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USE OF BRAIN MRI IN MANGANESE EXPOSURE

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Purpose. To assess the role of Magnetic Resonance Imaging (MRI) in detecting signal abnormalities in ferro-alloy workers with occupational exposure to low doses of manganese and in cirrhotic patients, in order to investigate the correlation between MR signal and the biological indices of Mn overload in these different categories of subjects.

Materials & Methods. Brain MRI examinations were performed in 2 different groups of subjects. The first group included 7 subjects selected out of a larger population of 61 ferro-alloy workers exposed to low doses of manganese on the basis of indices of cumulative exposure. The second group was composed by 7 hepatopatic patients affected by non-alcoholic cirrhosis (HBV, HCV). 3 Child A, 2 Child B and 2 Child C. None exhibited overt hepatic encephalopathy at the time of MRI examination. All these subjects and 7 age-matched healthy volunteers underwent measurement of whole blood (B Mn) and urinary (U Mn) manganese and brain MRI imaging at 1.5 T, with classic spin-echo sequences (T2 axial, T1 axial and coronal sections). A Pallidal Index (P.I.) was calculated as the ratio of globus pallidus to subcortical frontal white matter signal intensity in axial T1-Weighted (T1-W) images.

Results. Bilateral signal of hyperintensity on T1-W images was discovered in the globus pallidus (GP) and in the anterior pituitary gland in 100% and 57% of workers respectively. In cirrhotic patients MRI findings were similar to ferro-alloy workers, with 100% bilateral hyperintensity in GP and anterior pituitary gland, but the mean P.I. was statistically higher. No signal abnormalities were detected in control subjects. Statistical analysis showed a moderately strong relationship only between blood manganese and P.I. (R^2= 0,36; p=0,01). No correlation was found between P.I. and indices of cumulative exposure to manganese.

Discussion and Conclusions. To date there is little information about Mn accumulation in the brain in ferro-alloy workers exposed to low doses of this metal and our study is the first that compares subjects with different causes of Mn overload. On the basis of our findings there is an association between B Mn and P.I. and MRI seems to be able to detect signal abnormalities in basal ganglia and anterior pituitary gland in asymptomatic workers and hepatopatic patients before neurological signs or symptoms can occur. The MRI signal intensity variations could be interpreted as belonging to a "continuum" from normal population, to enviromentally exposed workers, hepatopatic patients and intoxicated workers. MRI hyperintensity seems to reflect the deposition of manganese in target areas as a product of current exposure and not of the manganese accumulation in the brain due to cumulative exposure. When the Mn doses in the GP overcome a certain "critical concentration" adverse effects may appear at a neurobehavioral level, and a progression is possible in a dose-dependent fashion to the clinical, irreversible level of dysfunction. This study suggests the use of MRI as a more efficient screening examination on a larger sample of occupationally exposed workers that could replace the cumulative indices of exposure at present utilized.