C A S E R E P O R T

Successful resuscitation after out-of-hospital cardiac arrest

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A 66-year-old woman presented to the emergency department after a witnessed cardiac arrest, having had compression-only cardiopulmonary resuscitation initiated by her son on the backseat of his car. She was resuscitated in the emergency department for 1 hour before the return of spontaneous circulation. She then underwent primary percutaneous coronary intervention and therapeutic hypothermia. She was discharged without significant neurological deficit. This case illustrates better survival and neurological outcome can be achieved by prompt implementation of a 'chain of survival' interventions and therapeutic hypothermia.

Case report

A 66-year-old woman complained of shortness of breath and chest pain since 10:30 am on 23 October 2009. She was an ex-smoker with an unremarkable medical history. She was being transported by her husband and son, when she collapsed in car on the way to hospital. Her son performed external cardiac massage without rescue breathes. On arrival to accident and emergency department at 11:44 am, ventricular fibrillation was noted (Fig 1), which was only aborted after 60 minutes of resuscitation, following 13 injections of adrenaline (1 mg), nine biphasic 150 J defibrillations, as well as amiodarone and dopamine infusions. The electrocardiogram after return of spontaneous circulation showed ST segment elevation over leads V1-6 (Fig 2) and acute myocardial infarction was diagnosed. Primary percutaneous coronary intervention (PCI) was performed, which showed a proximal left anterior descending artery 90% occlusion. Stenting was performed successfully. The door-to-balloon time (DBT) was 120 minutes. Post-PCI the patient received adrenaline, dopamine, and intra-aortic balloon pump haemodynamic support. One episode of generalised tonic-clonic convulsion was noted, whereupon she underwent therapeutic hypothermia with ice packs and fan cooling for 12 hours. She was extubated on day 2 and discharged on day 5 without gross neurological deficit. She could walk out of hospital independently on the day of discharge.

Discussion

This case illustrates the importance of the 'chain of survival' in the successful resuscitation of cardiac arrest patients. The role of chest compression-only cardiopulmonary resuscitation (CPR), therapeutic hypothermia, and early advanced care in out-of-hospital cardiac arrest (OHCA) are all crucial.

The chain of survival in the management of cardiac arrest patients has been described for more than 20 years. It now comprises five elements, namely, immediate recognition and rapid access, rapid CPR, rapid defibrillation, effective advanced care, and integrated post–cardiac arrest care.[1] The chain of survival should be started as soon as possible. If it can be implemented within 4 minutes of the event, patients have a higher chance of survival and better neurological outcomes.[2] Bystander-initiated CPR has been shown to increase survival; however it is performed in less than one-third of OHCAs[3]; the low attempt rate of bystanders contributes to the low overall survival rate. There are multiple reasons for bystanders not to initiating CPR for OHCA victims. In addition to being not adequately trained, some express worries about infectious disease transmission through mouth-to-mouth–assisted breathing and the complexity of simultaneously performing mouth-to-mouth ventilation and chest compression.[4] They also worry that CPR would do more harm rather than benefit the patient. All these apprehensions delay initiation of CPR, resulting in lower success rates and overall survival.

In adult OHCAs, bystanders performing compression-only CPR is now considered to be as effective as conventional CPR in terms of survival rates. The benefit is evident for short-duration cardiac arrest patients, especially when performed within 5 minutes

Key words
Cardiopulmonary resuscitation; Heart arrest; Hypothermia; Out-of-hospital cardiac arrest; Ventricular fibrillation

Hong Kong Med J 2012;18:536-8

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of cardiac arrest.[5] The postulated physiological mechanisms that err on the side of chest compression only include: (1) impairment of coronary perfusion occurs even with brief interruption of chest compression during rescue breathing interval[6]; and (2) elevated intra-thoracic pressure during ventilation impedes venous return to the heart.[7] These beneficial effects of compression-only CPR on cardiac output and coronary perfusion, together with better acceptance among bystanders, might explain the increasing evidence of better results from compression-only CPR. It is well known that promptly starting CPR before the availability of a defibrillator coupled with advanced care improves survival.[8] As illustrated in our case, the son initiated compression-only CPR immediately after his mother's cardiac arrest. This contributed to the subsequent successful resuscitation and good neurological outcome.

替院外心跳停止病人成功急救的病例報告

一名66歲婦人在乘車途中忽然心跳停止，她兒子立刻在車的後座為她進行心外壓。病人後來被送往急症室，進行一個小時的搶救後終於恢復生命表徵。後來病人繼續接受緊急經皮冠狀動脈介入術及低溫治療，出院時並無嚴重神經功能缺損。本病例顯示為心跳停止病人即時進行「生存鏈」的急救及低溫治療，有助增加病人的存活率及改善康復後的神經功能。

Therapeutic hypothermia is a crucial intervention in the management of patients with near drowning, traumatic brain injury, and OHCA.[9] Generally, after return of spontaneous circulation, the patient's core temperature should be lowered to 32 to 34°C for 12 to 24 hours. This can be achieved

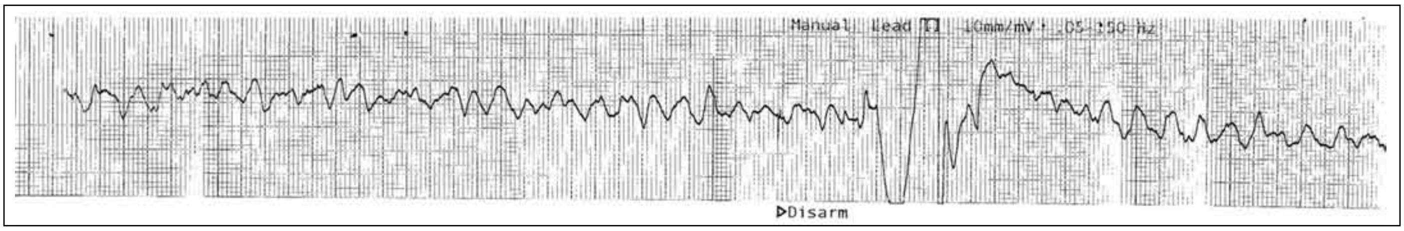

FIG 1. Cardiac monitoring strip of the patient showing ventricular fibrillation, upon arrival at the accident and emergency department

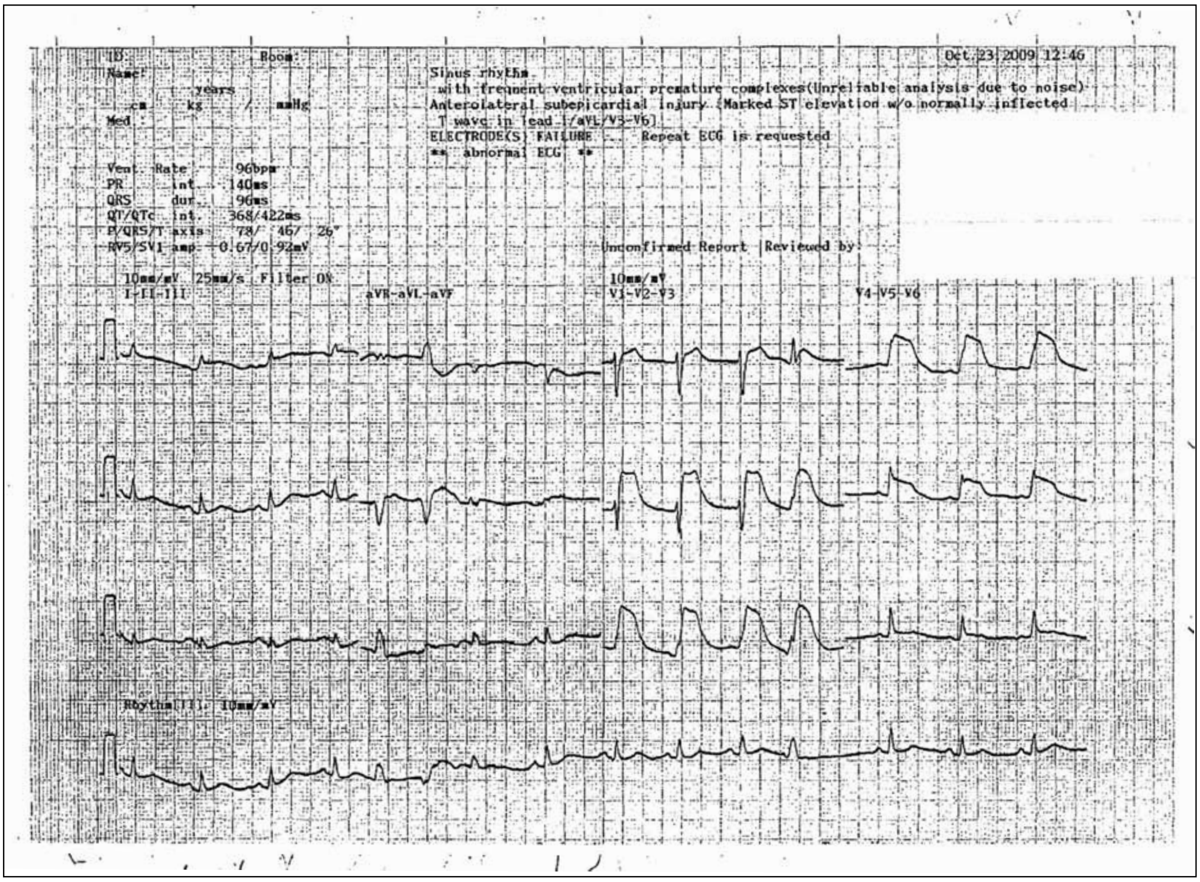

FIG 2. Electrocardiogram of the patient after successful resuscitation showing ST segment elevation myocardial infarction V1 to V6

by external cooling with ice packs, fan cooling, or cold water immersion, or invasively by methods entailing infusion of cold fluids or cardiopulmonary bypass. The patient should be monitored closely during the period of hypothermia in order to avoid complications such as cardiac arrhythmias, coagulopathies, and infections. Hypothermia appears to be neuro-protective by suppressing the oxygen utilisation and ATP consumption in the brain.[10] In animal studies, it also reduces lipid peroxidation and accumulation of free radicals in the brain.[11] Consequently, it suppresses the inflammatory process and minimises reperfusion injury that occurs after global cerebral ischaemia.[12] In post–cardiac arrest patients, therapeutic hypothermia has also been shown to increase survival and the chance of favourable neurological recovery at 6 months.[13] Besides ventilatory and haemodynamic support, optimal glucose control is also very important in post–cardiac arrest care in order to avoid organ damage. Nowadays, chest compression–only CPR as well as therapeutic hypothermia are accepted by the American Heart Association as treatment protocols during and following cardiac arrest.

Early recognition and prompt reperfusion are the mainstay treatments of acute ST elevation myocardial infarction. For reperfusion therapy, primary PCI is better than thrombolytics with respect to overall mortality, stroke, and re-infarction.[14] However, the delay in transferring the patient to a PCI facility may result in longer DBTs, which may also result in increased mortality.[15] The DBT can be shortened by using a standardised protocol and ensuring the availability of adequate trained personnel. In our hospital, the acute myocardial infarction management protocol adopted for ST-segment elevation myocardial infarction patients entails primary PCI, so long as it is not contra-indicated.

Conclusions

This case illustrates how the chance for survival improves when CPR is started immediately after cardiac arrest. Compression-only CPR is crucial and easily performed for OHCA victims even by non-trained bystanders. It should be promoted by educating the public, so as to promptly initiate the chain of survival. Early use of therapeutic hypothermia in comatose cardiac arrest survivors can optimise neurological outcomes. In the future, prehospital application of therapeutic hypothermia for OHCA victims could be considered in order to achieve better survival and outcomes.

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