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Successful treatment of left main coronary artery total occlusion combined with cardiogenic shock

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Abstract

Acute myocardial infarction (AMI) caused by total occlusion of the left main coronary artery (LMCA) is a catastrophic event. However, the clinical features and appropriate treatment of patients with this condition remain unclear. We report a man with total occlusion of the LMCA presenting with AMI combined with cardiogenic shock. He was successfully treated with angioplasty and drug-eluting stent implantation assisted by an intra-aortic balloon pump (IABP). This case suggests that percutaneous coronary intervention may be an optional therapeutic strategy in these patients, and that IABP implantation could improve clinical outcomes. A dominant right coronary artery and enhanced collateral circulation were considered to be key features related to the patient's survival.

Keywords

Left main coronary artery occlusion, percutaneous coronary intervention, intra-aortic balloon pump, shock, ST-elevation infarction, acute myocardial infarction

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Introduction

Acute total obstruction of the left main coronary artery (LMCA) resulting in acute myocardial infarction (AMI) is a rare clinical event, with incidences of 0.025% to 0.13% in different studies of patients with AMI undergoing coronary angiography.[1,2] The left main stem (LMS) provides two

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thirds of the myocardial blood supply, and acute occlusion of the LMS before establishment of the collateral circulation is often complicated by cardiogenic shock. Early reperfusion is associated with improved outcomes in patients with myocardial infarction complicated with shock.[3] However, serious reperfusion injury and malignant arrhythmia during surgery or percutaneous coronary intervention (PCI) reduce the long-term prognosis.[4] Herein, we report a 59-year-old man who experienced AMI and cardiogenic shock with acute total LMCA obstruction, and discuss the advantages and drawbacks of various methods of treatment.

Case report

A 59-year-old man with a 40-year history of smoking and 2-year history of hypertension presented to his local hospital with severe chest pain and dyspnea. Electrocardiogram (ECG) results suggested extensive anterior AMI. Dual antiplatelet therapy, anticoagulation, and statins were administered, but he refused further invasive treatment. His symptoms were slightly relieved but he continued to experience repeated chest pain attacks. He was referred to our hospital on the 8th day. His vital signs on admission were a heart rate of 108 beats/minute and blood pressure of 86/66 mmHg. The ECG showed ST-segment elevation in leads aVL and V1-V6, with significant ST depression in leads II, III, and aVF (Figure 1). An echocardiogram displayed anterior, septal, lateral, and inferior akinesia and severely impaired left ventricular function with an ejection fraction (EF) of 18%. Extensive anterior AMI (Killip Class IV) and cardiogenic shock were diagnosed. The patient was transferred immediately to the catheterization laboratory and an intra-aortic balloon pump (IABP) was placed via the right femoral artery (Figure 2a). Diagnostic coronary angiography revealed a dominant right coronary artery (RCA) and acute total occlusion of the distal LMS with no anterograde flow (Figure 2b). There was no significant stenosis in the RCA and the posterior descending and posterolateral ventricular branches were also normal (Figure 2c and 2d). He was treated with implantation of a paclitaxel-eluting stent in the proximal left anterior descending artery and distal LMS (Figure 3a and 3b). There was no residual stenosis, thrombus, or dissection after stent implantation, with TIMI 3 flow. However, he developed atrial tachycardia and was treated with amiodarone. The IABP was successfully removed 10 days after PCI. The patient subsequently made satisfactory progress and was discharged 23 days after hospital admission, with an EF of 41%. Angiography showed unobstructed stents 1 year later (Figure 3c) and an EF of 37% (NYHA Class II). The patient remained alive after 3 years of follow-up, with whole-heart enlargement and severe mitral regurgitation, and an EF of 32% (NYHA Class III) (Figure 3d).

The study protocol was approved by the institutional review board and Ethics Committee of The First Affiliated Hospital of Guangdong Pharmaceutical University. Written informed consent was obtained from the patient.

Discussion

AMI induced by total LMCA obstruction is a catastrophic event. However, its incidence is difficult to measure because many patients die outside the hospital. Existing statistics are inconsistent in terms of the definition, with some studies defining the condition as LMCA-related myocardial infarction with LMCA stenosis >50% but still with anterograde blood flow. Among survivors arriving at the hospital, coronary angiography often showed a dominant RCA and enhanced collateral circulation. The current patient underwent PCI

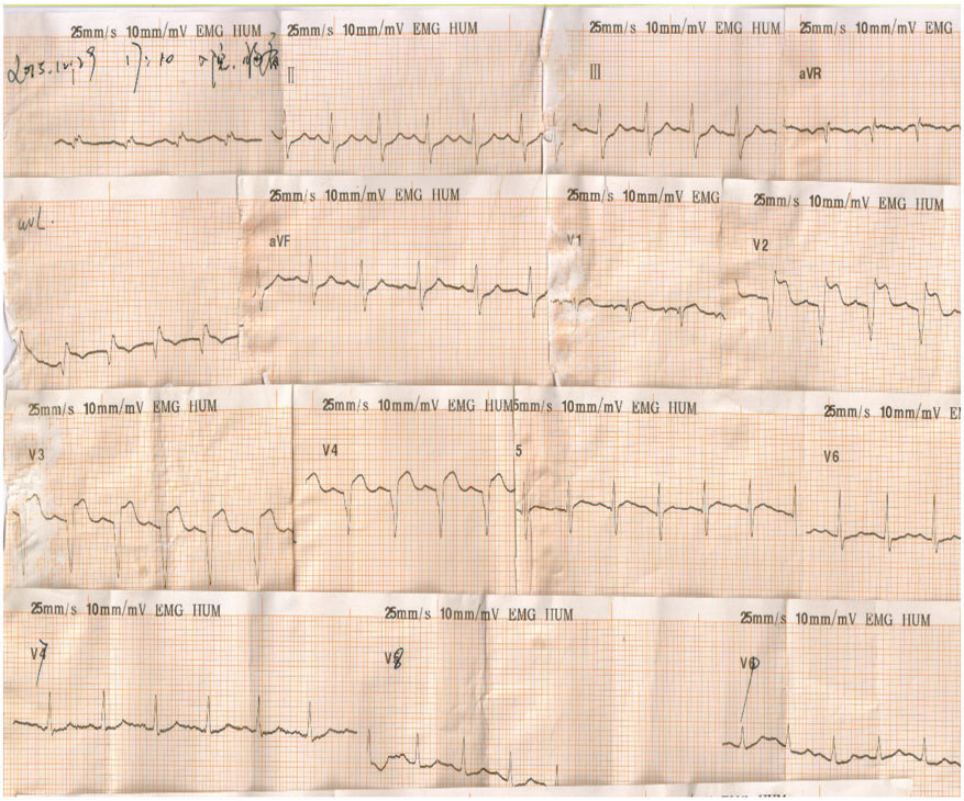

Figure 1. Electrocardiogram at first medical contact

immediately after admission and was found to have a dominant RCA and excellent collateral supply. He survived surgery and had a cardiac function of NYHA Class II–III after 3 years of follow-up. Some of the left ventricle was still supplied by the RCA, and his left ventricular systolic function was therefore not completely damaged. The incidence of cardiogenic shock in such patients can be as high as 50%, and is a significant independent predictor of mortality.[5,6] Patients with myocardial infarction complicated with cardiogenic shock are commonly treated with IABP. However, previous studies have suggested that placement of an IABP in AMI patients with cardiogenic shock under coronary angiography does not reduce the incidence of major adverse cardiovascular events, and is significantly associated with increased mortality.[7] However, guidelines (2017 ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation) suggest IABP for Class III with level B evidence.[8] Recent observational studies found similar mortality rates and risks of major cardiac and cerebrovascular events in patients with and without IABP implantation.[9] This may be due to the often poor basal conditions and higher mortality of patients with left main shock syndrome. Meanwhile, extracorporeal membrane oxygenation (ECMO) also provides a portable, rapid means of mechanical cardiopulmonary support for patients with cardiogenic shock. Nevertheless, ECMO resources are highly demanding, its initiation is usually based

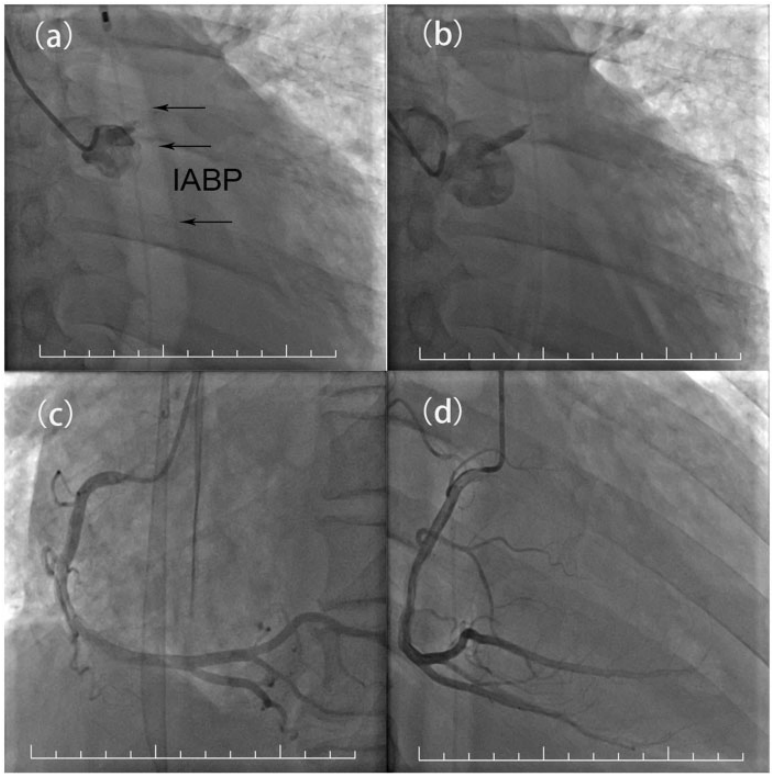

Figure 2. (a) Intra-aortic balloon pump already functioning; (b) occlusion of the left main coronary artery; (c and d) normal right coronary artery. The arrows indicate implantation of IABP. IABP, intra-aortic balloon pump

on subjective criteria, and it carries a considerable risk of serious complications. However, because left ventricular assist devices (LVADs) are often not available in clinical practice, these patients usually require IABP implantation.[8] Insertion of an easy-to-implant LVAD may be the best choice in these high-risk patients, but there is currently no relevant data to support this.

The therapeutic strategies for total occlusion of the LMCA include thrombolytic therapy, PCI, and emergency coronary artery bypass grafting. However, patients with left main shock syndrome do not benefit from thrombolytic therapy.[10] Compared with coronary artery bypass grafting, patients undergoing PCI had a shorter reperfusion time but higher incidence of ventricular tachycardia.[11] The mechanism responsible for this phenomenon is still not clear, but may be related to reperfusion injury.

We summarize the following three important features/steps related to the successful treatment of the current patient. First, a dominant RCA and enhanced collateral circulation were key features relating to survival. Second, implantation of an IABP before PCI helped maintain his hemodynamic status during the critical ischemic time. Third, the patient was transferred immediately to the catheterization laboratory on arrival at the hospital, and PCI of the LMCA promptly shortened the ischemic time. We therefore recommend PCI and IABP treatment in patients with

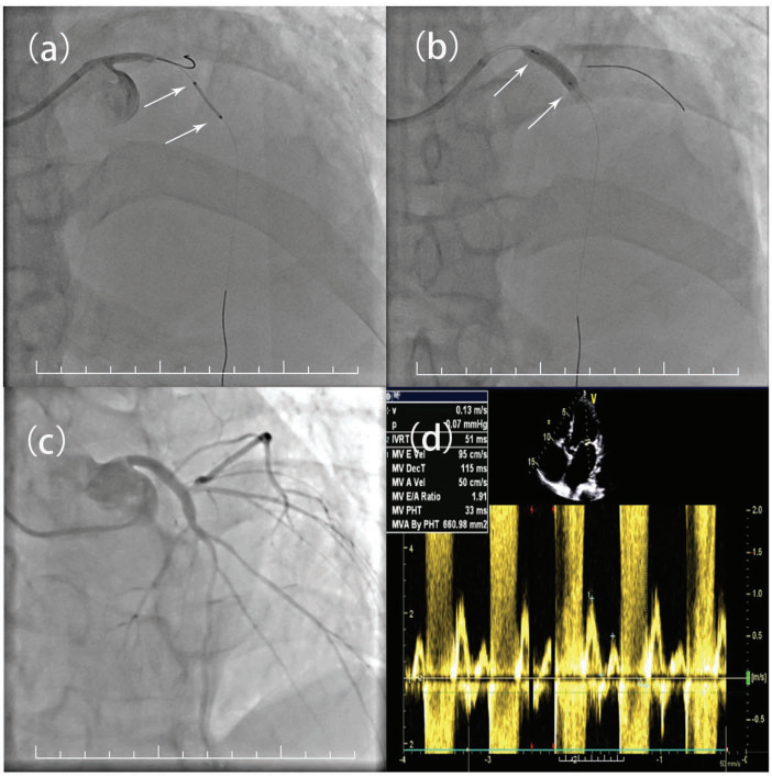

Figure 3. (a) Stent in proximal left anterior descendant artery; (b) stent in distal left main stem; (c) stents unobstructed (1-year follow-up); (d) heart enlargement and severe mitral regurgitation (3-year follow-up). The arrows in panel "a" indicate a stent in the proximal left anterior descending artery. The arrows in panel "b" indicate a stent in the distal left main stem

acute LMCA occlusion if LVAD is not available. This procedure can greatly shorten the time from first medical contact to revascularization and may thus improve hemodynamic stability.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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