Singapore Med J 2007; 48 (8) : 789

CME Article

Electrocardiographical case. Beware of this ECG in patients presenting with cardiogenic shock

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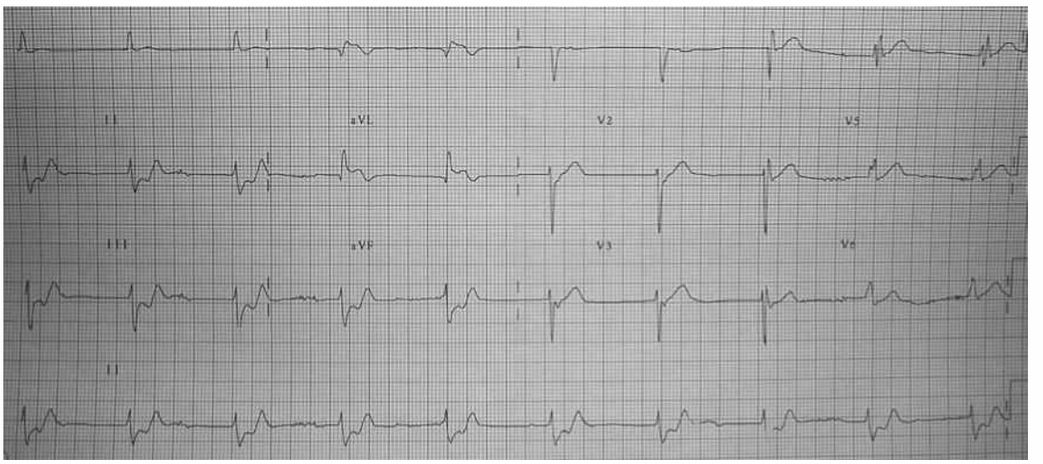

Fig. 1 12-lead ECG on admission.

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CLINICAL PRESENTATION

A 64-year-old Chinese man presented to the Accident and Emergency Department with the complaint of sudden onset of continuous central retrosternal crushing type of chest pain for a two-hour duration. The patient had a history of hypertension and smoked 20 sticks of cigarette a day for the past 30 years. Upon examination, the patient was diaphoretic with cold and clammy peripheries. Blood pressure (BP) was 68/41 mmHg, pulse rate was 53/min and oxygen saturation was 95% on high flow rebreather mask. Heart sounds were dual. There were bilateral crepitations in the lungs until the mid zone. Chest radiograph revealed pulmonary oedema. What does the electrocardiogram (ECG) show?

ECG INTERPRETATION

The ECG showed left anterior fascicular block with ST elevation in leads aVR and aVL, and ST depression in leads II, III and AVF (Fig. 1). The QRS complexes were broadened in precordial leads. There was no ST segment shift in the precordial leads.

DIAGNOSIS

Acute myocardial infarct (AMI) due to left main coronary artery (LMCA) occlusion.

CLINICAL COURSE

The patient was in cardiogenic shock. With inotropic and intra-aortic balloon pump (IABP) support, the patient underwent emergency coronary angiogram, which showed a totally occluded LMCA with TIMI 0 flow. A mobile thrombus was seen at the site of occlusion. The right coronary artery was dominant with minor irregularities. There were no collaterals to the left coronary artery (Fig. 2). After consultation with the cardiothoracic surgeon, a decision was made for percutaneous revascularisation. A 7F SL4 guider (Medtronic, Minneapolis, USA) was used. Two 0.014 inch PTCA guidewires (Renato and Asahi Soft Guidewires [Seto, Aichi, Japan]) crossed the left main occlusion easily into the left anterior descending (LAD) and left circumflex (LCX) arteries, respectively. Aspiration thrombectomy was performed with an EXPORT catheter (Medtronic, Minneapolis, USA).

There was transient initial re-establishment of TIMI 2 flow soon after the thrombectomy, but this was quickly followed by no re-flow phenomenon (Fig. 3). Despite administration of 100 mcg of intra-coronary adenosine and stenting of the residual 80% stenosis in LMCA, only sluggish TIMI 1 flow was achieved. His BP remained low while on inotropic and IABP support. The patient also developed episodes of ventricular tachycardia requiring cardioversion. Clinical course was further complicated by the development of acute renal failure. Despite maximal treatment, the patient passed away three days after the AMI. His peak CK was 18,000 U/L.

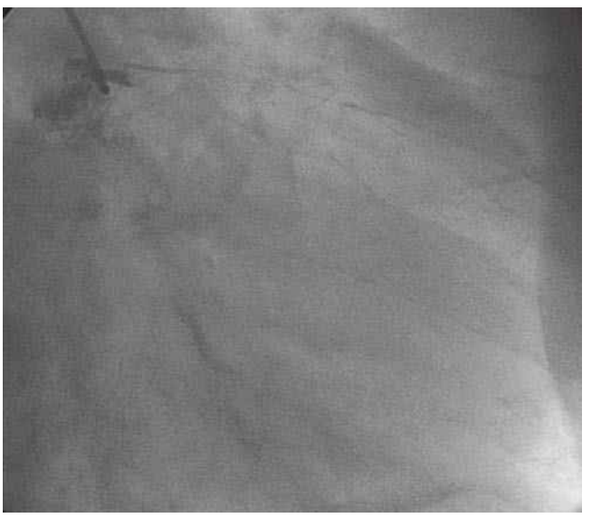

Fig. 2 Coronary angiogram (RAO caudal view) shows total occlusion of the left main coronary artery.

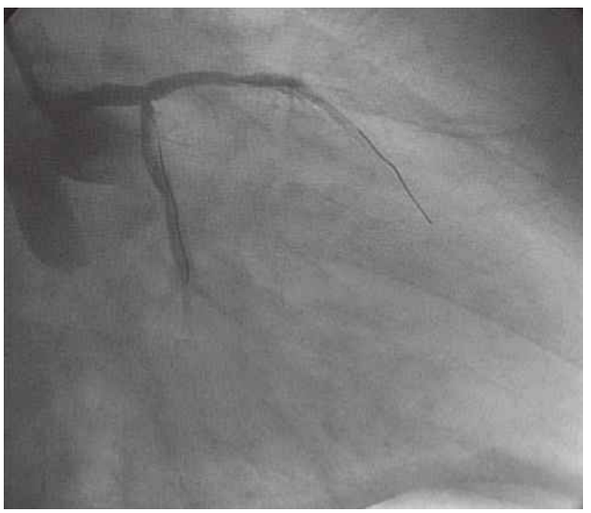

Fig. 3 Coronary angiogram (RAO caudal view) shows both the left anterior descending artery and the left circumflex artery cannulated with guidewires. Slow flow was noted after angioplasty of the left main coronary artery.

DISCUSSION

Compromise of a large area of myocardium in acute coronary syndrome (ACS) usually leads to haemodynamic instability. The most severe cases present with cardiogenic shock and high mortality. ECG is helpful in diagnosing the site and extent of myocardial ischaemia or injury. It also helps in risk stratification to guide the intensity of treatment for the ACS. For ST-segment elevation myocardial infarction, reperfusion therapy with either primary coronary angioplasty or thrombolytic therapy is indicated. In contrast, for non-ST segment elevation ACS (NSTE-ACS), intensive medical therapy (consisting of anti-ischaemic agents, antiplatelets and anticoagulants) followed by early coronary angiography and revascularisation (the so-called "early invasive approach"), is the current recommended method of treatment. This early invasive approach is especially beneficial for the moderate and high-risk sub-groups.

This dichotomous division of presenting ECG in ACS into "ST segment elevation" and "non-ST segment elevation" is generally useful in the clinical management. However, a specific sub-group of patients with NSTE-ACS warrants special attention. These patients may be having AMI due to acute LMCA occlusion. The ECG

pattern needs to be recognised, as early intervention may be life-saving. Acute LMCA occlusion is an uncommon angiographicaal finding in the setting of AMI. In one series, acute total or subtotal occlusion of LMCA was noted in 0.8% of 2,800 patients going for primary percutaneous transluminal coronary angioplasty (PTCA) for AMI.[1] As early revascularisation is potentially life-saving in this critical condition, early recognition is of paramount importance.

Clinical presentation of acute LMCA occlusion is usually stormy. Majority of the patients will be in cardiogenic shock on admission and need IABP support.[2] Malignant arrhythmia and cardiorespiratory failure requiring cardiopulmonary resuscitation and mechanical ventilation are common. In a series of left main coronary occlusion reported by Yip et al, cardiogenic shock was found in 77.8%, ventricular tachyarrhythmia in 33.3%, and acute respiratory failure requiring mechanical ventilatory support in 88.9% of the patients.[3] As such, left main occlusion should be suspected whenever a patient with ACS presents with the above-mentioned complications, especially cardiogenic shock.

Unlike the situations in ST-segment elevated anterior or inferior MI, the ECG changes in LMCA occlusion are often not as dramatic. There is no gross ST segment elevation in anterior or inferior leads. Instead, ST depression may be present in these leads. A casual ECG reader may misinterpret the ECG as one of NSTE-ACS. LMCA occlusion produces ischaemia not only in the anterior wall supplied by the LAD artery, but also results in posterior wall ischaemia from reduced flow in the LCX artery. Hence, acute LMCA occlusion may not cause ST elevation in the precordial leads due to concomitant posterior wall ischaemia producing counterbalancing electrical force. The ECG in our case did not have any ST elevation in the precordial leads at all. However, it showed ST elevation in leads aVR and aVL, with ST depression in inferior leads. Yamaji et al showed ST segment elevation in lead aVR with less ST segment elevation in lead V1 is an important predictor of acute LMCA obstruction.[4] The investigators suggested that ischaemia of the basal part of the interventricular septum is the electrocardiographic explanation for the occurrence of ST-segment elevation in this lead.

It has further been shown that ST elevation in both aVR and aVL, and ST depression in II, III or AVF with left anterior fascicular block (LAFB), predict AMI due to LMCA occlusion with high specificity and sensitivity, respectively.[5] Both these features were present in this patient's ECG. This underscores the importance of a careful evaluation of ECG features in ACS patients presenting with cardiogenic shock. The best method to reperfuse the occluded LMCA remains uncertain. Both coronary artery bypass graft surgery and PTCA in patients with LMCA occlusion presenting with cardiogenic shock still carry substantial morbidity and mortality. Prompt recognition of the clinical presentation and ECG features of LMCA occlusion is of vital importance. Hopefully with early and timely interventions, chances of survival will improve.

ABSTRACT

A 64-year-old Chinese man presented to the Accident and Emergency Department with chest pain and was found to be in cardiogenic shock. The electrocardiogram (ECG) showed features of acute myocardial infarction due to left main coronary artery occlusion, which had no ST elevation in precordial leads. Emergency coronary angiogram revealed left main coronary artery complete occlusion. Percutaneous intervention of the left main coronary artery was carried out. The epidemiology and clinical features of a left main occlusion were briefly described, and ECG features of a left main occlusion were discussed.

Keywords: acute myocardial infarction, cardiogenic shock, left main coronary artery occlusion

Singapore Med J 2007; 48(8):789–792

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SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME
Multiple Choice Questions (Code SMJ 200708B)

	True	False
Question 1. Clinical features of acute left main coronary artery occlusion include:		
(a) Cardiogenic shock.	☐	☐
(b) Chest pain.	☐	☐
(c) Malignant arrhythmia.	☐	☐
(d) Cardiorespiratory distress.	☐	☐
Question 2. ECG features of acute left main coronary artery occlusions are:		
(a) ST elevation in V1 higher than AVR.	☐	☐
(b) ST depression in inferior leads.	☐	☐
(c) Right bundle branch block (RBBB) and left anterior fascicular block (LAFB).	☐	☐
(d) ST depression in precordial leads.	☐	☐
Question 3. Regarding reperfusion to acute left main coronary artery occlusion:		
(a) The best method is primary PTCA.	☐	☐
(b) Emergency bypass should be offered in failed PTCA.	☐	☐
(c) Slow reflow is commonly seen during PTCA.	☐	☐
(d) Reperfusion carries significant mortality.	☐	☐
Question 4. Regarding treatment of non-ST elevated acute coronary syndrome:		
(a) Primary PTCA should be offered.	☐	☐
(b) The role of antiplatelet is unclear.	☐	☐
(c) Early invasive method includes early coronary angiogram and revascularisation.	☐	☐
(d) There is no role for medical treatment at all.	☐	☐
Question 5. Regarding acute left main coronary artery occlusion:		
(a) It is commonly seen in the cardiac catheterisation laboratory.	☐	☐
(b) It may present with no ST elevation on ECG.	☐	☐
(c) Early revascularisation improves outcome.	☐	☐
(d) ST elevation in aVR is due to ischaemia of the basal part of the interventricular septum.	☐	☐

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Name in full: _____

MCR number: _____ Specialty: _____

Email address: _____

SUBMISSION INSTRUCTIONS:
(1) Log on at the SMJ website: **www.sma.org.sg/cme/smj** and select the appropriate set of questions. (2) Select your answers and provide your name, email address and MCR number. Click on "Submit answers" to submit.

RESULTS:
(1) Answers will be published in the SMJ October 2007 issue. (2) The MCR numbers of successful candidates will be posted online at **www.sma.org.sg/cme/smj** by 15 October 2007. (3) All online submissions will receive an automatic email acknowledgment. (4) Passing mark is 60%. No mark will be deducted for incorrect answers. (5) The SMJ editorial office will submit the list of successful candidates to the Singapore Medical Council.

Deadline for submission: (August 2007 SMJ 3B CME programme): 12 noon, 25 September 2007