Critical Review Form
Case Series

PGY-3

Cortez E, Krebs W, Davis J, Keseg DP, Panchal AR. Use of double sequential external defibrillation for refractory ventricular fibrillation during out-of-hospital cardiac arrest. Resuscitation. 2016 Nov;108:82-86.

Objective: **"to describe the outcome of prehospital patients with refractory VF [ventricular fibrillation] treated with double sequential defibrillation with an established protocol for observation and management in the out-of-hospital setting." (pp. 82-83)**

Methods: **This retrospective chart review was conducted using patients encountered by the City of Columbus, Division of Fire EMS system in Columbus, OH between August 1, 2010 and June 30, 2014. Patients suffering out of hospital cardiac arrest (OHCA) with refractory VF, defined as VF refractory to 5 single defibrillation attempts, treated with double sequential defibrillation were eligible for inclusion. Patients who did not have double sequential defibrillation attempted, and those under 18 years of age, were excluded.**

Prehospital data were extracted from the EMS systems electronic patient care report and hospital data were obtained from EMS liaisons at receiving hospitals. Investigators were not blinded. The primary outcome measure was return of spontaneous circulation (ROSC). Other outcomes included conversion from refractory VF, survival to hospital discharge, and Cerebral Performance Category (CPC) score at discharge among survivors.

Out of 2428 cases of OHA during the study period, there were 499 with a shockable rhythm. Of these, 12 developed refractory VF and were treated with double sequential defibrillation. All but one of these patients was male, 85% received bystander CPR, and 50% were witnessed arrests. The initial rhythm was VF in 11 patients and PEA in one patient (that later converted to VF). The median number of dual defibrillation attempts was 2 (IQR 1-2).

Guide		Comments
A.	**Are the results valid?**	
1.	Were there clear criteria for inclusion in the case series?	Yes. Only adult patients with OHCA with VF refractory to at least 5 defibrillation attempts were eligible for inclusion.
2.	Was the condition identified and measured in a standard, reliable way for all participants included?	Yes. The condition (refractory VF) was well defined as VF refractory to at least 5 defibrillation attempts.

4.	Were consecutive patients included and was inclusion complete?	Uncertain. While there were strict criteria for inclusion, it is not clear if dual sequential defibrillation was in the protocol for management of refractory VF, or if there were eligible patients who did not receive double sequential defibrillation.
5	Was sufficient demographic information provided for included patients?	No. The authors do not provide median patient age (though they do provide raw ages for all but one patients) and do not provide any additional information regarding medical comorbidities.
6.	Was follow-up of subjects long enough to detect the outcome of interest?	Yes and no. Follow-up was achieved by review of the medical record (obtained from each receiving hospital by the EMS liaison). They were therefore able to provide information up to the point of discharge. They did not assess outcomes beyond hospital discharge. The Research Working Group of the American Heart Association Emergency Cardiovascular Care Committee has recommended that large trials designed to have a major impact should use longer-term endpoints at least 90 days out coupled with some neurological and quality-of-life assessment.
7.	Was follow-up complete?	Yes. Outcome data was available until the point of hospital discharge for all patients.
B.	**What were the results?**	
1.	What were the outcomes?	ROSC was achieved in 3 patients (25%, 95% CI 9% to 53%), all of whom survived to hospital discharge. The discharge CPC score was 1 in 2 of the patients and was 3 in the third, meaning that discharge with a good neurologic outcome occurred in 17% (95% CI 5% to 45%).
2.	How precise was the estimate of the outcomes? (i.e. what were the 95% confidence intervals?)	See above. This was a very small case series with resulting wide confidence intervals.
C.	**How can I apply the results to patient care?**	
1.	Were the study patients similar to my patient?	Yes. These were patients in an urban population suffering out of hospital cardiac arrest with likely similar comorbidities (though these were not detailed) and similar EMS run times to those seen in our institution.
2.	Were all clinically important outcomes considered?	No. The only outcomes considered were those accessible by review of the EMS and hospital records (ROSC, survival to discharge, CPC score at discharge). The study did not address more

		long-term, outcomes. The Research Working Group of the American Heart Association Emergency Cardiovascular Care Committee has recommended that large trials designed to have a major impact should use longer-term endpoints at least 90 days out coupled with some neurological and quality-of-life assessment.
3.	What are the implications of the results? Are the likely treatment benefits worth the potential harm and costs?	This was a very small case series, and hence not suitable to change current management. The results do seem to suggest that double sequential defibrillation is safe and may result in conversion to sinus rhythm (with ROSC) in a significant proportion of patients who would otherwise remain in VF, and hence would not survive.

Limitations:

1. **This was a retrospective case series in which the decision to perform the intervention was at the discretion of treating paramedics. In addition to introducing potential selection bias, this study is unable to compare outcomes in patients receiving the intervention to those who did not.**

2. **While there were strict criteria for inclusion, it is not clear if dual sequential defibrillation was in the protocol for management of refractory VF, or if there were eligible patients who did not receive double sequential defibrillation.**

3. **This was a very small case series with resulting wide confidence intervals.**

4. **The study measured only short-term outcomes, including survival to hospital discharge. The Research Working Group of the American Heart Association Emergency Cardiovascular Care Committee has recommended that large trials designed to have a major impact should use longer-term endpoints at least 90 days out coupled with some neurological and quality-of-life assessment.**

Bottom Line:

This small case series seems to suggest that double sequential defibrillation is safe and may result in conversion to sinus rhythm (with ROSC) in a significant proportion of patients who would otherwise remain in VF, and hence would not survive.