

ECG Interpretation Assessment Review Packet

ASSESSMENT FORMAT

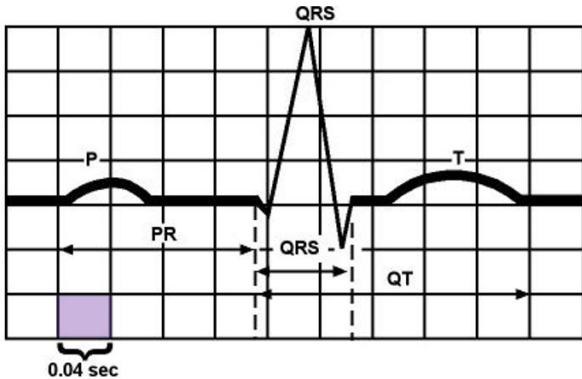
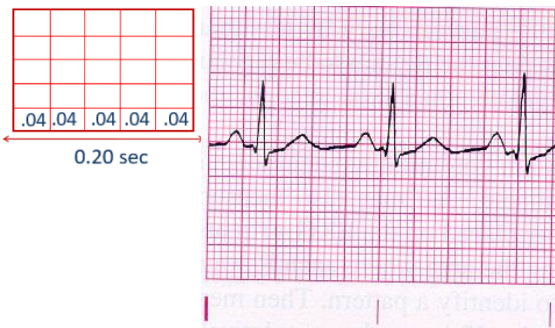
Nurses caring for adults will be provided no more than 2 hours to complete the 60-question assessment. The format of the ECG Interpretation Assessment consists of fill in the blank, multiple choice and select all that apply questions. Calipers will provide calipers for the examination. The exam will cover a variety of concepts, including but not limited to:

- Interval measurements: e.g. PRI, QRS, QT
- Atrial and ventricular rhythm regularity and rate
- Nursing considerations: e.g. physical assessment, interventions, treatment
- Rhythm interpretation

Scoring 83% or higher satisfies the "Basic Dysrhythmia Detection and Treatment" item within [skills packets](#) used in multiple work settings.

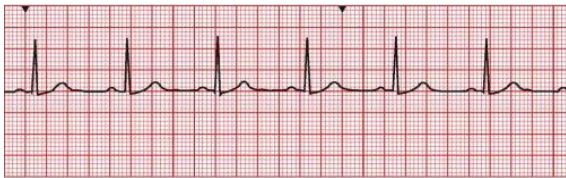
NORMAL SINUS RHYTHM AND SINUS DYSRHYTHMIAS

ECG Measurements:

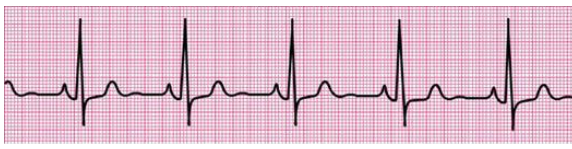


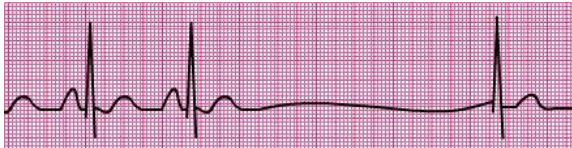


- **ECG Graph Paper:**
 - **Small square:** 1 mm in length, equals 0.04 seconds (40 msec)
 - **Large square:** 5 mm in length, equals 0.20 seconds (200 msec)
 - 5 large squares equals 1 second
 - 30 large squares equals 6 seconds
- **Rate:**
 - **Divide into 300 Method:** Count number of large boxes between two R waves & divide into 300 (Regular Rhythms Only)
 - **Square Counting Method:** Find a QRS that falls on a thick line. Move either right or left to the next QRS. Using scale 300, 150, 100, 75, 60, & 50 for each large box. (Regular Rhythms Only)
 - **6 Second Counting Method:** Count number of R waves in 6 secs (30 large boxes) and multiply by 10 (Regular & Irregular Rhythms)
- **Waveforms:**
 - P wave: Atrial Depolarization (Contraction). Insight to the how well the SA node is working
 - PR Interval (PRI): Time it takes the impulse to travel from the SA node, through the internodal pathways and to the ventricles
 - QRS: Represents the time it take for an impulse to travel through the ventricular muscle. Ventricular Depolarization (Contraction). Heart Rate
 - T Wave: Ventricular Repolarization (Rest)
 - QT Interval: Represents the sum of depolarization and repolarization periods
- **Interval Measurements:**
 - **PR Interval:** Normal Value: 0.12-0.2sec. Prolonged PRI >0.2sec indicates a First-degree AV bloc.
 - **QRS Complex:** Normal Value: 0.6-0.11sec. Narrow Complex: 0.6-0.11 sec. Wide Complex: >0.11 sec (Potential Bundle Branch Block)
 - **QT Interval:** Normal Value: 0.34-.43 sec. Varies in males, females, and by age. Prolonged QTc: Males:> 0.44sec and Females: > 0.45sec

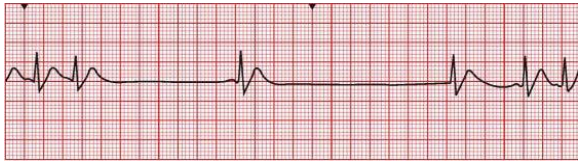
NORMAL SINUS RHYTHM



- **Rate:** SA node firing at 60-100 bpm
- **Rhythm:** Regular
- **P-Waves:** Present, similar morphology
- **PR Interval:** Normal (0.12-0.20 secs), consistent
- **P:QRS Ratio:** QRS is present after each P-wave (1:1 ratio of P's to QRS's)
- **QRS Width:** Narrow ($\leq .11$) or Wide ($\geq .12$)
- **T-Waves:** Present
- **Clinical Significance:** This is a rhythm of a healthy heart. The electrical pulse from your SA node (innate pacemaker of the heart) is being properly transmitted and depolarization is occurring.
- **Physical Assessment:** If beats are perfusing and patient is receiving adequate cardiac output, they should be asymptomatic.
- **Clinical Management:** Part of rhythm interpretation is to ALWAYS assess the patient, even if the rhythm is normal and healthy regular heart rhythm

<p>SINUS BRADYCARDIA</p> 	<ul style="list-style-type: none"> • Rate: SA node firing at <60 bpm • Rhythm: Regular • P-Waves: Present, similar morphology • PR Interval: Normal, consistent • P:QRS Ratio: 1:1 • QRS Width: Narrow or Wide • T-Waves: Present • Etiology: Ischemia/infarction of SA node, hypothermia, cardiac drugs, hypothyroidism, ↑ vagal tone, ↓ sympathetic tone • Clinical Significance: Decreased Cardiac output (CO), predisposes individual to ectopic beats • Physical Assessment: Slow pulse, S&S of decreased cardiac output (decreased BP, dizziness, altered mental state, syncope, weakness, fatigue, chest pain). • Clinical Management: Assess your patient. Are they symptomatic? Treat if symptomatic. Treatment includes oxygen, establish IV access, find and treat the underlying problem, atropine, continuous IV inotropes if atropine not effective (dopamine or epinephrine), transcutaneous pacing, permanent pacemaker (PPM) if cause cannot be reversed.
<p>SINUS TACHYCARDIA</p> 	<ul style="list-style-type: none"> • Rate: SA node firing at >100 bpm • Rhythm: Regular • P-Waves: Present, normal unless merged with T-Wave, similar morphology • PR Interval: Normal, consistent • P:QRS Ratio: 1:1 • QRS Width: Narrow or Wide • T-Waves: Present, may be merged with P-Wave • Etiology: Compensatory response to physiologic stressor (pain, emotions, anxiety, blood loss, hypovolemia, early sepsis, heart failure, allergic reaction, fever, exercise), substances (smoking, alcohol, caffeine, drugs) • Clinical Significance: ↑ oxygen consumption, ↑ workload on heart, ↓ CO if rate too fast for cardiac filling • Physical Assessment: Rapid heart rate/pulse, patients usually will not have many symptoms unless they have decreased cardiac output (decreased BP, dizziness, altered mental state, syncope, weakness, fatigue, chest pain) • Clinical Management: Assess your patient. Are they symptomatic? Treat if symptomatic. Treatment would depend on the underlying cause. Pain (give Tylenol or Norco), hypovolemia (give fluids), blood loss (administer blood product), etc. If it is not a compensatory mechanism administer beta blockers or calcium channel blockers. Avoid stimulants.
<p>SINUS ARRHYTHMIA/DYSRHYTHMIA</p> 	<ul style="list-style-type: none"> • Rate: Usually around 60-100 but can be slow or fast • Rhythm: Slightly irregular, usually varies with respiration (inspiration/expiration) • P-Waves: Present, similar morphology • PR Interval: Normal, consistent • P:QRS Ratio: 1:1 • QRS Width: Narrow or Wide • T-Waves: Present • Etiology: Common and normal finding in children and young adults, underlying heart disease, digitalis, exercise, mental stress, circadian rhythms • Clinical Significance: Usually none, can make heart more susceptible to ventricular dysrhythmias • Physical Assessment: Cardiac output is normal, patients usually do not experience any symptoms. • Clinical Management: Assess your patient. If the bradycardia is significant administer atropine. If the patient is on digoxin, notify the MD as it may be dig toxicity.
<p>SINUS ARREST/SINUS PAUSE</p> 	<ul style="list-style-type: none"> • Rate: Single or multiple pauses can occur • Rhythm: Irregular (due to break in rhythm) • P-Waves: Delayed or non-conducted (after a pause there may or may not be a P-wave) • PR Interval: Normal except during the pause event • P:QRS Ratio: Usually 1:1 except during the pause event • QRS Width: Narrow or Wide • T-Waves: Present • Etiology: Hypoxemia, ischemia, diseased SA node, drugs (digoxin, betablockers), cardiac disorders, vagal stimulation • Clinical Significance: Depends on patient's symptoms, if short and infrequent the patient may be symptomatic. If patient is symptomatic can have symptoms of ↓ CO. Pause may be followed by a Junctional Escape Beat (JEB) to prevent cardiac standstill. • Physical Assessment: A prolonged pause causes an irregular pulse. Recurrent pauses or long pauses may cause signs of decreased cardiac output. • Clinical Management: Assess your patient. Find the underlying cause. Treat if symptomatic. Goal of treatment is to maintain sufficient cardiac output. Medications such as atropine or epinephrine can be administered. Emergent treatment includes temporary pacing.

SICK SINUS SYNDROME



- **Rate:** Variable (bradycardia to tachycardia)
- **Rhythm:** Irregular
- **P-Waves:** Variable, can be delayed or non-conducted
- **PR Interval:** Variable
- **P:QRS Ratio:** Variable
- **QRS Width:** Narrow or Wide
- **Etiology:** Coronary artery disease, fibrosis of SA node, Trauma to SA node, antidysrhythmic drug side effects (digoxin, beta blockers, calcium channel blockers)
- **Clinical Significance:** Loss of reliable pacemaker, ↑ workload on heart, ↓ CO
- **Physical Assessment:** Pulse changes back and forth with bradycardia and tachycardia. Patient can have symptoms related to decreased cardiac output.
- **Clinical Management:** Assess your patient. No treatment is necessary if patient is asymptomatic. For symptomatic patients the goal is to alleviate signs and symptoms and correct the underlying cause. Atropine and epinephrine may be given for bradycardia. Metoprolol and digoxin may be used to treat tachyarrhythmias. Temporary pacemaker can be utilized. The only definitive treatment is a PPM

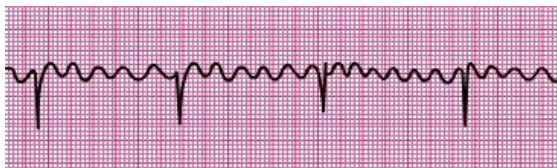
ATRIAL DYSRHYTHMIAS

PREMATURE ATRIAL CONTRACTION (PAC)



- **Rate:** PAC is a single complex. May occur in patterns: pairs, every other beat or every three beats.
- **Regularity:** Ectopic beat makes it irregular
- **P-Waves:** P-Wave for PAC is usually abnormally shaped or buried in preceding T-Wave, different morphology than underlying P waves
- **PR Interval:** Changes with the premature beat(s), $PR I \geq 12$
- **QRS Width:** Narrow
- **Etiology:** Stimulants, stress, anxiety, electrolyte imbalances, hypoxia, drug toxicity, coronary heart disease, fatigue, fever
- **Clinical Significance:** Depends on frequency, if more than 5-6/min then it is frequent and more significant, could ↓ CO. Predisposes to other dysrhythmias.
- **Physical Assessment:** Pulse is irregular if frequent PACs. Usually asymptomatic unless PACs are more frequent than they can cause a decrease in cardiac output.
- **Clinical Management:** Assess your patient. Treat the underlying cause. Assess to see if there is a trigger (stimulants, stress, etc).

ATRIAL FLUTTER



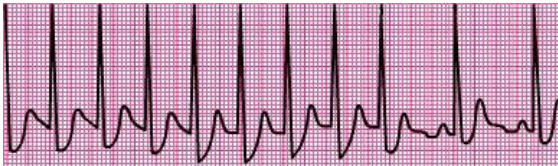
- **Rate:** Usually Atrial: 200-400 bpm, Ventricular: 100-300. Rate can be slower, depends on the AV conduction ratio.
- **Rhythm:** Variable presentation. Regular if consistent ratio of F-waves:QRS (2:1, 3:1, 4:1), irregular if variable ratio
- **P-Waves:** Absent, rather there are flutter "F-Waves" with a "sawtooth" appearance, F-waves are consistent
- **PR Interval:** None
- **QRS Width:** Narrow or Wide
- **T-Waves:** Not able to distinguish d/t F-Waves
- **Etiology:** Enlarged atrial tissue, elevated atrial pressures, digoxin toxicity, pulmonary embolism, ETOH abuse, following open heart surgery
- **Clinical Significance:** Abnormal movement of electrical depolarization in reentry circuit, loss of atrial kick, ↓ filling time, ↓ CO, blood stasis=increased incidence of clotting (clot dislodgment can cause pulmonary embolism or stroke), ↑ myocardial oxygen consumption
- **Physical Assessment:** Pulse can be regular or irregular depending on if the ratio is consistent or variable. If the ventricular rate is too fast or slow the patient may exhibit signs of decreased cardiac output. Evaluate the patient for a DVT, CVA and PE.
- **Clinical Management:** Assess your patient. Notify the provider. Treatment depends on stability of the patient.
 - Hemodynamically unstable (Low BP, AMS) immediately perform synchronized cardioversion.
 - Hemodynamically stable you want to control the rate (digoxin, propranolol, diltiazem, verapamil) and convert the rhythm (amiodarone can control the rate and convert the rhythm). Treatment varies on the patient's cardiac function. Synchronized cardioversion may be indicated if rhythm persists, however, risk vs benefit based on complications needs to be discussed.

ATRIAL FIBRILLATION



- **Rate:** Usually Atrial: 400-700 bpm, Ventricular: Variable. Depends on AV conduction. Controlled if HR<100, Uncontrolled/Rapid Ventricular Response (RVR) HR >100
- **Rhythm:** Irregularly irregular
- **P-Waves:** Absent, rather there are fibrillatory “f-Waves”
- **PR Interval:** None
- **QRS Width:** Narrow
- **T-Waves:** Can be difficult to distinguish d/t f-Waves
- **Etiology:** Acute MI, digitalis toxicity, long standing HTN, left atrial enlargement
- **Clinical Significance:** Loss of atrial kick, ↓ filling time, ↓ CO, blood stasis=increased incidence of clotting (clot dislodgment can cause pulmonary embolism or stroke)
- **Physical Assessment:** Irregularly irregular pulse, palpitations, if patient is not hemodynamically stable with this rhythm they may have symptoms of decreased cardiac output.
- **Clinical Management:** Assess your patient. Investigate the cause. Goal is to reduce ventricular rate. Treatment includes medication, synchronized cardioversion or both.
 - Hemodynamically unstable (Low BP, AMS) immediately perform synchronized cardioversion.
 - Hemodynamically stable you want to administer medications to assist the SA node in re-establish its role as the heart’s pacemaker (metoprolol, atenolol, esmolol, propranolol, diltiazem, verapamil, amiodarone).

SUPRAVENTRICULAR TACHYCARDIA (SVT)





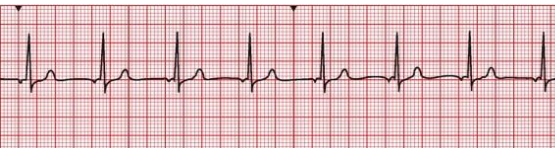

- **Rate:** 140-250
- **Rhythm:** Regular
- **P-Waves:** usually buried in QRS or T-Wave
- **PR Interval:** Not measurable
- **QRS Width:** Narrow unless distorted by buried P-Waves
- **T-Waves:** Present, can be merged with P-waves
- **Etiology:** Structurally related, heart failure, thyroid disease, excess of stimulants, pregnancy, surgery, chronic lung disease. SVT is a broad term covering many forms of arrhythmias that originate above the ventricles in the atria or AV node (supraventricular = above the ventricles)
- **Clinical Significance:** usually benign and self-limiting when the cause is removed, ↓ filling time, ↓ CO
- **Physical Assessment:** A fluttering in your chest, rapid heartbeat (palpitations), shortness of breath, lightheadedness or dizziness, sweating, a pounding sensation in the neck, fainting (syncope) or near fainting
- **Clinical Management:** Assess your patient. Find and treat the cause. Perform vagal maneuvers: bear down, coughing, (carotid sinus massage by provider only). Administer oxygen if hypoxemic. Medications to administer if vagal maneuvers are unsuccessful or patient unable to perform include adenosine and calcium channel blockers. Synchronized cardioversion if drug therapy and vagal maneuvers are unsuccessful.

WANDERING ATRIAL PACEMAKER



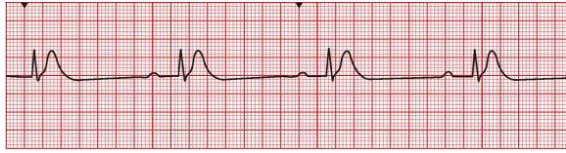
- **Rate:** <100 (considered multifocal atrial tachycardia (MAT) if >100)
- **Rhythm:** Irregularly irregular (sites of impulses vary)
- **P-Waves:** Present with variable morphologies. Minimum of 3 different morphologies required.
- **PR Interval:** Variable
- **P:QRS Ratio:** 1:1
- **QRS Width:** Narrow or Wide
- **Etiology:** □ vagal tone, digoxin toxicity, heart disease, COPD, Respiratory failure, atrial enlargement, electrolyte abnormalities, stimulants
- **Clinical Significance:** Can be normal in young pts and common in athletes, no clinical significance if patients are asymptomatic, correct underlying condition
- **Physical Assessment:** Most patients will be asymptomatic. Some may have mild palpitations.
- **Clinical Management:** Assess your patient. No treatment is necessary if asymptomatic. Correct the underlying cause.

JUNCTIONAL DYSRHYTHMIAS

<p>PJC</p> 	<ul style="list-style-type: none"> • Rate: PJC is a single complex. May occur in patterns: pairs, every other beat or every three beats. • Rhythm: The ectopic beat makes it irregular • P-Waves: Variable for the ectopic beat. 3 different P-wave presentations are possible (before, during or after QRS). Can be positive or negative deflection (inverted). • PR Interval: Variable for ectopic beat, <0.12 if P-wave present before QRS • P:QRS Ratio: Variable for ectopic beat, 1:1 if P-wave before QRS • QRS Width: Narrow unless distorted by P-wave • T-Waves: Present • Etiology: Digoxin toxicity, excessive caffeine intake, inferior MI, rheumatic heart disease, valvular heart disease, hypoxia, swelling of AV junction • Clinical Significance: Depends on frequency and if patient is symptomatic, if more than 5-6/min then it is frequent and more significant, could ↓ CO. Predisposes to other dysrhythmias. May have a pause after a PJC • Physical Assessment: Usually asymptomatic but may have palpitations. Irregular pulse and my experience decreased cardiac output if frequent. • Clinical Management: Assess your patient. Does not require treatment unless symptomatic. Find and treat the underlying cause.
<p>JUNCTIONAL RHYTHM/JUNCTIONAL ESCAPE RHYTHM</p> 	<ul style="list-style-type: none"> • Rate: 40-60 bpm • Rhythm: Regular • P-Waves: Variable. 3 different P-wave presentations are possible (before, during or after QRS). Can be positive or negative deflection (inverted). • PR Interval: Variable, short if P-wave present before QRS • P:QRS Ratio: Variable, 1:1 if P-wave before QRS • QRS Width: Narrow unless distorted by P-wave • T-Waves: Present • Etiology: Sick sinus syndromes, vagal stimulation, electrolyte imbalances, digoxin toxicity, inferior wall MI, rheumatic heart disease • Clinical Significance: ↓ HR and ↓ CO • Physical Assessment: Slow regular pulse, usually asymptomatic unless there is decreased cardiac output • Clinical Management: Assess your patient. Find the cause. Treat if symptomatic. Administer atropine to increase the heart rate. Temporary pacemaker if patient remains symptomatic.
<p>ACCELERATED JUNCTIONAL RHYTHM</p> 	<ul style="list-style-type: none"> • Rate: 60-100 bpm • Rhythm: Regular • P-Waves: Variable. 3 different P-wave presentations are possible (before, during or after QRS). Can be positive or negative deflection (inverted). • PR Interval: Variable, short if P-wave present before QRS • P:QRS Ratio: Variable, 1:1 if P-wave before QRS • QRS Width: Narrow unless distorted by P-wave • T-Waves: Present • Etiology: Digoxin toxicity, hypokalemia, hypercalcemia, inferior and posterior MI, rheumatic heart disease, valvular heart disease • Clinical Significance: loss of atrial kick and ↓ filling time if retrograde, ↓ CO • Physical Assessment: May be asymptomatic. May experience signs of decreased cardiac output. Pulse is regular. • Clinical Management: Assess your patient. Correct the underlying cause. If symptomatic and not improving, consider temporary pacing.
<p>JUNCTIONAL TACHYCARDIA</p> 	<ul style="list-style-type: none"> • Rate: 100-130 bpm • P-Waves: Variable. 3 different P-wave presentations are possible (before, during or after QRS). Can be positive or negative deflection (inverted). • PR Interval: Variable, short if P-wave present before QRS • P:QRS Ratio: Variable, 1:1 if P-wave before QRS • QRS Width: Narrow unless distorted by P-wave • T-Waves: Present • Etiology: inferior or posterior MI, SA node disease, hypoxia, ischemia, digoxin toxicity, □ vagal tone • Clinical Significance: loss of atrial kick and ↓ filling, ↓ CO, predisposes to other dysrhythmias, less dependable pacemaker, predisposes to heart failure • Physical Assessment: May be asymptomatic. May experience signs of decreased cardiac output, fluttering sensation, pulse is regular and fast. • Clinical Management: Assess your patient. Find and treat underlying cause. Treat decreased cardiac output by slowing heart rate with beta blockers, calcium channel blockers or digoxin. Consider vagal maneuvers and cardioversion. PPM or catheter ablation if rhythm continues.

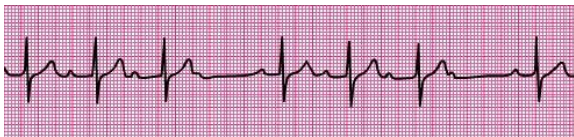
CARDIAC CONDUCTION BLOCKS

FIRST DEGREE AV BLOCK



- **Rate:** Variable, atrial rate = ventricular rate
- **Rhythm:** Regular
- **P-Waves:** Present, similar morphology
- **PR Interval:** Prolonged $>.20$, consistent
- **P:QRS Ratio:** 1:1
- **QRS Width:** Narrow or Wide
- **T-Waves:** Present
- **Dropped Beats:** No
- **Etiology:** Ischemia, myocardial infarction, rheumatic heart disease, CAD, cardiac medications (digoxin, beta blockers, calcium channel blockers)
- **Clinical Significance:** Not dangerous by itself, typically no symptoms, predisposes to progression to more serious block
- **Physical Assessment:** Usually asymptomatic. There is no impact on cardiac output as there is still atrial kick. Decreased cardiac output would be related to the rate of the rhythm.
- **Clinical Management:** Assess your patient. Treat the underlying cause. Watch for progression to second degree AV block.

SECOND DEGREE AV BLOCK TYPE I (MOBITZ I, WENCKEBACH)



- **Rate:** Ventricular rate is less than atrial rate d/t dropped QRS complexes
- **Rhythm:** Variable--atrial is regular, ventricular is irregular d/t non-conducted beat
- **P-Waves:** Present, similar morphology
- **PR Interval:** Variable, progressively gets longer before dropping a QRS complex. The shortest PRI is the one immediately following the dropped beat. The longest PRI is the one immediately before the dropped beat.
- **P:QRS Ratio:** Variable, $P > QRS$
- **QRS Width:** Narrow or Wide
- **Dropped Beats:** Yes
- **Etiology:** Ischemia, MI, CAD, drug toxicity such as digoxin, rheumatic fever, myocarditis, transient after heart surgery, cardiac medications (beta blockers, calcium channel blockers)
- **Clinical Significance:** Depends on the frequency of dropped QRS complexes, \downarrow CO, predisposes to progression to more serious block
- **Physical Assessment:** Pulse is irregular d/t dropped beats. If frequently dropped beats can experience signs of decreased cardiac output.
- **Clinical Management:** Assess your patient. Treat if symptomatic with atropine to improve AV node conduction. Temporary pacemaker for long term relief if symptoms persist. Find and treat underlying cause.

SECOND DEGREE AV BLOCK TYPE II (MOBITZ II)



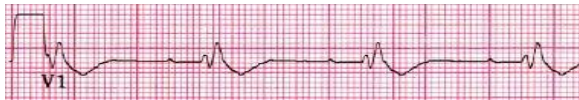
- **Rate:** Ventricular rate is less than atrial rate d/t dropped QRS complexes
- **Rhythm:** Variable--atrial is regular, ventricular is regular or irregular depending on number of blocked complexes
- **P-Waves:** Present, similar morphology
- **PR Interval:** Normal and consistent
- **P:QRS Ratio:** Variable, $P > QRS$. There can be a pattern of conducted beats to dropped beats (example: 2:1—2 P waves for every QRS)
- **QRS Width:** Narrow or Wide
- **Dropped Beats:** Yes
- **Etiology:** Septal wall necrosis, anterior septal MI, myocarditis, CAD, drug toxicity, cardiomyopathy
- **Clinical Significance:** Depends on the frequency of dropped QRS complexes, \downarrow CO, predisposes to progression to more serious block, unpredictable rhythm
- **Physical Assessment:** Pulse is slow due to dropped beats. Pulse can be regular or irregular depending on if there is a pattern in dropped beats. Symptoms of decreased cardiac output if present.
- **Clinical Management:** Assess your patient. Notify provider immediately as it can deteriorate fast. If asymptomatic usually will observe. If symptomatic temporary or permanent pacemaker. Medications include atropine, dopamine, and epinephrine for bradycardia.

THIRD DEGREE AV BLOCK (COMPLETE HEART BLOCK)



- **Rate:** Variable. Atrial rate usually 60-100 and ventricular rate 40-60 if AV node, 20-40 if Purkinje fibers are pacemaker cells
- **Rhythm:** Regular, P-waves will march out, QRS complexes will march out. The P-waves and QRS complexes have no correlation.
- **P-Waves:** Present, similar morphology
- **PR Interval:** Variable
- **P:QRS Ratio:** P > QRS, there is no correlation between P-wave and QRS
- **QRS Width:** Narrow or Wide
- **Etiology:** MI, digoxin toxicity, acute myocarditis, degenerative changes in the heart, calcium channel blockers, beta-adrenergic blockers, cardiac surgery
- **Clinical Significance:** Slow ventricular rate, ↓ CO, unreliable pacemaker, predisposes to lethal dysrhythmias, severity of symptoms depends on ventricular rate, may progress to asystole
- **Physical Assessment:** Pulse is regular and slow, most all patients are symptomatic with signs of decreased cardiac output. Severity of symptoms will depend on ventricular rate.
- **Clinical Management:** Assess your patient. Correct underlying cause. Make sure patient has IV access, administer oxygen, support cardiac output. Maintain bedrest to decrease oxygen demand. Administer atropine or isuprel to restore synchrony (use with caution), administer dopamine and epinephrine if indicated. Transcutaneously pace until temporary or permanent pacemaker can be placed.

BUNDLE BRANCH BLOCK



- **Rate:** Abnormal conduction in ventricle, can be right or left side of the pathway.
- **QRS Width:** Wide ≥ 12
- **Right BBB:** V1-Rabbit ear appearance with RSR' and inverted T-Wave; V6-widened S-Wave and upright T-wave
- **Left BBB:** V1- Wide S-Wave and positive T-Wave; V6- notch at top of QRS, inverted T-Wave
- **Etiology:** Right—congenital, anterior MI, CAD, PE. Left—hypertension, aortic stenosis, heart disease, CAD
- **Clinical Significance:** LBBB more serious than RBBB, examine V1 to determine if right or left, need 12 lead to diagnose
- **Physical Assessment:** Typically, there are no physical findings
- **Clinical Management:** Assess your patient. Usually, no treatment is necessary. Determine the underlying cause, watch for other heart blocks.

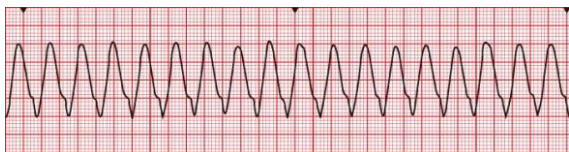
VENTRICULAR DYSRHYTHMIAS

PVC



- **Rate:** PVC is a single complex. May occur in patterns: pairs, every other beat or every three beats.
- **Rhythm:** Irregular d/t premature ectopic beat
- **P-Waves:** Absent with the ectopic beat
- **PR Interval:** None with the ectopic beat
- **QRS Width:** Early, wide, ≥ 12 and larger than normal QRS
- **T-Waves:** Usually in the opposite direction than the QRS of the PVC, wide and bizarre
- **Etiology:** Electrical irritability, hypoxia, MI, ischemia, electrolyte imbalance, acid base imbalance, stimulants, drugs, stress and anxiety
- **Clinical Significance:** Depends on frequency, can lead to more serious dysrhythmias, ↓ CO, PVCs do not perfuse adequately, can cause R-on-T phenomenon
- **Physical Assessment:** Palpitations, irregular pulse and signs of decreased cardiac output if frequent.
- **Clinical Management:** Assess your patient. Treat underlying cause (e.g. electrolytes). If symptomatic can administer amiodarone, however antidysrhythmic drugs are usually not indicated. IV or PO electrolytes if it is the electrolyte abnormalities are the cause, increase HR if caused by ischemia from bradycardia.
- **Terminology:**
 - Bigeminy: PVC every other beat
 - Trigeminy: PVC every three beats
 - Couplet: 2 PVCs in a row
 - Unifocal: coming from one focus, same shape and size (the example is unifocal PVCs, they are similar morphology)
 - Multifocal: coming from more than one irritable foci, different shapes and sizes. Multifocal is more significant as it means more than one area is irritated.

VENTRICULAR TACHYCARDIA






- **Rate:** 100-250 bpm (Monomorphic)
- **Rhythm:** Regular (may be slightly irregular at onset)
- **P-Waves:** Absent
- **PR Interval:** None
- **P:QRS Ratio:** Absent
- **QRS Width:** Wide and bizarre
- **Etiology:** Myocardial ischemia, MI, CAD, valvular heart disease, heart failure, cardiomyopathy, electrolyte imbalances, drug intoxication, stress, anxiety
- **Clinical Significance:** Very unpredictable and dangerous. Unreliable pacemaker. ↓ ventricular filling time, ↓ CO, quickly deteriorate to V Fib and complete cardiac failure. There are 3 presentations--
 - Stable VT with pulse
 - Unstable VT with pulse
 - VT without a pulse
- **Physical Assessment:** depends on the duration of the rhythm and if the patient is stable or unstable. They may have a flutter in their chest, anxiety and signs of decreased cardiac output.
- **Clinical Management:** Assess your patient. Treatment depends on if the patient is stable or unstable and with or without a pulse
 - Pulse is PRESENT:
 - If patient is hemodynamically STABLE, notify provider and expect drug intervention (amiodarone, lidocaine, procainamide) and a cardiology consult
 - If patient is hemodynamically UNSTABLE synchronized cardioversion. Follow AHA Ventricular Tachycardia WITH a pulse algorithm
 - Pulse is ABSENT call a code, start CPR, perform immediate defibrillation. Follow AHA Ventricular Tachycardia WITHOUT a pulse algorithm

TORSADES DE POINTES



- **Rate:** 150-250, Torsades is a variant of Polymorphic Ventricular Tachycardia caused by a prolonged QT
- **Rhythm:** Irregular
- **P-Waves:** Absent
- **PR Interval:** None
- **P:QRS Ratio:** Absent
- **QRS Width:** Wide with changing amplitudes
- **Etiology:** Prolonged QT from drugs, myocardial ischemia, electrolyte abnormalities—hypokalemia and hypomagnesemia
- **Clinical Significance:** dangerous rhythm that can lead to ventricular standstill
- **Physical Assessment:** depends on the duration of the rhythm and if the patient is stable or unstable. They may have a flutter in their chest, anxiety and signs of decreased cardiac output.
- **Clinical Management:** Assess your patient. Treatment depends on if the patient is stable or unstable and with or without a pulse. Administer magnesium for prolonged QT, K+ level, overdrive ventricular pacing may be necessary.
 - Pulse is PRESENT:
 - If patient is hemodynamically STABLE, notify provider and expect drug intervention (amiodarone, lidocaine, procainamide) and a cardiology consult
 - If patient is hemodynamically UNSTABLE synchronized cardioversion. Follow ACLS Protocol for Ventricular Tachycardia WITH a pulse.
 - Pulse is ABSENT call a code, start CPR, perform immediate defibrillation. Follow ACLS Protocol for Ventricular Tachycardia WITHOUT a pulse.

<p>VENTRICULAR FIBRILLATION</p> 	<ul style="list-style-type: none"> • Rate: Absent • Rhythm: Irregular • P-Waves: Absent • PR Interval: None • P:QRS Ratio: Absent • QRS Width: None • Etiology: Myocardial ischemia, MI, heart block, untreated V tach, acid base imbalance, electrolyte imbalance, drug toxicity, severe hypoxia, terminal event in many disease states • Clinical Significance: Ventricles are quivering instead of contracting, cardiac output is nonexistent, pacemaker cells are still working, leads to ventricular standstill and cardiac death • Physical Assessment: Unresponsive, no blood pressure, no pulse, apneic • Clinical Management: Assess your patient. Call a code, start CPR, perform early defibrillation. Follow ACLS Protocol for Ventricular Fibrillation.
<p>PULSELESS ELECTRICAL ACTIVITY</p> <p>Any organized rhythm will be present on the monitor (wave forms are visible) but the patient will NOT HAVE A PULSE</p>	<ul style="list-style-type: none"> • Rate, Rhythm, P-Waves, PR Interval, P:QRS Ratio, QRS Width, T-Waves: Variable—All based on the underlying rhythm • Etiology: Look at the H's and T's: H—hypovolemia, hypoxia, hydrogen ions, hyperkalemia, hypokalemia, hypothermia. T—Tablets, toxins, tension pneumothorax, thrombosis, thromboembolism, trauma • Clinical Significance: Heart muscles loses its ability to contract even though electrical activity is preserved. No heart contraction, no blood flow, no heart rate, no cardiac output • Physical Assessment: No pulse, no heart sounds, no BP, unconscious, apneic • Clinical Management: Assess your patient. Call a code and start CPR. Follow ACLS Protocol for PEA including epinephrine and finding and treating the cause.
<p>IDIOVENTRICULAR RHYTHM</p> 	<ul style="list-style-type: none"> • Rate: 20-40 bpm, if 40-100 then it is accelerated idioventricular rhythm, >100 is Ventricular Tachycardia • Rhythm: Regular (ventricular rhythm only, no atrial rhythm) • P-Waves: Absent • PR Interval: None • P:QRS Ratio: None • QRS Width: Wide ≥ 12 • T-Waves: Deflected opposite of QRS • Etiology: Digoxin toxicity, heart disease, pacemaker failure, metabolic imbalance, common following reperfusion therapy • Clinical Significance: Slow ventricular rate and loss of atrial kick reduce CO, progress to more lethal dysrhythmia. If just one idioventricular beat is generated it is called a ventricular escape beat • Physical Assessment: palpations, signs of decreased cardiac output. • Clinical Management: Assess your patient. Treatment goals are to increase heart rate, improve cardiac output and establish a normal rhythm. Medications administered include atropine to increase the heartrate. Dopamine and epinephrine can also be used to increased heartrate. Transcutaneous pacing may be utilized emergently until a temporary or permanent pacemaker can be inserted.
<p>ASYSTOLE</p> 	<ul style="list-style-type: none"> • Rate: None • Rhythm: None • P-Waves: None • PR Interval: None • P:QRS Ratio: None • QRS Width: None • T-Waves: None • Etiology: MI, severe electrolyte disturbance, massive PE, prolonged hypoxemia, severe uncorrected acid-base imbalance, electric shock, drug overdose, cardiac tamponade, hypothermia • Clinical Significance: atrial and ventricular activity is at a standstill, terminal rhythm, critical to determine if rhythm is true asystole or a pause, need to look in a minimum of 2 leads • Physical Assessment: No pulse, no heart sounds, no BP, unconscious, apneic • Clinical Management: Assess your patient, confirm in 2 leads. Call a code, Start CPR. Follow ACLS Protocol for Asystole including epinephrine and finding and treating the cause.

PACEMAKER RHYTHMS

ATRIAL PACED



VENTRICULAR PACED



DUAL CHAMBER PACED



Type of Pacemakers:

- **Atrial:** Pacemaker spike is followed by atrial depolarization (P-wave)
- **Ventricular:** Pacemaker spike is followed by ventricular depolarization (QRS)
- **Dual:** There will be an atrial pacing and ventricular pacing

Pacemaker Sensing Definitions:

- **Undersensing:** Pacemaker has failed to sense that the heart has initiated an intrinsic beat.
 - Pacing when it shouldn't
 - Pacemaker did not sense the patient's own intrinsic beat. This causes the pacemaker to send an impulse when it shouldn't. An impulse is sent, and extra cardiac depolarization can occur. This impulse can occur during the intrinsic beat of the patient, predisposing the patient to R-on-T phenomenon.
- **Oversensing:** Electrical activity is registered as cardiac activity that is not coming intrinsically and is counted as a cardiac beat
 - Not pacing when it should
 - Pacemaker sensed non-cardiac activity and interpreted it as an intrinsic beat. Pacemaker impulse is inhibited as the pacemaker falsely sensed the patient as having an intrinsic beat. An impulse is not sent, and cardiac depolarization does not occur. This leads to an overall decrease in heart rate and cardiac output.

Pacemaker Capture Definitions:

- **Capture:** When the pacemaker delivers an electrical impulse strong enough to result in depolarization.
 - 100% capture occurs when each pacemaker impulse produces a corresponding depolarization (atrial pacemaker impulse results in a P-wave, ventricular pacemaker impulse results in a QRS Complex). This means that the pacemaker is appropriately capturing/depolarizing.
- **Failure to capture:** When the pacemaker delivers an electrical impulse that does not result in depolarization.
 - The pacemaker sends an impulse, the pacer spike is visible, however, no corresponding waveform is present following the pacer spike (no p-wave for an atrial pacemaker, no QRS complex for a ventricular).
- **Failure to pace:** No electrical impulse is delivered, complete failure to sense the need or deliver the impulse to initiate pacing.
 - The pacemaker fails to send a pacing impulse when appropriate and no visible pacing spike is seen.