The effects of aging and HIV infection on the relationship between the Resting State of the brain and neurocognitive functioning Abstract

Anna Rita Egbert, MA

Promoter: Emilia Łojek, Professor, Ph.D.

Co-Promoter: Bharat Biswal, Professor, Ph.D.

Auxiliary Promoter: Agnieszka Pluta, Ph.D.

Abstract

Rationale and objective: The aging HIV seropositive (HIV+) population struggles with the brain functional and structural abnormalities. Consequently, HIV+ individuals can experience decline in neurocognitive performance. The current state of knowledge informs on the neuroinfectious actions of the HIV virus to a limited extent. However, with the new methods of brain imaging, such as resting state functional magnetic resonance imaging (RS-fMRI), we can now better understand the functional brain bases of the clinical neurocognitive portrait in this specific patient population. Up to date, few scientific reports addressed the effects of age and HIV infection on the resting state (RS) of the brain and cognitive functioning. Due to previous inconsistent findings, the issue remains unclear. This study aimed to examine the effects of aging and HIV infection on the RS of the brain in relationship to the cognitive functioning.

Methods: This study analyzed data from a final number of 108 participants between 25 and 75 years of age, including 54 HIV+ individuals (age M=41; SD=12 years) and 54 demographically matched HIV-seronegative controls (age M=43; SD=12 years), with the mean of 16 years of education. All HIV+ participants were receiving HAART. The data retained for the current analyses included neuroimaging data of resting state functional magnetic resonance imaging (RS-fMRI), and neurocognitive data from a comprehensive battery of tests assessing attention, executive functions, memory, psychomotor functions, and semantic skills. RS data was analyzed using Regions of Interest-based approach, Independent Component Analysis, and Voxel-based analysis. Cognitive tests outcome T-scores were comprised into Neurocognitive Factor Scores. Between group differences in RS and neurocognitive data was assessed with *T*-unpaired test. Bivariate correlations examined relationships between age, RS measures, and neurocognitive factors. Multiple Linear Regression Analysis were performed in order to investigate the effects of

age and HIV infection on the relationship between RS brain activity and neurocognitive performance.

Results: Control group revealed patterns of aging in RS functional connectivity (FC) and neurocognitive decline comparable to the general population. HIV infection was related to decreases and increases in RS-FC and deterioration in attention and sematic skills as compared to controls. Interaction effects of age and HIV infection were exposed in terms of intra- and inter-network remote FC, which was weakening with age in HIV+ group, while strengthening with age in healthy comparators. No age-HIV interaction effects were observed on cognitive factors. Significant relationships were distinguished between RS-FC measures sensitive to age-HIV interaction effects and neurocognitive factors. Age had no significant moderator effects on majority of the revealed relationships in controls. HIV significantly moderated relationship between RS-FC and neurocognitive factors. Age in HIV+ group did not reveal significant moderator effects on the relationship between RS-FC and neurocognitive factors.

Conclusions: Current study provides evidence that RS-fMRI is a sensitive technique to reveal not only additive but also interaction effects of age and HIV infection on the functioning of the brain. The results confirm that age and HIV infection lead to brain reorganization and decline in neurocognitive performance. Importantly, the study finds evidence for the employment of brain compensatory mechanisms in aging HIV+ patient population. The current findings support the hypothesis of rather accentuated than accelerated aging in the individuals aging with HIV.