Acute Coronary Syndrome

What Is the Affected Artery? Where Is the Occlusion Located? And How Important Is the Myocardial Mass Involved?

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ECG CHALLENGE

The patient is a 55-year-old woman with risk factors for coronary artery disease, including arterial hypertension, smoking, high cholesterol, and a strong family history, who presented to the emergency room with 2 days of intermittent chest pain, which now has been persistent for >2 hours.

The ECG recorded is shown in Figure 1. The patient was immediately transferred to the catheterization laboratory for coronary angiography and percutaneous coronary intervention. According to the ECG information, what is the affected artery, where is the occlusion located, and how important is the myocardial mass involved?

Please turn the page to read the diagnosis.

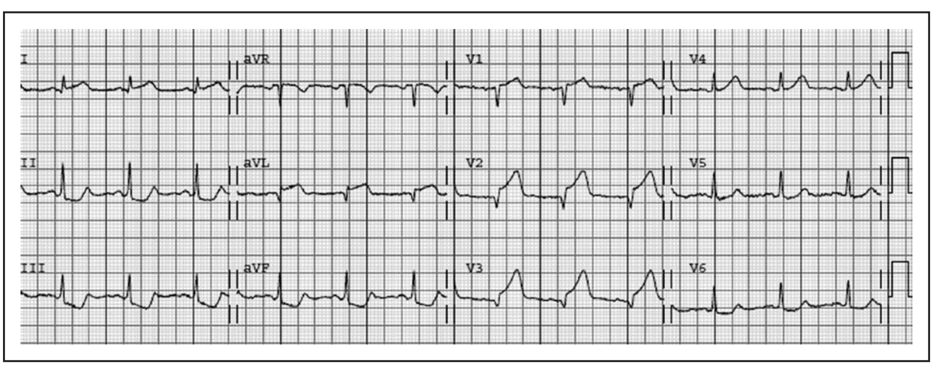

Figure 1. **ECG of ST-segment–elevation myocardial infarction caused by proximal left anterior descending coronary artery occlusion.**

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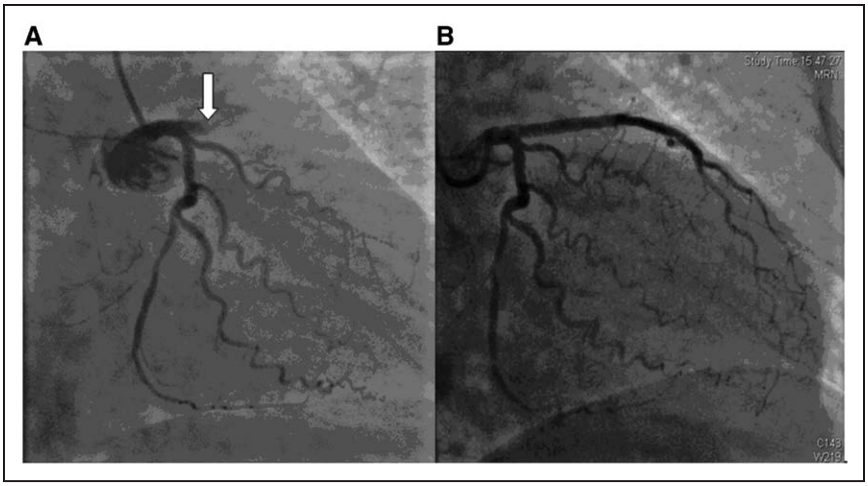

Figure 2. Coronary angiography confirms proximal left anterior descending coronary artery (LAD) occlusion (A), and after implantation of stents (B).

RESPONSE TO ECG CHALLENGE

This ECG shows the typical findings seen in ST-segment–elevation myocardial infarction caused by proximal left anterior descending coronary artery (LAD) occlusion located before the first diagonal (D1) and first septal (S1) branches.[1–3] The coronary angiogram confirmed the ECG findings (arrow, Figure 2A). Percutaneous coronary intervention was performed with implantation of 2 stents, 1 in the proximal LAD (Xience 3×23 mm) and the other in the mid-LAD (Xience 2.5×18 mm) with very good results (Figure 2B).

In ST-segment–elevation myocardial infarction with ST elevation in V_1 to V_3, it is important to recognize the anatomic location of the LAD occlusion because the area at risk is greater when the occlusion is more proximal and therefore the prognosis is worse. We show in Figure 3 an algorithm[3] that is useful to recognize if, in the case of ST-segment–elevation myocardial infarction caused by the LAD, the occlusion is proximal or distal to D1. If the occlusion is proximal, an ST-segment depression is present in the inferior leads because the injury vector is directed upward,[3] as observed in this case (Figure 4A). On the contrary, in the case of LAD occlusion distal to D1, the injury vector is directed downward, and therefore, in leads II, III, and VF, ST-segment elevation is usually seen (Figure 4B). At first glance, with a more distal occlusion, one may assume that because there are more leads with ST-segment elevation, more myocardium may be involved, but this is not the case as demonstrated in Figure 4.

There is in the ECG in Figure 1 another observation: In case of ST-segment–elevation myocardial infarction due to proximal LAD occlusion, the presence of the ↑ST VR+↑ST V1+ST↓ V6≥0 strongly favors that the occlusion is above the septal 1 (S1) artery, as happen in this case (≥3) (Figure 3). In addition, a new right bundle-branch block often appears in case of occlusion proximal to first septal branch, which was not observed in this case, perhaps because of a long conus artery that also appeared to perfuse the higher part of septum.

In summary, this ECG demonstrates an occlusion of the LAD proximal to the first septal and first diagonal branches. Careful observation of the ups and down of the ST segments in cases of acute coronary syndrome may provide enough information to allow identification of lesion location and the zone of myocardium involved.

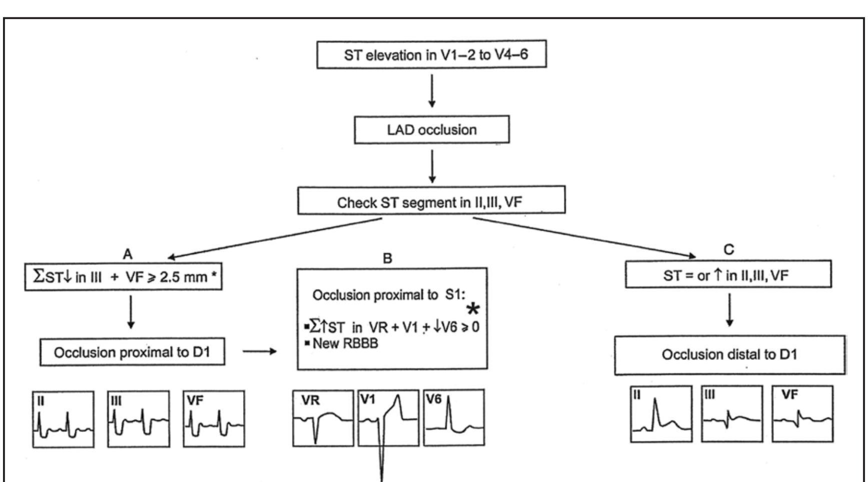

Figure 3. This algorithm demonstrates how the ups and downs of the ST segment can help determine whether left anterior descending coronary artery (LAD) occlusion is located proximal or distal to D1 and/or S1.
RBBB indicates right bundle-branch block.

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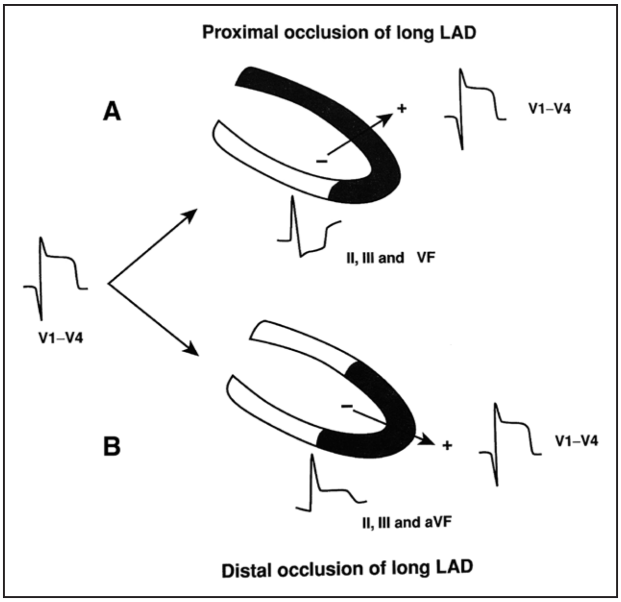

Figure 4. In an acute coronary syndrome with ST-segment elevation in V_1 and V_2 to V_4 to V_6 as the most striking pattern, the occluded artery is usually the left anterior descending coronary artery (LAD).
The correlation of the ST-segment elevation in V_1 to V_2 to V_3 to V_5 with the ST morphology in II, III, and VF allows us to know whether it is an occlusion proximal or distal to the first diagonal. If it is proximal, the involved muscular mass in the anterior wall is large, and the injury vector is directed not only forward but also upward, even though there can be a certain inferior wall compromise because usually the LAD wraps the apex. This explains the negativity recorded in II, III, and VF (**A**). In contrast, when the involved myocardial mass in the anterior wall is smaller, because the occlusion is distal to the first diagonal and (**B**) if the LAD is long, as usually occurs, the injury vector in this U-shaped infarction (infero-anterior) is of course directed forward, but often somewhat downward instead of upward, so it generally produces a slight ST-segment elevation in II, III, and VF.

DISCLOSURES

None.

AFFILIATIONS

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FOOTNOTES

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