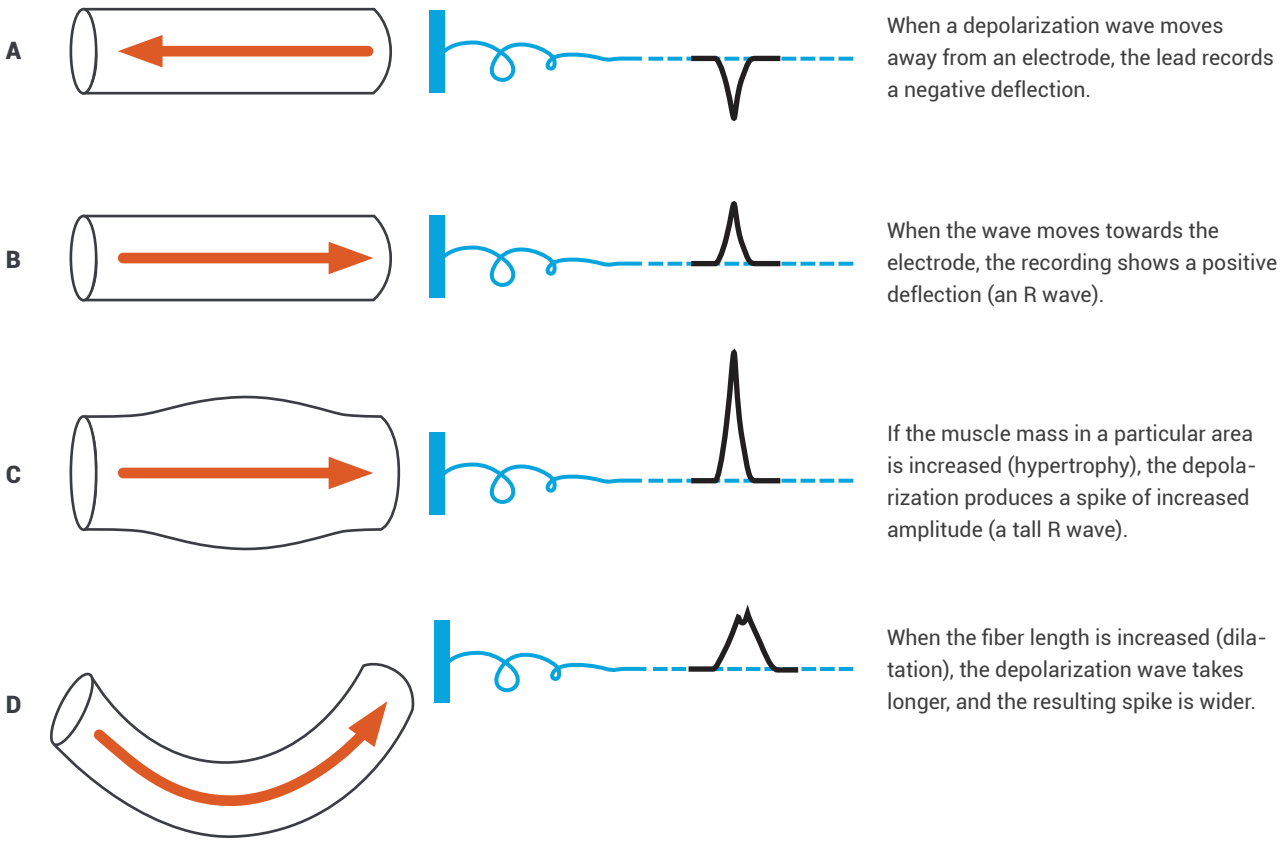
Level 6

What you really need to know about ventricular hypertrophy

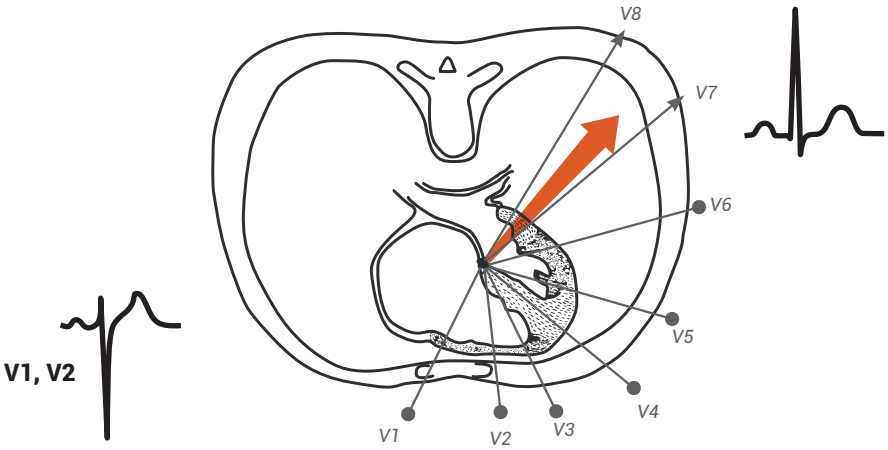
The ECG is an important tool for the identification of ventricular hypertrophy. In this chapter, you'll learn what to look for.

Key concepts

We learned in Level 4 that R waves increase as we go from right (V1) to left (V6). The size of the R wave is a reflection of the myocardial mass underneath the lead. That's why the R waves over the thin-walled right ventricle (V1 and V2) are smaller than the R waves over the muscular left ventricle (V5 and V6).
The waves of the ECG are a product of electrical depolarization. If depolarization moves toward a lead, the respective segment of the ECG wave will be positive. If depolarization moves away from the lead, the deflection will be negative.



It follows that a strong electrical vector that points in the direction of V5 and V6 produces a large R wave in V5 or V6 and a deep S wave in the opposite leads V1 and V2. In other words, the S wave in V1 and V2 is more or less a mirror image of the R wave in V5 and V6.



So remember these two important points:

- The higher the R wave over the left ventricle, the larger the muscular mass of the left ventricle (a direct sign of left ventricular hypertrophy).
- The deeper the S wave over the right ventricle, the larger the muscular mass of the left ventricle (an indirect sign of left ventricular hypertrophy).

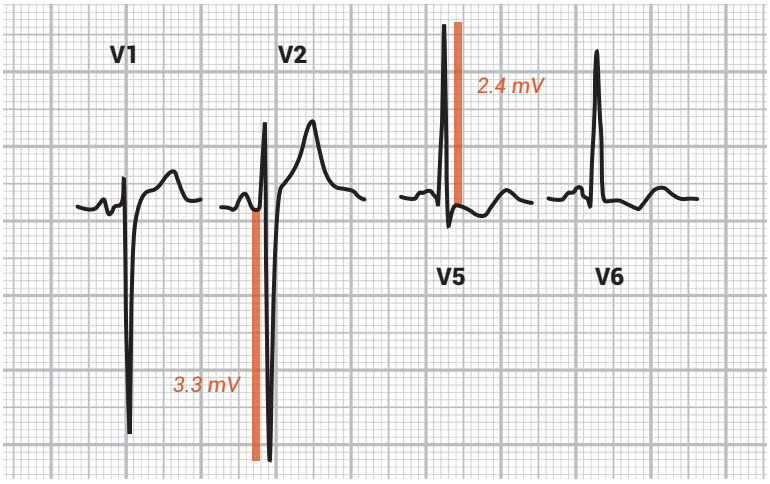
The Sokolow index

Under normal circumstances the left ventricle has a higher muscular mass than the right ventricle. To assess whether (abnormal) left ventricular hypertrophy is present, the Sokolow index can be used. It basically takes the preceding two statements and turns them into numbers. Here is how it's done:

1. Take the R wave (mV) in V5 or V6 (whichever one is taller).
2. Add the S wave (mV) in V1 or V2 (whichever one is deeper).
3. If the resulting number is more than 3.5 mV, left ventricular hypertrophy is probably present.

Sometimes the R wave in a left ventricular lead alone exceeds 2.5 mV; this can also be interpreted as a sign of left ventricular hypertrophy.

The following example illustrates how to use the Sokolow index:



Use the R in V5 because it's taller than the R in V6. The amplitude of that R wave is 2.4 mV. Then measure the S in V2 because it's deeper than the S in V1. That S wave is 3.3 mV. Then add up those numbers: 2.4 + 3.3 = 5.7 mV. Since 5.7 is larger than 3.5, left ventricular hypertrophy is probably present.

However, this technique should be used with caution. False-positive and false-negative results may occur. Also, this method is not suitable for patients younger than 35 years. A lot of people in this age group will exceed the threshold of 3.5 mV without having left ventricular hypertrophy (which means high rates of false positives!).

Now, let's turn to right ventricular hypertrophy...

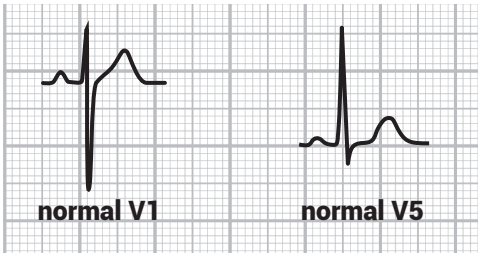
The ECG can also be used to assess right ventricular hypertrophy. However, all too often, clinicians forget about it—probably because it's just a little bit trickier than the assessment of left ventricular hypertrophy.

There are a couple of ECG findings that can be used for the assessment of right ventricular hypertrophy. Here are the ones that we find most useful—we call them our **RSS criteria**:

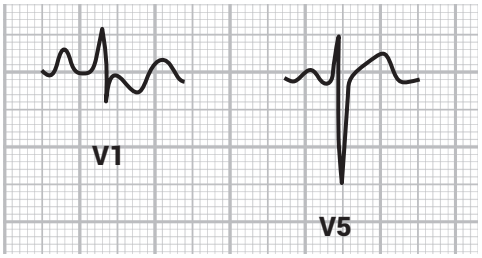
- **Criteria #1:** Look at the **R** wave in V1; present if it's ≥0.5 mV
- **Criteria #2:** Look at the **S** wave in relation to the R wave in V1; present if the R/S ratio in V1 is ≥1
- **Criteria #3:** Look at the **S** wave in V5: present if it's ≥0.5 mV

If two of the three criteria are present, right ventricular hypertrophy is probably present. If right-axis deviation (taught in Level 11) or an incomplete right bundle branch block is also present, the likelihood of right ventricular hypertrophy increases even further.

Here's an example:



normal patient



RRS right ventricular hypertrophy

#1: R (V1) = 0.6 mV ⟶ present
#2: R/S (V1) = 0.6/0.4 = 1.5 ⟶ present
#3: S (V5) = 1.3 mV ⟶ present

In this example, all RSS criteria are present. So right ventricular hypertrophy is probably present.

Note that this suspicion always has to be confirmed with echocardiography.