1

2 **Sinus Mechanisms – Objectives**

- Describe the ECG characteristics of a sinus rhythm
- Describe the ECG characteristics, possible causes, signs and symptoms, and emergency management for the following dysrhythmias that originate in the SA node:
  - Sinus bradycardia
  - Sinus tachycardia
  - Sinus arrhythmia
  - Sinoatrial block
  - Sinus arrest

3 **Overview**

- The normal heartbeat is the result of an electrical impulse that originates in the SA node
- A rhythm originating from the SA node will have one positive (upright) P wave before each QRS complex

4 **Overview**

- Dysrhythmia (arrhythmia)
  - A manifestation of abnormal electrical activity
- Variations in rhythms originating from the SA node include differences in:
  - Rate (i.e., fast/slow) and/or pattern
  - Rhythm (regularity)

5 **Sinus Rhythm**

- The SA node normally initiates electrical impulses at a rate of 60 to 100 beats/min
  - Faster rate than any other part of conduction system
  - SA node is normally primary pacemaker

6 **Sinus Rhythm**

- Sinus rhythm is the name given to a rhythm reflecting normal electrical activity
  - Impulse originates in the SA node and follows the normal pathway of conduction, resulting in atrial and ventricular depolarization

7 **Sinus Rhythm – ECG Characteristics**

8 **Sinus Rhythm**

9 **Sinus Bradycardia**

- If the SA node discharges fewer than 60 beats/min, the rhythm is termed “sinus bradycardia”
  - The rhythm originates in the SA node and followes the normal pathway of conduction

10 **Sinus Bradycardia – ECG Characteristics**

11 **Sinus Bradycardia**

12 **Sinus Bradycardia – Causes**

- Most common dysrhythmia associated with acute myocardial infarction (MI)
  - Often seen in patients with inferior and posterior infarction

13 **Sinus Bradycardia – Other Causes**

1

- Disease of the SA node
- Increased vagal (parasympathetic) tone
- Hypoxia
- Hypothermia

2
- Anorexia nervosa
- Hypothyroidism
- Hyperkalemia
- Uremia
- Glaucoma
- Sleep apnea syndrome
- Effects of medications
    - Calcium channel blockers (verapamil, diltiazem)
    - Digitalis
    - Beta-blockers (propranolol)

14 **Sinus Bradycardia – Clinical Significance**

- Cardiac output = Stroke volume ⍐ Heart rate
    - A decrease in either stroke volume *or* heart rate may result in a decrease in cardiac output
- Signs and symptoms of hemodynamic compromise:
    - Hypotension
    - Chest pain
    - Shortness of breath
    - Changes in mental status
    - Left ventricular failure
    - Fall in urine output
    - Cold, clammy skin

15 **Sinus Bradycardia – Intervention**

- No treatment if not symptomatic
- If symptomatic because of the bradycardia, treatment may include:
    - Oxygen
    - IV access
    - Atropine
    - Transcutaneous pacing (TCP)

16 **Sinus Tachycardia**

- If the SA node discharges at a rate greater than 100 times/min, the rhythm is termed a “sinus tachycardia”
- Sinus tachycardia begins and ends gradually

17 **Sinus Tachycardia – ECG Characteristics**

18 **Sinus Tachycardia**

19 **Sinus Tachycardia – Causes**

1
- Fever
- Pain
- Anxiety
- Hypoxia
- CHF
- Acute MI
- Infection
- Shock

2
- Hypovolemia
- Exercise
- Fright
- Dehydration
- Medications
    - Epinephrine
    - Atropine
    - Caffeine, nicotine
    - Cocaine

20 **Sinus Tachycardia – Clinical Significance**

- In the setting of acute MI, sinus tachycardia is a warning signal for heart failure, hypovolemia, and increased risk for serious dysrhythmias

21 **Sinus Tachycardia – Intervention**

- Directed at correcting the underlying cause

22 **Sinus Arrhythmia**

- Sinus arrhythmia occurs when the SA node discharges irregularly
  - Sinus arrhythmia associated with the phases of respiration and changes in intrathoracic pressure is called “respiratory sinus arrhythmia”
  - Sinus arrhythmia unrelated to the respiratory cycle is called “nonrespiratory sinus arrhythmia”

23 **Sinus Arrhythmia – ECG Characteristics**

24 **Sinus Arrhythmia**

25 **Sinus Arrhythmia – Causes**

- Respiratory sinus arrhythmia
  - Associated with phases of respiration and changes in intrathoracic pressure
  - Most commonly observed in infants and children, but may be seen in any age group

26 **Sinus Arrhythmia – Causes**

- Nonrespiratory sinus arrhythmia
  - Seen in older individuals and in those with heart disease
  - Common after acute inferior wall MI
  - May be seen with increased intracranial pressure
  - May be due to the effects of medications such as digitalis and morphine
  - May be due to carotid sinus pressure

27 **Sinus Arrhythmia – Intervention**

- Does not usually require intervention unless accompanied by a bradycardia that causes hemodynamic compromise
  - If hemodynamic compromise is present, IV atropine may be indicated

28 **Sinoatrial (SA) Block**

- Also called “sinus exit block”
- SA node generates impulses
- Impulses are blocked as they exit the SA node
- Results in periodically absent PQRST complexes

29 **SA Block – ECG Characteristics**

30 **SA Block**

31 **SA Block – Causes**

- Acute MI
- Digitalis, quinidine, procainamide, or salicylate administration
- Coronary artery disease
- Myocarditis
- Congestive heart failure
- Carotid sinus sensitivity
- Increased vagal tone

32 **SA Block – Intervention**

- None, if episodes are transient and there are no significant signs or symptoms
- If hemodynamic compromise is present:
  - Possible atropine
  - Possible permanent pacemaker

33 **Sinus Arrest**

- Also called “sinus pause” or “SA arrest”
- Sinus impulses are not generated

  - When the SA node fails to generate an impulse, escape pacemaker should assume pacing responsibility
    - AV junction
    - Ventricles
  - Results in absent PQRST complexes

34 **Sinus Arrest – ECG Characteristics**

35 **Sinus Arrest**

36 **Sinus Arrest – Causes**

- Hypoxia
- Myocardial ischemia or infarction
- Hyperkalemia
- Digitalis toxicity

- Reactions to medications such as beta-blockers and calcium channel blockers
- Carotid sinus sensitivity
- Increased vagal tone

37 **Sinus Arrest – Clinical Significance**

- May be associated with signs of hemodynamic compromise:
  - Weakness
  - Lightheadedness
  - Dizziness
  - Syncope

38 **SA Arrest – Intervention**

- None, if episodes are transient and there are no significant signs or symptoms
- If hemodynamic compromise is present:
  - Possible atropine
  - Possible permanent pacemaker