

Inhalation of hydrogen improves neurological injuries in a porcine model of prolonged cardiac arrest

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Background

Inhalation of hydrogen (H₂) has been demonstrated to mitigate post-resuscitation (PR) neurological injuries in rat studies. However, before application in clinical settings, the efficacy of H₂ needs to be verified in larger animals that have a physiology and pathophysiology similar to human beings. In the present study, we investigated the effects of treatments with H₂ on post resuscitation (PR) neurological function in a porcine model of prolonged cardiac arrest (CA). We hypothesize that Inhalation of H₂ improves neurological injuries after resuscitation in a CA porcine model.

Methods

Twenty male domestic pigs weighing 38±3 kg were utilized. Ventricular fibrillation (VF) was induced electrically and CPR was initiated after 10 mins of untreated VF. All the animals were resuscitated successfully and randomized into two groups immediately following resuscitation: Inhalation of H₂ (H group, N=10) or inhalation of room air (C group, N=10). Animals in the H group were ventilated with 2% H₂/21% oxygen from PR 5 min to PR 2 h. Serum levels of S100B and neuron-specific enolase (NSE) were measured by ELISA at baseline and PR 360 min. The neurological deficit score (NDS) was evaluated daily for a total of 72 hours.

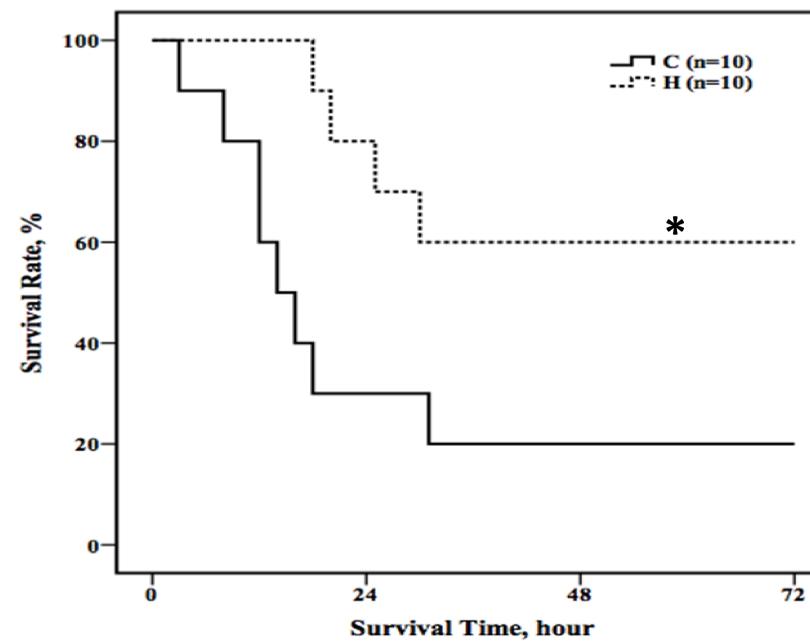
Results

Table NDS at different time points

	24h	48h	72h
C group	380±40	387±38	32.3±25.5
H group	231±122*	230±173*	64.2±45.3*

Values are presented as mean ± SD. NDS, neurological deficit score; C group, control group; H group, two hours delayed inhalation of H₂ group. * *p* < .05 vs. the C group

Figure Kaplan-Meier analysis of cumulative survival



C group, control group; H group, immediate inhalation of H₂ group. * *p* < .05 vs. the C group.

Results

A better NDS at 24h, 48h and 72h was observed in the H group compared with the C group (Table). The serum levels of S100B and NSE were lower in the H group when compared with the C group (Figure).

Conclusions

Inhalation of H₂ improves neurological injuries after resuscitation in a prolonged CA porcine model.

References

1. Hayashida K, Sano M, Kamimura N, et al. J Am Heart Assoc. 2012; 1: e003459.
2. Wang P, Jia L, Chen B, et al. Shock. 2016;46(3):312-8.