

Disturbances in brain circuitry linked to chronic exposure to solvents

Chronic occupational exposure to organic solvents, found in materials such as paints, printing and dry cleaning agents, is widespread all over the world, and is thought to damage the central nervous system. The pattern of cognitive impairment, involving memory, attention and psychomotor function, frequently persists even after exposure has ceased, is usually referred to as chronic solvent-induced encephalopathy (CSE).

Although CSE is an acknowledged occupational disease in an increasing number of western countries, and is classified according to the World Health Organization criteria and is included in the Diagnostic and Statistical Manual for Mental Disorders, it is still a controversial diagnosis, with still some debating whether or not it is a bonafide condition.

Various studies have attempted to pinpoint brain abnormalities caused by CSE, but their methodologies have been questioned. It has been proposed that deterioration within the frontal-striatal-thalamic (FST) circuitry, which is also associated with the psychomotor and attention impairment that takes place with natural aging, may play a role in CSE. A new study was the first to show that disturbances in this region are related to the clinical characteristics of CSE as well as to the severity of exposure. The study was published in the April 2008 issue of *Annals of Neurology*, the official journal of the American Neurological Association.

Led by Ieke Visser of the Academic Medical Center in Amsterdam, the study included 10 CSE patients who had been exposed to solvents and had mild to severe cognitive impairment, 10 participants who had been exposed to solvents but had no CSE symptoms, and 11 participants who were not exposed to solvents and had no symptoms. Subjects were classified according to the duration and level of exposure, symptoms of acute intoxication and the use of personal protection equipment. They also underwent MRI and single photon emission computed tomography (SPECT) scans to evaluate various aspects of FST-circuitry, as well as a battery of neuropsychological tests to assess attention and psychomotor speed.

The results showed that CSE patients had reduced striatal dopamine D2 receptor (D2R) binding ratios (dopamine receptor density is thought to play a role in psychomotor speed) which were predictive of impaired psychomotor speed and attention and were also linked to exposure severity. The exposed controls showed similar reductions, although to a lesser extent. Both groups also showed reduced levels of choline, which plays a role in neurotransmission, in the frontal grey matter. These findings suggest that certain parts within the FST-circuitry are compromised in CSE patients and also exposed workers who don't show any symptoms, according to the authors. "A better understanding of the nature, severity and specificity of these suspected biological markers may further validate diagnostic procedures, this reinforcing medical and social recognition, and underlining the importance of prevention," they state.

The authors acknowledge that the study was small and that using higher field scanners would no doubt shed further light in assessing chemical interactions in the brain. However, they note that this is the first study in CSE patients to show pronounced disturbances in the FST-circuitry that are related to the clinical findings and to the severity of solvent exposure. They conclude: "Our results can be an important incentive for further study, clarifying the nature and specificity of these disturbances, thereby improving diagnostic procedures and acknowledgement of CSE patients, as well as worldwide prevention of chronic occupational solvent exposure."

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