A truly simultaneous combination of functional transcranial Doppler sonography and H(2)(15)O PET adds fundamental new information on differences in cognitive activation between schizophrenics and healthy control subjects.

Abstract:
Working memory deficits are a cardinal feature of the pathophysiology of schizophrenia. Lesion studies and functional blood flow-dependent imaging methods with coarse temporal resolution, such as PET and functional MRI (fMRI), tend to paint a fairly static picture of the cortical regions involved. In contrast, functional transcranial Doppler sonography (fTCD) provides a high temporal resolution. Truly simultaneous fTCD-fMRI is not yet possible for technical reasons, but H(2)(15)O PET and fTCD can be used really simultaneously. However, this combination has not yet been used for cognitive activations in schizophrenia. We therefore investigated the extent to which there are both spatial (PET) and temporal changes (fTCD) in the activation patterns of schizophrenic patients. METHODS: Eleven clinically stable chronic schizophrenic, right-handed patients and 10 healthy, right-handed control subjects, matched for age, sex, education, and intelligence quotient, participated in the study. We selected stable chronic schizophrenic patients who could perform a working memory task (N-back task) as well as healthy volunteers to exclude the possibility of imaged artifacts due to poor performance. All subjects were examined with a truly simultaneous
fTCD-H(2)(15)O PET combination under cognitive activation. RESULTS: Schizophrenic patients activate a significantly larger cortical volume for adequate task performance (Por= /0.65/; P 0.4).

CONCLUSION: We demonstrated that schizophrenic patients exhibit qualitative differences in the spatial and temporal resolution of cognitive processing. All facts could be interpreted as a sign of alternative, less efficient problem-solving strategies in schizophrenia that lead to the working memory deficits observed during the further course of this disease. Truly simultaneous fTCD-PET can be used in neuroscience to add fundamental new information on spatial and temporal cognitive activation behavior to understand the true physiologic nature of the disease-specific differences of mental illnesses that are seen as disorders of the mind arising in the brain.