Brains can recover from alcoholic damage but patients should stop drinking as soon as possible

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The findings, published today in the online edition of the journal *Brain*, used sophisticated scanning technology and computer software to measure how brain volume, form and function changed over six to seven weeks of abstinence from alcohol in 15 alcohol dependent patients (ten men, five women).

The researchers from Germany, the UK, Switzerland and Italy measured the patients' brain volume at the beginning of the study and again after about 38 days of sobriety, and they found that it had increased by an average of nearly two per cent during this time. In addition, levels of two chemicals, which are indicators for how well the brain's nerve cells and nerve sheaths are constituted, rose significantly. The increase of the nerve cell marker correlated with the patients performing better in a test of attention and concentration. Only one patient seemed to continue to lose some brain volume, and this was also the patient who had been an alcoholic for the longest time.

The leader of the research, Dr Andreas Bartsch from the University of Wuerzburg, Germany, said: "The core message from this study is that, for alcoholics, abstinence pays off and enables the brain to regain some substance and to perform better. However, our research also provides evidence that the longer you drink excessively, the more you risk losing this capacity for regeneration. Therefore, alcoholics must not put off the time when they decide to seek help and stop drinking; the sooner they do

it, the better."

Dr Bartsch, who is senior neuroradiology resident and head of the structural and functional MR-imaging laboratory of the Department of Neuroradiology at the University of Wuerzburg, said the study was one of the first to be able to integrate data that showed how the brain regained volume and function early on, once alcoholics, who had no complicating factors, had stopped drinking alcohol. It was carried out in collaboration with colleagues from the University of Oxford's Centre for Functional Magnetic Resonance Imaging of the Brain (FMRIB) and from the University of Siena's Institute of Neurological and Behavioural Sciences.

The patients' brains were scanned using magnetic resonance imaging (MRI) and proton MR-spectroscopy upon admission and after short-term sobriety. Only the patients that managed to abstain from alcohol without receiving any psychotherapeutic medication were included in the study, and those with secondary alcohol-induced disorders, as well as heavy cigarette smokers (more than 10 cigarettes a day), were excluded. Ten healthy volunteers (six men, four women), matched for age and gender, were recruited as controls for the study. The data were analysed and evaluated using FSL, a sophisticated software package developed at the Oxford FMRIB Centre, and LCModel (a computer program that analyses spectroscopy data) to give estimates of changes to brain volume, form (morphology), metabolism and function.

The technology enabled the researchers to superimpose the images of the patients' brains upon follow-up on to the images of the brains at the start of the study so that they could see any morphological changes. They also measured how levels of various chemicals, including N-acetylaspartate (NAA) and choline, changed between the two time points. NAA can indicate how intact the brain's nerve cells are (i.e. it is a metabolic marker of neuronal integrity), while choline provides hints at how cell

membranes are being broken down and repaired.

In addition, the neuropsychological performance of the patients was tested at the beginning and end of the study, using a specific test (the d2-test) that primarily measures attention and concentration.

Dr Bartsch said: "After short-term sobriety of less than two months, we found that brain volume had increased by an average of nearly two per cent (1.82%), with a range of -0.19 to 4.32%. Only the one patient with the longest history of alcohol dependence (25 years) had a slightly reduced brain volume (-0.19%), but that value is within the margin of measurement error. Volumetric brain recovery was signified by the patients' brains expanding beyond their previous limits, with an outward brain edge shift for the outer regions and an inward shift for the inner ones.

"In addition, on average across all the patients, cerebellar choline levels increased by about 20%, while levels of NAA in the cerebellar and frontal region of the brain and frontal choline significantly increased by about 10%. Brain volume regeneration correlated with the percentages increase in choline, indicating that volume regain is driven primarily by rising choline levels, while the more the NAA recovered, the better the patients performed on the d2-test."

There were no significant changes in the controls.

Dr Bartsch and his colleagues were confident that the increase in brain volume and form was not simply due to rehydration of the brain, as concentrations of choline and NAA increased even when water levels and other metabolites did not change significantly.

"Our results indicate that early brain recovery through abstinence does not simply reflect rehydration. Instead, the adult human brain, and

particularly its white matter, seems to possess genuine capabilities for re-growth. Our findings show the ways that the brain can recover from the toxic insults of chronic alcoholism and substantiate the early measurable benefits of therapeutic sobriety. However, they also suggest that prolonged dependence on alcohol may limit rapid recovery from white matter brain injury.

"Modern neuroimaging enables us to monitor morphological, metabolic and other functional brain changes. Usually this has been applied to evaluate the degree and speed of brain degeneration in illnesses such as Alzheimer's disease or multiple sclerosis. Here, we show that neuroimaging can also demonstrate and quantify brain regeneration in substance and function. Data analysis is crucial to these endeavours, and modern software such as the tools delivered by the Image Analysis Group at the FMRIB centre in Oxford provides us with the utilities necessary for such studies. For instance, I am able to inform a specific patient how much exactly his or her brain has benefited from sobriety and, as a clinician, I believe this may be a very supportive part of their treatment," he concluded.

In an accompanying commentary, Professor Graeme Mason, wrote that the study was important not just because it unified several previously separate lines of research but because it might give doctors the tools to motivate their alcohol-dependent patients to stay sober.

"Doctors treating or studying alcoholism should be made aware of the research of Dr Bartsch because it may provide a motivational tool that is a broad set of concrete, tangible, and rapid benefits of sobriety: cognition, chemistry and brain volume," wrote the associate professor of diagnostic radiology and psychiatry at Yale University. Prof Mason believed this was a particularly valuable contribution of the study because "patients often become discouraged from the physical and cognitive difficulties of achieving and maintaining sobriety."

Source: Oxford University