Anterior cingulate cortex activity may represent a neurobiological risk for alcohol dependence

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Previous research has found that activation of the anterior cingulate cortex (ACC) is associated with risk factors for alcohol use disorders - such as low alcohol effects and positive alcohol expectations - among adolescents. This study used a spatial working-memory task to examine ACC activity among adults, finding that alcohol-dependent (AD) participants had a greater activation of the dorsal ACC (dACC) when compared to light and heavy social drinkers.

Results will be published in the May 2010 issue of *Alcoholism: Clinical & Experimental Research* and are currently available at Early View.

"In our study, we examined non-dependent light and heavy social drinkers as well as non-treatment-seeking AD drinkers with functional magnetic resonance imaging (fMRI) during a spatial working memory task," explained Sabine Vollstädt-Klein, a researcher at the Central Institute of Mental Health of the University of Heidelberg as well as corresponding author for the study. "To our knowledge, our study is the first to examine spatial working memory with fMRI in a spectrum of active drinking adults."

"In general, AD is a disorder that is characterized by neuronal adaptations that result from repeatedly exposing the brain to alcohol abuse," explained Kent Hutchison, a professor of psychology at The University of New Mexico. "It is also possible that there are premorbid

differences in brain structure and function that increase risk for the development of dependence. It is therefore critical to develop a better understanding of the neural networks that change as a result of AD, as well as an understanding of alterations in networks that may reflect premorbid risk factors."

To better understand these mechanisms, researchers asked 30 participants (16 men, 14 women) - divided into three groups of 12 light social drinkers, seven heavy social drinkers, and 11 alcohol-dependent drinkers - to perform a spatial working-memory task during fMRI. All of the participants were also asked to complete measures of automatic alcohol-related thoughts and behavior, provide information about alcohol use in the preceding 90 days, and answer questions designed to measure general intelligence.

"Although alcohol consumption in non-dependent heavy drinkers and AD drinkers was similar," said Vollstädt-Klein, "we found increased activation of the ACC in the group of AD drinkers. Furthermore, we found increased activation in the hippocampus and the thalamus in participants with frequent and intense automatic alcohol-related thoughts and behaviour."

Vollstädt-Klein explained that previous studies on natural reward have linked low capacity of working memory to more automatic and less self-regulatory behaviour regarding food and sexual stimuli.

"In other words, altered brain activation that we found in AD participants might be an indicator of less control over their alcohol-consuming behaviour and might in fact be the reason why this group became AD." She suggested that longitudinal studies should be conducted to examine whether increased ACC activation during a spatial working-memory task might be a neurobiological risk factor for, or a consequence of, the development of AD.

"These results suggest that working memory and ACC function may be critical for AD," said Hutchison. "At some point in the future, these studies may lead to diagnostic tools that will help match individuals with the best possible treatment. For example, deficits in ACC function may eventually suggest that a particular medication or psychosocial intervention is more likely to be effective than others."

Provided by Alcoholism: Clinical & Experimental Research

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