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Suitability of brain MRI in manganese exposed subjects

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Manganese is a metal with paramagnetic properties that are useful for the magnetic resonance image (MRI) study of the deposition and accumulation in the brain. Brain MRI can show a T1-hyperintensity in globus pallidus among intoxicated workers following abnormal high exposure to manganese. The same image can be found in patients with hepatic failure, due to a decreased excretion of manganese through the biliaric tract, and in subject with parenteral nutrition containing excessive amount of manganese. Recent surveys have also shown hyperintensity images in asymptomatic workers exposed to "low" airborne manganese concentrations, below the current TLV-TWA of 200 $\mu\text{g}/\text{m}^3$. An attempt to quantify the deposition of manganese can be done by calculating the "pallidal index", which is defined as the ratio of globus pallidus to subcortical frontal white-matter signal intensity in sagittal T1-weighted MRI planes multiplied by 100. This index can be considered as a "semi-quantitative" estimate of the amount of manganese accumulated in the brain and although representing an indirect indicator of the real dose, it has been found to correlate with the concentration of manganese in total blood. A review of the existing literature including original data from a pilot study on occupational exposed workers and hepatic patients is presented, focusing on methodological differences in MRI technique.

Since an important endpoint of the use of MRI in manganese exposure is the assessment of a dose-effect curve where the effect is represented by the hyperintensity level, a standardization of the methodology, including MRI equipment and testing procedure, is needed. An effort should be made also to identify a more accurate and precise indicator of the hyperintensity level reflecting the manganese dose in the brain.