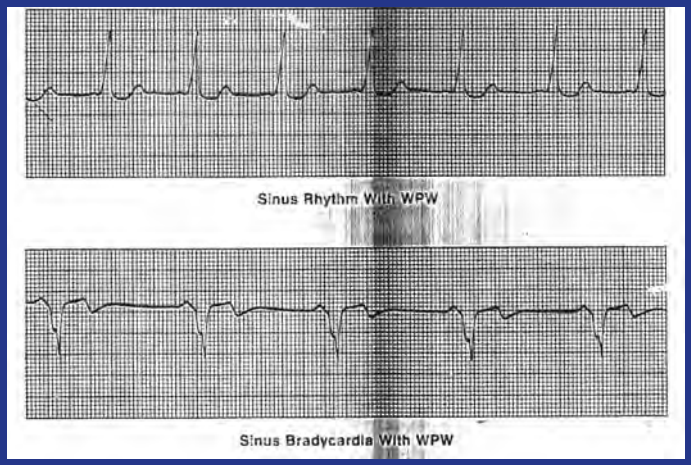
- 1 / 400 people have accessory pathways (bundle of Kent)
- HR 150 – 280 / minute.
- 40% of these patients get AF. ½% mortality rate.

Wolff-Parkinson-White synd.



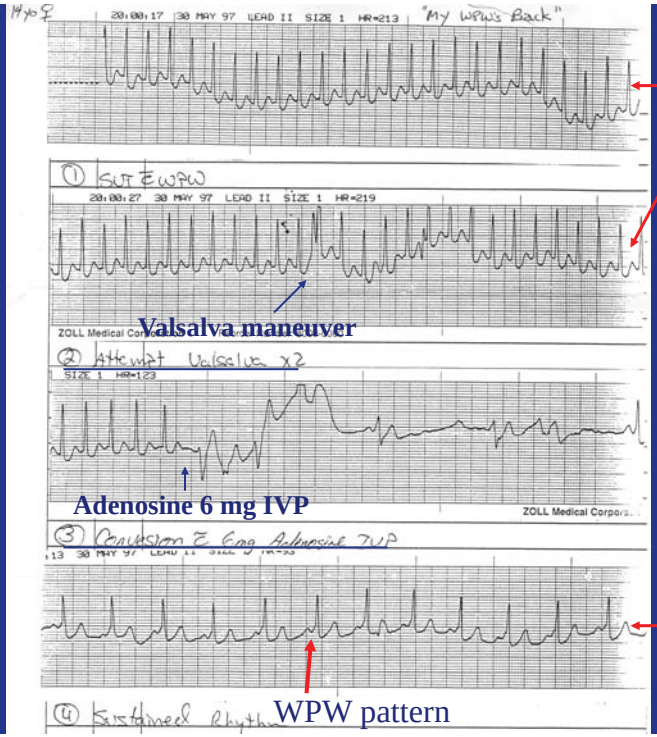
Drs. Wolff, Parkinson, & White

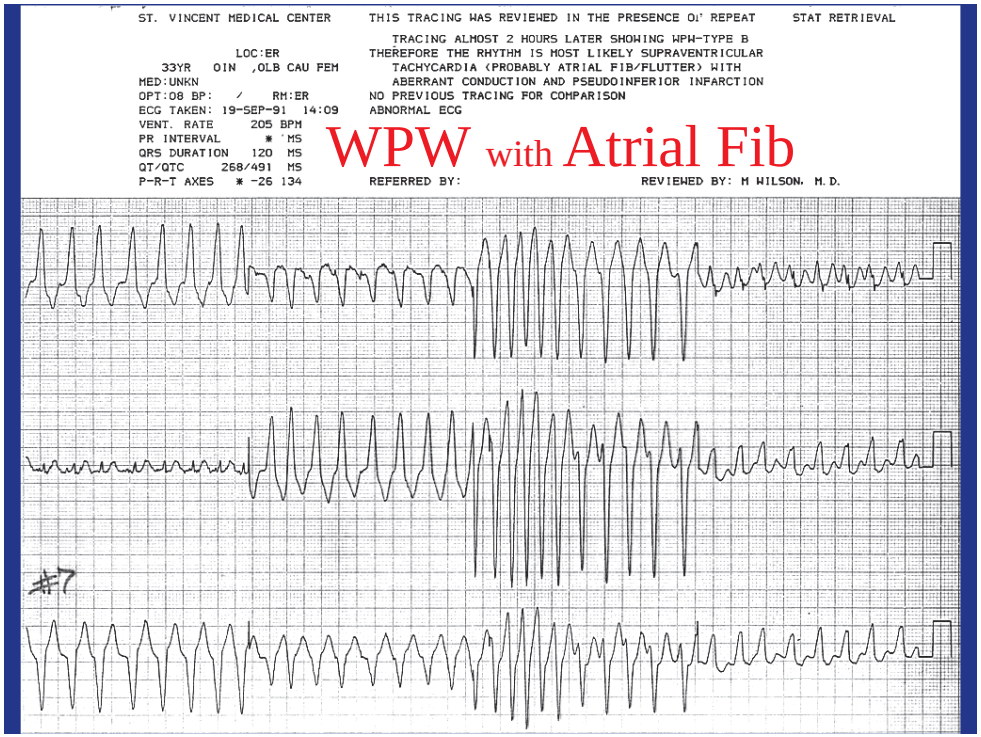
Wolff-Parkinson-White Syndrome

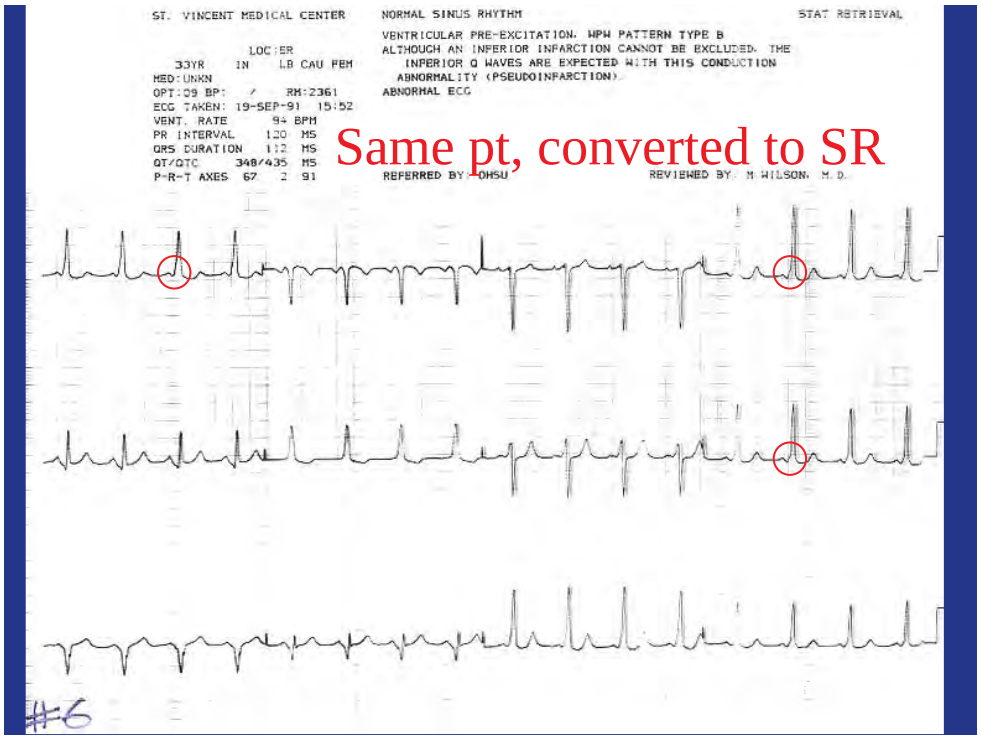


Drs. Wolff, Parkinson, and White *c. 1930*

- Short PR Interval • Wide QRS • "Delta" wave in some leads
- **Causes tachycardias** • Mimicks MI, BBB
- Pt is at-risk for sudden death ("R on T"; atrial fibrillation)
- Incidence may be 1/1000





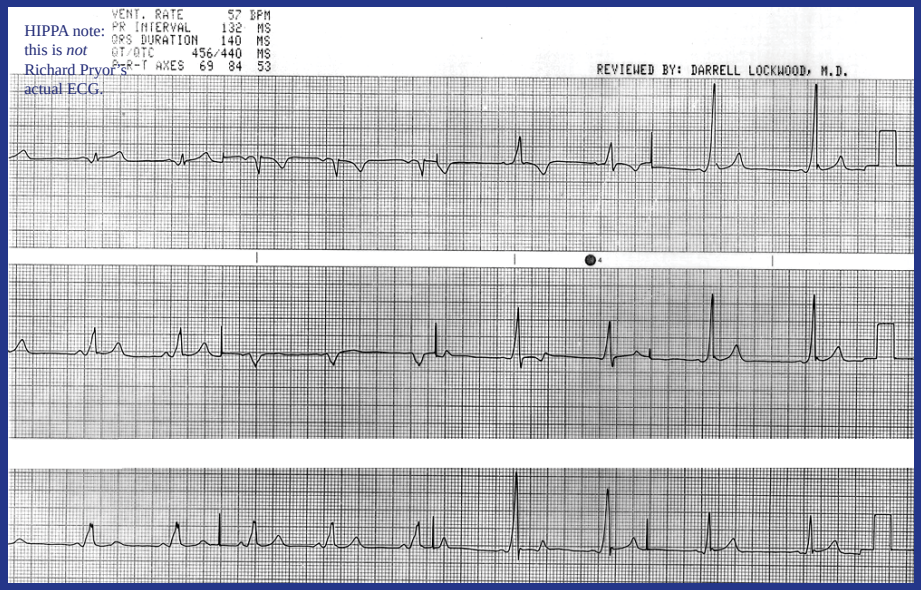


Case report:

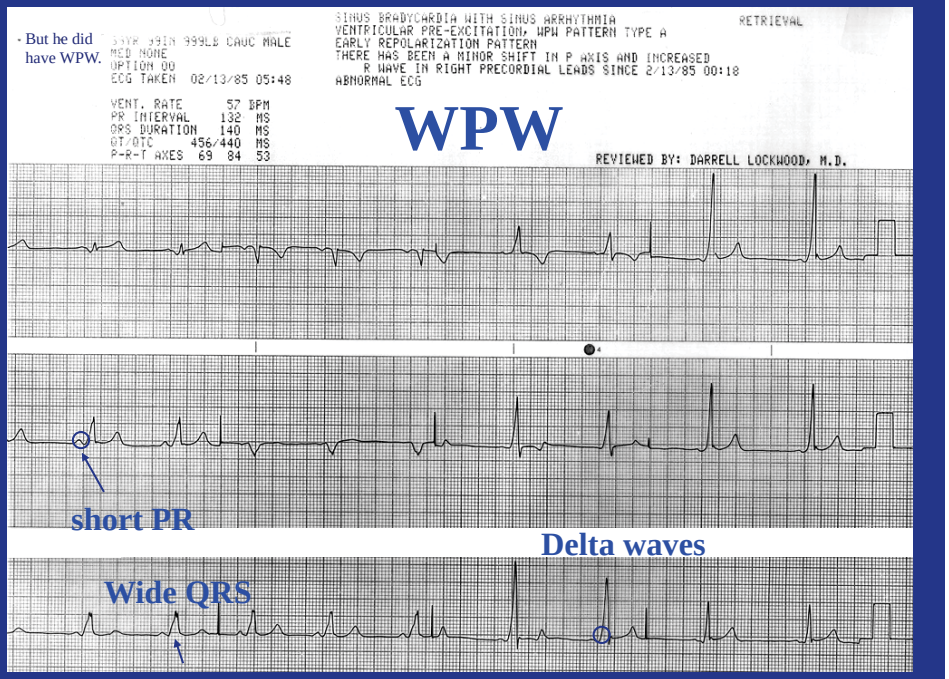
44 y.o. male comedian c/o episodes of rapid heart beat. Goes to the emergency department.

What is the Syndrome?

HIPPA note: this is *not* Richard Pryor's actual ECG.



- But he did have WPW.

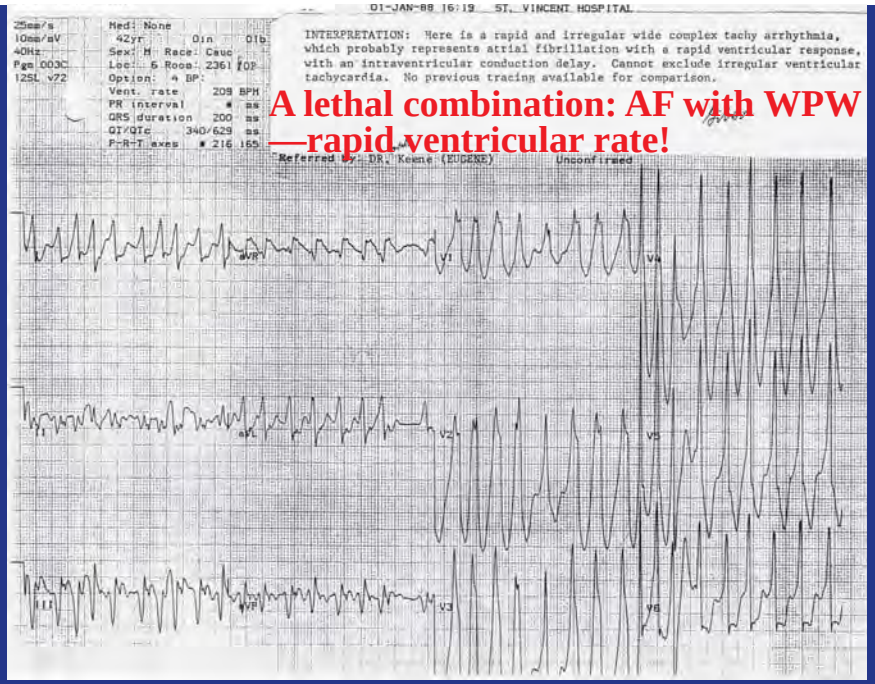


WPW

short PR

Delta waves

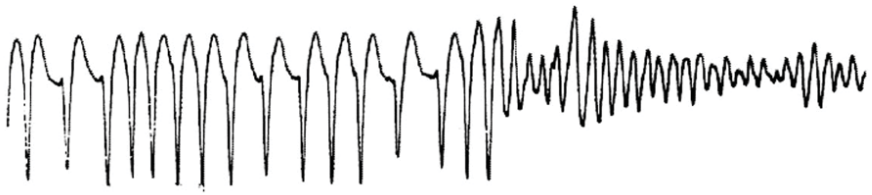
Wide QRS



A lethal combination: AF with WPW —rapid ventricular rate!

- **Defibrillate! 120 – 200J**

A-Fib with WPW degenerating to V-Fib

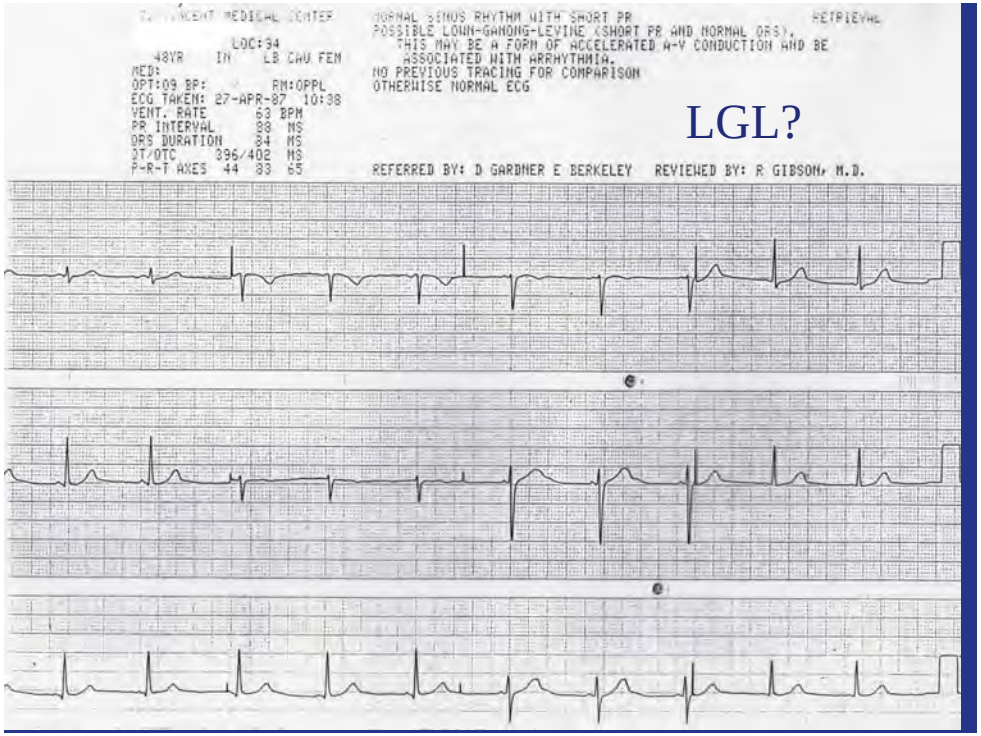


Defibrillate!

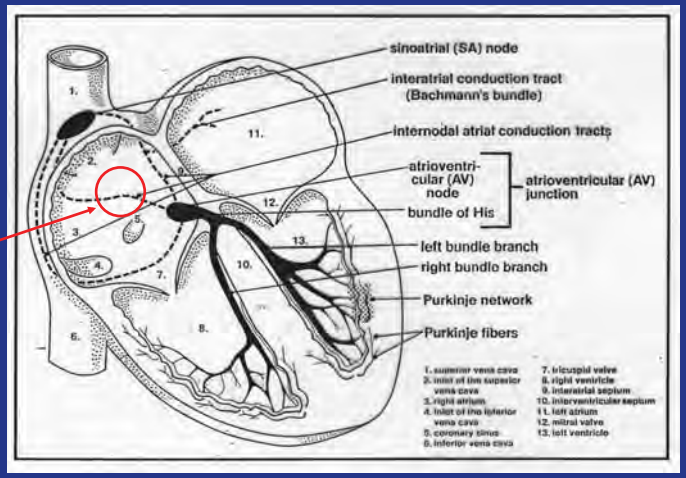
There are other "short PR" syndromes:

Lown-Ganong-Levine (LGL) Syndrome

- **Short PR interval**
- **<u>Normal</u> QRS (NOT wide)**
- **<u>No</u> "Delta" wave**
- **Must also have episodes of tachycardia in order to be called LGL" syndrome"**



Atrial Tachycardia

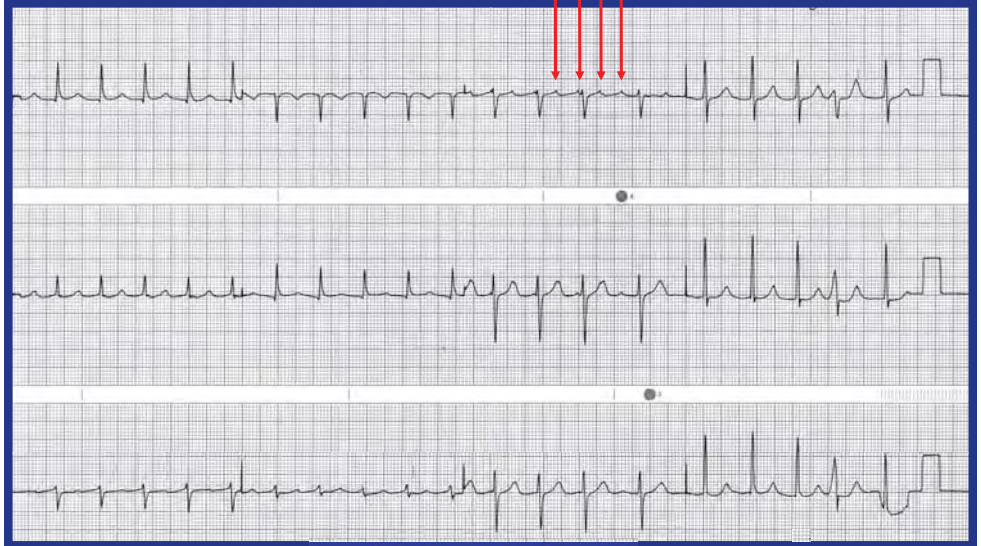


Rentry circuit *<u>or</u>* ectopic focus somewhere in one of the atria
Incidence: ~10% of all paroxysmal supraventricular tachycardias (excluding atrial fibrillation / flutter).

Atrial Tachycardia

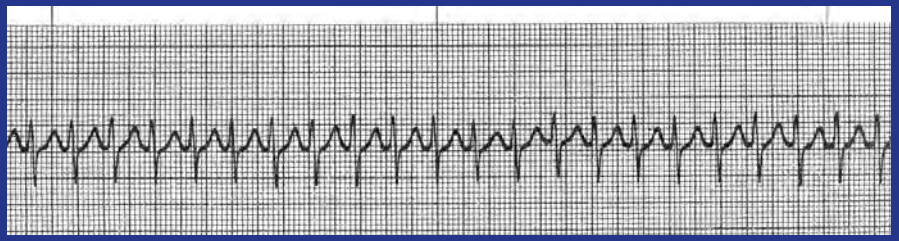
(with 2:1 & 3:1 conduction)

P waves look different



Atrial Tach rate is 150 – 250

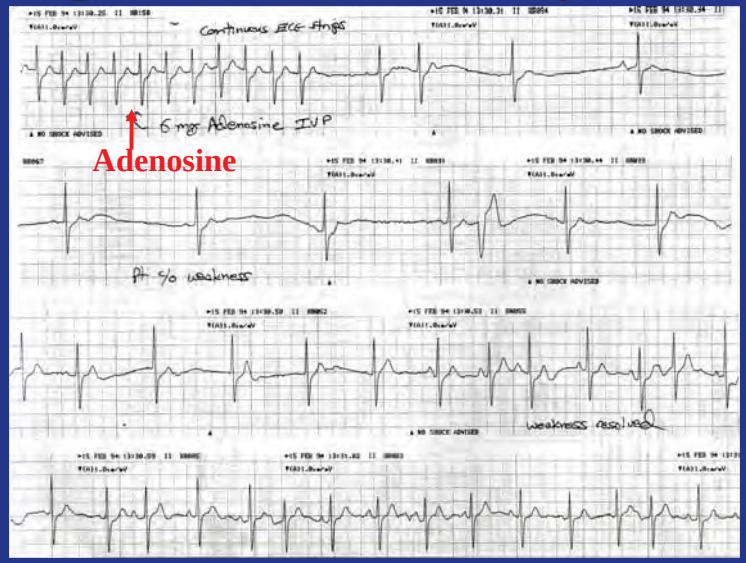
Supraventricular Tachycardia



"SVT"

Sometimes it's hard to make a specific diagnosis, so we call it "Supraventricular Tachycardia" and treat the fast heart rate and other symptoms.

Supraventricular Tachycardia



A nice example of adenosine's efficacy!

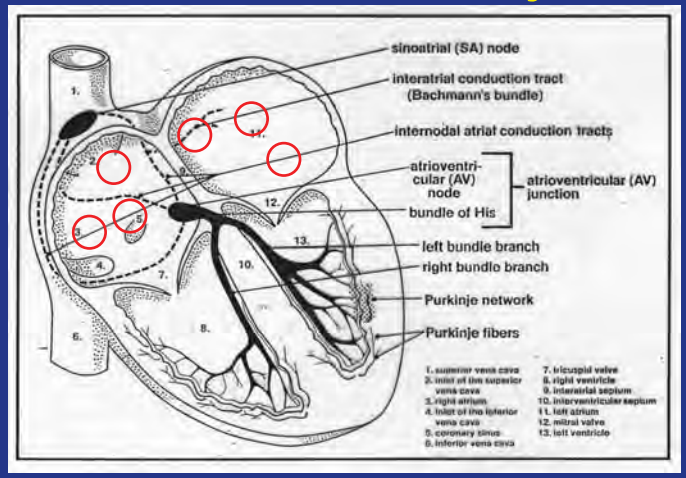
SVT Converting to SR with Valsalva

Valsalva's manuver

manuver stopped

(patient supine with legs elevated)

Multifocal Atrial Tachycardia

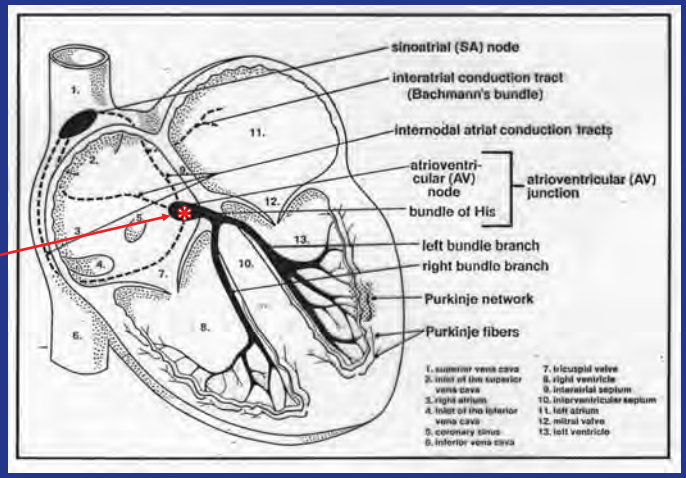


Multiple Ectopic foci in both atria.
Similar to WAP, but faster than 100/min.

Multifocal Atrial Tachycardia

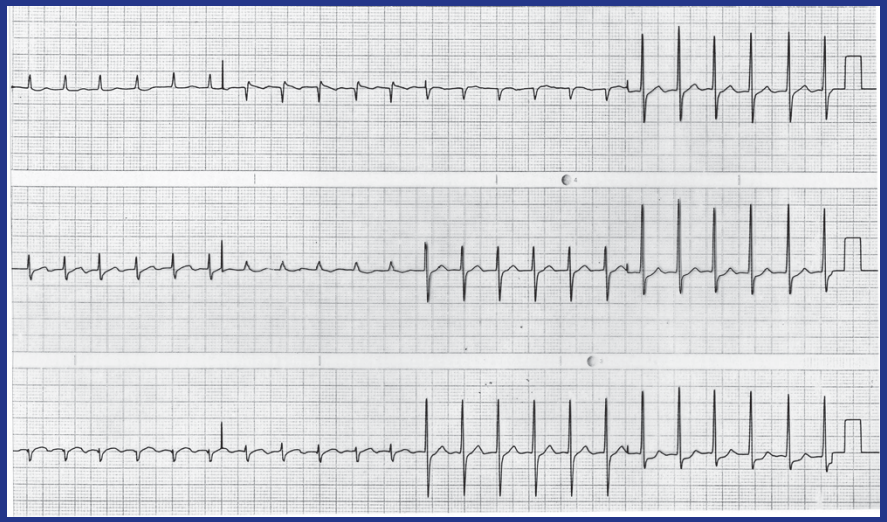
lots of different looking P waves…

Junctional Tachycardia



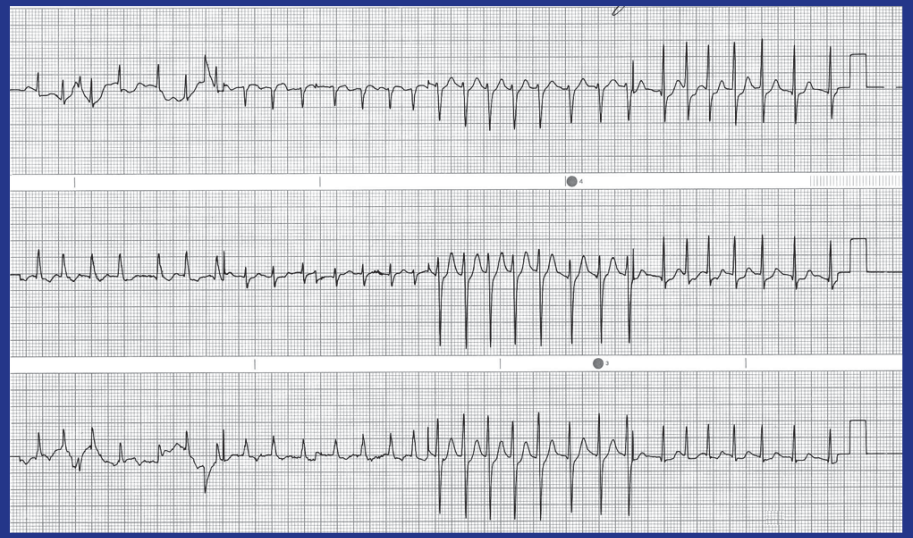
- **Automatic acceleration of the AV node**
- **Uncommon rhythm**

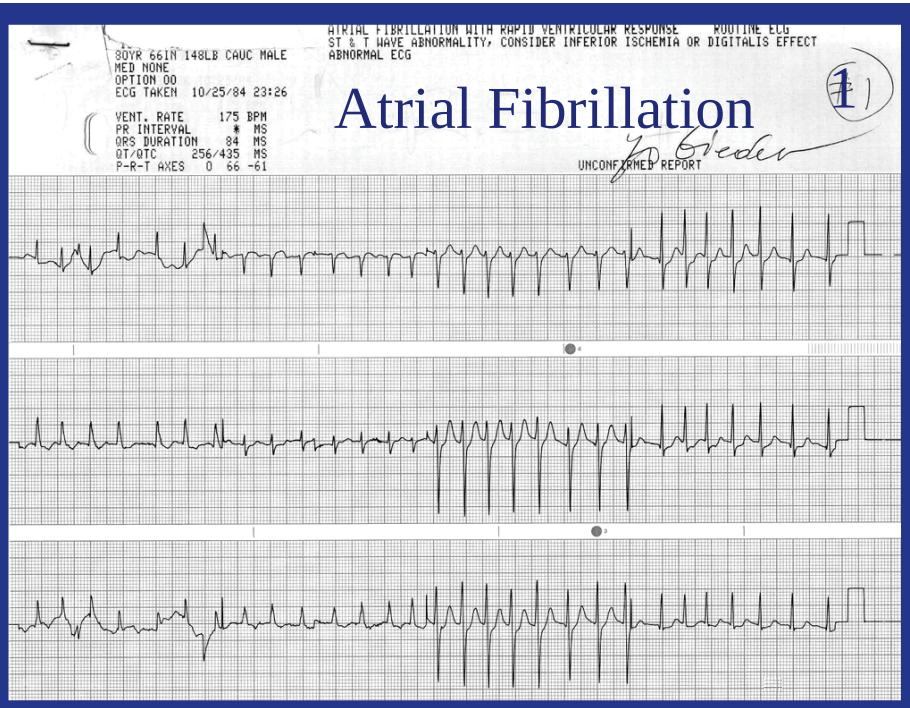
Junctional Tachycardia

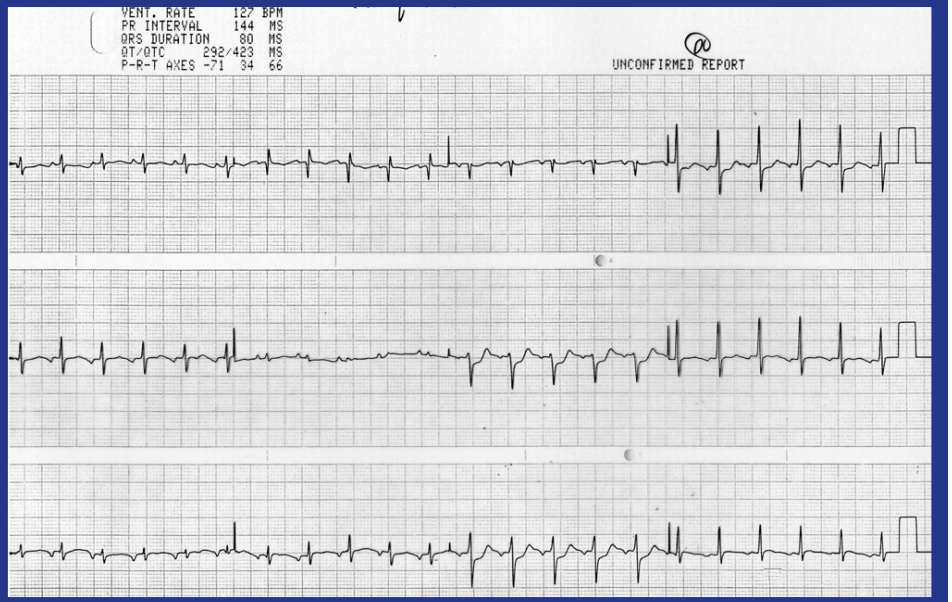


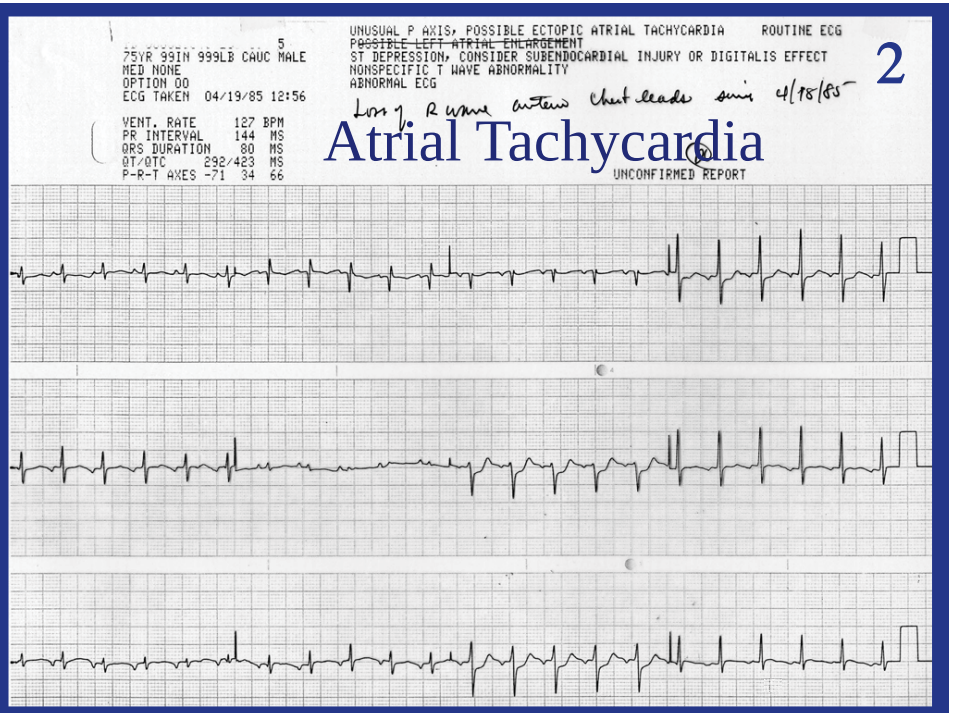
- **No P waves (or inverted Ps)**
- **Can be hard to distinguish from other SVTs**

Practice

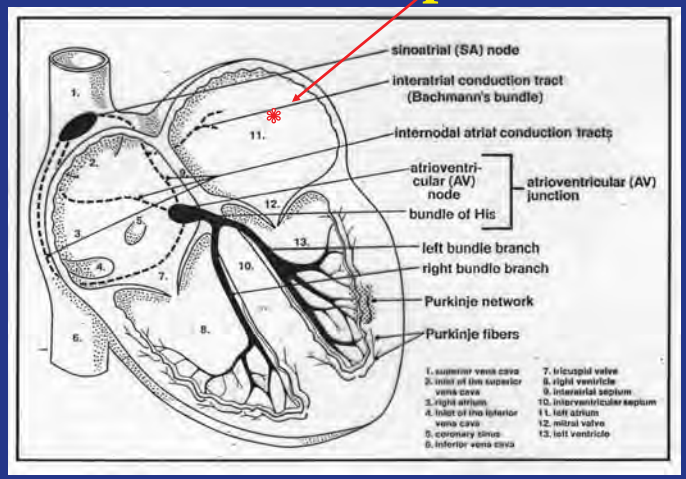








Left Atrial ectopic focus

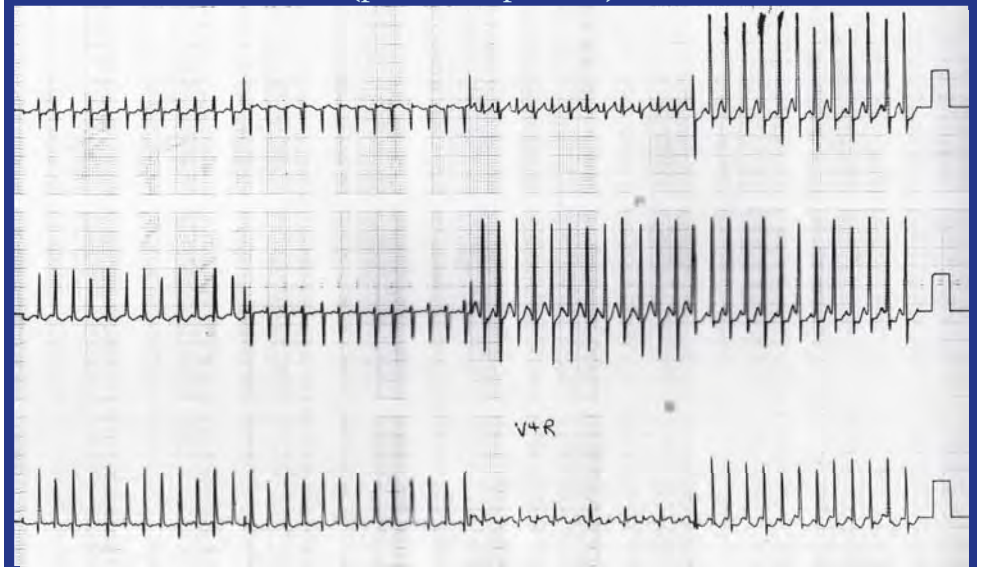


Inverted P in Lead II, but a <u>normal</u> PR Interval

What is the Rhythm?

(pediatric patient)

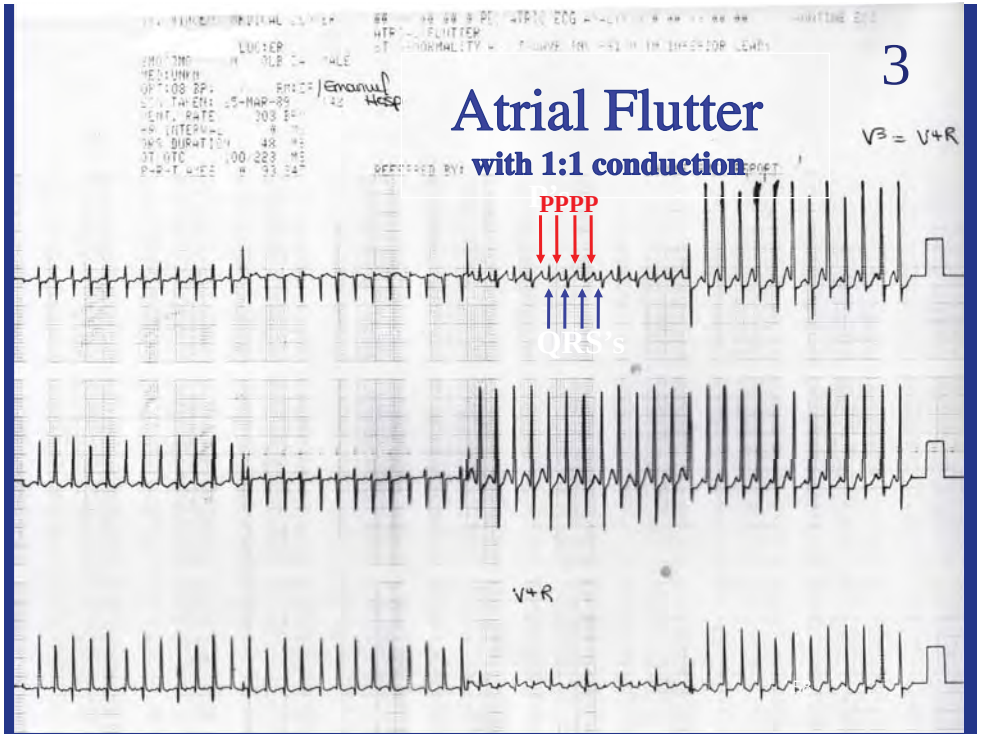
3



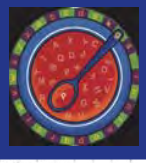
3

Atrial Flutter

with 1:1 conduction



Practice

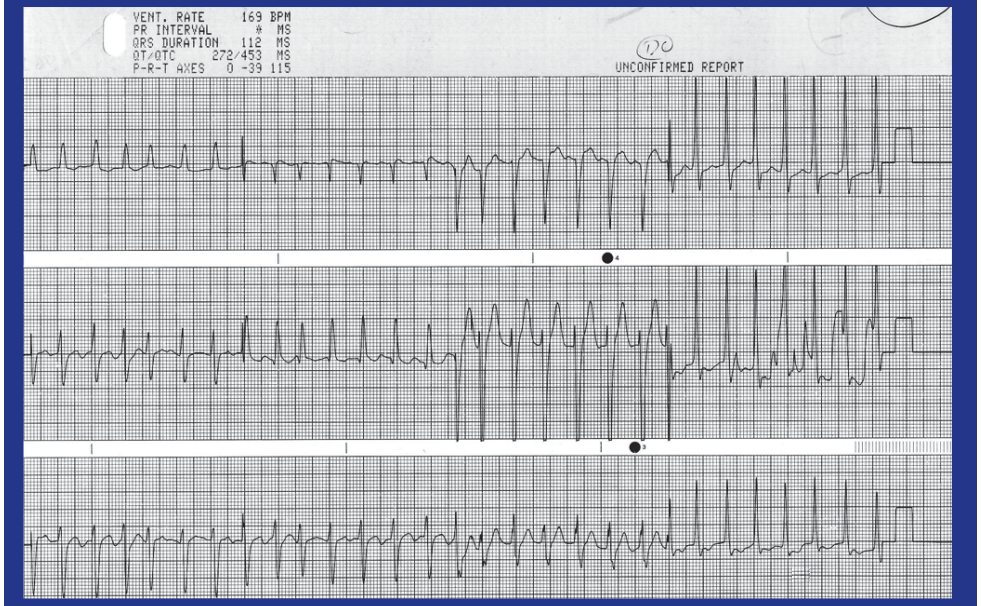


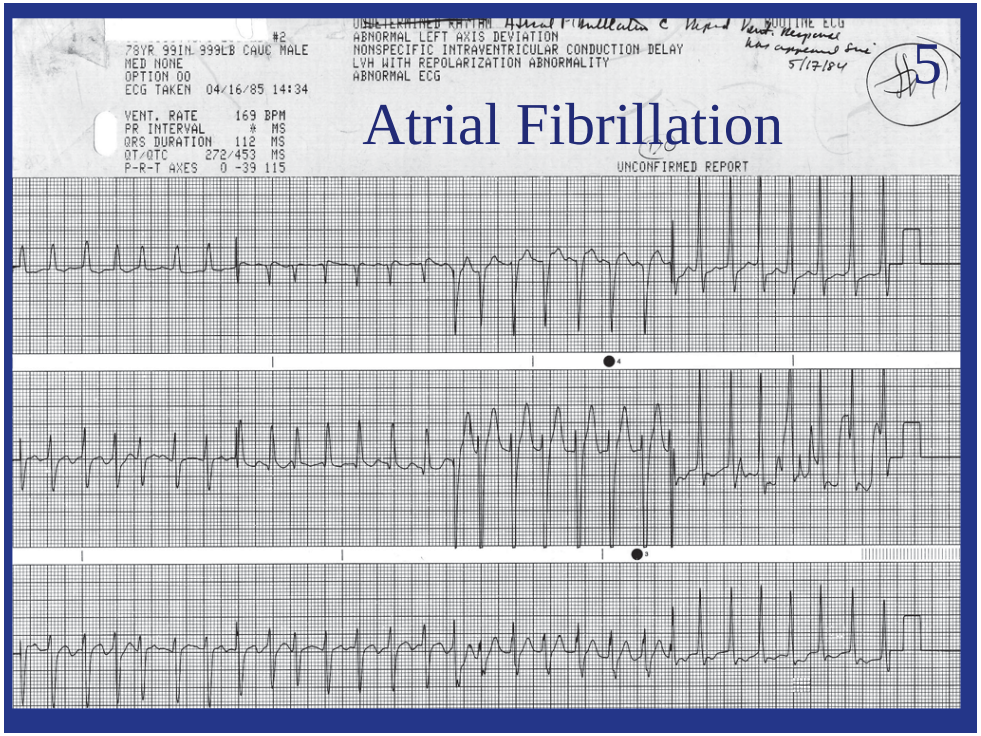
4

MAT — Multifocal Atrial Tachycardia

4

Practice 5





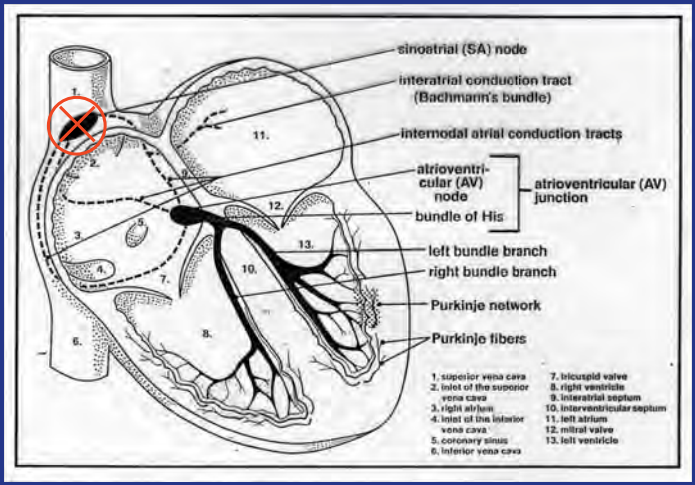
Atrial Fibrillation

Heart Blocks

Different Kinds of Heart Blocks

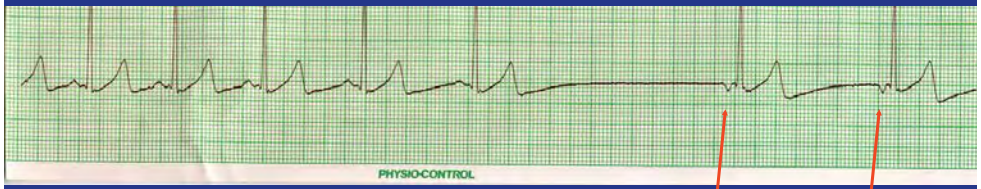
- **Sinus Arrest**
- **AV Blocks:**
  - **1st Degree AV Block** (PR > 20 msec.
  - **2nd Degree Block** (some Ps don't conduct)
    - **Wenckebach** (PRI lengthens, dropped QRS)
    - **Mobitz** (PR is constant, dropped QRS)
  - **3rd Degree Block** (complete A-V dissociation)
- **Bundle Branch Block*** (wide QRS > 120 msec)

Sinus Arrest



Sinus Arrest

(with Junctional Escape Rhythm)



Junctional escape beats

Causes: excessive vagal tone, atrial infarct or ischemia, antiarrhythmic drugs

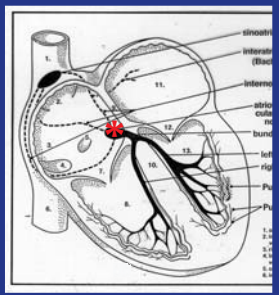
"Escape" Rhythms

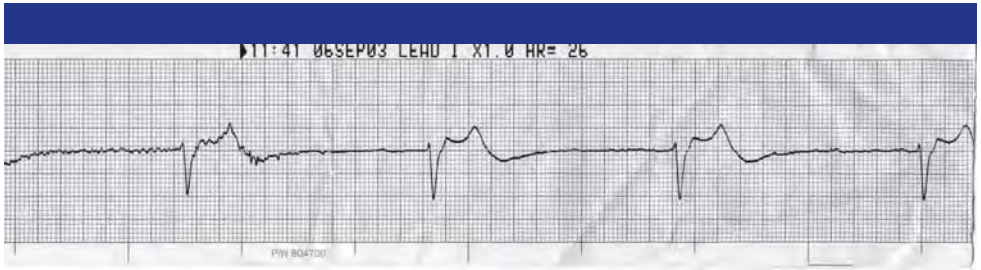
- Atrial Escape (weird Ps, normal PRI)
- Junctional Escape (inverted Ps, short PRI)
- Idioventricular Escape (no Ps, wide QRS)

Inverted Ps

Junctional Escape Rhythm

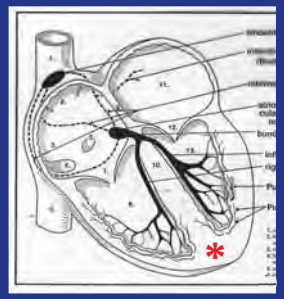
- Sinus arrest
- Inverted Ps following the QRSs
- HR 40 – 60 / minute





Idioventricular Rhythm

- Wide QRS, regular rhythm
- HR 15 – 40 / minute

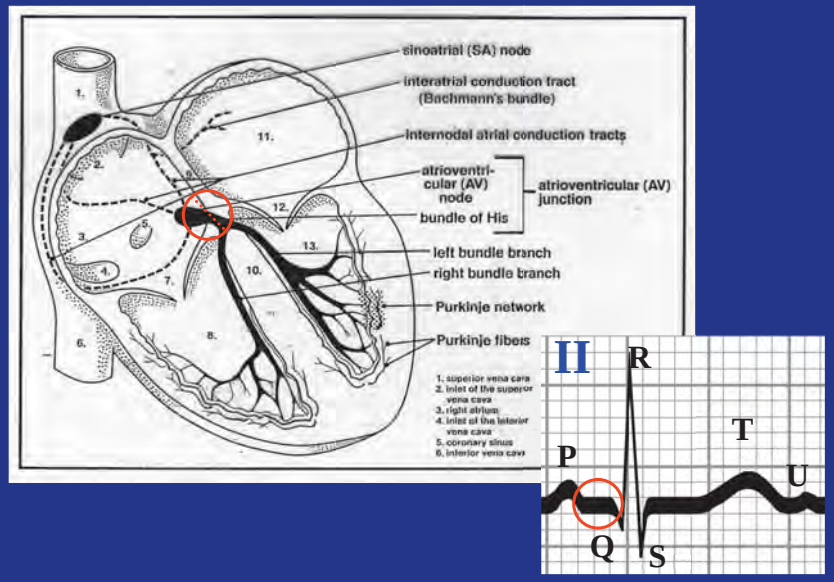


(Sometimes there is NO escape rhythm!)

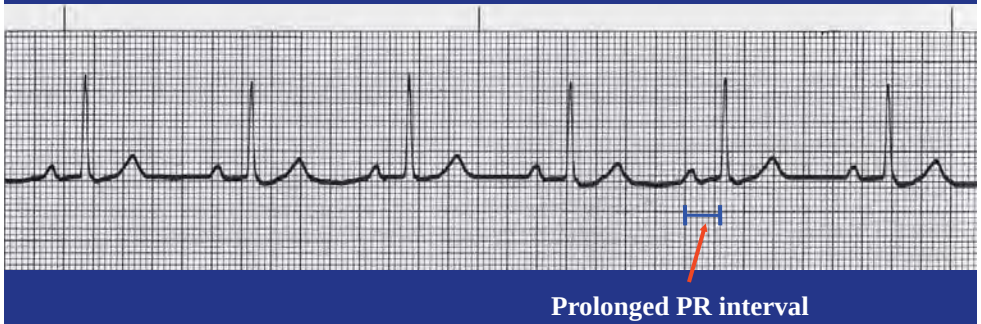
SR … Asystole — *Yikes!*

Treatment: CPR, Pacing, epinephrine 1 mg IV

1st° Block = AV Node depression



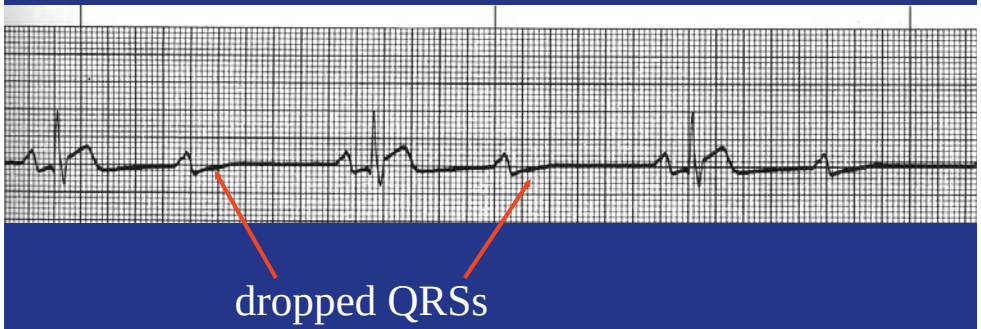
First Degree Block



Causes:

- **antiarrhythmic drugs such as digoxin, calcium blockers, beta blockers, etc.**
- **anatomically long AV node**
- **vagal stimulation**

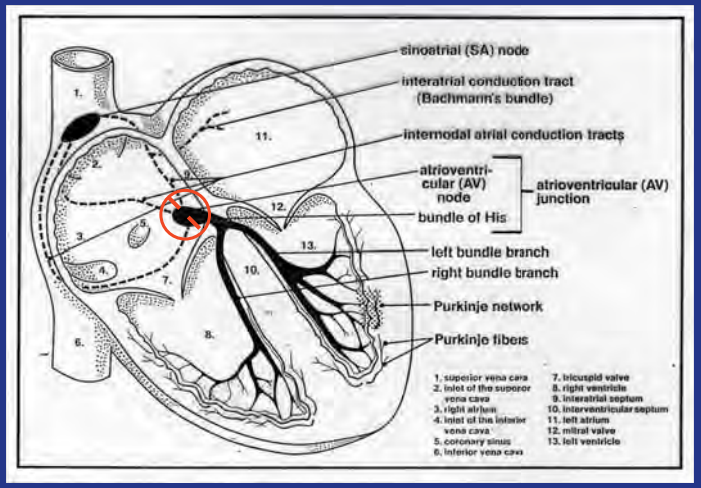
2nd Degree AV Block (dropped QRSs)



There are 2 kinds of 2nd degree block.

Wenckebach = worse AV node depression

Dr. Karel Wenckebach ca 1899



- ***Note: this is also called "2nd degree block, Mobitz I"***

2nd Degree Block (Wenckebach)

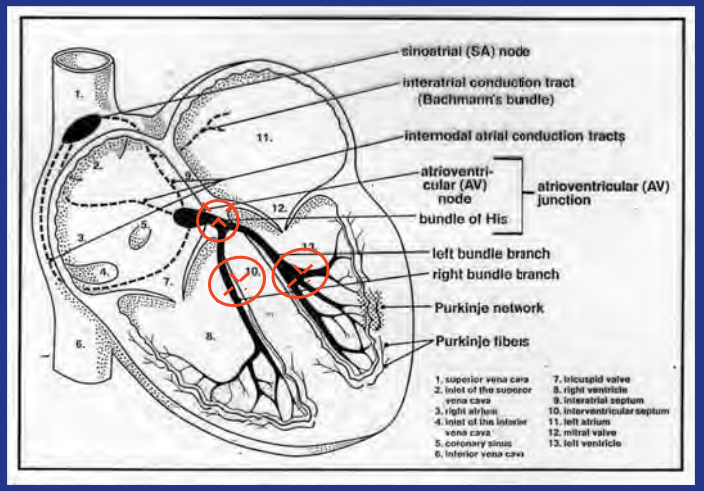
[PRI lengthens, then a dropped QRS]

PR gets longer dropped QRS

Causes:

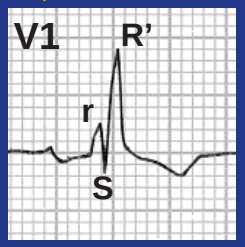
- **antiarrhythmic drugs such as digoxin, calcium blockers, beta blockers, etc.**
- **AMI**

Mobitz = AV (His) bundle infarction, *or* bundle branch infarction

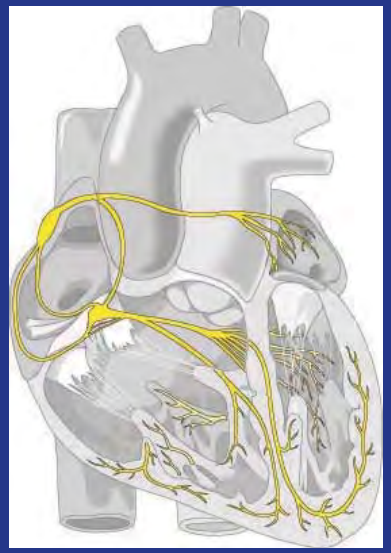


Bundle Branch Blocks
(QRS > 0.12 sec.)

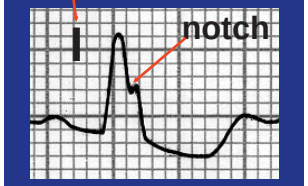
(right-sided lead)



Right BBB
(V1, MCL1: rsR' pattern)



(left-sided lead)



Left BBB
(L I, V5, V6: upright QRS with a notch)

Second Degree Block—Mobitz
(2 Ps for every QRS, BBB pattern)

• *Note: this is also called "2nd degree block, Mobitz II"*

2nd Degree AV Block (Mobitz)
(PRI stays constant, then a dropped QRS)

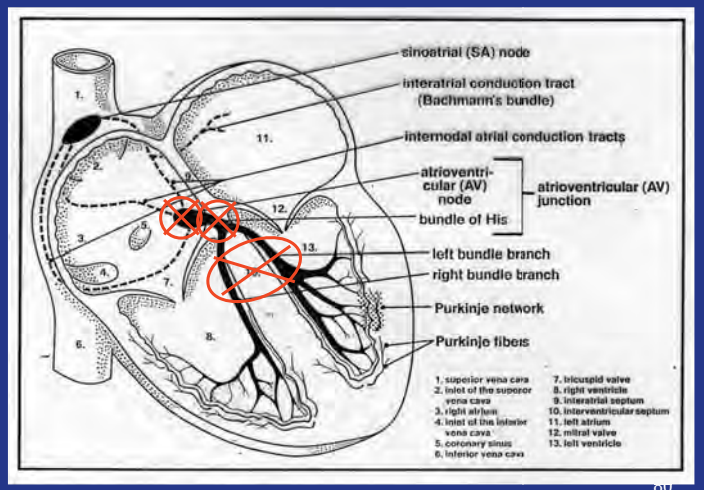
PR is constant

dropped QRSs

Causes:
• **infarction of the His bundle, or both bundle branches.**

Mobitz is a precursor for Complete AV Block!

Third Degree AV Block =
Infarction of the AV Node, or His Bundle, or both Bundle Branches



3rd Degree AV Block

(complete A-V dissociation)

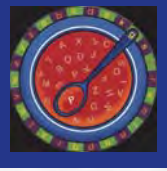
Ps with no relation to the QRSs

Causes:

- **Infarction of the AV Node, His Bundle, or both Bundle Branches**
- **antiarrhythmic drugs such as digoxin, calcium blockers, beta blockers, etc.**

These patients need pacemakers

What is the rhythm?



6

Sinus Arrest

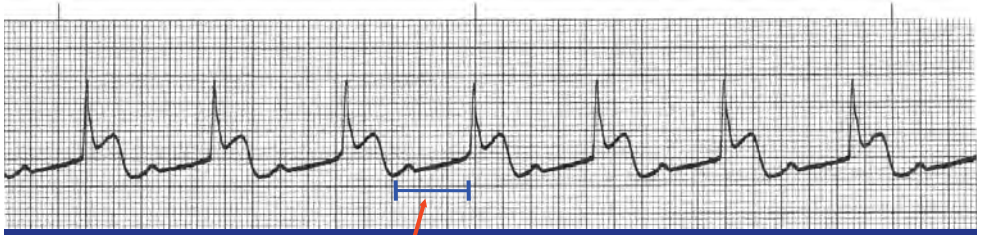
6

What is the rhythm?

7

How long is the PR interval?

1st Degree AV Block (long PRI) 7

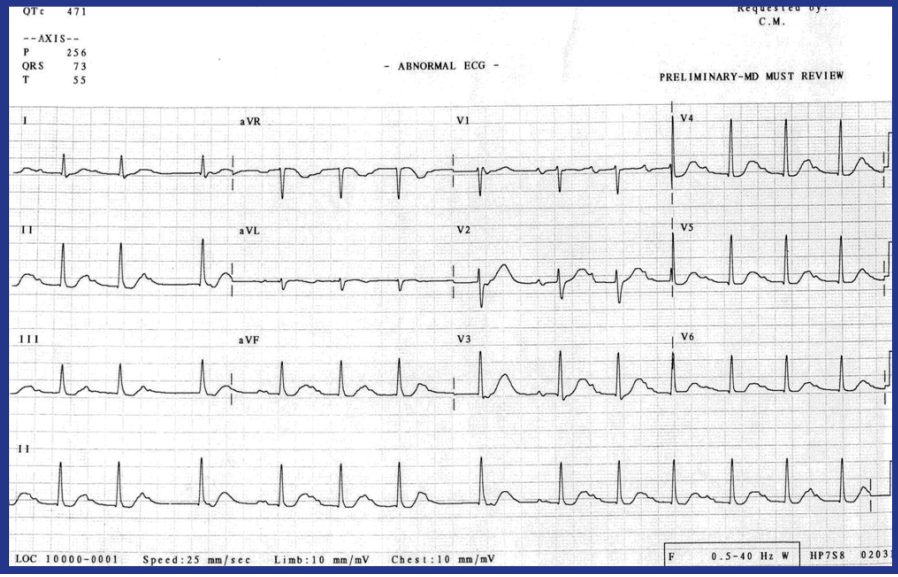


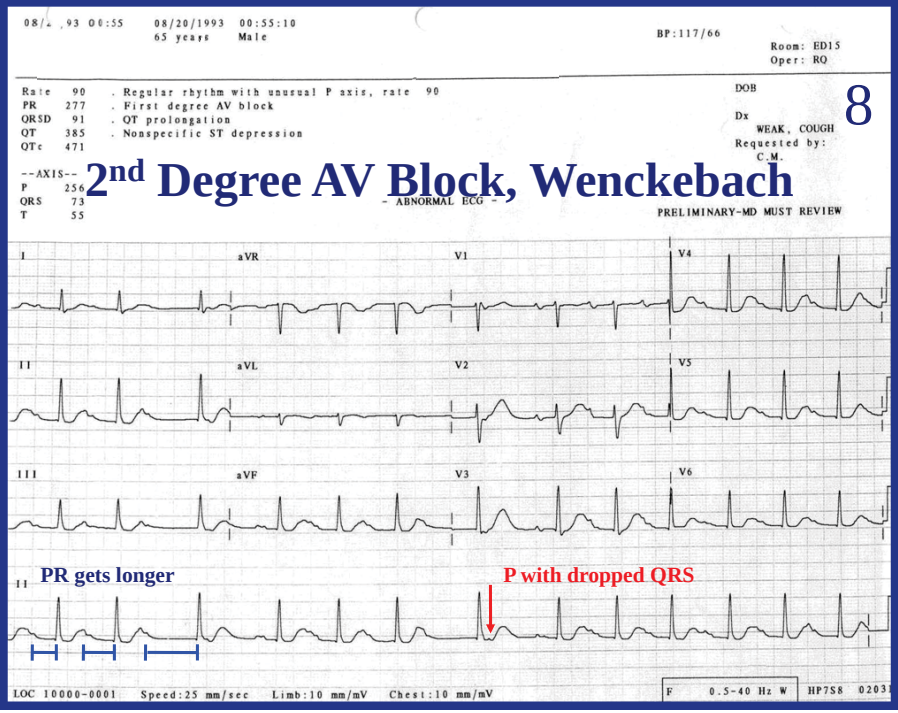
The PR interval is 480 msec!

This patient is having an acute MI

85

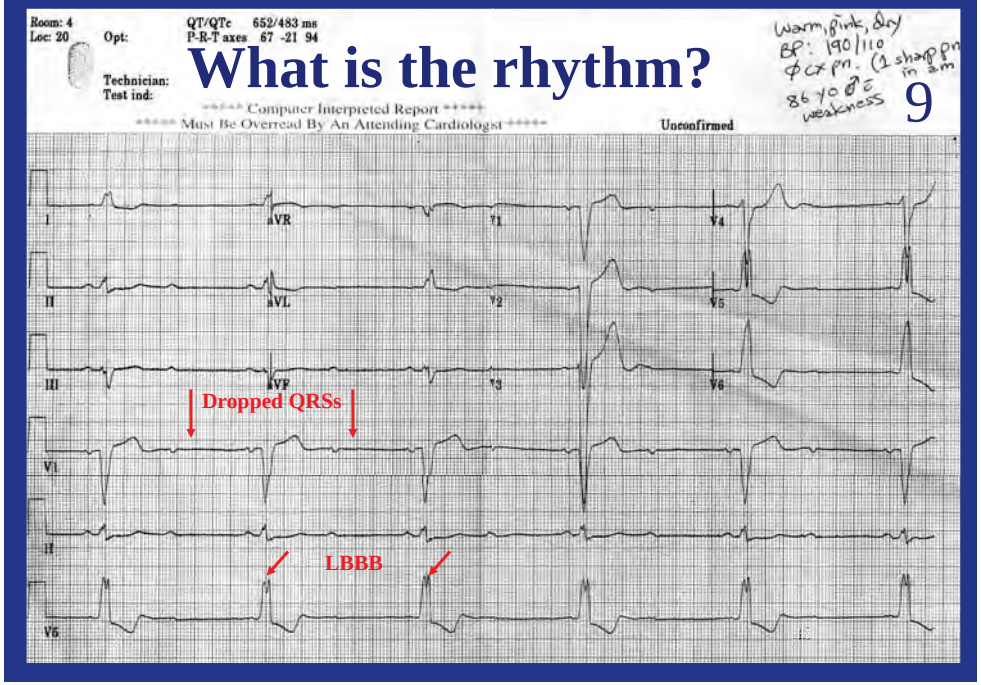
What is the rhythm? 8





8

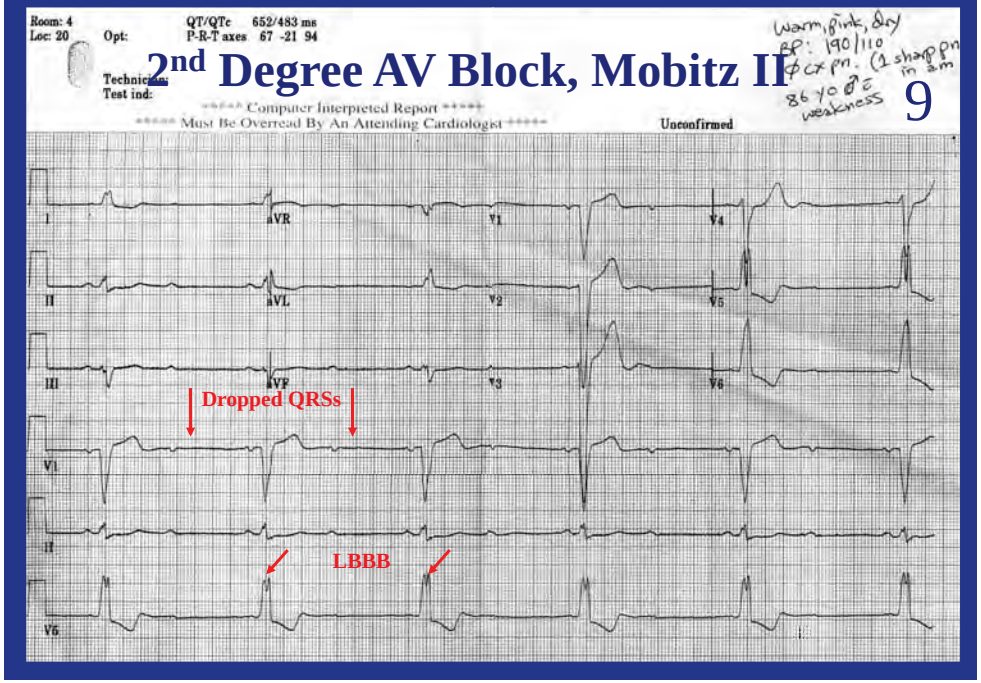
2nd Degree AV Block, Wenckebach



What is the rhythm? 9

2nd Degree AV Block, Mobitz II

9

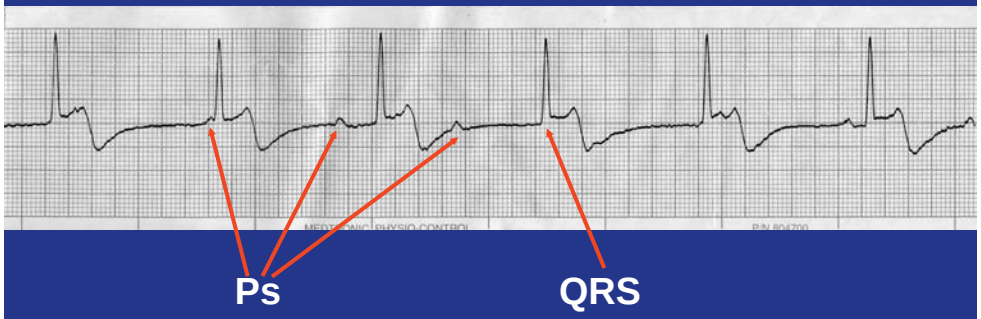


10

What is the rhythm?

10

What is the rhythm?

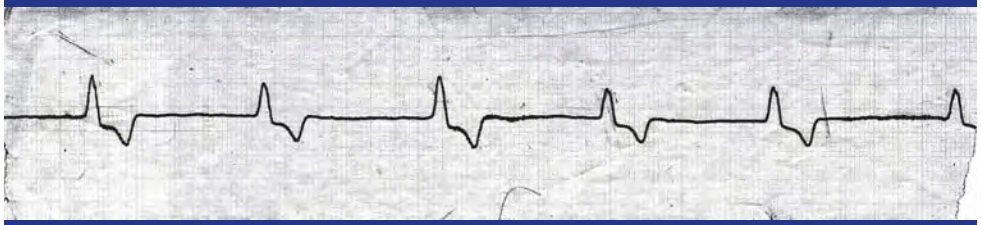


- Third Degree AV Block
  (no relationship between Ps & QRSs)

Case History

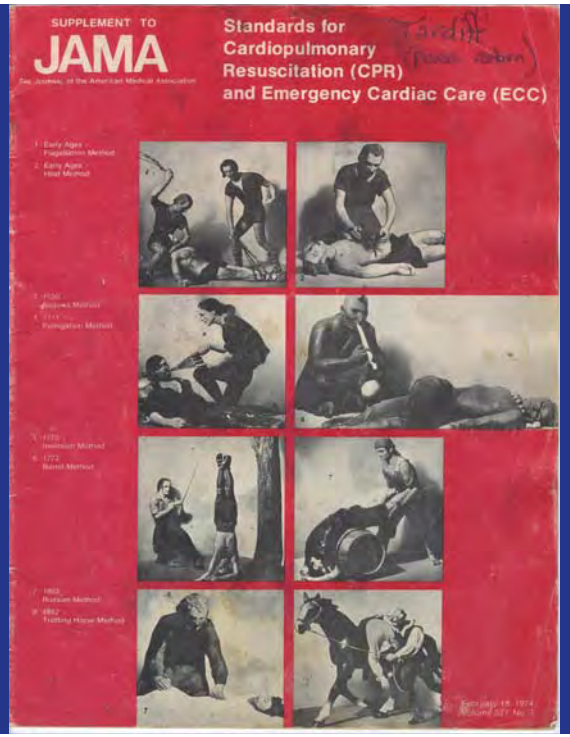
52 y.o male, allergic to bees, collapsed 20 minutes after being stung by two hornets. No pulse, agonal respirations

Idioventricular Rhythm (PEA)



Treatment: CPR, Pacing, epinephrine 1 mg IV
(he made a rapid recovery and walked out of the hospital the next day)

The Past…



I also teach…

- **How to Effectively Deal with Drug Seekers in your Clinical Practice**
- **and an ECG game:** ***"The Rhythm Method™"***

"The Rhythm Method™"

jontardiff@aol.com