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New insight of in vivo imaging in the understanding of brain disorders

ABSTRACT In the last few years the development of biotechnology has increase our knowledge on the structural and molecular modification attending brain disorders which are relevant not only for a better understanding and classification of diseases but also for the development of novel therapeutic interventions. In this era of targeted based therapy and personalized medicine, in vivo imaging techniques represent an unique tool for the early identifications of specific subset of patients on the basis of specific structural, functional and molecular regional brain features. The most advance approach, actually limited to oncology, is represented by radiomics that, in analogy with others omics techniques, transform data into specific imaging signature capturing tissue heterogeneity of patients. However other innovative analysis like functional MRI (resting state or during task) or diffusion tensor MRI imaging (DTI) has permitted to map at macroscopic levels the structural or functional networking present in brain. In addition the use of positron tomography techniques (PET) allows to image and quantify the distribution of neuroreceptors, transporter and enzyme or the abnormal presence of activated immune cells or misfolded protein present at regional level in central nervous system. Integration of molecular information with structural and functional data related to normal and pathological brain networking might provide in the next future new insight for the building of new neuropathological models of brain disorders. Here some representative example of structural, functional, molecular and multimodal imaging approach to the classification of brain disorders will be presented.

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