

## CASE REPORT

# Prolonged Resuscitation with Multiple Defibrillations; a Case Report

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**Abstract:** Although American Heart Association Guidelines (AHA) are practical and standardized in many aspects of cardiopulmonary resuscitation (CPR) performance, recommendations on when to terminate resuscitation are not fully understood and clear. There is not enough evidence about how long we can continue CPR in shockable rhythms and how many shocks can be delivered to patients, and if there is an end point for it or not. This issue is more challenging when we read papers published on survival rates and good functional and neurological outcomes after prolonged CPRs. Here, we demonstrate a case of cardiac arrest receiving CPR in the emergency room, for whom it was hard and challenging to make a decision on when to terminate the resuscitation attempts.

**Keywords:** Cardiopulmonary Resuscitation; Electric Countershock; Heart Arrest

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## 1. Introduction

Cardiopulmonary resuscitation (CPR) consists of a group of life-saving interventions, which aid in oxygenation and circulation when cardiac arrest happens (1). Cardiac arrest onset is defined as absence of palpable central pulse, apnea, or unresponsiveness. When CPR performance is stopped for a patient without the return of spontaneous circulation (ROSC), the patient is considered terminated (2, 3). Performing a high-quality CPR is a challenging issue. Although there are exact guidelines about its performance, some cases may be more complicated.

There is no agreement on which patients need prolonged conventional CPR and which patients are not good candidates for it. In most cases, it varies across hospital protocols (3) and is based on subjective team decision (4). Despite advancements in resuscitation, recent published data showed exceedingly poor outcomes for out- and in-hospital CPRs (5). The rate of survival with favorable neurologic out-

come is even lower (4).

Although American Heart Association (AHA) Guidelines are practical and standardized in many aspects of CPR performance, recommendations on when to terminate resuscitation are not fully understood and clear. There is not enough evidence about how long we can continue CPR in shockable rhythms and how many shocks can be delivered to patients, and if there is an end point for it or not. This issue appears to be even more challenging when we read published papers about survival rates and good functional and neurological outcomes after prolonged CPRs. Here, we demonstrate a case of cardiac arrest receiving CPR at the emergency department, for whom it was hard and challenging to make a decision on when to terminate the resuscitation attempts.

## 2. Case presentation

A 30-year-old male presented to the emergency department (ED) with cardiac arrest. He had had a seizure-like attack and cardiac arrest at home, no one performed basic life support for him. His family called emergency medical services (EMS), and within 5 minutes they reached the patient and advanced cardiac life support treatment, including endotracheal intubation and chest compressions based on AHA Guideline 2020

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version, was initiated for him.

The initial rhythm was not shockable. During CPR, automated external defibrillator (AED) delivered two shocks. He also received 1 mg epinephrine. The patient was transferred to our emergency department, 22 Bahman Hospital, Mashhad, Iran, about 15 minutes after cardiac arrest. His first rhythm was asystole in hospital. CPR was continued. After two minutes, rhythm was checked. It was ventricular fibrillation, he was defibrillated seventeen times, and received 1 mg epinephrine each three minutes, 300 mg intravenous (IV) amiodarone, followed by 150 mg IV amiodarone. The emergency department cardiac arrest team, which was being led by an emergency medicine specialist, continued with high quality CPR (our center does not have a cardiology unit). Other recommended medications that were used for this patient included: 1 mg/kg of sodium bicarbonate and lidocaine, and 2 g of magnesium empirically. The laboratory test results such as hemoglobin, coagulation state, kidney function test, and blood electrolytes were normal. About 10 minutes after the last antiarrhythmic drug use, his rhythm was converted to sinus with a palpable carotid pulse. The quality of CPR was monitored using the pressure of end-tidal CO<sub>2</sub> (PetCO<sub>2</sub>). The return of spontaneous circulation (ROSC) was confirmed by increase in end tidal CO<sub>2</sub>, from around 20 mmHg to 50 mmHg.

ED CPR lasted about 50 minutes, and the patient had received out-of-hospital CPR for 10 minutes. Patient's rhythm was shockable during a long portion of CPR period. In the post-resuscitation period, liver function test (LFT) results was impaired, with a positive methadone test. He was transferred to intensive care unit (ICU) but he was expired shortly thereafter. Other tests, such as ionogram, were normal. Troponin was positive in first blood sample, unfortunately our hospital lab did not report it as a quantitative value.

### 3. Discussion

We introduced a prolonged CPR case with shockable rhythm without underlying heart disease. The mentioned patient was young, with no cardiopulmonary complaints before arrest, and his post-ROSC electrocardiograph was normal sinus rhythm with no ST segment changes. His past medical history, physical examination, and preclinical evaluation showed no evidence regarding cardiologic problems whatsoever. This case was confusing because of numerous defibrillations and use of variable antiarrhythmic agents during CPR. He had systole rhythm for only one cycle, it is assumed that this rhythm might have been fine ventricular fibrillation (VF) that changed to ventricular tachycardia (VT) after epinephrine administration.

For our case, methadone toxicity might be an important underlying cause of arrhythmia, because such drugs can lead to

prolonged QT interval. But in the electrocardiography (ECG) performed after ROSC, QT interval was normal. Besides, echocardiography, performed by an emergency medicine specialist, was also reported to be almost normal. So structural and electrical abnormality can be ruled out in our patient. So, the exact cause of this resistant arrhythmia is not fully determined.

Generally, studies regarding the effect of duration of cardiopulmonary resuscitation on clinical outcome are few. A case study of prolonged resuscitation due to Torsade De Pointes with 99 defibrillations shows survival with good neurological outcome (5).

Conformingly, Bingyu Ling et al. described a case who had developed cardiac arrest due to propafenone intoxication and was successfully resuscitated after prolonged CPR without subsequent neurological complication (6). It seems that, intoxication might lead to cardiac arrest with shockable rhythm without basic cardiologic problems. Although our patient was a drug user (methadone), his family did not confirm any overdose or suicidal effort. Urine analyses showed methadone, but we were not able to measure its concentration level.

Prolonged CPR is a decision for physician and its outcome depends on various factors, like CPR quality. We tried to improve in-hospital CPR quality with regular staff training programs, selecting and announcing resuscitation code members daily, with defined positions for each of the six persons and assigning an emergency specialist or ICU physician as a CPR team director. The baseline status of the patient is another factor that would influence the duration of resuscitation, including patient's age and coexisting comorbidities. Our patient was young without underlying diseases.

Due to the Corona virus pandemic and increasing risk of pulmonary thromboembolism (PTE), bedside echocardiography was performed by an emergency medicine specialist post-ROSC, but it revealed no evidence of PTE. We were unable to find a reversible cause for cardiac arrest in our case.

Sudden cardiac death in all age groups is estimated to be responsible for 350000 deaths in the USA each year, and the survival rate is about 8% (7). The AHA's advanced cardiac life support (ACLS) guideline recommends immediate initiation of high-quality CPR, early defibrillation, and the administration of epinephrine and antiarrhythmic agents for the management of VF and pulseless VT (2). So, this should be a reminder for physicians to continue high quality CPR and shocking with less interruption in a specific group of cardiac arrest patients. But the maximum duration is still unclear.

Another important aspect is the critical role of percutaneous coronary intervention (PCI) in post-cardiac arrest. Coronary angiography is recommended emergently for patients with suspected cardiac etiology of arrest and ST elevation on ECG, it is logical to transfer patients like ours to cardiology or an-



giography units, since there was no evidence of heart disease in our patient but he had inexplicable rhythm during CPR with normal ionogram.

## 4. Conclusion

The maximum duration of resuscitation attempts for incrementing survival has not been established and it may vary from one patient to another. Considering the major factors that affect the outcomes of resuscitation, guidelines should better set clear and standard recommendations on optimal and most appropriate duration of CPR for patients with cardiac arrests and shockable rhythms. Further studies should be performed with regards to prolonged CPR, analyzing the different aspects relating to prolonged CPR and its outcomes.

## 5. Declarations

### 5.1. Acknowledgments

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### 5.2. Authors' contributions

All authors discussed the results and contributed to the final manuscript.

### 5.3. Funding and supports

We do not have a funding resource.

### 5.4. Conflict of interest

The authors have no conflicts of interest.

### 5.5. Ethical considerations

The authors adhered to confidentiality of patient's profile and ethical consideration regarding the biomedical re-

searches.

## References

1. Barker J, Koeckerling D, West R. A need for prone position CPR guidance for intubated and non-intubated patients during the COVID-19 pandemic. *Resuscitation*. 2020;151:135-6.
2. Nolan JP, Monsieurs KG, Bossaert L, Bottiger BW, Greif R, Lott C, et al. European Resuscitation Council COVID-19 guidelines executive summary. *Resuscitation*. 2020;153:45-55.
3. Costa I, Bittar CS, Rizk SI, Araujo Filho AE, Santos KAQ, Machado TIV, et al. The Heart and COVID-19: What Cardiologists Need to Know. *Arq Bras Cardiol*. 2020;114(5):805-16.
4. Kramer DB, Lo B, Dickert NW. CPR in the Covid-19 Era - An Ethical Framework. *N Engl J Med*. 2020;383(2):e6.
5. Taha HS, Shaker MM, Abdelghany MM. Cardiopulmonary resuscitation during the COVID-19 pandemic: a scientific statement on CPR management protocol of Kasr Al-Ainy University Hospital is presented. *Egypt Heart J*. 2020;72(1):73.
6. Hwang CW, Gamble G, Marchick M, Becker TK. A case of refractory ventricular fibrillation successfully treated with low-dose esmolol. *BMJ Case Rep*. 2019;12(3):e228208.
7. Herlitz J EJ, Svensson L, Young M, Angquist KA, Holmberg S. Decrease in the occurrence of ventricular fibrillation as the initially observed arrhythmia after out-of-hospital cardiac arrest during 11 years in Sweden. *Resuscitation*. 2004;3(60):283-90.

