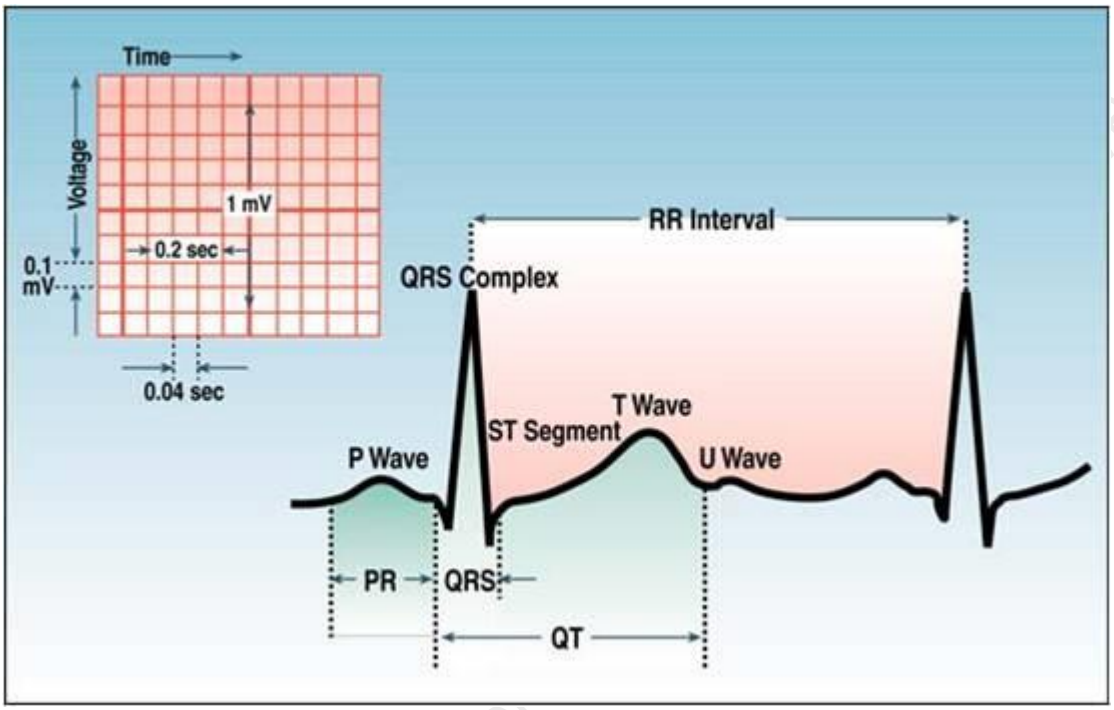
ECG

The standard 12-lead electrocardiogram is a representation of the heart's electrical activity recorded from electrodes on the body surface



- P wave: the sequential activation (depolarization) of the right and left atria
- QRS complex: right and left ventricular depolarization
- T wave: ventricular repolarization
- U wave: repolarization of papillary muscles
- PR interval: time interval from onset of atrial depolarization (P wave) to onset of ventricular depolarization (QRS complex)
- QRS duration: duration of ventricular muscle depolarization
- QT interval: duration of ventricular depolarization and repolarization
- RR interval: duration of ventricular cardiac cycle (an indicator of ventricular rate)
- PP interval: duration of atrial cycle (an indicator of atrial rate)

Orientation of the 12 Lead ECG

It is important to remember that the 12-lead ECG provides spatial information about the heart's electrical activity in 3 approximately orthogonal directions:

- Right ⇔ Left
- Superior ⇔ Inferior
- Anterior ⇔ Posterior

Each of the 12 leads represents a particular orientation in space, as indicated below (RA = right arm; LA = left arm, LL = left foot):

Bipolar limb leads (frontal plane):

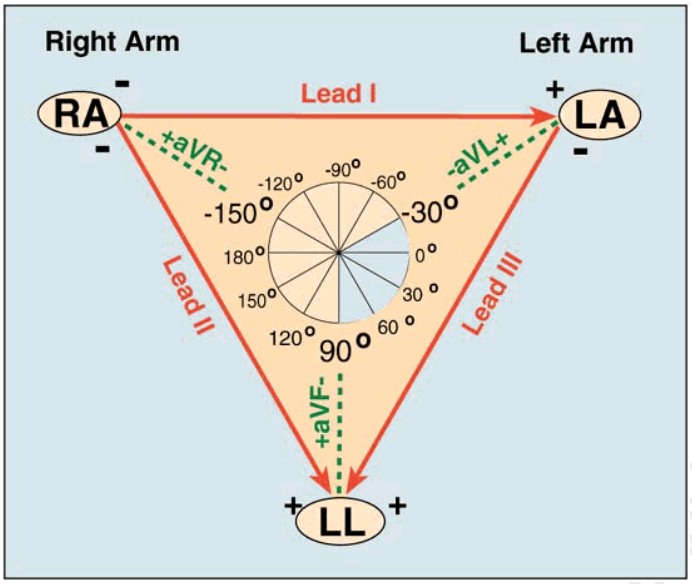
- Lead I: RA (-) to LA (+) (Right Left, or lateral)
- Lead II: RA (-) to LL (+) (Superior Inferior)
- Lead III: LA (-) to LL (+) (Superior Inferior)

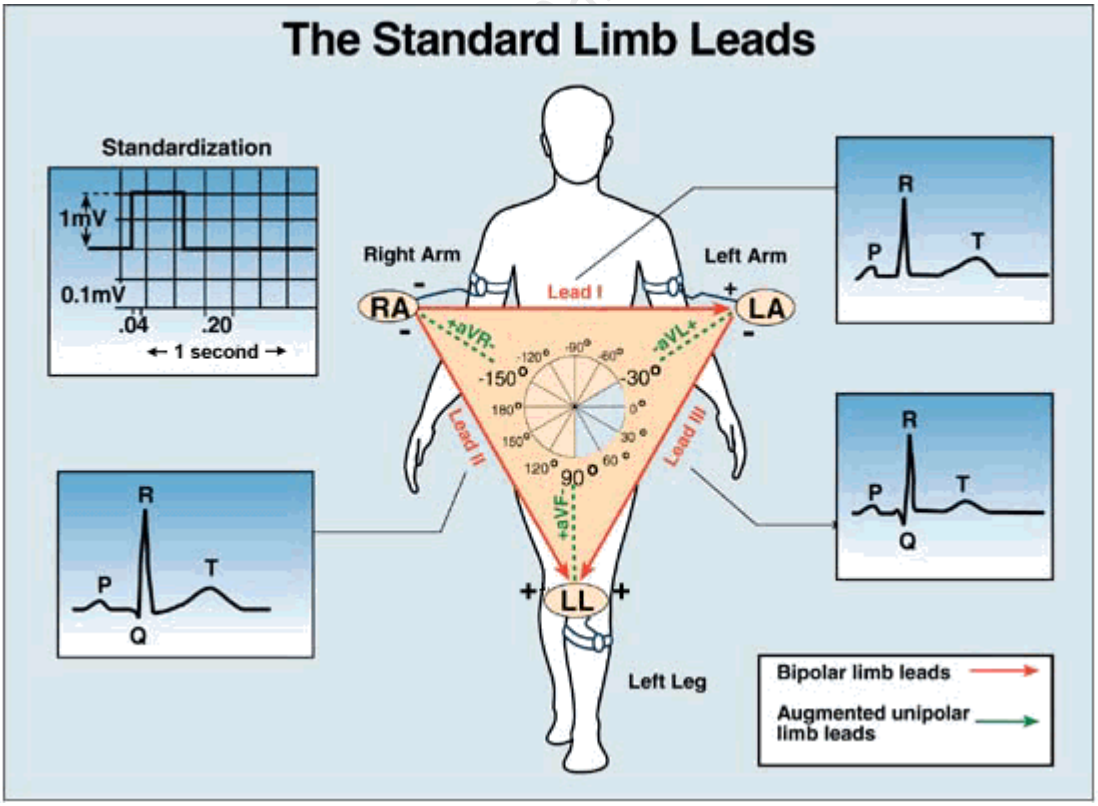
Augmented unipolar limb leads (frontal plane):

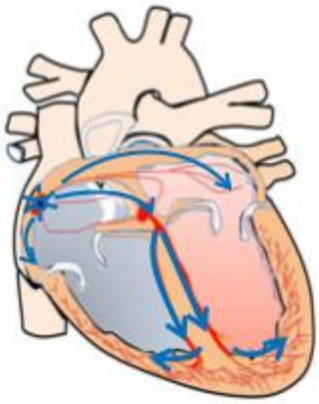
- Lead aVR: RA (+) to [LA & LL] (-) (Rightward)
- Lead aVL: LA (+) to [RA & LL] (-) (Leftward)
- Lead aVF: LL (+) to [RA & LA] (-) (Inferior)

Unipolar (+) chest leads (horizontal plane):

- Leads V1, V2, V3: (Posterior Anterior)
- Leads V4, V5, V6:(Right Left, or lateral)


Right Arm
Left Arm
RA
LA
LL
Lead I
Lead II
Lead III
+aVR-
-aVL+
+aVF-
-120°
-90°
-60°
-150°
-30°
180°
0°
150°
30°
120°
90°
60°


The Standard Limb Leads
Standardization
1mV
0.1mV
.04
.20
1 second
Right Arm
Left Arm
RA
LA
LL
Lead I
Lead II
Lead III
+aVR-
-aVL+
+aVF-
-120°
-90°
-60°
-150°
-30°
180°
0°
150°
30°
120°
90°
60°
R
P
T
Q
Left Leg
Bipolar limb leads
Augmented unipolar limb leads



Heart Rate in beats per min =

$$\frac{300}{\text{\# of Large squares in R-R interval}}$$

Or

$$\frac{1500}{\text{\# of small squares in R-R interval}}$$

Normal sinus rhythm

ECG OF SOME PATHOLOGICAL CONDITIONS

coarse Ventricular fibrillation

fine ventricular fibrillation

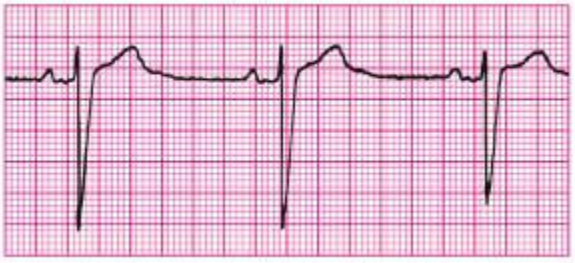
Sinus tachycardia

Tachycardia

Atrial flutter

Atrail fibrillation

ventricular tachycardia



Sinus bradycardia

First degree heart block

Second degree heart block type 1(mobitz type 2)

Secong degree block type 2 (mobitz type 1 or wenckback)

Third degree heart block