Level 9

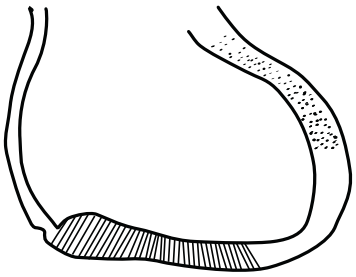
Inferior wall myocardial infarction—pearls and pitfalls

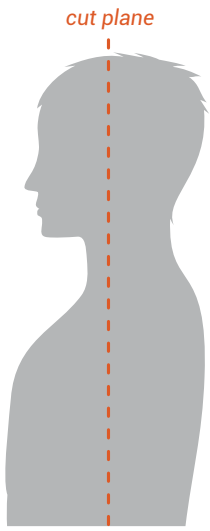
In the previous chapters, we focused on the precordial leads (chest leads). Learning the ECG works best if you have a thorough understanding of the precordial leads before learning about the limb leads. But now it's time to move on.

The limb leads

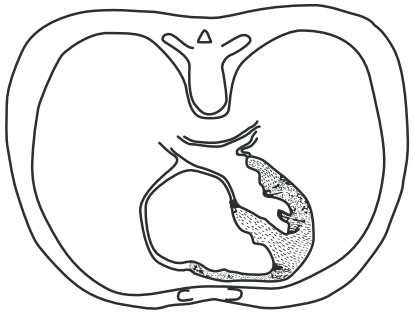
The limb leads and the precordial leads view the heart from two different perspectives. The precordial leads more or less show the horizontal plane, whereas the limb leads show the frontal plane.

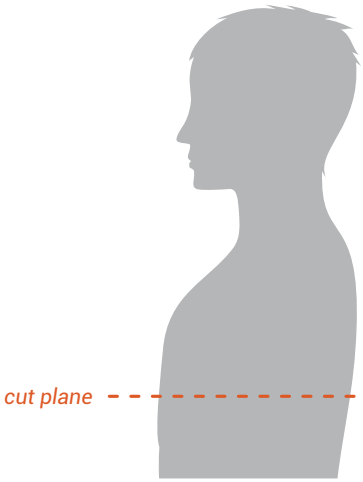
Limb Leads: Frontal Plane





Precordial Leads: Horizontal Plane



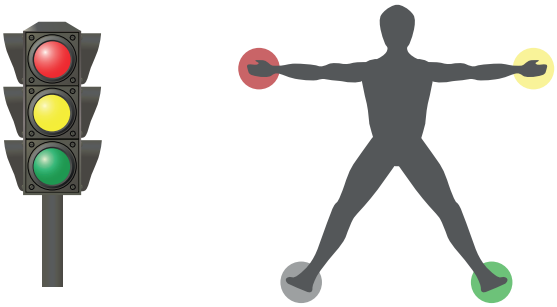


The limb leads consist of:

- Three standard leads called **I**, **II**, and **III**
- Three augmented leads called **aVR** (right arm), **aVL** (left arm), and **aVF** (foot)

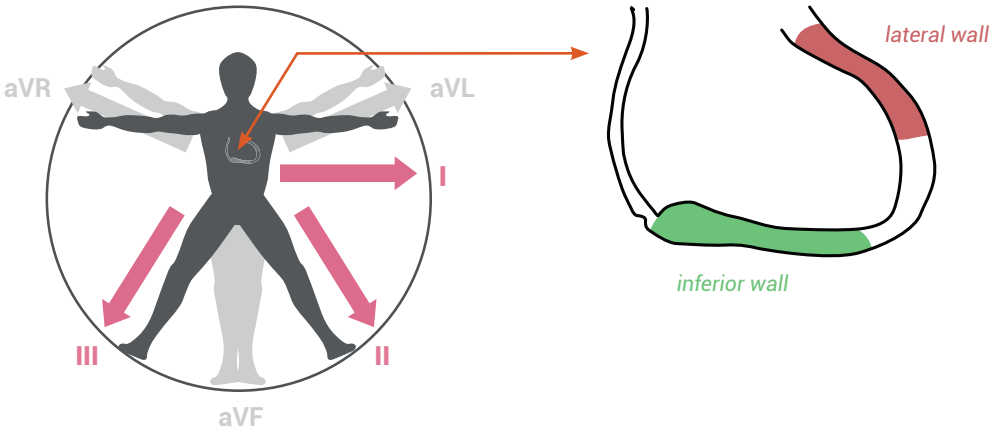
Four wires are needed to record these leads:

- The **red wire** goes onto the **right arm**.
- The **yellow wire** goes onto the **left arm**.
- The **green wire** goes onto the **left foot**.
- The **black wire** goes onto the **right foot**.



You can remember this sequence by picturing a traffic light with a red light on top, a yellow light in the middle, and a green light on the bottom:

Using these wires, you can now record the limb leads. As we said, these leads look at the electrical activity of the heart in a frontal plane:



The figure shows that changes of the lateral wall (red area), like myocardial infarction, are depicted by leads I and aVL. Changes in the inferior wall (green area) are depicted by leads II, III, and aVF.

Lead aVR is only occasionally used and you do not need to worry about it for now.

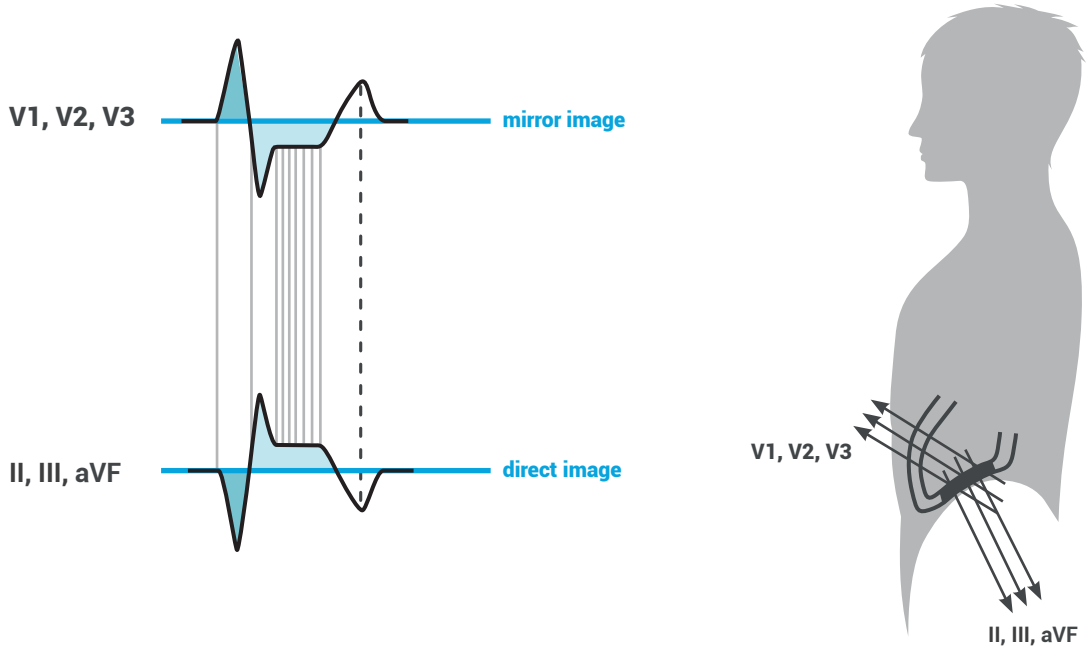
As we already learned, precordial leads V5 and V6 also depict the lateral wall. So we don't absolutely need leads I and aVL to make the diagnosis of problems of the lateral wall like myocardial infarction.

Conversely, the precordial leads don't show the inferior wall—at least not directly. So we need leads II, III, and aVF to evaluate the inferior wall.

Occasionally, leads II, III, and aVF will not detect inferior wall infarction, especially when it's small. That's when a little trick comes in handy.

Looking at mirror images

The direct electrical image of an inferior wall myocardial infarction is visualized in II, III, and aVF. Leads V1, V2, and V3 view the heart from the opposite side and can therefore produce so-called mirror images:



Example of an inferior wall myocardial infarction. Direct changes can be seen in leads II, III, and aVF: deep and broad Q wave, ST elevation, and negative T wave. A mirror image can be seen in leads V1, V2, and V3: broad R wave, ST depression, and positive T wave.

So we have to update our knowledge about the precordial leads. V1, V2, and V3 not only give you information about the right ventricle and the basal septum but also about the inferior wall…in the form of mirror images. A lot of people don't know about this!

Updating our knowledge about the Q-wave criteria

Let's quickly recap the criteria for pathologic Q waves from Level 8. We said that Q waves are pathologic if:

- The depth of the Q wave is ≥1/4 the size of the R wave in the same lead.

or

- The Q wave is >0.04 seconds (1 small box on the ECG paper).

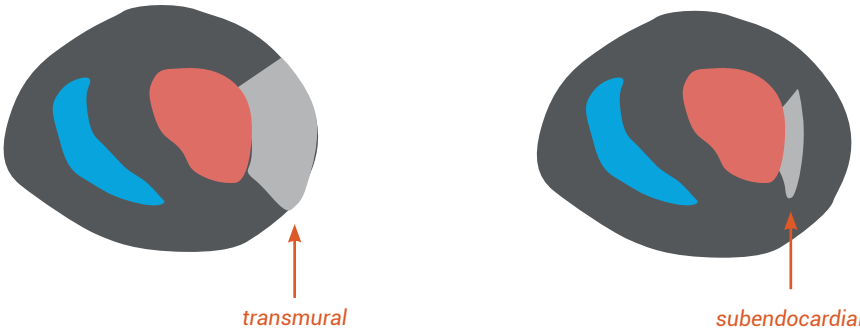
Now there are **two more criteria** for pathologic Q waves:

- Any Q waves in leads V1 to V3 (even if ≤0.04 s) are abnormal.
- In all cases, Q waves have to be present in two contiguous (neighboring) leads. Contiguous leads are I and aVL; II, III, and aVF; and V1 to V6 (e.g., V1 and V2 are contiguous, V3 and V4 are contiguous, etc.).

Q-wave and non–Q-wave infarctions

Not every patient with myocardial infarction develops Q waves. There are Q-wave and non–Q-wave infarctions. The presence and size of Q waves correlate with the extent of myocardial scarring; however, this correlation is far from perfect.

In the olden days, people thought that Q-wave infarctions were transmural (involving the entire thickness of the ventricle) and that non–Q-wave infarctions were only subendocardial. However, pathologic studies have found that this reasoning is flawed and that there were transmural infarctions that did not develop Q waves and subendocardial infarctions that did.



In the next chapter, you will learn how to diagnose myocardial infarction if Q waves are absent.

Please welcome ... the ECG cookbook!

Now, it's time to introduce you to our ECG cookbook. The cookbook will provide you with a step-by-step approach for evaluating an actual ECG without missing anything. There are a total of 11 steps in the cookbook. You should be able to complete 5 of them with the knowledge you've acquired so far. We'll add more steps to the cookbook as we progress. We recommend that you make it a habit to go through all the steps of the cookbook when evaluating an ECG. That way you'll make sure not to miss anything, you'll improve the odds of coming up with the right diagnosis, and you'll develop a habit, which will become second nature within a short time.

So without further ado, here's the cookbook….

Question	Answer	Diagnosis
1. Rhythm	[coming later]	[coming later]
2. Heart rate	[coming later]	[coming later]
3. P waves	[coming later]	[coming later]
4. PR interval	a) >0.2 s (if PR interval constant for all beats and each P wave is followed by a QRS complex)	I° AV block
	b) <0.12 s and QRS complex normal	LGL syndrome
	c) <0.12 s and visible delta wave	WPW syndrome
5. QRS axis	[coming later]	[coming later]
6. QRS duration	a) ≥0.12 s (always think of WPW syndrome as a differential)	complete bundle branch block
	b) >0.1 s and <0.12 s with typical bundle branch block appearance (notching)	incomplete bundle branch block
7. Rotation	Rotation is defined according to the heart's transition zone. Normally the transition zone is located at V4, which means that right ventricular myocardium is located at V1–V3 and left ventricular myocardium is at V5–V6.	transition zone at V5–V6: clockwise rotation transition zone at V1–V3: counterclockwise rotation NOTE: don't evaluate rotation in the setting of myocardial infarction, WPW syndrome, or bundle branch block
8. QRS amplitude	a) QRS amplitude <0.5 mV in all standard leads	low voltage
	b) Positive criteria for left ventricular hypertrophy	left ventricular hypertrophy
	c) Positive criteria for right ventricular hypertrophy	right ventricular hypertrophy
9. QRS infarction signs	abnormal Q waves, QS waves, missing R-wave progression	myocardial infarction; localization according to affected leads
10. ST–T segment	[coming later]	[coming later]
11. QT duration, T–U waves	[coming later]	[coming later]