

# EKG Review

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NURS 380

# Objectives

At the conclusion of the presentation and learning activities, learners will be able to:

1. Identify defining characteristics of atrial and ventricular rhythms/arrhythmias
2. Describe signs and symptoms that accompany atrial and ventricular arrhythmias
3. List causes for atrial and ventricular arrhythmias
4. Describe the treatments for atrial and ventricular arrhythmias
5. Apply knowledge of etiology, signs, symptoms when creating a plan of care for a patient with atrial/ventricular arrhythmias
6. List the roles in which a nurse may participate during a code blue or emergency
7. Identify commonly used medications utilized in code blue settings
8. Describe the differences in dosing adult and pediatric code blue medications

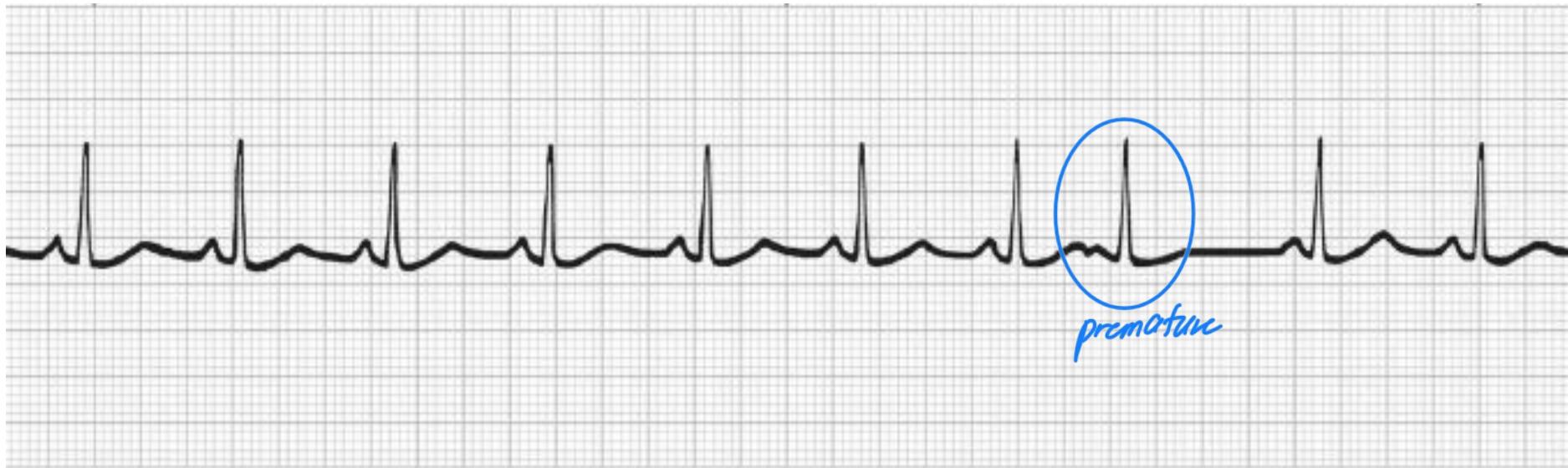


Sinus tach

# Sinus Tachycardia Identifying Features

Rhythm	Regular
Rate	100 - 160 beats/minute
P waves	Normal in size, shape, direction with one P wave before each QRS complex
PR interval	Normal (0.12 - 0.20 second)
QRS complex	Normal (0.06 - 0.10 second)

*Increases blood flow or oxygen demand*



PAC

# Premature Atrial Contraction (PAC) Identifying Features

typically benign  
re. sinus rhythm w/ a PAC

Rhythm	Not a rhythm, but a single beat
Rate	That of underlying rhythm
P waves	Premature, abnormal in size, shape, direction <i>In relation to other P waves on the strip</i>
PR interval	n/a; identify underlying rhythm
QRS complex	Premature; normal duration (0.06 - 0.10 second)

triggered by atrial myocardium  
not originating in SA node

treatment

$\beta$ -adrenergic blockers  
Type I A, IC, III anti arrhythmic agents?

- can be caused by  $\beta$ -agonists, digoxin, tricyclics (maybe also  $\beta$ -blockers)
- CAD or hypertrophic cardiomyopathy ↑ (MI, CHF, DM, COPD) risk



sawtooth waves

comes from abnormal impulse in atria  
somewhere other than the SA node

# Atrial Flutter Identifying Features

very common (2nd)

- originates in the right atria

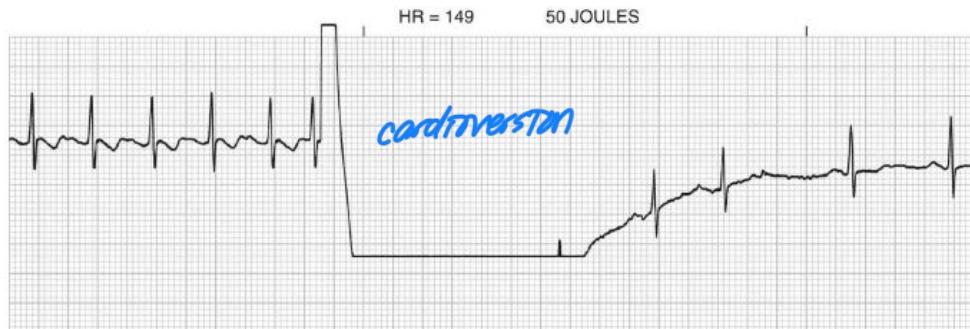
causes

) also long QT syndrome  
stimulants

) HF, cardiac ischemia  
myopathy & surgery

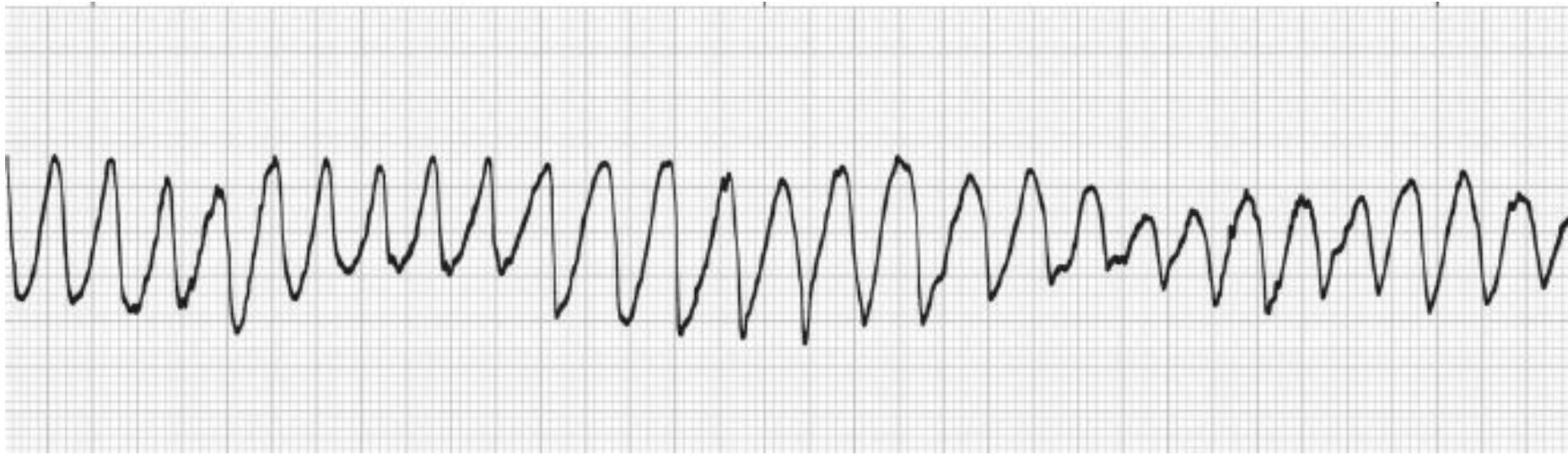
Rhythm	Regular or irregular (depends on AV conduction ratios)
Rate	Atrial rate: 250-400 beats per minute; ventricular rate will be less <i>(if you're counting QRS complexes)</i>
P waves	Sawtooth waves ("flutter waves"/F waves) on baseline
PR interval	Not measurable
QRS complex	Normal (0.06 - 0.10 second)

TX



$\beta$  blockers  
cardioversion

assess coagulation needs  
assessed



v Tach

# Ventricular Tachycardia Identifying Features

mega danger

- coordinated ventricular contractions are replaced by very rapid but ineffective contractions.

→ decreased ventricular filling → dramatic ↓ in CO

→ absent pulse



leads to decreased oxygenation

Rhythm	Regular or slightly irregular
Rate	140-250 beats/minute <i>(135~155 if脉搏less VTach)</i>
P waves	None
PR interval	Not measurable <i>can see if it is pulseless VTach</i>
QRS complex	Wide (> 0.12 second) <i>120ms</i>

- AV dissociation

causes/

cardiac scarring

too many PVCs

cardiomyopathy

electrolyte imbalances

hypoxia

binge drinking

SWAN placements

post MI / CABG

(hypokalemia - hyper)  
[magnesemia  
calcemia]

Tx/

cardioversion

\* amiodarone ↴

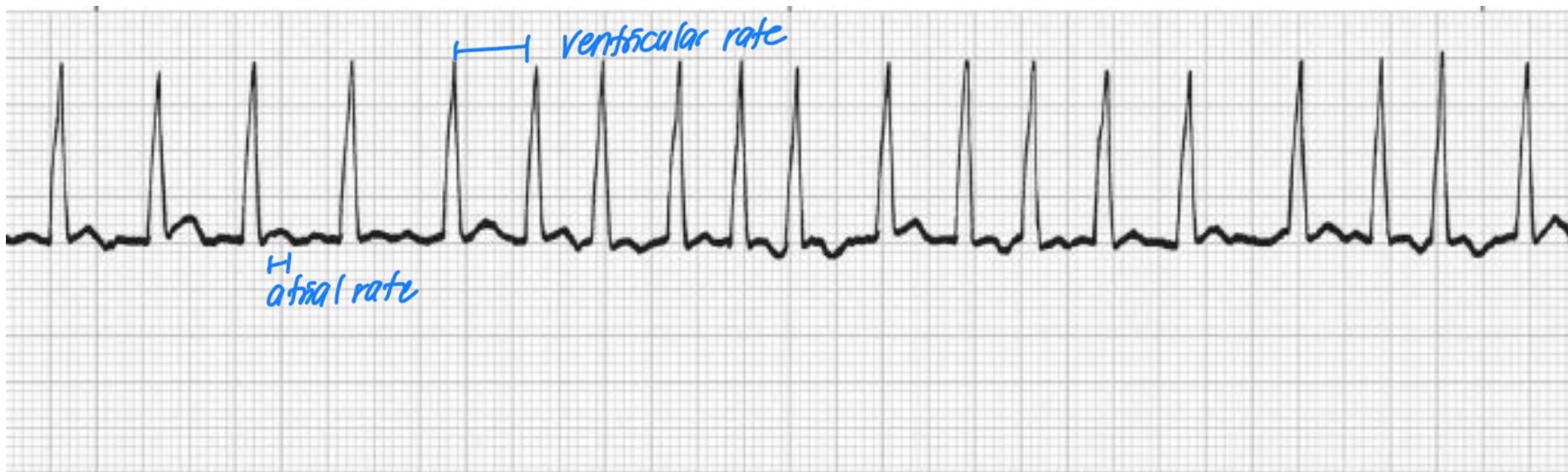
- IV vasopressors &

antiarrhythmics

- \* amiodarone   
- class III antiarrhythmic  
↳ special bc has broader range of action  
↳ inhibits potassium receptor responsible for repolarizing the heart → K+ CCB effect  
results → ↑ action potential duration, prolonged effective refractory period
- IV L 150mg IV / 10min → 1mg/min / 6 hrs → 0.5mg/mm / 18 hrs  
- oral L 800 or 1600 mg / daily

(C)

- 2nd / 3rd degree blocks w/out pacemakers
- concurrent atrib
- monitor electrolytes



- abnormal electrical activity within atria  
(irregular)
- leads to turbulent & abnormal flow of blood through heart
- decreased efficiency in pumping blood  
increased thrombus formation

most common

- leading cause of stroke

# Atrial Fibrillation Identifying Features

↑ prevalence w/ ↑ age → **RF** HTN, congenital heart disease  
can be episodic or chronic

causes/atrial ischemia  
inflammation  
chronic alcohol & drug use  
hemodynamic stress

Rhythm	Irregular - always
Rate	Atrial rate 400 beats/minute or more; ventricular rate varies but less than atrial rate
P waves	Irregular wave deflections ("fibrillatory waves") on baseline <i>not distinguishable</i>
PR interval	Not measurable
QRS complex	Normal (0.06 - 0.10 second)

unstable afib (S/S)

SOB  
right-headed

droplosets  
palpitations  
tachycardia

(Tx) anticoagulation

controlling rate

↳ CCB (diltiazem)

β-blockers (metop)

if episodic & tachy, amiodarone (also not first line)

*if unstable  
afib,  
cardiovert,*

digoxin, but not  
first line



coarse afib

when ventricular myocardium depolarize  
erratically

# Ventricular Fibrillation Identifying Features

① CPR defibrillation \*  
If no effect, administer epinephrine & amiodarone

Causes

NT

cardiac myopathy electrolyte disturbances  
hypoxia cocaine & meth

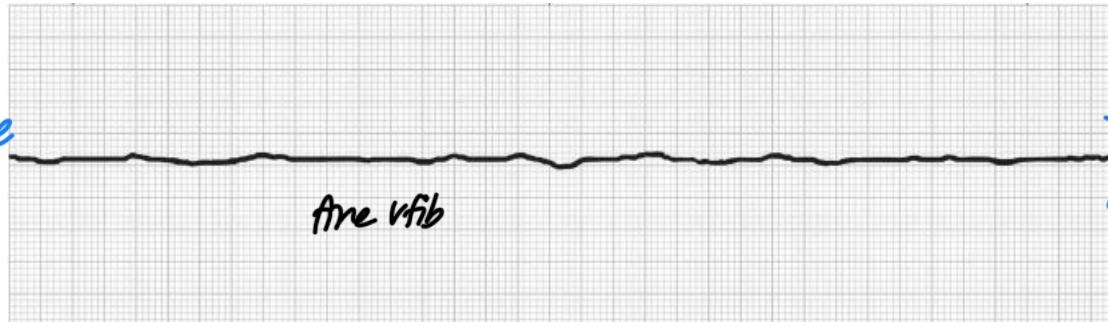
electrocution accidents

actual physical injury to the heart

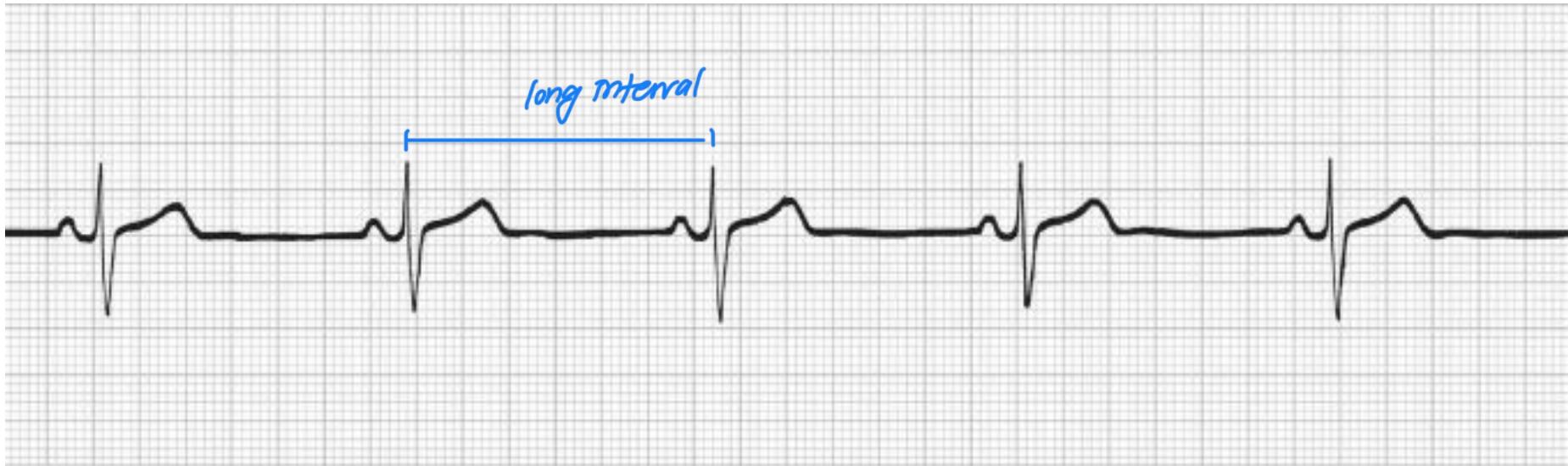
can occur spontaneously or preceded by PVCs

Rhythm	Irregular - always
Rate	Not measurable anywhere between 150 ~ 500
P waves	Absent; wavy, irregular deflections seen that vary in size, shape, and height. If small, then fine VF, if large, coarse VF
PR interval	Not measurable
QRS complex	Absent

\* better to defib someone than to not just in case



can be interpreted as afib



# Sinus Bradycardia Identifying Features

Rhythm	Regular
Rate	<60 beats per minute (typically 40-60)
P waves	Normal
PR interval	Normal (0.12-0.20 second)
QRS complex	Normal (0.06-0.10 second)

(Causes)  
inferior wall M<sup>1</sup>  
(SA node)  
hypoglycemia  
vagal stimulation / vasovagal reaction  
vagal implosion  
change in position  
TCA  
CCB  
β blockers  
digoxin

(Tx) atropine  
treat the cause

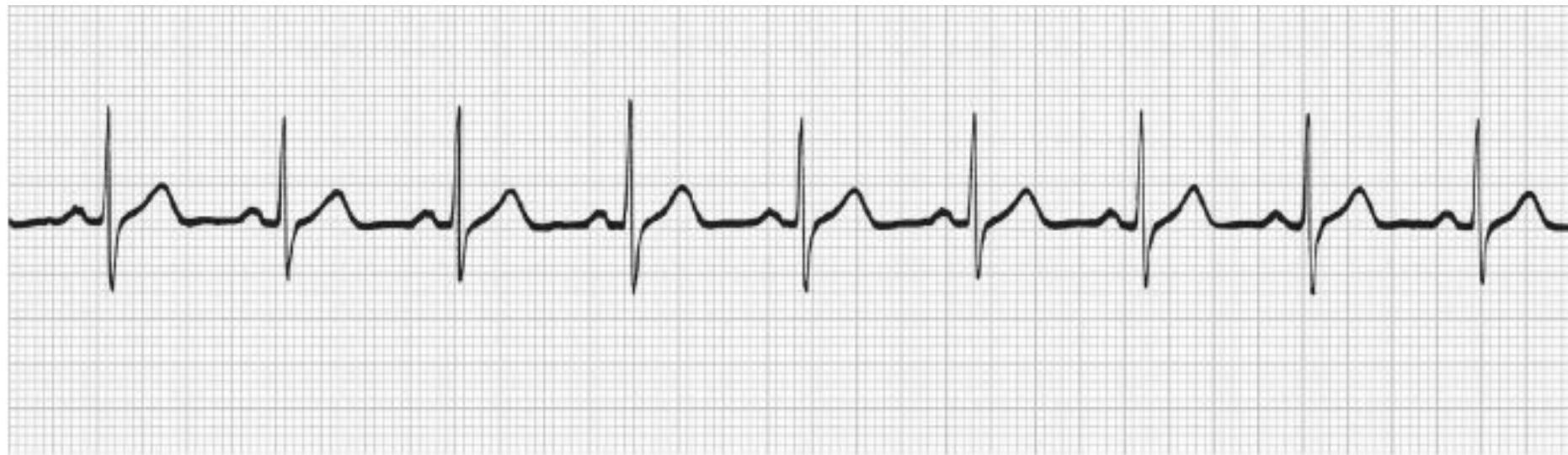


# Asystole Identifying Features

Px  
RR  
expiratory  
check if  
it is fine  
VFib

Rhythm	If P waves are present, will have atrial rhythm
Rate	None
P waves	Will either have a P wave with no associated QRS complex or a straight line
PR interval	Not measurable
QRS complex	Absent

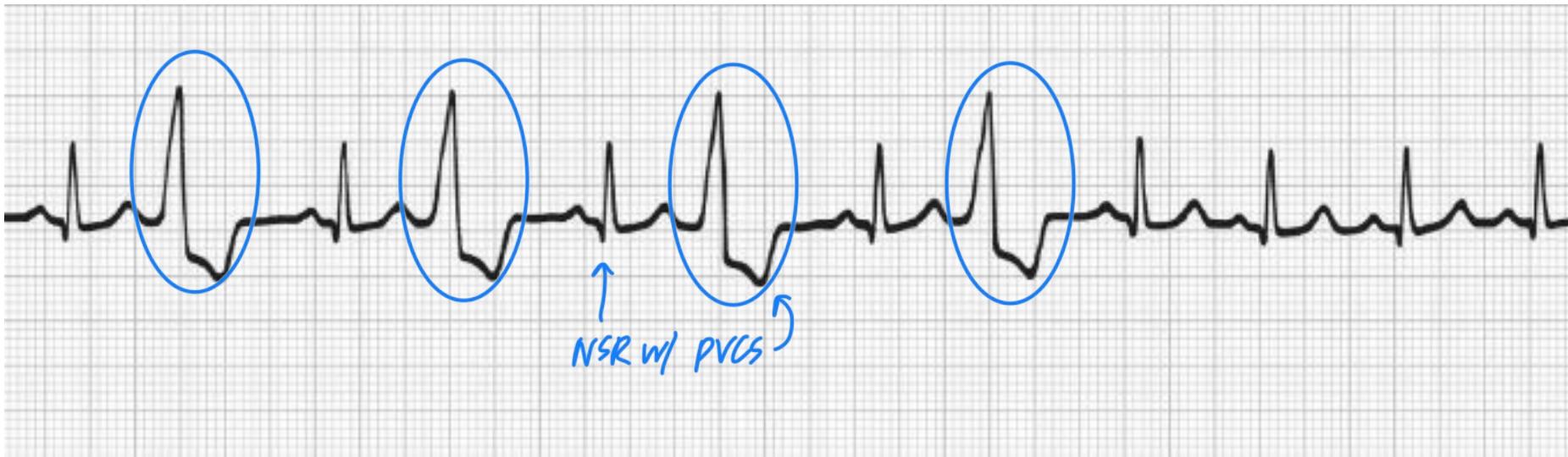




N

# Sinus Rhythm Identifying Features

Rhythm	Regular
Rate	60-100 beats per minute
P waves	Normal; one P wave precedes each QRS
PR interval	Normal (0.12-0.20 second)
QRS complex	Normal (0.06-0.10 second)



\*  
right atrium → SA-node  
→ conduct an electrical signal  
to AV node  
→ HIS & Purkinje fibers → ventricles  
→ ventricular contraction

heartbeat is initiated by Purkinje fibers rather  
than SA node

# Premature Ventricular Contraction (PVC) Identifying Features

74 can be called ~~a beat of~~  
a run of vtach

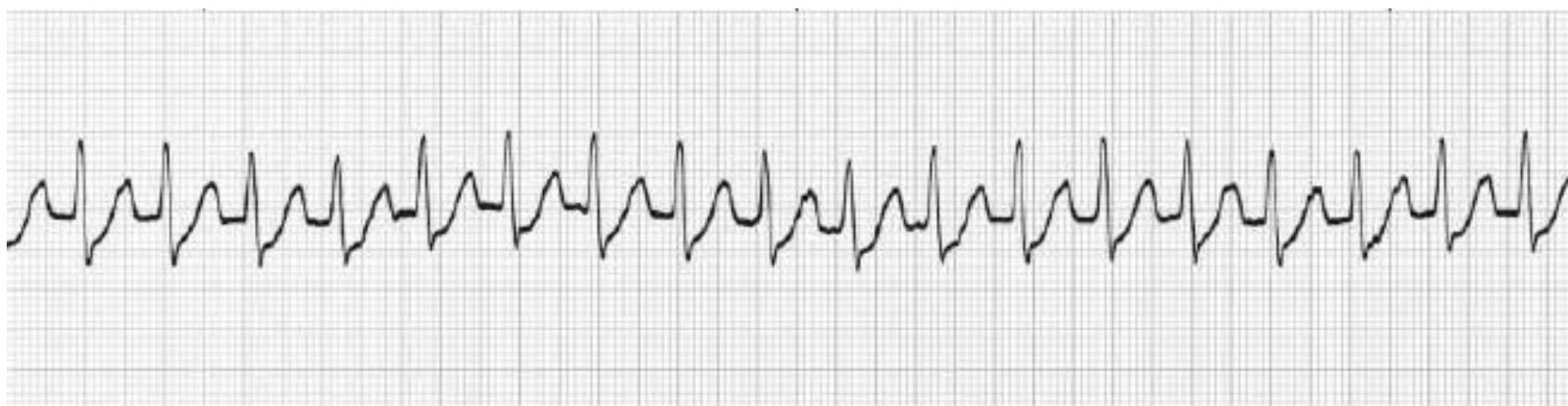
Rhythm	Not a rhythm, but a single beat. Underlying rhythm usually regular
Rate	That of underlying rhythm
P waves	None associated with PVC
PR interval	n/a; identify underlying rhythm
QRS complex	Premature; wide (0.12 second or greater)

causes

MI  
hyp. K<sup>+</sup>  
HF  
fabacol/caffiene  
hypocalcemia  
hypomagnesemia

(S/S) usually asymptomatic but can include vagal sx

(Tx) If asymptomatic usually no need for treatment  
but if frequent / symptomatic antiarrhythmics, β-blockers,  
CCBs (amiodarone & flecainide)



# Paroxysmal Atrial Tachycardia (PAT)/Supraventricular Tachycardia (SVT) Identifying Features

most common arrhythmia in children

mostly women

Rhythm	Regular
Rate	140-250 beats/minute
P waves	Abnormal (usually pointed); can be hidden in preceding T wave
PR interval	Usually not measurable
QRS complex	Normal (0.06-0.10 second)

IX

First step is to determine hemodynamic stability.

-unstable: adenosine  
→ cardioversion

Cardioversion (IV  
CB vagal maneuver

If significant enough,  
another AP will occur

cause

CMF

tobacco / alcohol  
adenosine

If hemodynamically stable

results from an electrolyte imbalance  
after an action potential  
- error occurs by a calcium  
reflex (origins from after action  
potential) which causes depolarization.

# Pharmacology Review

## B blockers - (0)

typically treat all diseases : tachycardia CHD  
HTN Hyperthyroid  
also treats MI  
long QT syndrome & CHF (if constipated)  
hypertrophic obstructive cardiomyopathy

## Mechanism of Action

Beta receptors bind to epinephrine, norepinephrine  
(effects) → also released from which ↑ BP  
(↓ BP ↓ HR ↓ CO ↓ renin ↓ oxygen demand) because of negative chronotropic & inotropic effects  
also lower melanin secretion

## Adverse Effects

may cause bradycardia & MoTIN  
not as common / bronchospasm  
reduced circulation

## Risks / Raymond's

Asthma → contraindicated  
cause in chronicity  
bradycardia or MoTIN are

## Monitoring

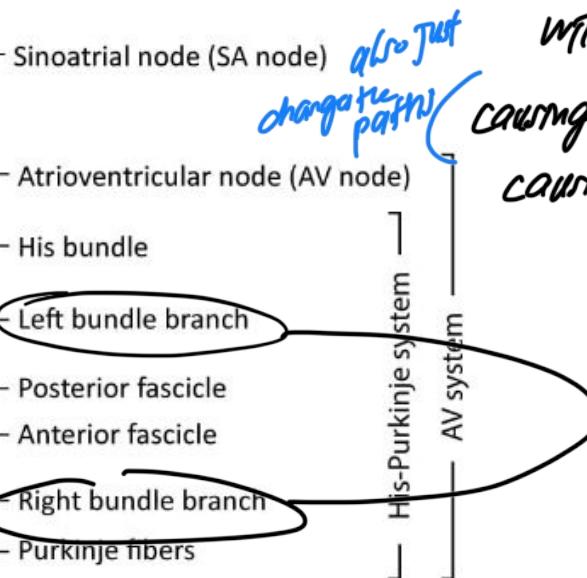
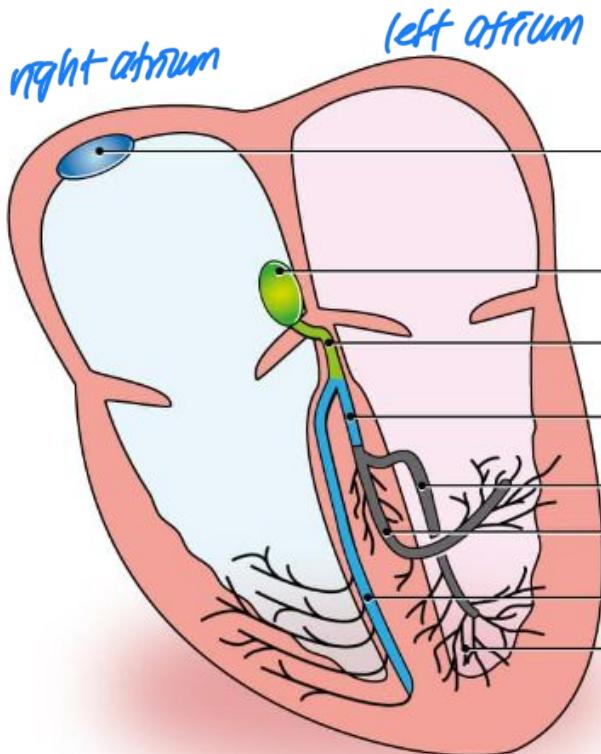
- BP
- & QT interval

# note  
overdose antidote = glucagon

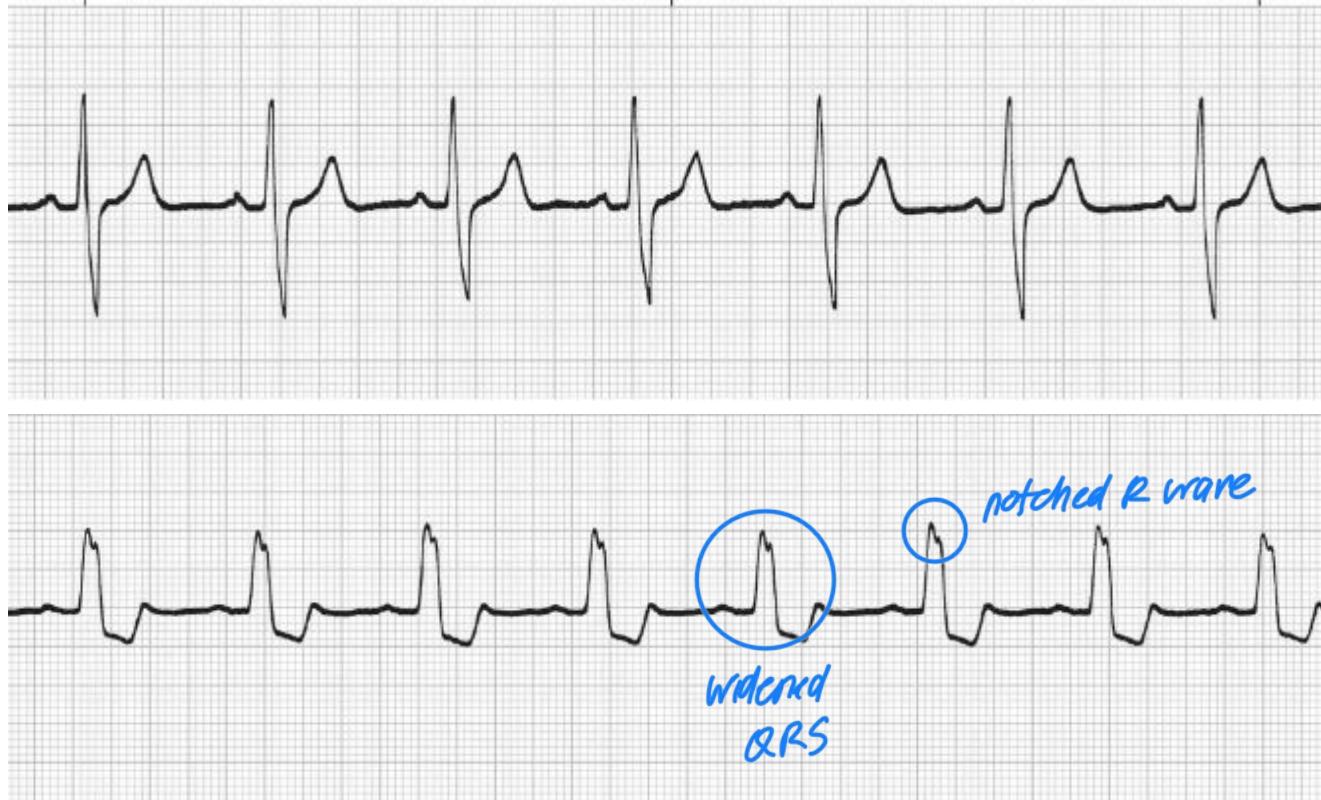
# **Advanced Cardiac Rhythms**

normally electrical activity begins at node  
→ left & right atria → AV node (Hearts pacemaker)  
→ bundle of His →  
left & right bundles

# Bundle Branch Block



# Bundle Branch Block (BBB)



# Bundle Branch Block Identifying Features

Right BBB - can be seen in healthy pt  
CAB  
can be temp/chronic



(Tx) control HTN or DM  
coronary angioplasty PT  
coronary artery  
occluded

Left BBB - typically hasn't have chronic heart disease  
Hypertensive heart disease



Rhythm	Regular
Rate	Rate of underlying rhythm
P waves	Sinus
PR interval	Normal
QRS complex	Wide (greater than 0.12 second)

means that it takes longer than normal for left ventricle to fully depolarize

(Tx) LBBB + syncope may require a pacemaker

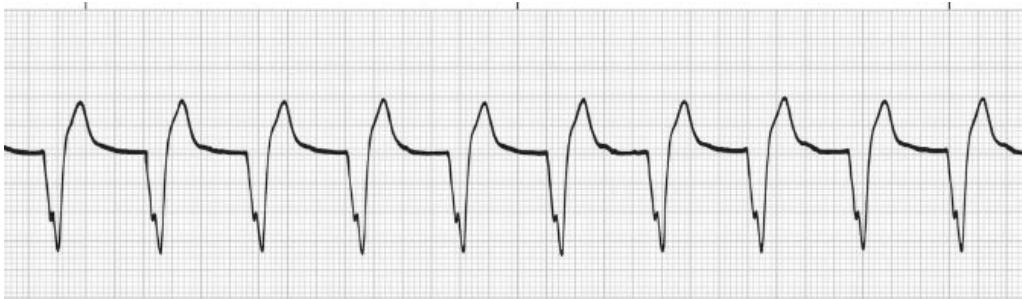
LBBB + prolonged QRS  
may benefit from  
biventricular pacemaker

(Tx) none

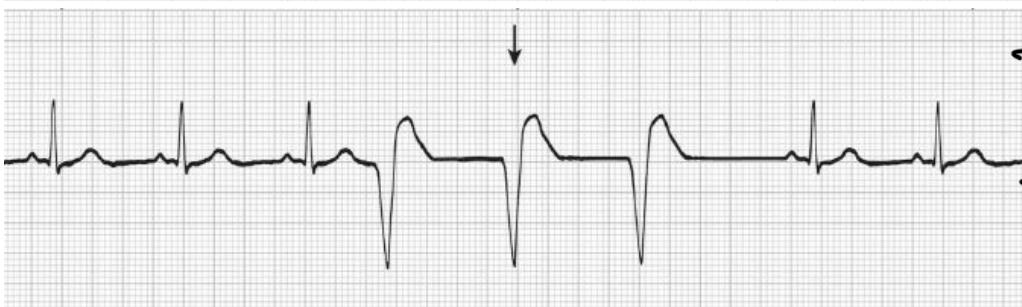
# Idioventricular Rhythm (IVR)



SA or AV node  
doesn't send a signal  
in rate high enough



signal comes from  
ventricles



regular escape rhythm

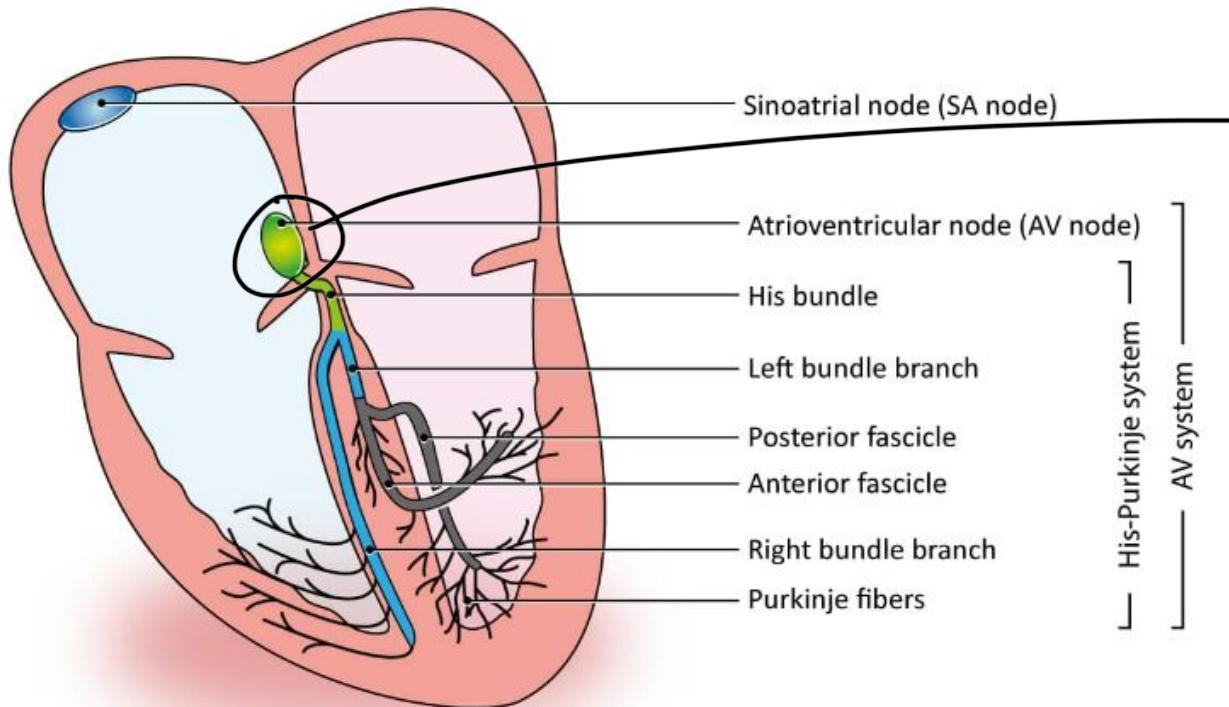
- con conducted
- ie. due to carotid sinus
- chronic
- due to advanced heart disease

# Idioventricular Rhythm Identifying Features

(Tx) chronic I VR usually leads to asystole  
if slow, treat re asystole

Rhythm	Regular
Rate	IVR slow (30-40 beats per minute); AIVR greater than 50 beats per minute
P waves	Absent
PR interval	Not measurable
QRS complex	Wide (greater than 0.12 second)

# Junctional Rhythm



if SA node < AV node signal  
then AV node becomes pacemaker  
starts here

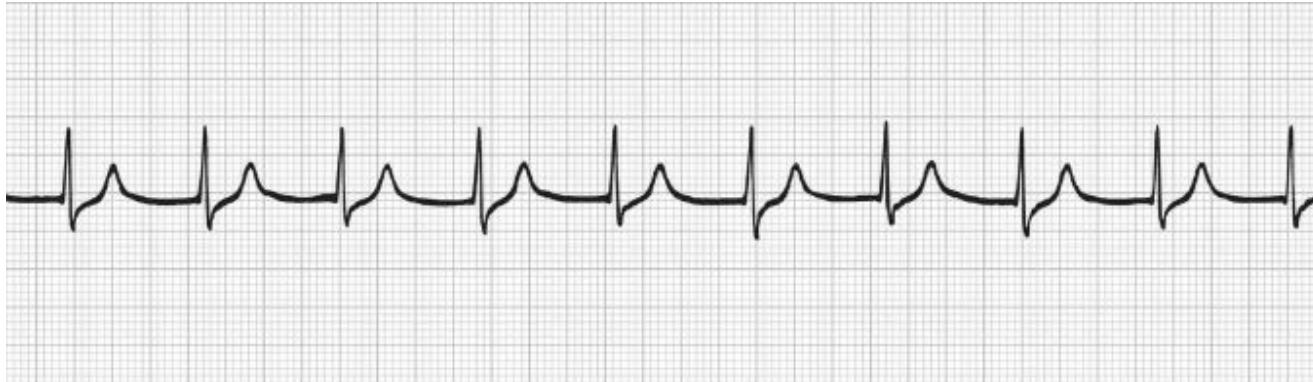
typically < 50 - 60 BPM

# Junctional Rhythm

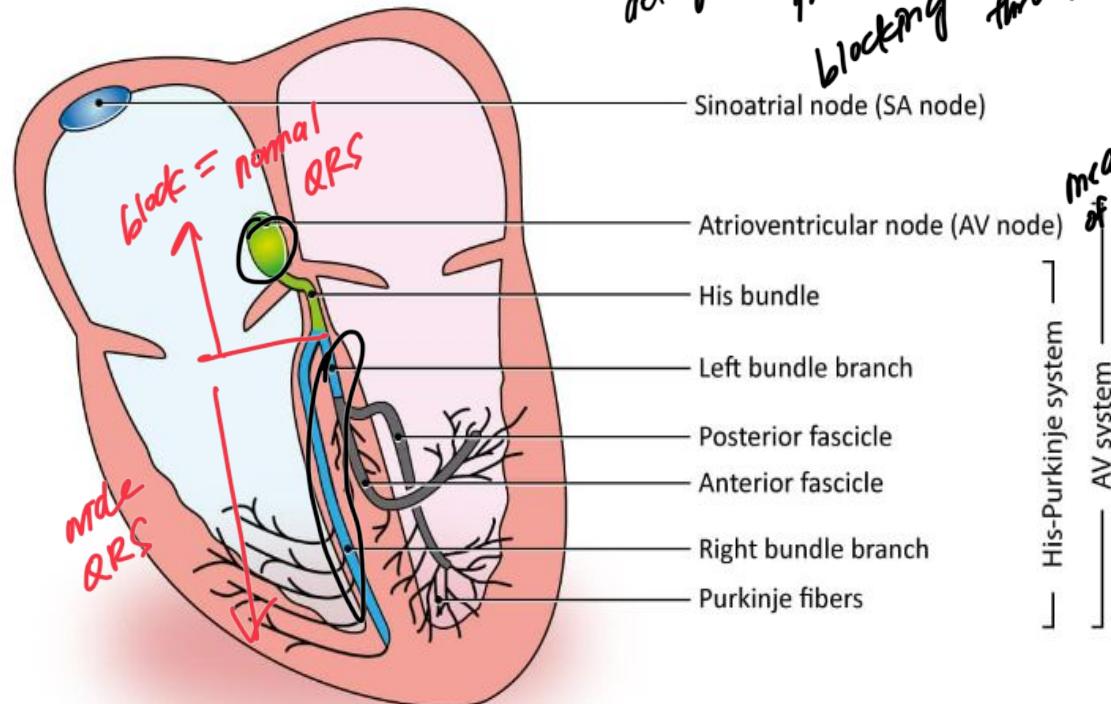


# Junctional Rhythm Identifying Features

Rhythm	Regular
Rate	40-60 beats per minute; accelerated 60-100 beats per minute
P waves	Inverted before QRS, immediately after QRS, or hidden within QRS
PR interval	Short (0.10 second) or not measurable
QRS complex	Normal



# AV Heart Blocks



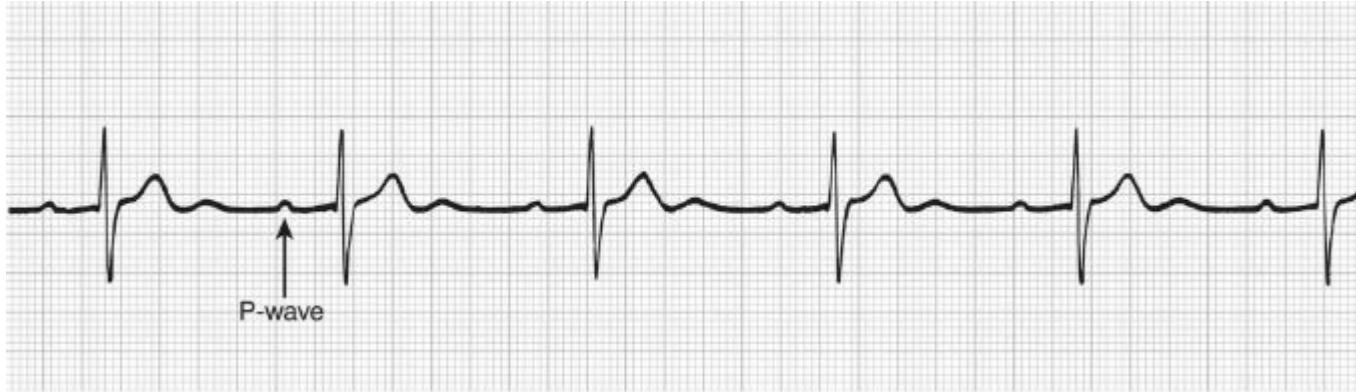
delayed conduction  
from AV to ventricles  
blocking conduction  
through AV node or  
bundle branches

*mechanism of conduction*

- Classification based on type and location of heart block
- PR interval is **key** for type
- QRS width is key for location

- Look for P wave. Is there one or more than one before each QRS?
- Measure regularity
- Measure PR interval
- Look at the QRS complex

# First Degree AV Block



1. Look for P wave. Is there one or more than one before each QRS?
2. Measure regularity
3. Measure PR interval *long*
4. Look at the QRS complex  
*normal*

# First Degree AV Block Identifying Features

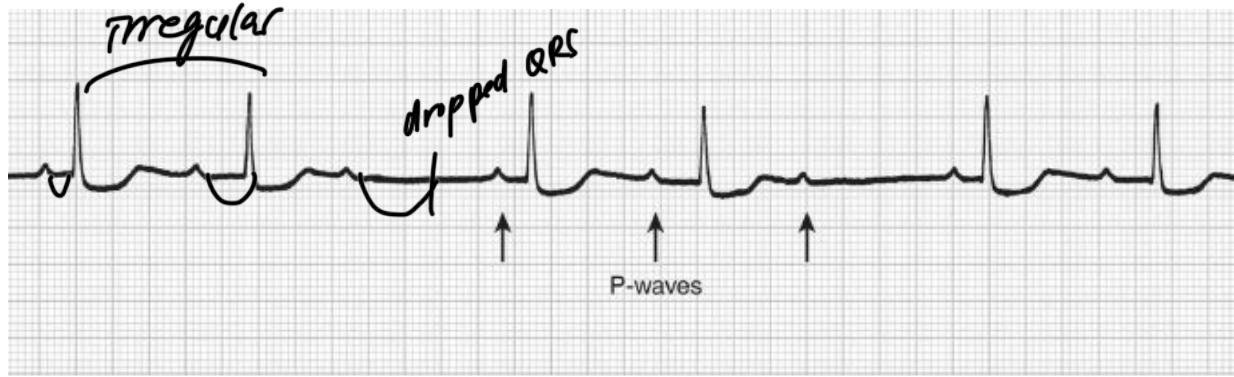
(SLS)  
asymptomatic

ischemia  
injury to AV node  
2 blocker (cCB) aware  
and aware

Rhythm	Regular
Rate	Rate of underlying rhythm
P waves	Sinus; one P wave to each QRS complex
PR interval	Consistent, prolonged (> 0.20 second)
QRS complex	Normal

delayed impulse from AV node

# Second Degree AV Block, Type I



AKA: Mobitz I or Wenckebach

1. Look for P wave. Is there one or more than one before each QRS?
2. Measure regularity
3. Measure PR interval
4. Look at the QRS complex

# Mobitz I Identifying Features

usually temporary & resolves on its own

(rarely)

↑ MII hyperkalemia  
↑ can be normal & asymptomatic  
in people who are very athletic

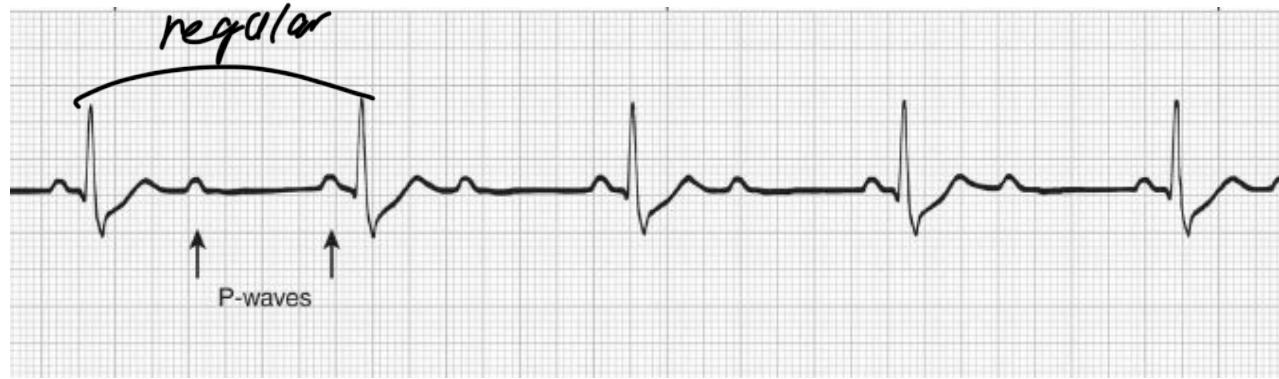
Rhythm	Regular atrial rhythm, irregular ventricular rhythm
Rate	Atrial: rate of underlying rhythm, ventricular: depends (will be less than atrial rate)
P waves	Sinus
PR interval	Varies, progressively lengthens until a P wave isn't conducted
QRS complex	Normal - <b>so where is location of this block?</b>

above the AV node



"Longer, longer, drop! Now you've got a Wenckebach!"

# Second Degree AV Block, Type II



AKA: Mobitz II

1. Look for P wave. Is there one or more than one before each QRS?
2. Measure regularity
3. Measure PR interval — *can be normal*
4. Look at the QRS complex  
*normal*

# Mobitz II Identifying Features

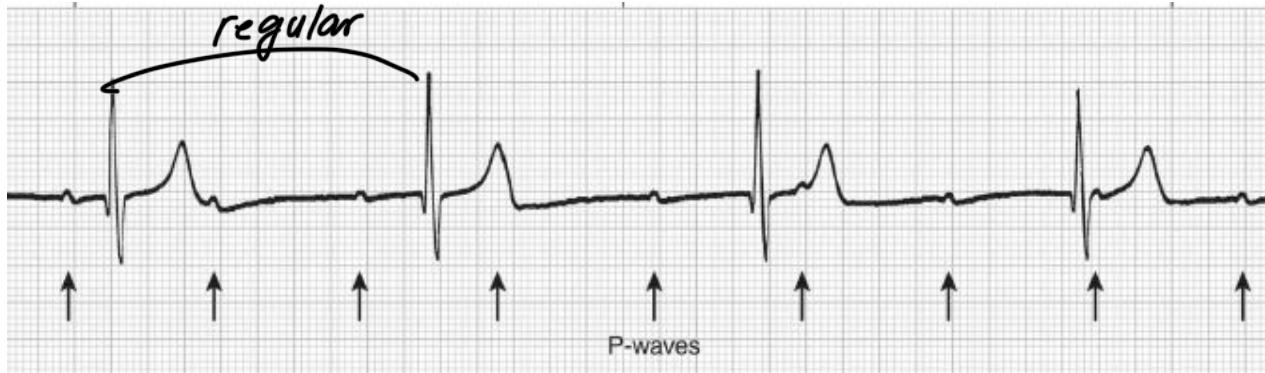
TX depends on HR & symptoms  
Tx permanent pacemaker!!!  
can progress to asystole  
if they have hiccups,  
they need to get it  
pedal. It is  
touching the  
vagus nerve.  
lol!!!  
settings  
can be other  
A-paced  
or  
V-paced  
or  
both

Rhythm	Regular atrial rhythm, ventricular rhythm can be regular or irregular
Rate	Atrial: rate of underlying rhythm, ventricular: depends (will be less than atrial rate)
P waves	Sinus; 2-3 (or more!) before each QRS complex
PR interval	Consistent; can be normal or prolonged
QRS complex	Normal or wide - <b>if wide, where is the location of the block?</b>

2 below  
AV node

aka complete heart block

## Third Degree AV Block



AKA: Complete heart block

1. Look for P wave. Is there one or more than one before each QRS?
2. Measure regularity
3. Measure PR interval — *inconsistent*
4. Look at the QRS complex

*atria & ventricles are  
not communicating*

# Third Degree AV Block Identifying Features

causes - Lyme disease  
massive heart attack

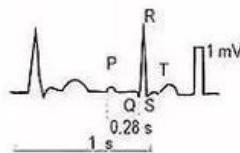
can be asymptomatic  
↳ bc IT is gradual onset

(Tx) pacemaker!!!

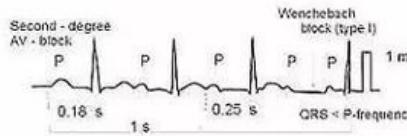
Rhythm	Regular (atria and ventricles)
Rate	Atrial: rate of underlying rhythm, ventricular: SLOW and always less than atrial rate
P waves	Sinus with no constant relationship to QRS complex
PR interval	Not consistent/variable
QRS complex	Normal or wide - <b>if wide, where is the location of the block?</b>

# "THE HEART BLOCK POEM"

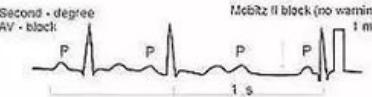
If the R is far from P,  
then you have a FIRST DEGREE.



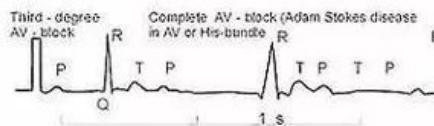
Longer, longer, longer, drop!  
Then you have a WENCKEBACH.



If some Ps don't get through,  
then you have MOBITZ II.

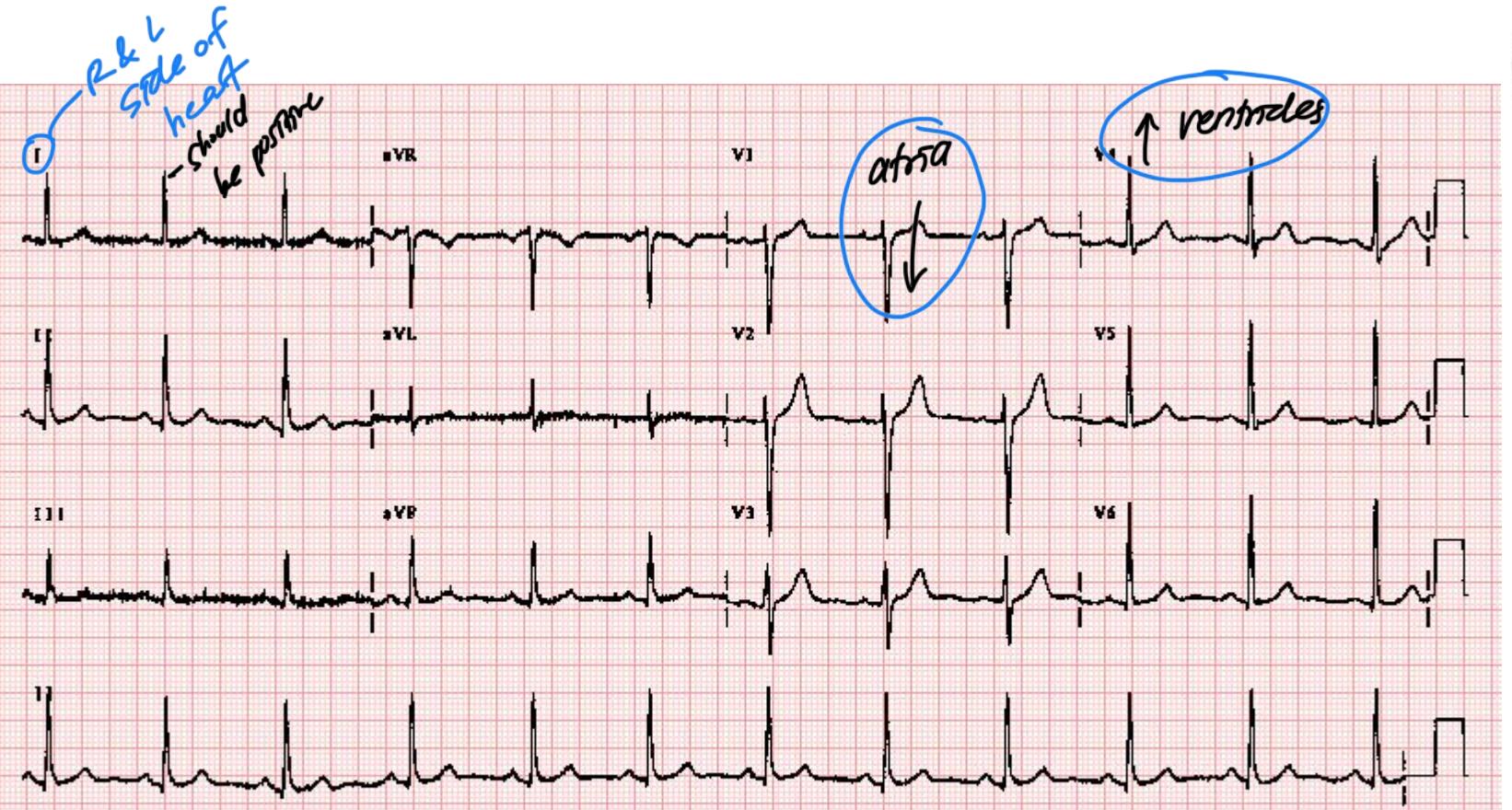


If Ps and Qs don't agree,  
then you have a THIRD DEGREE.



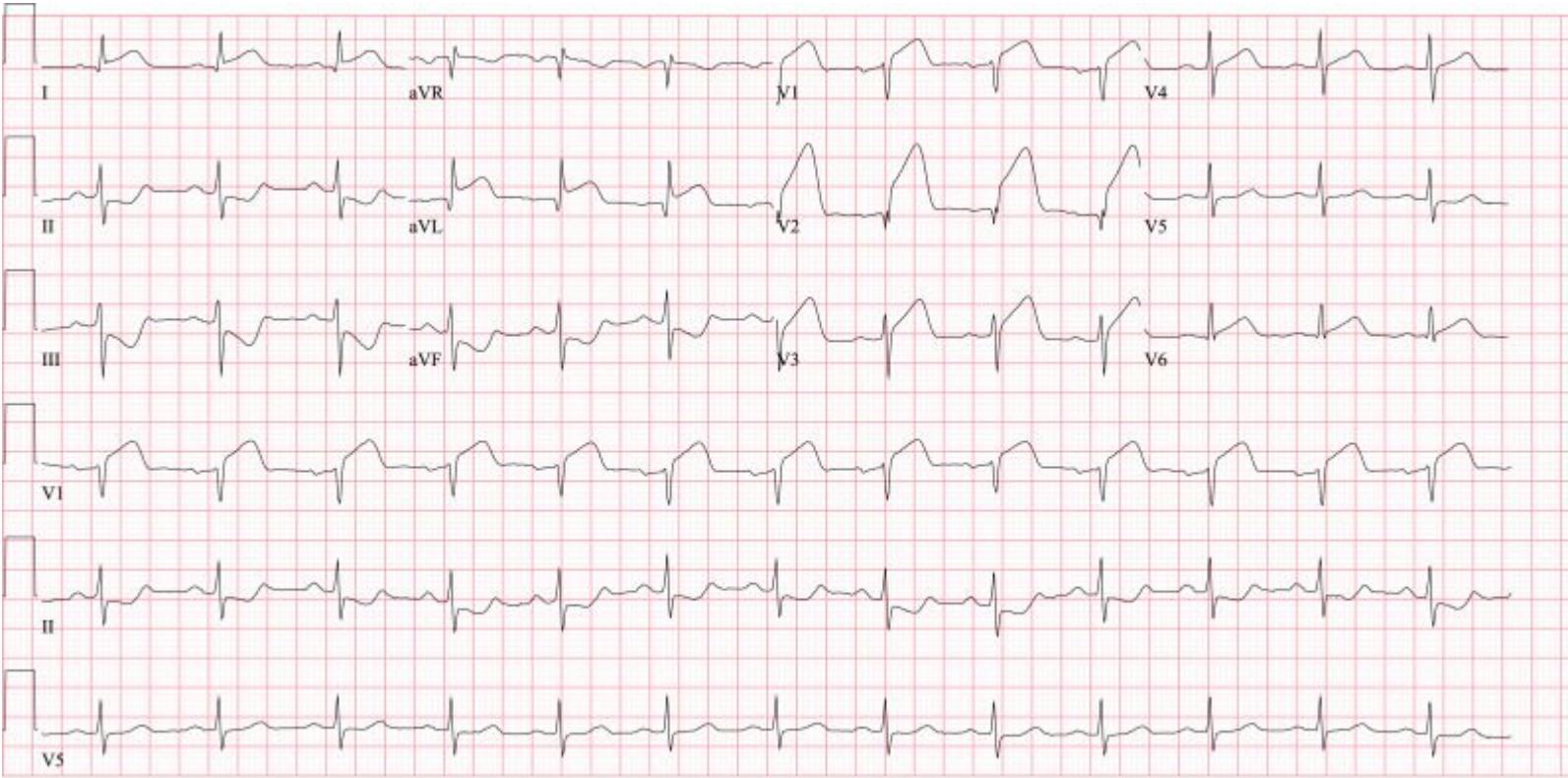


# 12 Lead EKG



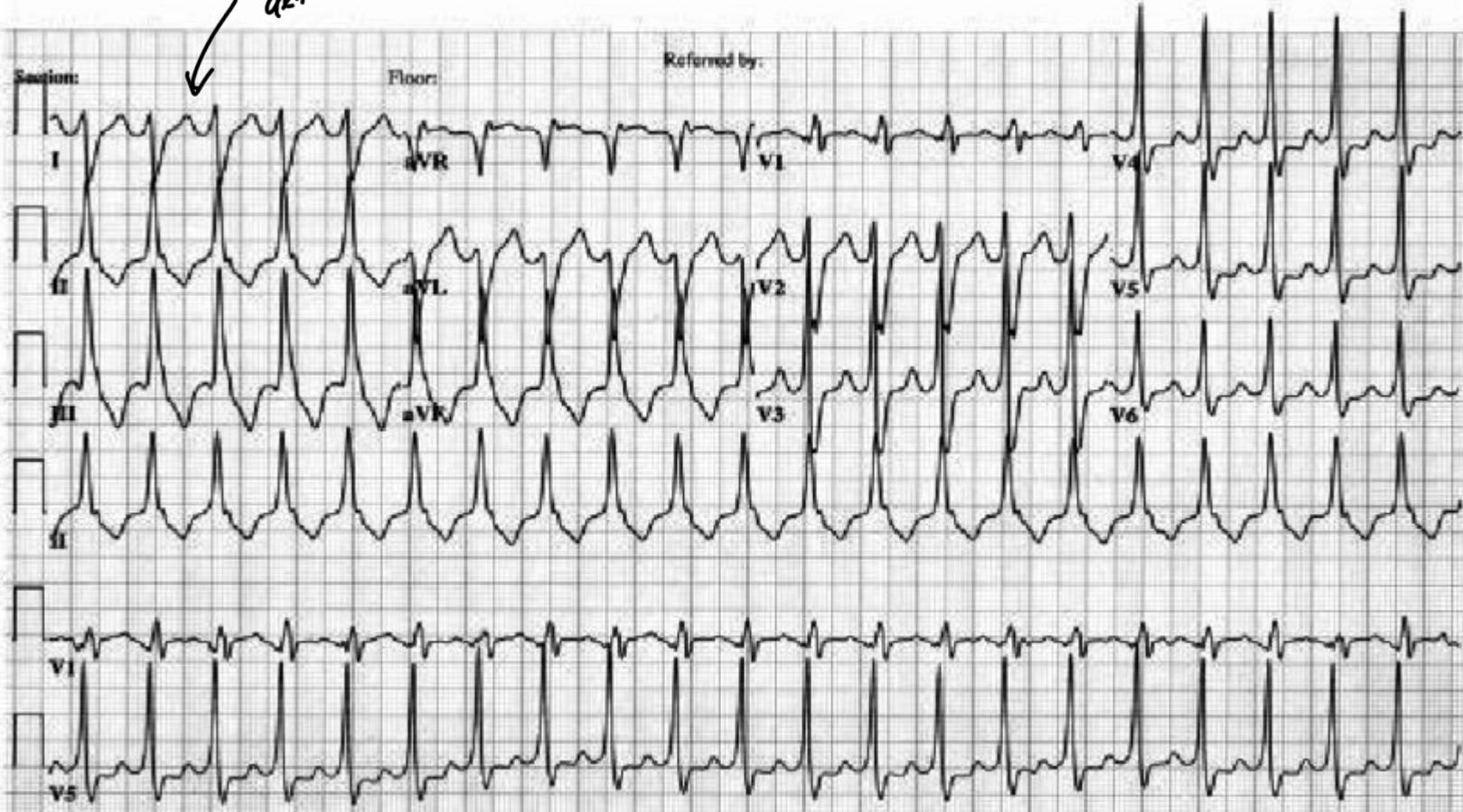


I Lateral	aVR	V1 Septal	V4 Anterior
II Inferior	aVL Lateral	V2 Septal	V5 Lateral
III Inferior	aVF Inferior	V3 Anterior	V6 Lateral



25mm/s 10mm/mV 40Hz

*negative  
deflections*



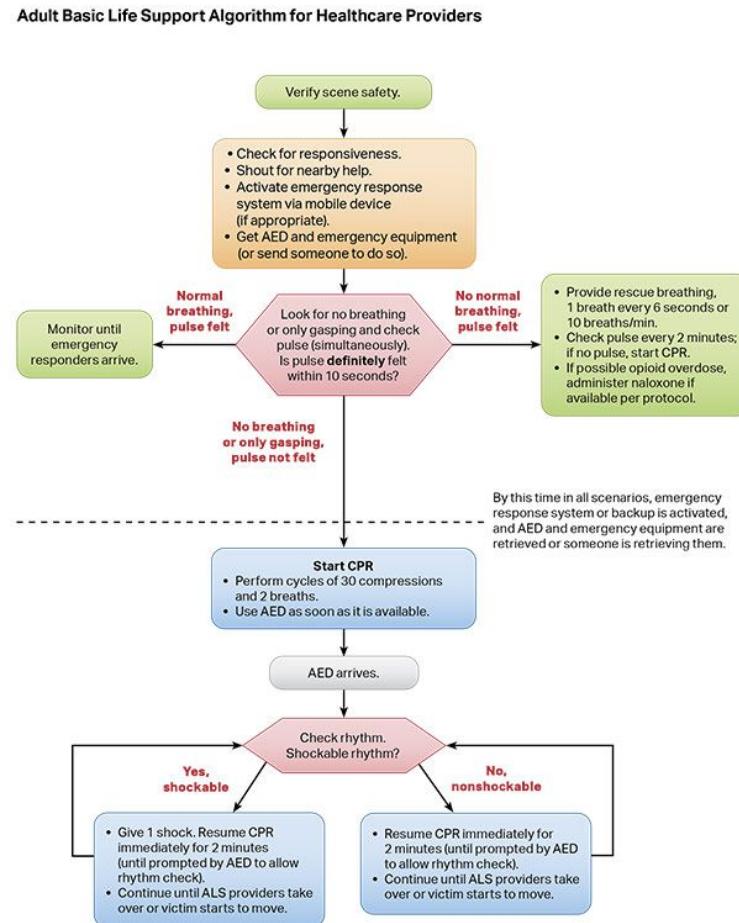
# Code Blue

# **Roles in a code blue**

- Compression team
- Recorder
- Medication RN
- Respiratory therapist/airway manager
- Defibrillator operator
- Physician/APP
- Family liaison

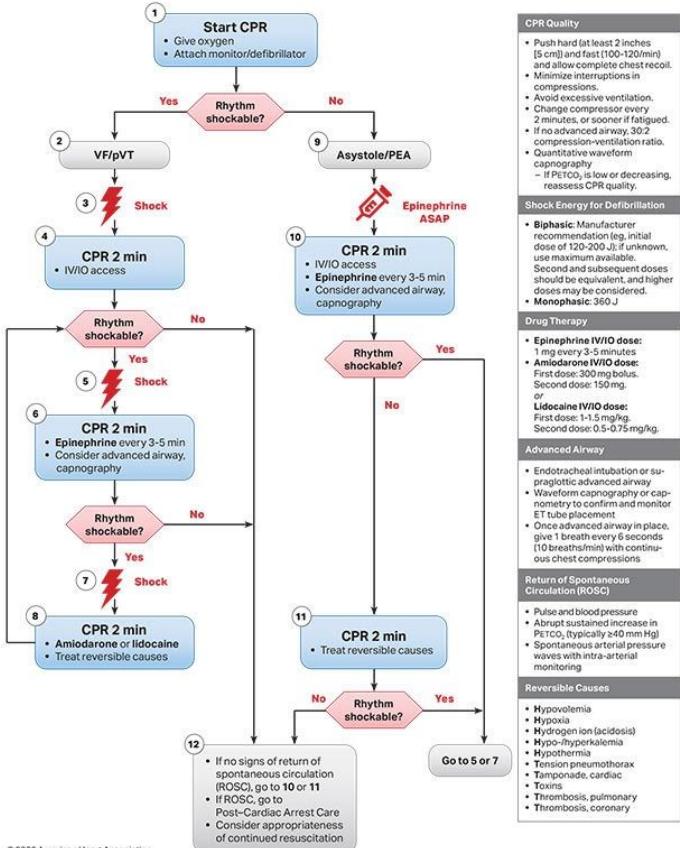
# **Basic Steps**

1. Identify arrest and call code blue
  2. Begin compressions
  3. Code cart and defibrillator pulled into room
  4. Backboard under patient
  5. Attach electrodes and defibrillator pads on patient
  6. Ensure IV access - if none, start PIV, central line, or intraosseous access

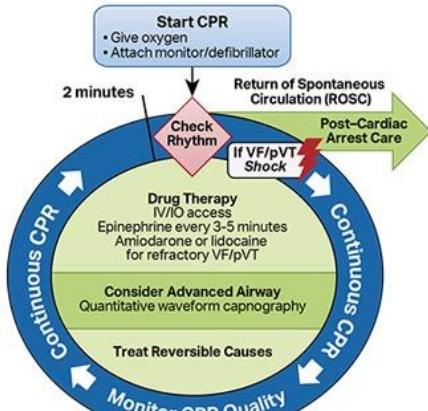


# Advanced Steps

Adult Cardiac Arrest Algorithm (VF/pVT/Asystole/PEA)



Adult Cardiac Arrest Circular Algorithm



CPR Quality

- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Change compressor every 2 minutes, or sooner if fatigued.
- Quantitative waveform capnography
  - If PETCO<sub>2</sub> is low or decreasing, reassess CPR quality.

Shock Energy for Defibrillation

- Biphasic:** Manufacturer recommendation (eg, initial dose of 120-200 J; if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.)
- Monophasic:** 360 J

Drug Therapy

- Epinephrine IV/IO dose:** 1 mg every 3-5 minutes
- Amlodarone IV/IO dose:** First dose: 300 mg bolus. Second dose: 150 mg. or
- Lidocaine IV/IO dose:** First dose: 1-1.5 mg/kg. Second dose: 0.5-0.75 mg/kg.

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

Return of Spontaneous Circulation (ROSC)

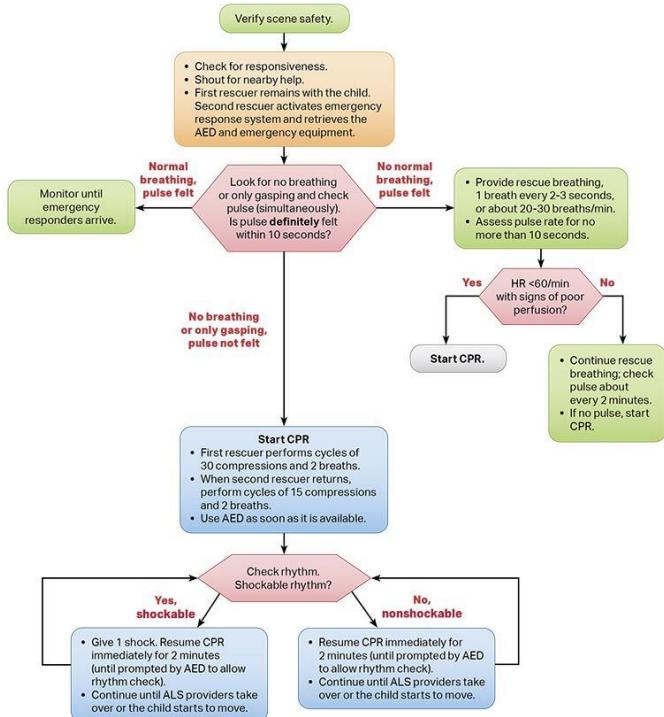
- Pulse and blood pressure
- Abrupt sustained increase in PETCO<sub>2</sub> (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes

- |                           |                         |
|---------------------------|-------------------------|
| • Hypovolemia             | • Tension pneumothorax  |
| • Hypoxia                 | • Tamponade, cardiac    |
| • Hydrogen ion (acidosis) | • Toxins                |
| • Hypo-/hyperkalemia      | • Thrombosis, pulmonary |
| • Hypothermia             | • Thrombosis, coronary  |

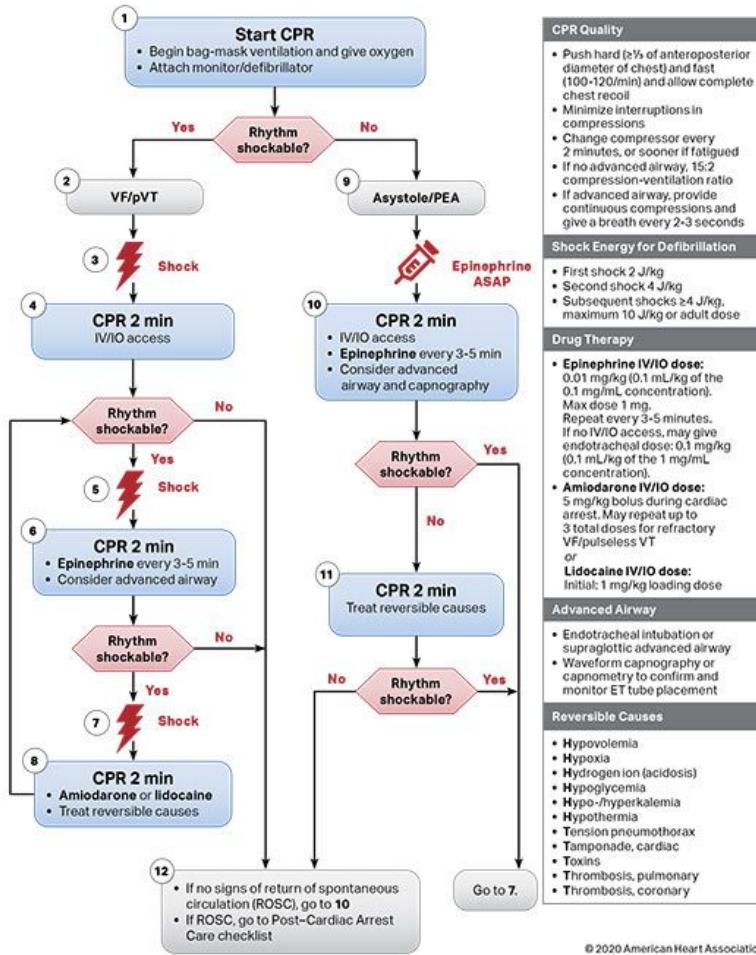
# Advanced Steps

Pediatric Basic Life Support Algorithm for Healthcare Providers—2 or More Rescuers



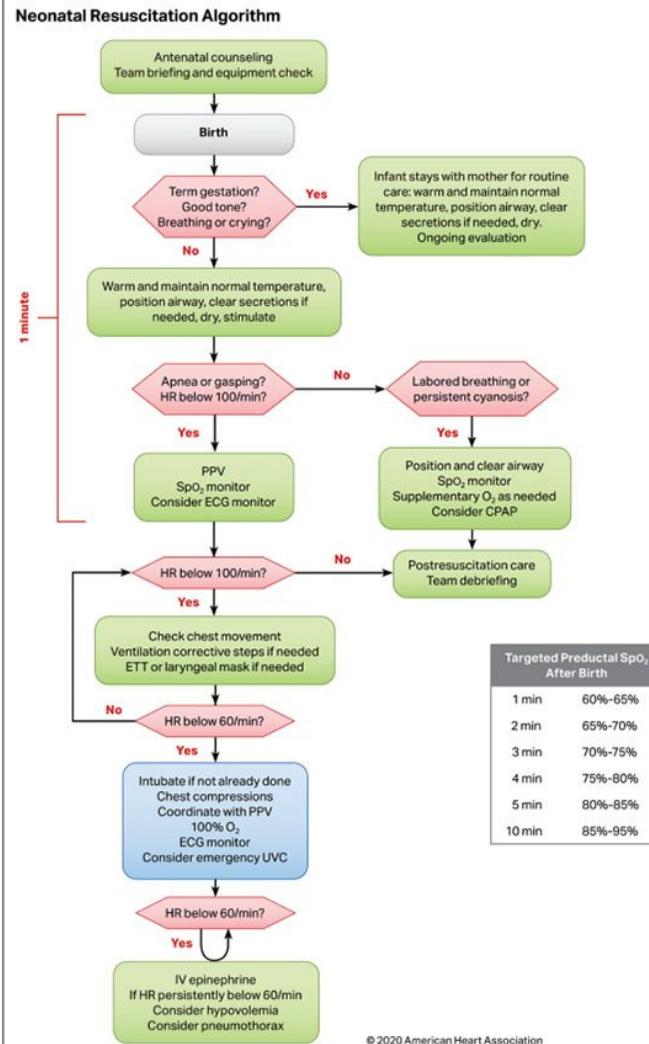
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Pediatric Cardiac Arrest Algorithm

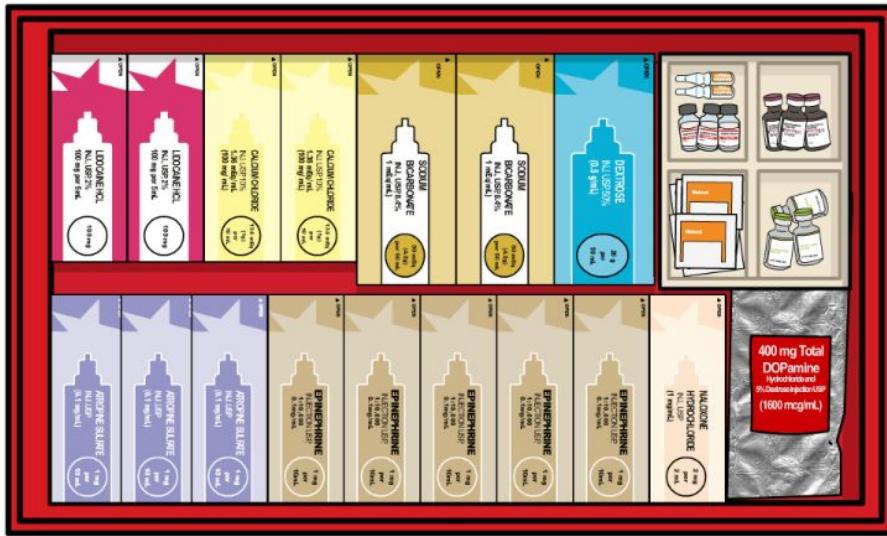


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# Advanced Steps



# Commonly Used Medications in Code Blue



- Epinephrine *v/fil*
  - 1 mg for adults
  - 0.1 mg/kg for children (max dose is 1mg)
  - 0.01 - 0.03 mg/kg for neonates (to prevent dosing errors, usually given via ETT (0.05-0.1 mg/kg))
- Atropine *brady*
  - 1 mg for adults (max is 3mg)
  - 0.02 mg/kg for children (max single dose is 0.5 mg)
  - 0.1 mg for neonates (not commonly used)
- Amiodarone *fachy*
  - 300 mg then 150 mg for adults
  - 5 mg/kg (x3 doses if refractory) for children
  - Not typically used in neonates

# Commonly Used Medications in Code Blue

- Sodium bicarbonate
  - Typical dose is 50mEq dose (pre-filled syringe) for adults
  - 1 mEq/kg of 8.4% solution for children
  - 1 mEq/kg of 4.2% solution for neonates
- Naloxone
  - 0.04 mg - 2mg for adults
  - 0.1 mg/kg IV for children < 20kg
  - 2 mg/kg IV for children >5 years and >20 kg
- Adenosine SVT & PAT treatment can give 3 times max
  - 6 mg, then 12 mg x2 doses for adults
  - 0.1 mg/kg, then 0.2 mg/kg, then 0.3 mg/kg for children < 50kg
- Shock Energy for Defibrillation
  - 150 - 200 joules initially; can increase to max of 360J
  - 2J/kg then 4J/kg in children

check for  
good IV access!!!

1/2 or 3 min  
or continuous IV  
infusion

correct  
severe met. acid.  
(cannot hypotension px)

push it as close to  
the patient as you can.  
~~don't~~ direct push  
& fast hard

flush  
afterwards



push to the heart  
central line preferred

# Post Code Blue Care

## Patient & Family

- Depends on outcome
- Family liaison
- Family debrief
- Clarifying goals of therapy/plan of care
- Post mortem care
- Notifications
  - LifeBanc, family

## Nurse/Healthcare Team

- Debrief
- Acknowledge patient if poor outcome
- Take a moment
- Feel your feelings
- Strategies for preventing compassion fatigue

# Advice/Alleviating Worries

- Know your patient's code status
- Know the signs of a code blue
- Know the H's and T's
  - Hypovolemia
  - Hypoxia
  - Hydrogen Ion (Acidosis)
  - Hyper/Hypokalemia
  - Hypothermia
  - Toxins
  - Tamponade
  - Tension Pneumothorax
  - Thrombosis
- Know where the supplies are:
  - Suction
  - Oxygen/ambu bag
  - Code cart
  - CPR lever on bed
  - Code blue button
- Nursing care
  - Bolus
  - Blood bank runner
  - Get an EKG
  - Get labs
- Get out of the way
- Get experience

