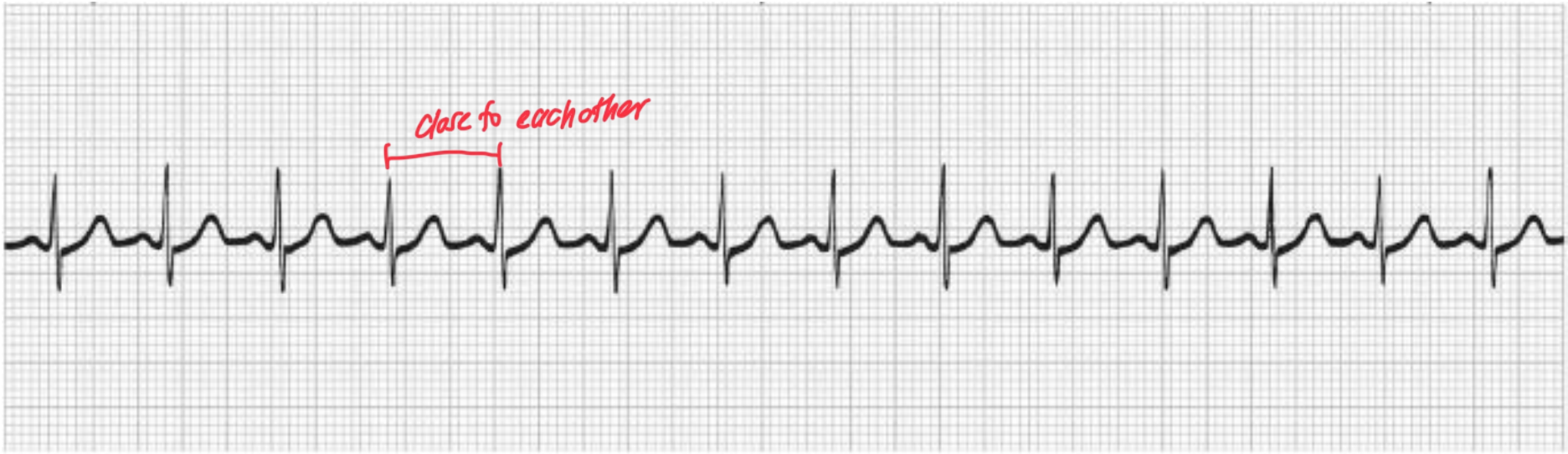
EKG Review

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

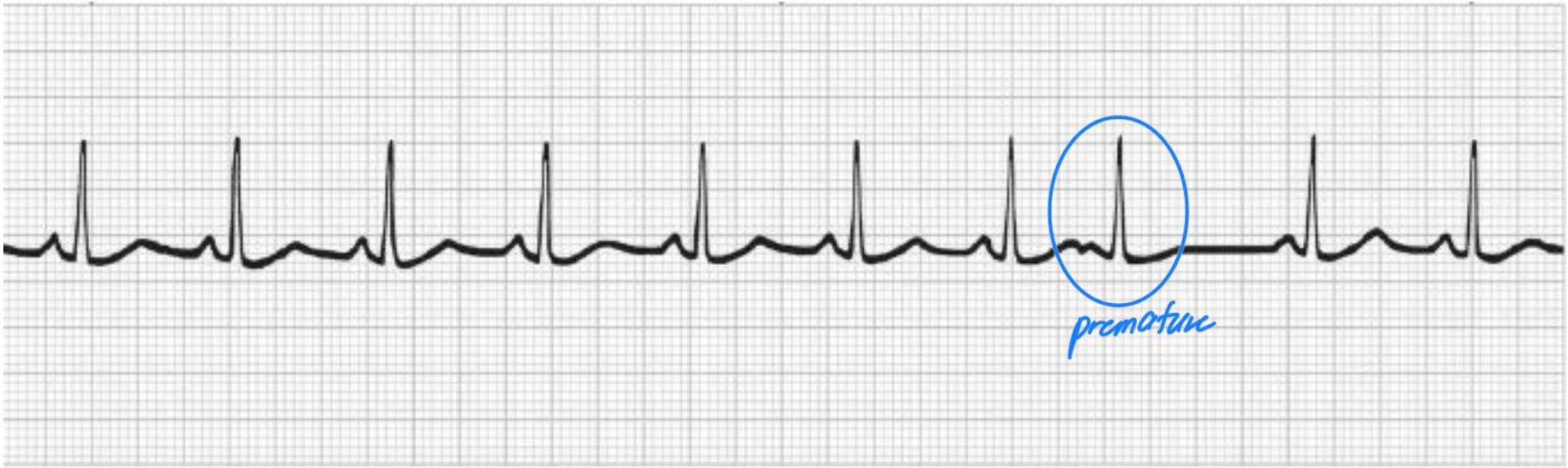


Sinus tach

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

typically benign

Premature Atrial Contraction (PAC) Identifying Features

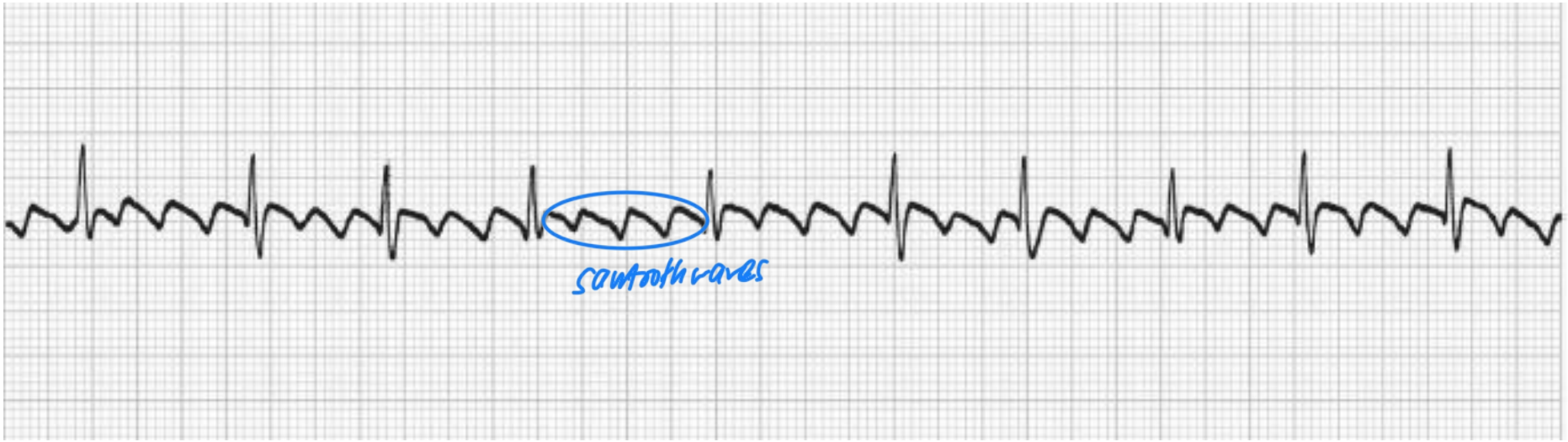
ie. sinus rhythm w/ a PAC

Rhythm	Not a rhythm, but a single beat
Rate	That of underlying rhythm
P waves	Premature, abnormal in size, shape, direction (in relation to other P waves on the strip)
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
- β-adrenergic blockers and Type IA, IC, III antiarrhythmic agents?

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



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 binge drinking & stimulants
- HF, cardiac ischemia myopathy & surgery

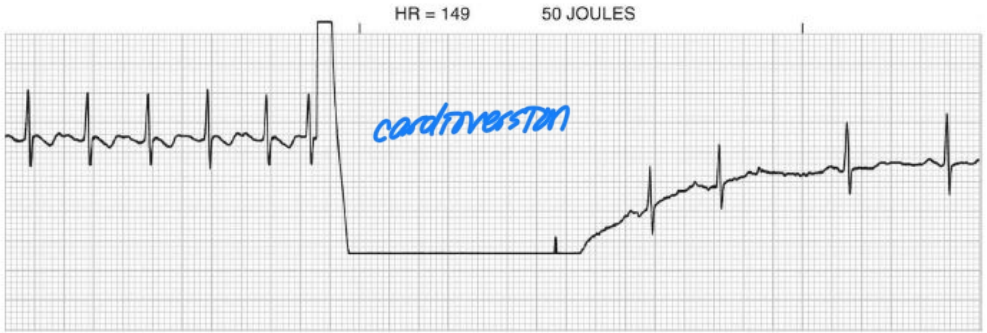
Rhythm	Regular or irregular (depends on AV conduction ratios)
Rate	Atrial rate: 250-400 beats per minute; ventricular rate will be less
P waves	Sawtooth waves (“flutter waves”/F waves) on baseline
PR interval	Not measurable
QRS complex	Normal (0.06 - 0.10 second)

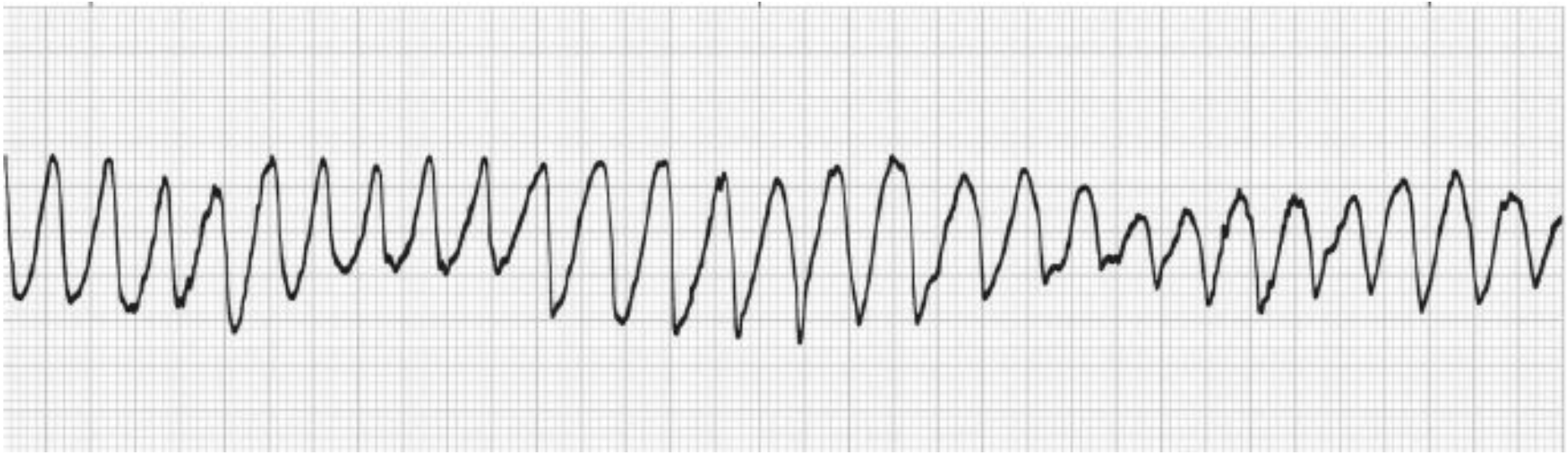
if youre counting QRS complexes

Tx

β 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 (135 ~ 155 if vtach w/ pulse)
P waves	None
PR interval	Not measurable — can see if it is pulseless vtach
QRS complex	Wide (> 0.12 second)

- AV dissociation

causes (120 ms)
- cardiac scarring
- too many PVCs
- cardiomyopathy
- electrolyte imbalances (hypo- kalemia — hyper) magnesemia calcemia
- hypoxia
- binge drinking
- SWAN placements
- post MI / CABG

Tx / pulseless
- cardioversion
- * amiodarone
- IV vasopressors & antiarrhythmics

* amiodarone 계열

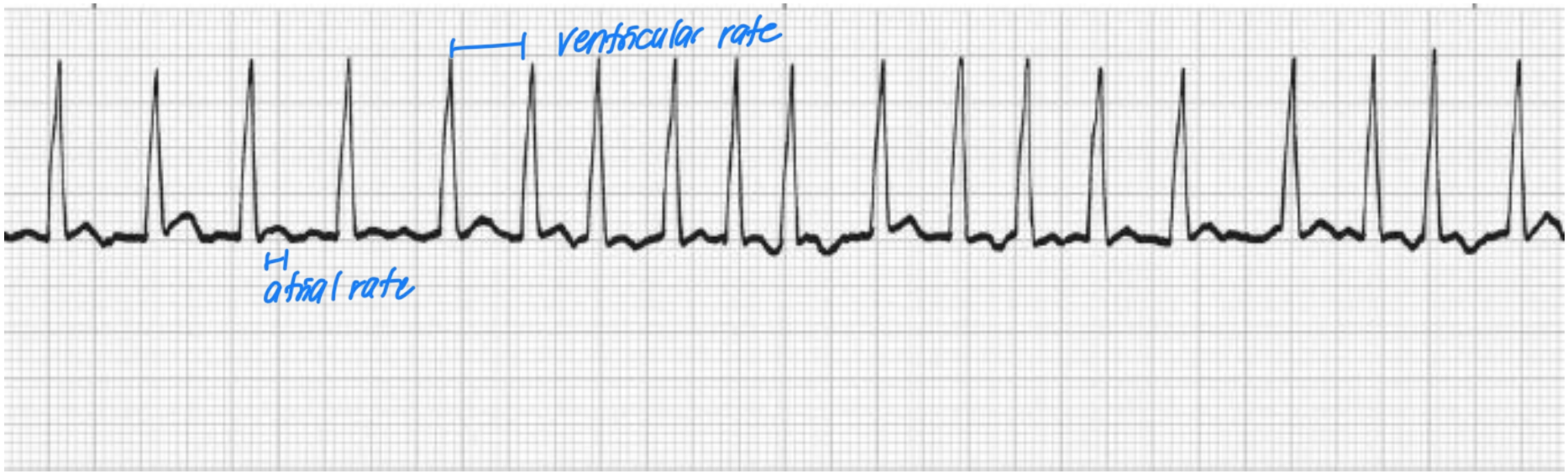
special bc has broader range of action

- class III antiarrhythmic
  - ↳ inhibits potassium receptor responsible for repolarizing the heart → K+ CCB effect

results → ↑ action potential duration, prolonged effective refractory period

- IV ↳ 150mg IV / 10min → 1mg/min / 6 hrs → 0.5mg/min / 18 hrs
- oral ↳ 800 ~ 1600 mg / daily

(CI)
- 2nd / 3rd degree blocks w/out pacemakers
- concurrent afib
- 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
PR interval	Not measurable
QRS complex	Normal (0.06 - 0.10 second)

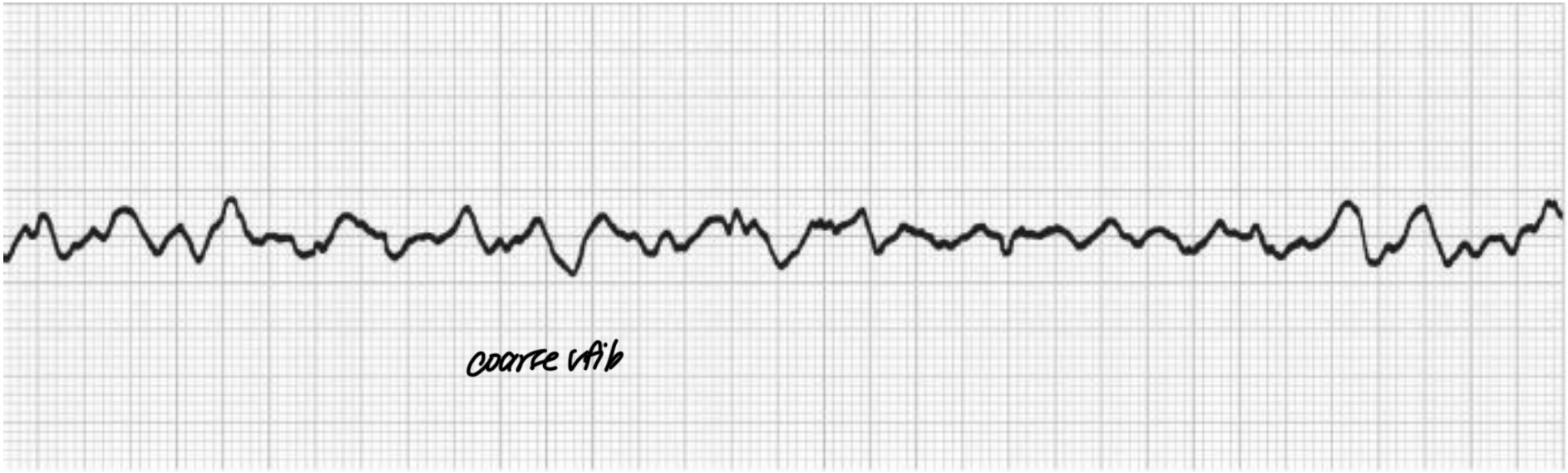
not distinguishable

if unstable afib, cardioversion

unstable afib (c/s)
SOB
lightheaded
diaphoresis
palpitations
tachycardia

(Tx) anticoagulation
controlling rate
└ CCB (diltiazem)
BBlockers (metop)
if episodic & tachy, amiodarone (also not first line)

digoxin, but not first line



when ventricular myocardium depolarize erratically

Ventricular Fibrillation Identifying Features

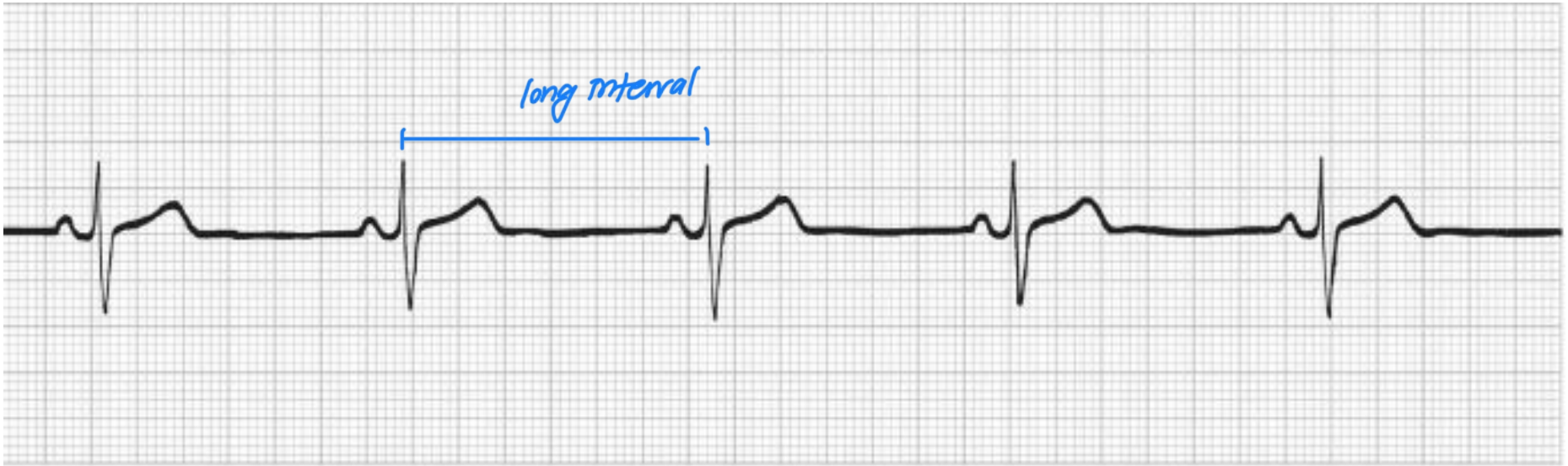
Tx CPR defibrillation * ↳ if no effect, administer epinephrine & amiodarone epi

CAUSES MI cardiac myopathy hypoxia hyper/hypokalemia hypocalcemia electrolyte disturbances 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

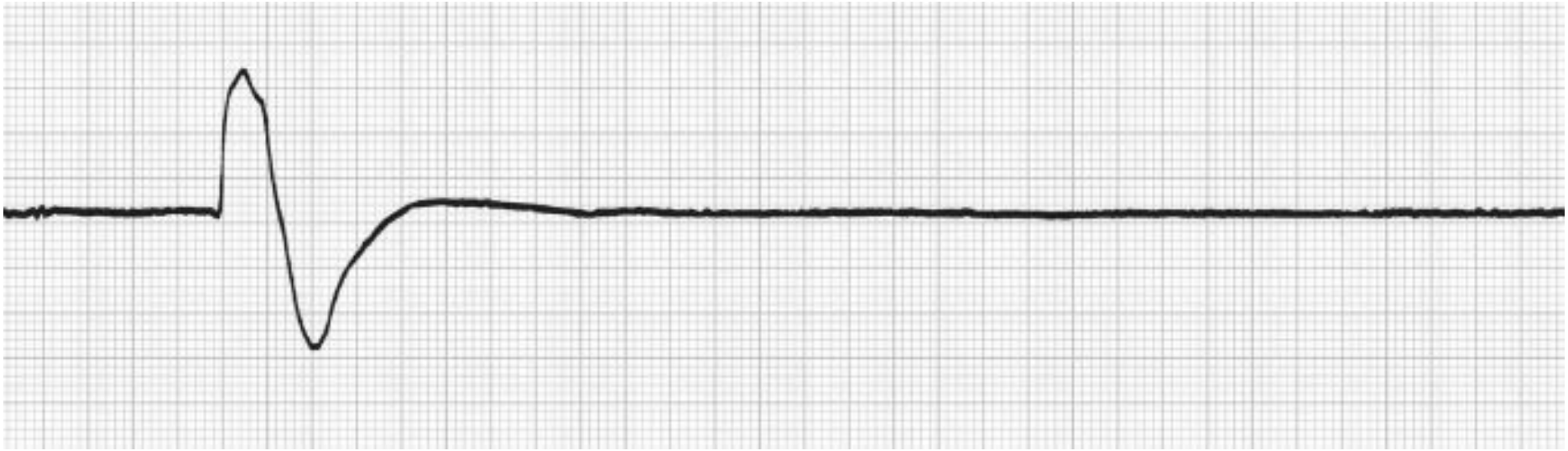

long interval

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 MI (SA node)
hypoglycemia
vagal stimulation / vasovagal reaction
change in position
↑ ICP
CCB
βblockers
digoxin

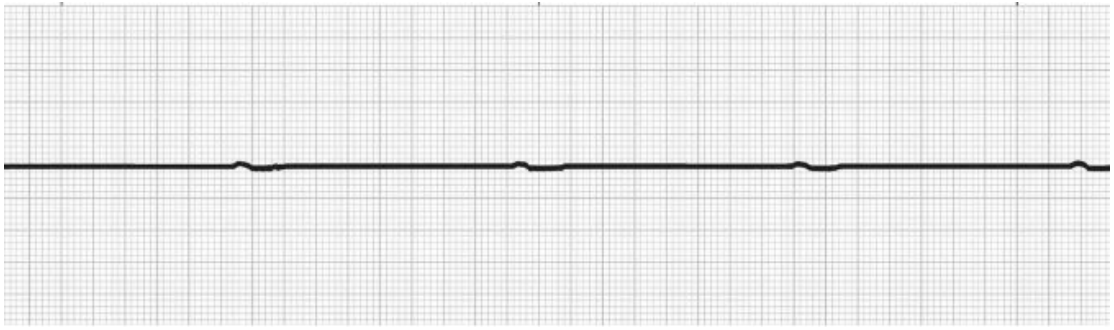
Rx
atropine
treat the cause

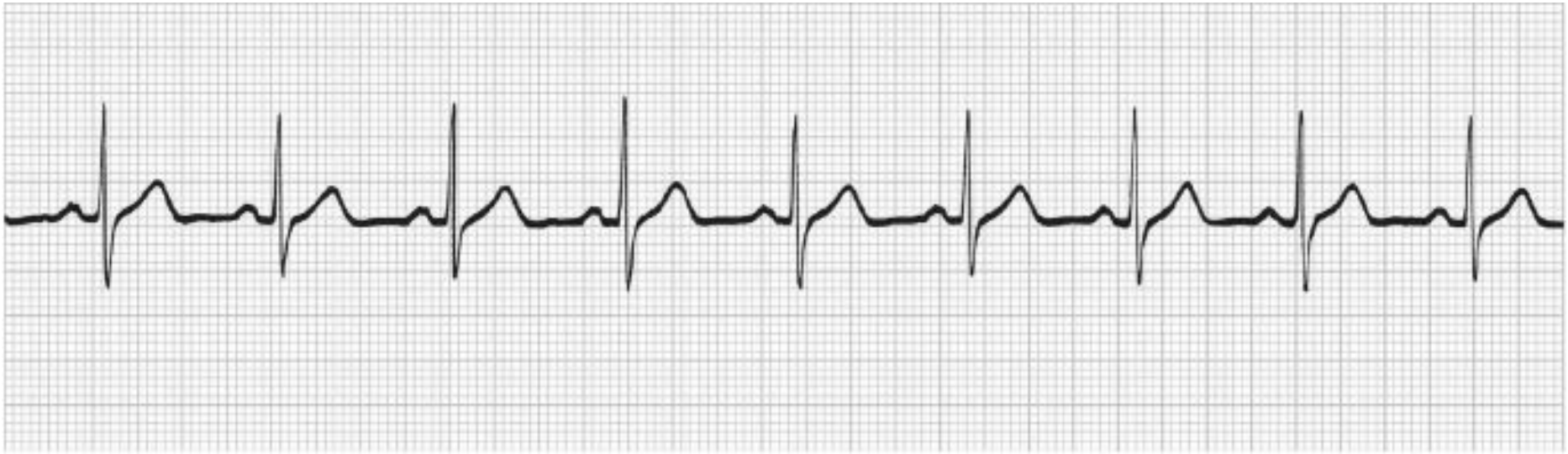


Asystole Identifying Features

Rx
CPR epinephrine
shock if it is fine vfib

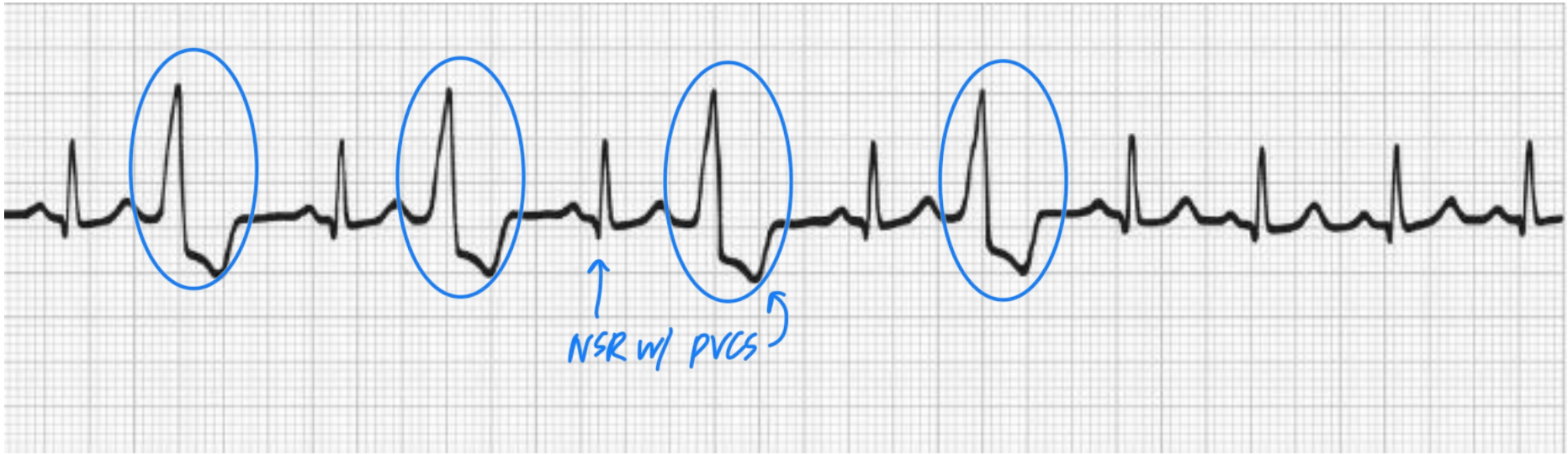
Rhythm	If P waves are present, will have atrial rhythm
Rate	None
P waves	Will either have a P wave with no associated QRS complex or a straight line
PR interval	Not measurable
QRS complex	Absent





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

7+ can be called ~~a beat of~~ a run of vtach

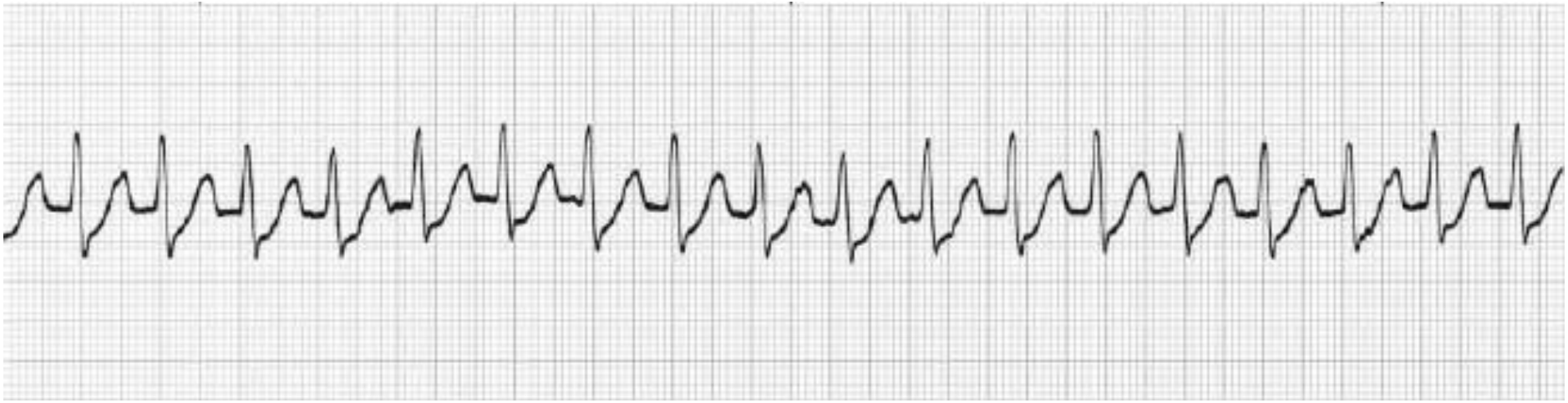
Rhythm	Not a rhythm, but a single beat. Underlying rhythm usually regular
Rate	That of underlying rhythm
P waves	None associated with PVC
PR interval	n/a; identify underlying rhythm
QRS complex	Premature; wide (0.12 second or greater)

causes

MI
hypoxia
HF
tobacco/caffeine
hypokalemia
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)

Tx

First step is to determine hemodynamic stability.

- Unstable: adenosine (IV) → cardioversion

cardioversion

CCB

β Blockers (IV)

vagal maneuver

if hemodynamically stable

Causes

CHF

tobacco / alcohol

adenosine

If significant enough, another AP will occur

results from an electrolyte imbalance affecting an action potential

- error occurs in a cardiac reflex (originates from other action potential) which causes depolarization.

Pharmacology Review

β blockers -lol

typically treat CV diseases : tachycardia, CAD, HTN, Hthyroid, MI, CHF (if constipated)

also treats long QT syndrome & hypertrophic obstructive cardiomyopathy

Mechanism of Action

Beta receptors ← bind to epinephrine, norepinephrine

→ also release renin which ↑ BP

(effects

↓BP ↓HR ↓CO ↓ renin ↓ oxygen demand) because of negative chronotrope & inotrope effects

also lower melatonin secretion

Adverse Effects

may cause bradycardia & HoTN

not as common/ bronchospasm, reduced circulation

RF by/ Raynaud's, Asthma → contraindicated

also in chronically bradycardic or HoTensive

Monitoring

- BP
- QT interval

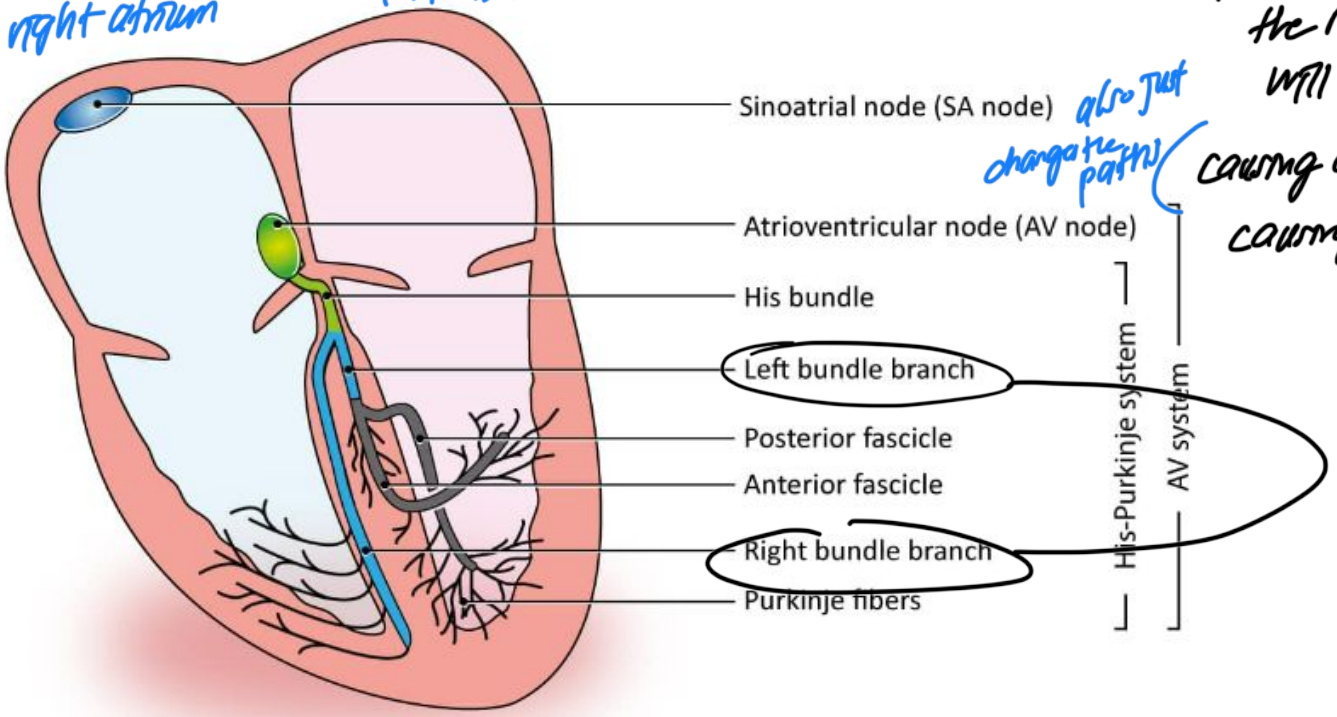
note

overdose antidote = glucagon

Advanced Cardiac Rhythms

Bundle Branch Block

normally electrical activity begins in SA node (heart's pacemaker) → left & right atria → AV node → bundle of His → left & right bundles

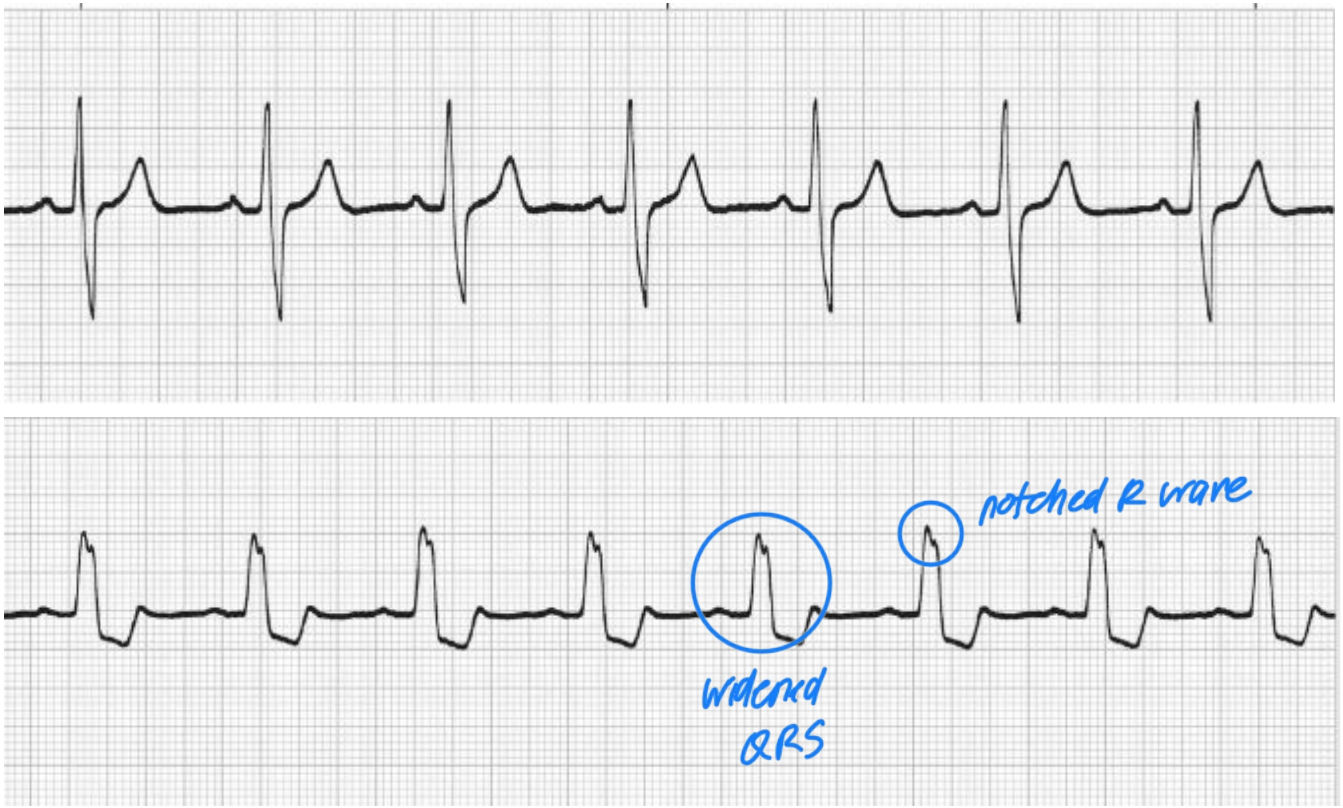


if one is blocked, the not blocked one will depolarize first, also just changing the path causing a delay causing a wide QRS complex

normally simultaneously depolarize

if then electrical current cannot conduct

Bundle Branch Block (BBB)

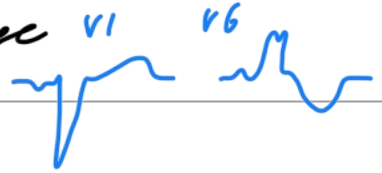


Bundle Branch Block Identifying Features

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

Tx control HTN or DM
coronary angioplasty if
coronary artery
occluded

Left BBB – typically have to have chronic heart disease
Hypertensive heart disease



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

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

Tx LBBB + syncope may require
a pacemaker

LBBB + prolonged QRS
may benefit from
biventricular pacemaker

Tx more

Idioventricular Rhythm (IVR)

due to suppression w/ structural damage or functional dysfunction

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

signal comes from ventricles

so the ventricle assumes the role of a dominant pacemaker

ventricular escape rhythm

can be intermittent

ie. due to vasovagal response

chronic

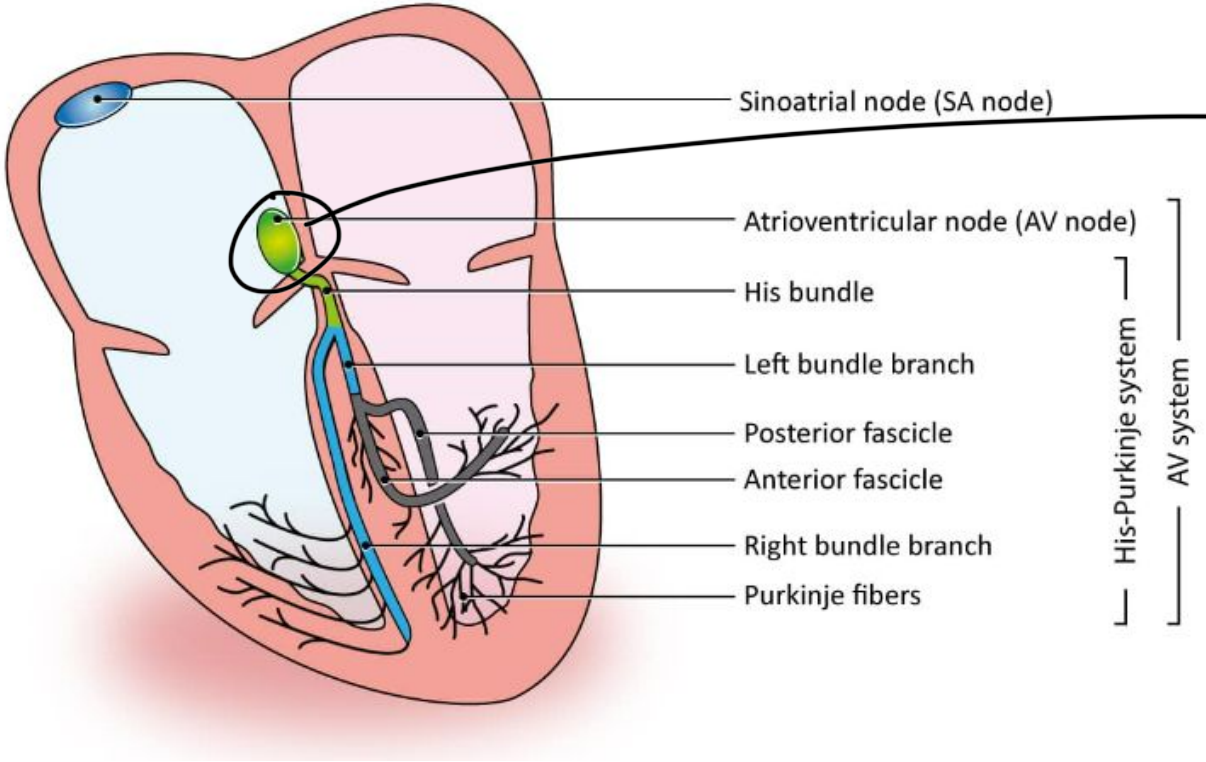
due to advanced Heart disease

Idioventricular Rhythm Identifying Features

Tx chronic IVR usually leads to asystole
↳ if there, treat the 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)

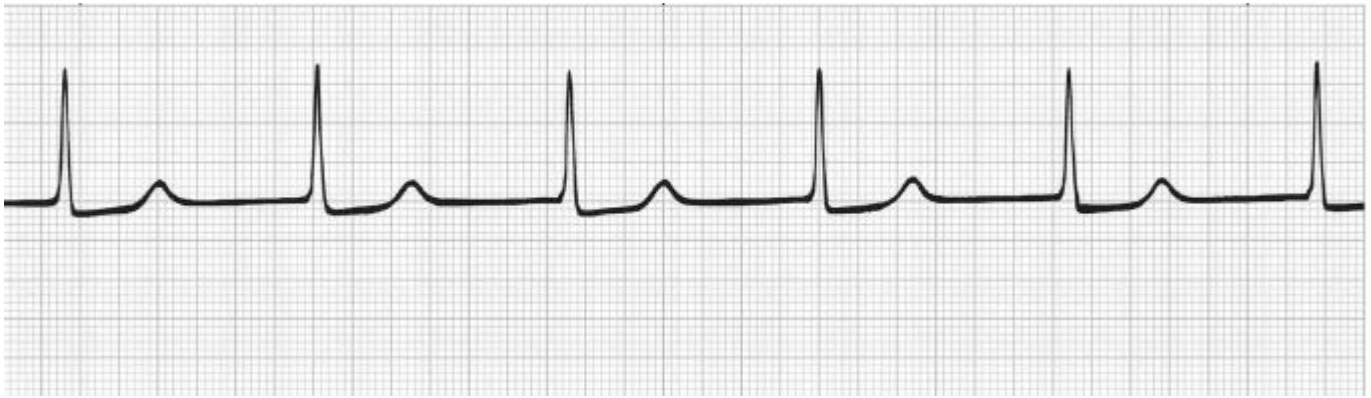
Junctional Rhythm

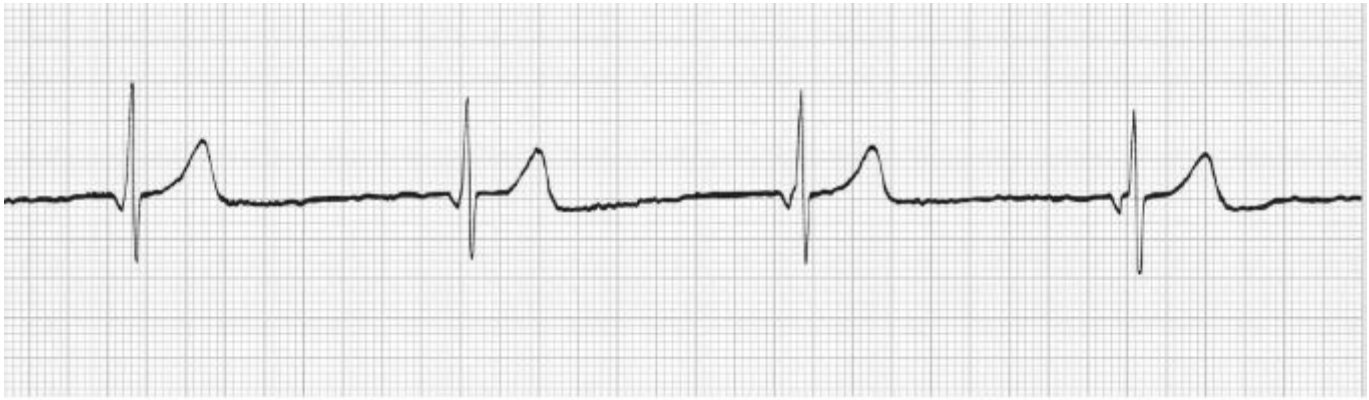


signal
if SA node < AV node signal
↓
then AV node becomes pacemaker
starts here

typically < 50 - 60 BPM

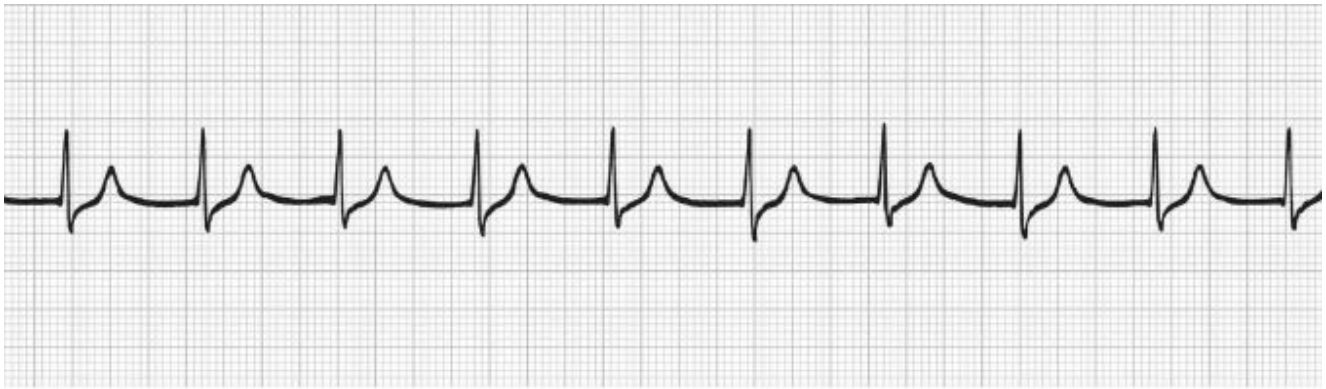
Junctional Rhythm





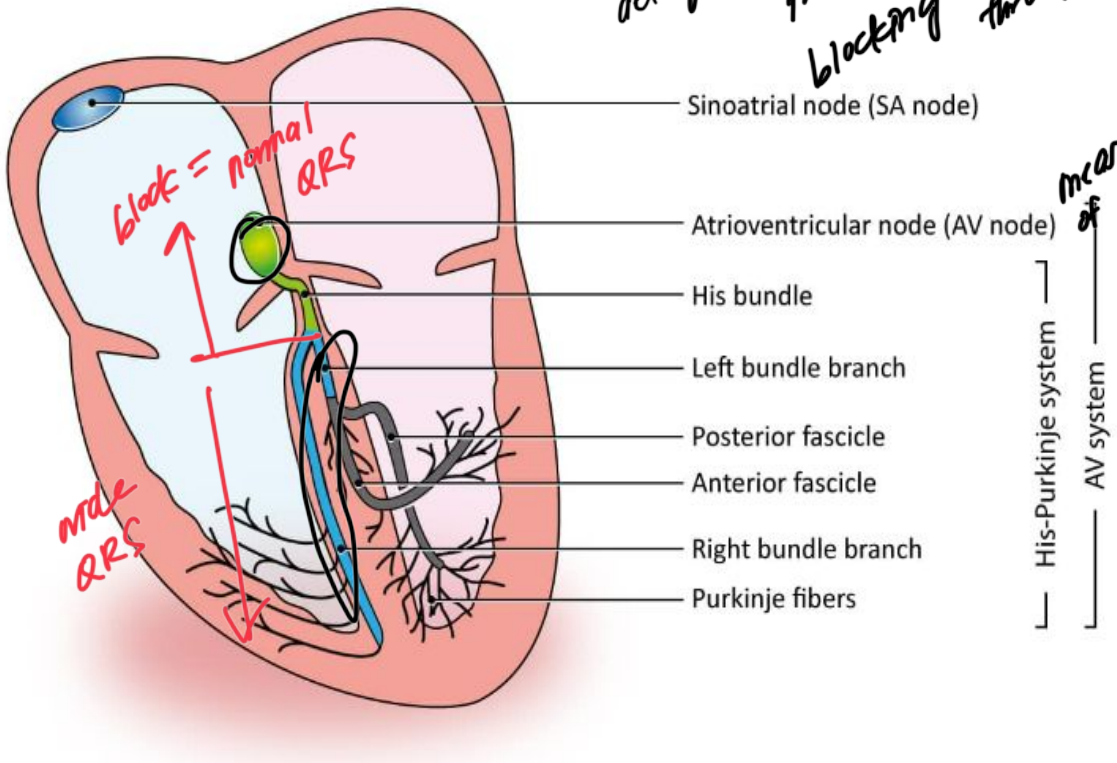
Junctional Rhythm Identifying Features

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 → ventricles
blocking conduction through AV node or bundle branches

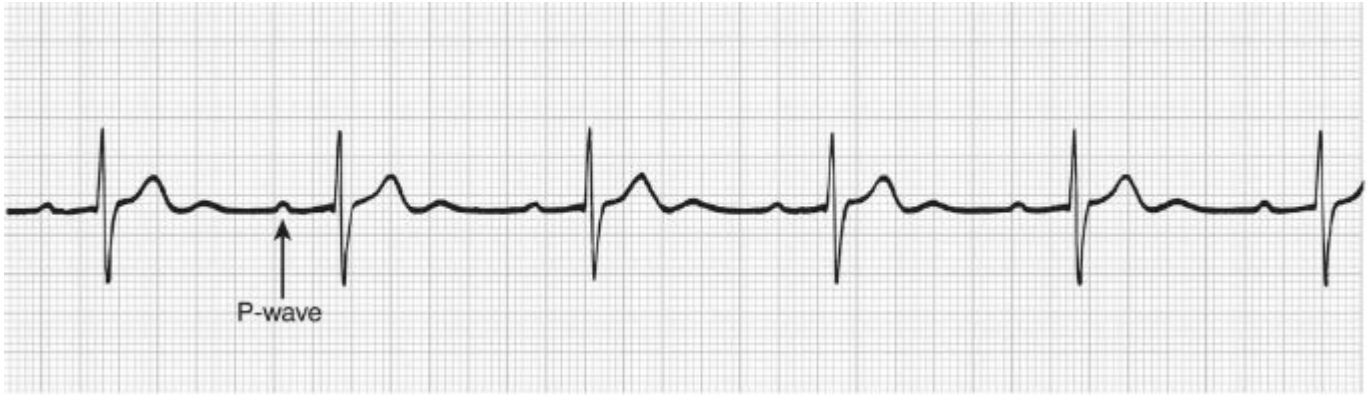


measure of conduction

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

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

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

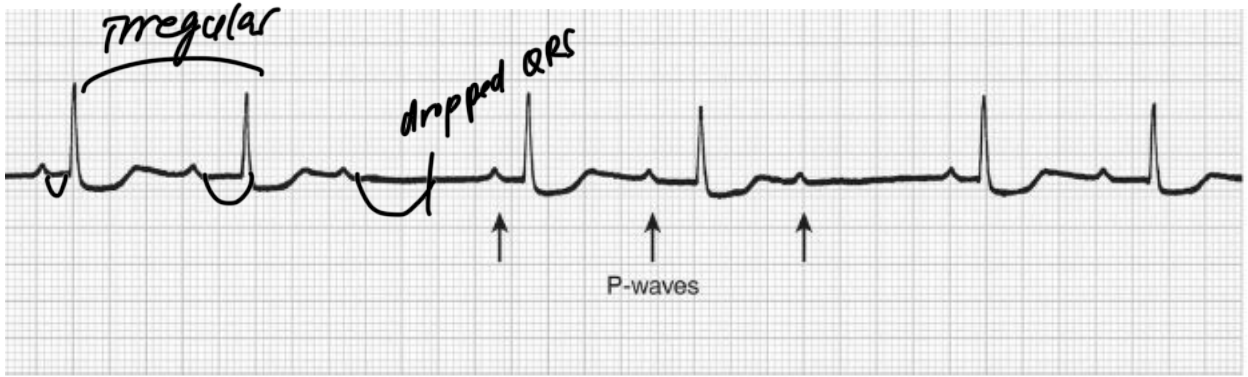
S/S asymptomatic

Ischemia
injury to AV node
2 β blocker / CCB
amiodarone
overuse

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

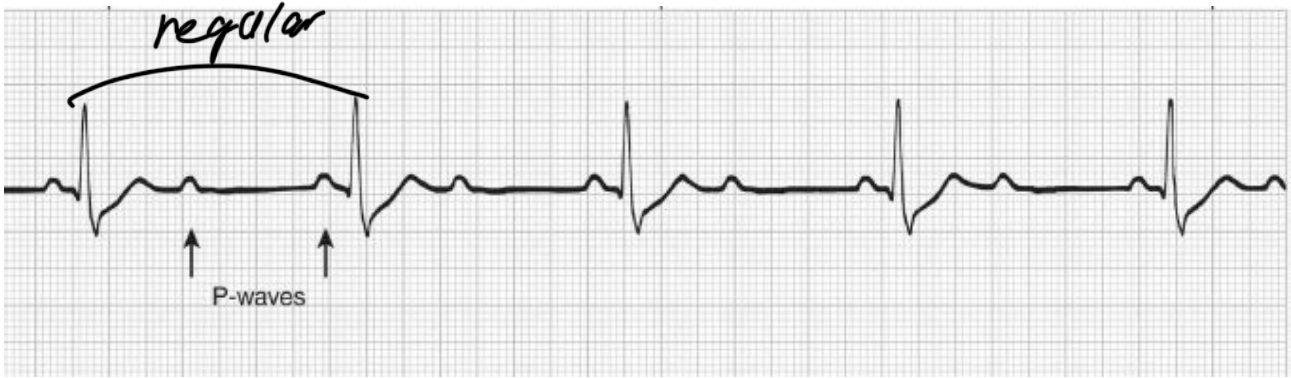
1. Look for P wave. Is there one or more than one before each QRS?
2. Measure regularity
3. Measure PR interval
4. Look at the QRS complex

Mobitz I Identifying Features

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 - **so where is location of this block?**

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

Second Degree AV Block, Type II

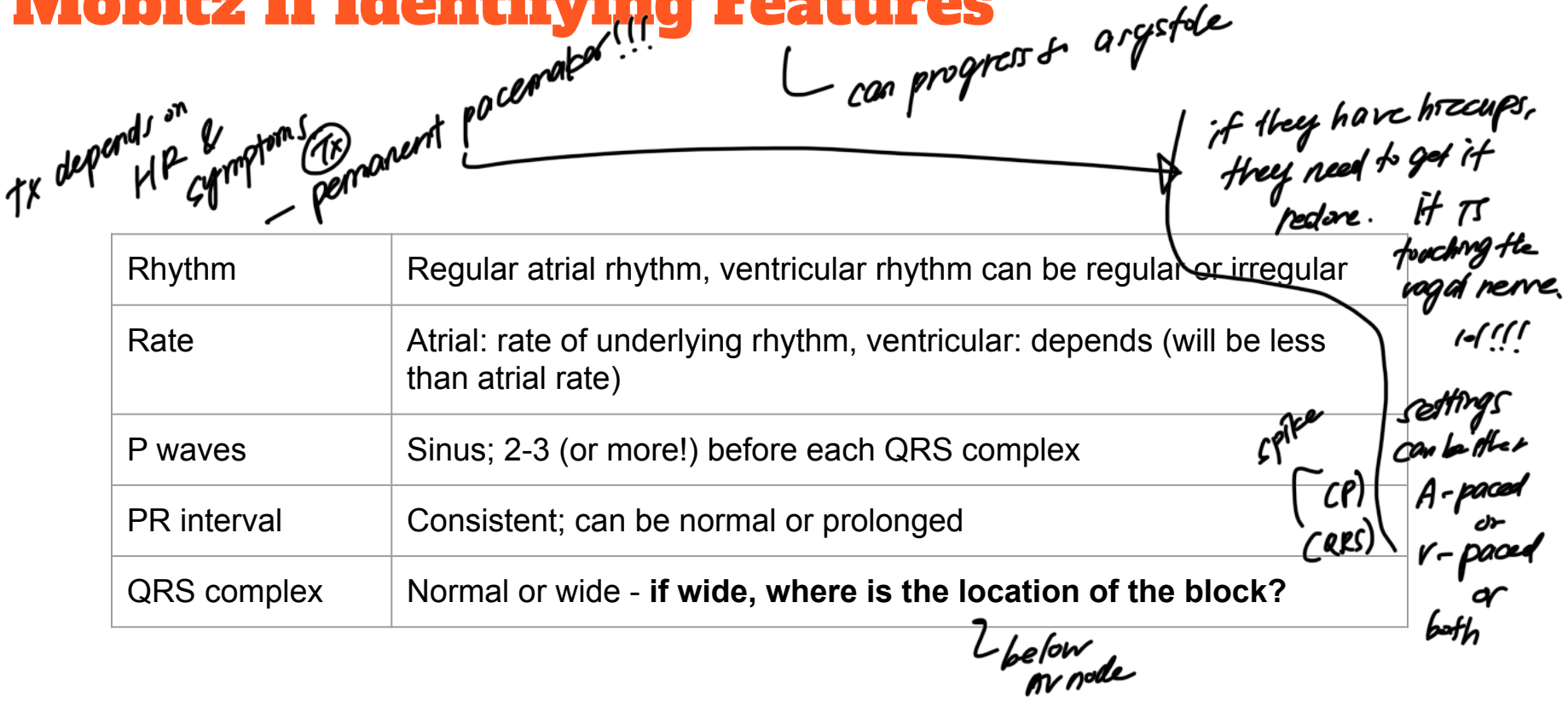


AKA: Mobitz II

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

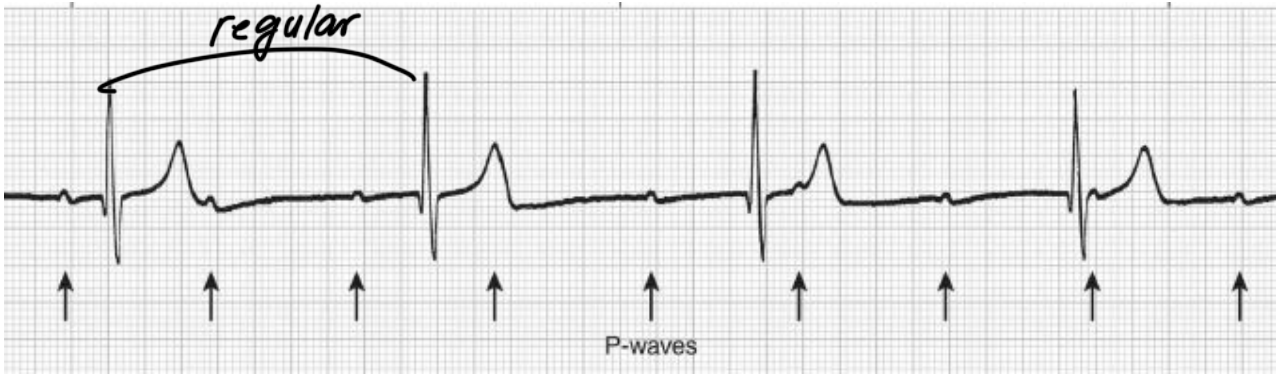
Mobitz II Identifying Features



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 - **if wide, where is the location of the block?**

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 & ventricules are not communicating

Third Degree AV Block Identifying Features

→ emergency

causes - lyme disease
massive heart attack

can be asymptomatic
↳ bc it is gradual onset

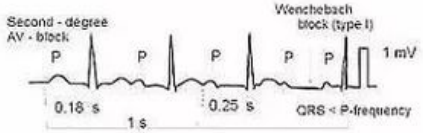
Tx pacemaker!!!

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 - **if wide, where is the location of the block?**

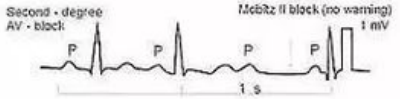
"THE HEART BLOCK POEM"

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

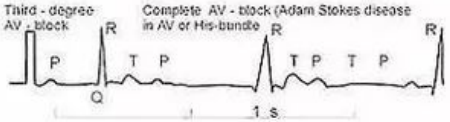
Longer, longer, longer, drop!
Then you have a WENCKEBACH.



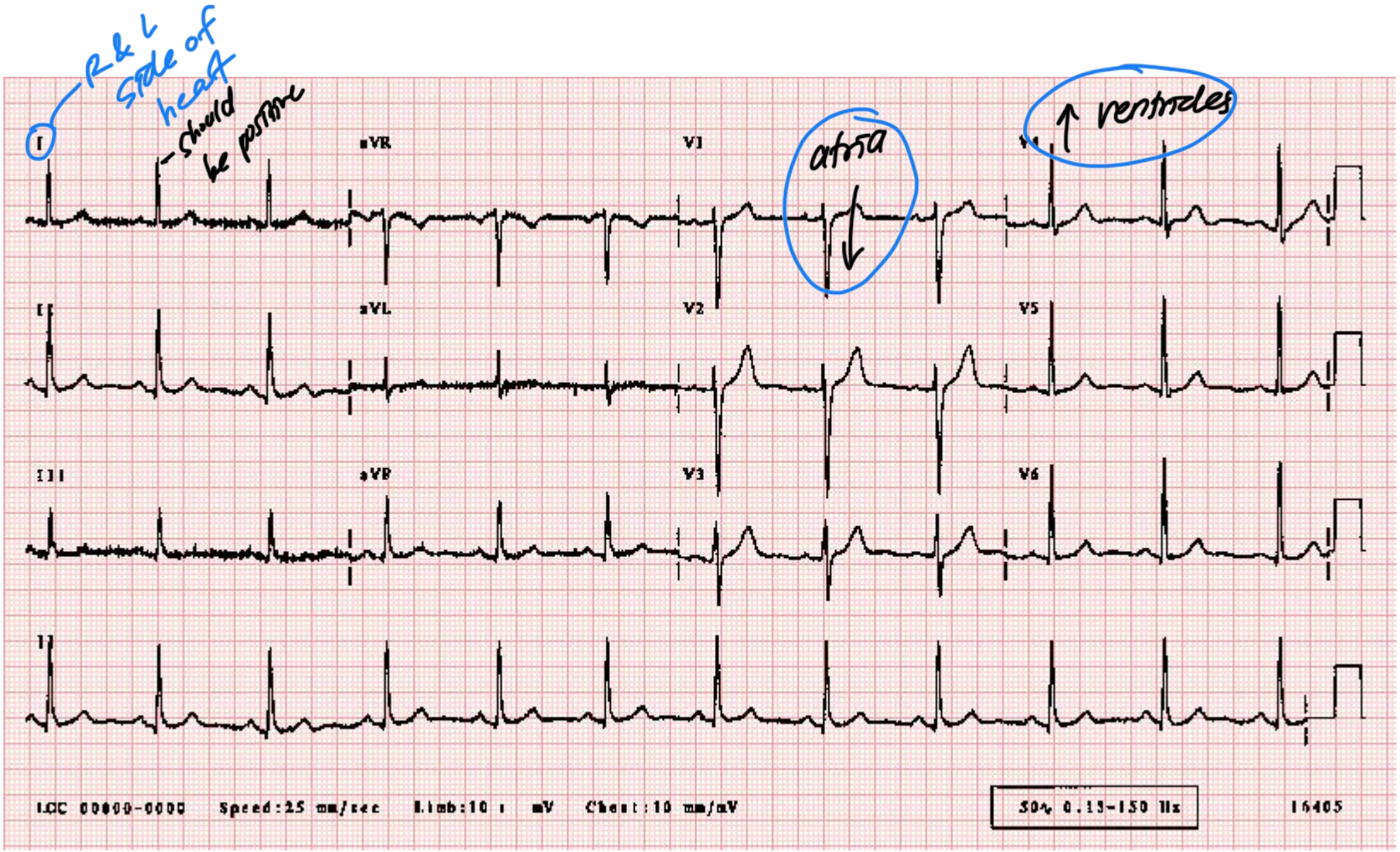
If some Ps don't get through,
then you have MOBITZ II.



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

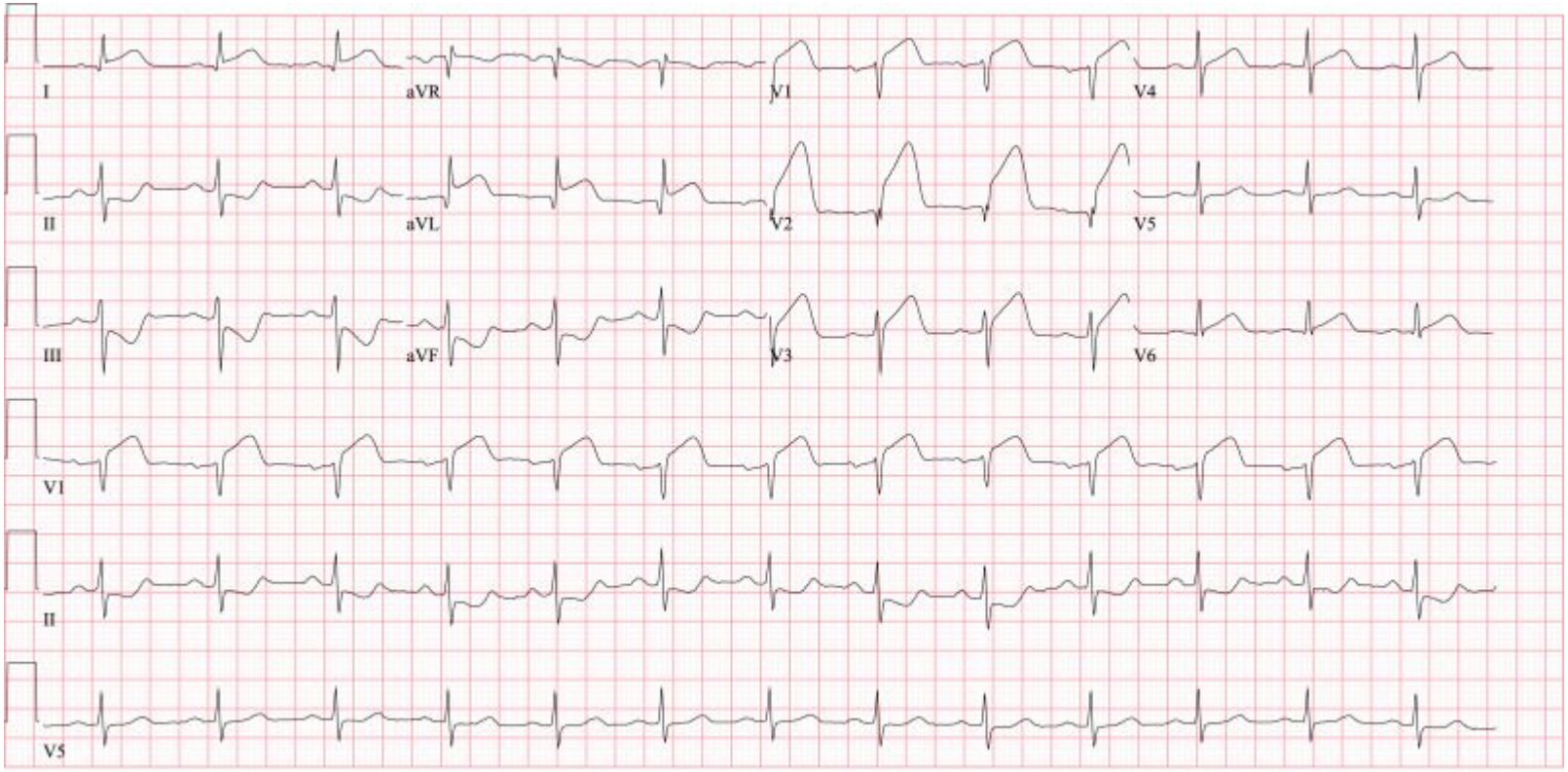


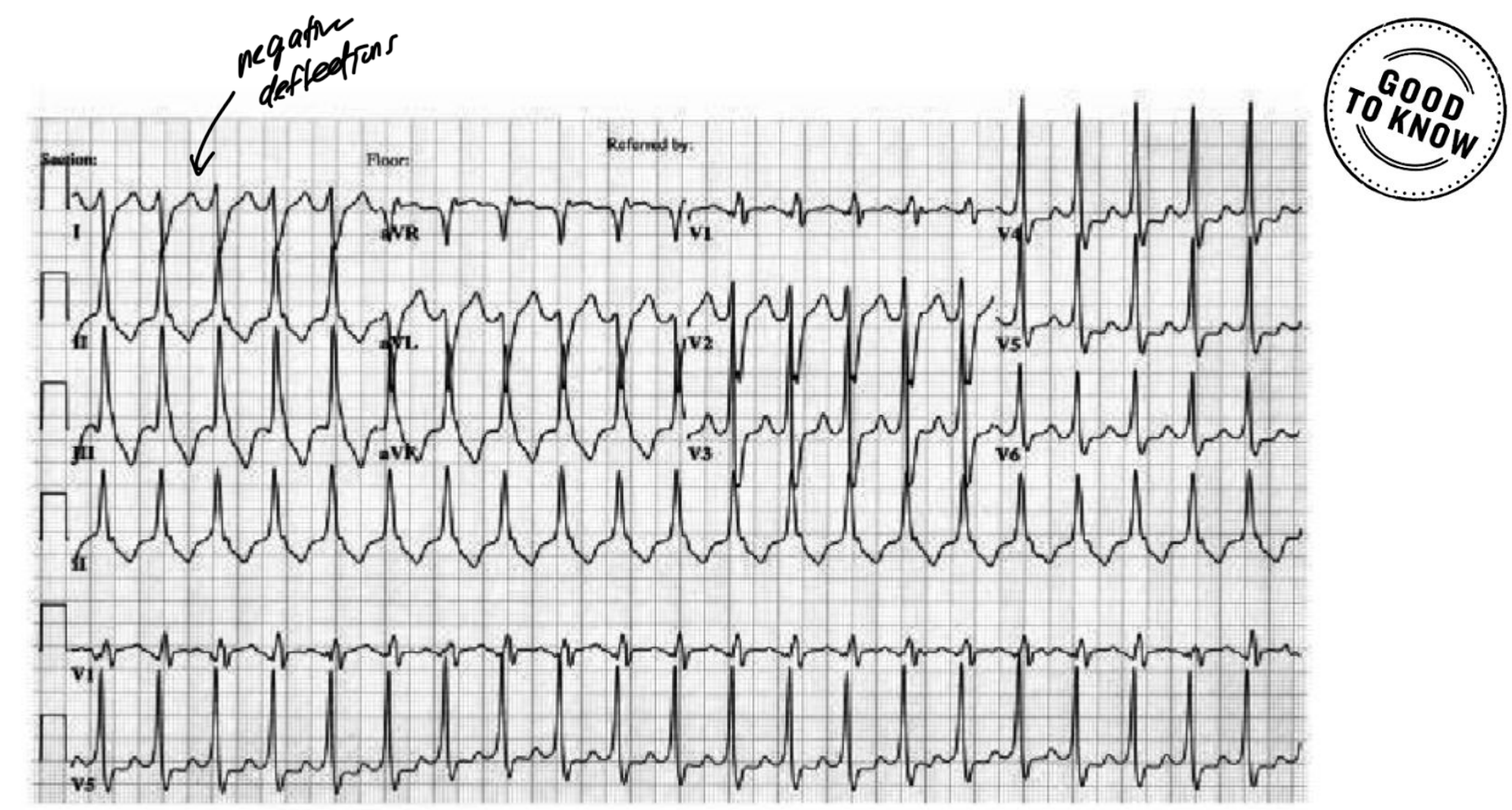
12 Lead EKG


R & L side of heart
- should be positive
I
aVR
V1
V4
atria
ventricles
II
aVL
V2
V5
III
aVF
V3
V6
II
LOC 00000-0000
Speed:25 mm/sec
Limb:10 mm/mV
Chest:10 mm/mV
50% 0.15-150 Hz
16405

GOOD TO KNOW

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


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
VI
II
V5
25mm/s 10mm/mV 40Hz


negative deflections
Section:
Floor:
Referred by:
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
V1
V5

GOOD TO KNOW

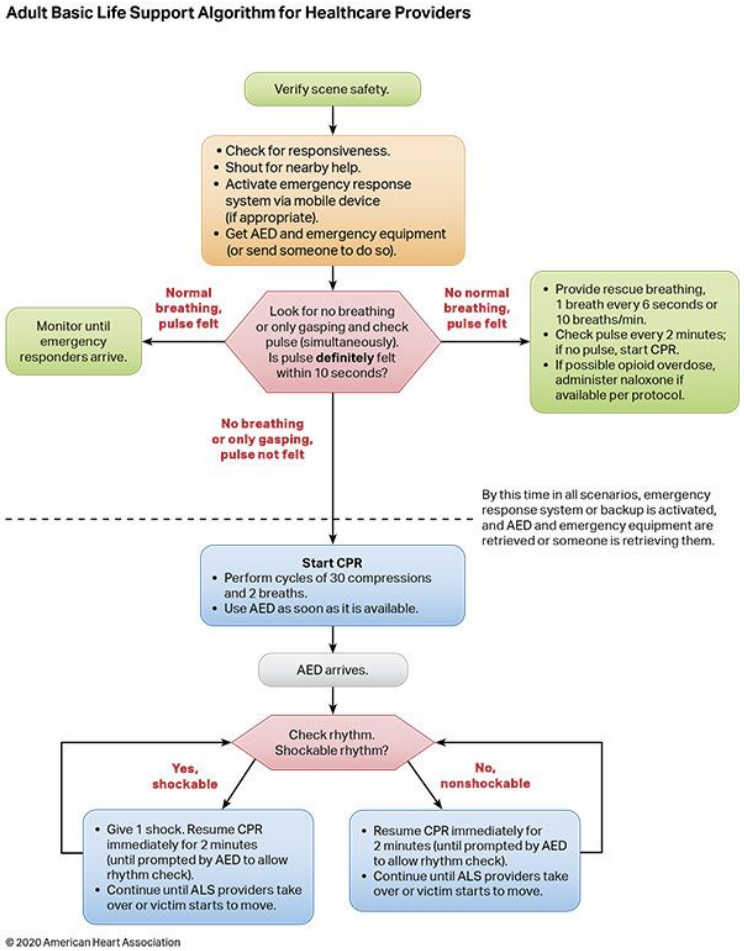
Code Blue

Roles in a code blue

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

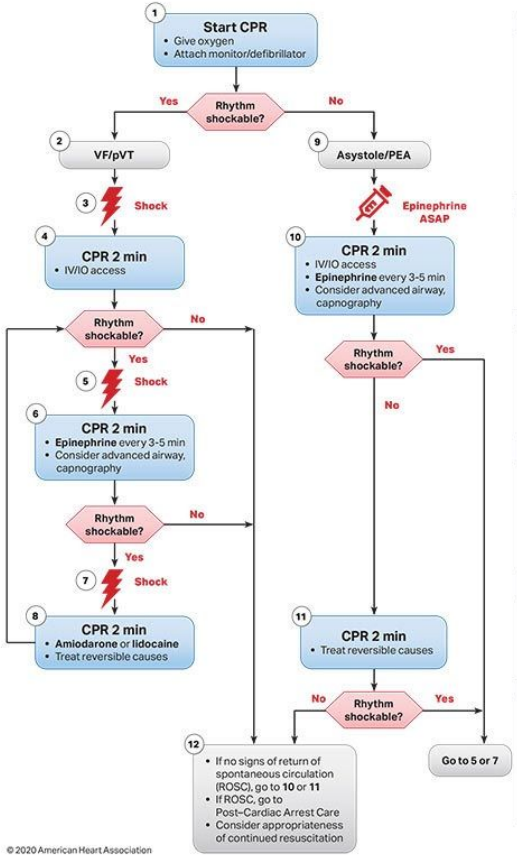
Basic Steps

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)



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.
- If no advanced airway, 30:2 compression-ventilation ratio.
- Quantitative waveform capnography
  - If P_{ETCO_2} 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
- **Amiodarone 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

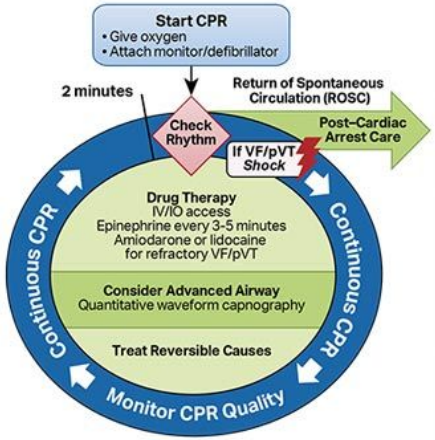
Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Abrupt sustained increase in P_{ETCO_2} (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

Adult Cardiac Arrest Circular Algorithm



CPR Quality

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- Quantitative waveform capnography
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- **Monophasic:** 360 J

Drug Therapy

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- Pulse and blood pressure
- Abrupt sustained increase in P_{ETCO_2} (typically ≥40 mm Hg)
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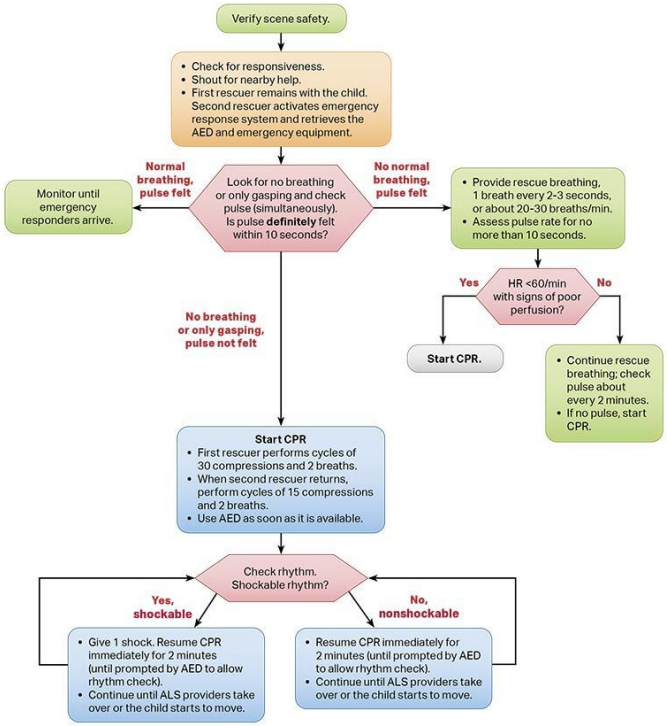
Reversible Causes

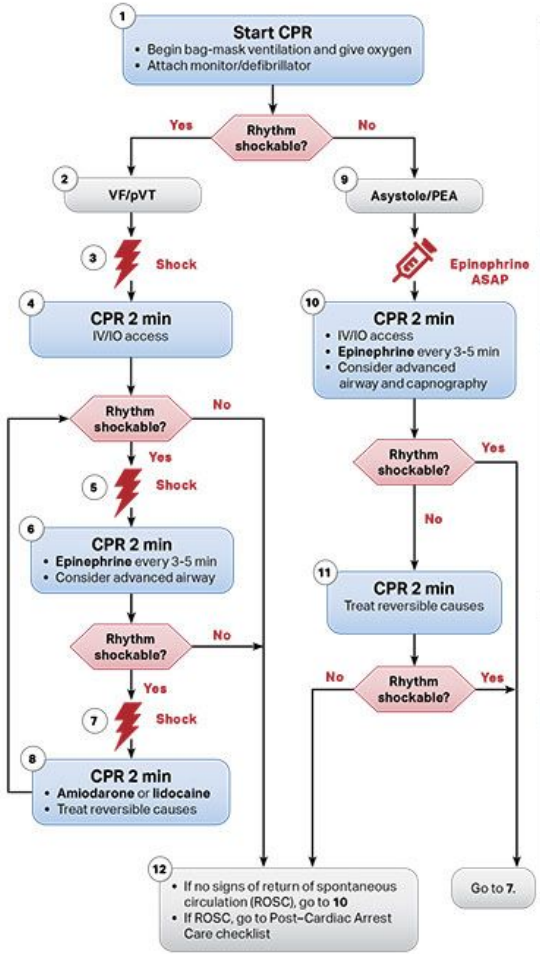
- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

Advanced Steps

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



Pediatric Cardiac Arrest Algorithm



CPR Quality

- Push hard (≥⅓ of anteroposterior diameter of chest) and fast (100-120/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Change compressor every 2 minutes, or sooner if fatigued
- If no advanced airway, 15:2 compression-ventilation ratio
- If advanced airway, provide continuous compressions and give a breath every 2-3 seconds

Shock Energy for Defibrillation

- First shock 2 J/kg
- Second shock 4 J/kg
- Subsequent shocks ≥4 J/kg, maximum 10 J/kg or adult dose

Drug Therapy

- **Epinephrine IV/IO dose:** 0.01 mg/kg (0.1 mL/kg of the 0.1 mg/mL concentration). Max dose 1 mg. Repeat every 3-5 minutes. If no IV/IO access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of the 1 mg/mL concentration).
- **Amiodarone IV/IO dose:** 5 mg/kg bolus during cardiac arrest. May repeat up to 3 total doses for refractory VF/pulseless VT
  or
  Lidocaine IV/IO dose: Initial: 1 mg/kg loading dose

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement

Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypoglycemia
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
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- **T**hrombosis, pulmonary
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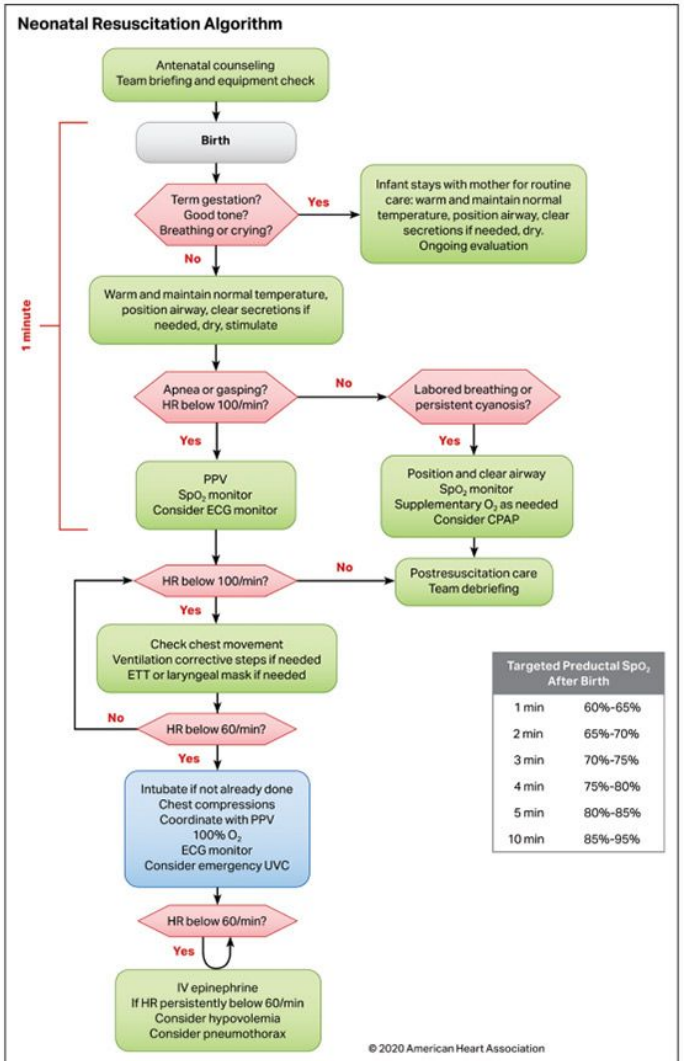
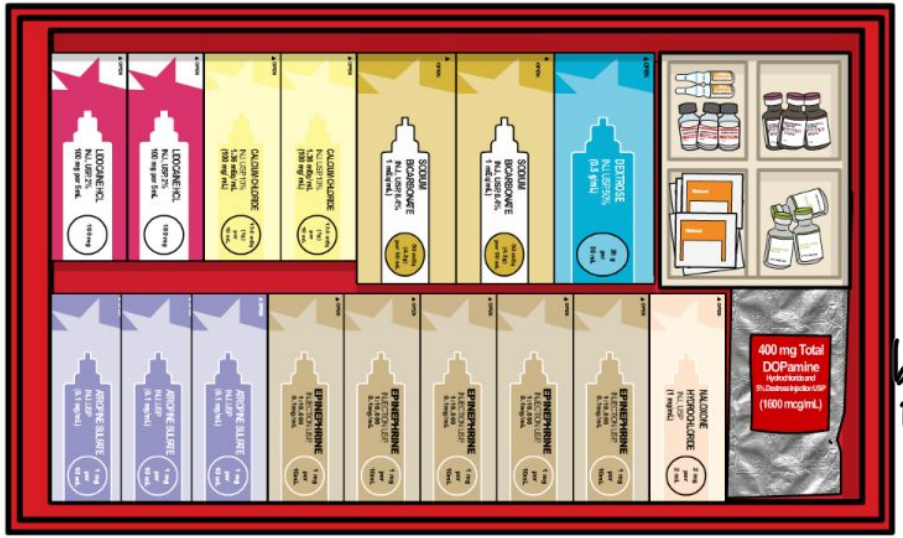
Advanced Steps



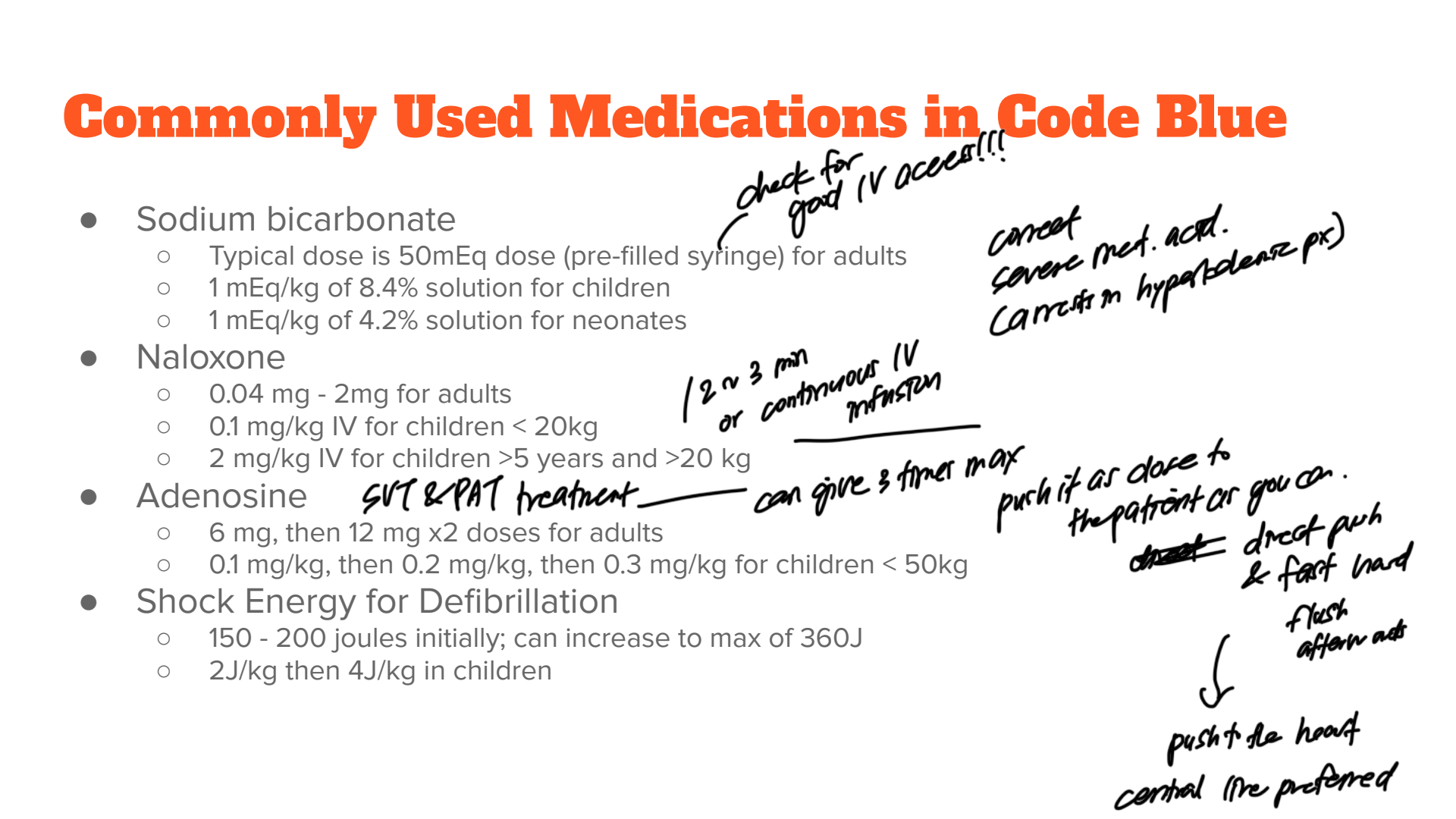
Commonly Used Medications in Code Blue



- Epinephrine
  - 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
  - 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
  - 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
  - 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



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