



Background

Immediate inhalation of hydrogen (H₂) has been demonstrated to improve post-resuscitation (PR) myocardial dysfunction. However, applying inhaled H₂ early is not practical especially in out of hospital cardiac arrest due to safety issues. In the present study, we investigated the effects of delayed treatments with H₂ on post resuscitation myocardial function in a porcine model of prolonged cardiac arrest (CA). We hypothesized delayed inhalation of H₂ reduces the severity of post resuscitation myocardial dysfunction in a CA porcine model.

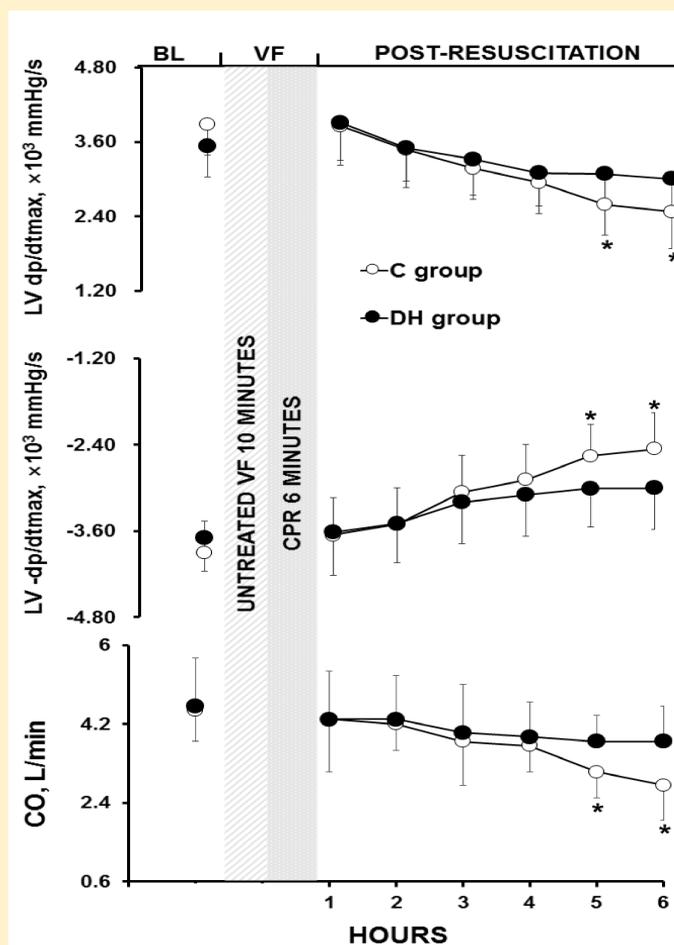
Methods

Animal Model

Twenty male domestic pigs weighing 39 ± 2 kg were utilized. Ventricular fibrillation was induced electrically and CPR was initiated after 10 minutes of untreated VF. All the animals were resuscitated successfully and randomized into two groups: delayed inhalation of H₂ (DH group) or continuous inhalation of room air (C group). Animals in DH group were ventilated with 2% H₂/21% oxygen from PR 2 hours until PR 4 hours. Left ventricle pressure (LVP) was recorded continuously and cardiac output (CO) was measured by thermo-dilution at baseline (BL) and then hourly after resuscitation for 6 hours. Serum levels of troponin T (Tn T) and N-terminal probrain natriuretic peptide (NTpro-BNP) were measured by ELISA at BL, PR 180 min and PR 360 min.

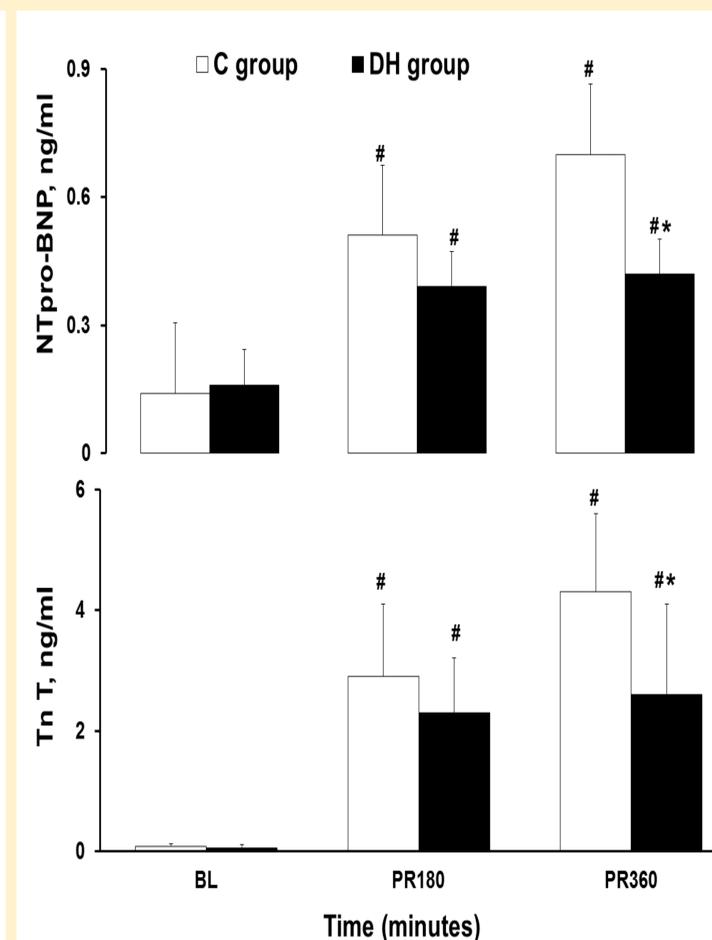
Results

Figure 1. Post-resuscitation myocardial dysfunction.



BL, baseline; VF, ventricular fibrillation; LV, left ventricle; CO, cardiac output; C group, control group; DH group, two hours delayed inhalation of H₂ group. * *p* < .05 vs. the DH group.

Figure 2. Changes in serum concentration of TnT and NTpro-BNP.



Tn T, troponin T; NTpro-BNP, N-terminal probrain natriuretic peptide; BL, baseline; PR, post-resuscitation; C group, control group; DH group, two hours delayed inhalation of H₂ group. # *p* < .05 vs. BL, * *p* < .05 vs. the C group.

Deterioration in the maximal rate of LVP increased (dp/dtmax), maximal rate of LVP declined (-dp/dtmax) and CO were observed in all animals after PR 4 hours (Figure 1). However, better dp/dtmax, -dp/dtmax and CO were achieved in the DH group after PR 5 hours when compared with the C group. The levels of both TnT and NTpro-BNP in serum were lower in animals treated with DH compared with those of C group (Figure 2).

Conclusions

Delayed treatment of H₂ attenuates myocardial injury and reduces post resuscitation myocardial dysfunction after resuscitation.

References

- Hayashida K, Sano M, Kamimura N, et al. J Am Heart Assoc. 2012; 1: e003459.
- Hayashida K, Sano M, Kamimura N, et al. Circulation. 2014; 130: 2173-80.

Disclosure

None