Identification of molecular imaging markers in PD mouse models

The poor knowledge of the mechanisms underlying striatal dopamine denervation and the lack of specific markers allowing the definition of a reliable Parkinson’s disease (PD) risk prediction, hinder proper prodromal PD diagnosis and development of disease-modifying therapies. Therefore, the identification of early markers of disease is of fundamental importance. Molecular imaging techniques as PET-CT can be applied in the study of PD differential diagnosis and in monitoring of disease course, using specific biomarkers\(^1\). A probable candidate of early-stage disease is represented by axonal degeneration. Axon growth is a process involving neurons and astrocytes. They play an important role in protecting neurons from damage caused by the excitotoxicity of the extracellular environment, and of trophic support providing nutrients and energy necessary for several processes, including axonal growth. Moreover, neuroinflammation and mitochondrial dysfunction have a role in the beginning and propagation of neurodegenerative process and the study of these mechanisms may be of help in the identification of potential therapeutic targets and strategies. The usefulness of the TSPO-specific radioligand \(^{18}\text{F}\)VC701 is applied to investigate \textit{in vivo} the role of neuroinflammation at early PD stage using CT-PET and MRI in the longitudinal monitoring of \textit{ad hoc} animal models. This marker can be related to axonal damage, mitochondrial dysfunction and other typical hallmarks of PD as dopaminergic degeneration and α-synuclein aggregation. Moreover, innovative Statistical Parametric Mapping (SPM) analysis can be applied in the automatic identification of brain areas that are significantly modified compared to the healthy condition. In addition, connectomics, the study of metabolic connection between brain areas, will provide crucial information regarding the early modifications induced by disease or drug treatment.

References:

Keywords: PD mouse models, Early disease markers, PET-CT imaging.

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