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Neuronal biomarkers of Parkinson's disease are present in healthy aging.

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Parkinson's disease (PD) is a chronic neurodegenerative disorder with its prodromal phase lasting for many years before the onset of clinical cardinal symptoms. There is a wide range of risk factors for developing PD including age, sex, genes, environment and life style (for instance regular pesticide exposure, specific genetic mutations, (non) smoking, diabetes mellitus, physical inactivity etc.). Yet, so far age remains the primary risk factor for developing Parkinson's disease. The prevalence of Parkinson's disease increases with healthy aging, from approximately 0.25 % at age 60 to 2.0 %–2.5 % at age 80. It has been suggested that both processes share similar cellular mechanisms and alterations in the dopaminergic system, and aging is associated with a pre-parkinsonian state potentially serving as a foundation for further development of PD. Therefore, we hypothesize that electrophysiological biomarkers associated with PD can be already present in normal aging process when comparing healthy young and elderly participants.

Previous work has shown that phase-amplitude coupling (PAC) between the phase of beta oscillations and the amplitude of broadband gamma activity, as well as beta bursts features can serve as electrophysiological biomarkers for PD. In this study, using resting state multichannel EEG measurements, we show that PAC between beta oscillation and broadband gamma activity (50–150 Hz) is elevated in a group of elderly (59–77 years) compared to young volunteers (20–35 years) without PD. Moreover, a trend for a higher percentage of longer beta bursts (> 0.2 s) along with the increase in their incidence rate is also observed for elderly subjects. Using inverse modeling, we further show that elevated PAC and longer beta bursts are most pronounced in the sensorimotor areas.

Taken together, our findings provide novel evidence that electrophysiological biomarkers of PD may already occur in apparently healthy elderly subjects. We postulate that PAC and beta burst characteristics in aging might reflect a pre-clinical state of PD and suggest their potential as markers for prodromal PD. This in turn can be tested in prospective longitudinal studies.

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