

Rapid brain cooling during cardiopulmonary resuscitation followed by systemic therapeutic hypothermia reduces myocardial damage in a porcine model of prolonged ventricular fibrillation

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Background: Hypothermia prior to induced ventricular fibrillation (VF) has been known to increase the success of defibrillation. Our previous studies have also demonstrated that excessive defibrillation shocks during CPR increase the severity of myocardial injury.

Hypothesis: Rapid brain cooling during CPR followed by systemic cooling after prolonged VF increases the success of defibrillation and shortens the duration of CPR. Consequently, it reduces post-resuscitation myocardial damage.

Methods: VF was induced in 16 domestic pigs and untreated for 10 minutes. CPR was then initiated for 5 minutes before defibrillation was attempted. Coincident with starting CPR, the hypothermia group (n=8) was cooled by a Rhinochill device, which cooled the brain, followed by systemic hypothermia. The cooling was continued to achieve a target core temperature of 34°C. The body temperature of the control group was not intervened after VF was induced. An electrocardiogram was recorded and analyzed before VF, at 15 minutes post-resuscitation, and hourly after return of spontaneous circulation (ROSC) for 4 hours.

Results: The cooled animals had required fewer defibrillation shocks (8.13±4.64 vs. 14.63±8.57, P=0.08) and a shorter duration of CPR (364.63±42.35 sec vs. 600.38±243.2 sec, P=0.017) prior to ROSC when compared with the control group. The cooled animals had lesser ST elevation which returned to a normal level 2 hours after ROSC. This contrasted with the control animals in which the ST elevation persisted for more than 4 hours (Table 1).

Conclusion: Rapid brain cooling during CPR followed by systemic cooling reduced the number of defibrillation shocks required for ROSC, shortened duration of CPR and reduced the severity of myocardial injury.

Table 1

ST elevation amplitude (mV)					
	PR 15min	PR 1h	PR 2h	PR 3h	PR 4h
Hypothermia	0.18±0.08	0.17±0.03	0.20±0.14	0.00±0.00*	0.00±0.00*
Control	0.20±0.10	0.15±0.03	0.18±0.07	0.13±0.03	0.10±0.00

***: P<0.005**