Chapter 28, Part 1
Cardiology

Part 1: Cardiovascular Anatomy & Physiology, ECG Monitoring, and Dysrhythmia Analysis

Cardiovascular Anatomy
• Coronary Circulation

Cardiac Physiology
• The cardiac cycle consists of ____________ and Systole
• Diastole: Relaxation phase
• Systole: ________________ phase
• ________________ fraction: during each contraction, the ventricles eject about 2/3 of the blood it contains
Cardiac Physiology

- **Volume**: amount ejected (70mL average)
- Stroke volume depends on:
  - **Preload**
  - **Cardiac**
  - ________

Cardiac Physiology

- **Cardiac Output** = stroke volume X heart ________
- Heart function is regulated by the ________ and parasympathetic nervous systems of the autonomic nervous system

Terms:
- **Chronotropy**: heart rate
- ________: contractile strength
- **Dromotropy**: rate of nervous ________ conduction

Cardiac Electrolytes:

- **(Na+)**: depolarization
- **Calcium (Ca++)**: depolarization and contractions
- **(K+)**: repolarization
- **Chloride (Cl-)**: Unsure
- **(Mg++):** Unsure
Cardiac Depolarization

- Resting Potential (__________________): The normal electrical state of cardiac cells. Negatively charged
- Action Potential: The stimulation of myocardial cells, as evidenced by a change in the membrane electrical charge, that spreads across the myocardium
- Cardiac ______________________: a reversal of charges at a cell membrane so that the inside of the cell becomes positive in relation to the outside. Positively charged

Cardiac Physiology

- Properties of the Cardiac Conductive System
  - ______________________: Cells are capable of responding to electrical stimulus
  - ______________________: Cells can transmit electrical impulses from cell to cell
  - ______________________: Each cell can depolarize without any outside impulse
  - ______________________: Cells have the ability to expand

Cardiac Conductive System Components:

- ______________________ Node
- Internodal Atrial Pathways
- Atrioventricular Node
- Atrioventricular ______________________
- Bundle of ____________________
- Left and Right Bundle Branches
- ______________________ Fibers
Cardiac Physiology

- SA node: __________ - __________ bpm
- AV node: __________ - __________ bpm
- Purkinje System: __________ - __________ bpm

Intrinsic Firing Rates of the Cardiac Conductive System

Electrocardiographic Monitoring

- The Electrocardiogram
  - Positive and Negative Impulses
  - ________________
    - Muscle tremors
    - Shivering
    - Patient ________________
    - Loose electrodes
    - __________ Hertz interference
    - Machine malfunction

Muscle Tremor Artifact

- Electrical interference caused by the patient's tensed muscles.
60 Cycle Interference

AC Interference (60 cycle)

Sixty even, regular spikes in a 1 second interval caused by electrical current near the patient

The Electrocardiogram

ECG Leads

• **(Limb)**
  – Einthoven’s Triangle
  – Leads I, II, III

• **(Unipolar)**
  – aVR, aVL, aVF
  – V1 – V6

Bipolar Lead Placement Sites

<table>
<thead>
<tr>
<th>Lead</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Left Arm</td>
<td>Right Arm</td>
</tr>
<tr>
<td>II</td>
<td>Left Leg</td>
<td>Right Arm</td>
</tr>
<tr>
<td>III</td>
<td>Left Leg</td>
<td>Left Arm</td>
</tr>
</tbody>
</table>

The Electrocardiogram

(Page 1141)

• Lead Systems and Heart Surfaces

<table>
<thead>
<tr>
<th>Leads</th>
<th>Portion of the heart examined</th>
</tr>
</thead>
<tbody>
<tr>
<td>I and aVL</td>
<td>The left side of the heart in a vertical plane</td>
</tr>
<tr>
<td>II, III, and aVF</td>
<td>The inferior (diaphragmatic) side of the heart</td>
</tr>
<tr>
<td>aVR</td>
<td>The right side of the heart in a vertical plane</td>
</tr>
<tr>
<td>V1 and V2</td>
<td>The right ventricle</td>
</tr>
<tr>
<td>V3 and V4</td>
<td>The intraventricular septum and the anterior wall of the left ventricle</td>
</tr>
<tr>
<td>V5 and V6</td>
<td>The anterior and lateral walls of the left ventricle</td>
</tr>
</tbody>
</table>
The Electrocardiogram

Routine Monitoring
- Information from a single lead shows:
  - Rate & ______________.
  - ______________ to conduct an impulse.

The Electrocardiogram

A single lead cannot:
- Identify/locate an ______________.
- Identify ______________ deviation or chamber enlargement.
- Identify right-to-left differences in conduction.
- The quality or presence of ______________ action.

The Electrocardiogram

ECG Paper
- Speed: __________ mm/sec is normal
- Amplitude and Deflection:
  - large boxes = 1 millivolt
  - Each small square = __________ seconds
  - Each larger square = __________ seconds

The Electrocardiogram

ECG Components:
- ________ Wave
- ________ Complex
- ________ Wave
- ________ Wave (rare)
- Isoelectric line: line with __________ electrical activity (flat)
The Electrocardiogram

P Wave (upright in lead II)
Impulse initiated in the sinus node

The Electrocardiogram

P Wave
Beginning of atrial excitation

The Electrocardiogram

P Wave
Atrial excitation

The Electrocardiogram

P Wave
Completion of atrial excitation
The Electrocardiogram

The Electrocardiogram

Normal Time Intervals

- P–R Interval (PRI) or P–Q Interval (PQI)
  - _________ __________ Seconds
- QRS Interval
  - _________ Seconds
- S–T Segment
- Q–T Interval
  - _________ Seconds
Refractory Periods

• ________________ : Heart CAN beat again but without adequate pumping action
• ________________ : Heart CANNOT pump again

S-T Segment Changes

• Elevation or depression of the S-T segment above or below the ________________ line
• Associated with Myocardial Infarctions
  – ________________
  – Injury

Interpretation of Rhythm Strips

• Always be __________________ and analytical.
• Memorize the rules for each dysrhythmia.
• Analyze a given rhythm strip according to a specific ________________ .
• Compare your analysis to the rules for each dysrhythmia.
• Identify the dysrhythmia by its similarity to established rules.

Five-Step Procedure

1. Analyze the ________________ (QRS).
• Over 100 = tachycardia
• Less than 60 = bradycardia
2. Analyze the ________________ .
• Regular or irregular?
• If irregular is it regularly irregular or irregularly irregular? (_______________ )
Five-Step Procedure

3. Analyze the __________-waves.
   • Present?
   • _______________ or inverted?

4. Analyze the __________ interval.
   • 0.12 to 0.20 is normal

5. Analyze the ________________ complex.
   • Broad or narrow?

Analyzing the Rate

R-R Interval
   • Only if heart rate is ________________
   • Measure duration between R waves in seconds and divide into __________
     – Example: 60 ÷ 0.65 seconds = 92 bpm
   • Count the number of large squares within the R-R interval and divide into __________
     – Example: 300 ÷ 3.5 boxes = 86 bpm
   • Count the number of small squares within the R-R interval and divide into __________

Triplicate Method
   • Used only with _______________ rhythms
   • Locate an R wave that falls on a dark line bordering a large box. Then assign numbers corresponding with to the heart rate to the next __________ dark lines to the right.
   • The order is 300, 150, 100, 75, 60, and 50.
   • The number that corresponds to the dark line closest to the ________________ of the next R wave is a rough estimate of the heart rate
What is the Rate?

________________ Beats Per Minute
________ small boxes between R waves
1500 divided by _________ = ________

What is the Rate?

• _______ Beats Per Minute
• __________ small boxes between R waves
• __________ divided by _________ = ________

Analyzing the Rhythm

• ________________ ?
• _______________ Irregular?
• _______________ Irregular?
• _______________ Irregular?

Is This Rhythm Regular?

• ________________
Is This Rhythm Regular?

• ____________________________

Analyzing the P Wave

• Reflects _______________ depolarization
• Are P waves present?
• Are the P wave _______________?
• Is there _______________ P wave per QRS complex?
• Are the P waves upright or _______________?
• Do all P waves look alike?

Analyze the P Waves

• Present, _______________ , 1 per QRS, upright, all look _______________
Analyze the P Waves

- Present, regular, ________ than 1 P wave for some QRS complexes, ________, all look alike

Analyze the P Waves

- ________ but not clear

Analyzing the P-R Interval

- Time needed for atrial depolarization and conduction of the impulse to the AV node
- Normal is ________ to ________ seconds (3-5 small boxes)
- Measured from beginning of ________ wave to beginning of ________ wave
- Any deviation is abnormal

Analyze the P-R Interval

- ________ seconds
Analyze the P-R Interval

- Varies: ___________ to _______________ seconds

Analyzing the QRS Complexes

- Do all the QRS complexes look alike?
- What is the QRS _________________________
- Normal duration is _________ to _________ seconds (narrow complexes)
- Anything longer than _________ seconds is abnormal (broad complexes)

What is the QRS Duration?

- ______________________ seconds

What is the QRS Duration?

- Narrow Complexes: ____________ seconds
- Wide Complexes: ______________ seconds
Normal Sinus Rhythm

• Rate: ___________–___________ bpm
• Rhythm: _________________________
• P waves: normal, ________________________, only before each QRS complex
• PR Interval: ___________–___________ seconds
• QRS Complex: normal, duration of <_________ seconds

Normal Sinus Rhythm

• Rate: ___________ bpm
• Rhythm: Regular
• P Waves: normal, upright, only before each QRS complex
• P-R Interval: ___________ seconds
• QRS Duration: _____________ seconds

Dysrhythmias

• Dysrhythmia: any deviation from _________________________ electrical rhythm
• _________________________: Absence of cardiac electrical activity
  – Often used interchangeably with dysrhythmia
Dysrhythmias

Mechanism of Impulse Formation
• _________________________ Foci
  – Caused by increased automaticity
  – When heart cells other than the pacemaker cells automatically _________________________
  – Produces _________________________ (abnormal) Beats
  – Premature Ventricular contractions (__________) or premature atrial contractions (__________)

Dysrhythmias
• Caused when disease or ischemia alters 2 branches of a pathway, slowing conduction in 1 branch and causing a unidirectional block in the other
• May be isolated beats or tachydysrhythmias
  – Atrial fibrillation (___________________)
  – Paroxysmal supraventricular tachycardia (__________)

Causes of Dysrhythmias
• Myocardial Ischemia, Necrosis, or _________________________
• Autonomic Nervous System Imbalance
• Distention of the Chambers of the Heart
• Blood _________________________ Abnormalities
• _________________________ Imbalances
• Trauma to the Myocardium

Causes of Dysrhythmias
• Drug Effects and Drug Toxicity
  • _________________________
• Hypothermia
  • _________________________ Damage
• Idiopathic Events
  • _________________________ Occurrences
Dysrhythmias

• Dysrhythmias in the healthy heart are of __________________________ significance
• Most, if not all persons, have occasional dysrhythmias
• TREAT THE PATIENT, **NOT** THE __________________________

Classification of Dysrhythmias

Some classification methods of dysrhythmias include:
• Nature of Origin: changes in automaticity versus disturbances in conduction
• _________________________ : major versus minor
• _________________________ : life threatening versus non-life threatening
• _________________________ of Origin: Where dysrhythmia is occurring (Most common)

Classification by Site of Origin

• Dysrhythmias Originating in the _________ Node
• Dysrhythmias Originating in the Atria
• Dysrhythmias Originating Within the AV Junction (AV ____________________________ )
• Dysrhythmias Sustained in or Originating in the AV Junction
• Dysrhythmias Originating in the _________________________
• Dysrhythmias Resulting from Disorders of _________________________

Dysrhythmias Originating in the SA Node

• Sinus _________________________
• Sinus Tachycardia
• Sinus _________________________
• Sinus _________________________
Rules of Interpretation: Sinus Bradycardia

- Description: results from slowing of the SA node
- Rate: Less than ___________
- Rhythm: _________________________
- Pacemaker site: SA Node
- P Waves: _________________________ and normal
- PRI: _________________________
- QRS: Normal

Sinus Bradycardia

- Etiology
  - Increased _________________________ (vagal) tone, intrinsic disease of the SA node, drug effects.
  - May be a normal finding in healthy, well-conditioned persons.
- Clinical Significance
  - May result in decreased cardiac output, hypotension, _________________________ , or CNS symptoms.
  - In healthy, well-conditioned person, may have no significance.
Sinus Bradycardia

Treatment:
• Generally unnecessary unless ______________________ or ventricular irritability is present.
• If treatment is necessary, normally treated with ______________________, fluids, or external ______________________.

Atropine Sulfate

• Extracted from the deadly nightshade jimsonweed
• ______________________ (parasympathetic) agent
• ______________________ of the acetylcholine receptors
  – ______________________ is the main neurotransmitter used by the PNS
• Atropine lowers the "rest and digest" activity of all muscles and glands regulated by the parasympathetic nervous system

Atropine Sulfate

• Increases firing of __________ node, conduction through AV node, opposes vagus nerve, blocks acetylcholine receptor sites, decreases bronchiole secretions.
• Indications: inadequate ______________________ bradyarrythmias, asystole (adults), organophosphate poisonings, premedication prior ____________ in pediatrics

Atropine Sulfate

• Contraindications include allergic, ______________________, and 2nd or 3rd degree heart ______________________
• Side Effects: Dilated pupils, headache, nausea, vomiting, ______________________ vision
Atropine Sulfate (4 of 4)

• Adult Cardiac Dosage: __________mg IV push (bradycardia) repeated as needed every 3-5 minutes to a max of _______mg total dose
• Pediatric Cardiac Dosage: 0.01 to 0.03mg/kg with a minimum of __________mg and a maximum of 0.5mg per dose and a maximum of ________ doses

Rules of Interpretation:
Sinus Tachycardia

• Description: results from an increased rate of the __________ node
• Rate: Greater than __________
• Rhythm: Regular
• Pacemaker Site: SA Node
• P-Waves: Upright and ______________
• PRI: Normal
• QRS: Normal

Sinus Tachycardia

Sinus Tachycardia

Sinus Tachycardia

Sinus Tachycardia
Sinus Tachycardia

• Etiology
  – Results from an increased rate of SA node discharge.
  – Potential causes include exercise, fever, anxiety, hypovolemia, anemia, pump failure, increased ______________ tone, hypoxia, or hypothyroidism.
• Clinical Significance
  – Decreased cardiac output for rates >_________. Very rapid rates can precipitate ischemia or infarct.

Sinus Tachycardia

• Treatment
  – Treatment is directed at the underlying ________________.
  – MI, shock, fear, stress, etc
  – No ________________ are normally given for sinus tach in the field

Rules of Interpretation: Sinus Dysrhythmia

• Description: results from a variation of the __________ interval
• Rate: __________ - __________
• Rhythm: ________________________
• Pacemaker Site: SA Node
• P-Waves: Upright and normal
• PRI: Normal
• QRS: Normal
Sinus Dysrhythmia

Sinus Arrhythmia

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usually 60-100 bpm</td>
<td>Irregular</td>
<td>Before each QRS, identical</td>
<td>.12 to .20</td>
<td>&lt;.12</td>
</tr>
</tbody>
</table>

**Sinus Dysrhythmia**

**Etiology**
- Often a normal finding, sometimes related to the respiratory cycle.
- May be caused by enhanced ____________ tone.

**Clinical Significance**
- Normal. Occurs in almost everyone

**Treatment**
- Typically, ____________ required.

**Sinus Arrest**

- Description: occurs when the sinus node fails to discharge, resulting in short periods of cardiac _________________. This standstill can persist until pacemaker cells lower in the conduction system discharge (________________________ beats) or until the sinus node resumes discharging.

**Rules of Interpretation: Sinus Arrest**

- Rate: Normal to ________________
- Rhythm: Irregular
- Pacemaker Site: __________ Node
- P-Waves: ________________ and normal
- PRI: Normal
- QRS: Normal
Sinus Arrest

• Etiology
  – Occurs when the sinus node fails to discharge.
  – May result from ischemia of the SA node, _____________ toxicity, excessive vagal tone, or degenerative fibrotic disease.
• Clinical Significance
  – Frequent or prolonged episodes may decrease cardiac output and cause ________________
  – Prolonged episodes may result in escape rhythms.
Dysrhythmias Originating in the Atria

• Wondering Atrial Pacemaker
• Multifocal Atrial Tachycardia
• Premature ________________________ Contractions
• Paroxysmal Supraventricular Tachycardia
• Atrial ________________________
• Atrial ________________________

Wandering Atrial Pacemaker

• Description: the ________________________ transfer of pacemaker sites from the sinus node to other latent pacemaker sites in the atria and AV junction. Often more than one ________________________ site will be present, causing variation in the R-R interval and P waves.

Rules of Interpretation: Wandering Atrial Pacemaker

• Rate: Usually normal (60-100)
• Rhythm: Slightly ________________________
• Pacemaker Site: varies among the SA node, atrial tissue, and the AV junction
• P-Waves: Variable or ________________________
• PRI: Varies, depending on site of impulse
• QRS: normal
Wandering Atrial Pacemaker

- **Etiology**
  - Variant of sinus dysrhythmia, which is a natural phenomenon in the very young or old.
  - May also be caused by ___________________ heart disease or atrial dilation.
- **Clinical Significance**
  - None, but may be precursor to other atrial dysrhythmias.
- **Treatment**
  - Typically, ___________________ required.

Multifocal Atrial Tachycardia

- **Description:** usually seen in acutely ill patients. Significant ___________________ disease is seen in about 60% of these patients.
- **Certain medications used to treat lung diseases** (Theophylline, ___________________) may worsen the condition.
- **3 different P waves are noticed,** indicating various ectopic foci.

Rules of Interpretation: Multifocal Atrial Tachycardia

- **Rate:** Greater than __________
- **Rhythm:** ___________________
- **Pacemaker Site:** Ectopic sites in atria
- **P-Waves:** Organized, non-sinus, with at least ________ different forms
- **PRI:** ___________________
- **QRS:** Varies depending on AV node’s refractory status when impulse begins
Multifocal Atrial Tachycardia

• Etiology
  – Often seen in acutely ill patients.
  – May result from pulmonary disease, metabolic disorders, ischemic heart disease, or recent
  ____________.

• Clinical Significance
  – Presence of multifocal atrial tachycardia often indicates a serious underlying illness.

• Treatment
  – Treat the underlying ________________.

Premature Atrial Contractions

• Description: result from a single electrical impulse originating in the atria
  ____________ of the SA node, which causes a ____________ depolarization of the heart before the next expected sinus beat.

• Interrupts the normal ________________

Multifocal Atrial Tachycardia

• Etiology
  – Often seen in acutely ill patients.
  – May result from pulmonary disease, metabolic disorders, ischemic heart disease, or recent
  ____________.

• Clinical Significance
  – Presence of multifocal atrial tachycardia often indicates a serious underlying illness.

• Treatment
  – Treat the underlying ________________.

Premature Atrial Contractions

• Creates a non-compensatory
  ________________ in the underlying rhythm.
  – Pause following an ectopic beat where the SA node is ________________ and the normal cadence is interrupted
Rules of Interpretation: Premature Atrial Contractions

- Rate: Depends on underlying rhythm
- Rhythm: Usually regular except for _______
- Pacemaker Site: Ectopic focus in the atrium
- P-Waves: Occurs _____________ than expected
- PRI: Varies depending on focus
  - Near SA node = 0.12 or less
  - Near AV node = 0.12 or more
- QRS: Usually ________________

Premature Atrial Contractions

- Etiology
  - Single electrical impulse originating outside the SA node.
  - May result from use of caffeine, tobacco, or alcohol, sympathomimetic drugs, ischemic heart disease, hypoxia, or digitalis toxicity, or may be ________________.
- Clinical Significance
  - ________________. Presence of PACs may be a precursor to other atrial dysrhythmias.
Premature Atrial Contractions

- Treatment
  - _______ if asymptomatic. Treat symptomatic patients by administering high-flow oxygen and establishing _______ access.

Paroxysmal Supraventricular Tachycardia

- Description: PSVT occurs when rapid atrial depolarization overrides the ______ node.
- Often occurs with sudden onset, may last minutes to hours, and terminates _______.
- Can be life threatening

Rules of Interpretation: PSVT

- Rate: ______ - _______
- Rhythm: ___________________
- Pacemaker Site: In Atria, outside the SA node
- P-Waves: Normally ___________ in preceding T-Wave
- PRI: Usually normal (but normally buried)
- QRS: Normal

Supraventricular Tachycardia
Supraventricular Tachycardia

Etiology:
- Rapid atrial depolarization overrides the ______ node.
- May be precipitated by _______________, overexertion, smoking, caffeine.

Clinical Significance:
- May be tolerated well by healthy patients for _______________ periods.
- Marked reduction in cardiac _______________ can precipitate angina, hypotension, or congestive heart failure.
- May be life threatening

Treatment of SVT

Treatment may include one or more of the following:
- _______________ Maneuvers
- _______________ Therapy
- _______________
Vagal Maneuvers

- Vagal Maneuvers stimulate the ____________________ nerve which may slow the conduction through the SA Node
- There are several types of vagal maneuvers:
  - Forced expiration against a closed glottis
  - “Bearing down” as if to move bowels (____________________ Maneuver)
  - Immersion of face in ice water (________________________ reflex)

Vagal Maneuvers

- ______________________ artery massage
  - Contraindicated in patients with carotid ________________ (sound of turbulent blood flow)
  - Contraindicated in patients with known cerebrovascular disease carotid artery disease

Pharmacological Therapy for Supraventricular Tachycardia

- Adenosine (Adenocard)
  - Slows conduction through the ________ node
  - Contraindications:
    - Allergic
    - 2nd or 3rd degree __________________
    - Wolfe-Parkinson-White Syndrome
**Adenosine (Adenocard)**

- **Dosage:**
  - _____mg rapid IVP immediately followed by fluid bolus of 10-15cc
  - If needed, repeat dosage (after 1-2 minutes) _____mg rapid IVP immediately followed by fluid bolus
- **Adverse Reactions:** dizziness, facial flushing, SOB
- **Causes a brief period of** ________________

**Verapimil**

- **AKA:** _______________ , Calan
- **_______________ Channel Blocker**
- **Contraindications:**
  - Allergies
  - _______________ Shock
  - Patients receiving beta blockers
- **Dosage:** ________ to _________mg
- **Can be repeated once in 15-30 minutes at a dose of 5 to 10mg**

**Verapimil**

- **Adverse Reactions:**
  - Dizziness
  - Headache
  - _______________
  - AV Blocks
  - _______________

**Electrical Therapy for SVTs**

- Used for hemodynamically **unstable** patients
- Consider sedation prior if conscious and Systolic BP above 90-100
  - _______________(Diazepam) 5-10mg IVP
  - _______________(Versed) 2-5mg IVP
  - _______________(Lorazepam) 1-4mg SIVP
Electrical Therapy for SVTs

• Synchronized cardioversion starting at 100J or biphasic equivalent.
  – If unsuccessful, increase as directed by medical control
  – Normally, ______ J, ______ J, ______ J, ______ J (or biphasic equivalent)
  – Do not __________________ if patient converts

Treatment Summary for SVTs

Stable Patients
• __________________
• Drug Therapy
  – Adenosine
  – Verapimil
• Electrical Shock

Unstable Patients
• __________________
• Electrical Shock
  – Synchronized cardioversion beginning at _____ J
• Drug Therapy

Atrial Flutter

• Description: results from rapid atrial reentry circuit and an ______ node that cannot conduct all impulses through to the ventricles.
• The AV node may allow impulses in a 1:1 (rare), 2:1, 3:1 or 4:1 ratio or even greater resulting is a discrepancy between ________________ and ________________ rates.

Rules of Interpretation: Atrial Flutter

• Rate: Atrial rate of ______-_______.
  Ventricle rate varies
• Rhythm: Usually regular
• Pacemaker Site: Atria; outside the SA node
• P waves: Flutter (F-waves) are present.
  “________________________” pattern
• PR Interval: Usually normal
• QRS Complex: ________________
Atrial Flutter

Etiology:
• Results when the _______ node cannot conduct all the impulses.
• Impulses may be conducted in fixed or ___________ ratios.
• Usually associated with organic disease such as congestive heart failure (rarely seen with ________).

Clinical Significance
• Generally well tolerated.
• Rapid ventricular rates may compromise cardiac output and result in ____________________.
• May occur in conjunction with atrial ____________________.
Treatment of Atrial Flutter

Note: A-Flutter is NOT normally treated prehospital)

- Electrical Therapy
  - Consider if ventricular rate > _________ and symptomatic.
  - Consider sedation with synchronized cardioversion starting at 100J.

- Pharmacological Therapy
  - Diltiazem (Cardizem)
  - Verapamil, Digoxin, beta-blockers, and Quinidine.
  - These drugs may not be commonly carried. If rate is above _________ bpm, consider sedation and ________________

Atrial Fibrillation

- Description: results from multiple areas of ___________________ within the atria or from multiple ectopic foci bombarding the _________ node which cannot handle all of the incoming impulses.
- AV conduction is _________________ and highly variable

Rules of Interpretation: Atrial Fibrillation (A-Fib)

- Rate: Atrial rate of _________-_________. Ventricular rate varies greatly
- Rhythm: _________________ irregular
- Pacemaker Site: numerous ectopic foci in atria (Outside the SA node)
- P-Waves: _________________ discernable
- PRI: none
- QRS: Normal
Atrial Fibrillation (A-Fib)

- Etiology
  - Results from multiple ______________ foci; AV conduction is random and highly variable.
  - Often associated with underlying heart disease.
- Clinical Significance
  - Atria fail to contract effectively, reducing cardiac ____________.
  - Well tolerated with normal ventricular rates.
  - High or low ventricular rates can result in cardiac ________________.

Atrial Fibrillation (A-Fib)

Note: A-fib is not normally treated prehospital unless rate is above 150

- Electrical Therapy
  - Consider if ventricular rate > 150 and ________________.
  - Consider sedation and synchronized cardioversion starting at ____________ J.

Treatment of A-Fib
Treatment of A-Fib

- Pharmacological Therapy
  - Diltiazem (___________________)
  - Verapamil, Digoxin, beta blockers, and Quinidine.
  - _________________ (heparin or warfarin).

AV Blocks

- The electrical impulses are ___________________ or blocked as it passes through the AV node
- Can be caused by pathology of the AV junctional tissue or by a physiological block such as with _________________ or A-Flutter

Dysrhythmias Originating Within the AV Junction (AV Blocks)

AV Blocks

- Locations:
  - At the ______ Node
  - At the Bundle of __________
  - Below the Bundle of His

Classifications of AV Blocks

- _________________ -Degree AV Block
- Type I Second-Degree AV Block
  - Mobitz I
  - _________________
- Type II Second-Degree AV Block
  - Mobitz II
  - _________________
- _________________ -Degree AV Block
First Degree AV Block

- Description: First degree AV block is a _______________ in conduction at the level of the AV node rather than an actual block.
- First degree AV block is NOT a _______________ itself, but a condition superimposed upon another rhythm.
- The _______________ rhythm must also be identified

Rules of Interpretation: First Degree AV Block

- Rate: depends on underlying _______________
- Rhythm: Usually _______________
- Pacemaker Site: SA node or atria
- P-Waves: normal
- P-R interval: greater than ___________ seconds
- QRS: Usually less than ___________ seconds

First Degree AV Block

Interpretation Keys

- Every _______ is caused by a P-wave. But, the PRI is consistently greater than 0.20 seconds and _______________
- One _______ wave for each QRS
First Degree AV Block

• Etiology
  – Delay in the conjunction of an impulse through the AV node.
  – May occur in ___________ hearts, but often indicative of ischemia at the AV junction.

• Clinical Significance
  – Usually not significant, but new onset may precede a more ___________ block.

First Degree AV Block

• Treatment
  – Generally, none required other than ___________.
  – Avoid drugs that may further ___________ AV conduction.

Type I Second Degree AV Block

• AKA: Mobitz I or Wenckebach
• Description: an ___________ block at the level of the AV node
• Produces a pattern which the ______ intervals become progressively longer until an impulse is blocked.
• Cycle is repetitive and the P-P interval is ___________.
• Pattern may be constant or variable
Type I Second Degree AV Block

Keys to Interpretation:
- PRI ___________________ until a QRS drops out
- Each _________ is caused by a P-Wave

Rules of Interpretation:
Type I Second Degree AV Block
- Rate: ________________ is normal, Ventricular is normal to slow
- Rhythm: Atrial is regular. Ventricular is irregular
- Pacemaker Site: _________ node or atria
- P-Waves: normal. Some P-waves are NOT followed by _________ complexes
- QRS: Usually less than 0.12 seconds

Type I Second Degree AV Block

Type I Second Degree AV Block

Type I Second Degree AV Block

Second Degree AV Block • Mobitz 1 (Wenckebach)

<table>
<thead>
<tr>
<th>P Wave</th>
<th>PR Interval</th>
<th>QRS (in Seconds)</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduction Intermittent</td>
<td>Increasingly Prolonged</td>
<td>&lt;.12</td>
<td>QRS dropped in a repeating pattern</td>
</tr>
</tbody>
</table>

153
154
155
156
Type I Second Degree AV Block

• Etiology
  – Delay increases until an impulse is ________________ .
  – Indicative of ischemia at the AV junction.
• Clinical Significance
  – Frequently dropped beats can result in ________________ compromise.

Type II Second Degree AV Block

• AKA: Mobitz II, or infranodal
• Description: an intermittent block characterized by P wave that are not conducted to the ventricles, but ________________ associated lengthening of the P-R interval before the dropped beats

Type I Second Degree AV Block

• Treatment
  – Generally, none required other than observation.
  – Avoid drugs that may further slow AV conduction.
  – Treat symptomatic ________________ .
• ________________ : 0.5mg repeated as needed every ______-__________ minutes up to a max of 3mg total dose
• External Pacing if Atropine is unsuccessful

Type II Second Degree AV Block

Keys to Interpretation:
• More _________ waves than QRS but every QRS is caused by a P wave
• ________________ is constant for conducted beats
Rules of Interpretation: Type II Second Degree AV Block

- Rate: ___________________ is normal.
  Ventricular is slow
- Rhythm: regular or ___________________
- Pacemaker Site: SA node or atria
- P-Waves: normal, some P-waves not followed by QRS
- PRI: constant for conducted beats, may be greater than ____________ seconds
- QRS: Normal or greater than 0.12 seconds

Etiology
- Intermittent block of impulses.
- Usually associated with _______ or septal necrosis.

Clinical Significance
- May compromise cardiac output and is indicative of MI.
- Often develops into _______________ AV blocks.
Type II Second Degree AV Block
Treatment
• Avoid drugs that may further slow AV conduction.
• Treat symptomatic bradycardia.
  – Atropine should ________________ be given
  – May increase atrial ________________ but worsen block
• Consider transcutaneous pacing.

Third Degree AV Block
• AKA: Complete Heart Block
• Description: the absence of conduction between the atria and the ventricles resulting from complete electrical block at or below the ____________ node
• The ________________ pacemaker, located below the atria, paces the heart

Third Degree AV Block
Keys to Interpretation:
• More P wave than QRS
• Each QRS is ________________ caused by a P-wave
• Both the P-waves and QRS rhythm is ________________ but unassociated

Rules of Interpretation: Third Degree AV Block
• Rate: Atrial is normal. Ventricular is _______-_________
• Rhythm: Both atrial and ventricular rate is regular.
• Pacemaker Site: SA node and AV junction or ________________
• PRI: no relationship between P waves and R waves
• QRS: greater than __________ if pacemaker is ventricular; less than 0.12 if pacemaker is junctional
Third Degree AV Block

Etiology
- Absence of conduction between the atria and the ventricles.
- Results from ________, digitalis toxicity, or degeneration of the conductive system.

Clinical Significance
- Severely compromised cardiac ________________.

Third Degree AV Block

Treatment
- Pacemaker insertion is ________________ treatment
- Transcutaneous ________________ for acutely symptomatic patients.
- Treat symptomatic ________________.
  - ________________ should NOT be given
  - May increase atrial rate but worsen block
  - Avoid drugs that may further slow AV conduction.

Third Degree AV Block

<table>
<thead>
<tr>
<th>P Wave</th>
<th>PR Interval (in seconds)</th>
<th>QRS (in seconds)</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal but not related to QRS</td>
<td>None</td>
<td>N/A</td>
<td>No relationship between P &amp; RS</td>
</tr>
</tbody>
</table>
Dysrhythmias Sustained or Originating in the AV Junction

Dysrhythmias:
• Premature Junctional ___________________
• Junctional ___________________ Complexes and Rhythm
• Accelerated Junctional Rhythm
• Paroxysmal Junctional Tachycardia

Characteristics:
• __________ P Waves in Lead II
• PRI of < __________ Seconds
• Normal QRS Complex Duration

Premature Junctional Contractions

• Description: PJC s result from a single electrical impulse originating in the AV node that occurs before the next expected ____________ beat.
• A PJC can result in a compensatory pause or a _______-compensatory pause.
• Compensatory pause: the pause following an ectopic beat where the ________ node is unaffected and the cadence of the heart is uninterrupted

Rules of Interpretation: PJC

• Rate: depends on _______________ rhythm
• Rhythm: depends on underlying rhythm
• Pacemaker Site: ectopic focus in the AV junction
• P-Waves: flat or ________________ . May occur ________________ QRS
• PRI: Normal if P occurs before QRS
• QRS: usually ________________
PJC

• Etiology
  – Single electrical impulse originating in the ________ node.
  – May occur with use of caffeine, tobacco, alcohol, sympathomimetic drugs, ischemic heart disease, hypoxia, or digitalis toxicity, or may be idiopathic.
• Clinical Significance
  – Limited, frequent PJC may precursor other junctional dysrhythmias.
• Treatment
  – ___________________ usually required.

Rules of Interpretation:
Junctional Escape Complexes and Rhythms
• Rate: 40-60
• Rhythm: irregular in single occurrence, regular in junctional escape rhythm
• Pacemaker Site: ___________ Junction
• P-Waves: inverted, ___________________ , or after QRS
• PRI: Normal if before QRS
• QRS: Usually ________________

Junctional Escape Complexes and Rhythms
• Description: results when the rate of the primary pacemaker (SA Node) is slower than that of the AV node.
• The AV node then becomes the ____________________ .
• AV node fires at it’s intrinsic rate: _______ - __________
• Safety mechanism that prevents cardiac ________________
Junctional Escape Complexes and Rhythms

• Etiology
  – Results when the AV node becomes the pacemaker.
  – Results from increased __________________ tone, pathologically slow SA discharges, or heart block.

• Clinical Significance
  – Slow rate may ______________ cardiac output, precipitating angina and other problems.

Junctional Rhythm

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-60 bpm</td>
<td>Regular</td>
<td>Inverted, absent or after QRS</td>
<td>&lt;.12</td>
<td>&lt;.12</td>
</tr>
</tbody>
</table>

Treatment:
• None if the patient remains ____________________.
• Treat symptomatic episodes with ________________ or pacing as indicated.
Accelerated Junctional Rhythm

• Description: results from increased automaticity in the AV junction, causing the AV junction to discharge faster than its __________ rate.
• As the rate increases, the AV node overrides the __________ node.
• The rate is not, technically, a __________ but because it is faster than its intrinsic rate of the AV junction, it is considered accelerated.

Rules of Interpretation: Accelerated Junctional Rhythm

• Rate: ________-__________
• Rhythm: ___________________
• Pacemaker Site: AV Junction
• P-Waves: Inverted, ________________, or after QRS complexes
• PRI: Normal if present and occurs before QRS
• QRS: ___________________
Accelerated Junctional Rhythm

- **Etiology**
  - Results from increased ____________ in the AV junction.
  - Often occurs due to ischemia of the AV junction.
- **Clinical Significance**
  - Usually well tolerated, but ______________ for other dysrhythmias.
- **Treatment**
  - ______________ generally required in the prehospital setting.

Paroxysmal Junctional Tachycardia

- **Description**: develops when rapid AV junctional depolarization overrides the SA node.
- Often occurs with sudden onset (______________ )
- May last minutes or hours.
- May be caused by increased automaticity of a single AV nodal focus or by a ______________ phenomenon at the AV node.
- Sometimes indistinguishable from ___________ due to rapid rate

Rules of Interpretation: Paroxysmal Junctional Tachycardia

- **Rate**: __________-__________
- **Rhythm**: Regular
- **Pacemaker Site**: AV Junction
- **P-Waves**: Inverted, absent, or ________________ QRS
- **PRI**: Normal if occurs before QRS
- **QRS**: ________________
Paroxysmal Junctional Tachycardia

- Etiology
  - Rapid AV junction depolarization overrides the ________ node.
  - Occurs with or without heart disease.
  - May be precipitated by stress, overexertion, smoking, or ____________ ingestion.

- Clinical Significance
  - May be well tolerated for brief periods.
  - Decreased cardiac output will result from prolonged episodes, which may precipitate angina, hypotension, or congestive heart failure.

Treatment: Same as ________________
- ________________ Maneuvers
- Pharmacological Therapy
  - ________________
    - Verapamil
- Electrical Therapy
  - Use if rate is > 150 and patient is hemodynamically unstable.
  - Synchronized cardioversion starting at ____________ J.

Paroxysmal Junctional Tachycardia

- Ventricular Escape Complexes and Rhythms
- Accelerated ________________ Rhythm
- Premature Ventricular Contractions
- Ventricular ________________
- Related Dysrhythmia
- Ventricular Fibrillation
- ________________
- Artificial ________________ Rhythm
Ventricular Escape Complexes and Rhythms

• AKA: ___________________ rhythm
• Description: results either when impulses from higher pacemakers fail to reach the ventricles or when the discharge rate of higher pacemakers become less than that of the ventricles (________-________ bpm).
• Serves to prevent cardiac ___________________

Rules of Interpretation: Ventricular Escape Complexes and Rhythms

• Rate: 15-40 (sometimes less)
• Rhythm: escape complex is ________________ . Escape rhythm is regular
• Pacemaker Site: Ventricle
• P-Waves: ________________
• PRI: ___________________
• QRS: Greater than ___________ seconds and bizarre in morphology

Ventricular Escape Rhythm

• Etiology
  – _______________ mechanism to prevent cardiac standstill.
  – Results from failure of other foci or high-degree __________ block.
• Clinical Significance
  – ________________ cardiac output, possibly to life-threatening levels.
Ventricular Escape Complexes and Rhythms

Treatment:
• For perfusing rhythms, administer _______________ and/or TCP (Pacing).
• For nonperfusing rhythms, follow pulseless electrical activity (__________) protocols.

Accelerated Idioventricular Rhythm

• Etiology
  – A subtype of ventricular escape rhythm that frequently occurs with ____________.
  – Ventricular escape rhythm with a rate of ____________–__________.
• Clinical Significance
  – May cause ________________ cardiac output if the rate slows.

Accelerated Idioventricular Rhythm

Treatment:
• Does not usually require treatment unless the patient becomes hemodynamically ____________.
• Primary goal is to treat the underlying ____________.

Accelerated Idioventricular Rhythm

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-100</td>
<td>Regular</td>
<td>Absent or not related</td>
<td>N/A</td>
<td>≥12</td>
</tr>
</tbody>
</table>
Premature Ventricular Contractions

• Description: A ________ is a single ectopic impulse arising from an irritable focus in either ventricle that occurs earlier than the next expected beat.
• May result from increased automaticity in the ______________ cell
• The altered sequence of ventricular depolarization results in a _______________ and bizarre QRS and may cause the T-wave to occur in the opposite direction of the QRS.

Premature Ventricular Contractions

• Pause following a PVC is ______________
• Occasionally, an interpolated beat occurs when a PVC falls between two sinus beats without interrupting the rhythm
• If more than 1 PVC occurs, each can be classified as Unifocal or ______________
  • Unifocal: from the same foci (looks alike)
  • Multifocal: from different sites (look different)

Groups of PVCs

• ______________: Every other beat is a PVC
• Trigeminy: Every third beat is a PVC
• Quadrageminy: Every fourth beat is a PVC

• ______________: Two consecutive PVCs
• Triplet: ______ or more consecutive PVCs
• Runs of V-Tach: group of ______ or more consecutive PVCs

Rules of Interpretation: PVCs

• Rate: Depends on underlying rhythm
• Rhythm: Normally ______________. Interrupts underlying rhythm
• Pacemaker Site: ______________
• P-Waves: ______________
• PRI: None
• QRS: Greater than __________ and bizarre
PVCs

Unifocal PVCs

Unifocal PVC's: identical shapes
Note: A single PVC is labeled isolated

Multifocal PVCs

Multifocal PVC's: more than one shape

PVC Couplets

Coupled PVC's: occur in pairs
PVC Triplets

Etiology
- Single ectopic impulse resulting from an irritable focus in either ___________________
- Causes may include myocardial ischemia, increased ___________________ tone, hypoxia, idiopathic causes, acid–base disturbances, ___________________ imbalances, or as a normal variation of the ECG.

PVCs

Bigeminy

Bigeminal PVC's: every other beat is a PVC.

PVCs

- May occur in ___________________
  - Bigeminy, trigeminy, or quadrigeminy.
  - _________________ and triplets.
  - Runs of _________________
PVCs

Clinical Significance:
• Malignant PVCs:
  – More than ________/minute, R on T phenomenon, couplets or runs of ventricular tachycardia, __________ PVCs, or PVCs associated with chest pain.
  – Ventricles do not adequately ___________________ , causing decreased cardiac output.
• Non-malignant PVCs do not usually require treatment in patients without a cardiac history.
  – Most people have _______________ PVCs
  – Cardiac patient with nonmalignant PVCs
    – Administer oxygen and establish _________ access
    – Watch EKG closely

Treatment of Malignant PVCs

• Treatment of PVCs is normally performed for __________ on __________ phenomenon and symptomatic patients
  – Two drugs to treat PVCs:
    – _______________
    – _______________
• Do NOT mix anti-dysrhythmics

Treatment of Non-Malignant PVCs

• Non-malignant PVCs do not usually require treatment in patients without a cardiac history.
• Most people have _______________ PVCs
• Cardiac patient with nonmalignant PVCs
  – Administer oxygen and establish _________ access
  – Watch EKG closely

R on T phenomenon

R on T: occur on the peak of the T wave of the preceding beat
Lidocaine for Malignant PVCs

- ________ – _________mg/kg IV bolus.
- If PVCs are not suppressed, repeat doses of ________-_________ mg/kg to max dose of ____________ mg/kg.
- If PVCs are suppressed, administer lidocaine drip ________-_________ mg/min.
- ______________ the dose in patients with decreased output or decreased hepatic function and patients > 70 years old.
- If patient is allergic to Lidocaine, consider Amiodarone

Lidocaine

- Antidysrhythmic (Sodium channel blocker)
- Contraindications: Allergic or allergic to ______________
- Indications: V-fib, PVCs, V-Tach
- A bolus should be followed with a drip if ______________
- Lidocaine Drip: usually mixed __________gm/250cc and is run at 2-4mg/min
- Side Effects: Dizziness, drowsiness, N/V, sensation of heat/cold, numbness

Amiodarone (Cordarone)

- Amiodarone is an alternative to Lidocaine
- Newer drug with proven success
- Amiodarone is an antiarrhythmic (Calcium Channel ______________)
- Long _________ life
- Indications:
  - Wide Complex Tachycardia, V-Fib, V-Tach, Supraventricular Tachycardia, Rapid A-Fib
- Contraindications: Allergic, _______________, Bradycardia

Amiodarone (Cordarone)

Effects:
- Inhibits abnormal ______________
- Increases refractory period at all sites
- Slows _________ and _________ node rate
- Causes peripheral ______________
Amiodarone (Cordarone)

Side Effects:
- Can produce hypotension or ______________
- Worsens ______________
- Paresthesias (numbness and tingling)
- Tremor
- ________________

Amiodarone (Cordarone)

Initial Dosage (For non per):
- ________ mg IV push
- Repeated (if needed) at _________ mg in 3-5 minutes
- ½ dose (150mg) for perfusing rhythm over 10 minutes

Amiodarone (Cordarone)

Maintenance Dosage:
- IV Drip: ________ - _________ mg/min
- Drip must be in glass or Viaflex bag
  - Glass container is good for 24 hours
  - Viaflex bag is good for ________ hours
- Amiodarone drips normally not established in ________________ setting
- Notify ER that Amiodarone was given

Ventricular Tachycardia V-Tach

- Description: ________ or more ventricular contractions in succession with a rate of ________ bpm or faster.
- Overrides the ________ node.
- May be present with or without a ______________
- Monomorphic V-Tach: all complexes appear the ________________ (Most common).
- Polymorphic V-Tach: complexes have different sizes and shapes. (Torsade de Pointes)
Rules of Interpretation: V-Tach

• Rate: __________-__________
• Rhythm: usually regular
• Pacemaker site: ______________
• P-Waves: If present, not associated with QRS
• PRI: ______________
• QRS: greater than _________ seconds and bizarre

Etiology:
• 3 or more ventricular complexes in succession at a rate of > __________.
• Causes include myocardial ischemia, increased sympathetic tone, ______________, idiopathic causes, acid–base disturbances, or electrolyte imbalances.
• VT may appear ______________ or polymorphic
V-Tach

Clinical Significance:
• Decreased ________________ output, possibly to life-threatening levels.
• May deteriorate into ventricular ________________.

Perfusing patient:
• Administer ________________ and establish IV access.
• Consider immediate synchronized ________________ starting at 100J for hemodynamically ________________ patients. (normally 100J, 200J, 300J, 360J or biphasic equivalent)
  – Sedate if necessary

Treatment of V-Tach

Perfusing Patient (Cont’d)
• ________________ 150–300 mg IV over 10 minutes. Repeated once at 150mg
• ________________ 1.0–1.5 mg/kg IV.
• Administer repeat doses of Lidocaine 0.5–1mg/kg to the max dose of 3.0 mg/kg, or until VT is suppressed. (Lidocaine ________________ if conversion)

V-Tach Treatment Summary

Conscious Patient
• BLS, IV
• Drugs
  – Amiodarone
  – Lidocaine
• Synchronized Cardioversion
  – Sedation?
  – 100J, 200J, 300J, 360J

Unconscious Patient With a Pulse
• BLS, IV
• Synchronized Cardioversion
  – 100J, 200J, 300J, 360J
• Drugs
  – Amiodarone
  – Lidocaine
Treatment of V-Tach

Non-Perfusing Patients (No Pulse):
• Treat as Ventricular ____________________ (V-Fib)

Torsade de Pointes

• Typically occurs in nonsustained bursts.
  – Prolonged ______-______ interval during “breaks.”
  – QRS rates from 166–300.
  – RR interval highly ___________________.
• Treatment
  – Do not treat as standard VT (_________________ not indicated)
  – Magnesium sulfate 1–2 g diluted in 100 ml D5W over 1–2 minutes is drug of choice.
  – Amiodarone 150–300 mg

Ventricular Fibrillation (V-Fib)

• Description: a ____________________ ventricular rhythm usually resulting from the presence of many reentry circuits within the ventricles.
• No ventricular polarization or depolarization
• May be ____________________ or course
• **CANNOT** produce a ________________
Rules of Interpretation: V-Fib

- Rate: no organized rhythm
- Rhythm: no organized rhythm
- Pacemaker Site: numerous ectopic foci throughout the ___________________
- P-Waves: Usually absent
- PRI: ________________
- QRS: ________________

V-Fib

Ventricular Fibrillation

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (in seconds)</th>
<th>QRS (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300-600</td>
<td>Extremely irregular</td>
<td>Absent</td>
<td>N/A</td>
<td>Fibrillatory baseline</td>
</tr>
</tbody>
</table>

Fine V-Fib

© RnCeus.com
Course V-Fib

V-Fib

• Etiology
  – Wide variety of causes, often resulting from advanced ______________ artery disease.

• Clinical Significance
  – ______________ dysrhythmia with no cardiac output and no organized electrical pattern.

Treatment of V-Fib

• Initiate CPR for 2 minutes unless witnessed or CPR has been in progress for 2 minutes or more.

• Defibrillate once at __________ J (or biphasic equivalent)

• Continue CPR without checking ______________ or ECG

• Establish __________ access and then control the airway

Treatment of V-Fib

• Administer Epinephrine 1:10,000 every __________ – __________ minutes for duration of arrest.

• Administer second-line drugs such as Lidocaine, Amiodarone, or Magnesium Sulfate.
  – Do NOT mix ______________

• Consider 40 IU ______________ IV instead of 1st or 2nd dose of Epinephrine (one time only).
Epinephrine 1:10,000

- ____________________________ agonist
  (Adrenalin)
- Stimulates both alpha and beta adrenergic ______________
- Alpha Receptors:
  – Peripheral ____________________________
    (arteries and veins)
  – Bronchoconstriction

Epinephrine 1:10,000

- Beta Receptors:
  – Increase of cardiac contractility and ______________ thus increasing cardiac output and heart rate
  – Relaxing of ____________________________ muscles in bronchi
  – Dilation of ____________________________ arteries

Epinephrine 1:10,000

- Epinephrine is mostly beta with some alpha
- Increases cardiac ____________________________ and automaticity
- Dilates ____________________________ passageways
- Decreases resistance to electrical shock
- Dilates coronary arteries
- ____________________________ peripheral blood vessels

Epinephrine 1:10,000

- Indications: ALL cardiac arrests, allergic reactions, severe asthma attacks
- Contraindications: None in cardiac arrest
- Adult Dosage: ____mg every _____-______ minutes for duration of arrest
- Side effects: none in cardiac arrest
- Normally supplied as _____mg in _____cc of solvent in ____________________________ syringes
Vasopressin

- AKA: Pitressin, ADH (Anti-Diuretic Hormone)
- Synthetic Pituitary Hormone
- Indication: V-Fib, pulseless V-Tach
- Actions: 
  - vasoconstrictor
- Decreases electrical heart rate to electrical shock
- Has no cardiac stimulatory properties
- Useful when heart is over

Vasopressin

- Contraindications: None in V-Fib or Pulseless V-Tach
- Dosage: _________ units IV push
- Currently, no dosage
- Used instead of _______ or _______ round of Epi

Asystole

- Description: Cardiac
- The of all cardiac electrical activity
- CANNOT produce a pulse
- “Flat Line”:
  - However, very rarely

Rules of Interpretation: Asystole

- Rate: No electrical activity
- Rhythm: No electrical activity
- Pacemaker Site: No electrical activity
- P-Waves:
- PRI:
- QRS:
Asystole

- **Etiology**
  - Primary event in cardiac arrest, resulting from massive myocardial infarction, ischemia, and necrosis.
  - ________________ outcome of ventricular fibrillation.
- **Clinical Significance**
  - Asystole results in cardiac arrest.
  - Poor ________________ for resuscitation.

---

**Treatment for Asystole**

- Administer CPR and manage the airway.
- Confirm in _________ Lead
- Treat for ventricular fibrillation if there is any doubt about the underlying rhythm.
- Epinephrine _________ mg every ______ - ______ minutes for duration
- Atropine _________ mg every ______ - ______ to minutes to a max of 3mg total dose
- Possibly sodium ________________.
Artificial Pacemaker Rhythm

• Description: results from stimulation of the heart by an artificial pacemaker
  • ________________ Rate
    Pacemakers: fire continuously at a preset rate; regardless of heart’s own electrical activity
  • ________________

Pacemakers: Monitors heart’s electrical activity and only fires if heart rate drops below a preset rate

Rules of Interpretation: Artificial Pacemaker Rhythm

• Rate: varies with rate of pacemaker
• Rhythm: regular if pacing regularly
• Pacemaker Site: Depends on electrode placement
• P-Waves: ________________ produced by ventricular pacemaker. Sinus P-waves may be seen but are unassociated with QRS. Pacemaker ________________ may be visible
• QRS: greater than ________ seconds, bizarre

Artificial Pacemaker Rhythm

• ________________ Pacemakers stimulate only the right ventricle resulting in a rhythm that resembles an idioventricular rhythm
• ________________ chambered pacemakers stimulate the atria first and then the ventricles
• Usually inserted in patients with severe symptomatic ________________
Atrial Pacemaker Rhythm

- **Etiology**
  - Single vs. dual chamber pacemakers.
  - Fixed-rate vs. demand pacemakers.

- **Clinical Significance**
  - Used in patients with a chronic high-grade heart block, sick sinus syndrome, or severe symptomatic bradycardia.

Ventricular Pacemaker Rhythm

- **Etiology**
  - Artificially induces electronic stimulus that paces the patient's rhythm causing a blip or spike on the ECG waveform.

Dual Chamber Pacemaker Rhythm

- **Etiology**
  - AV Sequential Pacemaker (dual chamber)

- **Clinical Significance**
  - Used in patients with a chronic high-grade heart block, sick sinus syndrome, or severe symptomatic bradycardia.

Artificial Pacemaker Rhythm

- **Etiology**
  - Single vs. dual chamber pacemakers.
  - Fixed-rate vs. demand pacemakers.

- **Clinical Significance**
  - Used in patients with a chronic high-grade heart block, sick sinus syndrome, or severe symptomatic bradycardia.

  - Pacemaker may NOT be seen. Obtain history in any patient who presents with broad QRS rhythms.
Artificial Pacemaker Rhythm

• Problems with Pacemakers
  – ____________________________ failure
  – “____________________________ ” pacers
  – Displaced ____________________________
• Use a ____________________________ to turn unit off if needed (contact medical control first)

Management Considerations:
• Identify patients with pacemakers.
• Treat the ____________________________ .
• Use an ____________________________ pacemaker if malfunctioning
• Try to avoid placing d-fib pads (or paddles) on pacemaker site
• The only way to confirm that a pacemaker is working correctly is to assure pulse corresponds with ____________________________

Pulseless Electrical Activity (PEA)

• Formerly called electrical mechanical dissociation (__________)
• Characteristics
  ☒Electrical impulses are present, but with no accompanying mechanical contractions of the ____________________________ .
  ☐Treat the patient, not the ____________________________ .
  ☐ECG could show ANY rhythm that is normally a perfusing rhythm

Causes of PEA

6 “H’s”
- Hypovolemia
- ____________________________
- Hydrogen Ion- Acidosis
- Hyper/Hypokalemia
- Hypothermia

5 “T’s”
- Tablets (OD)
- ____________________________
- Tension Pneumothorax
- Thrombosis (Cardiac)
- ____________________________, pulmonary (PE)
Treatment of PEA

- Prompt recognition and early treatment.
- ____________________________ 1 mg every 3–5 minutes.
- Identify and treat underlying ____________________________ of PEA.

Treatment of Underlying Causes of PEA

<table>
<thead>
<tr>
<th>Condition</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypovolemia</td>
<td>Pericardiosentesis</td>
</tr>
<tr>
<td>Cardiac Tamponade</td>
<td>Oxygen/Intubation</td>
</tr>
<tr>
<td>Tension Pneumothorax</td>
<td>Sodium Bicarbonate</td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>D50W</td>
</tr>
</tbody>
</table>

Dysrhythmias Resulting from Disorders of Conduction

Categories of Conductive Disorders:
- ____________________________ Blocks
- Disturbances of Ventricular Conduction
- ____________________________ Syndromes

Disturbances of Ventricular Conduction

- ____________________________ Conduction: a single supraventricular beat conducted through the ventricles in a delayed manner
- ____________________________ Branch Block: disorder in which all supraventricular beats are conducted through the ventricles in a delayed manner
Bundle Branch Block

- Can involve either the left or right bundle branch
- If both branches are involved, then a ____________ degree block exists
- Causes
- Ischemia or necrosis of a bundle branch
- PAC or _________ that reaches one of the bundle branches in a refractory period
- Causes wide _________ complexes with P-waves present

Pre-Excitation Syndromes

- Excitation by an impulse that bypasses the AV node
- Most common is Wolf-Parkinson-White (____________) Syndrome
- Characterized by a short _________ and a long _________ duration.
- Upstroke of the QRS often has a slur called a “____________________________” wave
- Treatment is to treat underlying rhythm

<table>
<thead>
<tr>
<th>P Wave</th>
<th>PR Interval (in seconds)</th>
<th>QRS (in seconds)</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before each QRS, identical</td>
<td>.12 to .20</td>
<td>≥.12</td>
<td>RR' in V5</td>
</tr>
</tbody>
</table>
Wolf-Parkinson-White Syndrome (WPW)

ECG Changes Due to Electrolyte Abnormalities and Hypothermia

Hyperkalemia:
• Tall __________
• Suspect in patients with a history of renal failure.

Hypokalemia:
• Prominent __________ waves

Hypothermia
• ___________________ wave (“J” wave)
• T wave inversion, sinus bradycardia, atrial fibr or flutter, AV blocks, PVCs, VF, asystole

Classifications of Cardiac Rhythms

Class I Rhythms: Not treated
• ____________________ Sinus Rhythm

Class II Rhythms: Not routinely treated by EMS
• Sinus ____________________
• Wandering ____________________
• Premature atrial contractions
• Atrial Flutter (Ventricular rate < 150bpm)
• Atrial Fibrillation (Ventricular rate < 150bpm)
• Premature Ventricular Contractions (<5 per minute)
Classifications of Cardiac Rhythms

Class II Rhythms: Not routinely treated by EMS (Continued):
- Premature junctional complex
- ____________________________ rhythm
- Accelerated junctional rhythm
- Junctional tachycardia (ventricular rate < 150)
- _________ degree AV block
- _________ degree AV block, type I (Wenckebach) (ventricular rate < 150)

Classifications of Cardiac Rhythms

Class III: Treated by EMS to prevent rhythm becoming Class IV:
- ____________________________
- Supraventricular Tachycardia (ventricular rate > 150)
- 2\textsuperscript{nd} Degree AV block, Type ___________
- _________ Degree AV block

Classifications of Cardiac Rhythms

Class III (Continued):
- Premature Ventricular Contractions, if:
  - ____________________________ Patients
  - Runs of V-Tach
  - _________ on _________ Phenomenon
  - ____________________________ PVCs

Classifications of Cardiac Rhythms

Class IV: Must be treated in pre-hospital setting, or death will result:
- Ventricular Fibrillation (VF or V-Fib)
- Ventricular Tachycardia (VT or V-Tach)
- Pulseless Electrical Activity (___________)
- ____________________________
Treating Cardiac Dysrhythmias

- Determine that there is a true need to treat the dysrhythmia before treating it
- Obtain a chief

BEFORE treating the dysrhythmia
- Most importantly……..

- TREAT THE PATIENT, **NOT**
  THE MONITOR