

EFFECTS OF HYPOVOLEMIA ON THE HYPERCAPNIC VENTILATORY RESPONSE IN EXPERIMENTAL HYPERTHERMIA

I. Zila, A. Brozmanova, M. Javorka, A. Calkovska, and K. Javorka

Department of Physiology, Comenius University, Jessenius Faculty of Medicine, Martin, Slovakia, zila@jfm.uniba.sk

The present study was undertaken to evaluate the effects of hypercapnia on cardiorespiratory control in normovolemic and hypovolemic rabbits in exogenous hyperthermia.

Material and methods: Hypovolemia was induced by administration of furosemide, the body temperature (T_b) was gradually elevated to 42°C by body surface heating. Subsequently, T_b was lowered back to the initial values by gradual cooling. Recordings were done at normothermia ($T_N=38$ °C), during heating at 40°C (T_{H1}) and 42°C (T_{H2}), in the course of T_b recovery at 40°C (T_{C1}), and at the recovered initial value (T_{C2}). The hypercapnic ventilatory response (HCVR) was estimated as the slope of minute volume (V_E) - end-tidal CO₂ (ETCO₂) curves.

Results: Heating caused an increase in the slope for V_E vs. ETCO₂ in the normovolemic (NV), but not hypovolemic (HV) rabbits. A between-group comparison revealed a significant increase in HCVR at T_{H2} and T_{C1} in NV vs. HV rabbits. Hypercapnia in hyperthermia (at T_{C2}) was accompanied by a significant decrease in heart rate only in the hypovolemic group. Recovery of T_b was unaccompanied by a significant change in HCVR in either the NV or HV group. In the course of cooling, a decrease in heart rate during hypercapnic challenge was present in both groups, in the HV the drop was less prominent.

Conclusions: Hypercapnia during heat stress in both normovolemic and hypovolemic rabbits is associated with altered cardiorespiratory responses. The hypercapnic ventilatory response during exogenous hyperthermia is augmented in normovolemic, but not hypovolemic, rabbits.