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[Case Report]

SURVIVAL OF A REFRACTORY VENTRICULAR FIBRILLATION BY COOPERATIVE TREATMENTS

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Abstract : In the case of acute myocardial infarction (AMI), prompt and appropriate initial treatment is essential for increasing the rate of survival and early reperfusion is a main determinant factor for long-term prognosis. The survival of a patient with refractory ventricular fibrillation was made possible by cooperative emergency medical care including air medical transport, despite long distance to the hospital. The patient was a 60-year-old man. Under a diagnosis of AMI, a helicopter emergency medical service (HEMS) with medical staff on board was requested. Although ventricular fibrillation (VF) occurred at the scene, quick and appropriate advanced cardiovascular life support (ACLS) was provided by the attending doctor, leading to the return of heartbeat. Since the patient still exhibited serious bradycardia and cardiac failure, he was airlifted while undergoing transcutaneous pacing. Upon arrival at the hospital, the patient underwent emergency percutaneous coronary intervention (PCI). During the PCI, VF recurred and chest compressions and a total of 17 defibrillations were performed. The PCI was continued with percutaneous cardiopulmonary support (PCPS). The patient survived without sequelae. Smoother cooperation between pre-hospital medical procedures and post-hospital emergency care is considered to be essential for the survival of patients such as this case.

Key words : acute myocardial infarction, refractory ventricular fibrillation, percutaneous cardiopulmonary support, helicopter emergency medical service

INTRODUCTION

In many patients with acute myocardial infarction (AMI), fatal arrhythmia and serious cardiac failure often occur. The treatment for ventricular fibrillation (VF) requires electrical defibrillation, followed by advanced cardiovascular life support (ACLS). To improve the prognosis of AMI, it is essential to quickly identify the underlying disease and transport the patient to an appropriate medical institution promptly. While performing the initial treatment, the quick judgment must be made by the emergency rescue team[1,2)]. However, sometimes it is difficult to implement the above measures in regions which are in remote locations from a medical institution. On the other hand, the helicopter emergency medical service (HEMS) is a system which enables quick dispatching of the medical staff consisting of a doctors and a nurse well versed in emergency medical care. Therefore, HEMS has the characteristics to greatly reduce the transport time to the hospital, and it is capable of providing the transport of the patient to a medical institution quickly for essential treatments. This system can thus greatly increase the chances of survival for emergency patients with serious diseases[3-5)].

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We will report a patient with AMI and recurrent VF, in whom shortened transportation time by HEMS would have been essential for his survival and full recovery.

CASE REPORT

The patient was a 60-year-old man who had been taking antihypertensive agents for over ten years. He experienced strong anterior chest pain at around 11 : 30 a.m. when he was mowing the grass at home. At about 12 : 00 noon, he called for an ambulance by his cellular phone. Upon arrival of emergency rescue team, ST-segment elevation and ventricular tachycardia were monitored electrocardiographically (Figure 1a), and acute coronary syndrome (ACS) was suspected. Since the scene was in a remote mountainous area, it was anticipated that it would take a long time to transport this patient to an appropriate hospital by ambulance car. HEMS was requested from the scene at 12 : 36. Four minutes later, the doctor helicopter departed from the base hospital and arrived at the scene at 12 : 49, the patient was able to talk in a clear consciousness level at that time. He was diagnosed as suffering from ACS. He suddenly lost his consciousness before commencing helicopter transport. VF was detected on the electrocardiogram (ECG) monitor. ACLS was started by the medical staff. Chest compressions, the defibrillation of three times in total (Figure 1b), and intubation were performed while epinephrine, lidocaine and magnesium were administered intraveneously. The patient's heartbeat returned (Figure 1c) and after confirming the

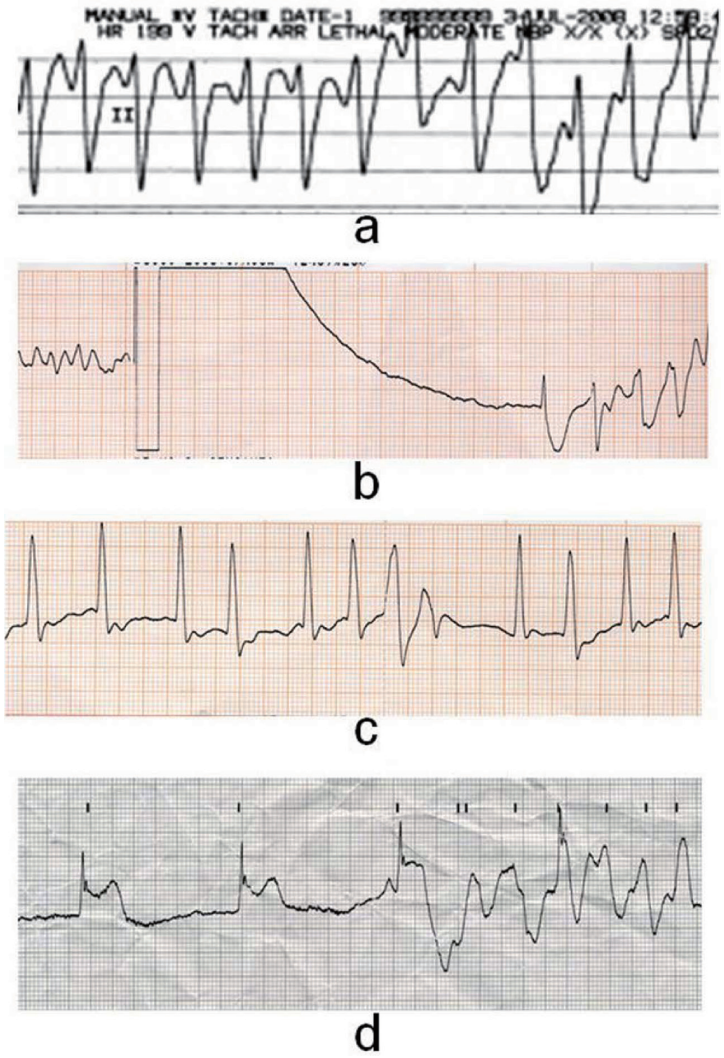

Fig. 1. (a) Ventricular tachycardia (VT) occurred during transport by emergency rescue team. (b) Three automated external defibrillations (AEDs) were performed. (c) ECG monitor showed R on T ventricular premature beat when the patient was carried into the helicopter. (d) ECG monitor showed bradycardia with noise caused by chest compressions.

beat of the carotid artery, the patient and the medical staff became airborne at 13 : 15. During the flight to the university hospital, complete A-V block with a heart rate of 30-40 beats/min and the carotid arterial pulse was occasionally nonpalpable, therefore transcutaneous pacing (TCP) and cardiopulmonary resuscitation (CPR) were performed (Figure 1d). SpO2 could not be detected during transport.

When the patient was admitted to the emergency outpatient unit at 13 : 42 (i.e., 27 min after departure), the patient's consciousness level was $E_1V_TM_2$ on the Glasgow Coma Scale (GCS) and his blood pressure was unmeasurable since the common carotid artery was barely palpable. Twelve-lead resting ECG revealed ST elevation in II, III, and aVF leads and escapes rhythm at the heart rate of 40 beats/min (Fig. 2). Echocardiography revealed extensive akinesis of the inferior wall. Laboratory findings at the time of admission showed a slightly increased white blood cell count and transaminase level. Creatine kinase (CK) and CKMB were in the normal range (CK elevated at the value of 2053 IU/L and CKMB, 201 ng/ml at 21 : 00). Arterial blood gas analysis showed progression of acidosis. These findings revealed that the patient had AMI in the right coronary artery.

With transvenous pacing and intra-aortic balloon pumping (IAPP), percutaneous coronary intervention (PCI) was performed for complete occlusion of right coronary artery (#1) at 14 : 04, however VF occurred during this treatment. Percutaneous cardiopulmonary support (PCPS) administered and stent insertion to #1 made it possible to obtain reperfusion. Chest compressions were performed for a total of 25 minutes and was performed 17 times.

After admission to the CCU, the patient had stable circulatory dynamics, and was moved to the general ward on hospitalization day 7, and he discharged on foot with a normal left ventricular ejection fraction of 66% and without sequelae on hospitalization day 28.

DISCUSSION

The main role of the HEMS is to transport the medical staff consisting of a doctor and a nurse to the scene of an emergency so that emergency treatment can be provided quickly[6]. HEMS is capable of reaching anywhere in our prefecture in less than an hour. It has the advantages of enabling a quick start of initial treatment and a selection of the most appropriate hospital for the patient's gravity, even if it is beyond the medical district area. Patients in serious conditions are generally carried by ambulance car to the nearest hospital from the scene. There are, however, cases where the hospital cannot provide the definitive treatments. HEMS, on the other hand, is able to select a hospital capable of providing such treatments and to quickly transport the patient. Therefore, HEMS is considered to be highly effective for patients with serious conditions, even in short distance cases. On the other hand, HEMS is limited by night dark and bad weather, such as low clouds, rain, and snow.

One main decisive factor for better long-term prognosis in AMI is early reperfusion ; the shorter the time to reperfusion, the greater the therapeutic effect[7]. It is also reported that the air-ambulance system can significantly reduce the time from the call for the emergency medical services system to the start of the initial treatment and the start of

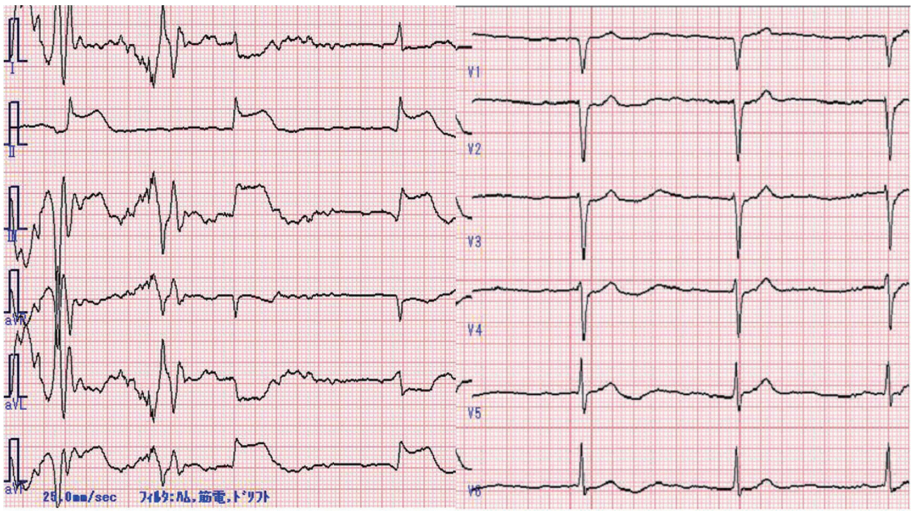

Fig. 2. Twelve-lead resting ECG on admission to the emergency outpatient unit.

PCI[8].

In this case, normal ground ambulance transport of the patient was estimated to take 70 to 80 minutes from the first call for an ambulance to its arrival at a medical institution. On the other hand, in the case of HEMS, it took the medical staff 51 minutes from the call to the initial treatment. The doctor was able to see the patient 20 to 30 minutes earlier than in the case of ground ambulance transport. In this case, VF occurred after the medical staff arrived at the scene, followed by the continued occurrence of serious bradycardia and cardiac failure. Taking the above developments into consideration, HEMS was significantly beneficial.

Cardiac arrest recurred in this patient after transportation to the hospital, and reperfusion therapy was ultimately completed with assisted circulation. The university hospital was chosen as a medical institution capable of providing high-level treatments including that for serious cardiac failure. The hospital was located approximately 17 km from the scene, as determined by drawing a straight line between these two points on a map. Since the scene was in a mountainous area, transportation would have taken more than approximately 40 minutes by ground ambulance. On the other hand, HEMS took only 7 minutes. With the high-quality medical care provided by the high-level medical institution taken into consideration, therefore, HEMS is highly useful for the long-distance transport of patients[9]. Without HEMS, the survival of this patient would have been difficult. HEMS makes it possible to select the most appropriate hospital in the region. The transmission of the patient information allows the hospital to prepare for the necessary clinical examination and treatment prior to the patients arrival. This will contribute to smoother cooperation between pre-hospital medical procedures and post-hospital emergency care. This case showed the importance of early measures taken against post-cardiac arrest syndrome, in addition to the current chain of survival to lifesaving of the cardiac arrest patient[10].

CONCLUSION

The survival of a patient with serious AMI was attained by HEMS, which made it possible to continuously perform ACLS from the pre-hospital stage. It is important that the emergency rescue team makes a quick judgment to request for HEMS, an appropriate hospital selection for the patient is made by HEMS, and the definitive treatments are performed by the hospital. In conclusion, to improve the survival rate of patients, the orchestrated cooperation of the emergency rescue team, HEMS and the hospital is essential.

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