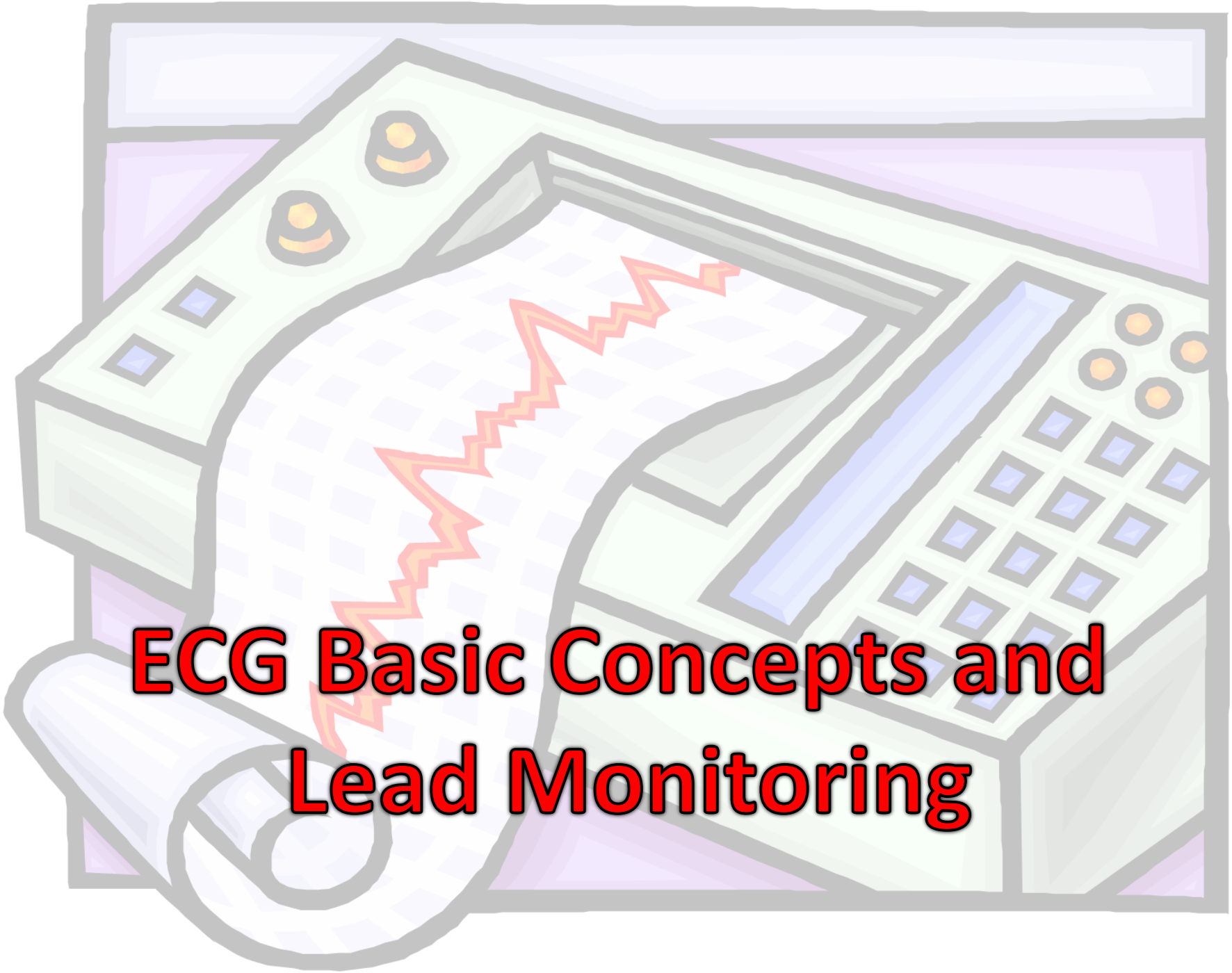

ECG Basic Concepts and
Lead Monitoring

Monitors and Telemetry Units

- **Telemetry = Process of monitoring cardiac electrical activity by transmitting the information to a monitor or telemetry unit**
  - **Includes machine, graph paper, ID of complex components, and interpretation of rhythm strips**
- **Electrocardiograph/Monitor = Machine that shows movement of electrical impulses through heart**
  - **Impulses are viewed as a pattern of waves**

Monitors and Telemetry Units

Monitors and Telemetry Units

- **BPM = Beat per minute**
- **SpO2 = Oxygen concentration**

Monitors and Telemetry Units

- **Rhythm strip = Printout of wave patterns on EKG**

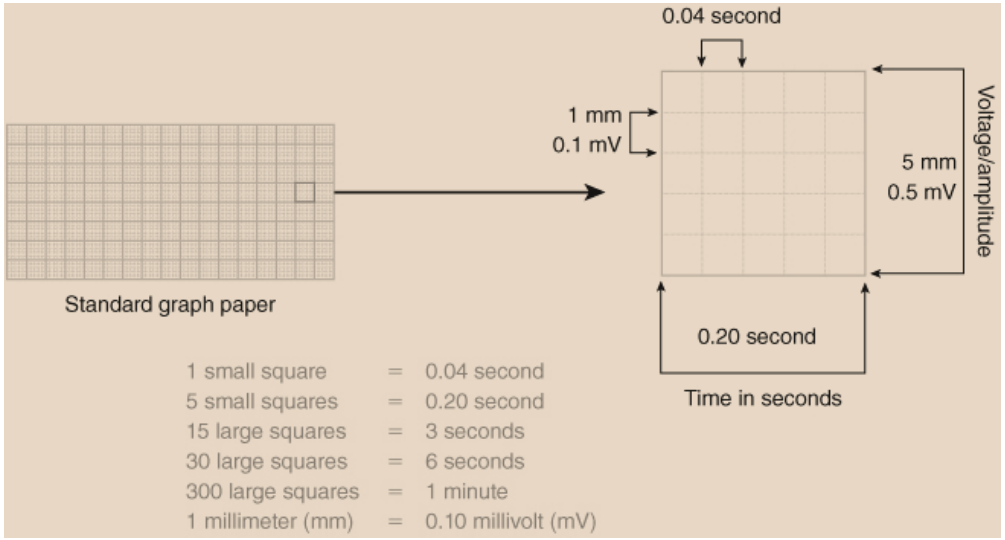
- **Freeze mode allows you to stop onscreen action to analyze**

Electrical Basis of ECG

- **Electric current generated by wave of depolarization that progresses through atria and ventricles followed by wave of repolarization of atria and ventricles in opposite direction**
- **Electrical activity readily detected by electrodes attached to skin**

Graph Paper

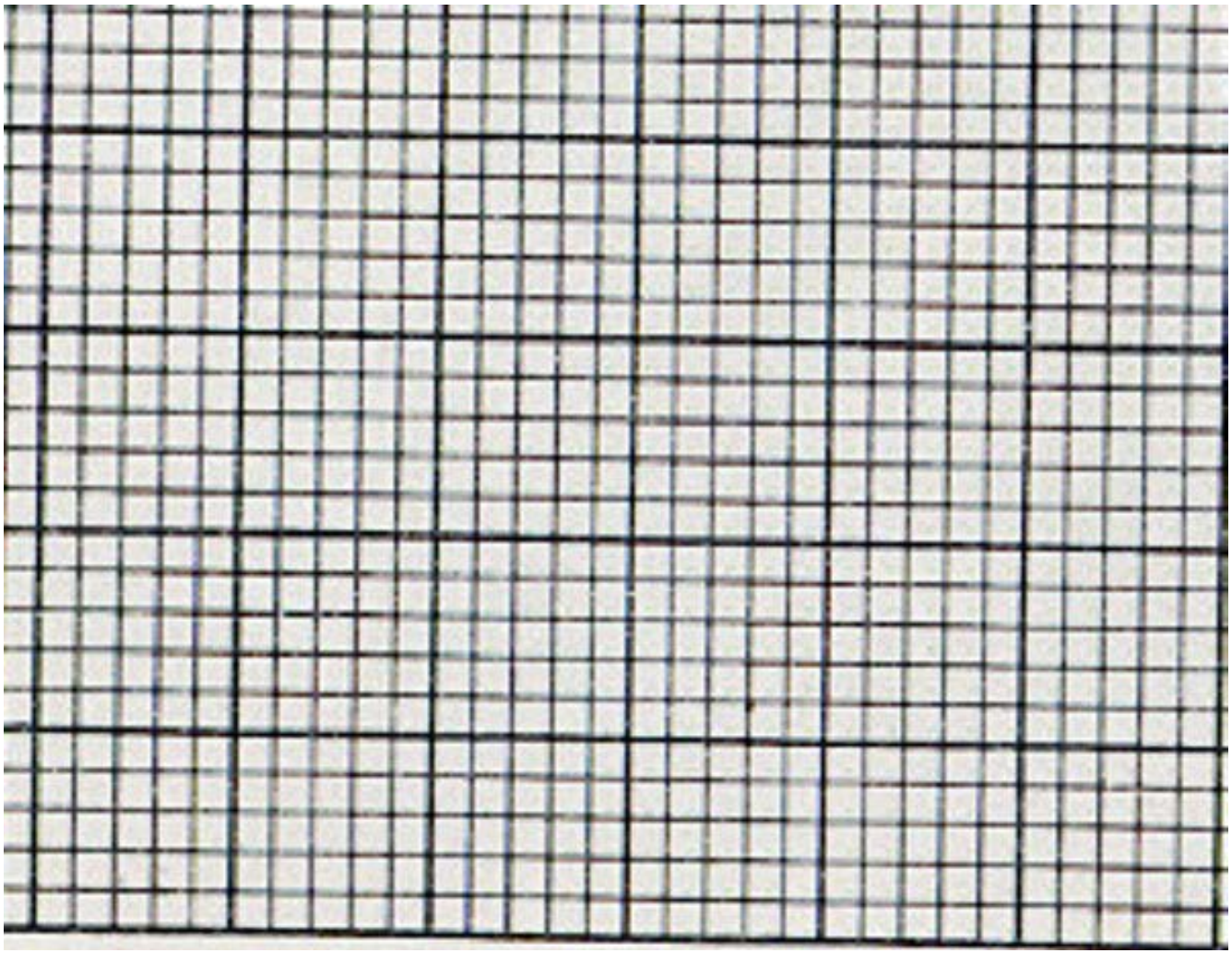
- **Rhythm strips are printed on ruled graph paper**
- **Graph paper divided into small squares that are 1 mm in height and width**
  - **Further divided by darker lines every 5th square vertically and horizontally**
  - **Each large square is 5 mm high x 5 mm wide**



Graph Paper

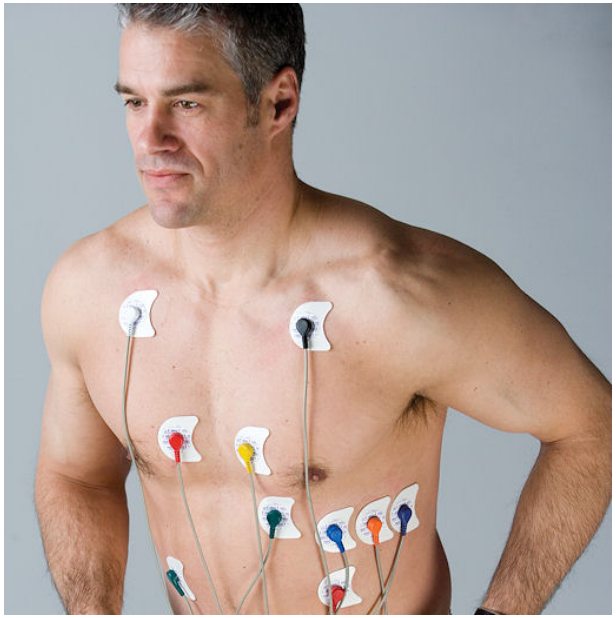
- Measures time and amplitude
  - Time = horizontal line
    - Small square = 0.04 second
    - Large square = 0.20 second
  - Amplitude = force of electrical impulse, measured on vertical line
    - Small square = 0.1 millivolt (mV)
    - Large square = 0.5 millivolt (mV)

Graph Paper



Electrodes and Leads

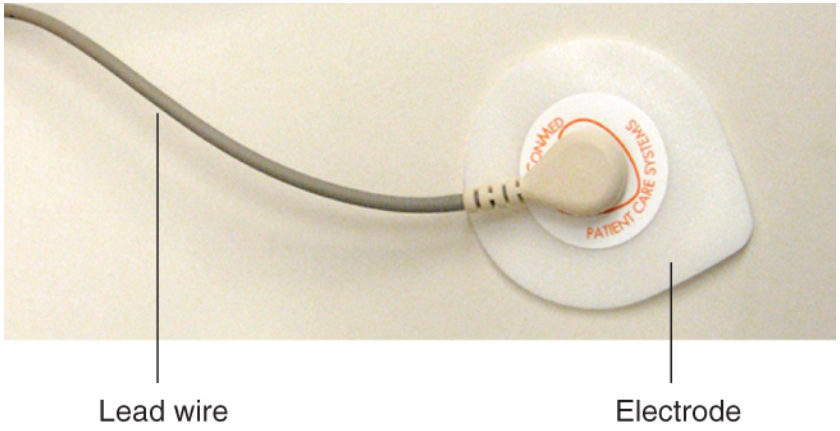
- **Electrodes = Adhesive pads that contain conductive gel and are attached to patient's skin; Sends electrical impulses from heart to monitor**



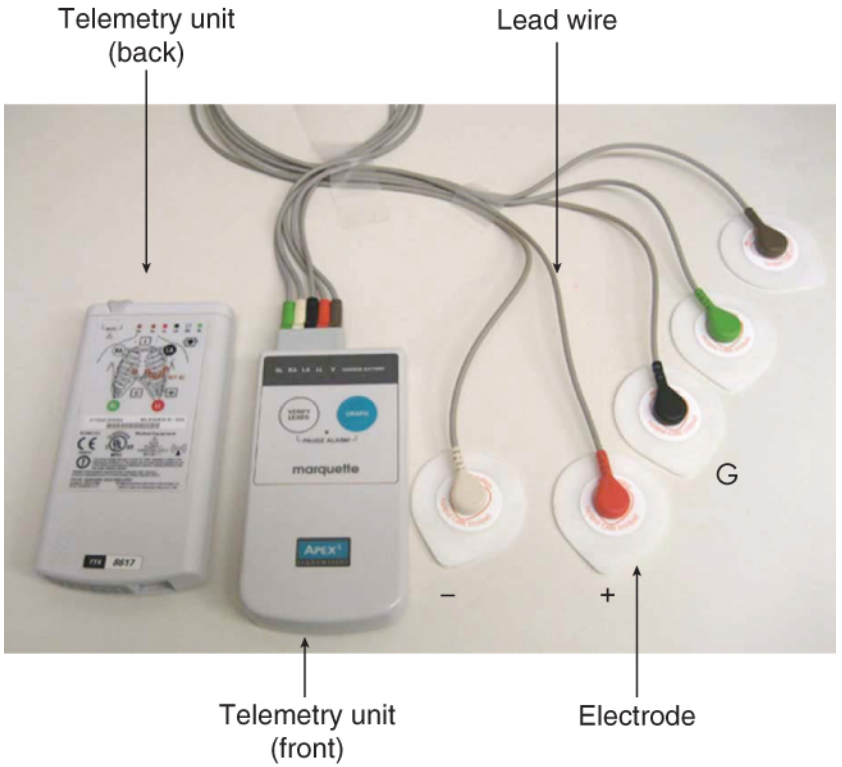
Electrodes and Leads

- When placing electrodes, make sure you prep the patient's skin for adhesive pads
- Leads are connected to a monitor or telemetry unit
  - Must use positive (red), negative (white), and ground lead
  - Telemetry unit = Small, battery-operated box approximately the size of a cell phone that transmits electrical impulses to monitor
  - In the case of EKG within PSGs, leads are plugged into head box and displayed on montage, usually below EEG waves

Electrodes and Leads



- **Monitor lead wire and electrode.**



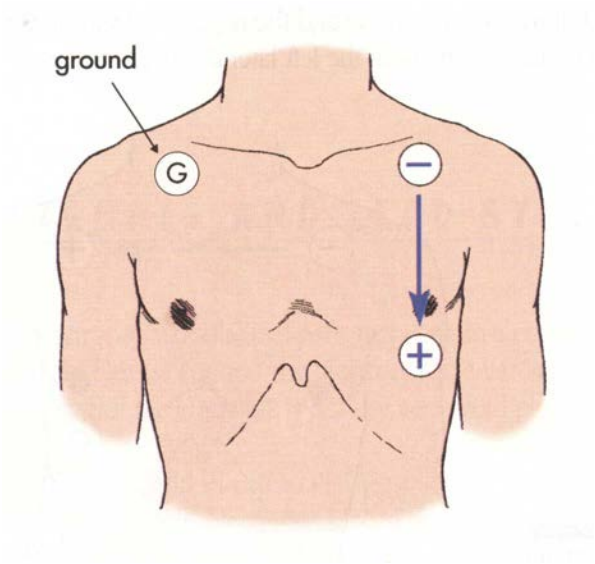
- **Telemetry unit with lead wires and electrodes.**

ECG Leads

- Two types used in ECG analysis:
  - Unipolar
  - Bipolar
- Unipolar leads = One positive electrode
- Bipolar leads = Lead with positive and negative electrode
  - Measure electrical potential between electrodes
  - Pattern on screen shows positive electrode's view
  - Also known as standard limb leads

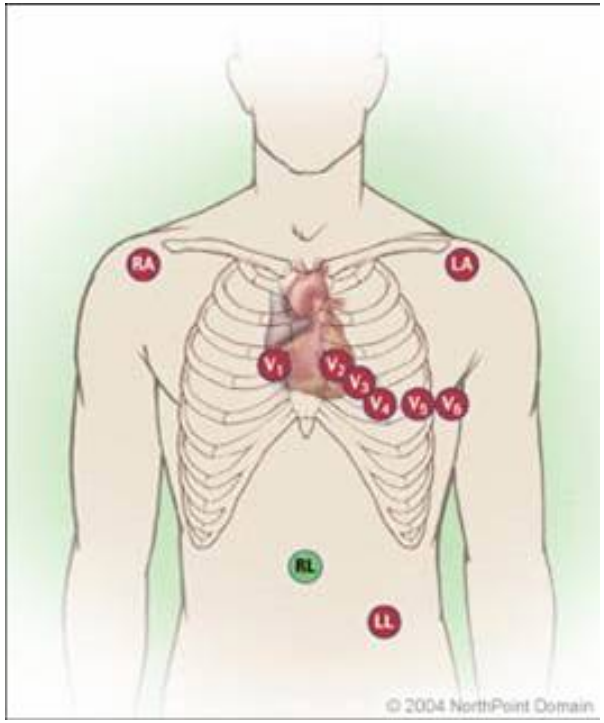
Lead Placement

- **Depends on type of EKG being done**
  - **Sleep labs use two or three lead systems**



Lead Placement

- **EKG analysis for heart dysrhythmias is typically a 12 lead system that looks at the heart from 12 different viewing angles**

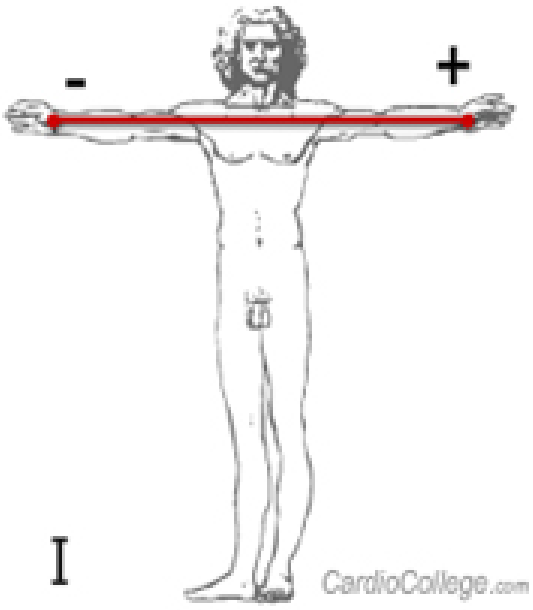


Lead Placement

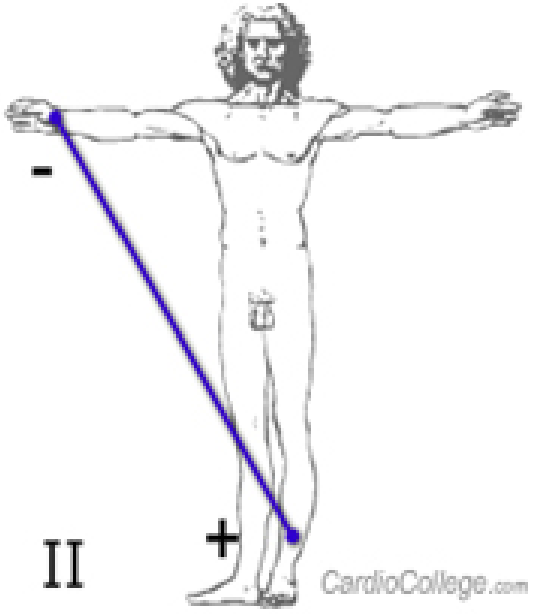
- **Placement determines the angle at which electrical impulses are received (what part of the heart observed)**

- **Leads I, II, III, and MCL_1 are typically used when continuous cardiac rhythm monitoring is required**

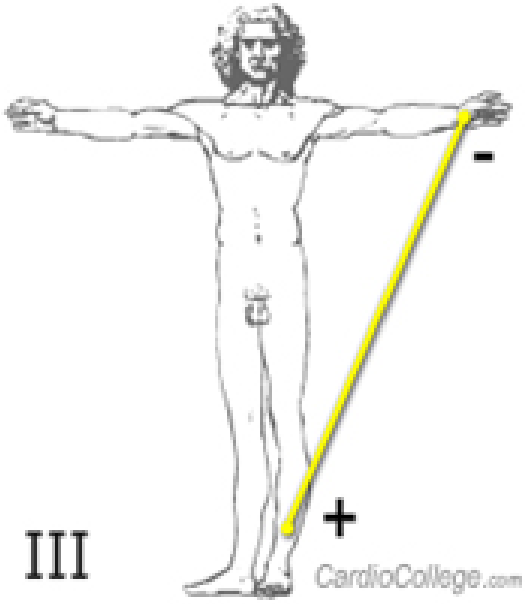
Monitoring Leads I-III



In lead I the left arm electrode is the positive pole and the right arm electrode is the negative pole.



In lead II the left foot electrode is the positive pole and the right arm electrode is the negative pole.

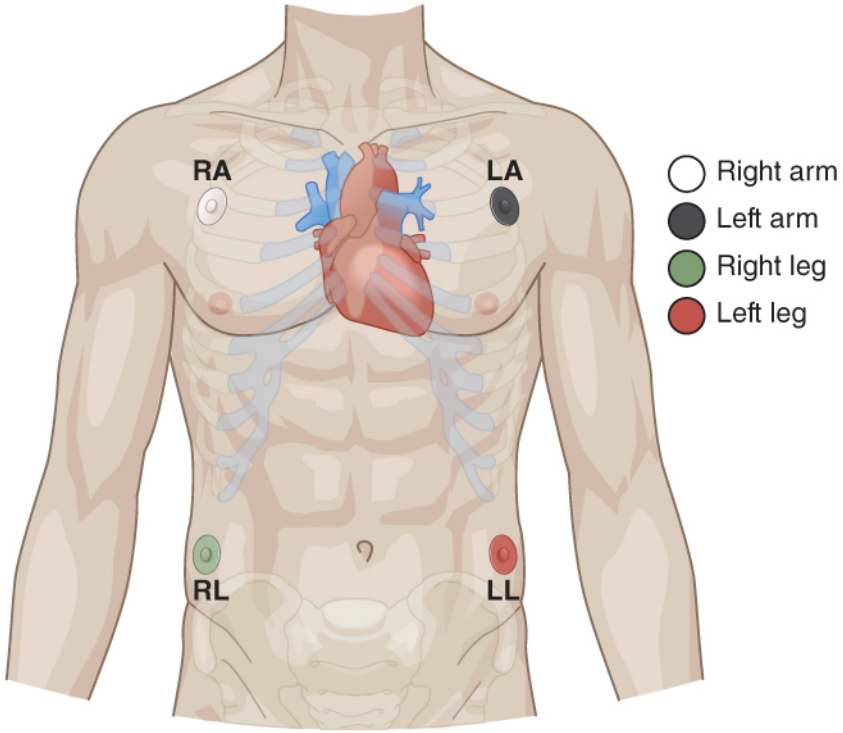


In lead III the left foot electrode is the positive pole and the left arm electrode is the negative pole.

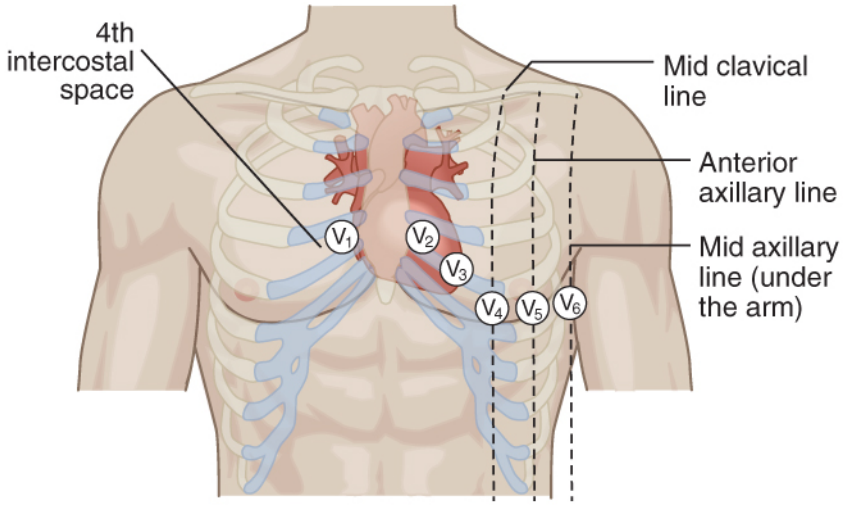
Lead Placement

- Standard 12-Lead ECG: Leads I, II, III, aVR, aVL, aVF, V_1, V_2, V_3, V_4, V_5, and V_6
  - Standard limb Leads: Leads I, II, and III
  - Augmented limb Leads: Leads aVR, aVL, aVF
  - Chest or precordial Leads: Leads V_1, V_2, V_3, V_4, V_5, and V_6
- Limb Leads
  - Electrodes are placed on the arms and legs or outer areas of the chest.
- Chest Leads
  - Electrodes are attached to very specific areas of the chest.
  - Placement of electrodes for chest Leads is sometimes changed slightly to “see” a specific area of the heart more clearly.

Lead Placement



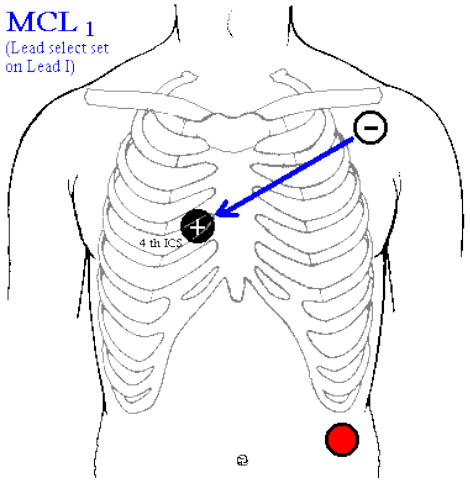
- Limb lead placement.



- Chest lead placement.

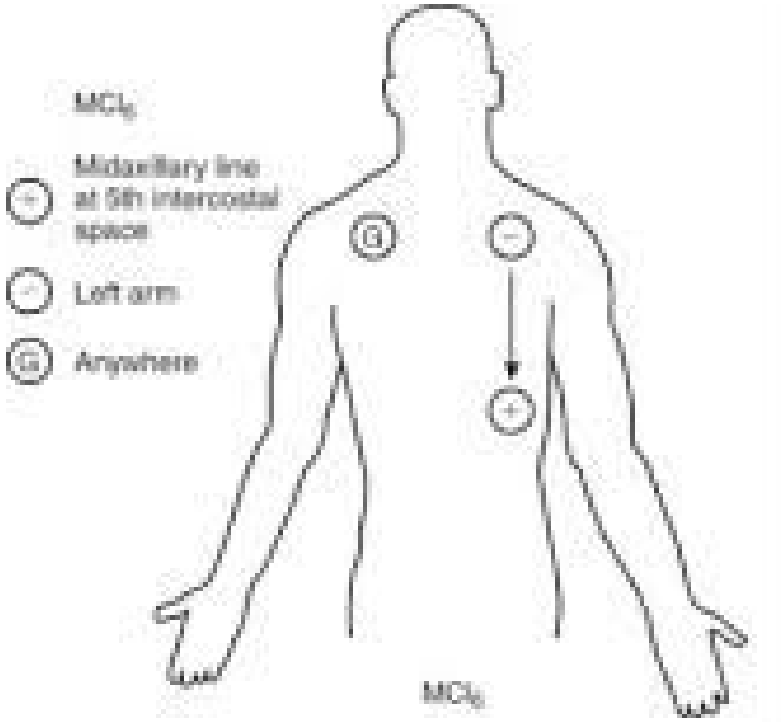
Other Lead Types

- **Modified chest leads (MCL)**
  - **Similar to unipolar leads but less sensitive**
  - **Only used for monitoring of select rhythms**
- **MCL_1**
  - **Helpful in identifying origin of certain dysrhythmias with wide QRS**

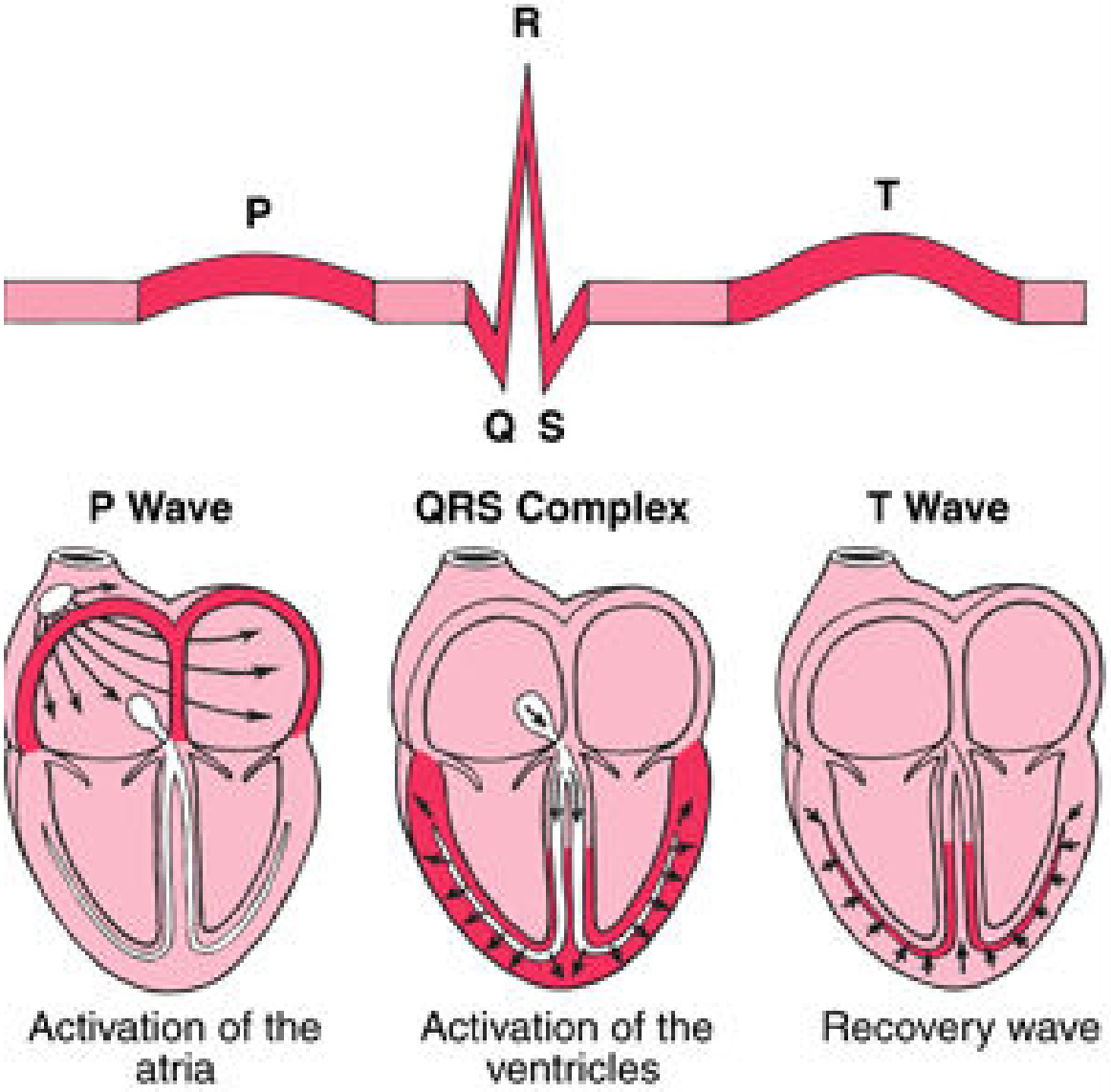


Other Lead Types

- **MCL6**
  - **Shows dissimilar QRS and T waves in certain heart conditions such as acute MI or bundle branch blocks**



Depolarization / Repolarization

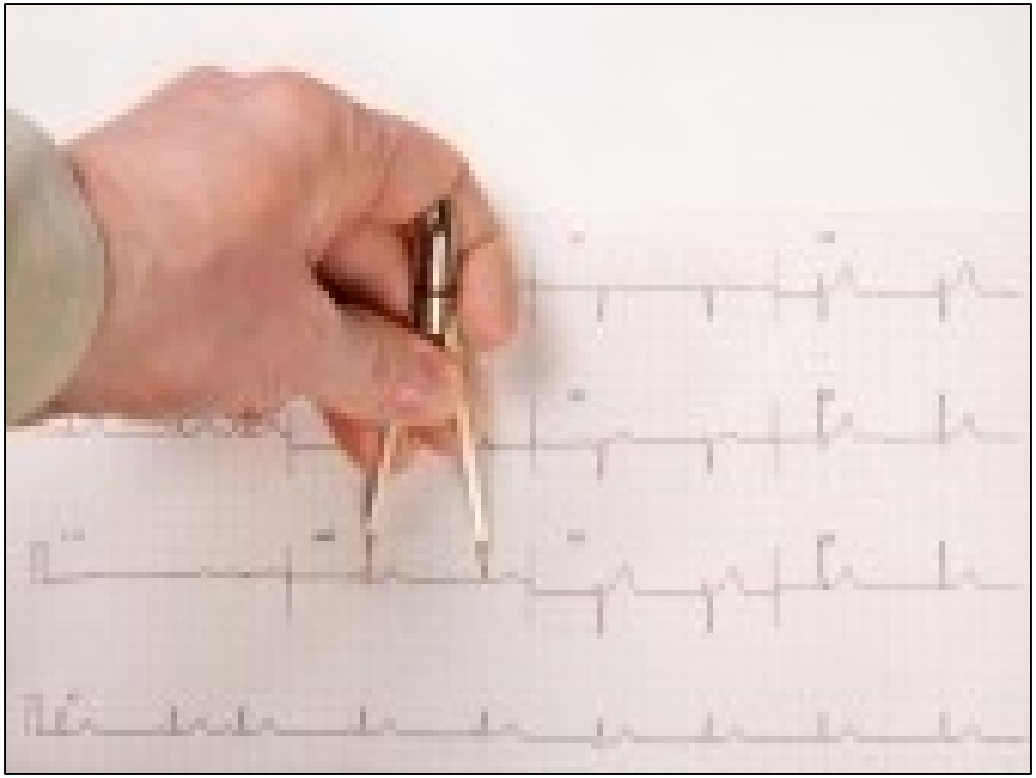


Rhythm

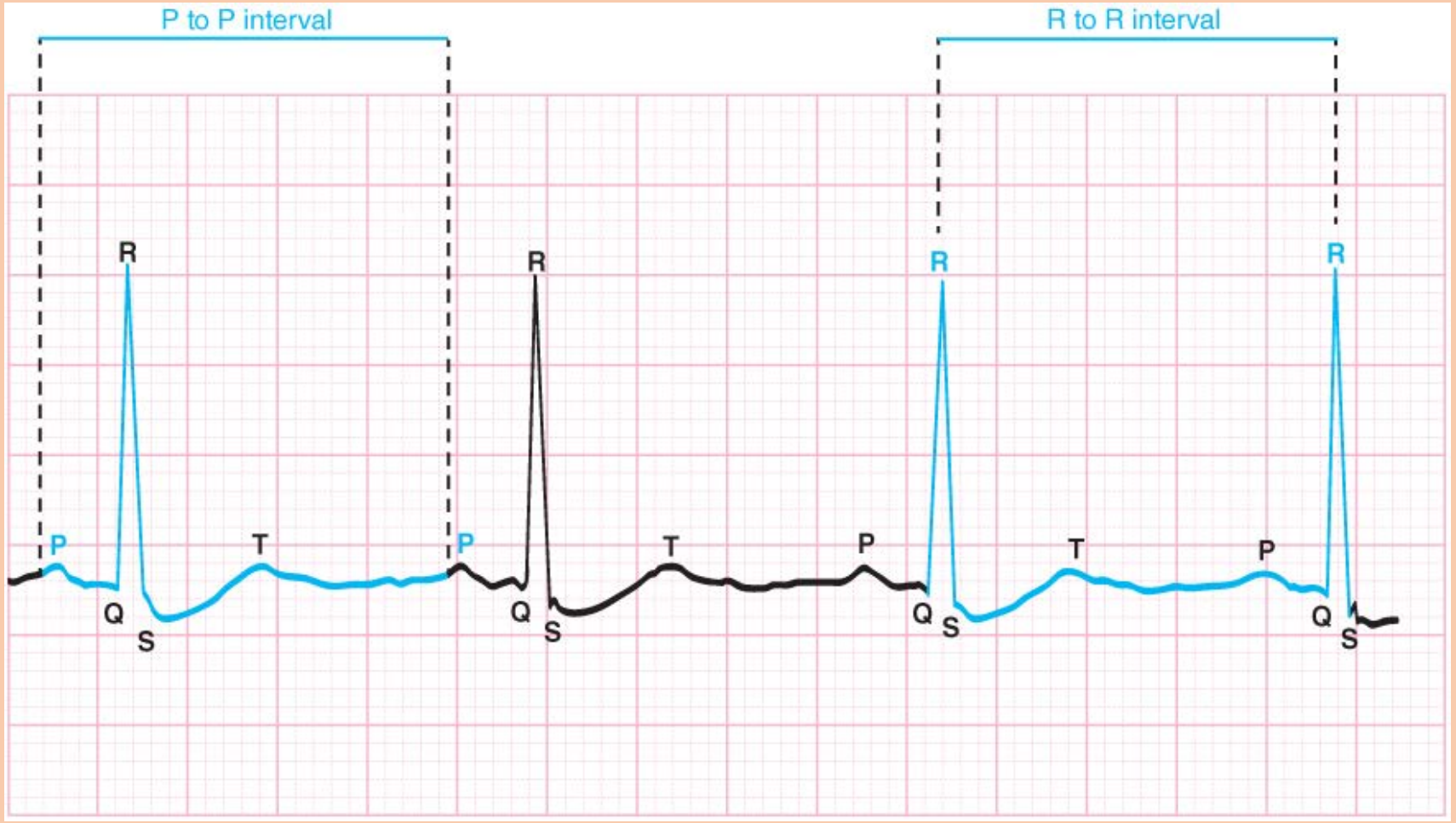
- Used to describe how regularly complexes occur
- If R-R intervals and P-P intervals are equal, rhythm is regular
- If P-P, R-R, or both intervals vary by < 0.06 second, can be considered regular
- > 0.06 seconds variance = irregular
- P-P intervals determine if atrial rhythm regular

Rhythm

- **Calipers provide most accurate measurement**
  - **If not available, use blank piece of paper and pencil**



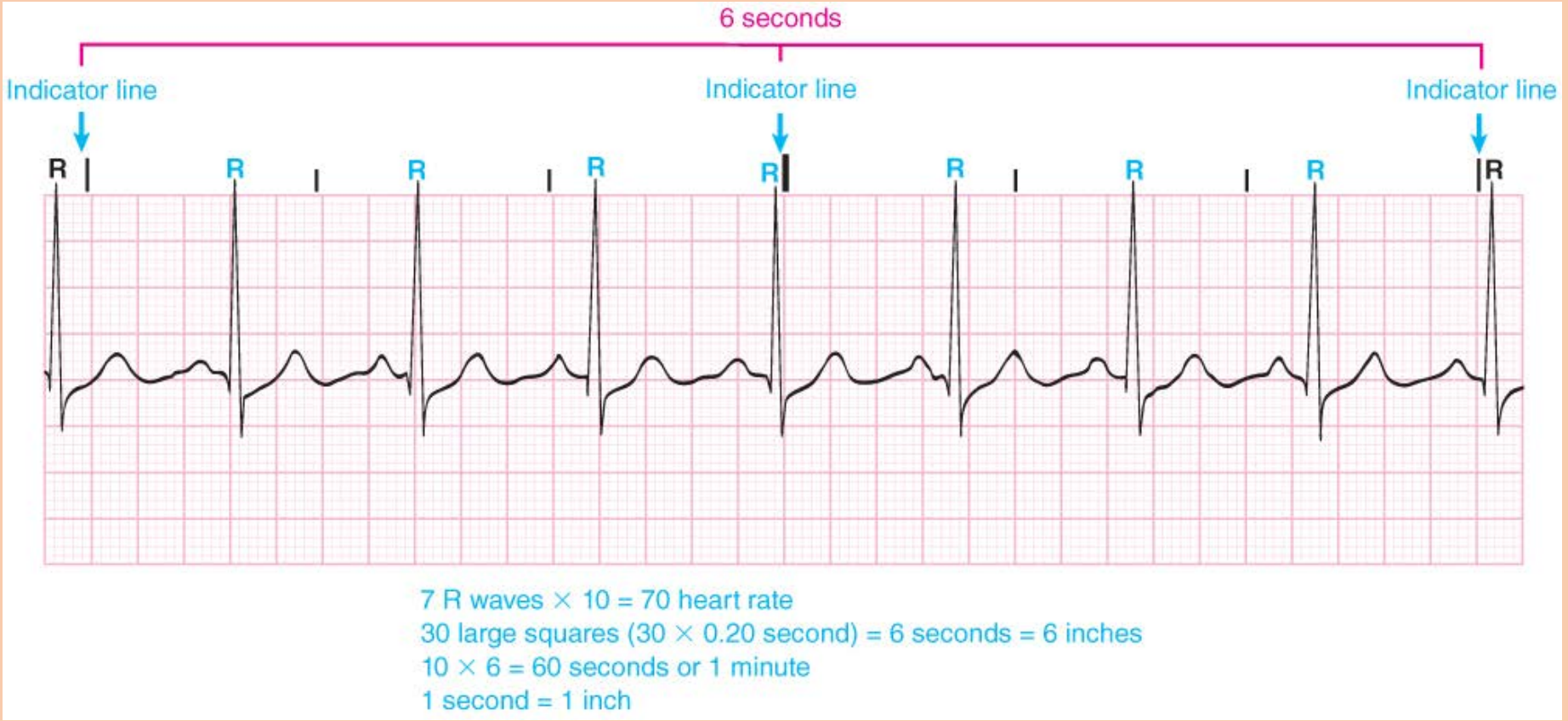
Rhythm



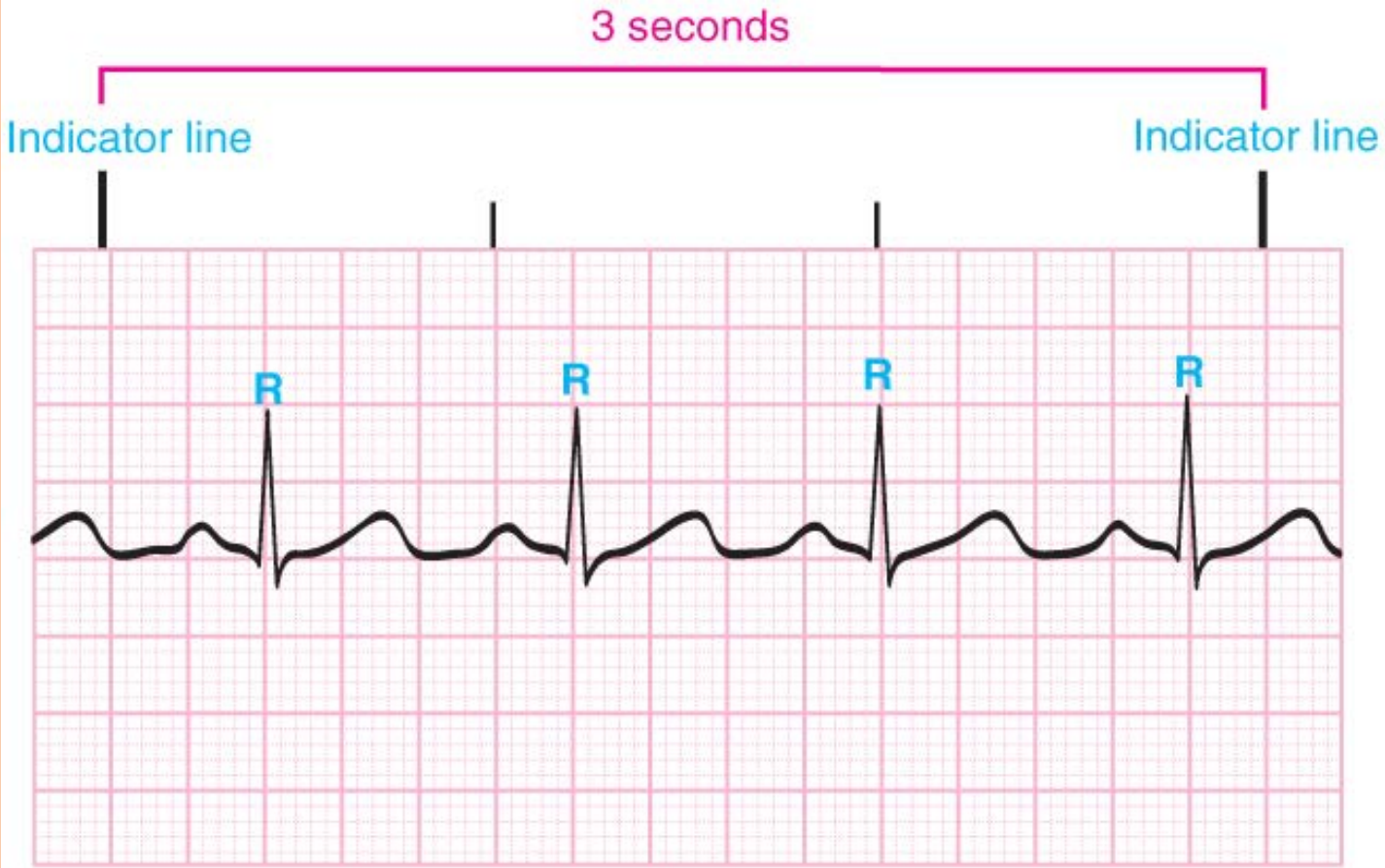
Rate

- Number of electrical impulse conducted through myocardium in 1 minute
- Atrial rate determined by # of P waves
- Ventricular rate determined by # of R waves
  - Should be the same as pulse rate
- Most frequently used calculating methods:
  - # of R waves in 6 second rhythm strip x 10
  - # of R waves in 3 second rhythm strip x 20
  - Division: Count # of large squares between 2 R waves and divide 300 by this number. If part of large square included, count each small square as 0.2.
  - Calculation by 1 minute rhythm strip most accurate but take longer to complete

6-second Rhythm Strip



3-second Rhythm Strip

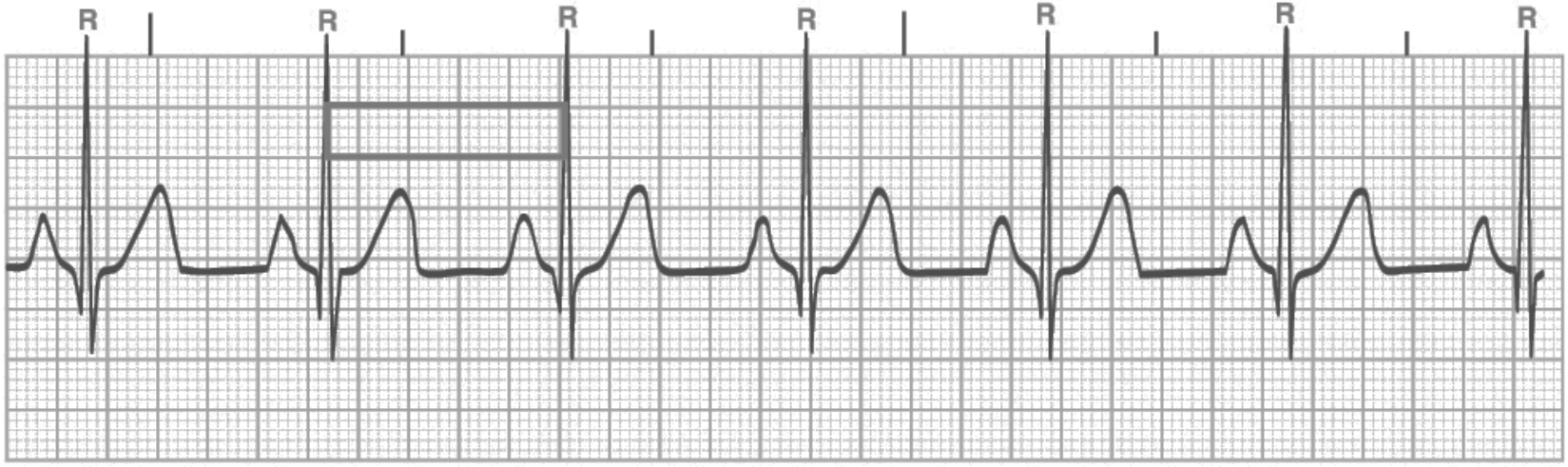


4 R waves × 20 = 80 heart rate

15 large squares (15 × 0.20 second) = 3 seconds = 3 inches

20 × 3 = 60 seconds or 1 minute

Division Method



Steps:

1. 4 large and 4 small squares between R waves
2. 4 small squares × 0.2 = 0.8
3. 300 ÷ 4.8 = 63

   Approximate heart rate = 63

OR

Steps:

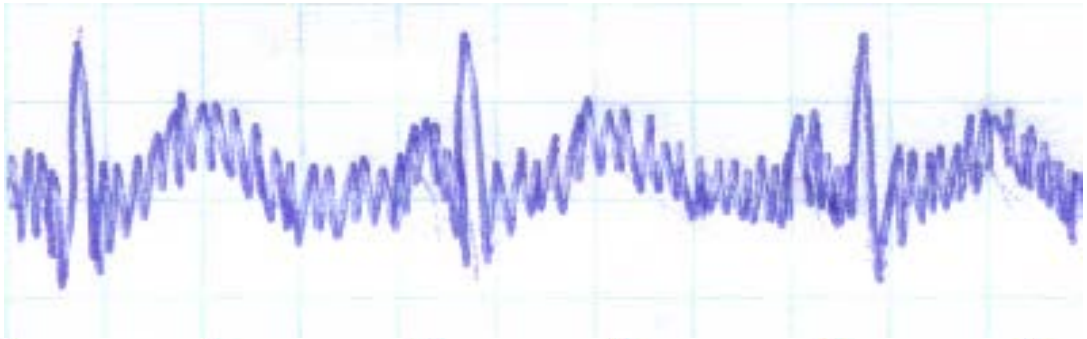
1. 24 small squares between R waves
2. 1,500 ÷ 24 = 62.5
3. Approximate heart rate = 63

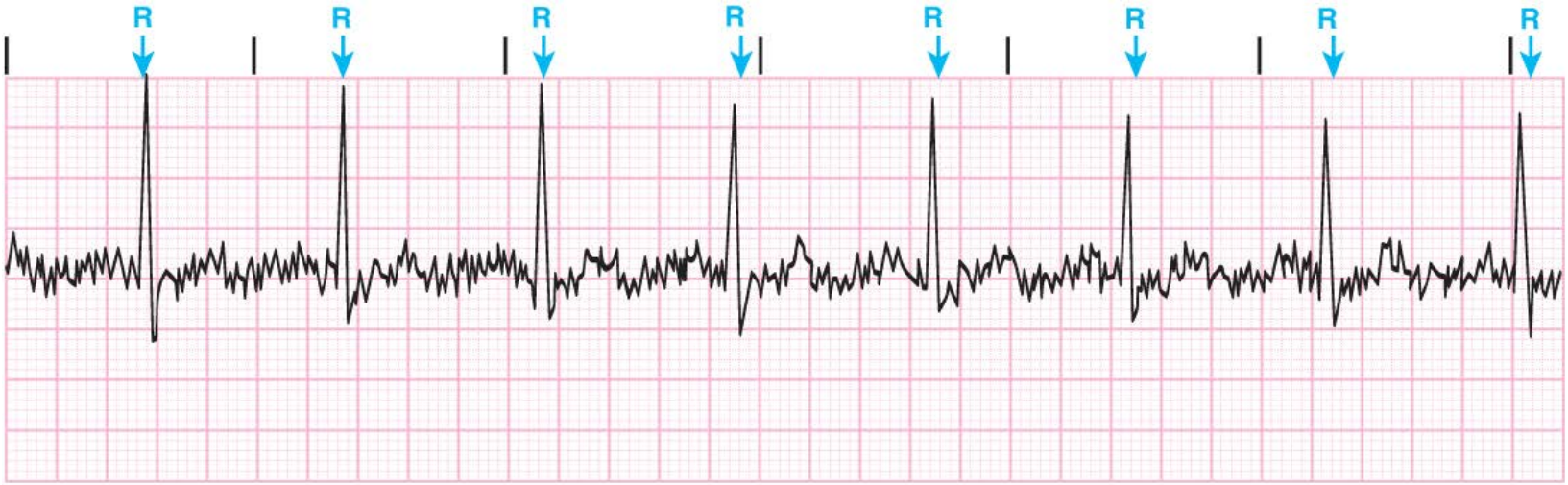
Artifact

- Interference/static seen on monitor or rhythm strip
- Could be caused by electrode popping (coming loose), movement, broken lead, bad ground wire, muscle tremors, electrical interference
- 60-cycle interference = fuzziness of baseline
  - Electrode lost contact with patient's skin
  - May be caused by patient or lead touching metal object
  - Also known as 60 Hz interference

Artifact

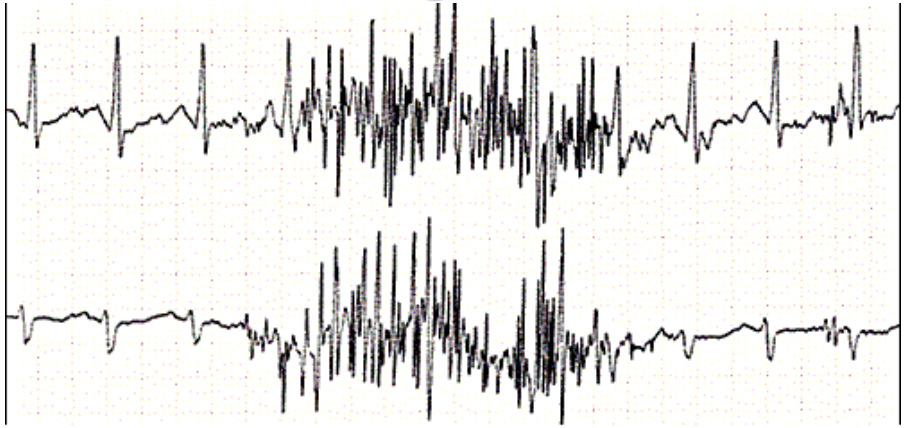
- **60-cycle interference**





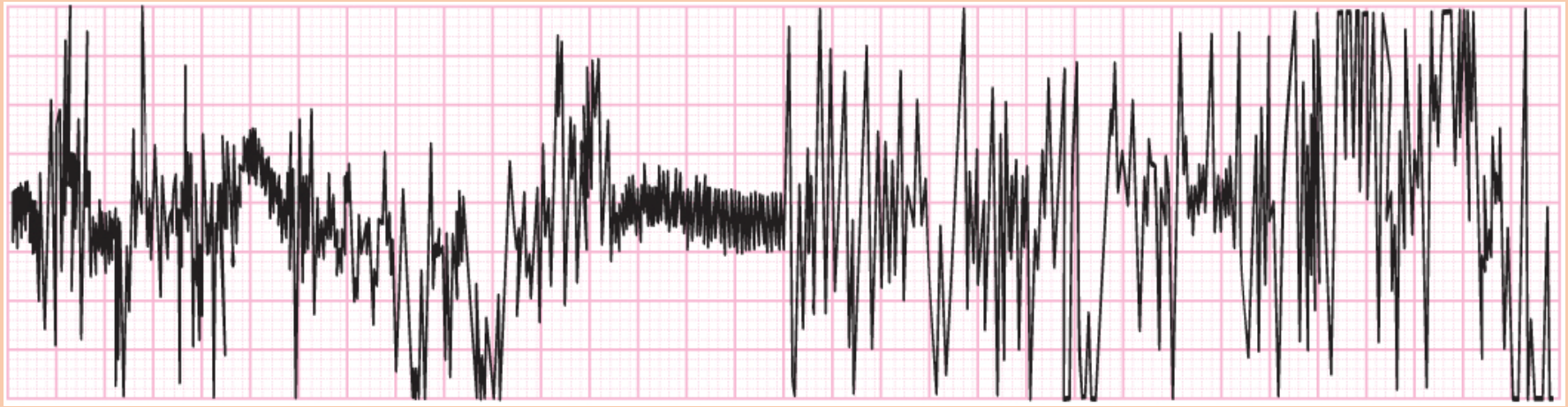
Artifact

- If P wave and QRS completely hidden, lead is either loose or patient is moving



- Monitoring and assessment important so as not to miss a lethal dysrhythmia
- If rhythm hard to see, increase gain

Artifact



Artifact

- **Wandering baseline = Movement or deep, rapid breathing that causes an artifact in which the baseline rapidly moves up and down**
  - **Corrected when patient lies still or change electrode placement**