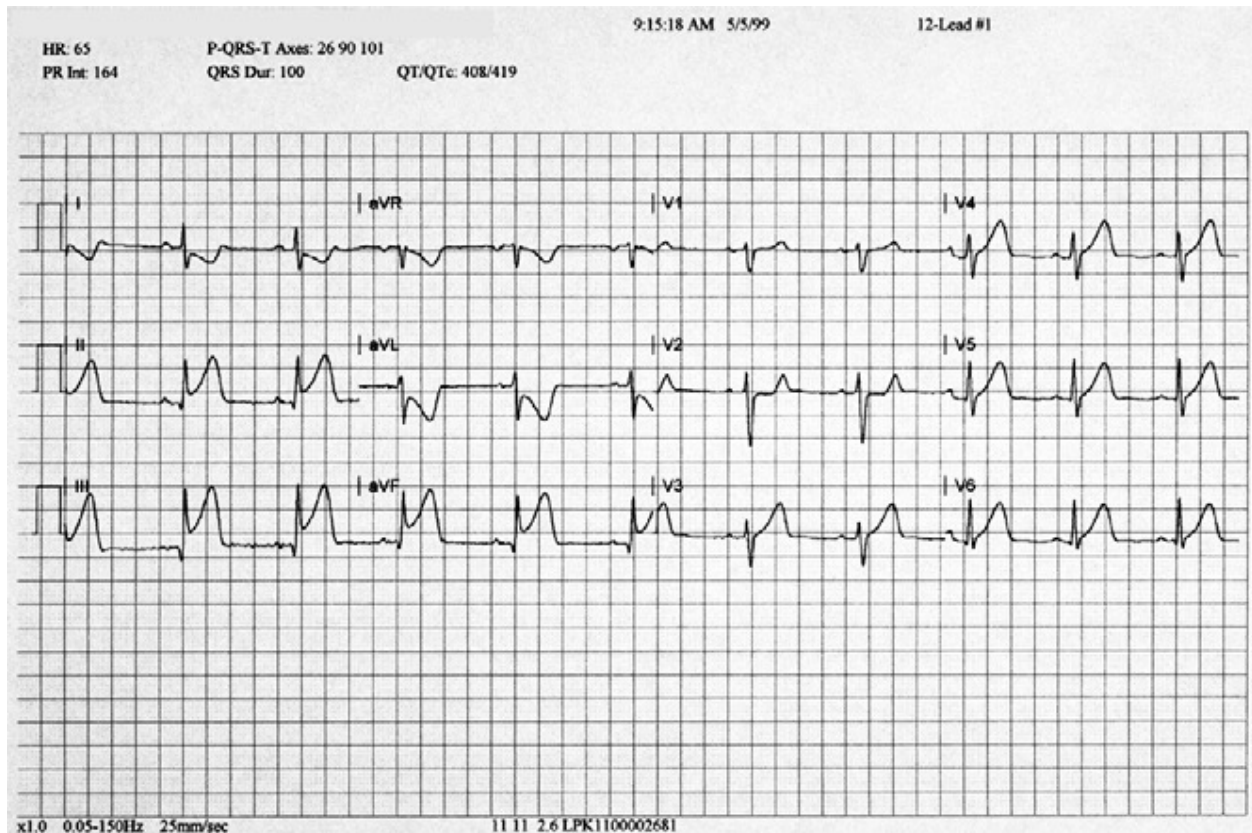


## The 12-lead ECG



It is important to remember where the positive and negative electrode of each lead is placed in relation to the heart, so that you can identify which part of the heart the lead is looking at. If you were to place a camera at the positive electrode, facing the negative electrode, you would be taking a picture of the area of the heart that particular lead is looking at. The lead we are most familiar with is Lead II, which is one of the limb leads.

Lead I, Lead II and Lead III combine to form a triangle around the perimeter of the heart.

This triangle is frequently referred to as Einthoven's Triangle, named in the early 1900's after a pioneer in electrocardiography.

When acquiring a 12-lead, the limb leads are normally placed close to the ankles and wrists, but it is acceptable to use the upper arm/thigh. The right arm electrode is always negative and the left leg electrode is always positive. This combination, with the camera sitting at the positive electrode

looking at the negative electrode, gives us Lead II and a view of the inferior wall of the left ventricle.

The left arm electrode can be switched between positive and negative depending on which lead is being viewed. Picture the camera sitting on the left arm when it is positive looking towards the negative (right arm) electrode. This is Lead I and gives us a view of the high lateral wall of the left ventricle. When the left arm electrode is negative and the view is from the positive left leg electrode, we are again looking up at the inferior wall of the left ventricle with just a slightly different angle.

### Augmented Leads

The augmented leads use the same lead locations as the limb leads. What gives us the difference in the view of the heart is the fact that all of the electrodes on the limbs are positive and they look towards the neutral center of the heart. Fortunately, changing the polarity of the electrodes is controlled by and completed rapidly by the monitor so we don't have to worry about how it's done, just what it's looking at.

When the positive electrode is at the right shoulder, this is referred to as augmented voltage right (aVR). The view we receive is of the upper right area of the heart and great vessels. This view is normally the least used view in 12-lead ECG interpretation.

When the positive electrode is at the left shoulder, this is referred to as augmented voltage left (aVL). The view we receive is of the high lateral wall of the left ventricle.

The final view, positive electrode on the left foot, is aVF or augmented voltage left foot.

This lead gives us a view of the inferior wall of the left ventricle.

### Precordial Leads

The precordial leads, like the augmented leads, are all positive and all use the neutral center of the heart as their "focus" point. We will go into the actual physical identification for locating these leads in another module, for

now it will be simplest to use the following chart to identify each electrode location and the section of the heart that the lead is viewing.

#### Lead Location View

- V1 4th intercostal space, right sternal border, Ventricular septum
- V2 4th intercostal space, left sternal border, Ventricular septum
- V3 Between V2 and V4, Anterior wall of left ventricle
- V4 5th intercostal space, midclavicular line, Anterior wall of left ventricle
- V5 Lateral to V4 at the anterior axillary line, Lateral wall of left ventricle
- V6 Lateral to V5 at midaxillary line, Lateral wall of left ventricle

You may have noticed that in a 12-lead ECG, the left ventricle is the target or viewpoint.

Remember that the left ventricle is the largest, most muscled portion of the heart and, therefore, is an area that is first to “complain” of the pain associated with a decrease in tissue perfusion (for example, angina). As well, tissue damage in the left ventricle can result in a potentially more lethal arrhythmia (atrial fibrillation compared to ventricular fibrillation). Something else you may have noticed is leads that look at the same portion of the left ventricle. These are considered “Anatomically Contiguous” leads. This particular grouping of leads is a very important aspect of 12-lead ECG interpretation.

Anatomically contiguous leads are two or more leads that look at adjoining areas of tissue. Determining which leads are contiguous may be confusing, but the easiest explanation is this; if the leads have the same name (for example, inferior) they are contiguous. With the chest leads, if they are consecutively numbered they are also contiguous. For example, V2 is called a septal lead and V3 an anterior lead, not the same name but they are both chest leads and numerically consecutive so, therefore, they are contiguous.

#### REVIEW

The following illustrations may make the previous section a little clearer. Understanding what the leads are viewing and if they are contiguous is as important in interpreting a 12-lead ECG as the changes that you will be looking for.

Leads II, III and aVF are leads that have their positive electrode located at the left foot.

They are contiguous leads that all look at the inferior wall of the left ventricle.

Leads I and aVL are leads that have their positive electrode located on the left arm.

These leads view the high lateral wall of the left ventricle.

I & aVL Lateral Wall

Leads V5 and V6 are positioned on the left lateral chest and view the lower lateral wall of the left ventricle.

Since Leads I, aVL, V5 and V6 all view the lateral wall of the left ventricle they are considered contiguous.

Leads V3 and V4 are on the anterior wall of the left chest which correlates with the viewing the anterior wall of the left ventricle.

Leads V1 and V2 are positioned on each side of the sternum and from that placement they “look through” the right ventricle and see the septal wall.

Going back to the earlier diagram of the 12-lead ECG and putting everything together on an overlaid diagram may look confusing at first but will become an excellent reference as you learn to interpret a 12-lead ECG.

9:15:18 AM 5/5/99

12-Lead #1

HR: 65

P-QRS-T Axes: 26 90 101

PR Int: 164

QRS Dur: 100

QT/QTc: 408/419

