Mediterranean Thematic Workshops in Advanced Molecular Imaging

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Characteristic metabolic brain networks associated with Parkinson's disease, multiple system atrophy and progressive supranuclear palsy

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Differentiation between neurodegenerative parkinsonisms, whose early clinical presentation is similar, may be improved with metabolic brain imaging. We identified the characteristic metabolic patterns for Parkinson's disease (PD), multiple system atrophy (MSA) and progressive supranuclear palsy (PSP) –PDRP, MSARP and PSPRP –in a new European cohort.

Brain scans of a Slovenian cohort of 20 PD, 20 MSA-P, 20 PSP patients and 40 healthy controls (HC) were acquired with 18F-fluorodeoxyglucose (FDG) and positron emission tomography (PET). The scaled subprofile model/principal component analysis was applied to identify PDRP, MSARP and PSPRP. Additionally, 56 MSA, 45 PSP, 116 PD and 61 HC subjects were analyzed for validation. We explored the effect of various PET image reconstruction algorithms on the expression of the patterns. We innovatively applied heat-map analysis to extract and graphically display the pattern's regional sub-scores in individual subjects.

PDRP was characterized by hypermetabolism in pallidum, putamen, thalamus, brain stem, cerebellum and sensory-motor cortex, associated with hypometabolism in posterior parietal, occipital and frontal cortex. MSARP was characterized by hypometabolism in cerebellum and putamen, and PSPRP by hypometabolism in medial prefrontal cortices, nucleus caudatus, frontal cortices and mesencephalon. Patterns'expression discriminated between PD/MSA/PSP patients and HCs as well as between different parkinsonian cohorts ($p<0.001$). We confirmed significant correlation of PDRP expression between the reference and other reconstruction algorithms ($r\geq0.993$, $p<0.0001$). Heat-map analysis showed differences within MSA/PSP subjects and HCs consistent with clinical presentation.

Replication and validation of PDRP, MSARP and PSPRP confirms robustness of these metabolic biomarkers and supports its application in clinical and research practice. We showed that different types of reconstruction algorithms have no significant impact on the pattern expression and that heat-map analysis improves insight into the heterogeneity of studied syndromes by displaying the contribution of various pattern's regions to patterns'expression in individual subjects.

Topic Selection

Brain Imaging

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