Brain atrophy and alcoholism

Alcoholism has no satisfactory definition, yet no more useful term is available to describe chronic and deleterious over-consumption. Alcohol is mostly drunk for its pharmacological effects on the nervous system, so not surprisingly the brain is one of the organs that suffers most—along with the liver, which detoxifies the alcohol. The effects on the nervous system include direct intoxication, the consequences of withdrawal after habitation, cerebral vascular events, cerebral trauma related to drunkenness, and the results of secondary nutritional deficiency and of liver disease.

Atrophy of the brain is also difficult to define with precision, but radiological studies have shown a clear reduction in brain volume in many chronic alcoholics. This is at least partially reversible with abstinence. How far these changes may be correlated with defects of cerebral function remains to be established.

Cerebral atrophy may be visualised by air encephalography and by computed tomography; both techniques show enlargement of the ventricles and widening of the sulci. These changes slowly resolve with prolonged abstinence. The rate of recovery of the shrinkage of the brain is too gradual for it to be explicable entirely in the terms of a return to normal in its content of water and electrolytes. Other mechanisms that might play a part include the regeneration of glial and neuronal proteins. Estimations of changes in cerebral water content by magnetic resonance imaging in alcoholics during alcohol withdrawal have yielded conflicting results. Besson and coworkers reported a decreased free water content during intoxication and an increase during withdrawal of alcohol. Smith and colleagues found the reverse—namely, that the brain became excessively hydrated during alcohol consumption and that abstinence led to its dehydration.

Neuropathological studies in cerebral atrophy have been meagre in the extreme. An attempt to remedy this was recently made by Harper and Kril, who conducted a necropsy study on 26 patients with alcoholics in comparison with 44 controls. As an index of brain shrinkage they measured the size of the pericerebral space—that part of the intracranial volume not occupied by the brain. This space was found to be greater in the alcoholics, particularly in those with histological evidence of Wernicke's encephalopathy and in those with alcoholic liver disease.

In Wernicke's encephalopathy the lesions have a predominantly periventricular distribution, mainly in the diencephalon and brain stem. These are associated with the classic clinical triad of cognitive dysfunction, ocular abnormalities, and ataxia; associated cerebral atrophy has been reported in a quarter of cases. Korsakoff's amnestic syndrome, in which the main disturbance is a defect of recent memory, represents a chronic sequel, as probably does alcoholic cerebellar degeneration. Wernicke's encephalopathy is due to thiamine deficiency, but there may also be a hereditary susceptibility related to genetic polymorphism for the transketolase enzyme which requires thiamine as a cofactor. This potentially treatable complication of alcoholism is often not recognised. Harper found that over four years 51 cases were diagnosed at necropsy in a series reported from Perth, Australia. Only seven had been recognised during life.

The relation between alcoholic liver disease and brain atrophy is not clearly established. In the necropsy study by Harper and Kril, as already mentioned, the reduction in brain tissue was greater in patients with alcoholic liver disease—and the shrinkage was more severe than in patients with Wernicke's encephalopathy. In only one instance was there histological evidence of hepatic encephalopathy. Acker and coworkers also reported a positive correlation between ventricular size (assessed by computed tomography) and liver disease identified by biopsy in a group of 41 detoxified chronic alcoholics. On the other hand, Harper and Kril—in a study so far unpublished—reckoned that thiamine deficiency was the main factor when they made a subjective assessment of cerebral atrophy in 150 chronic alcoholics coming to necropsy. In that series cerebral atrophy was no greater in those with Wernicke's encephalopathy and alcoholic cirrhosis than in those with Wernicke's encephalopathy alone. It was least in those with cirrhosis alone. Lee and her coworkers studied 37 young alcoholics using computed tomography and liver biopsy specimens and concluded that there was no correlation between atrophy and liver disease. Nevertheless, four of their seven patients with cirrhosis showed cerebral atrophy.

At present, therefore, and despite evidence from studies in animals, pathological evidence for direct cerebral damage produced by alcohol remains controversial—apart from the specific lesions of Wernicke's encephalopathy and those related to hepatic encephalopathy. The concept of an "alcoholic dementia" separate from Korsakoff's syndrome remains unsettled. Courville believed that alcohol is a frequent cause of diffuse cerebral atrophy, with predominant damage to the frontal lobes, but others have failed to confirm this. The issue clearly needs detailed quantitative analysis.

The cerebral insults in alcoholics are likely to be multiple. Nutritional deficiencies other than thiamine may also be important. These factors will require much further study to resolve their respective and interacting roles in the production of brain atrophy and dysfunction.

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