EKG theory

Warm-up:

What is something new that you witnessed/learned about when watching the 'Dr. Diaries' documentary. How can you apply this into your future career goals?

History of ECG

Concept of EKG

- Also called ECG

- Muscle tissue releases electrical energy when it depolarizes and causes a change in electrical potential across the surface of the skin

What is an EKG?

- A graphic representation of changes in energy over time

- Many diseases of the heart result in specific changes to the EKG

Standard grid

- Standard EKG paper contains small boxes - each measures 1 mm tall x 1 mm wide

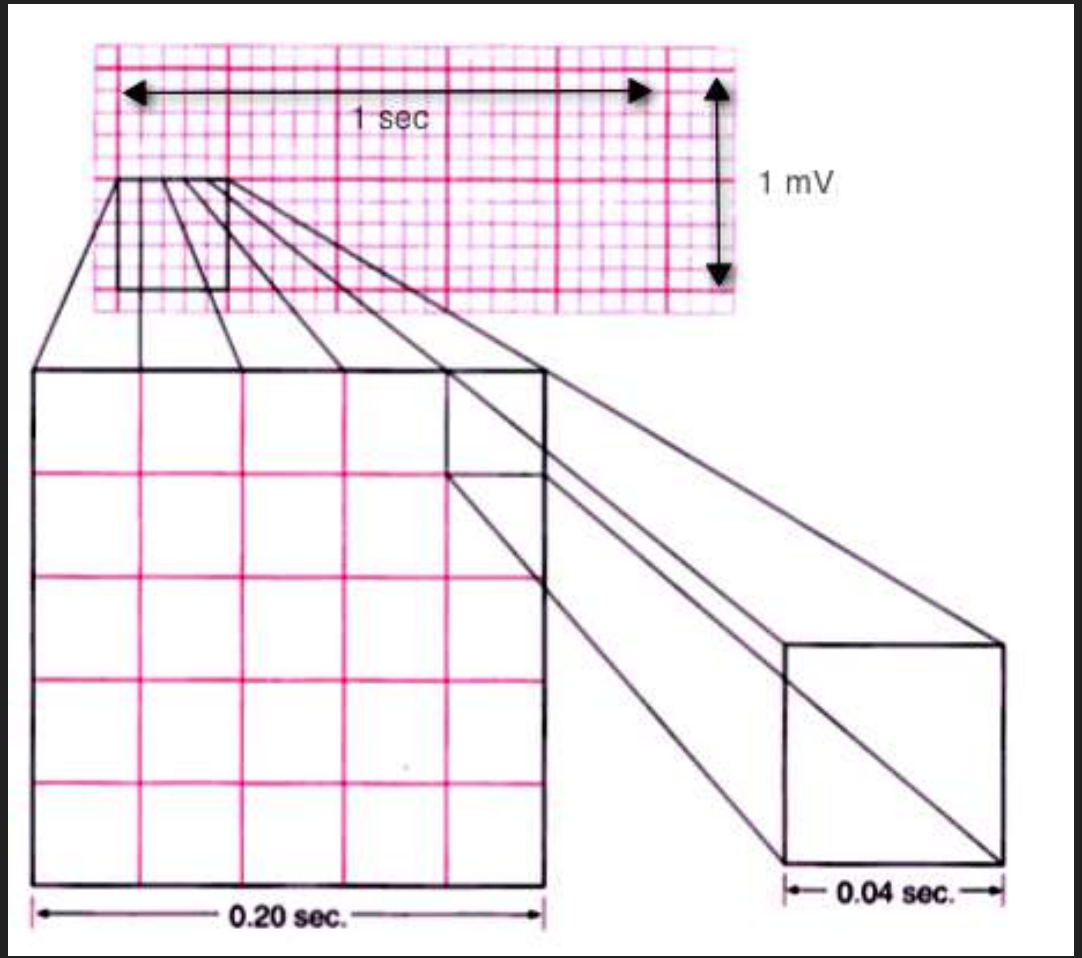
- 5 small boxes make up one large box
  - Thicker gridlines indicate 5 mm boxes

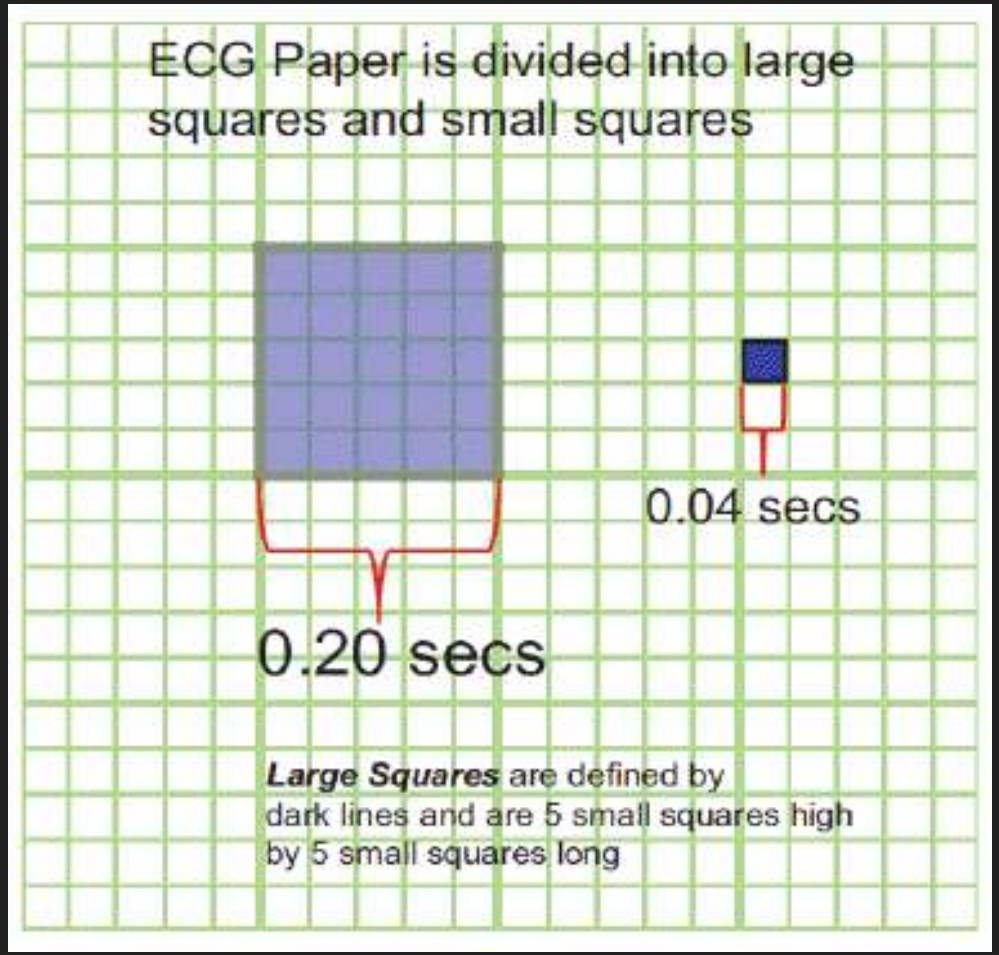
Standard grid (cont’d)

- Y axis is measured in millivolts (mV)
  - Each millimeter increment represents 0.1mV
- X axis measures time
  - 1 small box (mm increment) represents 40 milliseconds or 0.04 seconds

X Axis= time

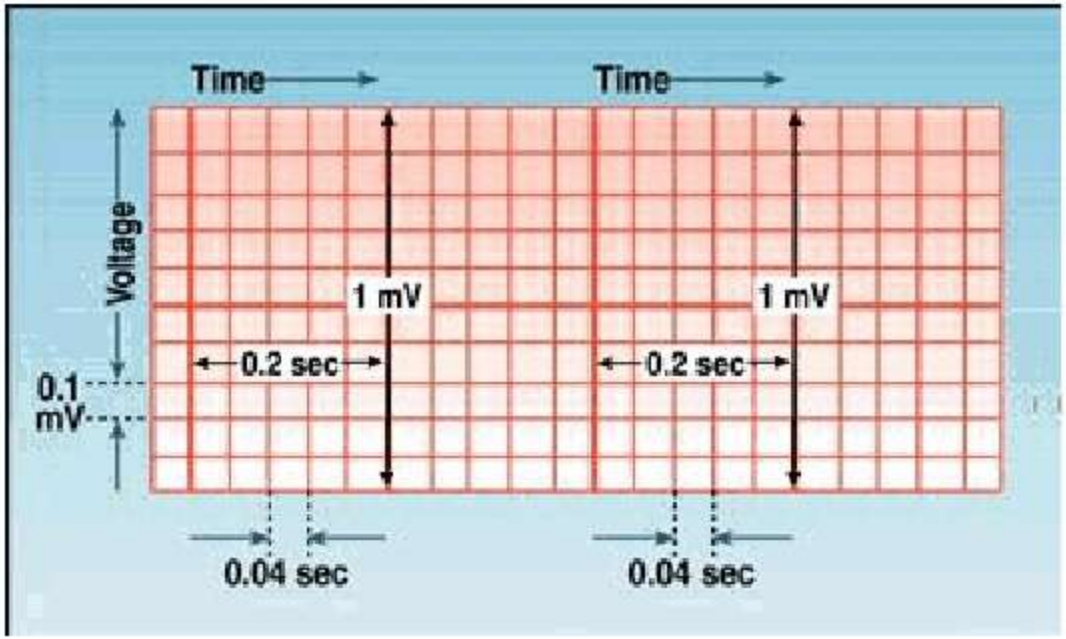
Y Axis = voltage




ECG Paper is divided into large squares and small squares
0.04 secs
0.20 secs
Large Squares are defined by dark lines and are 5 small squares high by 5 small squares long

ECG Graph Paper

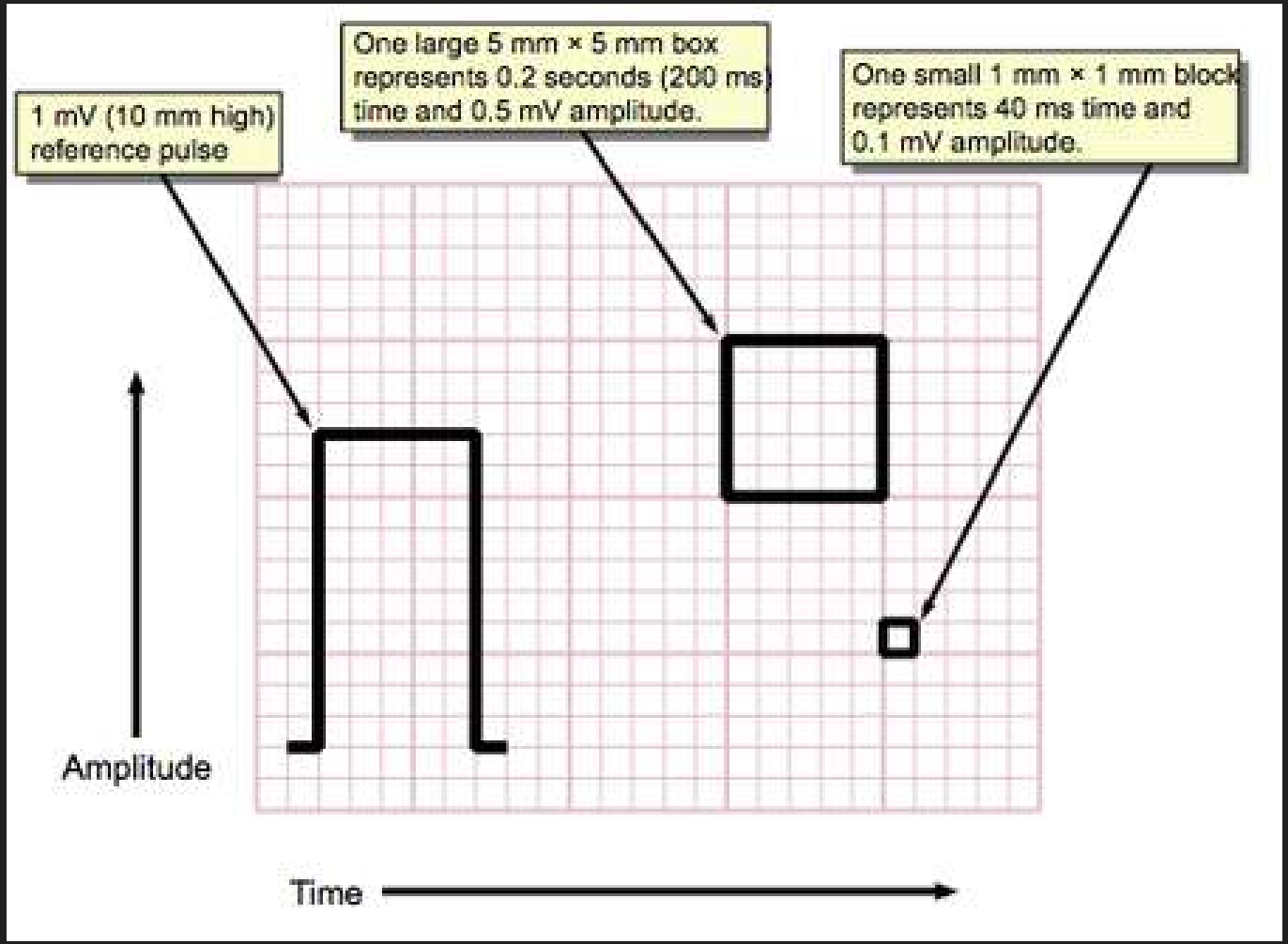
Y- Axis Amplitude in mill volts



X- Axis time in seconds

Standard amplitude

- Standard amplitude 10 mm/1 mV
- Standard calibration boxes should measure 10mm tall x 5mm wide and is seen at the beginning of the strip
- Indicates a standard paper speed
- A.K.A. Gain Control: normal is 1 mV


1 mV (10 mm high) reference pulse
One large 5 mm × 5 mm box represents 0.2 seconds (200 ms) time and 0.5 mV amplitude.
One small 1 mm × 1 mm block represents 40 ms time and 0.1 mV amplitude.
Amplitude
Time

Standard paper speed

- **25 mm/seconds**
- By increasing paper speed to 55 mm/second, the EKG appears to slow (or stretch out)

Paper speed can ONLY be changed with an MD order

- Improper paper speed can result in improper arrhythmia interpretation.

Fig 12 Adjusting the Gain setting

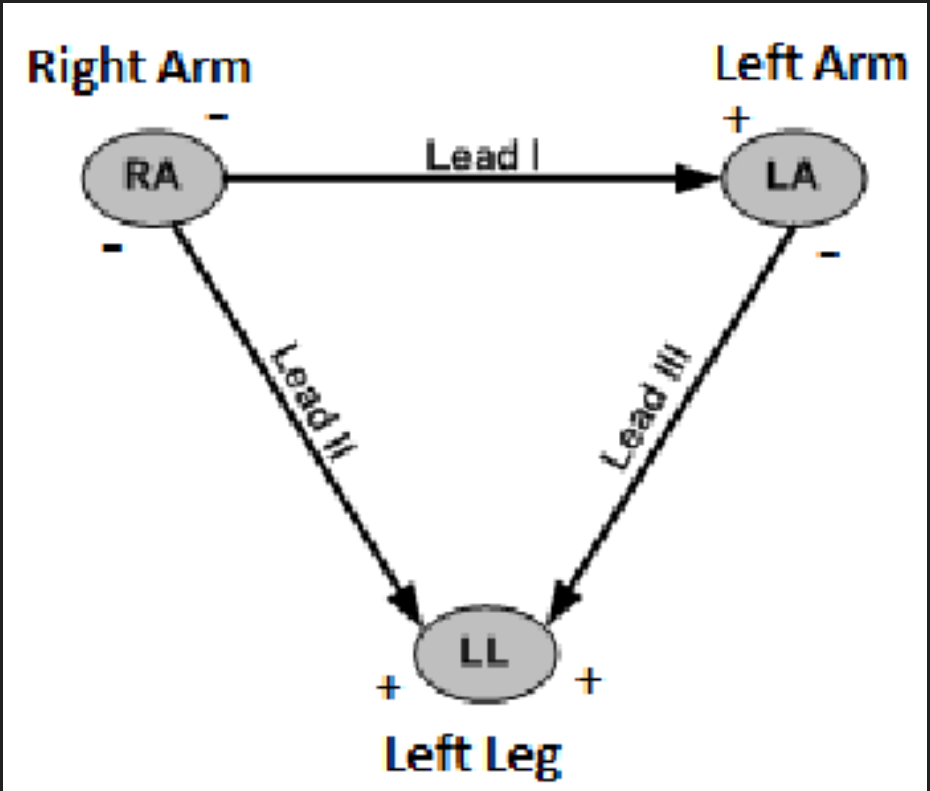
Practice: (we will do this in class thursday)

1. Label your own Graph paper
2. Compare it to the true EKG paper
3. Using the example EKG, circle/highlight and label the following:
    a. Gain Control
    b. Paper speed
    c. Time Axis
    d. Voltage/Amplitude Axis

Einthoven’s triangle

- His original data was used to form an imaginary inverted triangle over the torso with the heart at it’s center. This triangle is still used today.

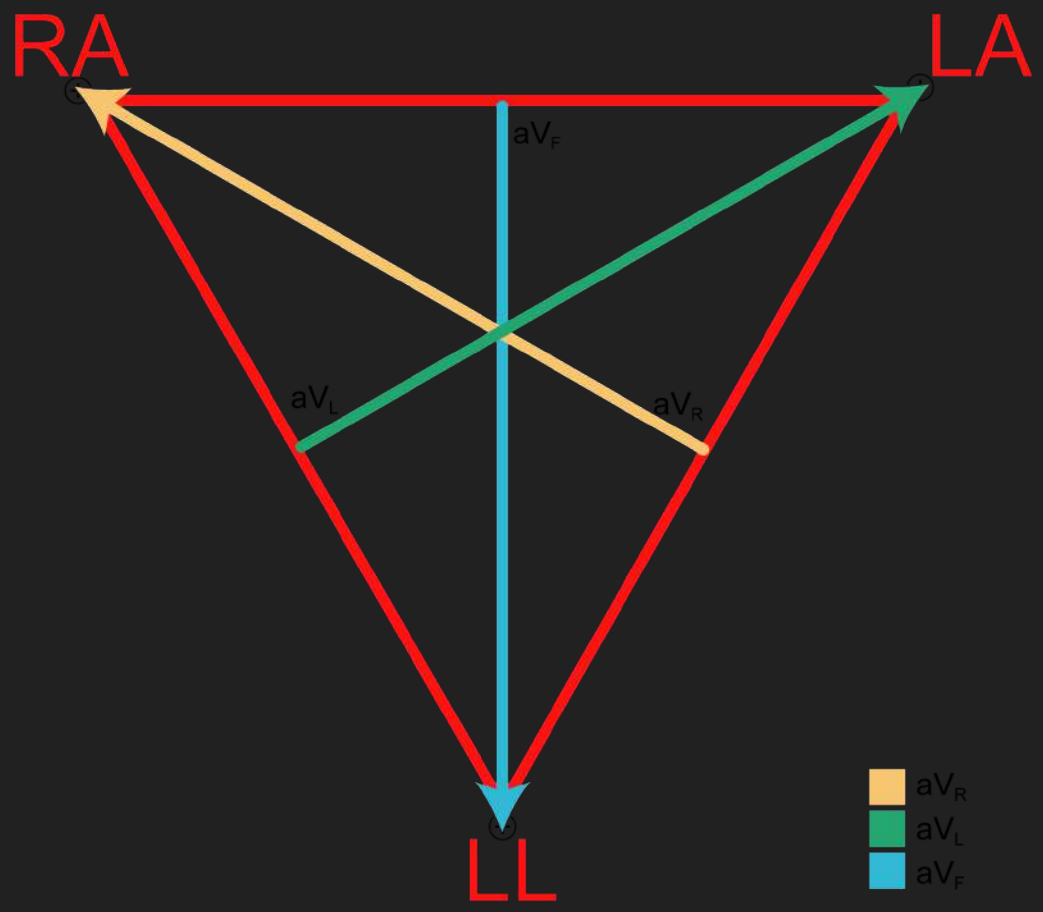
Einthoven's Triangle



**correct limb lead placement s of critical importance - measures the heart’s electrical axis and is a reference for unipolar leads

Wilson’s central terminal

- A reference point for six of the 12 leads
- Serves as a “zero” end
- Improper limb lead placement creates an incorrect WCT reference point
- WCT is the reference point for the unipolar leads (+)


RA
LA
LL
aV_F
aV_L
aV_R
aV_R
aV_L
aV_F

Unipolar and Bipolar leads

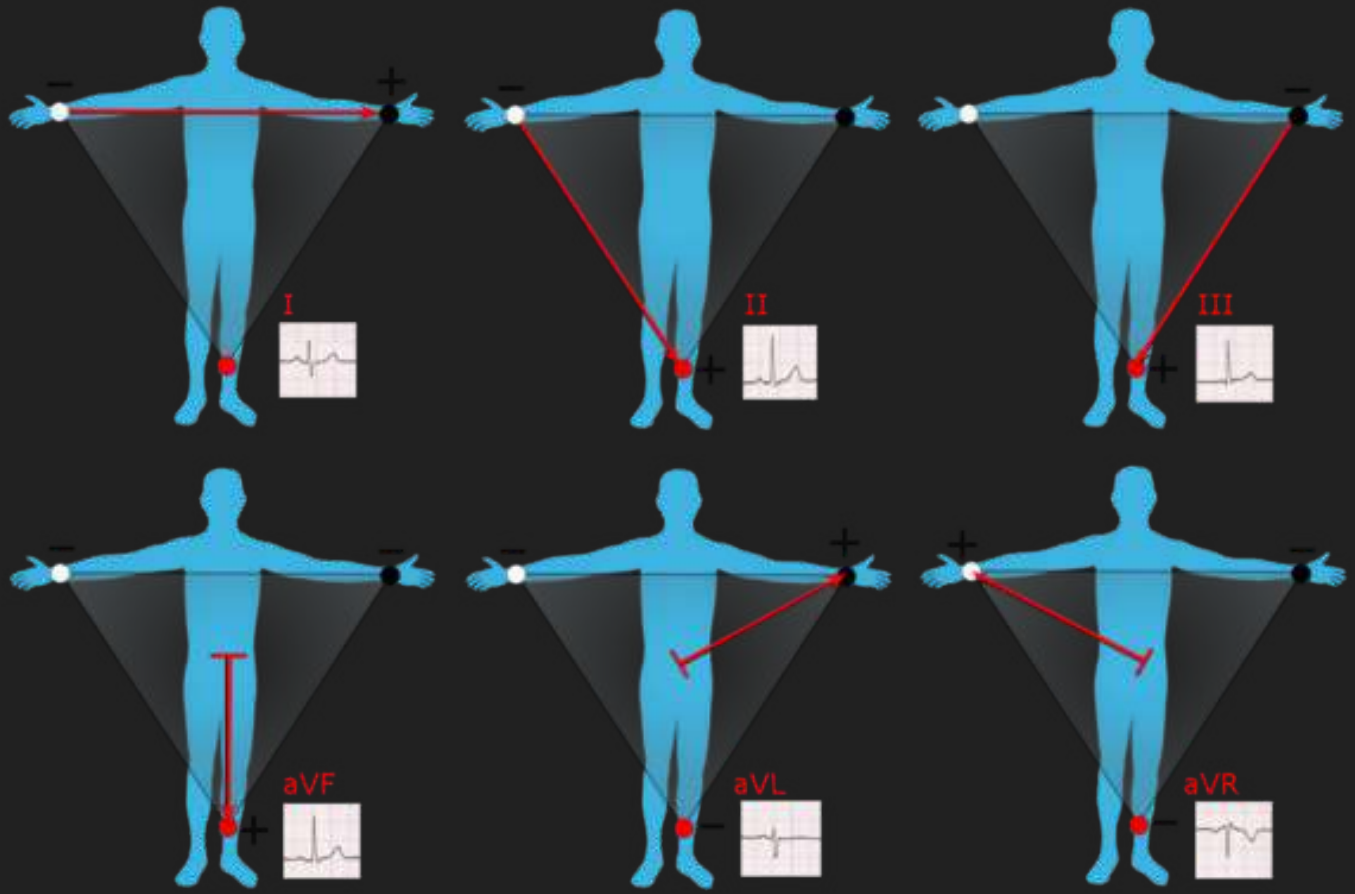
- Unipolar only have one “pole”
  - They use a reference point to create the “other end”
- Wilson’s central terminal serves as the reference point
- Bipolar leads: 2 poles, one positive and one negative

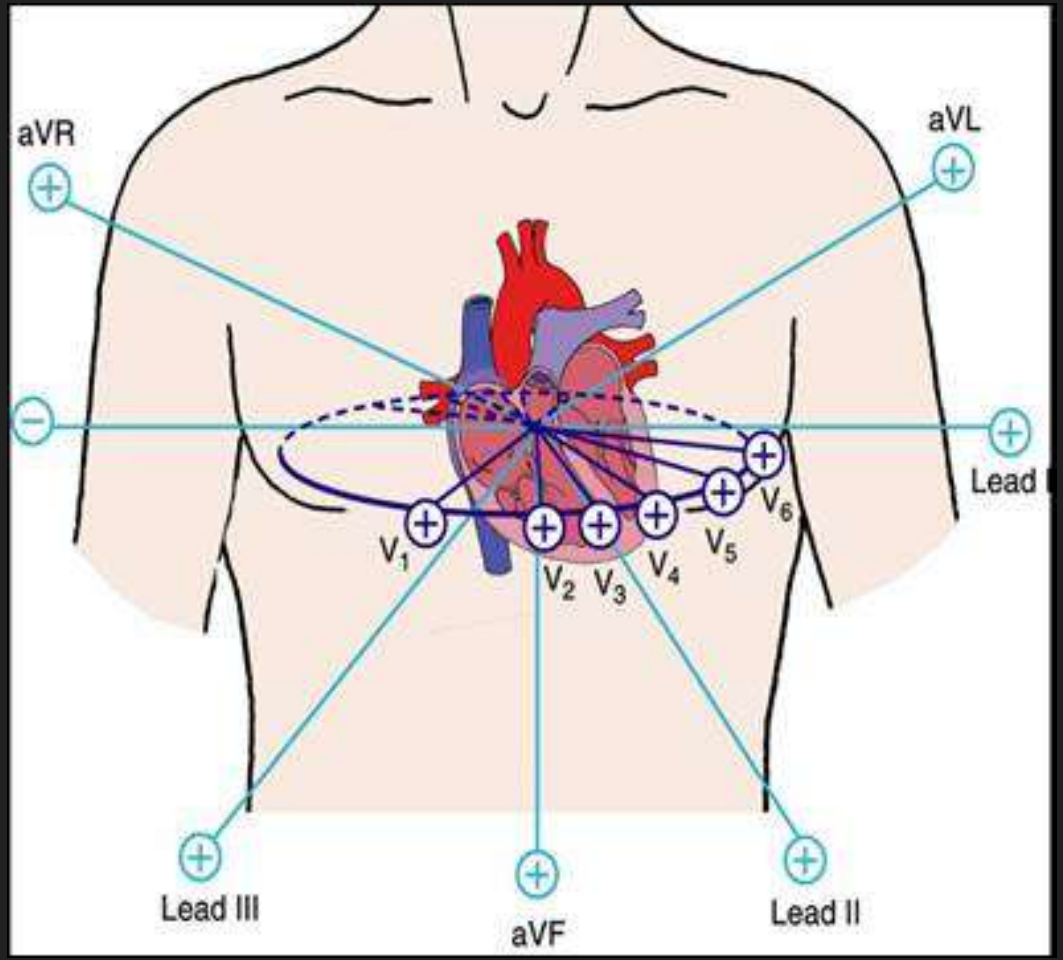
The 12 Leads

Limb leads (bipolar): I,II,III

Augmented leads (unipolar): avR, avL, avF

Precordial Leads (unipolar): V1, V2, V3, V4, V5, V6


I
II
III
aVF
aVL
aVR


aVR
aVL
Lead I
V1
V2
V3
V4
V5
V6
Lead III
aVF
Lead II