Double Sequence Defibrillation for Out-of-hospital Cardiac Arrest: Unlikely Survival

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Survival from out-of-hospital cardiac arrest (OHCA) is highest with early defibrillation and immediate, high-quality cardiopulmonary resuscitation. Return of spontaneous circulation (ROSC) is rare in OHCA. The purpose of this discussion and case report is to highlight the use of double sequence defibrillation (DSD) for refractory ventricular fibrillation (RVF). We present a 58-year-old male with RVF who successfully achieved ROSC after 38 minutes using DSD and had a good neurological outcome. DSD has shown promise in many case reports and case series as a means of increasing ROSC and survival rates in OHCA. [Clin Pract Cases Emerg Med. 2018;2(4):309–311.]

INTRODUCTION

The global incidence of out-of-hospital cardiac arrest (OHCA) is 55 per 100,000 adults per year, and the average survival (to hospital discharge) is 7% in adults. Ventricular fibrillation (VF) is the most common rhythm after OHCA occurring in approximately 70% of cases. Return of spontaneous circulation (ROSC) is rare in OHCA; however, recently improved prehospital ROSC rates have been demonstrated. These moderately improved rates are likely attributed to high-quality bystander cardiopulmonary resuscitation (CPR) with increased emphasis on uninterrupted CPR with good technique.

We report on a case where double sequence defibrillation (DSD) was used to treat refractory ventricular fibrillation (RVF). RVF is typically defined as persistent VF following three to five unsuccessful shocks. DSD has been used safely in electrophysiology labs for quite some time. When using DSD, two sets of pads are placed in the anteroapical and anteroposterior positions and deliver a shock nearly simultaneously. (Image)

CASE REPORT

A 58-year-old male with a history of hypertension and cardiac stents two years prior had just arrived at a Saturday morning prayer breakfast at church when he suddenly went unresponsive and was found to be pulseless and apneic by bystanders. CPR was immediately initiated. Emergency medical services (EMS) arrived with a six-minute response time. The patient was found to be in VF and defibrillated at 200 joules (J) unsuccessfully. Intraosseous access was established and epinephrine was administered. A supraglottic airway device was placed for ventilations and amiodarone 300mg was given. Over the course of 26 minutes five subsequent standard defibrillations were administered unsuccessfully.

At this point EMS contacted online medical control, and DSD was ordered. The patient had a second set of pads placed in the anteroapical position. Both the engine and medic defibrillators were used to deliver 360J, each nearly simultaneously. The
DISCUSSION
What makes this case remarkable is that this patient made a full neurological recovery despite the likelihood based on a recent publication out of Japan. Goto et al. showed that survival after 30 minutes of cardiac arrest was only 0.8% in a study group of over 17,000 cardiac arrest patients. Neurologically intact survival was only 0.4% in the same group after 30 minutes of cardiac arrest. This particular patient survived after 38 minutes with a cerebral performance category (CPC) score of one. The CPC score is a five-category scale for measuring neurological status after cardiac arrest (Table). A CPC score of one correlates to conscious and alert with good cerebral performance. A CPC score of five correlates to brain dead, circulation preserved. Many other factors most likely contributed to the good outcome of this patient’s case. First and foremost, this patient received immediate CPR after beginning cardiac arrest.

DSD is a tool that more physicians and EMS providers should become aware of. Several case reports and case series have been published in recent years supporting the potential use of DSD in OHCA. One case series by Cortez et al. showed a survival to discharge in three of 12 patients who presumably would have died if DSD had not been used after RVF. Two of the three patients (2/12, 17%) had a CPC score of one in the study. Merlin et al. showed even better results in another case series. three patients out of seven (3/7, 43%) in whom DSD was used after RVF survived to hospital discharge; once again these were patients who otherwise would presumably not have survived without the use of DSD. All three patients were discharged with CPC scores of one. Lastly, a less-successful case series by Cabanas et al. had 10 patients in whom DSD was used, but none survived to discharge. Three patients (3/10, 30%) achieved ROSC in the field with the utilization of DSD. An important discussion point is the presumed survival due to DSD; this caveat should not be ignored. Without further research we do not know if the next standard defibrillation attempt would have converted the patient from RVF.

Current guidelines have established that survival from OHCA is highest with early defibrillation and immediate, high-quality CPR. We would like to suggest that early use of DSD defibrillation may contribute to survival from OHCA. In the above trials mentioned, the average time from the determination of arrest to first DSD was 32.3 minutes. In those patients who achieved ROSC, it was 31.3 minutes. In the patients who survived, average time to first DSD was 24.2 minutes. While these data suggest that earlier DSD could potentially improve outcomes, further research is needed. The patient we
present achieved ROSC after 38 minutes of VF and survived neurologically intact.

CONCLUSION

Further research is required to establish DSD as an effective means for treating RVF. DSD has shown promise in these case reports and case series as a possible tool of increasing ROSC and survival rates in OHCA. We present a case that adds to this literature and shows that positive outcomes can be achieved beyond the time window generally accepted if coupled with effective and immediate CPR.

Table. Cerebral performance category (CPC) score: measuring neurological status after cardiac arrest.

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<tr>
<th>CPC score</th>
<th>Definition</th>
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<tbody>
<tr>
<td>1</td>
<td>Conscious and alert with normal function or only slight disability</td>
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<tr>
<td>2</td>
<td>Conscious and alert with moderate disability</td>
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<tr>
<td>3</td>
<td>Conscious with severe disability</td>
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<tr>
<td>4</td>
<td>Comatose or persistent vegetative state</td>
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<tr>
<td>5</td>
<td>Brain dead or death from other causes</td>
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REFERENCES