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A novel Neuroimaging technique to study Neuropathology of Neurological disorders

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Because of poor understanding of the neuropathology, it is often difficult to diagnose and treat many neurological conditions. Advances in neuroimaging techniques have helped us understand these conditions but these techniques are severely deficient in their ability to detect and measure neurotransmitters in the live human being. Since neurotransmitters are key components of the brain function, an important aspect of the brain function remains uninvestigated. Investigators are making efforts to develop techniques that allows accurate detection and measurement of a neurotransmitter. We developed one of those techniques. It is called neurotransmitter imaging technique or the single scan dynamic molecular imaging technique (SDMIT). The technique uses positron emission tomography (PET) to detect, map and measure neurotransmitters released acutely during cognitive or behavioral processing in the live human brain. It allows detection of impaired neurotransmission at a very early stage of a disease process to help make an early diagnosis of a number of neurological conditions that are associated with dysregulated neurotransmission. The technique exploits the competition between a neurotransmitter and its receptor ligand for occupancy of the same receptor site. In this technique after patients are positioned in the PET camera, a radio-labeled neurotransmitter ligand is injected intravenously and the PET data acquisition started. These data are analyzed using a receptor kinetic model to detect, map and measure neurotransmitter released dynamically in different brain areas. Patients are asked to perform a cognitive, behavioral or emotional task while in the scanner and the amount of neurotransmitter released in different brain areas measured. By comparing the amount with the data acquired in healthy control volunteers during performance of a similar task, it is determined whether release of a neurotransmitter is dysregulated in the patients and whether the dysregulation is responsible for clinical symptoms. Finding of a significant dysregulation would confirm diagnosis of many neurological conditions including, Parkinson's disease and many forms of dementia. Since this technique measures neurotransmitter released under conditions of cognitive stress, it can detect changes at a very early stage, when dysregulation of is not expressed at rest but manifests only under conditions of cognitive overload.

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