Effects of Iron Overdose on the Basal Ganglia of the Adult Albino Rat

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Abstract:

Abstract Background: Iron is the most abundant element on earth and an essential metal for life. It is used extensively by proteins involved in the electron transport chain, the active centers of many enzymes and oxygen transport. It is essential for the adequate development and functioning of the brain. The regulation of the iron metabolism is crucial since both the iron deficiency and the iron overload can cause a disease. Aim of the Work: To detect the effects of iron exposure during the postnatal period on the putamen, the subthalamic nucleus and the substantia nigra in adult albino rats. Material and Methods: A total number of twenty albino rats were used in the study. They were equally divided into a control group and an experimental group. The control group received tap water orally. The experimental group received 15 mg/kg of ferrous gluconate orally. The regimen started at postnatal day 12 and continued until three months old. The rats were anaesthetized and the brains were extracted. The specimens from the fixed brains were dissected and processed for the light and the electron microscopic examination. Morphometric measurements were also done. Results: The light microscopic study of the treated group revealed neurons of putamen had dense darkly stained nuclei and vacuolations appeared within the neuropil. Wide spaces between darkly stained neurons of the subthalamic nucleus were detected. The neuropil of the substantia nigra pars compacta (SNc) had many vacuoles and most of the neurons had darkly stained nuclei. Immunohistochemistry of the putamen using anti-TH demonstrated a reduction of TH expression in a patchy manner. Immunohistochemistry of SNc showed a weak TH immunoreactivity in the neuropil of the treated group and a decrease in the number of TH immunopositive neurons as compared to the control group. The electron microscopic study of the SNc and putamen of the treated group showed degeneration of the mitochondria, vacuolization of the cytoplasm, heterochromatic nuclei with irregular outline and marked loss of cell organelles in the cytoplasm. At the site of synaptic contact, there were an area of loss of presynaptic and postsynaptic densities and the synaptic terminal showed a small number of the synaptic vesicles, and swollen mitochondria with destructed inner cristae were also observed. Morphometric studies revealed significant decrease in the cell count and surface area of the neurons in SNc and putamen of the treated group as compared to the control group. 2 Conclusion: Iron overdose during postnatal period produces degeneration of the putamen, subthalamic nucleus and substantia nigra in the adult albino rat.

Keywords: Putamen, Subthalamic nucleus, Substania nigra, Iron, Albino rat

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