Cerebral blood flow changes in the primary motor 
and premotor cortices during hyperventilation

Kazunari Ishii, Masahiro Sasaki, Shigeru Yamaji, Setsu Sakamoto and Kiyoshi Maeda

Division of Neuroimaging Research and Radiology Service, Hyogo Institute for Aging Brain 
and Cognitive Disorders (HI-ABCD)

The aim of this study was to clarify the regional differences in cerebral blood flow (CBF) change 
during hyperventilation by using H$_2^{15}$O and positron emission tomography (PET). Eight healthy 
volunteers (age: 63.0 ± 8.9 yr.) were studied. Regional CBF was measured by the H$_2^{15}$O 
autoradiographic method and PET. Statistical parametric maps (SPM) and conventional regions of 
interest (ROI) analysis were used for estimating regional CBF differences in the normocapnic state 
with normal breathing and the hypocapnic state induced by hyperventilation. Total CBF decreased 
during the hypocapnic state. The SPM revealed that primary motor and premotor cortices were 
significantly activated by hyperventilation. In these areas absolute CBF values were significantly 
higher than those in the temporal, occipital and parietal lobes in the hypocapnic state, but there were 
no significant regional differences in the normocapnic state. In the hypocapnic state induced by 
hyperventilation, the primary motor and premotor CBF shows combined changes with vasoreaction 
to hypocapnia and increase in activation due to hyperventilation.

**Key words:** PET, $^{15}$O labeled water, hyperventilation, cerebral blood flow