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Image in Medicine

The human dopaminergic system: cerebral SPECT

O sistema dopaminérgico humano: SPECT cerebral

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Imaging exams have advanced remarkably in recent decades, and new technologies have been developed; today we can functionally assess populations of neurons in the central nervous system.[1-3] We are showing in this article the dopaminergic system in the brain of an adult man.

In Figure 1, we can appreciate a cerebral SPECT of the dopaminergic system. The patient was a 61-year-old man with gait disturbance and cognitive deficit. The scintigraphic and fusion (Spect/CT) image displays a normal tracer concentration in the right and left striatums. The quantification of the relative uptake of the striatum, caudate, and putamen in relation to the occipital cortex was also normal.

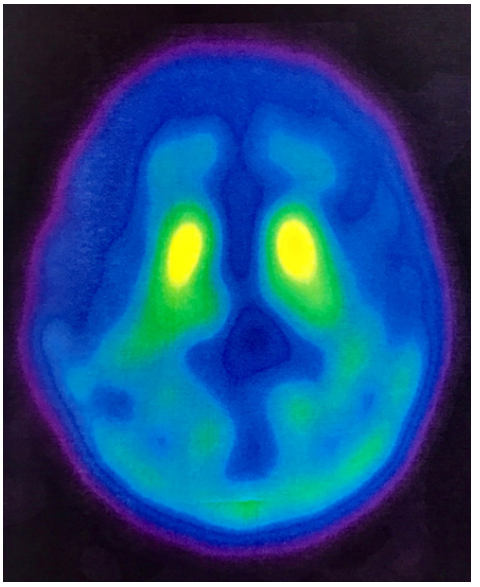

Figure 1. Cerebral SPECT of the dopaminergic system. A 61-year-old man with gait disturbance and cognitive deficit. The scintigraphic and fusion (Spect/CT) image displays a normal tracer concentration in the right and left striatums. The quantification of the relative uptake of the striatum, caudate, and putamen in relation to the occipital cortex was also normal.

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In the presynaptic cell membrane, dopamine transporters at dopaminergic neuronal endings are essential in regulating extracellular dopamine concentration.[4] These transporters influence the neural signals the striatum receives.[4-5] Disturbances that affect these transporters may cause Parkinson's disease, a condition intimately linked with the dopaminergic system.[6-9] It is believed that in Parkinson's disease, more than 70% of the dopamine-producing neurons have died.[10-11]

Dopamine transporters can be used as a biomarker for evaluating striatal neuronal function.[5,7] When 99mTc is labeled on the tropane analog TRODAT-1, 99mTc-TRODAT-1 is formed.[8]

99mTc-labeled Trodat scintigraphy is an exam that the tracer selectively binds to presynaptic dopamine receptors in the substantia nigra of the midbrain. With the death of dopaminergic neurons, there is also a loss of these receptors, which can be confirmed very sensitively on SPECT images even in the earlier stages of the disease. The reduction in the density of these receptors is associated with the severity and progression of Parkinson's disease. On the other hand, normal images rule out the hypothesis of Parkinson's disease.

In addition, the patient also underwent cerebral cisternoscintigraphy with intrathecal tracer injection. Cerebral scintigraphic images of the skull show abnormal tracer concentrations in the lateral ventricles on initial images, which persisted for 24 hours. There was a normal ascension of the tracer to the cerebral convexities (Figures 2 and 3). This is compatible with the diagnosis of normal pressure hydrocephalus.

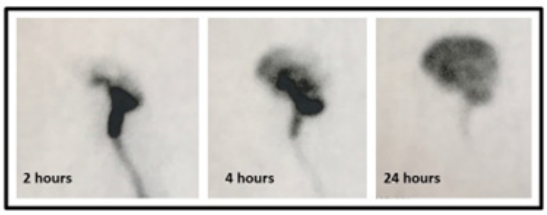

Figure 2. Cerebral scintigraphic images of the skull show abnormal tracer concentrations in the lateral ventricles on initial images, which persisted for 24 hours after the intrathecal tracer injection.

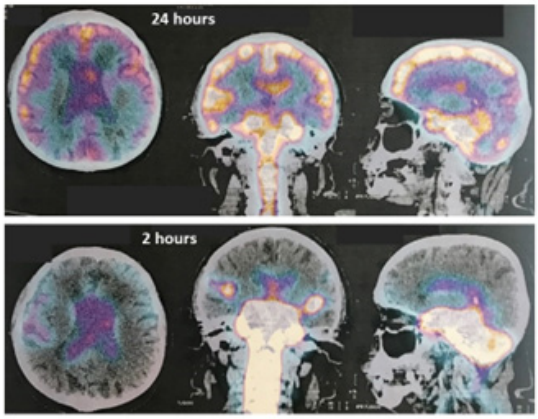

Figure 3. Cerebral scintigraphic images of the skull show abnormal tracer concentrations in the lateral ventricles on initial images, which persisted for 24 hours after the intrathecal tracer injection. There was a normal ascension of the tracer to the cerebral convexities. The exam was compatible with the diagnosis of normal pressure hydrocephalus.

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