<table>
<thead>
<tr>
<th>Arrhythmias</th>
<th>Description</th>
<th>Causes</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinus Arrhythmia</td>
<td>• Irregular atrial and ventricular rhythms.</td>
<td>• Normal variation of normal sinus rhythm in athletes, children, and the elderly.</td>
<td>• Atropine if rate decreases below 40bpm.</td>
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<td></td>
<td>• Normal P wave preceding each QRS complex.</td>
<td>• Can be seen in digoxin toxicity and inferior wall MI.</td>
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<tr>
<td>Sinus Tachycardia</td>
<td>• Atrial and ventricular rhythms are regular.</td>
<td>• Normal physiologic response to fever, exercise, anxiety, dehydration, or pain.</td>
<td>• Correction of underlying cause.</td>
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<td></td>
<td>• Rate &gt; 100 bpm.</td>
<td>• May accompany shock, left-sided heart failure, cardiac tamponade, hyperthyroidism, and anemia.</td>
<td>• Beta-adrenergic blockers or calcium channel blockers for symptomatic patients.</td>
</tr>
<tr>
<td></td>
<td>• Normal P wave preceding each QRS complex.</td>
<td>• May accompany shock, left-sided heart failure, cardiac tamponade, hyperthyroidism, and anemia.</td>
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<tr>
<td>Sinus Bradycardia</td>
<td>• Regular atrial and ventricular rhythms.</td>
<td>• Normal in a well-conditioned heart (e.g., athletes).</td>
<td>• Follow ACLS protocol for administration of atropine for symptoms of low cardiac output, dizziness, weakness, altered LOC, or low blood pressure.</td>
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<tr>
<td></td>
<td>• Rate &lt; 60 bpm.</td>
<td>• Increased intracranial pressure; increased vagal tone due to straining during defecation, vomiting, intubation, mechanical ventilation.</td>
<td>• Pacemaker</td>
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<td></td>
<td>• Normal P wave preceding each QRS complex.</td>
<td>• Sinoatrial (SA) arrest or block</td>
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<td>• Pause not equal to multiple of the previous rhythm.</td>
<td>• Infection</td>
<td>• Treat symptoms with atropine I.V.</td>
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<td></td>
<td>• Coronary artery disease, degenerative heart disease, acute inferior wall MI.</td>
<td>• Temporary pacemaker or permanent pacemaker if considered for repeated episodes.</td>
</tr>
<tr>
<td>Wandering atrial pacemaker</td>
<td>• Atrial and ventricular rhythms vary slightly.</td>
<td>• Rheumatic carditis due to inflammation involving the SA node.</td>
<td>• No treatment if patient is asymptomatic</td>
</tr>
<tr>
<td></td>
<td>• Irregular PR interval.</td>
<td>• Digoxin toxicity</td>
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</table>
### Premature atrial contraction (PAC)
- P waves irregular with changing configurations indicating that they aren’t all from SA node or single atrial focus; may appear after the QRS complex.
- QRS complexes uniform in shape but irregular in rhythm.
- Premature, abnormal-looking P waves that differ in configuration from normal P waves.
- QRS complexes after P waves except in very early or blocked PACs.
- P wave often buried in the preceding T wave or identified in the preceding T wave.
- May prelude supraventricular tachycardia.
- Stimulants, hyperthyroidism, COPD, infection and other heart diseases.
- Usually no treatment is needed.
- Treatment of underlying cause if patient is symptomatic.
- Carotid sinus massage.

### Paroxysmal Supraventricular Tachycardia
- Atrial and ventricular rhythms are regular.
- Heart rate > 160 bpm; rarely exceeds 250 bpm.
- P waves regular but aberrant; difficult to differentiate from preceding T wave.
- P wave preceding each QRS complex.
- Sudden onset and termination of arrhythmia
- When a normal P wave is present, it’s called paroxysmal atrial tachycardia; when a normal P wave isn’t present, it’s called paroxysmal junctional tachycardia.
- Physical exertion, emotion, stimulants, rheumatic heart diseases.
- Intrinsic abnormality of AV conduction system.
- Digoxin toxicity.
- Use of caffeine, marijuana, or central nervous system stimulants.
- If patient is unstable prepare for immediate cardioversion.
- If patient is stable, vagal stimulation, or Valsalva’s maneuver, carotid sinus massage.
- Adenosine by rapid I.V. bolus injection to rapidly convert arrhythmia.
- If patient has normal ejection fraction, consider calcium channel blockers, beta-adrenergic blocks or amiodarone.
- If patient has an ejection fraction less than 40%, consider amiodarone.

### Atrial flutter
- Atrial rhythm regular, rate, 250 to 400 bpm
- Ventricular rate variable, depending on degree of AV block
- Saw-tooth shape P wave configuration.
- QRS complexes uniform in shape but often irregular in rate.
- Heart failure, tricuspid or mitral valve disease, pulmonary embolism, cor pulmonale, inferior wall MI, carditis.
- Digoxin toxicity.
- If patient is unstable with ventricular rate > 150bpm, prepare for immediate cardioversion.
- If patient is stable, drug therapy may include calcium channel blockers, beta-adrenergic blocks, or antiarrhythmics.
<table>
<thead>
<tr>
<th>Atrial Fibrillation</th>
<th>Junctional Rhythm</th>
<th>Premature Junctional Conjunctions</th>
<th>First-degree AV block</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Atrial rhythm grossly irregular rate &gt; 300 to 600 bpm.</td>
<td>• Inferior wall MI, or ischemia, hypoxia, vagal stimulation, sick sinus syndrome.</td>
<td>• MI or ischemia</td>
<td>• Atrial and ventricular rhythms regular</td>
</tr>
<tr>
<td>• Ventricular rhythm grossly irregular, rate 160 to 180 bpm.</td>
<td>• Acute rheumatic fever.</td>
<td>• Digoxin toxicity</td>
<td>• PR interval &gt; 0.20 second.</td>
</tr>
<tr>
<td>• PR interval indiscernible.</td>
<td>• Valve surgery</td>
<td>• Excessive caffeine or amphetamine use</td>
<td>• P wave preceding each QRS complex.</td>
</tr>
<tr>
<td>• No P waves, or P waves that appear as erratic, irregular base-line fibrillatory waves</td>
<td>• Digoxin toxicity</td>
<td>• Correction of underlying cause.</td>
<td>• QRS complex normal.</td>
</tr>
<tr>
<td></td>
<td>• Correction of the underlying cause.</td>
<td>• Discontinuation of digoxin if appropriate.</td>
<td>• Correction of underlying cause.</td>
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<tr>
<td>Section</td>
<td>Description</td>
<td>Treatment</td>
<td>Notes</td>
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| Second-degree AV block Mobitz I (Wenckebach) | - Atrial rhythm regular.  
- Ventricular rhythm irregular.  
- Atrial rate exceeds ventricular rate.  
- PR interval progressively, but only slightly, longer with each cycle until QRS complex disappears.  
- PR interval shorter after dropped beat.  

Severe coronary artery disease, anterior wall MI, acute myocarditis.  
Digoxin toxicity.  

| Atropine, epinephrine, and dopamine for symptomatic bradycardia.  
| Temporary or permanent pacemaker for symptomatic bradycardia.  
| Discontinuation of digoxin if appropriate.  
|-------|
| Third-degree AV block (complex heart block) | - Atrial rhythm regular.  
- Ventricular rhythm regular and rate slower than atrial rate.  
- No relation between P waves and QRS complexes.  
- No constant PR interval.  
- QRS interval normal (nodal pacemaker) or wide and bizarre (ventricular pacemaker).  

Inferior or anterior wall MI, congenital abnormality, rheumatic fever.  

| Atropine, epinephrine, and dopamine for symptomatic bradycardia.  
| Temporary or permanent pacemaker for symptomatic bradycardia.  
|-------|
| Premature ventricular contraction (PVC)     | - Atrial rhythm regular  
- Ventricular rate 140 to 220 bpm, regular or irregular.  
- Myocardial ischemia, infarction, or aneurysm  
- Coronary artery disease  

If warranted, procainamide, lidocaine, or amiodarone I.V.  
Treatment of underlying cause.  
Discontinuation of drug causing toxicity.  
Potassium chloride IV if PVC induced by hypokalemia.  
Magnesium sulfate IV if PVC induced by hypomagnesaemia. |

Premature QRS complexes occurring singly, in pairs, or in threes; alternating with normal beats; focus from one or more sites.  
Ominous when clustered, multifocal, with R wave on T pattern.  

Heart failure; old or acute myocardial ischemia, infarction, or contusion.  
Myocardial irritation by ventricular catheters such as a pacemaker.  
Hypercapnia, hypokalemia, hypocalcemia.  
Drug toxicity by cardiac glycosides, aminophylline, tricyclic antidepressants, beta-adrenergic.  
Caffeine, tobacco, or alcohol use.  
Psychological stress, anxiety, pain |

If pulseless: initiate CPR; follow ACLS protocol for defibrillation.  

Ventricular Tachycardia |
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<tr>
<th>Condition</th>
<th>Description</th>
<th>Treatment</th>
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<tr>
<td>Ventricular Fibrillation</td>
<td>Ventricular rhythm and rate are rapid and chaotic. QRS complexes wide and irregular, no visible P waves</td>
<td>Myocardial ischemia or infarction, R-on-T phenomenon, untreated ventricular tachycardia, Hypokalemia, hyperkalemia, Hypercalcemia, alkalosis, electric shock, hypothermia. Digoxin, epinephrine, or quinidine toxicity. If pulseless: start CPR, follow ACLS protocol for defibrillation, ET intubation, and administration of epinephrine or vasopressin, lidocaine, or amiodarone; ineffective consider magnesium sulfate.</td>
</tr>
<tr>
<td>Asystole</td>
<td>No atrial or ventricular rate or rhythm. No discernible P waves, QRS complexes, or T waves</td>
<td>Myocardial ischemia or infarction, aortic valve disease, heart failure, hypoxemia, hypokalemia, severe acidosis, electric shock, ventricular arrhythmias, AV block, pulmonary embolism, heart rupture, cardiac tamponade, hyperkalemia, electromechanical dissociation. Cocaine overdose. Start CPR.</td>
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