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Hydrogen Inhalation is Superior to Mild Hypothermia in Improving Cardiac Function and Neurological Outcome in an Asphyxial Cardiac Arrest Model of Rats

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Abstract

Background: Non-shockable rhythms represent an increasing proportion of reported cases of out-of-hospital cardiac arrest but with an associated poor prognosis. In the present study, we investigated the effects of hydrogen inhalation on cardiac and neurological function after cardiopulmonary resuscitation and compared the therapeutic benefit with hypothermia in an asphyxial rat model of cardiac arrest.

Methods: Cardiopulmonary resuscitation was initiated after 5 min of untreated asphyxial cardiac arrest. Animals were randomly assigned to three experimental groups immediately after successful resuscitation: ventilation with 2% hydrogen/98% oxygen under normothermia (H2 inhalation), ventilation with 2% nitrogen/98% oxygen under normothermia (Control), and ventilation with 2% nitrogen/98% oxygen under hypothermia (TH). Mixed gas inhalation continued for 1 h while hypothermia continued for 2 h. Animals were observed up to 96 h for assessment of survival and neurologic recovery.

Results: No statistical differences in baseline measurements were observed among groups and all the animals were successfully resuscitated. Serum cardiac troponin T and S100B measured during earlier post-resuscitation period were markedly reduced in both H2 inhalation and hypothermic groups. However, significantly better left ventricular ejection fraction, cardiac work, and neurological deficit score were observed in the H2 inhalation group. Ninety-six hours survival rate was significantly higher in the H2 inhalation group (75.0%), either compared with TH (45.8%) or compared with Control (33.3%). But there was no statistical difference between TH and Control.

Conclusions: Small amounts of inhaled hydrogen were superior to mild hypothermia in improving cardiac function and neurological outcome in this asphyxial rat model of cardiac arrest.

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