



Case Report

Successful resuscitation with extracorporeal membrane oxygenation support for refractory ventricular fibrillation caused by left main coronary artery occlusion



Ting-Yuan Ni ^a, Fu-Yuan Siao ^{a,b,*}, Chun-Wen Chiu ^a, Hsu-Heng Yen ^c

^a Department of Emergency Medicine, Changhua Christian Hospital, Changhua, Taiwan

^b Department of Mechanical Engineering, Chung Yuan Christian University, Taoyuan, Taiwan

^c Department of Internal Medicine, Changhua Christian Hospital, Changhua, Taiwan

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ABSTRACT

Refractory ventricular fibrillation with cardiac arrest caused by occlusion of the left main coronary artery may rapidly become fatal. In this report, we describe the case of a 70-year-old male who presented to emergency department with chest pain. Electrocardiogram showed ST-segment elevation in leads aVR and aVL and ST-segment depression in leads v3, v4, v5, v6, 2, 3, and aVF. Occlusion of the left main coronary artery was suspected. While waiting for percutaneous coronary intervention, the patient experienced sudden refractory ventricular fibrillation with cardiac arrest. In the emergency department, resuscitation of a patient with refractory ventricular fibrillation caused by occlusion of the left main coronary artery and ongoing cardiopulmonary resuscitation is a clinical challenge. Resuscitation with extracorporeal membrane oxygenation support was initiated approximately 35 min after prolonged conventional cardiopulmonary resuscitation. Emergency coronary angiography showed almost total occlusion of the left main coronary artery. Percutaneous coronary intervention with a stent restored coronary perfusion. The patient was discharged on day 6 without serious sequelae or neurological deficits.

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1. Introduction

Sustained return of spontaneous circulation (ROSC) was not achieved after prolonged conventional cardiopulmonary resuscitation (CPR) due to refractory ventricular fibrillation with cardiac arrest caused by left main coronary occlusion. Resuscitation with extracorporeal membrane oxygenation (ECMO) support was initiated for refractory ventricular fibrillation, resulting in sustained ROSC, permitting subsequent percutaneous coronary intervention (PCI) with a stent. PCI restored coronary perfusion and enabled good recovery.

2. Case report

A 70-year-old male presented with chest pain that lasted for 30 min. He had no significant previous medical history or family history. In the emergency department, he presented with fatigue and was diaphoretic, with the following clinical parameters: blood pressure, 126/72 mm Hg; respiration rate, 22 breaths/min; pulse, 98 beats/min; and oxygen saturation, 96%. A chest X-ray performed on admission revealed mild

pulmonary edema. The patient's electrocardiogram showed ST-segment elevation in leads aVR and aVL and ST-segment depression in leads v4, v5, v6, 2, 3, and aVF (Fig. 1). Occlusion of the left main coronary artery was suspected. Aspirin at 300 mg, one sublingual nitroglycerin tablet, clopidogrel at 300 mg, and intravenous heparin at 4000 U followed by 12 U/kg/min were administered. In addition, the PCI team was informed and activated. The cardiac monitor showed irregular wide QRS complexes followed by ventricular fibrillation. Immediate defibrillation using 200 J (biphasic waveforms) and advanced cardiopulmonary life support were provided. Ventricular fibrillation was resistant to three defibrillations, 3 mg of epinephrine, and 600 mg of amiodarone, and there was no ROSC after CPR for >15 min. Based on the diagnosis of refractory ventricular fibrillation secondary to acute myocardial infarction, it was decided to use ECMO for CPR. Mechanical chest compression devices were used during the ECMO set-up, and the duration of resuscitation was approximately 35 min, after which sustained ROSC was achieved. Levels of the cardiac enzyme troponin I were found to be elevated (1.7 ng/ml), whereas those of electrolytes were within the normal range. In addition, echocardiography revealed diffuse left ventricular hypokinesia with a left ventricular ejection fraction of 5%. An emergency coronary angiography showed almost total occlusion of the left main coronary artery (Fig. 2). PCI with a stent restored coronary perfusion (Fig. 3) within 100 min after the onset of

* Corresponding author at: Department of Emergency Medicine, Changhua Christian Medical Center, Changhua, Taiwan.

E-mail address: 57385@cch.org.tw (F.-Y. Siao).

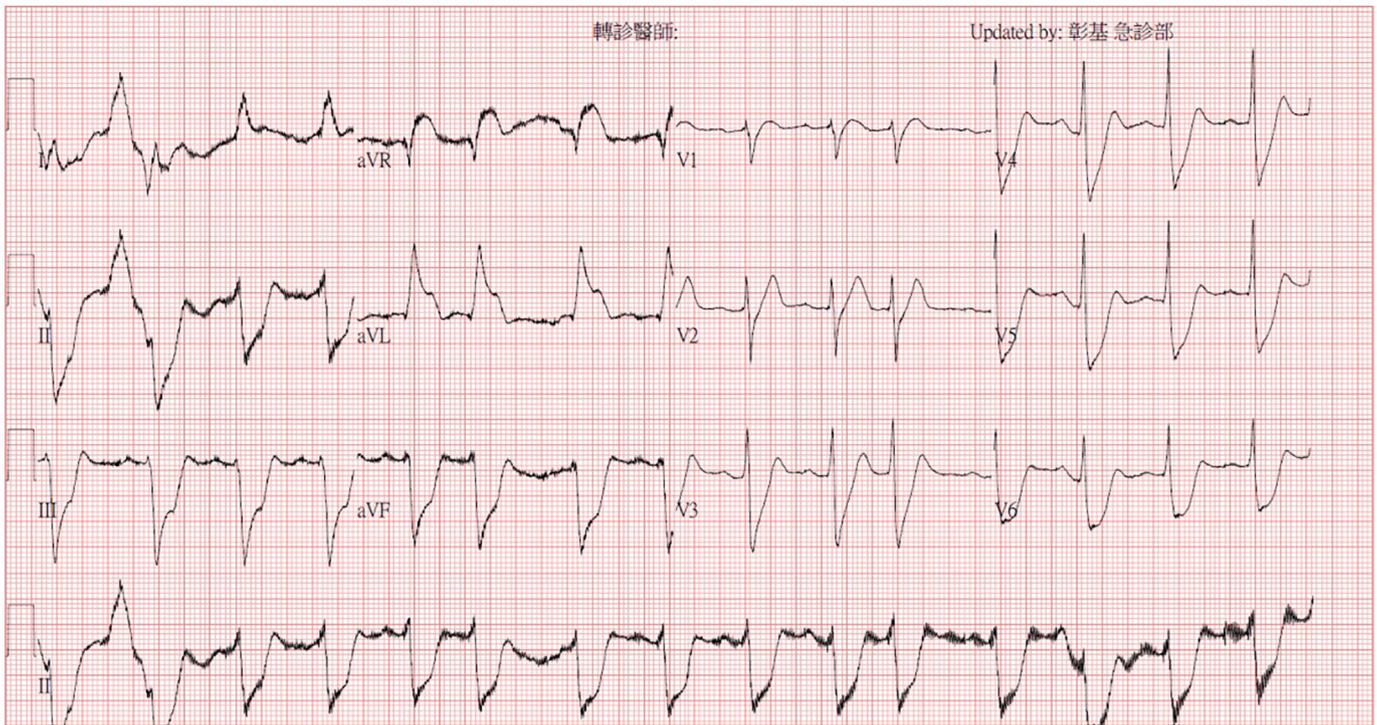


Fig. 1. The electrocardiogram revealed ST-segment elevation in leads aVR and aVL and ST-segment depression in leads v4, v5, v6, 2, 3, and aVF.

chest pain, followed by a normal electrocardiogram (Fig. 4). Post-resuscitation and reperfusion treatment, serial echocardiograms revealed gradual recovery of cardiac contractility; the left ventricular

ejection fraction increased from 5% to 60% in the following 4 days. The patient was discharged on day 6, without serious sequelae or neurological deficits.

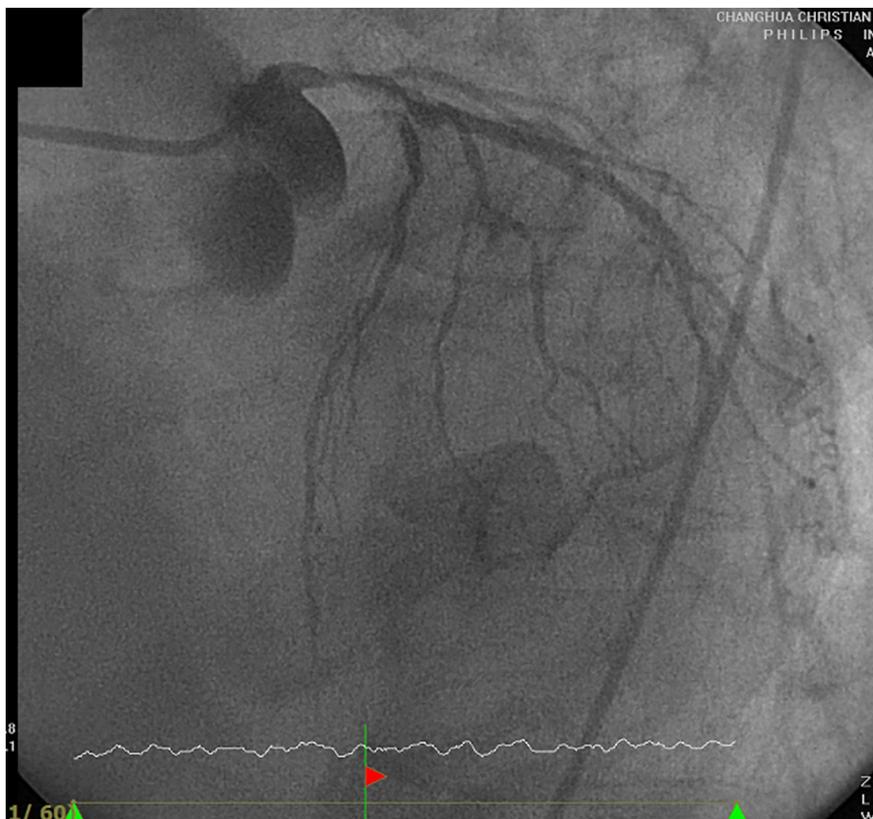


Fig. 2. Coronary angiography showed obstructive lesions in the left main coronary artery.

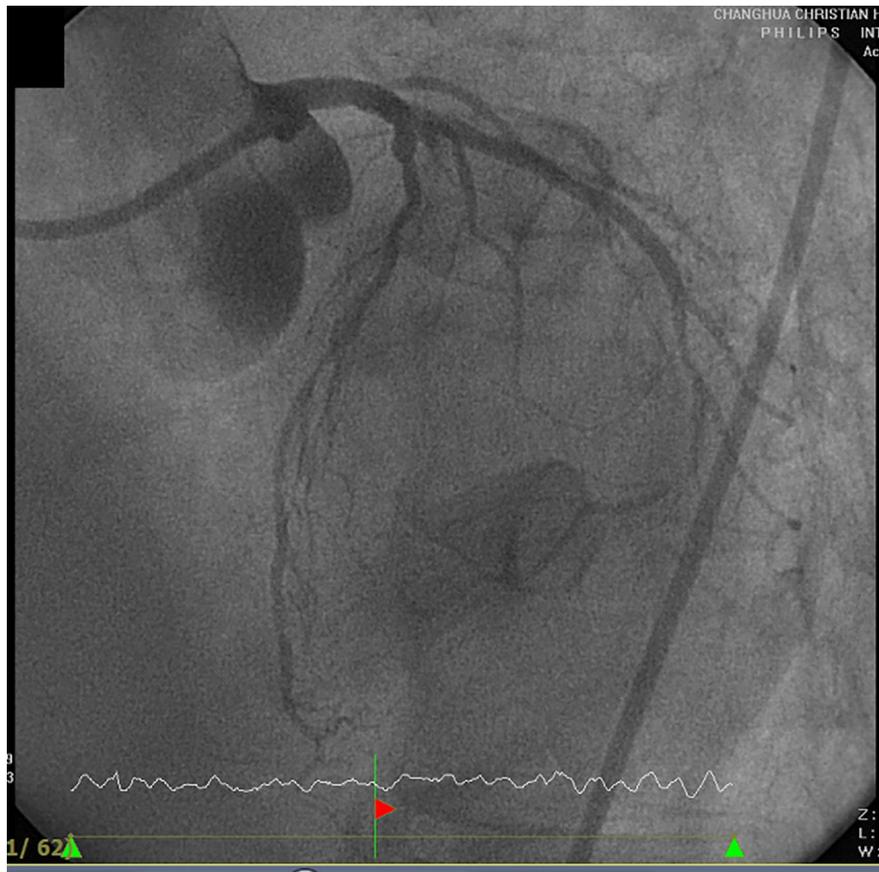


Fig. 3. Coronary angiography showed restored coronary perfusion after stent implantation.

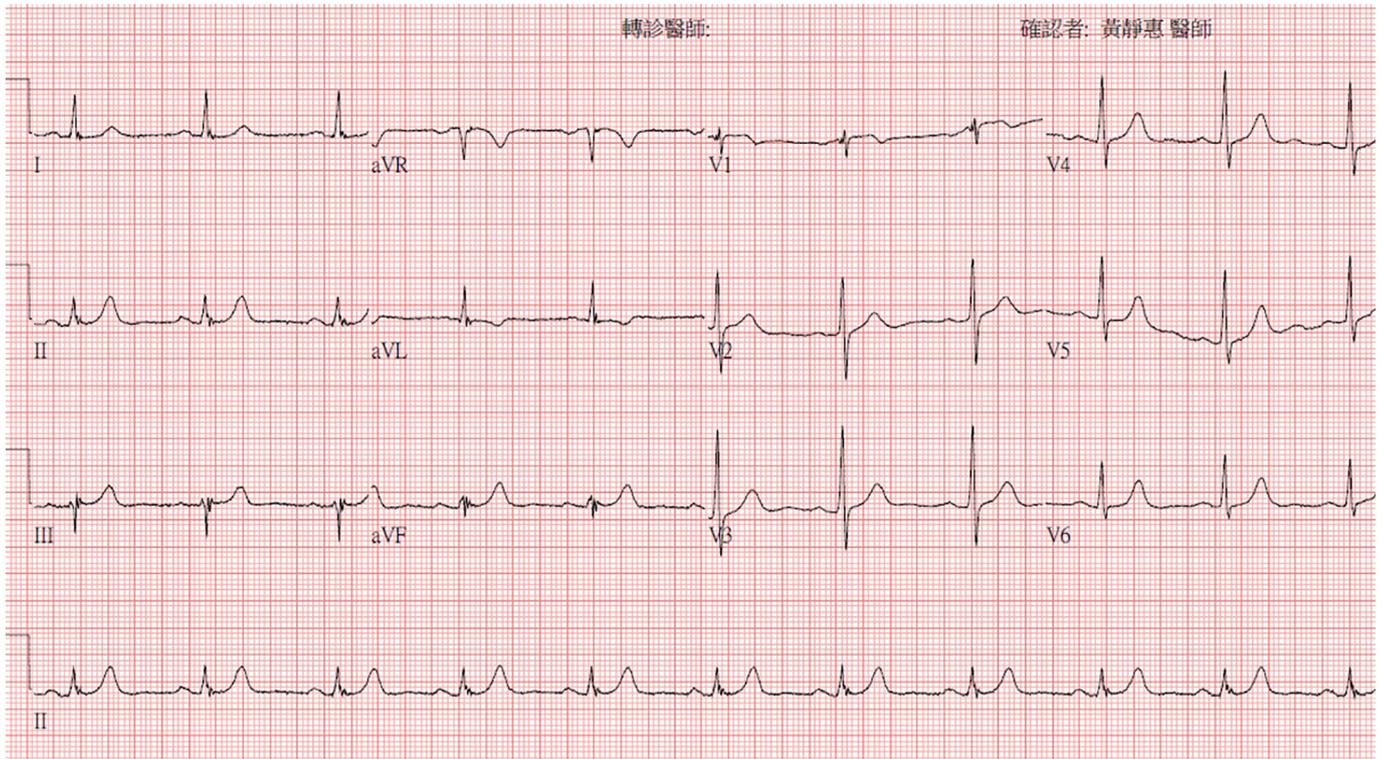


Fig. 4. The electrocardiogram normalized after percutaneous coronary intervention.

3. Discussion

The present case showed ST-segment elevation >5 mm (0.5 mV) in leads aVR and aVL with less ST-segment elevation in lead V1, and multilead ST-segment depression ≥ 1 mm (0.1 mV) in leads v4, v5, v6, 2, 3, and aVF, implicating occlusion of the left main coronary artery. These findings can result in a challenging clinical course [1,2].

Refractory ventricular fibrillation secondary to acute myocardial infarction caused by occlusion of the left main coronary artery will rapidly lead to death without quick intervention. According to the 2015 American Heart Association Guideline for CPR and Emergency Cardiovascular Care, emergency coronary angiography is recommended for patients with a suspected etiology of cardiac arrest and ST-segment elevation observed on electrocardiogram [3]. In the presence of refractory ventricular fibrillation requiring ongoing CPR, our main clinical obstacle was the transfer of this patient to the cardiac catheterization lab. To overcome this, ECMO can be utilized in the place of mechanical CPR.

Timely use of ECMO helps maintain perfusion to vital organs during resuscitation, and in this challenging case, it permitted the subsequent life-saving intervention. The survival rate of conventional CPR had improved from 15.4% in 1998 to 24.4% in 2015, but neurologic outcomes have remained poor [4,5]. An increasing number of studies have demonstrated advantages of ECMO-CPR over conventional CPR for refractory ventricular fibrillation in terms of neurologic outcomes (40.0% vs 7.5% and 41.9% vs 15.3%, respectively) [6,7]. These investigations revealed a high prevalence of acute myocardial infarction in patients with refractory ventricular fibrillation. Hence, early recognition of ECG changes indicating the need for emergent reperfusion [8] and implementation of ECMO-CPR when conventional CPR failed helped to save our patient's life. The present case demonstrates that the timely use of ECMO-CPR to maintain perfusion to vital organs during resuscitation in the emergency department provides time for subsequent intervention, which shall contribute to improved survival and neurologic outcomes.

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Disclosures

The authors have no conflict of interest to disclose.

Author contributions

Ting-Yuan Ni and Hsu-Heng Yen contributed equally to the care of the patient and writing and final approval of the manuscript. All the authors review and approve the final manuscript.

Writing assistance

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