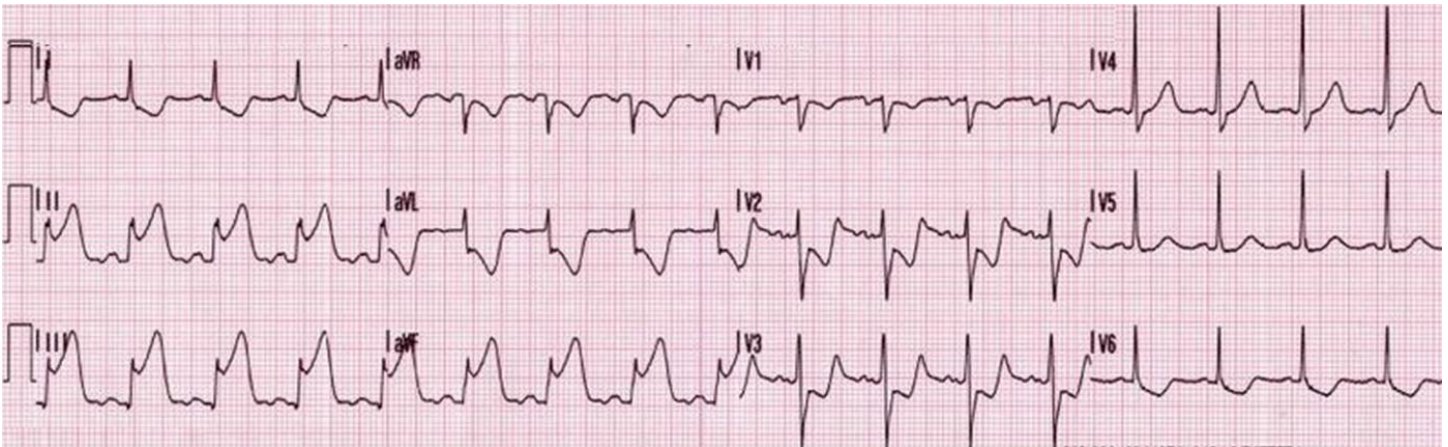


# Acute Inferior ST Elevation with ST Depression in Leads V5 and V6 A Very, Very Ominous Situation!

## Discussion

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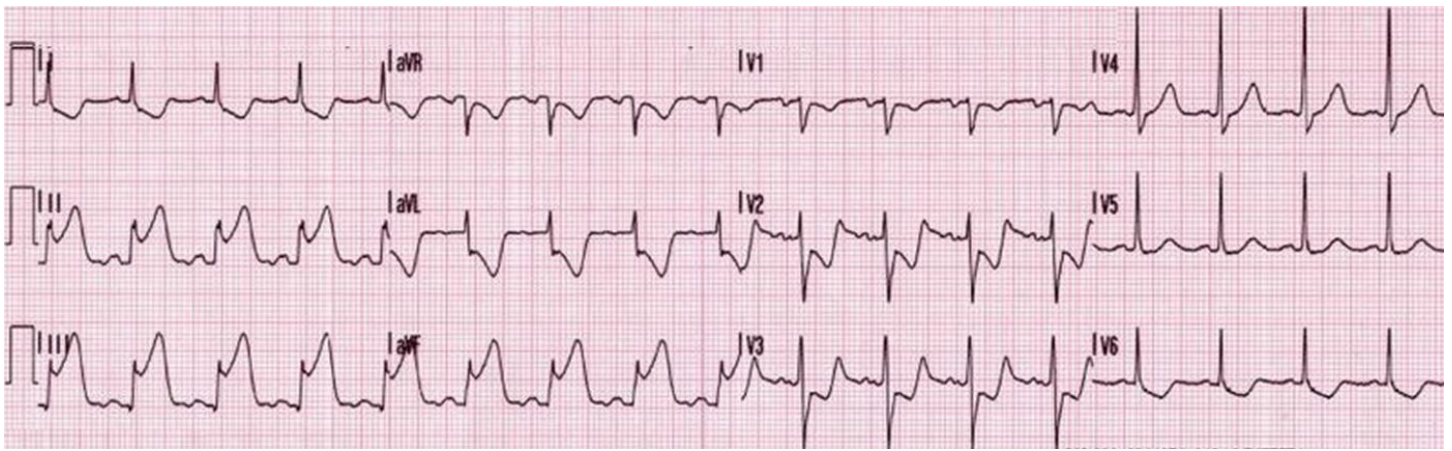
**Figure 1**

Most of you should have no difficulty recognizing the acute ST elevation in the inferior leads (II, III, aVF). If you are slightly more advanced, you will have noticed several findings that strongly indicate the right coronary artery (RCA) as the culprit artery as opposed to the left circumflex artery (LCx)...

1. The STE in Lead III is taller than the STE in Lead II, indicating an injury vector pointing more toward  $+120^\circ$  and thus, the vascular distribution of the RCA. While this is not 100% proof of RCA occlusion, it is *still a very good indicator*.
2. There is marked ST depression in Leads I and aVL (especially Lead aVL) that is not seen (to this degree) in occlusions of the other two coronary arteries.

You may also have noted the marked ST depression in Leads V2 and V3 indicating involvement of the basolateral (actually *lateral*) wall of the left ventricle. An occlusion of either the RCA or the LCx can do this, but I think it is pretty obvious that we are dealing with an RCA occlusion here. Also, the LCx will not produce ST depression in Lead aVL except under rare circumstances and never to this degree!

But what about the ST depression with T wave inversion in Lead V1? First of all, I would be more concerned about the ST depression since T wave inversion in V1 can be normal. What concerns me most about the ST depression in Lead V1 is how *little there is* compared to another lead immediately adjacent to it – Lead V2. The difference in the magnitude of the two ST depressions is quite remarkable! Could something be interfering with the ST depression in Lead V1 – perhaps preventing it from being more profound?



**Figure 1 (repeated)**

The answer to that question is “absolutely!” There is ST elevation also present in Lead V1 indicating an *acute right ventricular wall ischemia*. You can’t see the STE because it is being cancelled by the reciprocal ST depression caused by the acute posterolateral (lateral) epicardial ischemia (or, STEMI). When ST elevation competes with ST depression – *in the same lead* – there is always a cancellation of ischemic vectors on the ECG. In this case, the posterolateral ischemia must be intense because the ST elevation of the right ventricular ischemia is not quite able to “neutralize” it and there is some residual ST depression. This patient should have had posterior and right ventricular leads recorded – but that did not happen, unfortunately.

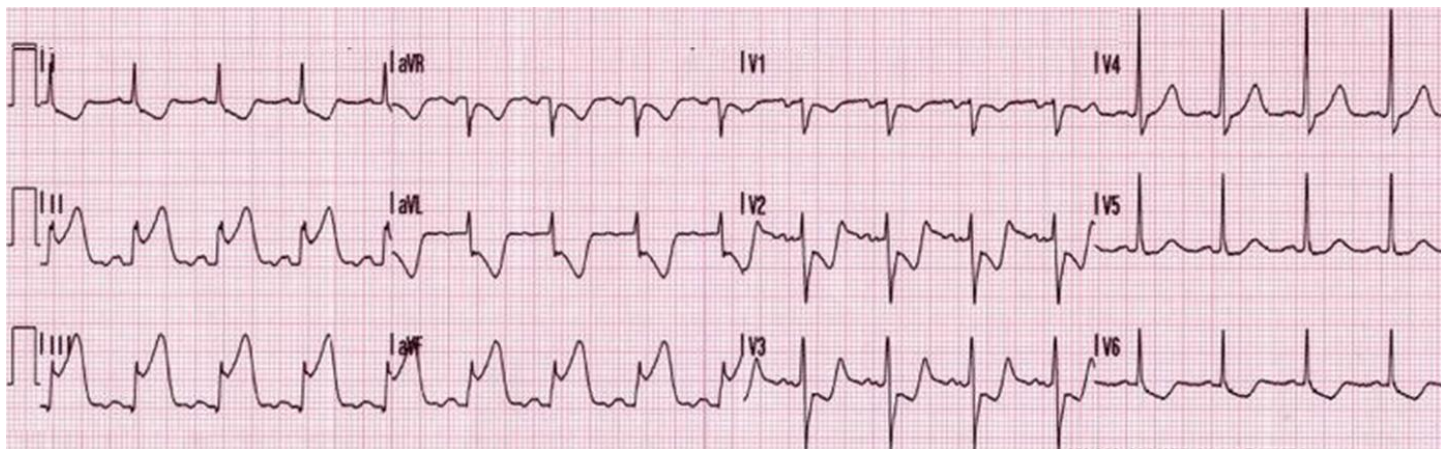
So, here we have not only a very significant acute ischemia of the *inferior wall of the left ventricle* (I say “ischemia” because ***there is no infarction on this ECG!\****), but we also have major involvement of the *left lateral ventricular wall* and the *right ventricle* as well!

Many years ago when I was an internal medicine resident, we were taught that right ventricular infarctions were relatively rare. Today, we now know that they can occur in up to 50% of RCA occlusions. Now, not *every* right ventricular ischemia causes hemodynamic collapse... *but about 1/3 of them do!* Just look at all the ischemic areas on this unfortunate patient’s 12-lead ECG! Could it get any worse than that?

Unfortunately, yes it can... *and it did!*

Look at Lead V6. Do you see the rather marked ST depression in that Lead? *This is a very, very ominous sign!* Whenever you have a patient with an acute inferior wall ischemia, always check Leads V5 and V6 for ST *depression*. Of course you also want to look for ST *elevation* in those leads as well – but ST depression will be your biggest problem.

During the course of an acute inferior wall ischemia, ST elevation in Leads V5 and V6 indicate a more extensive area at risk, caused either by an occluded LCx or by an occluded RCA with a long posterolateral branch (the terminal branch of the RCA). OK... that tells you that the inferior



**Figure 1 (repeated)**

ischemia is more extensive than usual. But what does ST *depression* in Leads V5 and V6 tell you?

ST depression in Leads V5 and V6 – in the presence of acute left inferior wall ischemia – tells you that *this occluded vessel was providing blood to that area of the heart*. The loss of this supplemental blood supply has had a major adverse effect on the other vessels supplying blood to that area: the LAD, the LCx and the (sometimes) ramus intermedius. Normally they should supply enough circulation to that area to prevent any ischemia, but in this case, the occlusion resulted in acute subendocardial ischemia! That means the other vessels may not have been healthy enough to do their job! On the other hand, it could mean that the LAD was a Type 1 (short) LAD and the ramus intermedius (present only about 30% of the time) was missing, which leaves the LCx as the only other provider of circulation to that area.

So, I'm sure you already know that if there is ST elevation in Leads II, III, and aVF, you should always check to see if there is ST depression in Leads V1 – V3 and you should always immediately record right ventricular leads (at least Lead V4R). You should order the right ventricular leads *even if the ST elevation in Lead II is taller than in Lead III*. Why? Because the rule about greater STE in Lead III than in Lead II indicating an RCA occlusion is *NOT 100% accurate!* I have an ECG in my collection that shows those changes and yet the heart cath revealed an open RCA and an occluded LCx. *But don't take any chances!* If there is ST elevation in the inferior leads, get a right-sided ECG *immediately*. The right ventricular changes will disappear from the ECG very quickly, so you don't want to procrastinate and miss them.

I hope you learned something from this post. I'm always working to help you improve your ECG interpretation skills.