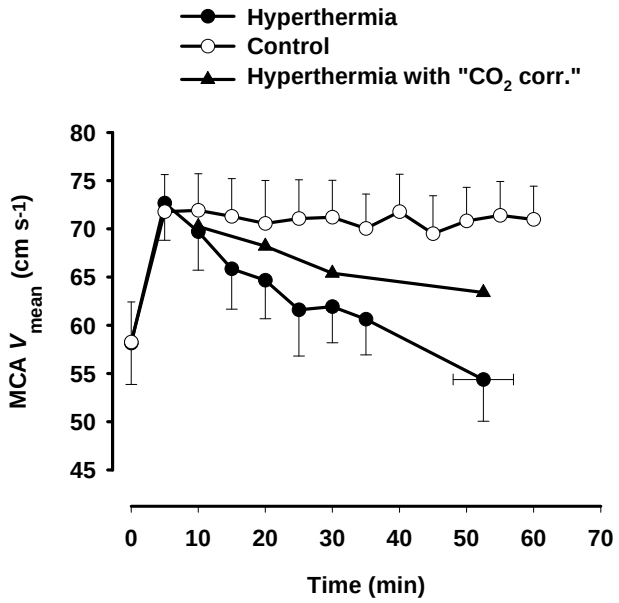
MIDDLE CEREBRAL ARTERY BLOOD FLOW VELOCITY IS REDUCED WITH HYPERTHERMIA DURING PROLONGED EXERCISE IN HUMANS

L. Nybo and B. Nielsen, Institute of Exercise and Sport Sciences, University of Copenhagen, Denmark.

The present study examined the effect of hyperthermia on the middle cerebral artery mean blood velocity (MCA V_{mean}) during prolonged exercise. We hypothesized that the cerebral circulation would be impaired when hyperthermia is superimposed during exercise and assumed that this could be observed as a reduced MCA V_{mean}. Eight endurance trained men [V_{O2max} 70±1 ml min^{-1} kg^{-1} (mean ± SE)] performed two exercise trials at 57% of V_{O2max} on a cycle ergometer in a hot (40°C; hyperthermic trial) and in a thermoneutral environment (18°C; control trial). In the hyperthermic trial, the oesophageal temperature increased throughout the exercise period reaching a peak value of 40.0±0.1°C at exhaustion after 53±4 min of exercise. In the control trial, exercise was maintained for 1 h without any signs of fatigue and with core temperature stabilized at 37.8±0.1°C after ˜ 15 min of exercise. Concomitant with the development of hyperthermia, MCA V_{mean} declined by 26±3% from 73±4 cm s^{-1} at the beginning of exercise to 54±4 cm s^{-1} at exhaustion (*P<0.001*). In contrast, MCA V_{mean} remained unchanged at 70-72 cm s^{-1} throughout the 1 h control trial (see the figure). When individually determined regression lines for MCA V_{mean} and arterial P_{CO2} obtained during preliminary exercise tests were used to ascribe for the differences in arterial P_{CO2} between the hyperthermic and control trial, it appeared that more than half of the reduction in MCA V_{mean} (56±8%; see the figure) was related to a hyperventilation-induced drop in arterial carbon dioxide pressure. Declining cardiac output and arterial blood pressure during the hyperthermic trial presumably accounted for the last part of the reduction in MCA V_{mean}. The present results clearly demonstrate that the development of hyperthermia during prolonged exercise is associated with a marked reduction in middle cerebral artery mean blood velocity.



elsen@aki.ku.dk