

Intra-Arrest Rapid Head Cooling Improves Amplitude Spectrum Area of Ventricular Fibrillation And Facilitates Defibrillation

Min-Shan Tsai, MD^{1,4}; Wanchun Tang, MD, FCCM^{1,2}; Hao Wang, MD¹; Jun Guan, MD¹;
Shijie Sun, MD, FCCM^{1,2}; Denise Barbut, MD, MRCP.³; Becky Inderbitzen³;
Max Harry Weil, MD, PhD, FCCM^{1,2}

¹The Weil Institute of Critical Care Medicine, Rancho Mirage, CA

²The Keck School of Medicine of the University of Southern California, Los Angeles, CA

³Benechill Inc., San Diego, CA

⁴Department of Emergency Medicine, National Taiwan University Hospital, Taipei, Taiwan

Background: Hypothermia prior to induced ventricular fibrillation (VF) has been known to increase the success of defibrillation. Our previous studies have demonstrated that amplitude spectrum area (AMSA) predicts the success of electrical defibrillation with high specificity.

Hypothesis: Rapid head cooling initiated at the beginning of cardiopulmonary resuscitation (CPR) improves AMSA of VF, and thus the success of defibrillation.

Methods: VF was induced in 16 domestic pigs and untreated for 10 minutes. Eight animals were randomized to hypothermia and 8 to controls. CPR was then initiated for 5 minutes before defibrillation was attempted. Coincident with starting CPR, the hypothermia group was cooled by the Rhinochill™ device, a device which produces evaporative cooling through the nostrils of the pigs. No hypothermia was administered to the control animals. If spontaneous circulation was not restored after defibrillation, CPR was resumed for 1 minute prior to the next defibrillation attempt until the animal was either successfully resuscitated or for a total of 15 minutes. Five seconds of VF waveform, recorded immediately preceding delivery of a shock, were analyzed utilizing the AMSA algorithm.

Results: Fewer defibrillation shocks were required to achieve ROSC in the hypothermia group (8.1±4.6 vs. 14.6±8.6, P= 0.08) than in the control group. The hypothermia group had a higher success rate for total shocks than the control group (88±18% vs. 66±19%, P=0.034) but not initial shocks (75% vs.38%, P=0.315). The AMSA of the initial shock and total shocks in the hypothermia group was significantly higher than in the control group (Table).

Conclusion: Intra-arrest head cooling improves AMSA of VF and the success of defibrillation.

Table

Control	Hypothermia	p
---------	-------------	---

	N=8	N=8	
No. of electric shock	14.6±8.6	8.1±4.6	0.080
Initial shock success	38%	75%	0.315
Total shock success	66±19%	88±18%	0.034
AMSA of initial shock (mV-Hz)	21.4±2.2	26.1±5.3	0.049
AMSA of total shocks (mV-Hz)	21.3±2.9	25.3±5.2	0.006