

A Man with Simultaneous Occurrence of Acute Lower Extremity Arterial Embolization and Acute Myocardial Infarction: A Case Report

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Case Report

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Abstract

Background: Spontaneous co-occurrence of acute myocardial infarction (AMI) and acute lower extremity arterial embolism (ALEAE) has rarely been reported.

Case presentation: A 44-year-old male with a history of 4 years of type1 diabetes was admitted to hospital when he suddenly experienced severe pain in his right lower limb and felt tightness in the left anterior chest area. Ultrasonography revealed distal occlusion of the right superficial femoral artery. ECG showed acute anterior interstitial myocardial infarction. After conservative treatment for 2 days, the patient had severe necrosis of lower limbs and secondary injury of multiple organs. Hemodialysis and heparin anticoagulant therapy were performed before amputation. Twelve days after the operation, the patient's condition was stable and he was transferred out of ICU.

Conclusions: Emergency amputation and multidisciplinary approaches may offer a chance for survival if patients lost the opportunity for early treatment.

Background

The most devastating complications of diabetes mellitus (DM) are microvascular and macrovascular lesions that clinically encompass cardiovascular disease (CVD), retinopathy, nephropathy and neuropathy ^[1]. Peripheral- and coronary artery embolism disease are not uncommon in diabetic patients ^[2]. Re-vascularization or thrombotomy at the embolized site may result in distal embolization. However, spontaneous co-occurrence of acute myocardial infarction (AMI) and acute lower extremity arterial embolism (ALEAE) has rarely been reported. Here, we report a case of type 1 diabetic male with simultaneous ALEAE and AMI.

Case Presentation

A 44-year-old male (BMI 22.5) with a history of 4 years of type1 diabetes was admitted to the local hospital when he suddenly experienced severe pain in his right lower limb while driving in the afternoon on the day of onset. During this period, the patient felt tightness in the left anterior chest area. Initial electrocardiogram (ECG) examination showed sinus tachycardia and ST-T segment changes. Ultrasonography revealed distal occlusion of the right superficial femoral artery. Laboratory tests indicated 35.06 ng/ml of myoglobin, 3.02 ng/ml of troponin I, 1138 pg/ml of BNP, 0.699 mg/L of D-Dimer, 98 µmol/L of serum creatinine (CRE). The patient received conservative treatment at the local hospital, but did not improve. Next day, the patient was transferred to a higher medical authority. At this time, myoglobin increased to 592.9 ng/ml, troponin to 3.33 ng/ml, BNP to 1930 pg/ml, and CRE to 101 µmol/L. Cardiac ultrasound revealed that the left ventricular ejection fraction was 28%, the left ventricular end-diastolic diameter was 61 mm, and the pressure gradient across pulmonary valve was 57 mmHg.

The patient was immediately transferred to our hospital for further treatment. The Chest CT showed suspicious infection of both lungs, interstitial lesions, and bilateral pleural effusion. ECG showed acute

anterior interstitial myocardial infarction (**Fig. 1**). The level of serum creatine kinase elevated to 30394 U/L, and CRE increased to 177.4 $\mu\text{mol/L}$. The skin color of the anterior tibia of the patient's right leg was significantly darker than that of the contralateral limb, accompanied by severe pain, and the fluctuation of dorsal foot artery disappeared (**Fig. 2**). There has been severe skeletal muscle necrosis in the affected lower extremities. After multidisciplinary consultation, it was decided that hemofiltration and heparin anticoagulant therapy should be performed immediately, followed by emergency right lower limb amputation.

ECG monitoring and oxygen inhalation were initiated upon admission to the operating room, and the patient was prepared for general anesthesia. Invasive blood pressure (IBP) monitoring was performed in the left radial artery before the induction of anesthesia. IBP was 140/80 mm Hg, heart rate was 110 beats per minute, and pulse oxygen saturation was 94%. The oxygenation index (OI) was about 310. General anesthesia was induced with etomidate, sufentanil, and cisatracurium, followed by endotracheal intubation. The tidal volume during mechanical ventilation was set at 6 ~ 8 ml/min and PEEP was 6 ~ 7cmH₂O. Norepinephrine was administered to maintain that the IBP fluctuated within $\pm 20\%$ of basal blood pressure during intraoperative period. The lowest oxygenation index of patient dropped to 150 during amputation performing. Methylprednisolone 0.5 g and dexamethasone 10 mg were administrated. Until the end of the amputation, the patient's OI returned to 210.

Then the intubated patient was transferred to the intensive care unit (ICU), and was extubated 3 days after operation. The creatine kinase of patient dropped to 5422 U/L on the first day after surgery, and returned to normal on the 9th day after the operation. Hemodialysis continued for nine days until creatinine levels returned to normal. Twelve days after the operation, the patient's condition was stable and he was transferred from ICU to the general ward of cardiology department for further treatment.

Discussion

Both DM and other disorders of glucose metabolism are risk factors for CVD. In diabetic patients with pervasive insulin resistance, the development of CVD is characterized by early endothelial dysfunction and vascular inflammation, leading to mononuclear cell recruitment, foam cell formation, and subsequent development of fat striations. More than half the mortality and a vast amount of morbidity in people with DM is related to CVD [2].

The causes of myocardial infarction in diabetic patients may be multifactorial. Coronary artery embolism (CE), in which obstructive material enters the coronary artery, block its blood flow, and cause ischemia, is an uncommon cause of AMI. Patients with CE represent a high-risk subgroup of patients with AMI [3]. The shedding of cardiogenic embolus can theoretically lead to embolization of lower extremity arteries, but spontaneous co-occurrence of acute embolization of the coronary arteries and the great arteries of the lower limbs is very rare.

Previous study reported that atrial fibrillation (AF) is the most frequent cause of CE [4]. DM is frequent in patients with AF. Community studies demonstrated the presence of DM in 13% of patients with AF [3]. However, DM is not necessarily an independent risk factor for AF. The patient in this case did not have AF. In the follow-up of the medical history, the patients diagnosed with type 1 diabetes did not control or monitor his blood glucose in any way. Due to the difficulty in using insulin to control blood glucose during hospitalization, we suspected that the patient's blood glucose level before admission was not well controlled. Therefore, he was at high risk of developing CVD due to long-term hyperglycemia. We speculated that the most likely cause of AMI in this patient was shedding of embolus in coronary artery or changes in coronary blood flow under stress state after lower limb artery occlusion.

In addition to cardiovascular disease, DM is also considered as an established risk factor for cerebrovascular and peripheral vascular diseases including stroke and peripheral artery disease (PAD) [5]. A proinflammatory state in diabetic patients was considered as a possible reason that increased the levels of some clotting factors and impaired the fibrinolytic system leading to a hypercoagulable state. But the association between DM and venous thromboembolism (VTE) was not seemed to be confirmed by studies [5, 6]. Recently study reported that type 1 DM appeared to be an independent risk factor for VTE development [7]. We know that the clinical characteristics between arterial and venous embolic diseases are different. The symptoms and signs of PAD are variable. Arterial ischemia is often characterized by low skin temperature, pain, or intermittent claudication. However, studies have demonstrated that the majority of patients with confirmed PAD do not have typical claudication [8]. Acute limb ischemia (ALI) is one of the most treatable and potentially devastating presentations of PAD. This present case patient presented with an acute embolism of the lower extremity arteries, without any other PAD related symptoms before admission. Long-term abnormal blood glucose level in this patient may be a potential cause of lower extremity arterial disease (LEAD).

LEAD is particularly frequent in DM patients with worse outcomes, especially the risk of lower limb amputation (LLA), compared with non-diabetic subjects [9–11]. The pathogenesis of LEAD in individuals with diabetes included endothelial dysfunction and increased arterial wall stiffness, which may promote the process of atherosclerosis [12, 13]. Treatment strategies for LEAD patients include drug therapy and surgical or endovascular revascularization. However, in patients with ALEAE, the earlier the embolus is removed, the better the chance of preserving the lower extremity function. According to the guideline suggestion that if expertise of treatment for acute ischemia is not locally or rapidly available, there should be strong consideration of transfer of the patient to a facility with such resources [14].

Lower extremity symptoms in ALI can include both pain and loss of function. The longer these symptoms are present, the less likely the possibility of limb salvage [15, 16]. The duration of skeletal muscle tolerance to ischemia is roughly 4–6 hours [17]. Systemic anticoagulation with heparin should be administered in patients with ALI unless contraindicated. For threatened limbs, revascularization should be performed emergently within 6 hours. For viable limbs revascularization should be performed within 6–24 hours. In

the setting of prolonged ischemia (> 6 to 8 hours) are unlikely to save the limb, and the reperfusion and circulation of ischemic metabolites can result in multiorgan failure and cardiovascular collapse.

In this present case, the patient underwent amputation under general anesthesia during the stage of AMI. Preoperative multidisciplinary consultation provided adequate treatment preparation for patient. We used glucocorticoids intraoperatively to prevent the release of ischemic metabolites that cause inflammation during amputation. Protective lung ventilation strategies improved patients' OI. Although studies^[18] have reported that regional anesthesia alone may be safer for amputations in critically ill patients, we consider that stress response under regional anesthesia may increase the risk of cardiac ischemia. Appropriate hemodynamic support and ventilation strategies under general anesthesia may reduce organ response to tissue necrosis metabolites.

Conclusion

Simultaneous occurrence of AMI and ALEAE spontaneously is very rare. Effective treatment for early acute arterial ischemia is important. Emergency amputation and multidisciplinary approaches may offer patients a chance for survival if they lost the opportunity for early treatment.

Abbreviations

AMI=acute myocardial infarction

ALEAE=acute lower extremity arterial embolization

CE=Coronary artery embolism

PAD=peripheral artery disease

ALI=Acute limb ischemia

LEAD=lower extremity arterial disease

CVD= cardiovascular disease

DM= diabetes mellitus

OI= oxygenation index

Declarations

Ethics approval and patient consent:

The ethics committee of the Aerospace Center Hospital in the city of Beijing has reviewed this case report and approved its publication.

Consent for publication:

Informed consent for the publication of the case report was obtained from the patient and his wife in written form.

Availability of data and materials:

The data analyzed in this case report are not publicly available due to the privacy policies of the hospital but may be requested from the corresponding author if deemed reasonable.

Competing interests

The authors have nothing to disclose and no conflicts of interest.

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Authors' contributions:

L-Y Lu drafted the manuscript and performed anesthesia together with Y-Y Xue. Y-L Han performed cardiology treatment. T-X Bao performed an orthopedic amputation. Z-M Yang supervised the surgical procedure and revised of manuscript. All authors read and approved the final manuscript.

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Figures

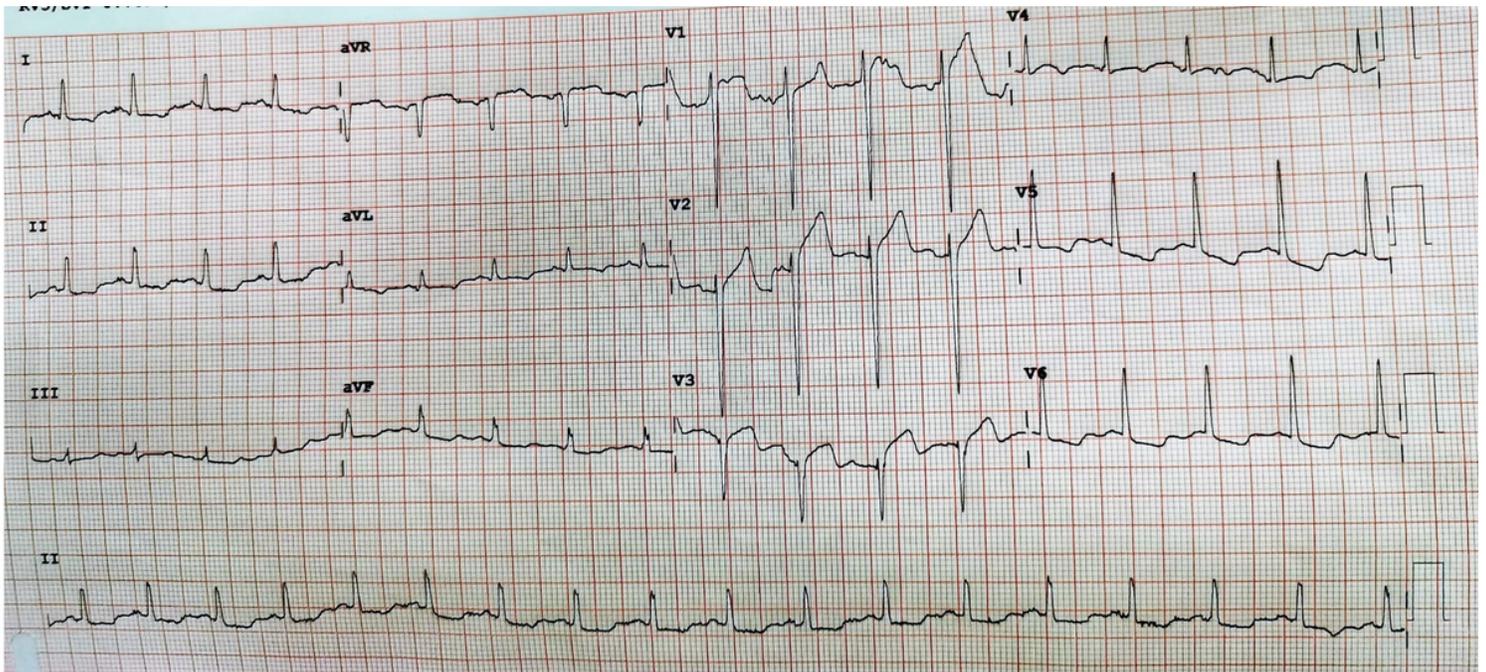


Figure 1

The patient was immediately transferred to our hospital for further treatment. The Chest CT showed suspicious infection of both lungs, interstitial lesions, and bilateral pleural effusion. ECG showed acute anterior interstitial myocardial infarction



Figure 2

The level of serum creatine kinase elevated to 30394U/L, and CRE increased to 177.4 μ mol/L. The skin color of the anterior tibia of the patient's right leg was significantly darker than that of the contralateral limb, accompanied by severe pain, and the fluctuation of dorsal foot artery disappeared

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