## ECG Conversion for Heart Rate

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C. **Conduction System**

1. **Sinoatrial (SA) Node** - a small cluster of cells located in the upper right atrium; it is the pacemaker of the heart; normal or inherent rate is 60 to 100 beats per minute

2. **Internodal Pathways** - impulses sent by the SA node travel through the atrial muscle fibers via the intra-atrial pathways; allows for simultaneous depolarization and contraction of the atria

3. **Atrioventricular (AV) Node** - located in the lower portion of the right atria, receives impulse from the SA node; delays the conduction to allow for the atria to contract, then conducts to the ventricle.

4. **Bundle of His** - lies in the upper part of the intraventricular septum and connects the AV node with the bundle branches; the AV node and Bundle of His are collectively known as the **Junctional Area**; normal or inherent rate = 40-60; back-up system for the SA node

5. **Right Bundle Branch** - arises from the Bundle of His and travels down the right side of the septum

6. **Left Bundle Branches** - arise from the Bundle of His and travel down the left side of the septum; branches off into two sections because the left ventricle is much larger than the right ventricle

7. **Purkinje Fibers** - smaller branches of the bundle branches; spread throughout the myocardium and terminate there; normal or inherent rate = 20-40
D. **Pattern of Electrical Conduction**

1. The electrical impulse originates in the SA node and travels via internodal pathways, to the AV node causing the atria to contract.

2. The impulse then travels to the Bundle of His which becomes the right and left Bundle Branches, and terminates in the Purkinje Fibers in the ventricles resulting in an orderly contraction of the ventricles.

![Image of heart with labeled nodes and pathways]

SA Node
60-100/min

AV Junction
40 – 60/min

Purkinje Network
20 – 40/min

E. **Inherent Rate**

1. **SA Node** 60-100 beats/min
2. **AV Junction** 40-60 beats/min
3. **Ventricle** 20-40 beats/min

G. **Ectopic Pacemaker** - stimulus outside the normal conduction system

Impulse fires outside of SA node
V. Cardiac Cycle

A. **Cardiac Cycle** consists of one heart beat (or one P-QRS-T sequence); it represents a sequence of atrial contraction (systole) and relaxation (diastole) followed by ventricular contraction and relaxation.

B. **Isoelectric Line** - a flat line seen between cardiac cycles. The monitor returns to this flat line between heart beats.
VI. **COMPONENTS OF A CARDIAC ELECTRICAL CYCLE**

A. **P WAVE** - depolarization of the atria

B. **PR INTERVAL** - time it takes for the electric impulse (which originates in the SA node) to reach the ventricular conduction system; normal = 0.12 - 0.20 seconds; measured from the beginning of the P wave to the beginning of the QRS complex

C. **QRS COMPLEX** - depolarization of the ventricles; normal = 0.06 - 0.10 seconds

D. **ST SEGMENT** - early repolarization of the ventricles; ST elevation or depression (1 mm) indicates cardiac injury/ischemia; normal ST segment is flat (isoelectric)

E. **J POINT** - junction between QRS complex and ST segment

F. **T WAVE** - ventricular repolarization

G. **QT INTERVAL** - time between onset of ventricular depolarization and end of ventricular repolarization; normal = varies with heart rate
1. QT varies with heart rate; at fast rates the QT shortens, at slow rates the QT lengthens
2. As a rule, the QT Interval should not exceed half the R-R interval at normal heart rates
3. Causes of lengthened QT interval:
   Electrolyte imbalances, antidysrhythmics, cocaine & congenital defects.

H. **U Wave** - probably represents the final stage of ventricular repolarization

I. **REFRACTORY PERIODS**

**Absolute Refractory Period**

*Period of time during the cardiac cycle when the ventricles are fully depolarized (fully contracted) and unable to respond to even a stronger than normal impulse.*

**Relative Refractory Period**

*Period of time during the cardiac cycle when the ventricles are repolarizing. If a stronger than normal impulse stimulates the ventricles during this period, the heart may enter into a lethal dysrhythmia (referred to as R of T phenomena) resulting in ventricular tachycardia or ventricular defibrillation.*
C. INFORMATION OBTAINED FROM AN ECG

1. The ECG monitor provides information about electrical activity only. The ECG monitor does not provide information about mechanical (pumping/pulse) activity.

2. The two basic electrical activities of the heart seen on the ECG waveform are:
   a. Depolarization (P, QRS)
   b. Repolarization (ST segment, T wave)

3. Analysis of an ECG tracing can supply information related to:
   a. Conduction abnormalities
   b. Electrolyte imbalances
   c. Myocardial muscle injury/ischemia (ST segment elevation and depression)

D. ECG PAPER

1. Standardization - all EKG paper is manufactured alike (i.e. standardized); allows for comparative analysis of the ECG wave patterns

2. Amplitude - height of the complex measured in millivolts (mV); each horizontal line is one millimeter apart and represents 1/10 a millivolt

3. Duration - represents time; each vertical line is one millimeter apart and represents 0.04 seconds
4. Bold Lines - every fifth line, both horizontal and vertical is inscribed boldly, producing a series of large squares; large squares represent 0.5 millivolts vertically and 0.20 seconds horizontally. Five (5) large blocks equals one second.

IX. **INTERPRETATION OF RHYTHM STRIP (FIVE (5) STEPS)**

A. **REGULARITY** - atrial and ventricular

B. **RATE** - atrial and ventricular; method of determining rate based on regularity

1. Regular

   a. Rate table - number of small boxes between two (2) consecutive P waves or QRS complexes

   b. Calculation
      1. Number of small boxes between two (2) consecutive P waves or QRS complexes, divided into 1500 Or
      2. Number of large boxes between two (2) consecutive P waves or QRS complexes divide into 300
2. Irregular - number of complexes in six (6) seconds, multiplied by ten (10)

C. **P WAVES** - present or absent; all look the same and ratio of P waves to QRS complexes

D. **PR INTERVAL** - normal = 0.12 – 0.20 seconds

C. **QRS COMPLEX** - normal = 0.06 – 0.10 seconds

D. **QT Interval** – normal = ≤ .40: rate dependent
Rhythms of Sinus Origin

Inherent Rate: 60-100
P Waves: 1:1, all look the same
PR Interval: normal
QRS Duration: normal

NORMAL SINUS RHYTHM

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INTERPRETATION

TREATMENT

Origin: SA node
Regularity: Basically regular, but subject to respiratory influence
Rate: 60-100 beats per minute in adults
P Waves: Precede each QRS complex
PR Interval: Normal, constant: 0.12 - 0.20 seconds
QRS Duration: Normal: 0.06 - 0.10 seconds
QT Interval: 0.40 seconds or less
Conduction: Normal
Comments: The hemodynamically ideal rhythm. Atrial and ventricular contraction is synchronized and allows adequate time for atrial emptying and ventricular filling.
Sinus Bradycardia

**Interpretation**

**Treatment**

**Origin:** SA node

**Regularity:** Basically regular, but subject to respiratory influence

**Rate:** Less than 60 beats per minute in adults

**P Waves:** Precede each QRS

**PR Interval:** Normal, constant: 0.12 - 0.20 sec

**QRS Duration:** Normal: 0.06 - 0.10 sec

**QT Interval:** Varies with rate

**Conduction:** Normal

**Causes:** May be secondary to sinus node disease (acute MI, CAD), increased vagal tone (vomiting) or drug effects (digoxin, diltiazem, metoprolol); may be normal for some athletes or while the person is asleep

**Signs & Symptoms:** Seldom produces symptoms unless the rate is markedly decreased resulting in decreased cardiac output. In patients with a diseased heart which is unable to compensate for the decreased rate by increasing the stroke volume, this arrhythmia may result in fainting, dizziness, weakness, angina.

**Comments:** An important warning arrhythmia in the patient with an acute MI

**Treatment:** RN: Usually no treatment unless symptomatic. If symptomatic Atropine and pacing.

MW: Notify RN in 1-2 minutes if acute change, notify RN stat if \( \leq 50 \)
### Sinus Tachycardia

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**Interpretation**

**Treatment**

**Origin:** SA node

**Regularity:** Regular

**Rate:** 101-150 beats/min but may be higher with extreme exertion

**P Waves:** Precede each QRS, but may be buried in the preceding T wave

**PR Interval:** Normal, constant: 0.12 - 0.20 sec (children 0.10 - 0.20)

**QRS Duration:** Normal: 0.06 - 0.10 sec

**QT Interval:** Varies with rate

**Conduction:** Normal

**Causes:** Physiologic response to a demand for a higher cardiac output: stress, fever, exercise, anemia, anoxia, hypovolemia, shock, and pain; also caused by stimulants such as coffee, tea, tobacco, or alcohol

**Signs & Symptoms:** May complain of “palpitations” or “racing”; due to increase oxygen requirements and decreased coronary artery perfusion, patients with myocardial disease may complain of angina

**Treatment:**

RN: Correct underlying cause when possible

MW: Notify RN in 1-2 minutes if acute change, notify RN STAT if rate ≥ 150
SINUS ARRHYTHMIA

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INTERPRETATION

TREATMENT

Origin: SA node

Regularity: Irregular with a repetitive variation in cycle length according to respiration; cycle lengths vary by more than 0.12 sec (3 small boxes)

Rate: 60-100 beats/min, increases with inspiration and decreases with expiration

P Waves: Normal, precede each QRS

PR Interval: Normal, constant: 0.12 - 0.20 sec

QRS Duration: Normal: 0.06 - 0.10 sec

QT Interval: Varies with rate

Conduction: Normal

Causes: Commonly occurs in the young or aged, especially with slower heart rates or following enhanced vagal tone from digoxin or morphine administration

Comments: Respiratory - the heart rate increases during inspiration as a result of reflex inhibition of vagal tone or enhancement of sympathetic tone or both; breath holding eliminates the cyclic variation

Treatment: None
INTRAVENTRICULAR CONDUCTION DEFECT (IVCD)

- **Origin:** The cardiac impulse normally originates in the SA node
- **Regularity:** Regular
- **Rate:** Usually normal
- **P Waves:** Normal
- **PR Interval:** Normal, constant (0.12 - 0.20 sec) because impulses reach uninvolved ventricle without delay
- **QRS Duration:** 0.12 or more; complex distorted (delay in conduction causing widening of the complex, may see notching
- **QT Interval:** Varies with rate
- **Conduction:** Originates in SA node and passes through AV node to the Bundle of His; the impulse is then delayed in either the right or left bundle branches
- **Causes:** Acute MI, CAD, cardiomyopathy, ventricular hypertrophy
- **Comment:** May also be known as Bundle Branch Block (BBB) and may also be seen in other rhythms
- **Treatment:**
  - **RN:** Treat underlying heart disease
  - **MW:** Notify RN in 1-2 minutes if IVCD is new
**Sinus Arrest**

![ECG waveform]

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**Interpretation**

**Treatment**

**Origin:** The stimulus, when it occurs, comes from the SA node; the problem during sinus arrest is that the **SA node does not fire**; there will be a pause.

**Regularity:** Irregular; periods of sinus arrest not a multiple of basic sinus cycle length

**Rate:** Usually 60-100 but frequently in the bradycardia range

**P Waves:** Precede each sinus QRS

**PR Interval:** Constant, normal (0.12 - 0.20 sec)

**QRS Duration:** Normal: 0.06 - 0.10 sec

**QT Interval:** Varies with rate

**Conduction:** Normal

**Comments:** To measure the arrest interval: count the number of large blocks from the QRS before the arrest, to the first QRS after the arrest. Divide the number of large blocks by 5. This is the number of seconds of the arrest. Could also count the number of small blocks and multiply times 0.04 seconds to obtain the time interval of the arrest.

**Causes:** Acute MI, digoxin toxicity, chest trauma, excessive vagal tone or degenerative forms of fibrosis

**Signs & Symptoms:** If there is an exceptionally long pause, one might experience palpitations or dizziness

**Treatment:**

**RN:** Discontinue digoxin therapy; if symptomatic: Atropine, pacing

**MW:** Notify RN STAT if rate ≤50, new or acute change
**Summary**

*Inherent Rate:* 60-100

*P Waves:* 1:1, all look the same

*PR Interval:* normal

*QRS Duration:* normal

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**Sinus Rhythm:** rate 60-100

**Sinus Bradycardia:** rate less than 60

**Sinus Tachycardia:** rate 101-150

**Sinus Arrhythmia:** rhythm irregular

**Sinus with IVCD:** wide QRS (0.12 seconds or greater)

**Sinus Arrest:** pause, missing complexes, loss of sinus P
RHYTHMS OF ATRIAL ORIGIN

P Waves: different from those of sinus origin
PR Interval: normal
QRS Duration: normal

Premature Atrial Contraction (PAC)

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INTERPRETATION

TREATMENT

Origin: Atria; premature atrial beats indicate a site in the atrium has become irritable and fired before the normal firing time of the SA node; underlying rhythm is sinus.

Regularity: Regular, except when the PAC occurs

**Rate: Based on the rate of the underlying rhythm**

P Waves: Configuration of the P wave of a PAC is different from the P waves originating from the SA node; the P wave may be buried in the preceding T wave

PR Interval: Normal (0.12-.20 sec.); may vary from the PR intervals of impulses originating from the SA node

QRS Duration: Usually normal.

Conduction: Usually normal.

Causes: PACs may be seen in normal hearts, but are often associated with organic disease, particularly in older patients. They may occur in a variety of situations. Some of these may include myocardial ischemia, infection, medications, and use of alcohol, tobacco or caffeine.

Signs & Symptoms: Usually no signs or symptoms; the patient may complain of skipped beats.

Treatment: Usually none, but omission of alcohol, tobacco, or caffeine may be
Atrial Tachycardia

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**INTERPRETATION**

**TREATMENT**

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**Regularity:** Regular

**Rate:** 151-250 beats/min

**P Waves:** Configuration of the P wave of atrial tachycardia is different from the P waves that originate from the SA node. The P wave is frequently buried in the preceding T wave.

**PR Interval:** Normal, constant if P waves can be seen; usually difficult to measure

**QRS Duration:** Normal (0.06-0.10 sec)

**Conduction:** One ventricular response to each atrial stimulus; conduction time is usually normal

**Causes:** Rhythm may be triggered by alcohol, tobacco, caffeine, fatigue, emotions, sympathetic nervous system stimulus, catecholamines, organic disease including coronary artery disease and thyrotoxicosis

**Signs & Symptoms:** Symptoms range from feelings of anxiety and nervousness, palpitations, angina, syncope, heart failure or shock – depending on the duration, rate of tachycardia, and the presence of underlying cardiac disease

**Comments:** Abrupt onset with abrupt cessation is referred to as paroxysmal Atrial tachycardia (PAT)

**Treatment:**

- **RN:** Depends on the tolerance of the ventricular rate: vagal stimulating maneuvers (Valsava and gagging), Adenosine, beta blockers (Lopressor), calcium channel blockers (Cardizem). Cardioversion may be necessary if the patient does not tolerate the rhythm (patient is unstable).

- **MW:** Notify RN STAT
Atrial Flutter

Origin: Atria.

Regularity: A: regular; V: usually regular, but may be irregular

Rate: Atrial rate is **250-350** beats/min; the ventricular rate may be one-half the atrial rate in untreated atrial flutter; if treatment has been started, the ventricular rate is usually less than 100

P Waves: The atria are stimulated through a rapid pathway within the atria causing a broad, bizarre atrial deflection which have been termed Flutter waves (F waves) and occur in regular saw-tooth or picket fence pattern

PR Interval: Not measurable

QRS Duration: Normal (0.06-0.10 sec)

Conduction: Varying; 2:1 (2 Flutter waves:1 QRS), 3:1, 4:1, etc.; conduction time is normal

Causes: CHF, myocardial ischemia/infarction, COPD

Signs & Symptoms: Symptoms related primarily to the ventricular response; a 3:1 or 4:1 conduction ratio may result in no symptoms, yet a 2:1 or varying conduction ratio may produce palpitations, shortness of breath, angina, or pulmonary edema

Treatment: **RN:** Treatment depends on ventricular rate and patient symptoms; calcium channel blockers (Cardizem), Digoxin, beta blockers (Lopressor), Amiodarone. In acute situations (patient has been in the rhythm less than 48 hours), Ibutilide, procainamide, or Rythmol may be administered. If medications are unsuccessful, synchronized cardioversion may be performed.

**MW:** Notify RN in 1-2 minutes if new onset or STAT if ventricular rate is 150 or greater

**Note:** Anticoagulation is necessary prior to synchronized cardioversion if the patient has been in atrial flutter for greater than 2 days
Atrial Fibrillation

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INTERPRETATION

TREATMENT

Origin: Atria; multiple atrial foci causing total disorganization of atrial activity. The atria “quiver”.

Regularity: **Irregular**

Rate: Atrial activity is difficult to identify and too fast to count; the ventricular rate depends on control of impulses to the ventricle by the AV junction: uncontrolled ventricular response – average ventricular rate is greater than 100 beats/min; controlled ventricular rate – average ventricular rate is 100 beats/min or less

P Waves: **No discernable P waves**; ECG shows small deflections appearing as irregular baseline undulations of variable amplitude and contour indicating fibrillatory atrial activity

PR Interval: Not measurable

QRS Duration: Normal (0.06-0.10 sec)

Conduction: Normal

Causes: Chronic atrial fibrillation is almost always associated with underlying heart disease

Signs & Symptoms: Symptoms are related to the ventricular response; patients are at risk for throwing systemic micro-emboli that may lead to CVA (stroke), MI (heart attack), or pulmonary emboli
Treatment: RN: Treatment depends on ventricular rate, patient symptoms, underlying heart disease and duration of being in the rhythm. Calcium channel blockers (Cardizem), Digoxin, beta blockers (Lopressor), Amiodarone are frequently first line treatment. On occasion Quinidine or procainamide may be used. In acute situations (patient has been in the rhythm less than 48 hours*), Ibutilide, procainamide, or Rythmol may be administered. If medications are unsuccessful, synchronized cardioversion may be performed.

MW: Notify RN in 1-2 minutes if new onset or STAT if ventricular rate is 150 or greater

*Note: Anticoagulation is an intervention that is necessary prior to synchronized cardioversion if the patient has been in atrial fibrillation for greater than 2 days
**SUMMARY OF ATRIAL RHYTHMS**

**Sinus with PAC**
- **P Waves:** look different from sinus P wave
- **PR Interval:** normal, may be different from sinus beats
- **QRS Duration:** normal

**Atrial Tachycardia**
- **Atrial Rate:** 151-250 beats/minute
- **P Waves:** look different from sinus P wave
- **PR Interval:** usually difficult to measure
- **QRS Duration:** normal

**Atrial Flutter**
- **Atrial Rate:** 250-350 beats/minute
- **P Waves:** Flutter waves
- **PR Interval:** not measurable
- **QRS Duration:** normal

**Atrial Fibrillation**
- **Atrial Rate:** unable to determine
- **P Waves:** fibrillatory waves
- **PR Interval:** not measurable
- **QRS Duration:** normal
### Treatment of Atrial Rhythms

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<th>Atrial Flutter</th>
<th>Atrial Fibrillation</th>
<th>SVT*</th>
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</thead>
<tbody>
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<td>-</td>
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<td>✓</td>
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</table>

*Supraventricular tachycardia (SVT) identified as a rhythm that originates from above the ventricles. Other criteria include: not being able to see the onset of the tachycardia, not being able to determine the origin (atria or AV junction) and the rhythm is regular. Possible rhythms include atrial tachycardia, 2:1 atrial flutter, and junctional tachycardia.
Rhythms of Junctional Origin

- P waves may be before, during or after the QRS
- if the P wave is before the QRS, the PR interval will be short (less than 0.12 sec)
- in leads where an upright P wave is normally seen (Leads II or III), the P wave will be inverted
Origin: Junctional tissue (A V node or Bundle of His area); underlying rhythm is sinus

Regularity: Underlying rhythm is regular, except where PJCs occur

Rate: Based on underlying rhythm

P Waves: In PJCs (in Leads II or III), inverted P Waves may occur before or after the QRS complex. There may be no P wave present

PR Interval: If the P Wave precedes the QRS, the PR interval is less than 0.12 seconds

QRS Duration: Normal

Conduction: Atria are depolarized in a backward (retrograde conduction); ventricles are stimulated in forward (antegrade conduction)

Causes: May occur with consumption of alcohol or use of stimulants such as coffee, tea or tobacco; in older adults, frequently accompanies coronary artery disease, digoxin toxicity or inferior wall MI

Signs & Symptoms: Patients are frequently unaware of this dysrhythmia or may report “skipped beats”; exhibits irregular pulse

Treatment: Observe
Escape vs. Premature Beats

Escape beats occur because the sinus node has slowed or stopped working. Premature beats come in early, whereas escape beats come in late.

Junctional escape beats

Considered a protective mechanism that is a response to a dysrhythmia, such as Sinus Arrest. Treatment is based on the underlying dysrhythmia, NOT the escape beat.
Junctional Rhythm

REGULARITY

RATE

P WAVE

PR INTERVAL

QRS DURATION

QT INTERVAL

INTERPRETATION

TREATMENT

Origin: Junctional tissue
Regularity: Regular
Rate: 40-60 beats/min (the inherent discharge rate of the AV junction)
P Waves: In Leads II or III inverted P Waves may occur before or after the QRS complex. There may be no P wave present.
PR Interval: If the P Wave precedes the QRS, the PR interval is less than 0.12 sec
QRS Duration: Normal: 0.06-0.10 sec
Conduction: Atria are depolarized in a backward (retrograde conduction); ventricles are stimulated in a normal (antegrade conduction)
Causes: Excessive vagal stimulation, ischemic damage of the SA node, digoxin toxicity, inferior wall MI
Signs & Symptoms: Seldom produces symptoms of low cardiac output; patient exhibits slow, regular pulse distinguishable from other bradyarrhythmias only by ECG
Comments: Junctional rhythm occurs when the rate of discharge of the SA node, (the primary pacemaker), becomes less than that of the AV junction
Treatment: RN: Atropine; if symptomatic, hold digoxin, check digoxin level
MW: Notify in 1–2 minutes if acute onset.
Notify RN STAT if ventricular rate <50
**Accelerated Junctional Rhythm**

<table>
<thead>
<tr>
<th>REGULARITY</th>
<th>A</th>
<th>V</th>
<th>RATE</th>
<th>A</th>
<th>V</th>
</tr>
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<tbody>
<tr>
<td>P WAVE</td>
<td></td>
<td></td>
<td>PR INTERVAL</td>
<td></td>
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<tr>
<td>QRS DURATION</td>
<td></td>
<td></td>
<td>QT INTERVAL</td>
<td></td>
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</tr>
</tbody>
</table>

**INTERPRETATION**

**TREATMENT**

**Origin:** Junctional tissue  
**Regularity:** Regular  
**Rate:** 61-100 beats/min  
**P Waves:** In Leads II or III inverted P Waves may occur before or after the QRS complex. There may be no P wave present  
**PR Interval:** If the P Wave precedes the QRS, the PR interval is less than 0.12 seconds  
**QRS Duration:** Normal: 0.06-0.10 sec  
**Conduction:** Atria are depolarized in a backward (retrograde conduction): ventricles are stimulated in normal (antegrade conduction)  
** Causes:** CAD, myocardial ischemia and most commonly digoxin toxicity  
**Treatment:**  
RN: Hold Digoxin, check Digoxin level  
MW: Notify RN in 1-2 minutes if acute change
Junctional Tachycardia

Origin: Junctional tissue
Regularity: Regular
Rate: Greater than 100 beats/min
P Waves: In Leads II or III inverted P Waves may occur before or after the QRS complex. There may be no P wave present.
PR Interval: If the P wave precedes the QRS, the PR Interval is less than 0.12 seconds.
QRS Duration: Normal: 0.06 - 0.10 seconds
Conduction: Atria are depolarized in a backward (retrograde conduction); ventricles are stimulated in a normal (antegrade conduction)
Causes: CAD, myocardial ischemia and most commonly digoxin toxicity
Signs & Symptoms: Symptoms are those anticipated with a rapid ventricular rate
Treatment:

RN: If stable, vagal stimulation followed by Adenosine. If no change, consider Amiodarone, beta blockers, or calcium channel blockers. If unstable, consider sedation and synchronized cardioversion.

MW: Notify RN in 1-2 minutes if acute change
Notify RN STAT for rate 150 or greater
**SUPRAVENTRICULAR TACHYCARDIA (SVT)**

---

<table>
<thead>
<tr>
<th>REGULARITY</th>
<th>A</th>
<th>V</th>
<th>RATE</th>
<th>A</th>
<th>V</th>
</tr>
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<tbody>
<tr>
<td>P WAVE</td>
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<tr>
<td>QRS DURATION</td>
<td></td>
<td></td>
<td>QT INTERVAL</td>
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</table>

**INTERPRETATION**

**TREATMENT**

*SVT is a term used to refer to a tachycardia initiated above the ventricles (supraventricular), when one cannot distinguish between atrial and junctional tachycardias. SVT is characterized by a normal QRS duration and usually occurs at higher rates when P Waves are not discernable. SVT is treated the same as atrial tachycardia.*

---

**Origin:** Atrial or junctional tissue  
**Regularity:** Regular  
**Rate:** Greater than 150 beats/min  
**P Waves:** Not discernable  
**PR Interval:** Not measurable  
**QRS Duration:** Normal: 0.06 - 0.10 sec  
**Conduction:** If junctional origin, conduction is the same as PJC.  
**Signs & Symptoms:** Based on rate: palpitations, hypotension, angina, congestive heart failure, decreased level of consciousness.  
**Treatment:**  
- **RN:** If stable, vagal stimulation, Adenosine then beta blocker, calcium channel blocker or digoxin; If the patient is severely symptomatic, consider sedation and synchronized cardioversion.  
- **MW:** Notify RN STAT
Summary of Junctional Rhythms

Inherent Rate: 40-60

P Waves: none or inverted before, during, or after QRS

PR Interval: less than 0.12 seconds if present

QRS Duration: 0.06 - 0.10 second

**Junctional Escape Beat**

SINUS ARREST WITH ESCAPE BEAT COMING FROM THE JUNCTION

Junctional Rhythm: rate 40-60

Accelerated Junctional Rhythm: rate 61-100

PJC: sinus rhythm with premature beat coming from the junction

Junctional Tachycardia: rate greater than 100

Supraventricular Tachycardia: rate greater than 150, no discernible P waves
ECG INTERPRETATION SELF EVALUATION - DAY ONE

ANATOMY AND PHYSIOLOGY
ELECTROPHYSIOLOGY
Sinus Rhythm
Atrial Tachycardia

1. Identify what each wave, segment and interval of a normal beat represents within the heart.
   
   Example: P Wave represents depolarization of the atria
   
   PR INTERVAL ____________________________
   QRS COMPLEX __________________________
   ST SEGMENT ____________________________
   T WAVE ________________________________

2. Label the P wave, QRS complex and T wave on each of the following beats. Measure the PR, QRS and QT intervals for each of the following beats.

   PR ______
   QRS ______
   QT ______

   PR ______
   QRS ______
   QT ______

3. Identify the normal range for the PR interval:
   
   Normal Range ________________________________

4. A QRS measurement of 0.12 is:
   
   A. normal
   B. abnormal but insignificant
   C. abnormal and indicative of impaired ventricular conduction (IVCD)
   D. abnormal and indicative of impaired ventricular repolarization

5. An ECG can provide information about the pumping activity of the heart muscle?
   
   A. True
   B. False

CCI
6. Elevation of the ST Segment may indicate:
   A. the need to further evaluate the patient’s cardiac status
   B. myocardial injury
   C. inadequate blood flow to the heat muscle
   D. all of the above
   E. none of the above

7. A prolonged QT interval can lead to lethal dysrhythmias.  A. True  B. False

8. Identify the normal, intrinsic/inherent, rates of the SA node, AV node and ventricles.
   SA NODE
   ________________________________
   AV NODE
   ________________________________
   VENTRICLES
   ________________________________

9. A regular sinus rhythm with a rate of <60 is called: ________________________.

10. The rate for sinus tachycardia is:
    A. 40 – 60
    B. 60 - 150
    C. 101 - 150
    D. 200 - 300

11. Provide the appropriate term for the following characteristics:
    A. event during which the SA Node does not fire:
       ________________________________
    B. sinus rhythm in which all interval and wave forms are normal except for a QRS measurement of ≥0.12:
       ________________________________

12. In Lead II and Lead III the P wave is normally upright.  A. True  B. False

    Notify the RN _________________________
    RNs:  You go to assess the patient and find that the patient is dizzy.
    Drug most commonly used to treat symptomatic sinus bradycardia: ________________

14. Monitor Watchers:  You identify a new episode of sinus arrest on the monitor:
    Notify the RN _________________________
    RNs:  You assess the patient and notify the MD of the sinus arrest: Initially, the patient is asymptomatic, but the periods of sinus arrest are becoming longer and more frequent.
    Name one intervention the patient may require: ____________________________
15. A premature beat originating from the atria has which of the following characteristics?
   A. different shaped P Wave is early in the regular cycle
   B. different shaped P Wave is late in the regular cycle
   C. normal P Wave is early in the regular cycle
   D. normal P Wave is late in the regular cycle

16. Interpret the following rhythms:

![Cardiogram Image]

**Interpretation:** __________________________________________________________

**Intervention:** __________________________________________________________

![Cardiogram Image]

**Interpretation:** __________________________________________________________

**Intervention:** __________________________________________________________

17. **RNs:** Adenosine may be used to slow which of the following rhythms?
   A. atrial flutter
   B. accelerated junctional rhythm
   C. Atrial Tachycardia
   D. atrial fibrillation

**Monitor Watchers:** You identify atrial flutter with a ventricle rate of 80:

Notify the RN __________________________

*The ventricular rate increases to a rate of 155:*

Notify the RN __________________________
18. A beat that originates from the AV Junction will have an _______________ P Wave in a normal Lead II or III; the P Wave may be seen _______________, or _______________ in relation to the QRS Complex. If the P Wave is before the QRS Complex, the PR interval will be _______________.

19. Identify:

A. a rhythm originating from the junction with a rate of 45 _______________

B. a rhythm originating from the junction with a rate of 140 _______________

C. a rhythm originating from the junction with a rate of 98 _______________

20. What is the difference between a junctional escape beat and a premature junctional beat? _______________

21. Both junctional tachycardia and atrial tachycardia are forms of supraventricular tachycardia.

A. True   B. False

22. Interpret the following rhythms:

**Interpretation:** __________________________________

**Intervention:** __________________________________

**Interpretation:** __________________________________

**Intervention:** __________________________________
RHYTHMS OF VENTRICULAR ORIGIN

Inherent Rate: 20-40
P Waves: none
PR Interval: none
QRS Duration: wide (0.12 or greater)

IDIOVENTRICULAR RHYTHM (IVR)

Origin: Ventricle
Regularity: Regular
Rate: 20-40 beats/min
P Waves: None
PR Interval: None
QRS Duration: Wide, bizarre, 0.12 seconds or greater; T wave is directed opposite the QRS
Conduction: Ventricles are stimulated backward or by retrograde conduction
Causes: Slowing of supraventricular pacemakers, acute MI
Signs & Symptoms: Idioventricular rhythm produces dizziness, hypotension or syncope
Comments: Patients in end-stage cardiac disease frequently go into IVR; Treatment and action is based on code status
Treatment: RN: Pacing
MW: Notify Any RN STAT
ACCELERATED IDIOVENTRICULAR RHYTHM

Origin: Ventricle
Regularity: Regular
Rate: 41-100
P Waves: None
PR Interval: None
QRS Duration: Wide, bizarre, 0.12 seconds or greater; T wave is directly opposite the QRS
Conduction: Ventricles are stimulated backward or by retrograde conduction
Causes: Ischemic heart disease, digoxin, reperfusion arrhythmia

Treatment:
RN: Usually none; watch for slowing of rhythm; may need pacing based on rate and symptoms
MW: Notify RN 1-2 minutes if new onset
Notify RN stat if rate <50
# Premature Ventricular Contraction (PVC)

## Interpretation

<table>
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<tr>
<th>Regularity</th>
<th>A</th>
<th>V</th>
<th>Rate</th>
<th>A</th>
<th>V</th>
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<tr>
<td>P Wave</td>
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<td>PR Interval</td>
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<td></td>
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<tr>
<td>QRS Duration</td>
<td></td>
<td></td>
<td>QT Interval</td>
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</tbody>
</table>

## Treatment

- **Origin:** Ventricles; underlying rhythm can be any rhythm
- **Regularity:** Based on underlying rhythm (PVC occurs early)
- **Rate:** Based on underlying rhythm
- **P Waves:** None or often lost in QRS or T wave of PVC
- **PR Interval:** None
- **QRS Duration:** Wide, bizarre, 0.12 seconds or greater; will have variety of configuration if multiple foci exist; T wave is generally large and opposite in direction to the major deflection of the QRS
- **Conduction:** Ventricles are stimulated backward or by retrograde conduction
- **Causes:** Hypoxia, congestive heart failure, acute MI, electrolyte imbalance, acid base imbalance, digoxin toxicity and mechanical irritation
- **Signs & Symptoms:** Palpitations
- **Comments:** Seriousness of PVCs lies in the fact that they may lead to more serious ventricular arrhythmias
- **Treatment:**
  - RN: If asymptomatic, no treatment. If symptomatic, give amiodarone or lidocaine
  - MW: Notify RN 1-2 minutes for new onset.
### VENTRICULAR TACHYCARDIA

<table>
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<th>Regularity</th>
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<th>Rate</th>
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<td>P Wave</td>
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<td>QRS Duration</td>
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<td></td>
<td>QT Interval</td>
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</tbody>
</table>

**Interpretation**

- **Origin:** Ventricle
- **Regularity:** Regular
- **Rate:** Greater than 100 beats/min
- **P Waves:** None
- **PR Interval:** None
- **QRS Duration:** Wide, bizarre, 0.12 seconds or greater; T wave is deflected opposite the QRS
- **Conduction:** Ventricles are stimulated backward (retrograde conduction)
- **Causes:** Hypoxia, congestive heart failure, acute MI, electrolyte imbalance, acid base imbalance, digoxin toxicity, mechanical irritation
- **Signs & Symptoms:** Vary from no symptoms to loss of pulse

**Treatment**

**RN:**
- If stable: amiodarone
- If unstable with a pulse: cardioversion
- If pulseless: defibrillate, CPR

**MW:** Notify any RN stat
### Ventricular Fibrillation

<table>
<thead>
<tr>
<th>Origin:</th>
<th>Ventricle; multiple ventricular foci causing total disorganization of ventricular activity. The ventricles quiver.</th>
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<tbody>
<tr>
<td>Regularity:</td>
<td>Extremely irregular and uncoordinated</td>
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<tr>
<td>Rate:</td>
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<tr>
<td>P Waves:</td>
<td>None</td>
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<tr>
<td>PR Interval:</td>
<td>None</td>
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<tr>
<td>QRS Duration:</td>
<td>None</td>
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<tr>
<td>Conduction:</td>
<td>Foci are located in ventricles, but so many are firing at one time there is no organized conduction</td>
</tr>
<tr>
<td>Causes:</td>
<td>Hypoxia, congestive heart failure, acute MI, electrolyte imbalance, acid base imbalance, digoxin toxicity, mechanical irritation</td>
</tr>
<tr>
<td>Signs &amp; Symptoms:</td>
<td>Loss of consciousness, pulse and respiration</td>
</tr>
</tbody>
</table>
| Treatment:      | **RN:** Defibrillation and CPR  
                  **MW:** Notify any RN STAT |
**Synchronized Cardioversion vs. Defibrillation**

**Synchronized Cardioversion**

* delivery of electrical energy, synchronized to the R wave of the QRS, to depolarize the remaining cardiac tissue in hopes the sinus node will assume electrical control of the heart

* used for **unstable** dysrhythmias of supraventricular tachycardia or ventricular tachycardia **with a pulse.**

**Defibrillation**

* delivery of electrical energy, unsynchronized to heart’s activity, to depolarize all of the muscle mass in the hopes the sinus node will assume electrical control of the heart

* used for ventricular fibrillation and **pulseless** ventricular tachycardia

**Sternal - Apex Paddle Position**

**Posterior - Anterior Paddle Position**
ASYSTOLE

Comments: There is no electrical activity in the myocardium, thus no P waves or QRSs; there is no cardiac output and thus no pulse or blood pressure.

Treatment: RN: Check another lead to verify the rhythm is not ventricular fibrillation; CPR based on Code Status, possible epinephrine/vasopressin.

MW: Notify any RN STAT.
VENTRICULAR STANDSTILL

When there is atrial activity (P waves), but no ventricle activity, the rhythm is called Ventricular Standstill. The treatment is the same as asystole.

__________

REGULARITY A_________ V_________ RATE A_________ V_________
P WAVE _________ PR INTERVAL _________ QRS DURATION _________ QT INTERVAL _________

INTERPRETATION

TREATMENT

Comments: There is no electrical activity in the ventricular myocardium, thus P waves are present, but there are no QRSs; there is no cardiac output and thus no pulse or blood pressure

Treatment: RN: Check another lead to verify the rhythm is not ventricular fibrillation; CPR based on Code Status, possible epinephrine/vasopressin

MW: Notify any RN STAT
**SUMMARY OF VENTRICULAR RHYTHMS**

- **Inherent Rate:** 20-40
- **P Waves:** none
- **PR Interval:** none
- **QRS Duration:** wide, bizarre, 0.12 seconds or greater

**Idioventricular Rhythm:** rate 20-40

**Accelerated Idioventricular Rhythm:** rate 41-100

**Premature Ventricular Contraction:** premature ventricular beat

**Ventricular Tachycardia:** rate greater than 101

**Ventricular Fibrillation:** irregular, no distinct QRS

**Asystole:** no activity

**Ventricular Standstill:** P Waves only, no QRS
PACEMAKER CODE

Pacemakers are coded by a sequence of letters to describe pacemaker type and mode of pacing. As pacemakers have become more sophisticated, pacemaker codes have grown to include as many as five letters. We however, will focus only on the first three letters.

<table>
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<tr>
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<th>3rd</th>
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<tbody>
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<td>Chamber (s)</td>
<td>Chamber(s)</td>
<td>Response to Sensing</td>
</tr>
<tr>
<td>Paced</td>
<td>Sensed</td>
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</tr>
<tr>
<td>A = Atrium</td>
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<td>I = Inhibited</td>
</tr>
<tr>
<td>V = Ventricle</td>
<td>V = Ventricle</td>
<td>T = Triggered</td>
</tr>
<tr>
<td>D = Dual (A+V)</td>
<td>D = Dual (A+V)</td>
<td>D = Dual (T+I)</td>
</tr>
<tr>
<td>O = None</td>
<td>O = None</td>
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</table>

EXAMPLES

Chamber Paced

Chamber Sensed

Action or Response to a Sensed Event

V V I

VVI PACED RHYTHM
PACEMAKER TERMINOLOGY

A. Electrical Stimulus

1. **Pace/fire**: the artificial pacemaker emits an electrical impulse.

2. **Pacing spike**: Small vertical line recorded on the ECG tracing when the artificial pacemaker emits an electrical impulse. (When pacing spikes are difficult to visualize on the ECG tracing, use an alternate lead).

3. **Pacing Rate**: The programmed rate at which the pacemaker will pace the heart in the absence of intrinsic cardiac activity is the set rate of the pacemaker; programmed interval between two consecutive pacing spikes.
B. Capture

1. **Capture**: indicates that the ventricle has responded to a pacing stimulus. This is reflected on the ECG as a wide QRS complex **immediately** following the spike.

   a. Temporary pacemaker output/mA dial: controls the strength of the stimulus released by the pacemaker; adjusted to ensure capture. The higher the number on the dial, the stronger the stimulus strength. Output is measured in milliamperes (mA).
C. Sensing

1. **Sense**: the ability of the pacemaker to detect or “see” a naturally occurring intrinsic depolarization (QRS).

2. Pacing is inhibited with intrinsic activity. The intrinsic cardiac activity (QRS) **resets** the “timer”.

   ![Lower Rate Interval Diagram]

   **Example**: The pacemaker has a preset rate of 60 beats per minute. If the patient’s heart rate is above 60, the pacemaker is inhibited or “just watches” the intrinsic cardiac activity. If the patient’s intrinsic ventricular rate drops below 60, the pacemaker will pace at a rate of 60.

3. **Temporary pacemaker sensitivity/mV dial**: controls how sensitive the pacemaker is to “seeing” an intrinsic beat.

   ![Sensitivity Dial and Pacemaker Device]

   a. A **higher** number (mV) means that the pacemaker is **less** sensitive to seeing the person’s own beat. Asynchronous (highest number) means essentially that the sensitivity is turned off.
STEPS FOR PACED RHYTHM INTERPRETATION

1. Is intrinsic (underlying rhythm) activity present?

2. Are pacing spikes present?

3. Is there capture with each pacing spike?

4. Is intrinsic activity (QRS) appropriately sensed?

5. What is the intrinsic heart rate?

6. What is the pacemaker rate?

Intrinsic Activity: Y/N  Can you determine the intrinsic rhythm? ____________________

Pacing Spikes: __________  Capture_________  Pacing Rate__________

Appropriate Sensing: Y/N

Pacing Malfunction:
Failure to Capture_____  Over Sensing_____  Under Sensing_______

Treatment: __________________________________________________________
TROUBLESHOOTING PACEMAKER MALFUNCTIONS

I. FAILURE TO CAPTURE (NON-CAPTURE)

The pacemaker delivers the pacing stimulus at the appropriate timing intervals but the expected paced QRS complex does not follow the pacing spike.

NOTE: Will not have capture following a ventricular pacer spike that occurs during the absolute refractory period. (This represents a sensing problem).

Causes:
- Output (mA) set too low
- Loose connections
- Battery depletion
- Lead dislodgment
- Lead fracture
- Increased pacing threshold (for example, change in patient condition such as, pacer lead fibrosis, drug therapy, ischemia, MI, hyperglycemia, hypoxia, hypercarbia, metabolic acidosis or alkalosis, hyperkalemia or other electrolyte imbalances)

Treatment:
- Increase mA
- Check connections
- Check battery
- Obtain CXR
- Turn patient to left side
- Reposition or change lead (a physician function)

Monitor Watcher – notify the RN STAT
SENSING FAILURES

2. OVERSENSING

The pacemaker is inappropriately inhibited from firing because it detects electrical signal other than the intended R-wave (for example, myopotentials, artifact, T-waves). Ex: Pacemaker does not fire because it senses the “false” electrical signals and thinks it’s a QRS complex.

It is recognized by pauses where pacing spikes were expected. The overall rhythm’s rate is less than the set rate of the pacemaker.

Causes:
- Inappropriate sensitivity setting (mV set too low)
- Large T wave
- Myopotentials – electrical signals produced by skeletal muscle contraction (i.e., muscle contractions, shivering or seizures)
- Electromagnetic interference (hospital EMI sources may include electrocautery, defibrillation, lithotripsy, ablation, and MRI which is usually contraindicated)

Treatment:
- Decrease sensitivity - increase the number on the mV dial
- Treat cause of myopotentials
- Remove source of electromagnetic interference

Monitor Watcher – notify the RN STAT
3. UNDERSENSING

Failure of the pacemaker to sense (see) the R-wave. The pacemaker emits inappropriately timed impulses.

Recognized by pacing spikes that follow too closely behind intrinsic QRS complexes. Pacemaker fires too early after the patient’s own beat.

Causes:
- Inappropriate sensitivity setting (mV set too high)
- Loose connections
- Battery depletion
- **Lead displacement**
- Lead fracture

Treatment:
- Increase sensitivity - decrease the number on the mV dial.
- Assess continued need for pacemaker
- Check connections
- Check battery
- Obtain CXR
- Reposition or change lead (a physician function)

Monitor Watcher – notify the RN STAT
4. FAILURE TO PACE

Pacemaker fails to emit impulses.

Recognized by absence of pacing spikes on the ECG; rate is less than the set rate of the pacemaker.

Causes:
- Loose connections
- Battery depletion
- Pacemaker generator failure
- Lack of output
- Lead wire fracture or dislodgment

Treatment:
- Rule out oversensing problem
- Check connections
- Replace the battery
- Replace pacemaker generator
- Increase mA
- Obtain chest X-ray to determine lead placement
- Reposition or replace pacing lead wire (a physician function)

Monitor Watcher – notify the RN STAT
## Atrioventricular Blocks

### SINUS RHYTHM WITH FIRST DEGREE A-V

- **REGULARITY**: A________ V________
- **RATE**: A________ V________
- **P WAVE**: ________
- **PR INTERVAL**: ________
- **QRS DURATION**: ________
- **QT INTERVAL**: ________

### INTERPRETATION

### TREATMENT

### ORIGIN:
SA node

### REGULARITY:
Regular

### RATE:
Based on underlying rhythm

### P WAVES:
Precede each QRS

### PR INTERVAL:
Greater than 0.20 seconds; constant

### QRS DURATION:
Normal: 0.06 - 0.10 seconds

### CONDUCTION:
AV conduction abnormally delayed producing prolonged PR interval; otherwise normal.

### CAUSES:
Drug toxicity (Quinidine, digoxin), myocardial ischemia, infectious disease (usually disappears when the infection is treated)

### COMMENTS:
This event is important because it may reflect injury to the AV junction and may warn of more serious forms of heart block

### TREATMENT:
- **RN**: Hold digoxin
- **MW**: If new onset, inform RN within 1-2 minutes.
SECOND DEGREE A-V BLOCK - MOBITZ I (WENCKEBACH)

<table>
<thead>
<tr>
<th>Regularity</th>
<th>A</th>
<th>V</th>
<th>Rate</th>
<th>A</th>
<th>V</th>
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<td>QRS Duration</td>
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<td>QT Interval</td>
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</tbody>
</table>

**Interpretation**

**Treatment**

**Origin:** SA node

**Regularity:** Atrial - regular; ventricle - irregular, depending on the degree of AV block

**Rate:** Atrial - based on sinus rate; ventricular - less than atrial

**P Waves:** Precede each QRS; more numerous than QRS complexes but are related to QRS complexes in a consistent, repetitive fashion

**PR Interval:** Variable. **Patterned** progressive lengthening of the PR interval until finally one P Wave is not conducted through to the ventricles; the cycle then repeats

**QRS Duration:** Normal

**Conduction:** Impulse usually originates in SA Node and travels to the AV Junction; with each impulse, there is a progressive delay at the AV Junction until finally, the sinus impulse is blocked at the AV Junction; thus, no QRS follows that P Wave; the next impulse finds the AV Junction polarized and ready for normal conduction

**Causes:** Drug toxicity (most often digoxin and Quinidine), degenerative cardiac disease, inferior MI

**Comments:** This arrhythmia is important because it may reflect injury to the AV junction

**Treatment:** RN: Usually none; Atropine or pacing if symptomatic from low ventricular rate; stop digoxin
MW: If new onset, notify RN in 1-2 minutes. Notify RN stat if ventricular rate is <50.
SECOND DEGREE A-V BLOCK - MOBITZ II

REGULARITY: A_______  V_______
RATE: A_______  V_______
P WAVE _______  PR INTERVAL _______  QRS DURATION _______  QT INTERVAL _______

INTERPRETATION: 

TREATMENT: 

ORIGIN: SA node

REGULARITY: Atrial - regular; ventricular - regular if the degree of block is constant (i.e. constant 2:1 block); irregular if the degree of block varies

RATE: Atrial - based on sinus rate

P WAVES: Normal; there may be two or more P Waves for each QRS complex

PR INTERVAL: Normal or prolonged, but remains the same for conducted beats. Constant.

QRS DURATION: Often greater than 0.10 seconds as this type of AV block frequently occurs below the Bundle of His

CONDUCTION: One or more of the sinus impulses are not conducted through the AV Junction

CAUSES: Myocardial ischemia and inferior or anterior MI

SIGNS & SYMPTOMS: May result in signs and symptoms of cerebral and myocardial insufficiency

COMMENTS: Usually indicates serious involvement of the AV Junction - may progress to complete AV block, (3rd degree).

TREATMENT: RN: Pacing; atropine if no pacer available and patient symptomatic
            MW: Notify RN STAT
THIRD DEGREE A-V BLOCK (COMPLETE HEART BLOCK - CHB)

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<tr>
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<th>RATE</th>
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<th>V</th>
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<tr>
<td>QRS DURATION</td>
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<td></td>
<td>QT INTERVAL</td>
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</tbody>
</table>

INTERPRETATION

TREATMENT

ORIGIN: Atrial pacemaker is sinus; ventricular pacemaker may be near or below the Bundle of His depending on the site of the block

REGULARITY: Atrial - regular; ventricular - regular

RATE: Atrial - more rapid than ventricular; based on sinus rate; Ventricular - depends on whether the escape focus is near the His Bundle bifurcation (about 40-60 beats/min) or below (20-40 beats/min)

P WAVES: Normal; have no association with the QRS complexes; P waves may “march through” the QRS or T wave

PR INTERVAL: Variable. There is no relationship between the P Waves and the QRS complexes.

QRS DURATION: Usually wide. May be within normal limits if impulse originates above the Bundle Branches.

CONDUCTION: Two independent pacemakers operating; sinus impulses completely blocked at the AV Node

CAUSES: Acute MI, particularly anterior or anteroseptal; degenerative cardiac disease

SIGN & SYMPTOMS: May result in signs and symptoms of cerebral and myocardial insufficiency, congestive heart failure and Adams-Stokes Syncope

TREATMENT: RN: Pacing, atropine if no pacer available and patient symptomatic
            MW: Notify RN STAT
# Summary

<table>
<thead>
<tr>
<th></th>
<th>Sinus 1&lt;sup&gt;st&lt;/sup&gt; Degree AVB</th>
<th>Mobitz I Wenckebach</th>
<th>Mobitz II 2&lt;sup&gt;nd&lt;/sup&gt; Degree AVB</th>
<th>CHB 3&lt;sup&gt;rd&lt;/sup&gt; Degree AVB</th>
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<tbody>
<tr>
<td><strong>Atrial Rhythm</strong></td>
<td>Regular</td>
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<tr>
<td><strong>Ventricular Rhythm</strong></td>
<td>Regular</td>
<td>Irregular</td>
<td>Regular or Irregular</td>
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<tr>
<td><strong>P Waves</strong></td>
<td>1:1</td>
<td>More than QRS</td>
<td>More than QRS</td>
<td>More than QRS</td>
</tr>
<tr>
<td><strong>PRI</strong></td>
<td>Constant, &gt;0.20 seconds</td>
<td>Progressively lengthens until dropped QRS</td>
<td>Same for conducted beats</td>
<td>Varies, No Relationship</td>
</tr>
</tbody>
</table>
ECG INTERPRETATION SELF EVALUATION - DAY TWO

VENTRICULAR RHYTHMS
ATRIO-VENTRICULAR
CARDIAC PACING

1. All ventricular beats or rhythms will possess the following characteristic:
   A. QRS width > 0.12
   B. QT interval > 0.50
   C. inverted P wave immediately preceding or following the QRS
   D. rate < 60 beats/min

2. Your patient’s monitor shows the following rhythm:

   This rhythm is:
   A. supraventricular tachycardia (SVT)
   B. ventricular tachycardia

   Explain: ____________________________________________

3. Identify the following rhythm: __________________________

   RNs: Amiodarone is a drug commonly used to treat this rhythm. True or False

   Monitor Watchers: Notify the RN __________________________
4. Identify the following rhythm: ______________________________

RNs: Name one appropriate intervention ____________________________

Monitor Watchers: Notify the RN ____________________________

5. Interpret the following rhythm: ________________________________

RNs: Identify two appropriate interventions for this rhythm:

1. ____________________________

2. ____________________________

Monitor Watchers: Notify ____________________________

6. A characteristic of all AV blocks is:
A. a delay in impulse conduction through the atria
B. a delay in impulse conduction through the AV node
C. an increase in impulse conduction through the ventricles
D. an increase in impulse conduction through the sinus node

7. Match the following characteristic with the type of AV block:
A. PR interval is prolonged >0.20 seconds
B. PR interval progressively prolongs then drops a QRS complex
C. PR interval is consistent but suddenly drops a QRS complex
D. no relationship between the P wave and QRS complex

1. _____2<sup>nd</sup> degree AV block, Mobitz I (Wenckebach)
2. _____3<sup>rd</sup> degree AV block, (Complete Heart Block)
3. _____1<sup>st</sup> degree AV block
4. _____2<sup>nd</sup> degree AV block, Mobitz II
8. Interpret the following rhythms.

Interpretation_____________________________________________________________________
Intervention_____________________________________________________________________

Interpretation_____________________________________________________________________
Intervention_____________________________________________________________________

Interpretation_____________________________________________________________________
Intervention_____________________________________________________________________
9. **Monitor Watchers:** You identify any pacemaker malfunction.

Notify the RN ____________________

10. **RNs:** You identify following pacemaker malfunctions. Match each with an appropriate intervention.

   _____ oversensing  
   A. increase sensitivity (decrease mV setting)  
   B. decrease mA (output)  

   _____ undersensing  
   C. increase mA (output)  
   D. decrease sensitivity (increase mV setting)  

   _____ loss of capture

11. For VVI pacing, an intrinsic ventricular complex (QRS) should be sensed and inhibit pacing. The intrinsic cardiac event (QRS) resets the “timer”.

   A. True  
   B. False
<table>
<thead>
<tr>
<th>Practice-7</th>
<th>Practice-9</th>
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</thead>
<tbody>
<tr>
<td>Regularity</td>
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<td>P wave</td>
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<td>PR interval</td>
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<td>QRS duration</td>
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<td>QT interval</td>
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<td>Treatment</td>
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**Practice-7**

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**Practice-9**

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CCI

DAY TWO PUTTING IT ALL TOGETHER PRACTICE

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**PRACTICE-10**

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<td>QRS Duration</td>
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<td>QT Interval</td>
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**INTERPRETATION**

CAPTURE

SENSING

**TREATMENT**

---

**PRACTICE-11**

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<th>A</th>
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**INTERPRETATION**

**TREATMENT**

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**PRACTICE-12**

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<td>QT Interval</td>
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**INTERPRETATION**

**TREATMENT**
CCI
DAY TWO PUTTING IT ALL TOGETHER PRACTICE

PRACTICE-13
REGULARITY A________ V________ RATE A_______ V_______
P WAVE ________ PR INTERVAL ________ QRS DURATION ________ QT INTERVAL ________
INTERPRETATION ____________________________________________________________
TREATMENT ________________________________________________________________

PRACTICE-14
REGULARITY A________ V________ RATE A_______ V_______
P WAVE ________ PR INTERVAL ________ QRS DURATION ________ QT INTERVAL ________
INTERPRETATION ____________________________________________________________
TREATMENT ________________________________________________________________

PRACTICE-15
REGULARITY A_______ V_______ RATE A_______ V_______
P WAVE ________ PR INTERVAL ________ QRS DURATION ________ QT INTERVAL ________
INTERPRETATION ____________________________________________________________
TREATMENT ________________________________________________________________
### Day Two Putting It All Together Practice

**Practice-16**

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**Interpretation**

**Treatment**

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**Practice-17**

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<td>QRS Duration</td>
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**Interpretation**

**Capture Sensing**

**Treatment**

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**Practice-18**

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**Interpretation**

**Treatment**
CCI
DAY TWO PUTTING IT ALL TOGETHER PRACTICE

**Practice-22**

<table>
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Interpretation: ____________________________________________________________

Treatment: ________________________________________________________________

**Practice-23**

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Interpretation: ____________________________________________________________

Treatment: ________________________________________________________________

**Practice-24**

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<td>QRS Duration</td>
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Interpretation: ____________________________________________________________

Treatment: ________________________________________________________________
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<tr>
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<th>Rate</th>
<th>P Wave</th>
<th>PR Interval</th>
<th>QRS Duration</th>
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PRACTICE-31
REGULARITY A_________ V_________ RATE A_________ V_________
P WAVE ________ PR INTERVAL ________ QRS DURATION ________ QT INTERVAL ________
INTERPRETATION ___________________________________________
TREATMENT ________________________________________________
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<tr>
<th>Practice</th>
<th>Description</th>
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<tbody>
<tr>
<td>Practice 1</td>
<td>accelerated junction rhythm</td>
</tr>
<tr>
<td>Practice 2</td>
<td>SR with IVCD and PVC</td>
</tr>
<tr>
<td>Practice 3</td>
<td>2nd degree AV block Mobitz I (Wenckebach)</td>
</tr>
<tr>
<td>Practice 4</td>
<td>ventricular paced rhythm with failure to pace</td>
</tr>
<tr>
<td>Practice 5</td>
<td>sinus rhythm with PAC</td>
</tr>
<tr>
<td>Practice 6</td>
<td>paced with failure to capture and undersensing</td>
</tr>
<tr>
<td>Practice 7</td>
<td>sinus brady with 1st degree AV block and IVCD</td>
</tr>
<tr>
<td>Practice 8</td>
<td>sinus rhythm with bigeminal PACs</td>
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<tr>
<td>Practice 9</td>
<td>ventricular fibrillation</td>
</tr>
<tr>
<td>Practice 10</td>
<td>normal ventricular paced rhythm, (VVI)</td>
</tr>
<tr>
<td>Practice 11</td>
<td>atrial flutter</td>
</tr>
<tr>
<td>Practice 12</td>
<td>ventricular tachycardia</td>
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<tr>
<td>Practice 13</td>
<td>complete heart block</td>
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<tr>
<td>Practice 14</td>
<td>sinus bradycardia with sinus arrest followed by a junctional escape beat</td>
</tr>
<tr>
<td>Practice 15</td>
<td>ventricular fibrillation into asystole</td>
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<tr>
<td>Practice 16</td>
<td>Supraventricular tachycardia</td>
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<tr>
<td>Practice 17</td>
<td>ventricular paced rhythm with oversensing</td>
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<tr>
<td>Practice 18</td>
<td>atrial fibrillation uncontrolled with PVCs</td>
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<tr>
<td>Practice 19</td>
<td>2nd degree AV block, Mobitz II</td>
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<td>Practice 20</td>
<td>sinus bradycardia</td>
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<td>Practice 21</td>
<td>sinus with 1st degree AV block</td>
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<td>Practice 22</td>
<td>atrial fibrillation</td>
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<tr>
<td>Practice 23</td>
<td>sinus rhythm with 2.72 sec sinus arrest</td>
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<tr>
<td>Practice 24</td>
<td>2nd degree AV block, Mobitz II with IVCD</td>
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<tr>
<td>Practice 25</td>
<td>2nd degree AV block, Mobitz I (Wenckebach)</td>
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<tr>
<td>Practice 26</td>
<td>ventricular paced rhythm with loss of capture</td>
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<tr>
<td>Practice 27</td>
<td>sinus with 1st degree AV block with 2 PVCs</td>
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<td>Practice 28</td>
<td>junctional rhythm</td>
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<td>Practice 29</td>
<td>Idioventricular rhythm</td>
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<td>Practice 30</td>
<td>Accelerated IVR</td>
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<td>Practice 31</td>
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