

# Advanced Cardiac Life Support

FOR REAL LIFE!



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# Chain of Events for Survival

- Recognize early warning signs
- Activate EMS
- Basic CPR
- Defibrillation
- Airway and ventilation
- Intravenous medications
- Return of Pulses
- Post Arrest Care

# Initial BLS

- A-V-P-U
- Calling the Emergency
- C-A-B!
- BLS before ALS

# CPR Practice/ Management of Respiratory Arrest

- 30:2 – Continuous Compressions when Intubated
- Airway Positioning – Head Tilt/Chin Lift or Possible Jaw Thrust (trauma)
- Airway management tools – Barrier Devices, OPA's, NPA's, and BVM.
- Rescue Breathing: 1 every 5 seconds

# PRACTICE

- CPR

- RESPIRATORY

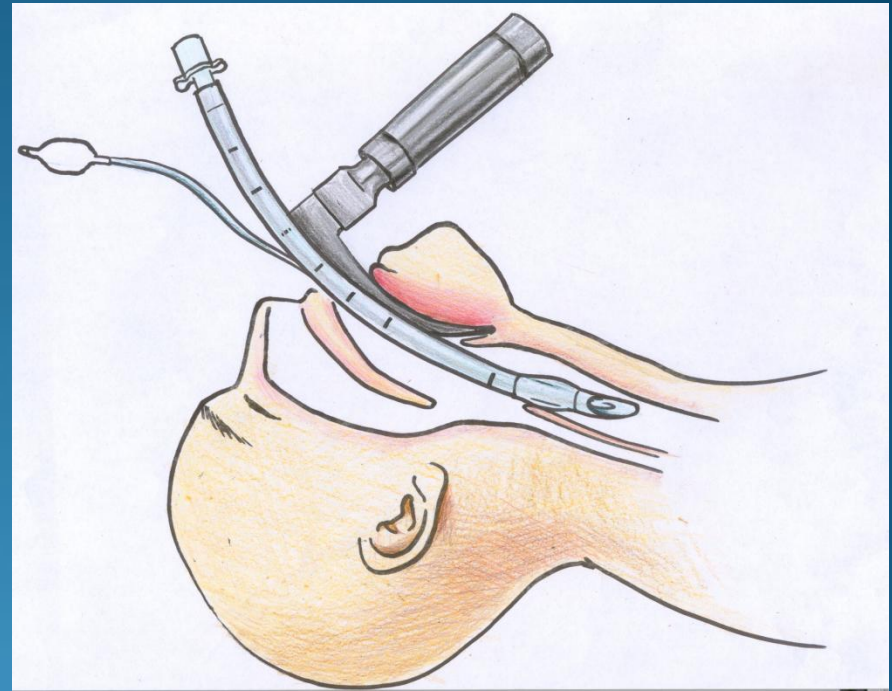
ARREST

# ACLS Secondary Survey

- PADS/Rhythm interpretation
- Airway control – Intubation or other comparable devices, Suction?
- I.V. Setup and Pharmacology
- Consider surrounding factors, Drips? Respirator? Etc.

# Intubation

- Oxygenate Pt. with Oral Adjunct and BVM
- Prepare equipment - Tube, suction, etc.
- Attempt to Intubate for <30 seconds – Cric Pressure
- Visualize tube passing the cords and inflate cuff
- Verify tube placement
- Record depth and Secure
- Problem Solving



# Intubation Practice



# Technology Review

- Type of Defibrillator
  - Monophasic/Biphasic
  - Setting Joules
  - Defibrillation
  - Synchronized Cardioversion
  - Pacing
- I.V. Pumps



# Defib: Biphasic V.s. Mono

- Monophasic – Recommended defibrillation dose = 360 joules
- Biphasic – Recommended defibrillation dose = 120 – 200 joules (depending on manufacturer)
- Know your Equipment!

# Synchronized Cardioversion

- ONLY FOR PERFUSING RHYTHMS
- Escalating Shock Therapy – 100- 200- 300 – 360.
- Synchronizing keeps time with QRS to reduce risk of “R on T” shock which can put the Patient into V-Fib.
- Use on:
  - Atrial tachycardia
  - Ventricular tachycardia
    - Monomorphic (usual) 100 joules
    - POLYMORPHIC (torsades de pointes) Magnesium Sulfate

# Other Defibrillator Points:

- Synchronize for any perfusing rhythm
  - Avoids precipitating ventricular fibrillation
  - Hold button down
- Check two leads for asystole
  - If no ventricular fibrillation noted, defibrillation not effective
- Lead disconnect can simulate asystole

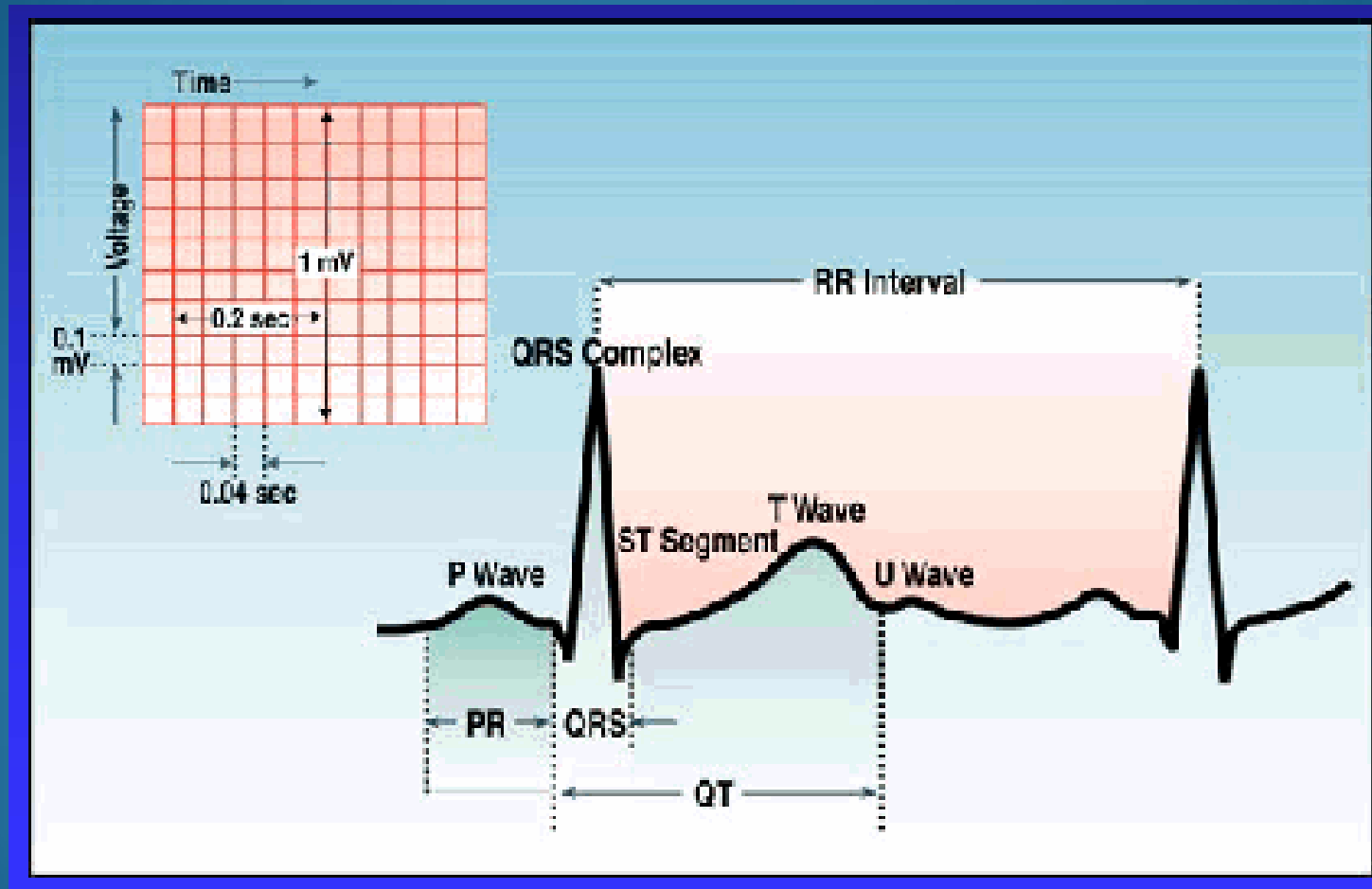
# Rhythms to recognize

- Normal sinus rhythm
- Atrio-ventricular (AV) blocks
  - 1<sup>st</sup> degree(not important)
  - 2<sup>nd</sup> degree
    - Type I (Wenkebach)
    - Type II (dangerous)
  - 3<sup>rd</sup> degree (complete, AV disassociation)
- Premature complexes
  - Atrial (no pause)
  - Ventricular (compensatory pause)

# Rhythms to Recognize

- Ventricular tachycardia
  - Monomorphic
  - Polymorphic (Torsades de pointe)
- Ventricular fibrillation
- Asystole (confirm)

# Basic Interpretation



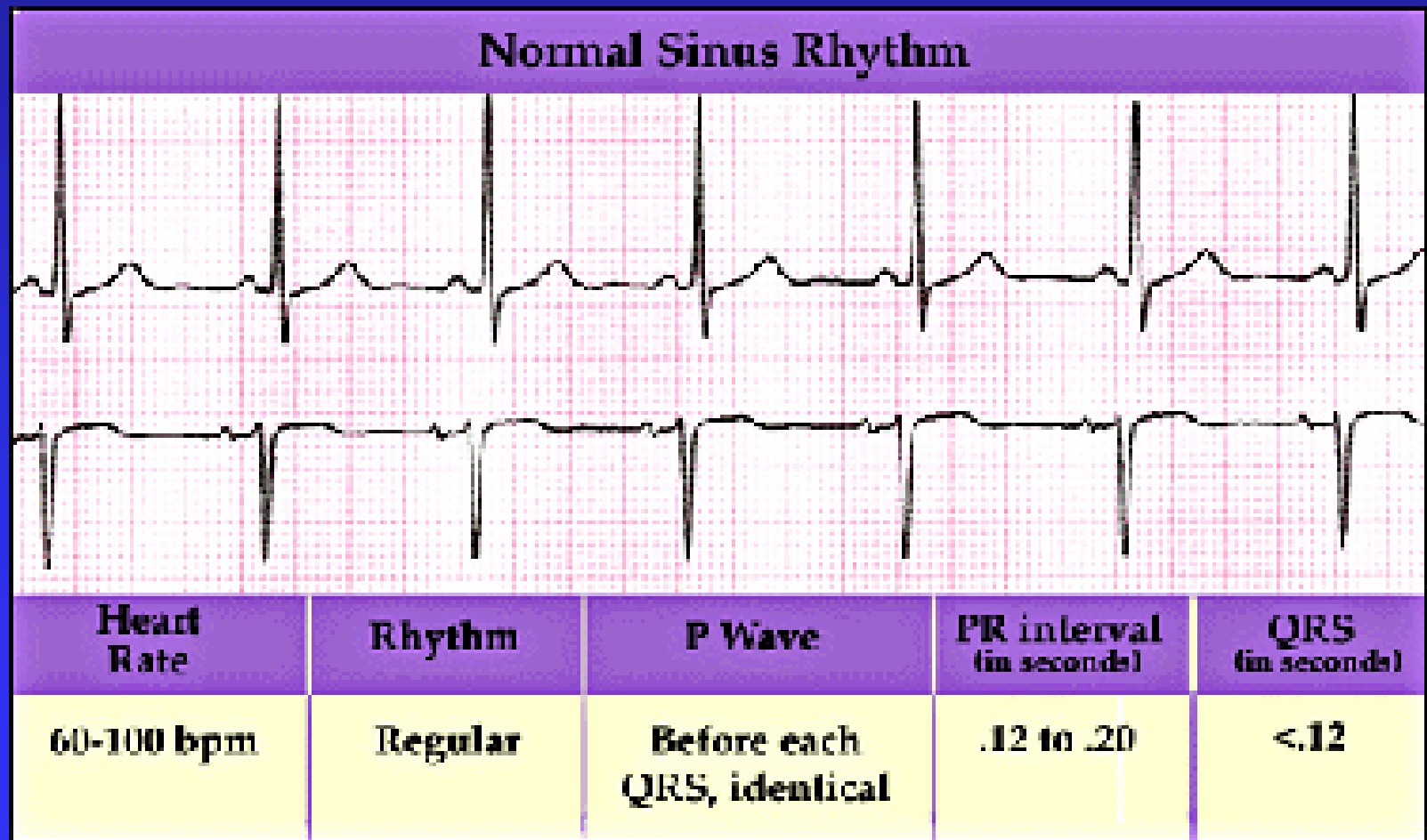
# Basic Interpretation continued

- Steps to Interpretation:

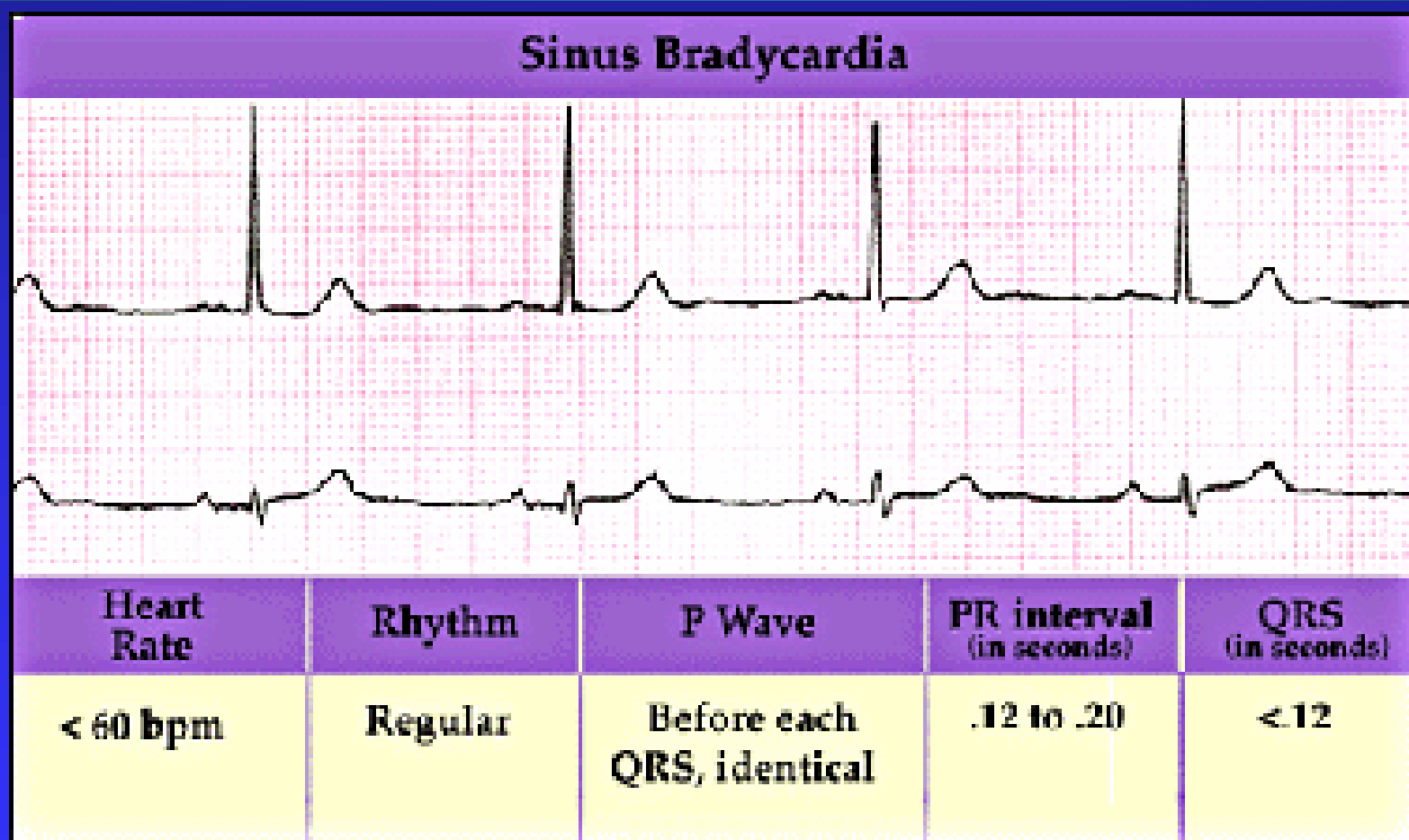
1. Rate?
2. Regular or Irregular?
3. P wave present?
4. P – R interval?
5. Does the QRS correlate with the P wave?



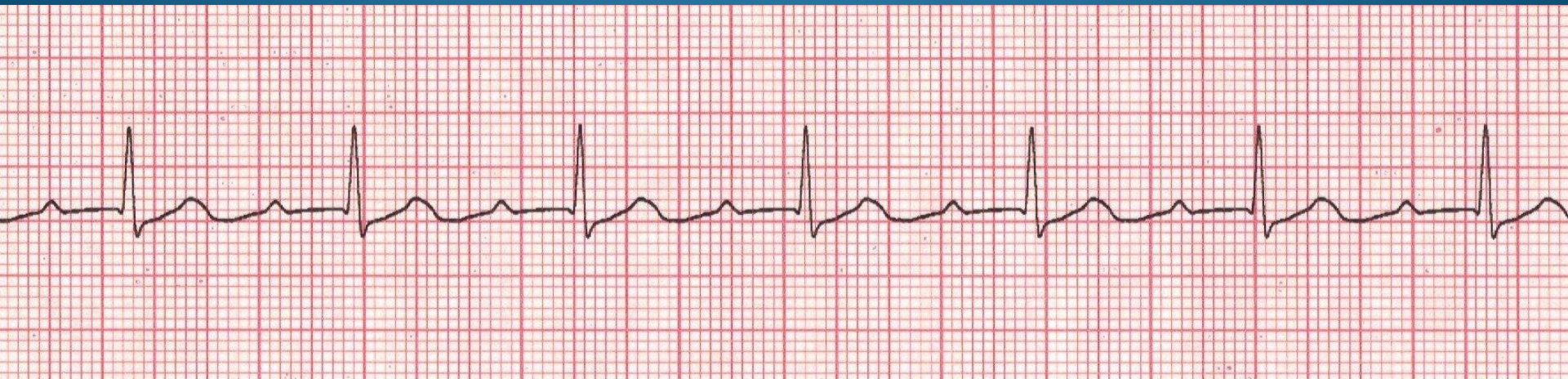
# Normal Sinus Rhythm



# Bradycardia



# First Degree Block



**Regularity:** R-R intervals are regular, overall rhythm is regular.

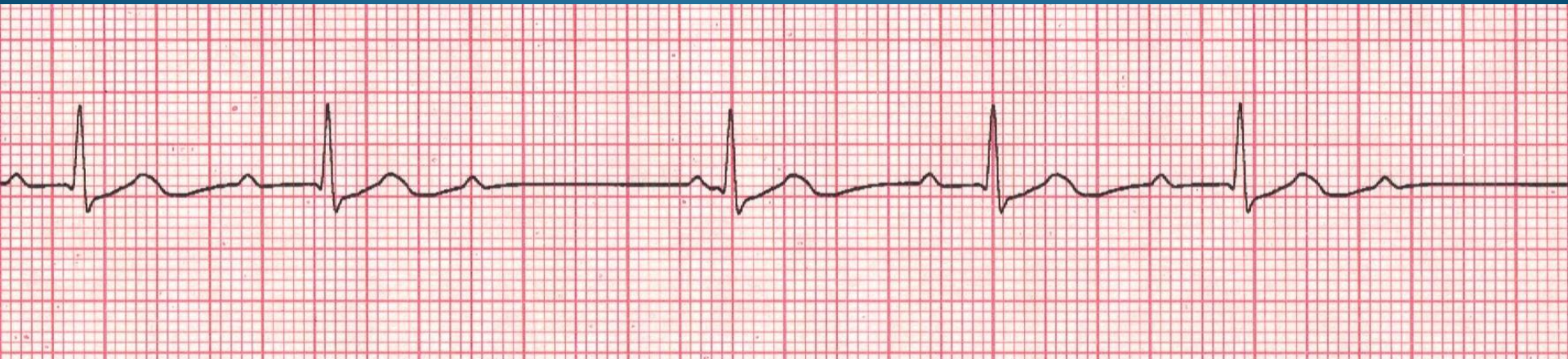
**Rate:** The rate depends on the underlying rhythm.

**P WAVE:** There is one p wave in front of every QRS. The P waves appear uniform.

**PRI:** Measures more than 0.20 seconds in duration. PRI is consistent.

**QRS:** Measures less than 0.12 seconds.

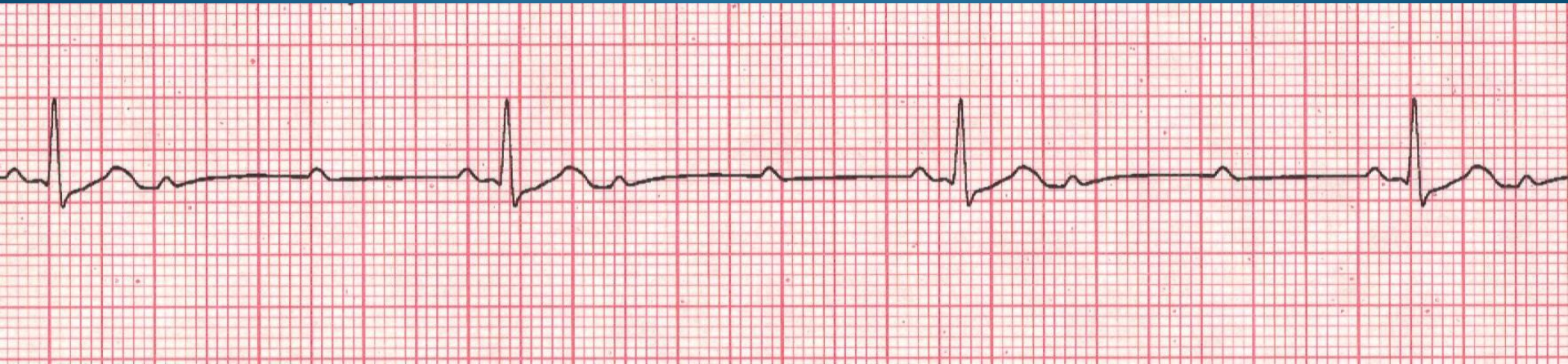
# 2<sup>nd</sup> Degree Block Type 1 (Wenkebach)



- **Regularity:** The R-R interval is irregular, but there is usually a pattern to it. The R-R interval gets longer as the PRI gets longer. **Rate:** The ventricular rate is usually slightly higher than the atrial rate due to some atrial beats not being conducted. The atrial rate is usually normal.
- **P WAVE:** P waves are upright and uniform. Most complexes will have a P wave in front of them, however there will be some that do not have a P wave.
- **PRI:** PR interval gets progressively longer until there is a dropped QRS complex.
- **QRS:** Measures less than 0.12 seconds

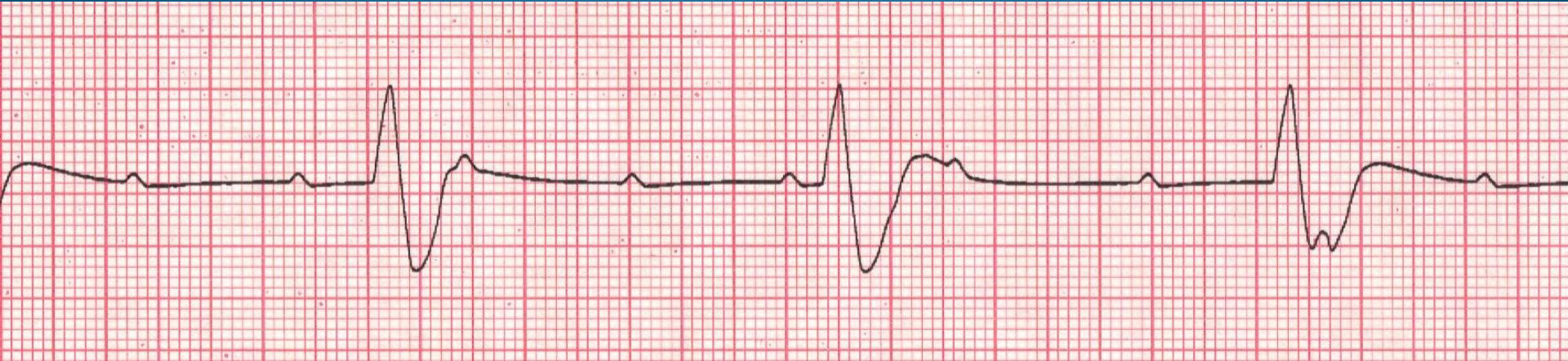


# 2<sup>nd</sup> Degree Block Type 2



- **Regularity:** If there is a **CONSISTENT** conduction ratio, then the R-R interval will be regular. If the conduction ratio is not constant, the R-R interval will be irregular. **Rate:** The atrial rate will be normal. The ventricular rate will be slower, usually  $1/2$  to  $1/3$ , than the atrial rate.
- **P WAVE:** P waves are upright and uniform. There is not a QRS following every P wave.
- **PRI:** PRI can only be measured on conducted beats, and it is usually constant across the strip. It may or may not be longer than a normal PRI (0.12 seconds).
- **QRS:** Measures less than 0.12 seconds.

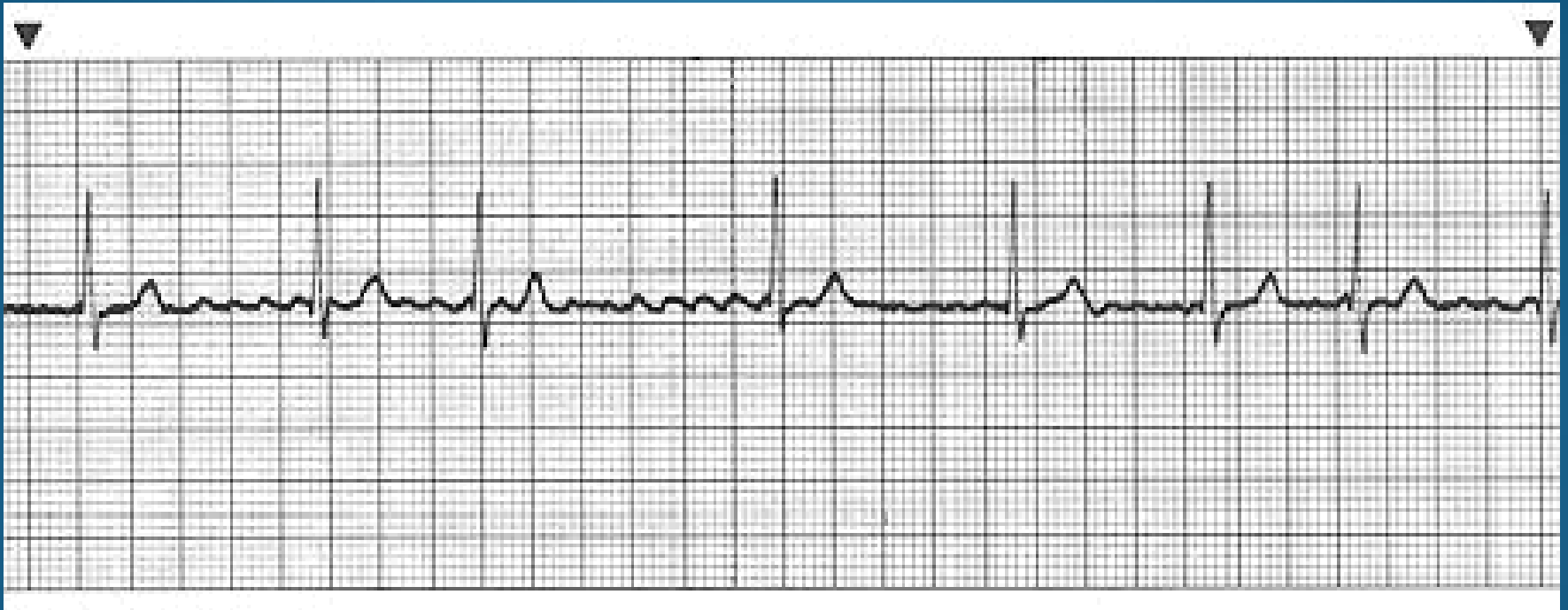
# 3<sup>rd</sup> Degree Block



- **Regularity:** R-R interval will be regular. P-P interval will also be regular.
- **Rate:** The atrial rate will be regular and normally be 60-100. Rate of the QRS complexes is dependent on the focus. If the focus is ventricular, the rate will be 20-40. If the focus is junctional, the rate will be 40-60.
- **P WAVE:** P waves are upright and uniform. There will be more P waves than QRS complexes.**PRI:** PRI is not measured because there is no relationship between P waves and QRS complexes.
- **QRS:** Usually measures more than 0.12 seconds, however if the focus producing the QRS complex is junctional, it will be less than 0.12 seconds.

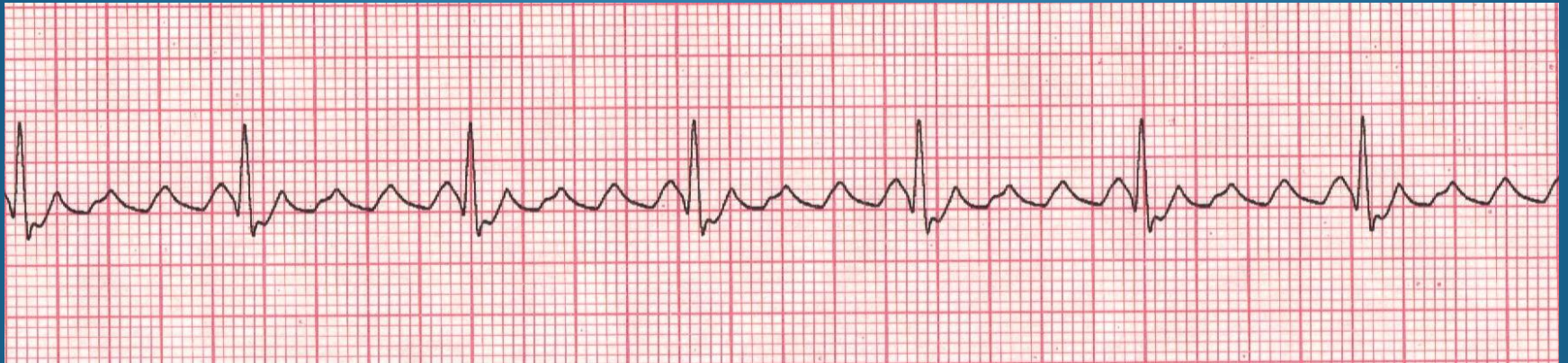
# Atrial

## FIBRILLATION





# Atrial Flutter

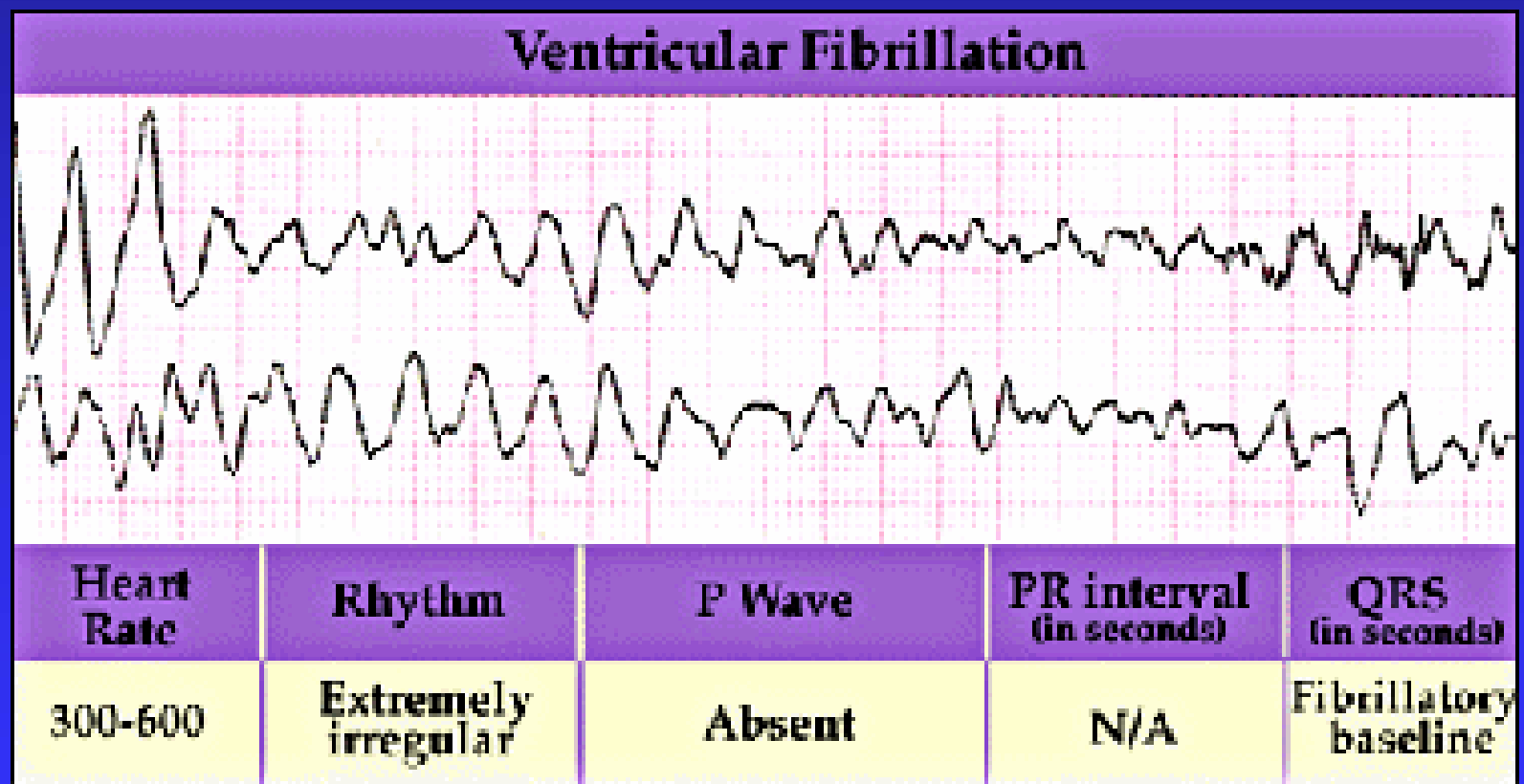




# Supra Ventricular Tachycardia



# V-Fib



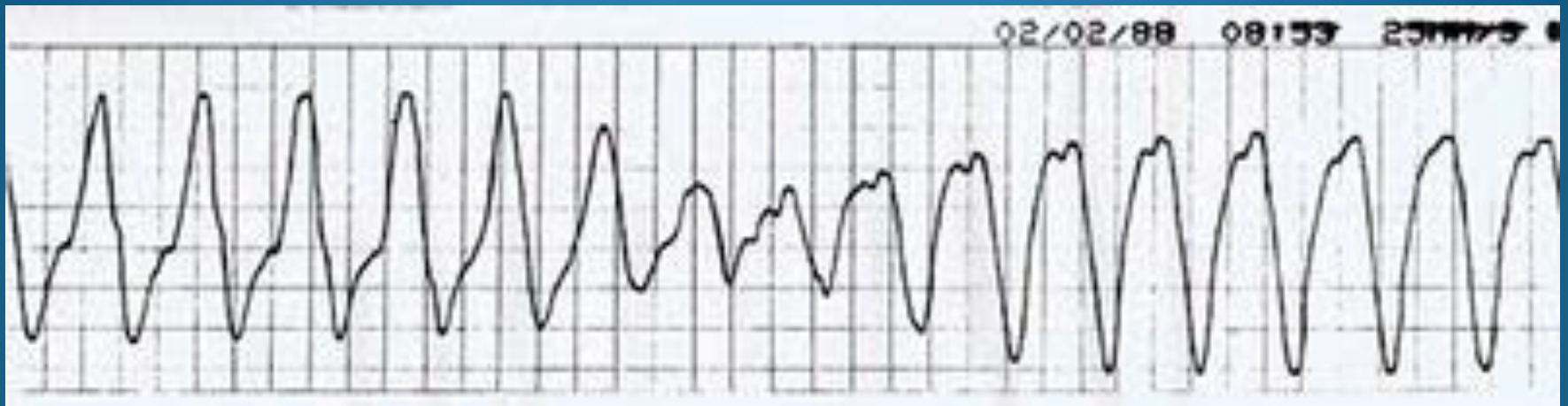
# V-Tach

**Ventricular Tachycardia (3 or more consecutive beats)**

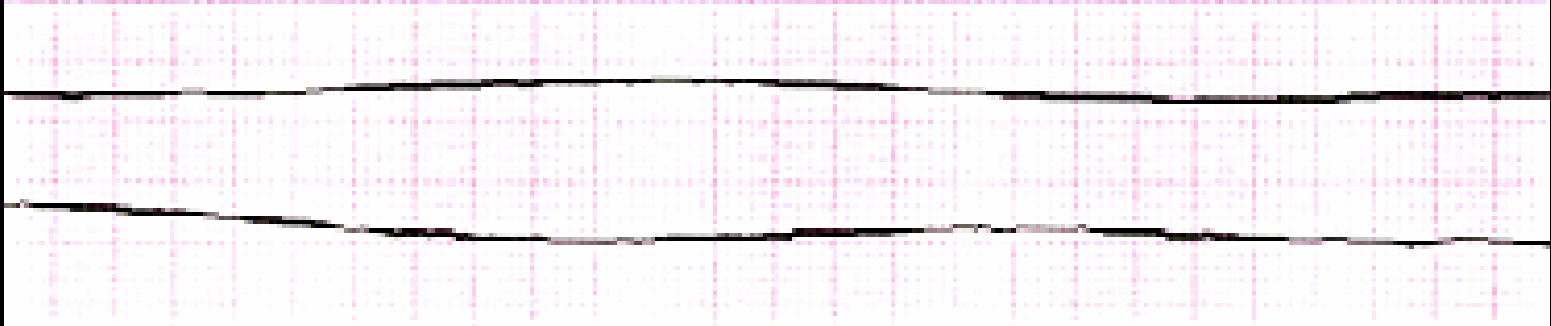


Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
<100	Regular	Absent or not related	N/A	$\geq .12$

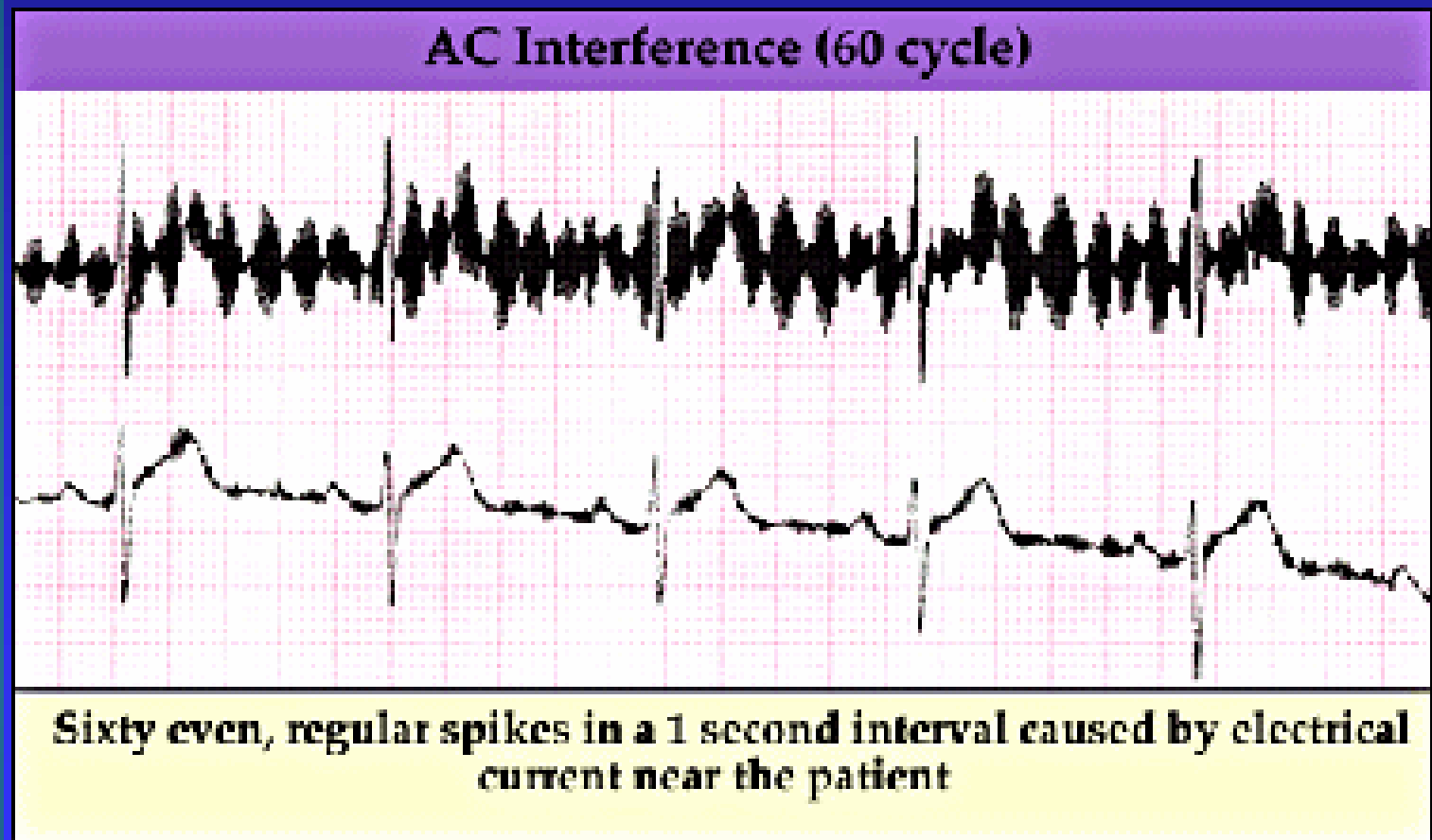
# Torsades de Pointes



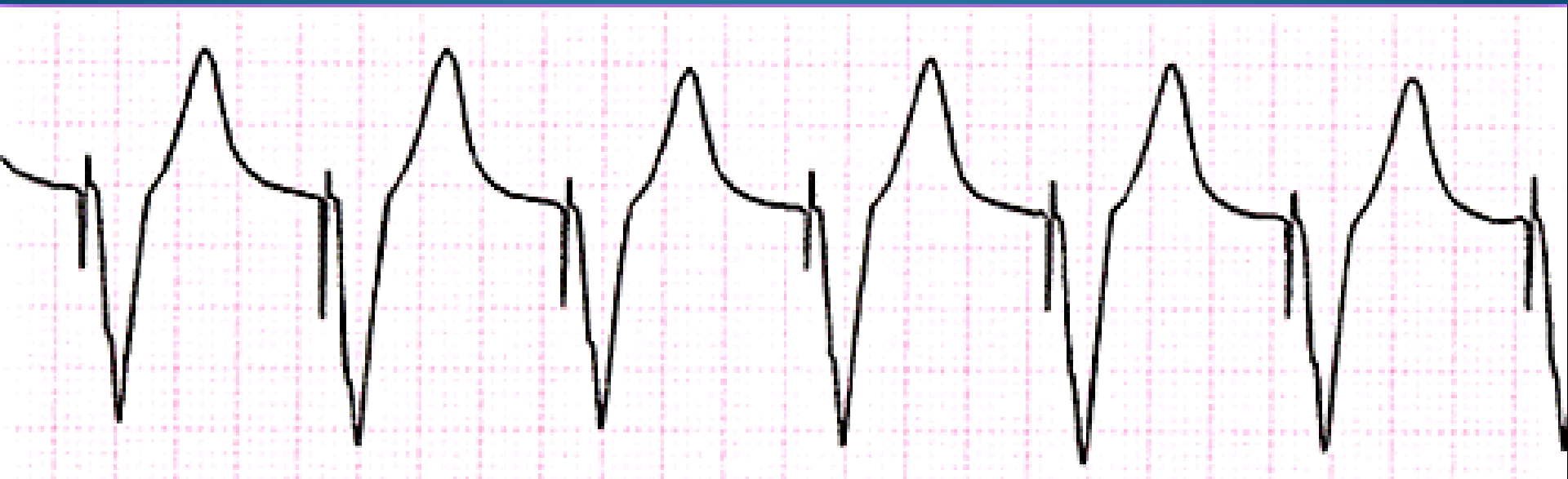
# Asystole

Ventricular Asystole (standstill)				
				
Heart Rate	Rhythm	P Wave	PR interval (in seconds)	QRS (in seconds)
Absent	Absent	Absent or present	N/A	Absent

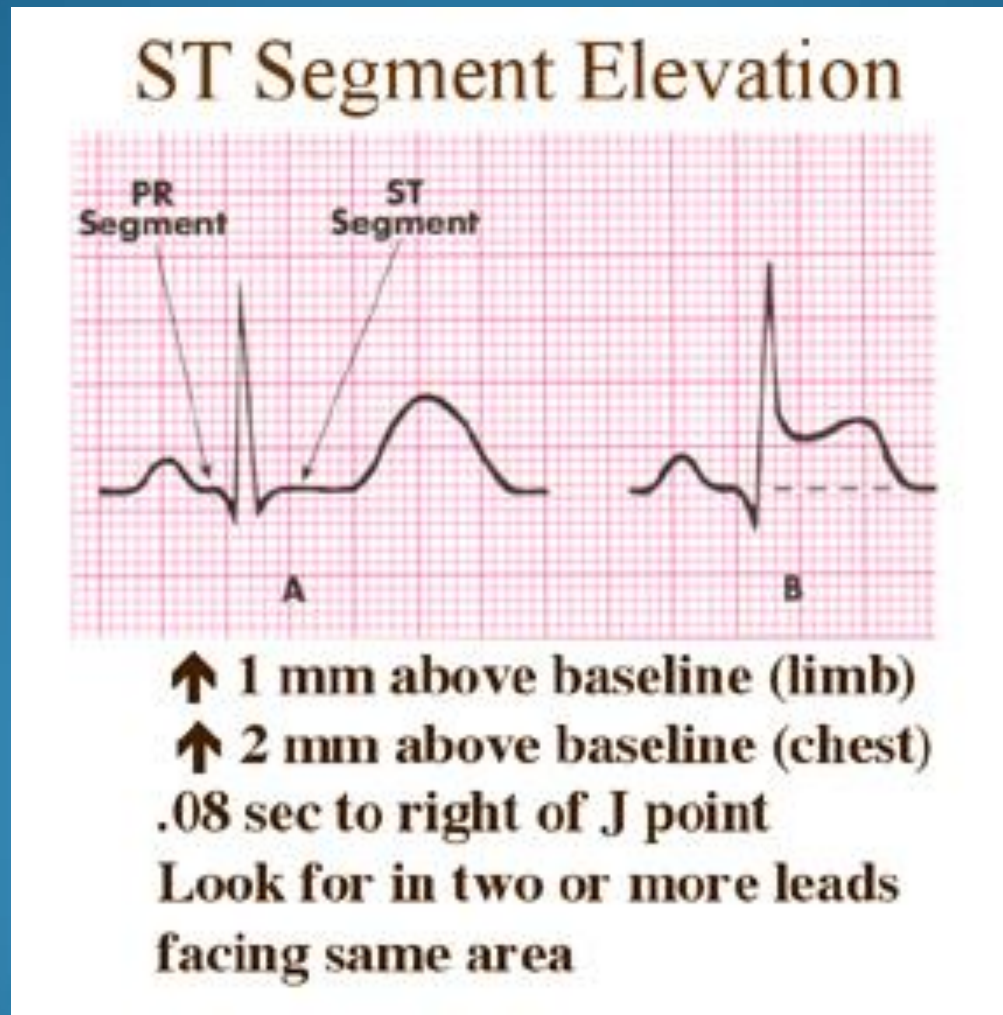
# Artifact



# What is going on here?

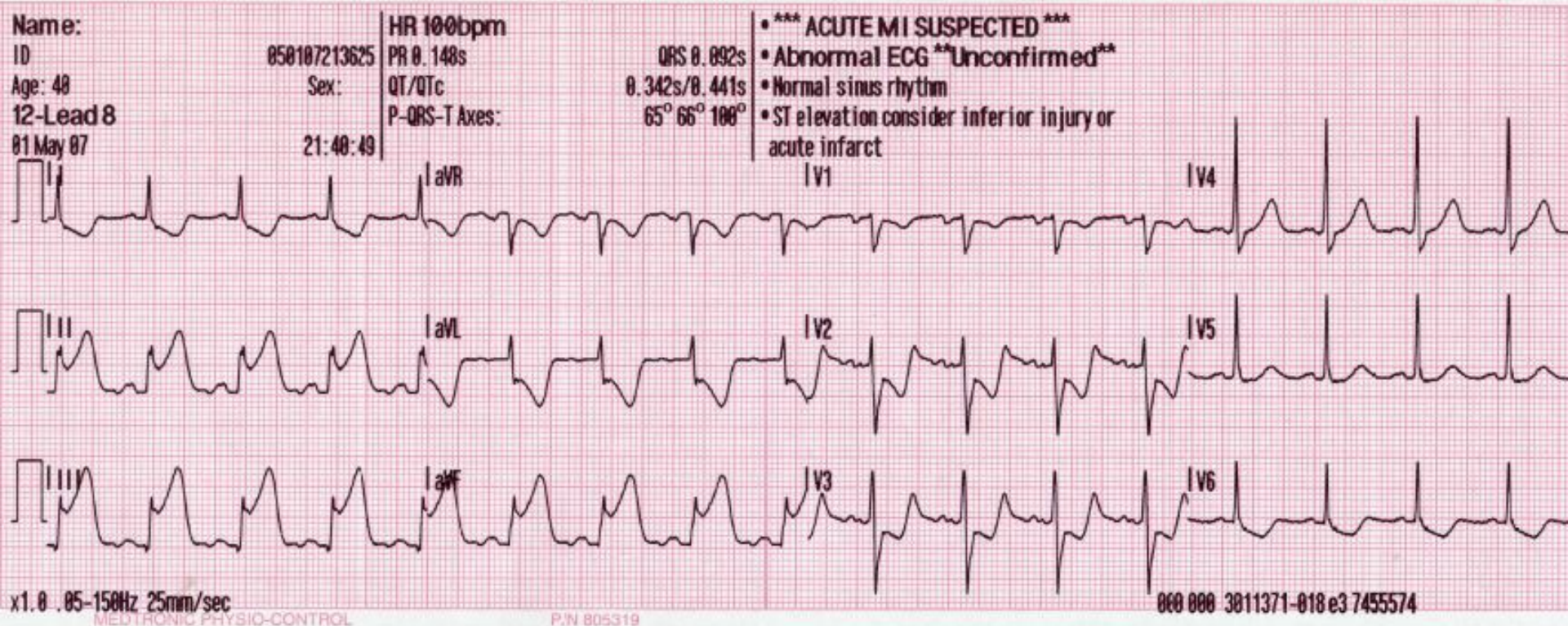


# Myocardial Infarction (12-Lead)



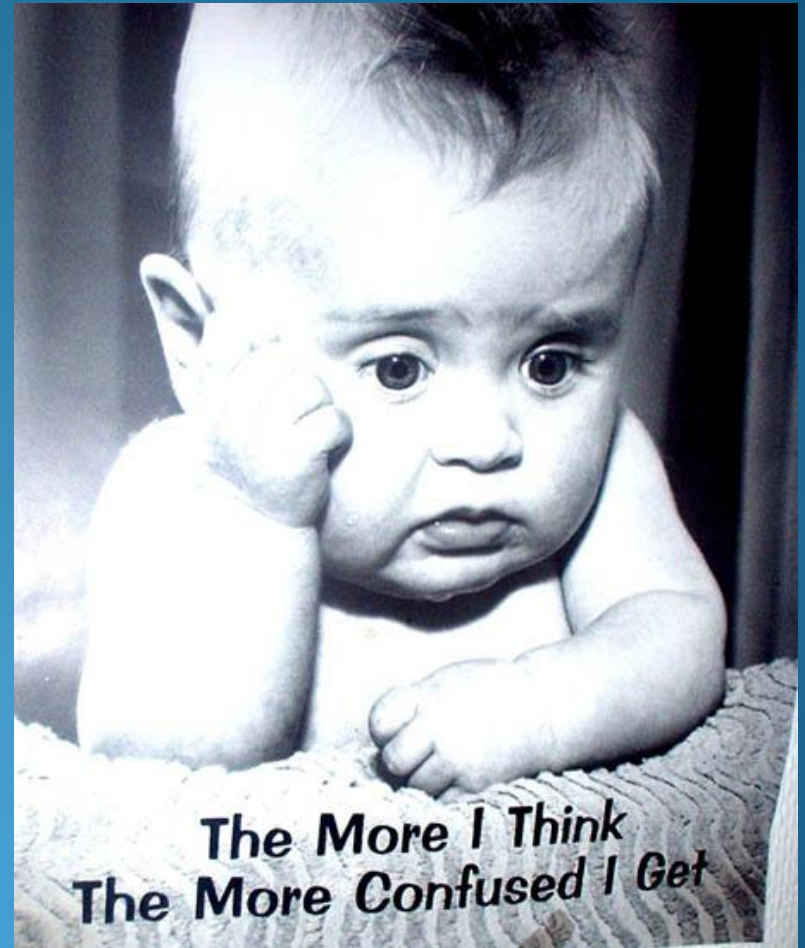


# Can you diagnose this problem?



# 12-Lead => Another Class

- Too much to learn in one day
- Consider Taking a 12-lead course

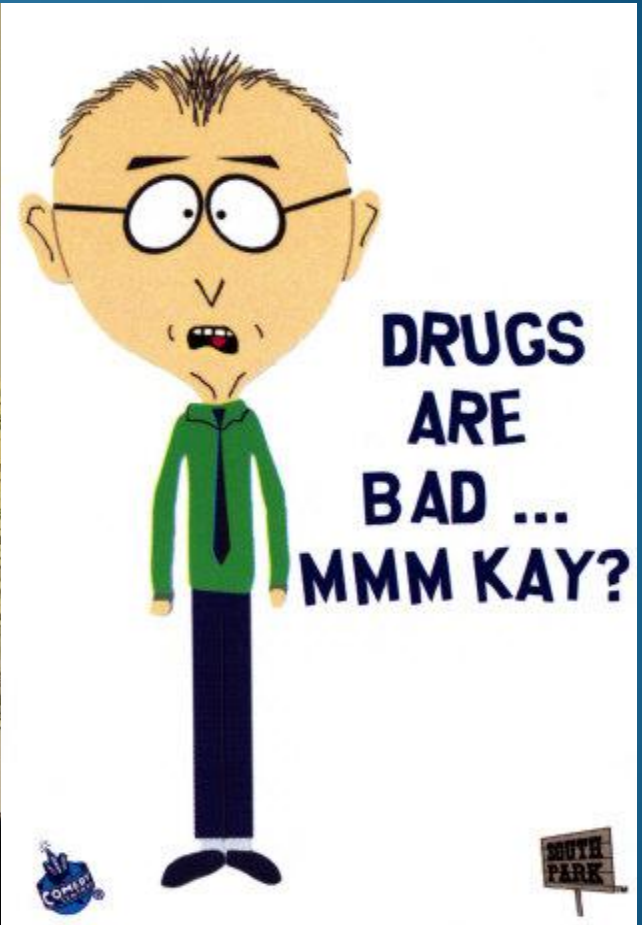


The background is a solid blue color with a gradient. At the top, there are several thin, wavy lines in shades of blue and green, creating a sense of movement or a horizon line.

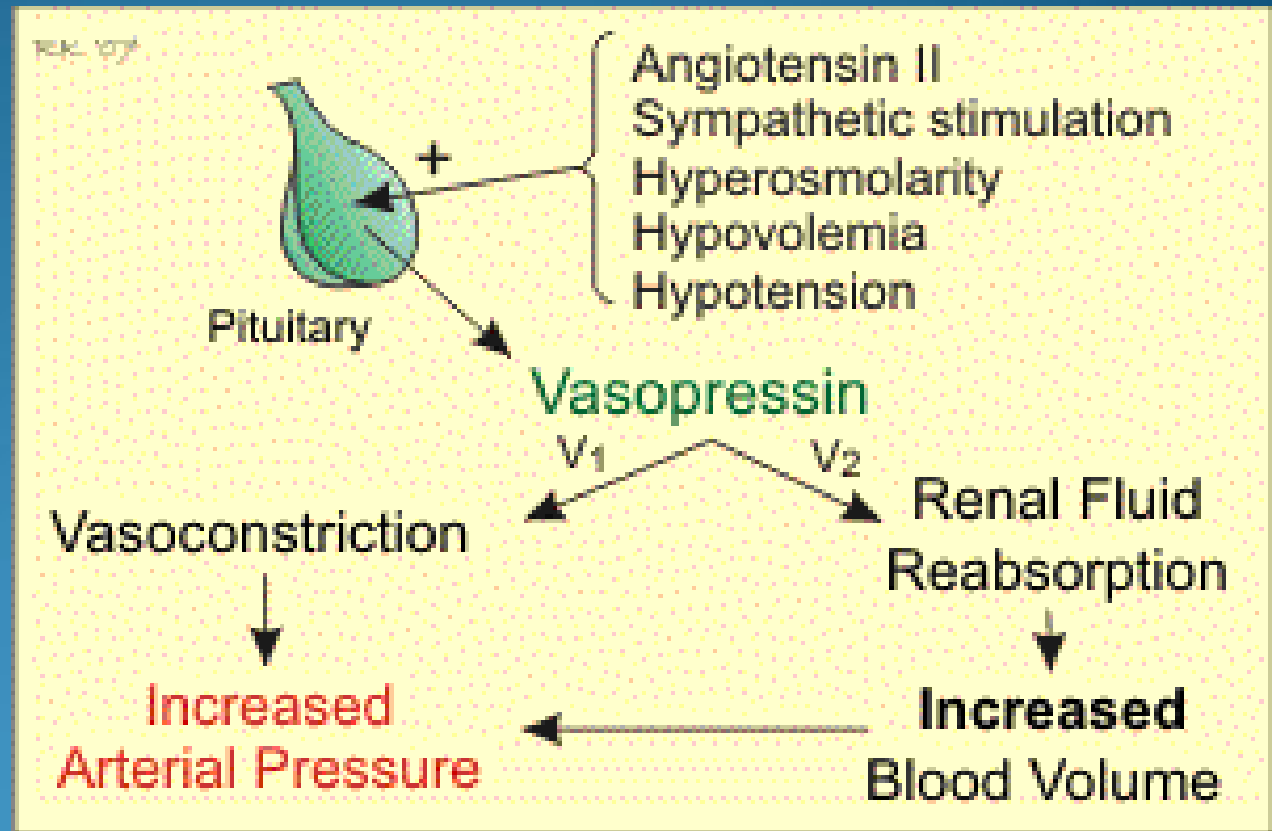
**BREAK!**



# DRUGS!!!



# Vasopressin – 40 units (first or second line only)



# Epinephrine – 1mg q 3-5mins

- Alpha effects confer benefit
- Increases systemic vascular resistance
- Increases aortic root pressure
- Perfuses coronaries
- Perfuses brain at expense of body
- Escalating or high doses without



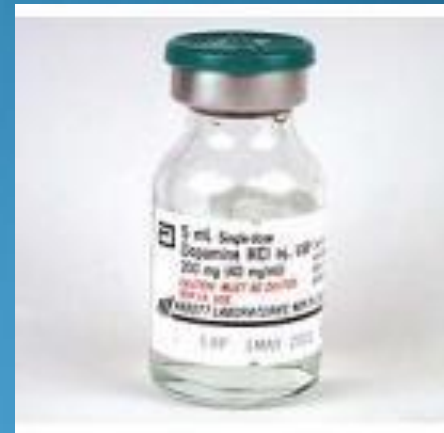
# Norepinephrine

- Potent alpha and beta agonist
- Indicated for severe hypotension (SBP < 70)
- Dose 1-30 micrograms/min
- Extravasation: infiltrate 5-10 mg of phentolamine



# Dopamine – 5-20 mcgs/min/kg

- Precursor of norepinephrine
- Alpha and beta adrenergic agonist
- Indicated with hypotension and bradycardia (raises SBP and HR)
- Dose 5-20 micrograms/min after cardiac arrest
  - 5-10 primarily beta stimulation
  - 10-20 additional potent alpha effect





# Dobutamine

- Potent beta-1 selective ventricular inotrope
- Use for severe systolic dysfunction
- Reflex tachycardia due to peripheral vasodilation
- 5-20 micrograms/min



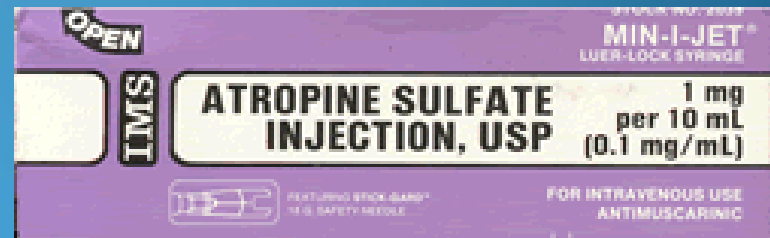
# Antiarrhythmics

- Amiodarone – 300 mg, 150 mg
  - Potassium-channel blocker. - Class III antiarrhythmic.
  - Sodium – Potassium Pump
- Lidocaine – 1 to 1.5 mg/kg
  - Increases the V-Fib Threshold to return heart to a non-lethal rhythm
- Know the Meds you carry!



# Atropine 0.5 to 1 mg q 3-5 mins, max of 3mg

- Injections of atropine are used in the treatment of bradycardia. This works because the main action of the vagus nerve of the parasympathetic system on the heart is to decrease heart rate. Atropine blocks this action and, therefore, may speed up the heart rate.
- Beware of Blocks and M.I.



# Adenocard - 6mg... 12mg

- Adenocard (adenosine injection) slows conduction time through the A-V node, can interrupt the reentry pathways through the A-V node, and can restore normal sinus rhythm in patients with paroxysmal supraventricular tachycardia (PSVT), including PSVT associated with Wolff-Parkinson-White Syndrome.



# Cardizem – 20mg slow IVP

- Diltiazem is a potent vasodilator, increasing blood flow and variably decreasing the heart rate via strong depression of A-V node conduction. Its pharmacological activity is somewhat similar to verapamil.
- Negative chronotropic effect. Diltiazem causes a modest lowering of heart rate. This effect is due to slowing of the SA (sinoatrial) node. It results in reduced myocardium oxygen consumption.



# Sodium Bicarbonate – 1 meq/kg

- No changes
- Hyperkalemia (class I)
- Pre-existing acidosis (class IIa)
- TCA overdose (class IIa)
- ASA overdose (class IIa)
- Prolonged arrest (class IIb)
- Return of spontaneous circulation (class IIb)
- NOT in hypoxic, lactic acidosis cardiac arrest!

# Other Basic ACLS Drugs

- Oxygen – Yes it's a drug
- Aspirin
- Nitro
- Morphine
- Calcium Chloride
- Magnesium Sulfate
- Narcan
- Dextrose

# Routes for Drug Administration

- Evidence for effectiveness for all drugs is weak
- Drugs are secondary interventions
- I.O.
- Peripheral still first choice
  - flush with NS
  - 1-2 minutes to central circulation
- If no response to drugs and defibrillation
  - Consider central line
    - Internal jugular (IJ) preferred (or supraclavicular subclavian)
    - Femoral less preferred
  - Avoid non-compressible sites if possible





# Care for Myocardial Infarction

- Oxygen is routine
- Aspirin: 160-325mg
- FULL Set of Vital Signs including 12-Lead
- SAMPLE and OPQRST
- Nitroglycerin
  - Be careful with Sexual enhancing drugs
  - Need SBP >90
  - 3 sprays q 3-5 minutes until drip is established
- Morphine if 3 sprays don't relieve pain
- Blood Testing and Troponin Levels

# Care for Stroke

- S/S of possible stroke
- CAB , O<sub>2</sub>, and other Supportive Measures
- Perform Prehospital Stroke Scale
- Establish time when Pt. was last scene normal
- Call Stroke Alert
- Blood work, 12- Lead, In depth stroke assessment, and I.V. access
- NON – Contrast CT of brain
  - Bleed – Consult Neurosurgeon
  - Ischemic - Consider Fibrinolytics

# Mega code Review

- V-Fib/V-Tach
- Asystole
- PEA
- A-Fib/Flutter
- SVT
- Bradycardia
- Post Resuscitation – Rate, Rhythm, Blood Pressure



# V-Fib/Pulseless V-Tach

- This is easy!
- CAB / CPR
- Defib 2 minutes apart between CPR (360)
- Airway and I.V. Upgrades
- Epi 1mg IV every 3-5 minutes, or Vasopressin 40 units IVP once, but then followed by Epi
- Amiodarone (Ib) 300mg IVP (second dose if recurrent V-fib 150 mg) or other antiarrhythmic.
- Consider surrounding possible causes – H's and T's

# V-Fib & Pulseless V-Tach

- 1) Initiate BLS Care, Attach Defib Pads, and Call Code
- 2) For a patient with an unwitnessed onset of V. Fib or Pulseless V. Tach, initiate BLS CPR for 2 minutes. If Witnessed, Shock can be immediate.
- 3) Defibrillate once at **360 joules and repeat defibrillation every 2 minutes, after BLS CPR and medications Defibrillation dose should escalate with each shock**
- 4) Continue BLS CPR for a minimum of two minutes. Then re-assess ECG Rhythm. If still VF:
- 5) Defibrillate at **360 joules. Resume BLS CPR**
- 6) Administer **Vasopressin once or Epinephrine, circulate with 2 minutes of BLS CPR**
- 7) Defibrillate at **360 joules. Resume BLS CPR**
- 8) Administer **Antiarrhythmic, IV/IO push, circulate with 2 minutes of BLS CPR**
- 9) Defibrillate at **360 joules. Resume BLS CPR**
- 10) Administer **Epinephrine, 1 mg IV/IO push, circulate with 2 minutes of BLS CPR**
- 11) Defibrillate at **360 joules. Resume BLS CPR**
- 12) Administer **Amiodarone, 150 mg, IV/IO push, circulate with 2 minutes of BLS CPR**
- 13) Defibrillate at **360 joules. Resume BLS CPR**
- 14) Administer **Epinephrine, 1 mg IV/IO push, circulate with 2 minutes of BLS CPR**
- 15) Defibrillate at **360 joules. Resume BLS CPR**
- 16) **If patient is in polymorphic ventricular tachycardia (Torsades) Administer Magnesium Sulfate**
- 17) Defibrillate at **360 joules. Resume BLS CPR for 2 minutes**
- 18) If pulses are restored move on to Post Resuscitative Care

# Aystole

- 1) BLS and CPR
- 2) Confirm Asystole in 2 or more leads
- 3) Administer **Vasopressin or Epi IV/IO push, circulate with 2 minutes of BLS CPR**
- 4) Administer **Epinephrine, 1 mg IV/IO, 3 to 5 minutes after first Vasopressor dose, circulate with 2 minutes of BLS CPR**
- 5) Administer **Epinephrine IV/IO, 3 to 5 minutes after previous Epinephrine dose, circulate with 2 minutes of BLS CPR**
- 6) Administer **Epinephrine every 3 to 5 minutes while circulating with 2 minutes of BLS CPR. Atropine is usually only given 3 times in 1 mg increments. Consider H's and T's**
- 7) If pulses are restored, start Post Resuscitative Care.

# PEA – Pulseless Electrical Activity

- Same exact steps as Aystole, however, be more aware of the H's and T's:
  - Hydrogen Ion Acidosis- Consider **Sodium Bicarbonate, 1 Meq/Kg**
  - Hyperkalemia (renal failure)- Consider **Calcium Chloride 1 gram then Sodium Bicarbonate 1Meq/kg**
  - Hypovolemia- Consider fluid bolus (check lung sounds)
  - Hypothermia- Consider warming the patient
  - Hypoglycemia- Check blood glucose level and treat as appropriate
  - Hypomagnesemia - Administer **Magnesium Sulfate 2 grams IV**
  - Thrombosis (AMI)- Consider **Dopamine infusion, 5 mcg/kg/min**
  - Toxins or tablets (Drug Overdose)- Consider antidote
  - Tension Pneumothorax- Pleural Decompression



# Post Resuscitative Care

- RATE
  - Less than 60 – Consider Atropine
- RHYTHM
  - Does this Pt. Require a Antiarrhythmic Drip?
  - Is the Pt. showing signs of deterioration? Ex. PVC's
- BLOOD PRESSURE
  - Fluid Bolus
  - Dopamine or similar drug
- 12-LEAD
- INDUCED HYPOTHERMIA





# Tachyarrhythmias

- Narrow QRS complex (<120 msec)
  - Sinus
  - Atrial fibrillation
  - Atrial flutter
  - Atrial tachycardia (digoxin toxicity)
  - Multifocal atrial tachycardia (COPD)
  - AV nodal re-entrant tachycardia (PSVT)
  - Junctional tachycardia

# Supraventricular Tachycardia (SVT)

- **DO NOT Administer Adenosine if ECG Rhythm is A-Fib or A-Flutter**
- **If STABLE**
  - Attempt Vagal Maneuver
  - Administer **Adenosine 6 mg Rapid IV (over 1-3 seconds)** If no change after 1 minute, repeat **Adenosine 12 mg Rapid IV (over 1-3 seconds)**
  - If rhythm has not converted, or the rhythm is A-Fib or A-Flutter, administer **Cardizem up to 20 mg IV over 2 minutes (titrate until heart rate is controlled)**
- **If UNSTABLE (BP, LOC, PE, MI)**
  - If time permits - sedate
  - Perform **synchronized cardioversion: 100 joules, 200 joules, 300 joules, 360 joules, until rhythm is corrected**
- Use a Calcium Channel Blocker for rapid A-Fib or A-Flutter that is stable.
- Unstable A-Fib or A-Flutter should be treated just like any other unstable SVT.

# Tachyarrhythmias

## V-Tach with Pulses

- Wide QRS ( $>120$  msec)
  - Ventricular tachycardia (usually 160 msec)
  - Supraventricular tachycardia with aberrant conduction (usually not this wide)
- ABC's, Vital Signs, PUT ON PADS!!!
- If Stable consider Antiarrhythmic Drip (Stable =  $\text{CAOx3}$ ,  $\text{BP} > 90$  systolic)
- Unstable – Consider sedation (BP/Time) and Synchronized Cardioversion. (100, 200, 300, 360)
- Before Cardioversion assure Pt. has I.V. Etc. if Possible

# Bradycardia

- **STABLE**

Monitor Patient



- **UNSTABLE (hypotensive due to bradycardia or ventricular escape beats with bradycardia)**

Administer **Atropine IV**. If patient is in 2nd degree type II or 3rd degree AV Block, go directly to step 4. Do not administer atropine

If after 3 minutes there is no response to the first Atropine dose,  
Administer **Atropine 0.5 mg IV**

If no response activate **External Pacemaker** at a rate of 60 BPM

If no response to External Pacemaker administer **Dopamine 5 mcg/kg/min IV infusion** Dopamine may be titrated up to 20 mcg/kg/min

# PACING

- Set BPM
- Increase Joules until Capture achieved
- How do you know you have capture???



# Induced Hypothermia

- Clinical trials show moderate advantages and success rates as apposed to non use.
- Induced hypothermia is initiated at ROSC, a core temperature of  $32^{\circ}\text{C}$  -  $34^{\circ}\text{C}$  must be maintained.
- In the normal brain, hypothermia reduces the cerebral metabolic rate for oxygen ( $\text{CMRO}_2$ ) by 6% for every  $1^{\circ}\text{C}$  reduction in brain temperature.
- Mild hypothermia is thought to suppress many of the chemical reactions associated with reperfusion injury.
- Cooling must be maintained
- Although supporting data is limited, many critical care clinicians routinely sedate and ventilate the lungs of comatose survivors of cardiac arrest for at least 12 to 24 hours; thus, application of therapeutic hypothermia over this period would be simple.

# Mega code/Resuscitation Team Concept

- Leader
- Scribe
- Airway Manager
- Med Manager
- Defibrillator Manager
- CPR Muscle
- All responsible for safety of Patient and Responder







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