

Electrocardiographic changes of ST-elevation myocardial infarction in patients with complete occlusion of the left main trunk without collateral circulation: Differential diagnosis and clinical considerations[☆]

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Abstract

Acute coronary syndromes due to involvement of the left main trunk usually present with subtotal occlusion and electrocardiographic pattern with predominant ST depression (non-ST-elevation myocardial infarction). The cases with complete occlusion frequently present an ST-elevation myocardial infarction pattern, but these patients usually die before reaching the hospital. We present a series of 7 patients with total left main trunk occlusion without collateral circulation showing ST-elevation myocardial infarction pattern. The electrocardiographic pattern is similar to left anterior descending coronary artery proximal occlusion to first septal and first diagonal but without ST elevation in V₁ and aVR because of left circumflex coronary artery compromise. In 4 (60%) of 7 of cases, there is also advanced right bundle-branch block plus superoanterior hemiblock. Despite severe clinical state at entrance (5/7 presented cardiac arrest/cardiogenic shock), 3 patients (43%) survived after percutaneous coronary intervention.

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Keywords:

Left main trunk; Acute myocardial infarction; Cardiogenic shock

Introduction

Usually, acute coronary syndrome (ACS) due to involvement of the left main trunk (LMT), as a culprit artery, presents with either subtotal occlusion or total occlusion with good collateral circulation (CC). The electrocardiogram (ECG) shows non-ST-elevation myocardial infarction (NSTEMI) pattern with 7 or more leads with ST depression and a reciprocal ST elevation in aVR and often in V₁.^{1–3} When occlusion is total and occurs with transmural involvement, without CC, it corresponds to the clinical syndrome ST-elevation myocardial infarction (STEMI) and shows a corresponding pattern in the ECG. Unfortunately, these patients usually die before reaching the hospital. The

ECG changes in LMT involvement may be misinterpreted because an NSTEMI-ECG pattern is expected, consisting of predominant. Currently, some patients with total occlusion of LMT arrive alive to the hospital. These patients may present STEMI pattern with typical clinical ECG characteristics: (a) very frequent cardiogenic shock/cardiac arrest and (b) the ECG pattern described in proximal left anterior descending coronary artery (LAD) occlusion to first septal (S1) and first diagonal (D1) but without ST elevation in aVR and V₁ due to left circumflex coronary artery compromise, plus very often right bundle-branch block (RBBB) and left anterior hemiblock (LAH). So far, only few case reports of LMT occlusion presenting as STEMI have been described.^{1,4–6} True incidence is unknown because in these publications,^{1,4,7,8} ACS with LMT subtotal occlusion (thrombolysis in myocardial infarction [TIMI] flow ≥ 1) or total occlusion with CC is not distinguished from total occlusion with transmural involvement and no CC (TIMI flow = 0). In this study, 7 patients with total LMT occlusion without CC evident on coronary angiography, showing a STEMI pattern in the ECG, are described.

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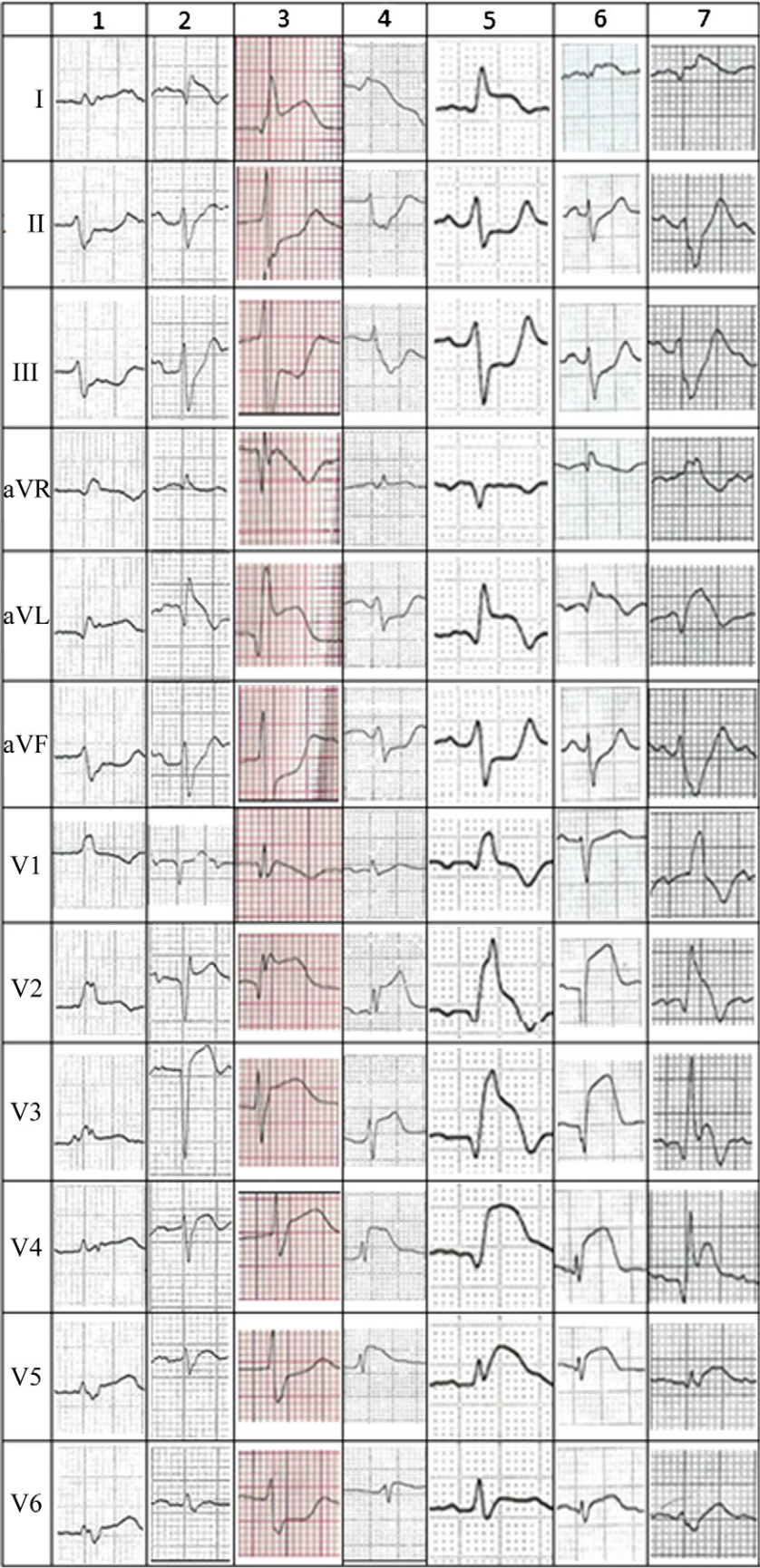


Fig. 1. One complex of all 12 leads in the 7 cases. Color illustration online.

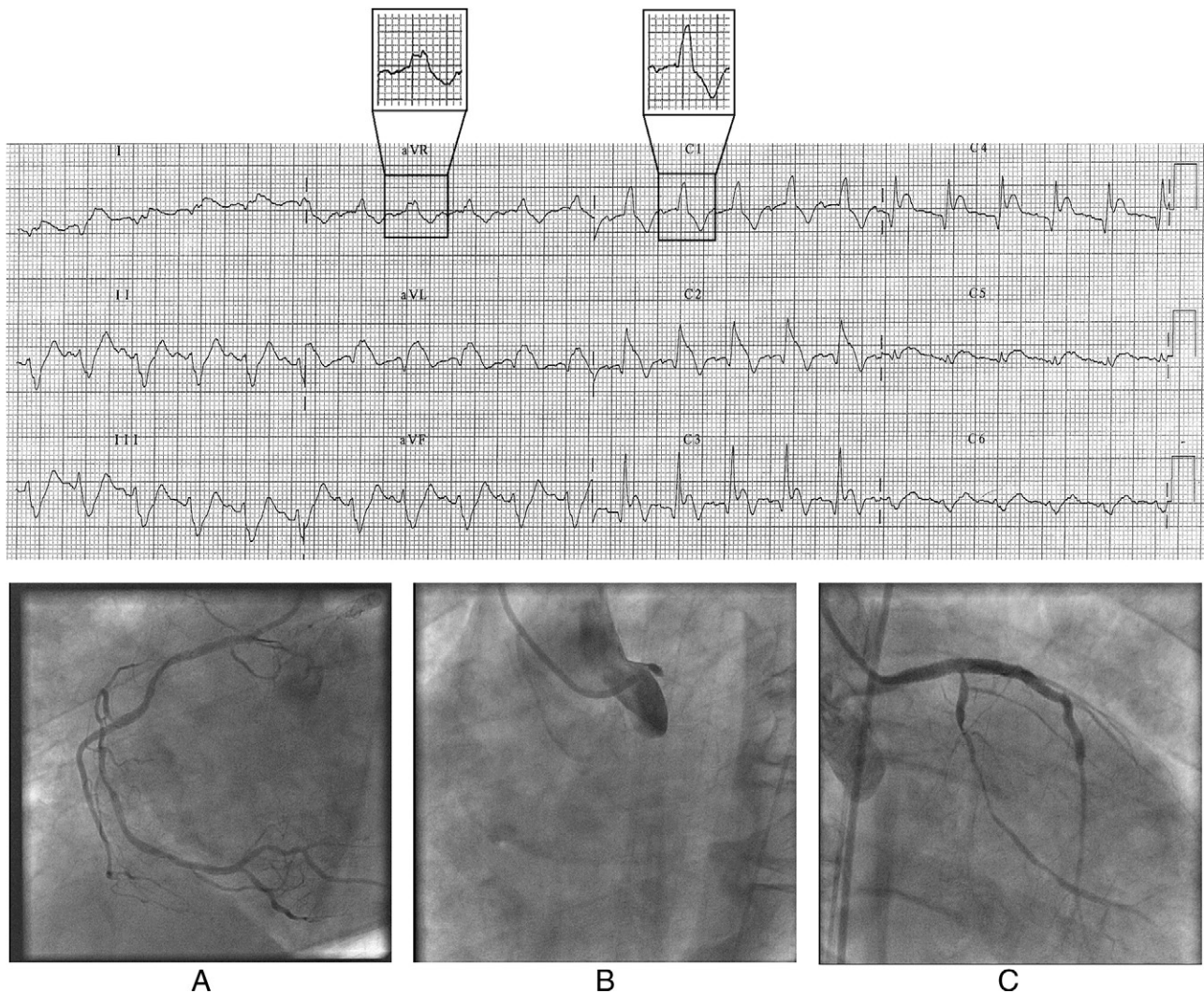


Fig. 2. Above. An example (case 7) of LMT with the ST elevation in V_2 to V_5 , I and VL, and ST depression in II, III and VF, but without ST elevation in V_1 and aVR (see text). Below. See the coronary angiography of RCA (A) and left coronary tree before (B) and after (C) PCI.

Methods

From January 2008 to December 2010, 7 patients (6 men and 1 woman), representing 2% of all ACS cases in which a percutaneous coronary intervention (PCI) was performed, were included in the study. They presented with total occlusion of the LMT and a STEMI pattern in the ECG. No other artery with significant stenosis was present. Exclusion

criteria were left bundle-branch block, previous myocardial infarction and cardiac surgery, and lack of ECG recording close to the time of PCI.

Results

The ECG characteristics of ST elevation in the study group are shown in Fig. 1, and a complete case (number 7),

Table

Characteristics of patients with acute total occlusion of left main coronary artery.

Case	Age (y)	Sex	Risk factors	Time from onset of pain to ECG (min)	HR on Adm. (beats per min)	BP on admission (mm Hg)	Cardiac arrest	Cardiogenic shock	Intravent. conduct. disturb.	Therapy	Patient outcome
1	69	M	To HBP	50	40	30/15	No	Yes	LAH RBBB	PCI	Dead
2	33	M	To Cocaine	1008	140	60/30	No	Yes	LAH	PCI	Survived
3	77	F	—	96	75	125/74	No	No	LAH RBBB	PCI	Survived
4	73	M	To	155	80	79/60	Yes	Yes	LAH	PCI	Dead
5	74	M	To	190	110	110/50	Yes	Yes	LAH RBBB	PCI	Dead
6	39	F	To	30	90	100/60	No	No	LAH	T/PCA/CS	Survived
7	49	M	HBP cocaine	160	127	106/67	Yes	Yes	LAH RBBB	PCI	Dead

M indicates male; F, female; HR, heart rate; BP, blood pressure; PCI, percutaneous coronary intervention; T, thrombolysis; CS, cardiac surgery; To, tobacco; HBP, high blood pressure.

in Fig. 2. Additional data regarding the ECG, demographic, clinical, and management parameters are shown in Table. Aspirin was given to all patients before arriving to hospital. The patients were treated according to the European Society of Cardiology guidelines⁹; all patients were in sinus rhythm. Four patients (60%) presented RBBB plus LAH. Patient number 6 presented spontaneous coronary dissection of the LMT, and after unsuccessful thrombolysis, cardiac surgery was performed. The 3 patients with cardiac arrest and 4 of 5 with cardiogenic shock (80%) died in hospital.

Discussion

The LMT as the culprit artery in ACS presents in most of the cases subtotal occlusion of the artery. Acute complete occlusion rapidly triggers cardiogenic shock and ventricular fibrillation, and the patient usually dies before reaching the emergency department. However, new treatments and logistic systems of care have enabled prompt arrival to the emergency department, and consequently, more patients with complete occlusion of the LMT are seen in clinical practice. Nevertheless, in-hospital mortality remains high.

Different ECG patterns related to acute total occlusion of the LMT have been described in small series.^{1,10} These patients presented with either NSTEMI or STEMI patterns. The global ischemia ECG pattern, involving widespread ST-segment depression that encompasses negative T waves and shows ST-segment elevation in lead aVR and often V₁ (aVR > V₁), has been the typical pattern in NSTEMI cases. The few patients with complete occlusion of the LMT and a NSTEMI pattern usually present with well-developed CC.^{11–15}

To our knowledge, no series describing LMT occlusion (TIMI flow = 0) with a STEMI pattern has been published in the literature. We found that the most typical ECG pattern in our small series was the one described in proximal occlusion of a long LAD, consisting of ST elevation in the precordial leads from V₂ to V₄ through V₆ and in leads I and aVL, as well as ST depression in the inferior leads¹⁶ and often with RBBB and LAH. In complete occlusion of the LMT, there is involvement of the left circumflex coronary artery, which generates ST depression in V₁ and aVR, and consequently attenuates ST elevation in both leads. This causes the lack of ST changes in V₁ and aVR that are frequently found in total occlusion of a long LAD. However, we have to remember that in cases of proximal LAD occlusion before the first septal branch, ST elevation is not always present in V₁ despite proximal LAD occlusion to first septal if there exists a large conal branch of the right coronary artery (RCA)¹⁷ that perfuses the high septum together with the first septal branch. This double perfusion of the high septum provides protection from ischemia. Patients with LMT occlusion who survive usually present with a very dominant RCA and a poor hemodynamic state when compared with those with LAD proximal occlusion.

To conclude, complete LMT occlusion with transmural involvement must be suspected in the following clinical

situations: (1) cardiogenic shock and/or cardiac arrest at admission (70%) (5/7 cases), (2) STEMI pattern of LAD occlusion proximal to first septal and first diagonal without ST-segment elevation in V₁ and aVR was present in 100% of cases, and (3) frequent intraventricular conduction disturbances (RBBB with LAH) (60%). Despite the severe clinical state of these patients at admission, 3 of them (43%) survived, 2 of them without cardiogenic shock and/or cardiac arrest.

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