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
- Each system secretes ____________________

Sympathetic Nervous System

- Has 2 types of receptor fibers at the nerve endings:
  - Alpha and Beta
- The chemical neurotransmitter of the SNS is ____________________
- These nerve endings are called ____________________
Terms

- Chronotropy: heart rate
- ____________________ : contractile strength
- Dromotropy: rate of nervous ____________________ conduction

Cardiac Cell Groups

Two types:
- Myocardial ____________________ cells: responsible for generating the physical contraction of the heart muscle
- Specialized ____________________ cells
  - Coordinates rate and rhythm within the conduction system
  - Do not contract

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 Cell Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Cardiac Cells</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excitability</td>
<td>Pacemaker Cells</td>
<td>Electrical</td>
</tr>
<tr>
<td>Conductivity</td>
<td>All Cells</td>
<td>Electrical</td>
</tr>
<tr>
<td>Conductivity</td>
<td>All Cells</td>
<td>Electrical</td>
</tr>
<tr>
<td>Contractility</td>
<td>Working Cells</td>
<td>Mechanical</td>
</tr>
</tbody>
</table>
**Cardiac Physiology**

Cardiac Electrolytes:
- \( \text{_______________}(\text{Na}^+): \) depolarization
- Calcium (\( \text{Ca}^{++} \)): depolarization and contractions
- \( \text{_______________}(\text{K}^+): \) repolarization
- Chloride (\( \text{Cl}^- \)): Unsure
- \( \text{_______________}(\text{Mg}^{++}): \) 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
Cardiac Conductive System Components:
• ____________________ Node
• Internodal Atrial Pathways
• Atrioventricular Node
• Atrioventricular _________________
• Bundle of _________________
• Left and Right Bundle Branches
• _________________ Fibers

Intrinsic Firing Rates of the Cardiac Conductive System
• SA Node: ________ - _________ bpm
• AV Node: ________ - _________ bpm
• Purkinje System: ________ - _________ bpm

Electrocardiographic Monitoring
The Electrocardiogram
• Positive and Negative Impulses
• _________________
  – Muscle tremors
  – Shivering
  – Patient _________________
  – Loose electrodes
  – _________ Hertz interference
  – Machine malfunction
Muscle Tremor Artifact

Muscle Tremor (somatic)

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>
Table 28-2 OVERVIEW OF ECG LEAD GROUPINGS

<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>

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
Completion of atrial excitation

P-R Interval
Impulse delay at AV junction

The Electrocardiogram

QRS complex
Electrical excitation of the ventricles

T Wave
Ventricular repolarization
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? ________________
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

• 6 seconds method
  – Count the number of complexes in a 6 second interval (______ large squares) and multiply by 10
• Heart Rate Calculator ________________
  – Commercially available rulers

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 ______

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

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

Analyze the P Waves

- 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
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

Sinus Bradycardia

<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>&lt;60 bpm</td>
<td>Regular</td>
<td>Before each QRS, identical</td>
<td>.12 to .20</td>
<td>&lt;.12</td>
</tr>
<tr>
<td>Sinus Bradycardia</td>
<td></td>
<td></td>
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<tr>
<td>-------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Etiology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Increased ______ (vagal) tone, intrinsic disease of the SA node, drug effects.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– May be a normal finding in healthy, well-conditioned persons.</td>
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<tr>
<td><strong>Clinical Significance</strong></td>
<td></td>
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<tr>
<td>– May result in decreased cardiac output, hypotension, ________________, or CNS symptoms.</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>– In healthy, well-conditioned person, may have no significance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Atropine Sulfate (1 of 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extracted from the deadly nightshade jimsonweed</strong></td>
</tr>
<tr>
<td><strong>__________________________(parasympathetic) agent</strong></td>
</tr>
<tr>
<td><strong>__________________________ of the acetylcholine receptors</strong></td>
</tr>
<tr>
<td>– ________________ is the main neurotransmitter used by the PNS</td>
</tr>
<tr>
<td><strong>Atropine lowers the &quot;rest and digest&quot; activity of all muscles and glands regulated by the parasympathetic nervous system</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Atropine Sulfate (2 of 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increases firing of ______ node, conduction through AV node, opposes vagus nerve, blocks acetylcholine receptor sites, decreases bronchiole secretions.</strong></td>
</tr>
<tr>
<td><strong>Indications: inadequate ________________ bradyarhythmias (other than high degree blocks), organophosphate poisonings, premedication prior to ____________ in pediatrics</strong></td>
</tr>
</tbody>
</table>
Atropine Sulfate (3 of 4)

- 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

Dopamine (1 of 2)

- AKA: ___________________________
- Drug Class: Sympathomimetic
- Given only via IV _______________________
- Actions: Increases cardiac contractility and causes peripheral ____________________________
- Used regularly in prehospital setting
- Indication: Cardiogenic shock with hypotension and bradycardia resistant to Atropine and fluids

Dopamine (2 of 2)

- Contraindications: tachyarrhythmias, V-Fib, Hypovolemia prior to fluid resuscitation
- Dosage: IV drip at _________-_______mcg/kg/min to maintain BP and or heart rate
  – Most common range is 2-10mcg/kg/min
- Adverse Reactions: Ectopic beats, dyspnea, hypertension, palpitations, necrosis of skin with IV ____________________________
- Over 20mcg/kg/min will shut off blood flow to kidneys and GI tract
Epinephrine Drip

- AKA: _________________________
- Drug Class: Sympathomimetic
- Effects: increases cardiac rate, contractility, force, increase electrical activity of heart, increases BP
- IV Drip dosage is ___________ - ___________ mcg/min
- Epi is discussed further later

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

- Heart Rate: > 100 bpm
- Rhythm: Regular
- P Wave: Before each QRS, identical
- PR interval (in seconds): .12 to .20
- QRS (in seconds): <.12
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

- **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:** ________________ Node 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.

- Treatment
  - None if patient is ____________________
  - Treat symptomatic ____________________
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.

- **Treatment**
  - 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 _____________

PACs

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

- [Heart diagram]
PSVTs

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 ________________

Verapamil

- 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

Verapamil

- 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

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: ___________________

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

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.

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

Treatment of Atrial Flutter

• 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 __________________

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 _______________.

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 then 300J and 360J.
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 where 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

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

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

• 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 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

Type II Second Degree AV Block

- 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.

<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;QRS</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.

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 its intrinsic rate: _______-___________
• Safety mechanism that prevents cardiac ________

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

- **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>

Junctional Escape Complexes and Rhythms

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

Dysrhythmias Originating in the Ventricles

- 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

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

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.
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.

Groups of PVCs

- _______________: Every other beat is a PVC
- Trigeminy: Every third beat is a PVC
- Quadrugeminy: 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

Multifocal PVCs

PVC Couplets
PVCs

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.

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.

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

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

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 ________________
- Parestesias (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, OR
• ___________________ 1.0–1.5 mg/kg IV
  – Mixing of antiarrhythmics is NOT recommended
• 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

Fine V-Fib
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

- 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 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
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: nonexistent
• PRI: nonexistent
• QRS: nonexistent
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 outcome 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.
- Consider causes: 6 H's and 5 T's.
- Possibly sodium ____________________.
Causes of Asystole

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

5 “T’s”
- Tablets (OD)
- Tension Pneumothorax
- Thrombosis (Cardiac)
- _____________________, pulmonary (PE)

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
- _____________________, Pulmonary (PE)
  Pacemakers: Monitors heart’s electrical activity and only fires if heart rate drops below a preset rate

Rules of Interpretation:

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 _____________________

- 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

Atrial Pacemaker Rhythm

One spike producing an abnormal P wave (atrial capture) followed by a normal QRS

Ventricular Pacemaker Rhythm

Electronic Pacemaker Spikes

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

Dual Chamber Pacemaker Rhythm

AV Sequential Pacemaker (dual chamber)

One spike followed by an abnormal P (atrial capture) followed by a Second spike producing a wide QRS (ventricular capture).
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)**

Artificial Pacemaker Rhythm

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
Treatment of PEA

- Prompt recognition and early treatment.
- ________________ 1 mg every 3–5 minutes.
- Identify and treat underlying ___________________________ of PEA.
  – 6 H’s and 5 T’s (same as asystole)

Treatment of Underlying Causes of PEA/Asystole

<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
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 fib 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: 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