Case Report

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Acute Occulusion of Diagonal Branch: Triad of Severe Pain, Small Infarct & Specific Ekg Pattern

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Abstract

A 59 years female, known case of Non-Insulin Dependent Diabetes Mellitus (NIDDM) for 10 years with a strong family history of coronary artery disease (both parents & siblings have CAD), presented with severe agonizing precordial chest discomfort, radiating to left shoulder associated with profuse sweating for last 3 hours. In emergency room, patient was restless, pulse = 100 / min., BP = 170 / 100 mm Hg, O_2 saturation 98%. There was no sign of cardiac failure. ECG recorded in emergency room revealed ST elevation of 5 to 6 mm in lead I, aVL, 4 mm ST elevation in lead II, V2 and shuttle ST segment sagging in lead II, 4 mm ST segment depression in lead III & Avf (South African Flag Sign) (Fig 1).

Keywords: Case report South African Flag Sign, Acute occlusion of diagonal branch, Specific EKG pattern, Coronary Artery Disease, ST elevation in Lead I, avL&V2, ST depression in inferior leads.

Introduction

Based on ECG, a diagnosis of high lateral myocardial infarction was made. Patient's Troponin T was positive. Blood chemistry revealed normal liver and kidney function tests. The lipids were grossly deranged, total cholesterol 230 mg /dl, triglycerides = 249 mg / dl, HDL – 29 mg/dl & LDL = 149 mg/dl. Cardiac enzymes CPK was 40, CPK-MB was 09, SGOT of 57 & SGPT = 46 I/U.

The echocardiography in emergency room revealed mild concentric left ventricular hypertrophy, hypokinetic apex and mid lateral wall with mild LV dysfunction (EF = 50%). There was trace mitral regurgitation (MR). X-ray chest was unremarkable. After informed consent, patient was taken for coronary angiography and primary PCI.

Coronary angiography revealed normal left main, 60% calcified eccentric stenosis in mid LAD after the origin of large diagonal branch. Large diagonal branch was totally occluded with thrombus at ostia. The left circumflex artery had proximal 70% calcific stenosis followed by extreme distal 80% tandem lesion. The right coronary artery revealed proximal 40% plaque followed by 70% stenosis at crux (Fig. 2). In view of ongoing pain, it was decided to go ahead with primary PCI of culprit vessel (diagonal branch).

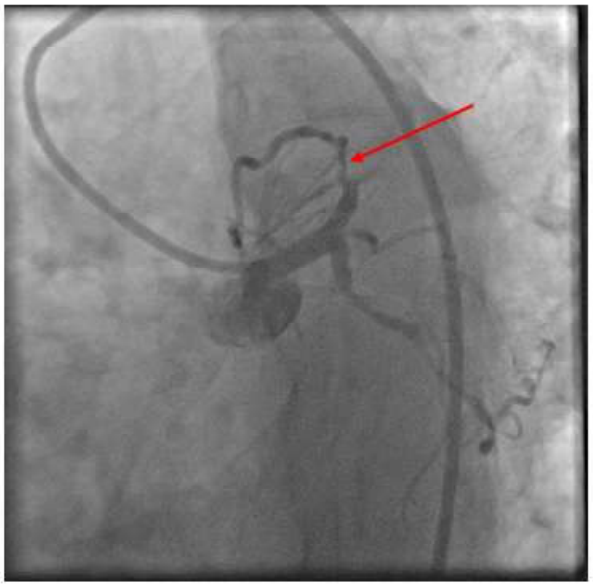

Fig.2: Left coronary angiogram showing totally occluded D1 (arrow).

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The left coronary ostium was hooked with guiding catheter and diagonal lesion was crossed with BMW 0.014" wire. Following this, some antegrade flow was noted in the mid and distal part of diagonal branch. 2 mm x 10 mm Clear Line balloon was advanced over the wire across the lesion and dilated at 10 atm. pressure. Subsequent angiogram revealed TIMI grade IV flow in the large diagonal branch which was distally bifurcating (Fig. 3). The lesion was stented with Xience Prime stent 2.25 x 23 mm at 14 atm pressure. Post deployment dilatation was done at 18 atm pressure. There was successful deployment of stent with brisk antegrade flow in the diagonal artery and its branches. There was no evidence of dissection or thrombus. Patient was hemodynamically stable throughout the procedure and was relieved of pain. Patient was pretreated with Aspirin, Ticagrelor. During procedure, intra coronary Tirobifan & Sodium nitroprusside was given.

Fig. 3: Left Coronary Angiogram Post stenting.

Post procedure ECG revealed ST segment settling in Lead I, aVL and V2 & reciprocal ST segment depression disappeared from inferior leads.

Discussion

The localization of site of occlusion in a coronary artery is an important step in the diagnosis and management of patients with acute myocardial infarction. Pre intervention localization of site of occlusion helps in proper planning and strategy for intervention especially in a patient who is hemodynamically compromised. In our case the ECG features was classical in the line of described "South African Flag Sign" which helped us to predict that culprit vessel occluding and giving MI, is probably diagonal branch which was proved by coronary angiography.[1] It helped us in prompt intervention and also counselling of the relative of patient about the possible need for intervention of a branch only. As the patient was hemodynamically stable and became free of chest pain therefore other vessels intervention was deferred from second sitting.

High lateral STEMI usually results from occlusion of a large first diagonal branch of left anterior descending artery (LAD). The classical ECG changes of ST elevation in lead I, aVL, V2 with reciprocal ST depression in lead II, III, aVF has been named as "South African Flag Sign"(2) (Fig. 4).

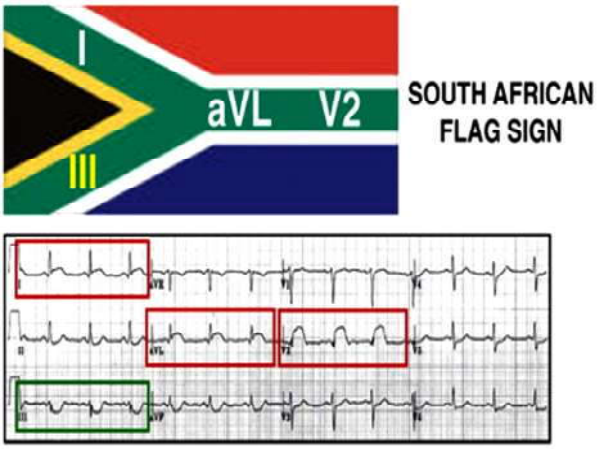

Fig. 4: ST Elevation in Leads I, aVL and V_2 ST Depression in the Inferior Leads.

In high lateral infarct, the ST vector is pointing towards the axilla and is usually directed from 0° to - 90° in the frontal plane. There are actually 6 ECG leads clustered in this area that can pick up a high lateral ST vector. 0° corresponds to lead I, -30° corresponds to aVL, -60° corresponds to the mirror image of lead III, and -90° corresponds to the mirror image of aVF. Being to the left and higher than the center of the heart, the frontal plane projection of lead V2 too is pointing towards the axilla. The morphology of the complexes in V2, therefore, frequently resembles the morphology in lead aVL. Based on the cartoon displayed in below Fig. 5, it is easy to understand why LAD-D STEMI is characterized by ST elevation in leads I, aVL and V2, and by ST depression in leads III and aVF.

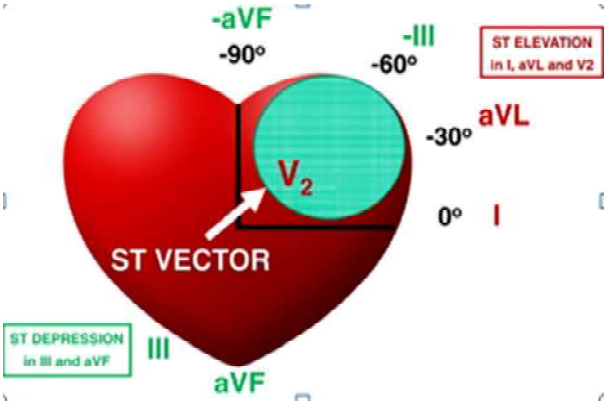

Fig. 5: It is easy to understand why LAD-D STEMI is characterized by ST elevation in leads I, aVL and V2, and by ST depression in leads III and aVF.

Most electrocardiographs display the 12 lead ECG in a 4x3 lead format. With such a display, the arrangement of ST segment deviation resembles the pattern of the South African flag with ST elevation in the upper left panel (lead I) and in the two middle panels in the second and third columns (leads aVL and V2, respectively), and ST depression in the bottom left panel (lead III). Fig. 1 displays a case where the STEMI is unmistakable and therefore, it helps memorize the South African flag pattern. It also demonstrates that the marked ST elevation seen in V2 must be a frontal plane rather than a horizontal plane reflection of the ST vector because there is absolutely no corresponding ST elevation in leads V1 and V3, the two neighboring chest leads.

This study highlights that acute occlusion of diagonal branch has distinct pattern in form of disproportionate severe chest pain, despite being a small territory involved. Severity of chest pain per se does not correlate with severity of coronary artery disease. The size of MI may not correlate to the severity of chest pain. High lateral STEMI is considered the smallest one but accompanied by the severe chest pain.[3] Patients with isolated branch vessel disease have clinical presentation indistinguishable from those of patients with coronary disease involving the major cardiac vessel.

Rahman et al observed that patient with diagonal branch vessel coronary artery disease have more severe chest pain in the condition of acute myocardial infarction.[4] This pathophysiological feature is explained by the diameter of vessel. The delivery of oxygen reach blood to the myocardium is influenced by coronary artery diameter, presence of collaterals and perfusion pressure determined by the pressure gradient from aorta to coronary arteries. Because of small diameter compared to the epicardial artery, a branch vessel can have persistent vasomotor tone during the coronary ischemia, resulting in severe pain due to lack of vasodilatation. Beside this, the diameter of vessel has some relation with coronary auto regulatory mechanism during coronary hypoperfusion.

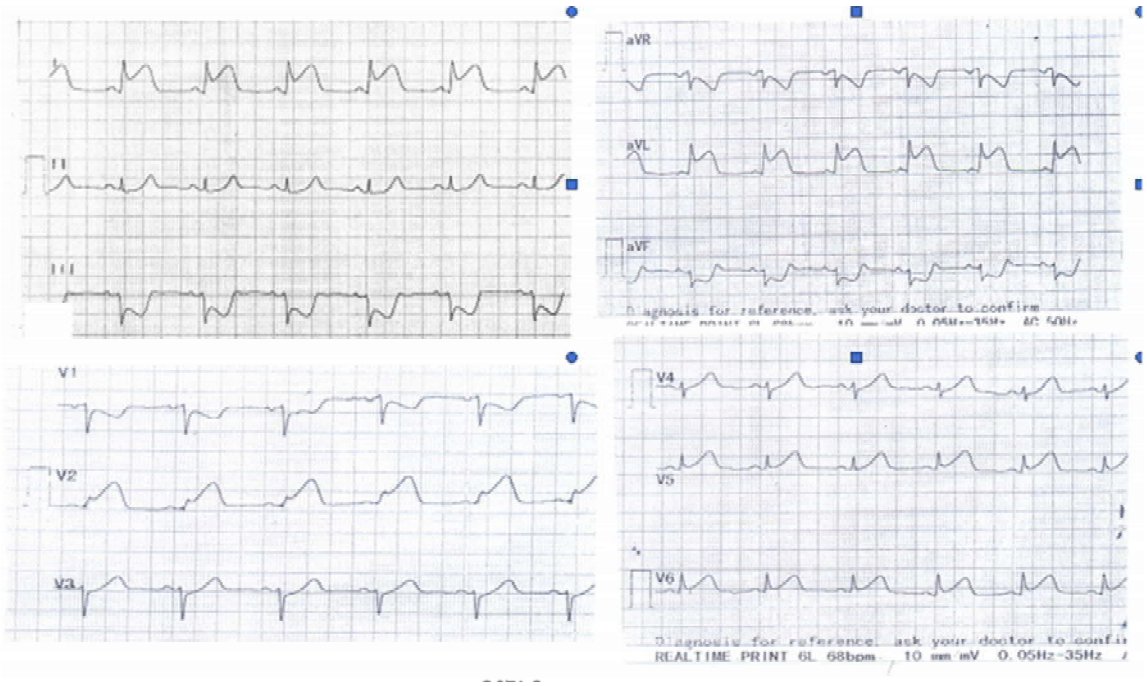

Fig. 1: Displays a case where the STEMI is unmistakable and therefore, it helps memorize the South African flag pattern.

Sun et al[5] in their study of coronary microvasculature have shown that the magnitude of dilatation during coronary hypo-perfusion is inversely related to the initial diameter of the vessel. However, myocardial ischemia and cardiac pain has a mysterious relationship.[6] It seems that there is a undefined mechanism between pain pathways and ischemic territories being sensitive to particular branches or vessels.

Conclusion

This study highlights an importance of thorough clinical evaluation of the patient with an eye on catching specific electrocardiographic pattern, so as to predict site of occlusion in coronary artery. This will help in prognostication and drawing the strategy for management.

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