Hormone and neurotransmitter systems disturbed in alcoholics' brains

April 29 2016

The brain tissue of persons with alcohol dependence shows a variety of changes compared to non-alcoholic control persons. All alcoholics' brains share some characteristics, but some are exclusive to the brain tissue of anxiety-prone type 1 alcoholics or impulsive type 2 alcoholics, according to a recent study from the University of Eastern Finland.

The researchers analysed post-mortem brain tissue from alcoholic persons and non-alcoholic controls. Alcoholics were divided into two groups on the basis of Cloninger's typology: type 1 and type 2 alcoholics. Type 1 alcoholics develop alcohol dependence relatively late in life, and they are prone to anxiety. Type 2 alcoholics, on the other hand, develop alcohol dependence at a young age and they are characterised by antisocial behaviour and impulsiveness.

"From the viewpoint of the study setting, this division was made in order to highlight the wide spectrum of people suffering from alcohol dependence.. The reality, of course, is far more diverse, and not every alcoholic fits into one of these categories," says Olli Kärkkäinen, MSc (Pharm), who presented the results in his doctoral thesis.

One of the changes shared by all alcoholics were increased levels of dehydroepiandrosterone in the brain. Dehydroepiandrosterone is a steroid hormone that affects the central nervous system. These increased levels can, for their part, explain alcohol tolerance, which develops as a result of long-term use and in which alcohol no longer causes a similar feeling of pleasure as before. Moreover, all alcoholics showed decreased

levels of serotonin transporters in posterior insula and posterior cingulate cortex, brain regions associated with recognition of feelings and social cognitive processes. This finding could be related to social anxiety type behaviour seen in alcohol dependent individuals.

The study also found changes specific to the alcoholic type. For instance, the brain samples of impulsive, type 2 alcoholics had increased levels of AMPA receptors in the anterior cingulate cortex. By modifying the function of synapses between neurons, AMPA receptors play a role in the learning and regulation of, e.g., behavioural models. This can be associated with the impulsive nature of type 2 alcoholics. In type 1 alcoholics, however, changes were seen in the endocannabinoid system, which modulates stress responses, among other things. For example, docosahexaenoylethanolamide levels were increased in the amygdala, possibly associated with the anxiety prone nature of type 1 alcoholics.

"These findings enhance our understanding of changes in the brain that make people prone to alcoholism and that are caused by long-term use. Such information is useful for developing new drug therapies for alcoholism, and for targeting existing treatments at patients who will benefit the most," Kärkkäinen says.

Globally, the disease burden caused by alcohol is estimated to be roughly as great as the burden caused by the use of all illegal substances together. In Western countries, approximately 10–15 per cent of the population are alcohol dependent.

Provided by University of Eastern Finland

brains.html