The responses of internal and external carotid artery blood flows to resistance exercise

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Purpose: Heavy resistance exercise normally causes a pronounced elevation in arterial pressure and it occasionally may result in intracerebral bleeding. Ordinarily, however, cerebral circulatory homeostasis is well maintained even during an exercise-induced hypertension. The aim of this study was to test our hypothesis that change in extracranial blood flow prevents an over-perfusion to the intracranial cerebral vasculature during resistance exercise.

Methods: Five healthy subjects performed static two-leg extension at 20% of maximal voluntary contraction for 2.5 min. The blood flow velocity in the middle cerebral artery (MCA) and external carotid artery (ECA) blood flow were evaluated by transcranial Doppler and duplex ultrasonography, respectively.

Results and Discussion: During static exercise, the MCA blood flow velocity and the ECA blood flow increased compared with the resting condition (26 ± 15%, P = 0.021 and 114 ± 35%, P < 0.001, respectively). The increase in the ECA blood flow was 4-5 times larger than that of the MCA blood flow velocity. Since both internal and external carotid arteries are the branches from the common carotid arteries, these results suggest that the larger increase in ECA blood flow may prevent an over-perfusion to the intracranial region.

Key words: external carotid artery, resistance exercise, mean arterial pressure

The distribution of blood flow in the external and internal carotid arteries during exercise with heat stress

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Purpose: The mechanism underlying the decrease in cerebral blood flow (CBF) during dynamic exercise with heat stress remains unclear. This study assessed the regional distribution of extra-and intracranial blood flow during exercise with and without heat stress. Methods: Nine subjects performed two exercise trials at 60% of VO₂peak on a semi supine cycle ergometer in a hot (36°C; heat stress trial: H) and in a thermonutral environment (25°C; control trial: C). We evaluated external carotid (ECA) and internal carotid (ICA) blood flows using Doppler ultrasound. Results: ICA and ECA blood flow were significantly negatively correlated in both conditions (H: r = −0.41, C: r = −0.26). Regarding the relationship between end-tidal partial pressure of carbon dioxide (PETCO₂) and ICA blood flow a strong positive correlation was observed in the H condition (r = 0.76) and C condition (r = 0.43). Conclusion: During dynamic exercise with heat stress, the regulation of ICA blood flow was limited by a large increase in ECA blood flow, one function of which is thermoregulation during exercise. The mechanism of the decrease in CBF appears to be partly due to exercise-induced redistribution of arterial blood flow to the head and brain and along with changes in arterial CO₂, may be a major factor contributing to the regulation of CBF during dynamic exercise.