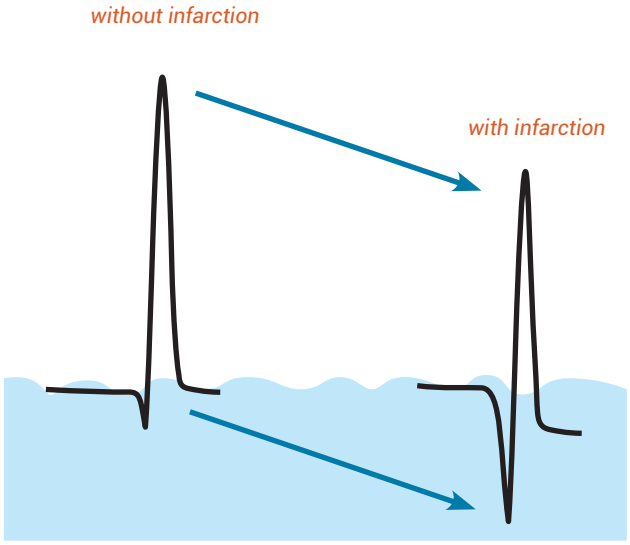
Level 8

What everybody ought to know about myocardial infarction and the QRS complex

In this chapter, you will learn how myocardial infarction affects the appearance of the QRS complex.

Drowning in negativity

There's one big idea that you have to keep in mind to remember what myocardial infarction does to the QRS complex. And the big idea is this: **drowning in negativity.**

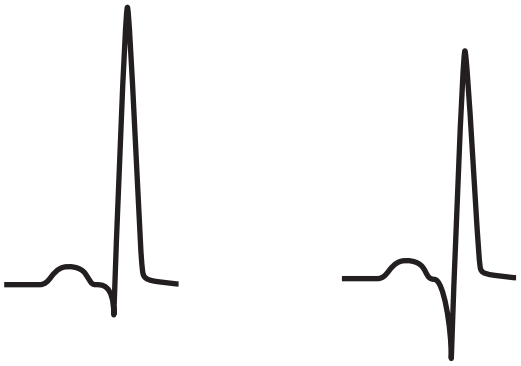


Drowning means that certain parts of the QRS become negative (Q waves) while other parts will decrease in size (R waves). In other words, one or more of the following things can happen:

- A preexisting **R wave decreases** in size
- A preexisting **Q wave gets deeper**
- A **new Q wave** develops

The resulting pattern is highly dependent on the initial form of the QRS complex. As we've said before, if you know what the QRS complex in each lead looks like, you'll also know when something's wrong.

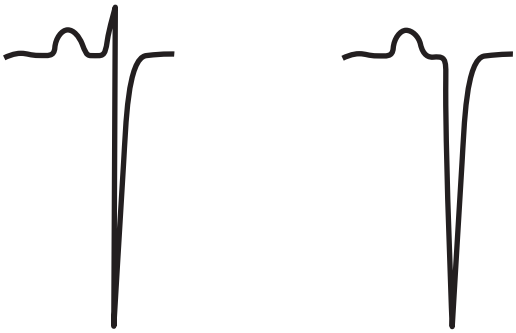
Let's have a look at some examples:



without infarction *with infarction*

Example A: In this example, there's an initial Q wave even without myocardial infarction. This could be V5 or V6 where we would typically see a small Q wave even in normal patients. When myocardial infarction develops, the Q wave gets much deeper than before—here it's 1/3 the size of the R wave.

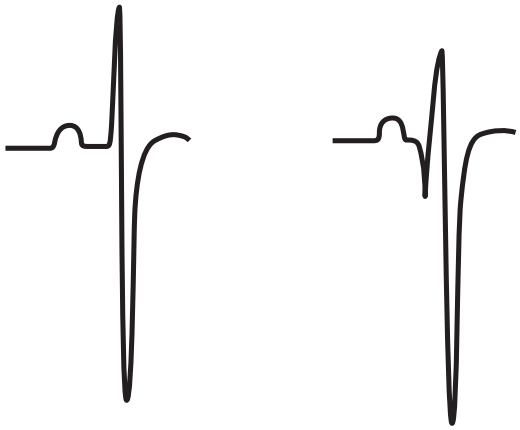
Small Q waves can be present in leads V5, V6, I, aVL, II, and III of healthy patients.



without infarction *with infarction*

Example B: Here we have a small initial R wave. This is the typical appearance of leads V1 or V2. When myocardial infarction develops, the R gets lost and we end up with one deep QS complex.

Example C: In this example, the R wave is already pretty tall (left side, without infarction), while the S is still fairly deep (R/S ratio <1). So this must be an area under leads V2 to V4. In these leads we usually don't see any Q waves. But when myocardial infarction develops, there's a new Q wave at the beginning of the QRS complex—the initial R wave is lost.



without infarction *with infarction*

These changes appear over the parts of the ventricle that are affected by myocardial infarction, which makes localization of the affected area fairly easy.

It's useful to know that these changes to the QRS complex can be seen in both acute and old myocardial infarctions. When you observe them in a patient who does not have any symptoms of acute myocardial infarction, this probably means that you are dealing with an old infarct.

Pathologic or not pathologic—that is the question

It can sometimes be tricky to differentiate between normal Q waves and pathologic Q waves. Pathologic Q waves in the setting of myocardial infarction are usually deeper and wider than normal Q waves. The criteria for pathologic Q waves are:

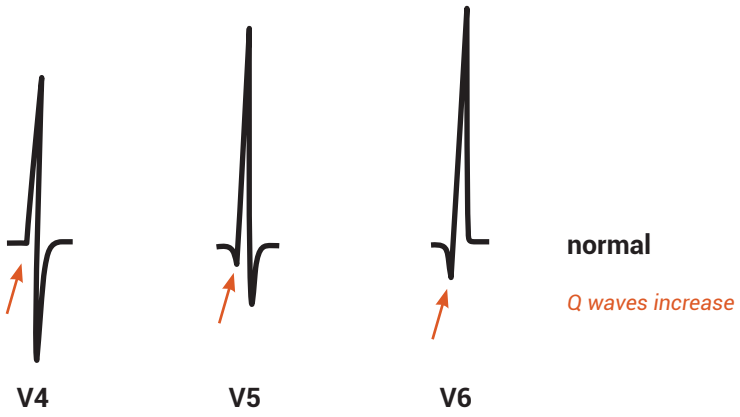
- The depth of the Q wave is ≥1/4 the size of the R wave in the same lead.

or

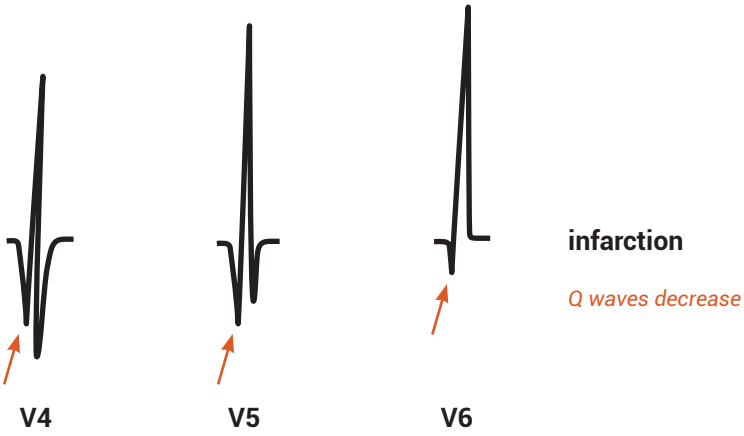
- The Q-wave duration is >0.04 seconds (1 small box on the ECG paper).

There are a couple of additional criteria, but these are the ones you should remember for now.

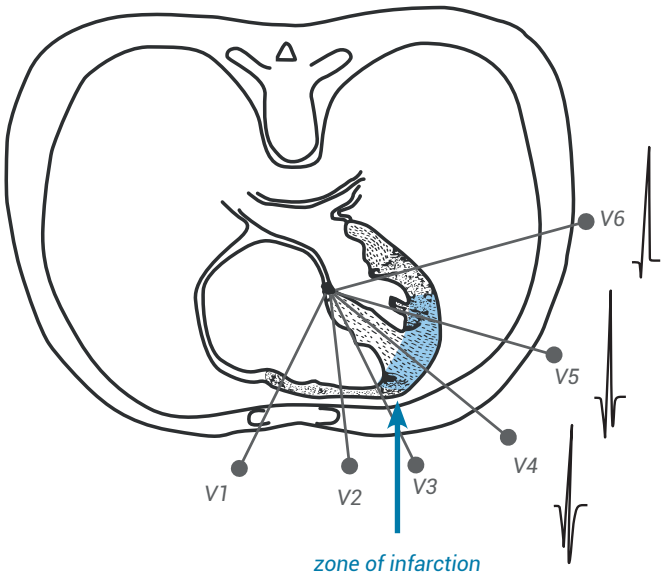
One other trick that you can use in the precordial leads is to look at the Q-wave progression in leads V4 to V6. Under normal conditions, the depth of the Q wave increases as we go from V4 (where in most cases there is no Q-wave yet) to V6, as seen in the following example:



However, when there's an infarct in the area of V4 and V5, Q waves will decrease in size as we go from V4 to V6, as seen in the following example:

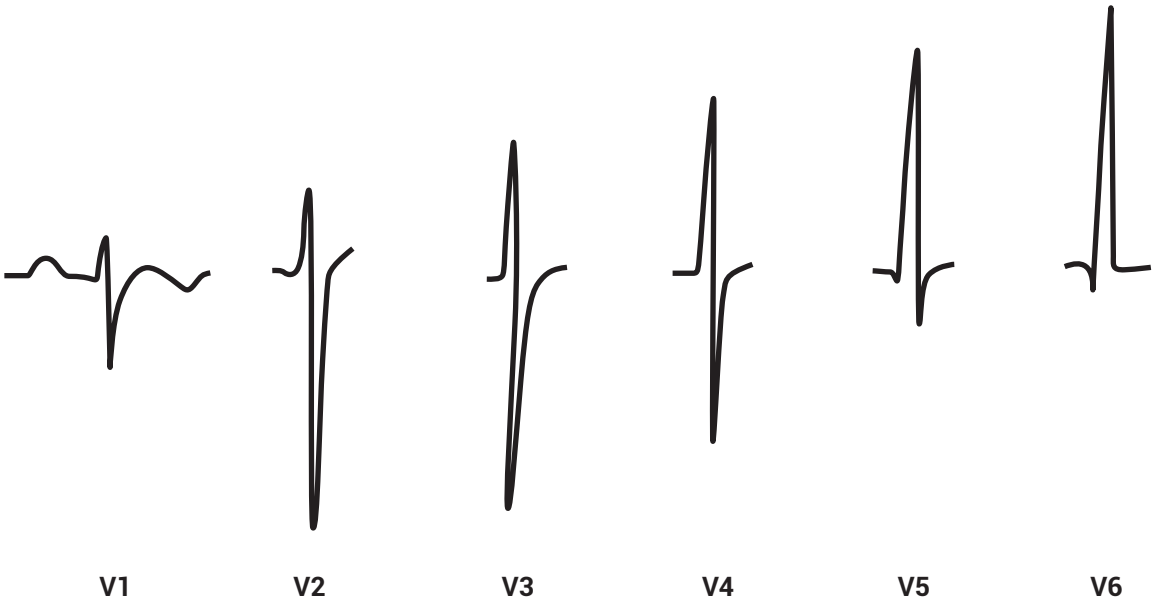


The following image shows an infarct at the anterolateral region. In this example, there will be pathologic Q waves in V4 and V5 that will be bigger and more pronounced than the small Q wave in lead V6.



So remember, when Q waves get smaller from V4 to V6, myocardial infarction is probably present in the area around V4.

Now let's have a look at the normal appearance of the precordial leads again:



Two important tricks for your toolbox

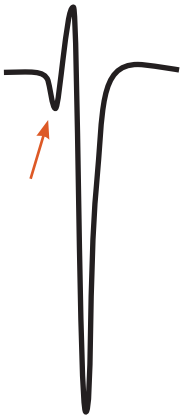
You'll have to learn two important facts that are critical for ECG mastery:

Fact #1 says **leads V1, V2, and V3 usually start with an initial R wave.**

V1 can sometimes come without an initial R wave, but from V2 onward we almost always see it.
In V3 the R wave is usually already pretty big.

Small initial R wave
seen in V1 and V2

Now take a look at this example:



Small initial Q wave

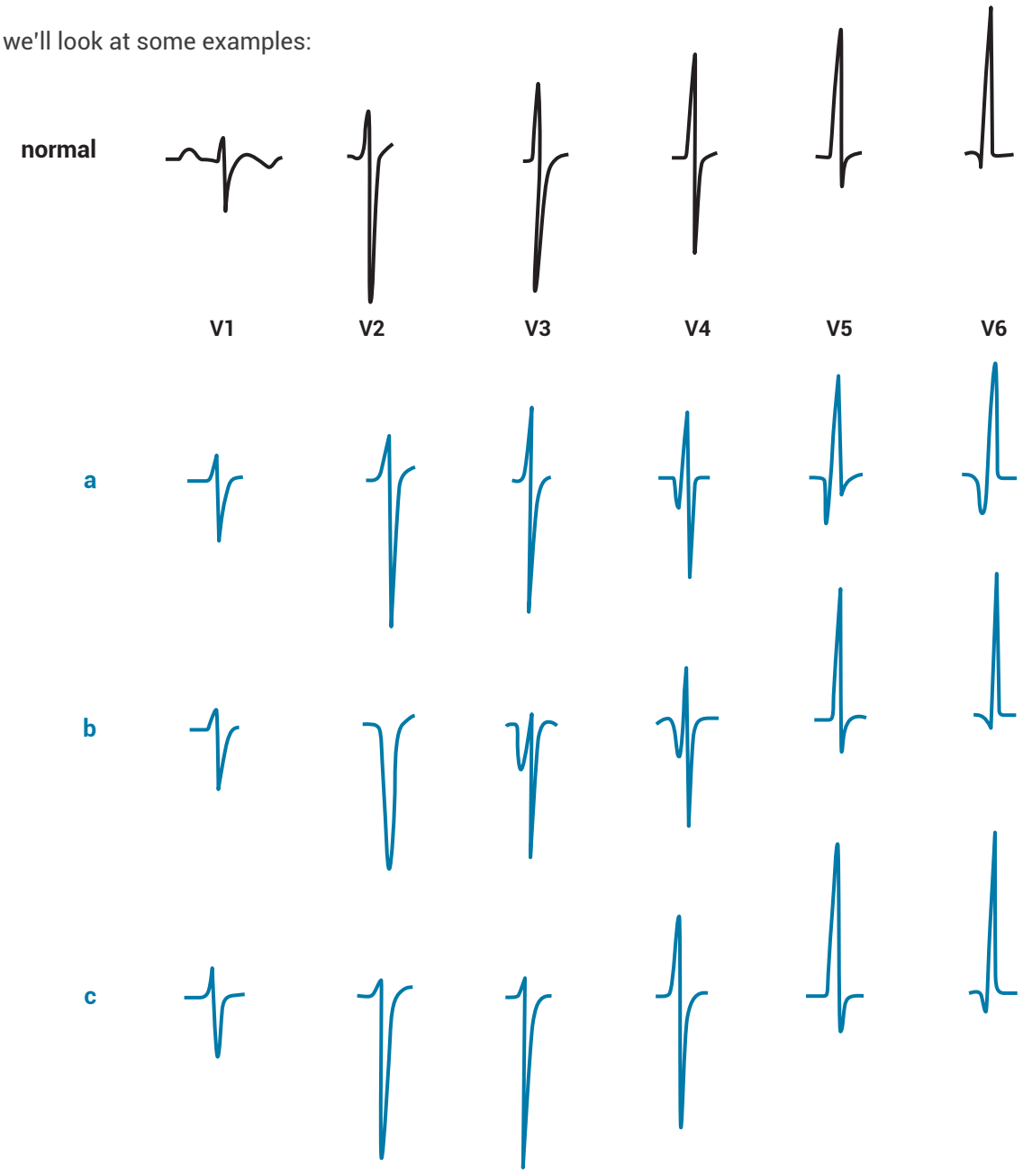
Beware of anything that looks
like this in leads V1, V2, or V3!

This QRS complex also has a small R wave, but there's a small Q wave preceding it. If you see something like this in leads V1, V2, or V3, you should always remember fact #1. Myocardial infarction is very likely in these cases.

Fact #2 says **R-wave amplitudes normally increase as we go from V1 to V6.**

If R-wave amplitude does not increase from V1 to V3 or if R wave amplitude even decreases, we also have to think about the possibility of myocardial infarction in the anterior wall.

Now we'll look at some examples:



- **Example a:** There are abnormal Q waves in leads V4 to V6. Also, R-wave amplitude decreases from V3 to V4. These are clear signs of myocardial infarction of the anterolateral region (V4 = anterior wall, V5 and V6 = lateral wall).
- **Example b:** The R wave seen in V1 gets completely lost in V2, where we see a large QS complex. Furthermore, pathologic Q waves can be seen in V3 and V4. This is a clear case of an anterior wall myocardial infarction (V2 to V4 = anterior wall).
- **Example c:** Here the signs of myocardial infarction are more subtle than in the previous examples. R-wave amplitude decreases as we go from V1 to V2 and stays the same from V2 to V3. R-wave progression in V4 is normal again. This is probably a case of myocardial infarction of the basal septum (V2 and V3 = basal septum).