DETECTION OF CENTRAL ACTIVATION BY MANGANESE ION CONTRASTED T_1-WEIGHTED MAGNETIC RESONANCE IMAGING IN RATS

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Summary

To examine the usefulness of Mn^{2+} contrasted MRI in central imaging, images obtained using T_1-weighted MRI were compared with Fos expression, which is known to increase after activation of voltage-dependent Ca^{2+} channels. Intravenous infusion of $MnCl_2$ elicited a rapid increase in the T_1-weighted MRI signal intensity in the vessels and ventricles, but not in the brain parenchyma, suggesting that Mn^{2+} did not diffuse freely across the blood-brain barrier. When the blood-brain barrier was broken by right intracarotid arterial injection of 25 % D-mannitol, an increased signal intensity was seen in the right brain. Intracarotid arterial injection of hypertonic NaCl elicited rapid and striking increases in signal intensity in the paraventricular hypothalamic nucleus, supraoptic nucleus, and preoptic area, which are thought to be involved in central osmotic regulation. These observations were consistent with the Fos expression results. Using this technique, a time course of central activation induced by an intracerebroventricular injection of hypertonic NaCl solution was detected. Furthermore, a central activation induced by more physiological stimulus, i.e., an oral administration of hypertonic NaCl was also detected. These results indicate that Mn^{2+} contrasted MRI has reasonable spatial and temporal resolution and is a useful technique for investigating a functional activation of the brain.