Imaging Biomarkers in Parkinsonism

One of the main research areas of our center concerns imaging biomarkers in parkinsonism. In the last few years, we focused on three different large projects:

I) **Development and validation of new powerful diagnostic biomarkers to differentiate Parkinson’s disease (PD) from progressive supranuclear palsy (PSP) in research centers.** We have recently validated in a large international study the diagnostic performances of a morphometric MR biomarker based on the measurement of brain structures typically involved in PSP, termed Magnetic Resonance Parkinsonism Index (MRPI), demonstrating its accuracy in distinguishing PSP from PD in a large patient group from different geographic regions. In addition, we also developed a new version of this biomarker, termed MRPI 2.0, which allows to properly classify patients with milder PSP phenotypes, who have a clinical picture strongly resembling that of PD and are difficult to identify in the early stage of the disease. These biomarkers are extremely accurate in differentiating PSP from PD patients and are also promising biomarkers of disease progression in PSP, but they are complex and require high-level technology and deep technical expertise, thus being more suitable for research purposes rather than for clinical routine.

II) **Development and validation of simple diagnostic biomarkers that balance complexity and feasibility to differentiate between PSP from PD in everyday clinical practice.** Very recently, we have developed and validated a new MR linear biomarker to differentiate PSP from PD patients in the early stages of the diseases, based on the measurement of the third ventricle width (3rdV/ID). This simple and accurate biomarker can be performed on routine MR images also by non-expert physicians, and thus could positively impact the clinical care of PD and PSP patients in clinical settings and the selection of patients for clinical trials of new disease-modifying therapies, worldwide.

III) **Development of diagnostic biomarkers for differentiating between degenerative parkinsonism and normal pressure hydrocephalus (NPH).** We have recently developed a linear MR biomarker, termed Magnetic Resonance Hydrocephalic Index (MRHI), to differentiate between PSP and normal pressure hydrocephalus (NPH), two neurological diseases that share several clinical and imaging features. The importance of differentiating NPH from neurodegenerative disorders, such as parkinsonism and dementia, is linked to the extremely different management and prognosis of these diseases. PSP in an untreatable disease, while NPH patients show partial or complete recovery after neurosurgical shunt therapy. Thus, imaging biomarkers are crucial to identify patients who may benefit from surgery and prevent shunt procedures in NPH mimics.

In conclusion, our findings provide a strong impetus for using imaging biomarkers in addition to clinical criteria in differentiating PD from PSP, and in the selection of patients in clinical trials on disease-modifying therapy.

**References:**


2. “Magnetic Resonance Imaging Biomarkers Distinguish Normal Pressure Hydrocephalus From Progressive Supranuclear Palsy” Quattrone A, Sarica A, La


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