INTERPRETING EKG RHYTHMS

What is Sinus Rhythm?
- Originate in the SA node
- Examples include:
  - Normal Sinus Rhythm
  - Sinus Bradycardia
  - Sinus Tachycardia
  - Sinus Arrhythmia
  - Sinus Pause/Arrest

What are Atrial Rhythms?
- When SA node fails-atrial tissues or intermodal pathways may take over
- Examples include:
  - Atrial Flutter
  - Atrial Fibrillation
  - Premature Atrial Complexes (PAC’s)

What are Ventricular Rhythms?
- When the SA node and the AV junctional tissues fail to generate an impulse the ventricles will assume the role of pacing the heart
- Examples include:
  - Premature Ventricular Contractions (PVC’s)
  - Ventricular Tachycardia
  - Ventricular Fibrillation
  - Supraventricular Tachycardia
  - Asystole (Cardiac Standstill)
Normal Sinus Rhythm

- **Definition:**
  - The normal regular rhythm of the heart set by the natural pacemaker of the heart

- **EKG Interpretation:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the Rate?</td>
<td>60-100 bpm</td>
</tr>
<tr>
<td>2. What is the Rhythm?</td>
<td>Atrial rhythm regular/Ventricular rhythm regular</td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS?</td>
<td>Yes</td>
</tr>
<tr>
<td>Are P waves upright and uniform?</td>
<td>Yes</td>
</tr>
<tr>
<td>4. What is the length of the PR interval?</td>
<td>0.12-0.20 seconds (3-5 squares)</td>
</tr>
<tr>
<td>5. Do all QRS complexes look alike?</td>
<td>Yes</td>
</tr>
<tr>
<td>What is the length of the QRS complex?</td>
<td>0.06-0.12 seconds (1.5-3 squares)</td>
</tr>
</tbody>
</table>

- **Treatments/Nursing Interventions:**
  - NONE Required!
**Sinus Bradycardia**

- **Definition:**
  - Vagal stimulation causes automaticity of AV node to be depressed

- **EKG Interpretation:**
  
<table>
<thead>
<tr>
<th>1. What is the Rate?</th>
<th><strong>LESS THAN 60 BPM</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>2. What is the Rhythm?</td>
<td>Atrial Rhythm Regular/Ventricular Rhythm Regular</td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS?</td>
<td>Yes</td>
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- **Causes:**
  - Hypothermia
  - Hyperkalemia
  - MI
  - Medications like Digoxin, calcium channel blockers, beta blockers
  - Valsalva Maneuver
  - Vomiting
  - Ischemia of SA node
  - Arteriosclerosis
  - Common in athletes or during sleep

- **Signs/Symptoms:**
  - Syncope
  - Dizziness
  - Cool/Clammy

- **Treatment/Nursing Interventions:**
  - If asymptomatic- do nothing
  - If symptomatic give Atropine 0.5-1.0 mg (max 3 mg) and consider external transcutaneous pacing- DON’T GIVE ATROPINE TOO SLOW IT CAN SLOW RATE EVEN MORE!
Sinus Tachycardia

- **Definition:** Sympathetic nervous system causes increase in automaticity of AV node

- **EKG Interpretation:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the Rate?</td>
<td><strong>GREATER THAN 100 BPM</strong></td>
</tr>
<tr>
<td>2. What is the Rhythm?</td>
<td>Atrial Rhythm Regular/Ventricular Rhythm Regular</td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS?</td>
<td>Yes</td>
</tr>
<tr>
<td>Are P waves upright and uniform?</td>
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</table>

- **Causes:**
  - Normal response to exercise and stress
  - If persistent at rest may indicate more severe problem like fever, dehydration, blood loss, anemia, anxiety, HF, hypermetabolic states of ingestion of a lot of stimulants
  - Drugs like atropine, isuprel, epinephrine, dopamine, norepinephrine and caffeine can cause sinus tachy too

- **Signs/Symptoms:**
  - Rapid Pulse
  - Heart Palpitations
  - Chest Pain

- **Treatment/Nursing Interventions:**
  - If asymptomatic- do nothing/observe
  - If symptomatic- find cause and treat it!
    - Fever- give acetaminphen or ibuprofen
    - Stimulants- stop use (caffeine, OTC meds, herbs, drugs)
    - Anxiety- give reassurance or anti anxiety meds
    - Sepsis, Anemia, Hypotension (NO BETA BLOCKERS), MI, HF, Hypoxia
    - Narrow QRS-consider vagal maneuvers (put ice packs on neck- DO NOT DO CAROTID MASSAGE!), adenosine, beta blocker, calcium channel blocker or synchronized cardioversion
    - Wide QRS- consider anti arrhythmic med
**Sinus Arrhythmias**

- **Definition:** Irregular or disorganized rhythm

- **EKG Interpretation:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the Rate?</td>
<td>60-100 bpm</td>
</tr>
<tr>
<td>2. What is the Rhythm?</td>
<td>IRREGULAR (varies more than 0.08 secs)</td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS?</td>
<td>Yes</td>
</tr>
<tr>
<td>Are P waves upright and uniform?</td>
<td>Yes</td>
</tr>
<tr>
<td>4. What is the length of the PR interval?</td>
<td>0.12-0.20 seconds (3-5 squares)</td>
</tr>
<tr>
<td>5. Do all QRS complexes look alike?</td>
<td>Yes</td>
</tr>
<tr>
<td>What is the length of the QRS complex?</td>
<td>0.06-0.12 seconds (1.5-3 squares)</td>
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</table>

- **Causes:**
  - Heart Disease
  - Moderate to extreme stress
  - Excessive consumption of stimulants like caffeine, nicotine, and alcohol
  - Intake of meds like diet pills as well as cough and cold medicines

- **Signs/Symptoms:**
  - Usually asymptomatic

- **Treatment/Nursing Interventions:**
  - If asymptomatic- do nothing
  - If symptomatic- find and treat the cause
  - Usually only treated if accompanied with bradycardia
**Sinus Arrest/Pause**

- **Definition:**
  - Transient absence of sinus p waves that last from 2 seconds to several minutes

- **EKG Interpretation:**

<table>
<thead>
<tr>
<th></th>
<th>VARIABLE, depending on frequency</th>
<th>IRREGULAR, when sinus arrest is present</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the Rate?</td>
<td>VARIABLE, depending on frequency</td>
<td></td>
</tr>
<tr>
<td>2. What is the Rhythm?</td>
<td>IRREGULAR, when sinus arrest is present</td>
<td></td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS? Are P waves upright and uniform?</td>
<td>Yes, if QRS is present Yes, if QRS is present</td>
<td></td>
</tr>
<tr>
<td>4. What is the length of the PR interval?</td>
<td>0.12-0.20 seconds (3-5 squares)</td>
<td></td>
</tr>
<tr>
<td>5. Do all QRS complexes look alike? What is the length of the QRS complex?</td>
<td>Yes 0.06-0.12 seconds (1.5-3 squares)</td>
<td></td>
</tr>
</tbody>
</table>

- **Causes:**
  - This may occur in individuals with healthy hearts during sleep
  - Myocarditis
  - Cardiomyopathy
  - MI
  - Dig Tox
  - Age- elderly
  - Vagal Stimulation

- **Signs/Symptoms:**
  - Dizziness
  - LOC
  - Bradycardia

- **Treatment/Nursing Interventions:**
  - Only treated if patient is symptomatic- either Atropine or with a Pacemaker
  - Look at cause and treat cause
    - Medication
    - Electrolyte Imbalance
    - Natural deterioration of cardiac system
    - May require artificial pacemaker for treatment if asymptomatic
**Atrial Flutter**

- **Definition:** Ectopic focus in atria causing atria to contracts 250-400 times per minute

- **EKG Interpretation:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the Rate?</td>
<td>ATRIAL- 250-400 BPM</td>
</tr>
<tr>
<td>2. What is the Rhythm?</td>
<td>Atrial rhythm regular/Ventricular rhythm may be irregular</td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS? Are P waves upright and uniform?</td>
<td>Normal P waves are absent; FLUTTER WAVES (F WAVES) (SAWTOOTH PATTERN)</td>
</tr>
<tr>
<td>4. What is the length of the PR interval?</td>
<td>Not measurable</td>
</tr>
<tr>
<td>5. Do all QRS complexes look alike? What is the length of the QRS complex?</td>
<td>Yes 0.06-0.12 seconds (1.5-3 squares)</td>
</tr>
</tbody>
</table>

- **Causes:**
  - Stress
  - Hypoxia
  - Drugs/Alcohol
  - HTN
  - Chronic Heart Disease/Valve Disorder

- **Signs/Symptoms:**
  - Palpitations
  - Syncope

- **Treatment/Nursing Interventions:**
  - Control Rate with CCB (Diltiazem) or BB and then either cardiovert OR give anticoag therapy (depending on timing)
  - 2 Scenarios-
    - If flutter is present greater than 48 hours-
      - Evaluate and give anticoagulant therapy for 3 weeks to convert rhythm and then they are to remain on it for an additional 4 weeks
      - Or you can get an echocardiogram to rule out thrombus, load pt with heparin and then cardiovert followed by anticoagulant for 4 weeks
    - If flutter is present less than 48 hours-
      - Unstable patient- cardiovert immediately
      - Stable patient- give BB/CCB/ Dig/Amiodarone or Procainamide and then cardiovert
Atrial Fibrillation

- **Definition:** Regularly irregular (grossly irregular heart rate)

- **EKG Interpretation:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the Rate?</td>
<td>ATRIAL- 350-400 BPM</td>
</tr>
<tr>
<td></td>
<td>VENTRICULAR- VARIABLE</td>
</tr>
<tr>
<td>2. What is the Rhythm?</td>
<td>IRREGULARLY IRREGULAR</td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS?</td>
<td>Normal P waves are absent; REPLACED</td>
</tr>
<tr>
<td>Are P waves upright and uniform?</td>
<td>BY F WAVES</td>
</tr>
<tr>
<td>4. What is the length of the PR interval?</td>
<td>Not discernable</td>
</tr>
<tr>
<td>5. Do all QRS complexes look alike?</td>
<td>Yes</td>
</tr>
<tr>
<td>What is the length of the QRS complex?</td>
<td>0.06-0.12 seconds (1.5-3 squares)</td>
</tr>
</tbody>
</table>

- **Causes:**
  - HTN
  - MI
  - CHF/COPD
  - Heart disease
  - Chronic lung disease

- **Signs/Symptoms:**
  - Dizziness
  - Fainting
  - Confusion

- **Treatment/Nursing Interventions:**
  - Control Rate with CCB (Diltiazem) or BB and then either cardiovert OR give anticoag therapy (depending on timing)
  - Same as Aflutter
Premature Atrial Contractions (PAC’s)

- **Definition**: Ectopic focus within one of atra fires prematurely

- **EKG Interpretation**:

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the Rate?</td>
<td><strong>USUALLY REGULAR</strong> but depends on the underlying rhythm</td>
</tr>
<tr>
<td>2. What is the Rhythm?</td>
<td><strong>IRREGULAR</strong> as a result of the PAC</td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS?</td>
<td><strong>USUALLY UPRIGHT BUT PREMATURE</strong> and abnormal shape</td>
</tr>
<tr>
<td>Are P waves upright and uniform?</td>
<td></td>
</tr>
<tr>
<td>4. What is the length of the PR interval?</td>
<td>0.12-0.20 seconds (3-5 squares)</td>
</tr>
<tr>
<td>5. Do all QRS complexes look alike?</td>
<td>Yes</td>
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<td>What is the length of the QRS complex?</td>
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</table>

- **Causes**:
  - Emotional Distress
  - Fatigue
  - Tobacco/Smoking
  - Caffeine
  - Dig Tox

- **Signs/Symptoms**:
  - Palpitations
  - Skipped beat

- **Treatment/Nursing Interventions**:
  - No treatment necessary if asymptomatic
  - Treat the cause
Premature Ventricular Contractions (PVC’s)

- **Definition**: One or more ectopic foci stimulate premature ventricular rate, may decrease efficiency of hearts pumping action

- **EKG Interpretation**:
  
  | 1. What is the Rate? | Atrial: Usually Normal  
  |                     | Ventricular: Usually Normal  
  |                     | (depends on underlying rhythm)  
  
  | 2. What is the Rhythm? | Depends on Underlying Rhythm;  
  |                       | **IRREGULAR DURING PVC’S**  
  
  | 3. Is there a P wave before each QRS?  
  | Are P waves upright and uniform? | Absent with PVC’s  
  
  | 4. What is the length of the PR interval? | Not Measurable during PVC’s  
  
  | 5. Do all QRS complexes look alike?  
  | What is the length of the QRS complex? | Varies  
  |                       | **WIDE AND BIZARRE (<0.12 sec), occurs earlier than expected**  

- **Types of PVC Patterns**:
  
  - Ventricular Bigeminy- PVC every other beat
  - Ventricular Trigeminy- PVC every third beat
  - Ventricular Quadrigminy- PVC every fourth beat
  - Couplets- Two PVC’s together
  - Runs of Ventricular Tachycardia (VT)- Three of more PVC’s in a row

- **Causes**:
  
  - Stress
  - Caffeine, tobacco, alcohol, exercise
  - New MI
  - Electrolyte Imbalances- hyperkalemia and hypocalcemia
  - Dig Tox

- **Signs/Symptoms**:
  
  - Palpitations
  - “Lump in the throat”

- **Treatment/Nursing Interventions**:
  
  - If asymptomatic- observe and rule out hypokalemia and hypoxemia, give oxygen
  - If symptomatic- treat the cause
    - In acute MIs PVCs indicate the need to aggressively treat with MONA
    - Antiarrhythmics are usually not needed-Lidocaine, Amiodarone, Sotalol, Procanamide
**Ventricular Tachycardia**

- **Definition**: Three or more PVCs that arise in a row, indicative of severe myocardial irritation

- **EKG Interpretation**:

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the Rate?</td>
<td>101- 250 bpm</td>
</tr>
<tr>
<td>2. What is the Rhythm?</td>
<td>ATRIAL RHYTHM NOT DISTINGUISHABLE/VENTRICULAR RHYTHM USUALLY REGULAR</td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS? Are P waves upright and uniform?</td>
<td>No</td>
</tr>
<tr>
<td>4. What is the length of the PR interval?</td>
<td>Not Measurable</td>
</tr>
<tr>
<td>5. Do all QRS complexes look alike? What is the length of the QRS complex?</td>
<td>WIDE AND BIZARRE (&gt;0.12 SEC)</td>
</tr>
</tbody>
</table>

- **Causes**:
  - Hypoxia/Ischemia
  - Acidosis
  - Dig tox
  - Electrolyte imbalance
  - Increased ICP

- **Signs/Symptoms**:
  - Chest discomfort (angina)
  - Syncope
  - Light headedness or dizziness

- **Treatment/Nursing Interventions**:
  - **V Tach Pulseless** - TREAT LIKE VFIB
    - ACLS/CPR
    - Defibrillation
    - Epinephrine
    - Amiodarone
  - **V Tach With Pulse** - (STABLE)
    - Either Amiodarone (monitor for bradycardia/hypotension) or Lidocaine (monitor for slurred speech, seizure, LOC, twitching, bradycardia), Give O2, Get EKG, Check electrolytes
  - Chronic of Recurrent VT (UNSTABLE)
    - Antiarrhythmics
    - ICD
    - Lidocaine
    - Amiodarone
    - Magesium
    - Beta Blocker
● Ablation

**Torsade de Pointes-** (Means Twisting at the Point) type of V Tach caused by electrolyte imbalance, condition deteriorates quickly, treat with Magnesium and Calcium→ looks like a party streamer
DO NOT GIVE TOO MUCH MG TOO FAST BECAUSE IT CAN CAUSE HYPOTENSION OR ASYSTOLE
**Ventricular Fibrillation**

- **Definition**: Occurs as a result of multiple weak ectopic foci in the ventricles. Most serious cardiac dysthymia and can lead to standstill (death) if not treated

- **EKG Interpretation**:

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the Rate?</td>
<td>NOT DISCERNIBLE</td>
</tr>
<tr>
<td>2. What is the Rhythm?</td>
<td>RAPID, UNORGANIZED, NOT DISCERNIBLE</td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS? Are P waves upright and uniform?</td>
<td>NO</td>
</tr>
<tr>
<td>4. What is the length of the PR interval?</td>
<td>NONE</td>
</tr>
<tr>
<td>5. Do all QRS complexes look alike? What is the length of the QRS complex?</td>
<td>NONE</td>
</tr>
</tbody>
</table>

- **Causes**:  
  - AMI  
  - Hyperkalemia  
  - HTN  
  - Hypoxia  
  - Cardiac cath  
  - Cardioversion  
  - Extreme hypothermia

- **Signs/Symptoms**:  
  - Loss of consciousness  
  - Absent Pulse

- **Treatment/Nursing Intervention**:  
  - Assess your patient  
    - Many things can mimic v-fib on a monitor strip such as electric razor or shivering  
    - **YOU MUST CHECK THE PATIENT!!**  
  - Treatment must be aggressive and immediate  
    - ACLS with immediate defibrillation  
    - The patients are always pulseless- Call Code Blue!!  
    - Epinephrine after first unsuccessful defibrillation then q every 3-5 minutes  
    - Can also use 1 dose of Vasopressin instead of Epi  
    - For V-fib that persist Amiodarone is used

**Vegara Syndrome-** Asian patients with normal HR, few risk factors, but family has history of sudden cardiac death
**Superventricular Tachycardia (SVT)**

- **Definition:** Encompasses all fast (tachy) dysrhythmias in which heart rate is greater than 150 beats per minute

- **EKG Interpretation:**

<table>
<thead>
<tr>
<th>1. What is the Rate?</th>
<th>ATRIAL: 150-250 BPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. What is the Rhythm?</td>
<td>Regular</td>
</tr>
<tr>
<td>3. Is there a P wave before each QRS?</td>
<td>USUALLY NOT DISCERNIBLE, ESPECIALLY AT THE HIGH RATE RANGER</td>
</tr>
<tr>
<td>Are P waves upright and uniform?</td>
<td></td>
</tr>
<tr>
<td>4. What is the length of the PR interval?</td>
<td>USUALLY NOT DISCERNIBLE</td>
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<td>What is the length of the QRS complex?</td>
<td>0.06-0.12 seconds (1.5-3 squares)</td>
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</tbody>
</table>

- **Causes:**
  - Simulants
  - Hypoxia
  - Stress
  - Hypokalemia
  - Atherosclerotic heart disease

- **Signs/Symptoms:**
  - Palpitations
  - Syncope
  - Pounding pulse
  - SOB
  - Chest discomfort

- **Treatment:**
  - Asymptomatic: observe
  - Symptomatic:
    - Adenosine (ACLS) has 6.5 second half life
      - 3 doses: 6 mg, 6 mg, 12 mg → rapid IV push
      - This drug causes transient asystole to reset heart- tell patient they will feel really weird stay with me, the patient will either revert back to SVT (give more drug) or they’ll go back to NSR or whatever their norm is
    - Synchronized Cardioversion- sync with beat and shock
    - Carotid sinus massage
Asystole

- **Definition:**
  - Ventricular Standstill

- **EKG Interpretation:**

  1. What is the Rate? | NONE
  2. What is the Rhythm? | NONE
  3. Is there a P wave before each QRS? Are P waves upright and uniform? | NONE
  4. What is the length of the PR interval? | NONE
  5. Do all QRS complexes look alike? What is the length of the QRS complex? | NONE

- **Causes:**
  - End stage cardiac disease
  - Ischemia
  - MI
  - Acidosis
  - Hypoxia

- **Signs/Symptoms:**
  - No palpable pulse
  - No measurable BP
  - Loss of consciousness

- **Treatment/Nursing Interventions:**
  - Assess your patient
  - Treatment must be aggressive and immediate
  - Call Code Blue
  - Start CPR/ACLS
  - Epinephrine and Atropine are the only hope → get some type of rhythm so you can defibrillate
Four Rhythms that Produce Pulseless Cardiac Arrest:
1. Ventricular Fibrillation (VF)
2. Rapid Ventricular Tachycardia (VT)
3. Pulseless Electrical Activity (PEA)
4. Asystole

Cardiac Arrest “H’s and T’s” Treatable Causes:
1. Hypovolemia
2. Hypoxia
3. Hydrogen Ions (Acidosis)
4. Hyper/Hypo kalemia
5. Hypothermia
6. Hypoglycemia

1. Toxins
2. Tamponade
3. Tension pneumothorax
4. Thrombus (coronary)
5. Thrombus (pulmonary)
6. Trauma