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Aspects of Cognition/Health Failure by HIV-infected Individuals: Amelioration through Exercise

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Editorial

A profile of progressive neurological symptoms referred to collectively as HIV-associated neurocognitive disorder (HAND) has been found to be linked to human immunodeficiency virus type 1 (HIV-1) with symptoms implicating several cognitive domains, including attention, learning, memory, affect and motor functioning [1-3]. Neuropsychological testing indicates that around fifty percent of HIV patients, in antiretroviral therapy, present evidence of mild cognitive impairment (MCI)/HIV dementia which implies that prevalence was unchanged from the pre- to the potent antiretroviral period, although incidence of MCI had increased and HIV dementia decreased [4]. In children and adolescents presenting HIV, the status of stimulant treatment fot cognitive, behavioral and quality-of-life deficits remains an expectancy, rather than a guarantee of long-term improvement [5]. The syndrome, HAND, presents a spectrum of neurocognitive-neurologic deficits characterized, on the one hand, by poor concentration, memory impairments and psychological sluggishness, and on the other hand, by psychomotor retardation, deficits in fine motor control, balance and posture problems with accompanying clumsiness, and tremors. The behavioral deficits include apathy, flatness of affect, lethargy and loss of spontaneity [6]. HIV-induced metaboliceencephalopathy engenders HAND symptoms with immune activation arising from macrophages and microglia [7], with accompanying neurotoxin release, dendritic abnormality and neuron loss [8] and cerebellar and subcortical gray matter atrophy [9]. Su et al. [10] have shown the HIV-infected males dislayed greater white matter hyperintensities that was associated independently with higher age levels, higher diastolic blood pressure and D-dimer levels and longer periods with lower CD_{4+} cell counts. Although HAND is linked generally with HIV diagnosis, for most infected individuals receiving antiretroviral therapy combined with virologic suppression the disorder is not progressive during a four-year follow-up period [11,12]; nevertheless, certain variants of HIV-linked neurocognitive deficits were shown to be related to attentional bias that included motor deficits commonly associated with HIV-induced damage to the basal ganglia and previous inability to avoid risk-taking behaviors [13].

It has been observed that age-related co-morbidities exacerbate the risk for cognitive deficits in patients with HIV diagnosis, a reality that requires consideration when examining individual-based factor affecting progression and expression, such as age, gender, ethnicity and genetics. With advancing age, individual presenting HAND are at greater for progressive deterioration of daily life activities, medical decision-making and quality-of-life [14-16]. In a study deriving an estimate of 'cognitive reserve from the Brief Intelligence Test and the Cognitive Reserve Index, it was observed that lifestyle choices affected coping-capacity to deal with HIV in aging and HIV-related neurodegeneration [17,18]. It has been shown that in a cohort of HIV patients (aged 60 years and above) that the adherence to antiretroviral therapy was related to cognitive impairment [12], apolipoprotein E4 genotype, monocyte efficacy scores, with trend associations for diabetes and low CD4+ cell count [19,20]. Plasma microRNA profiling of genes, applied to estimate neural development, cell death, neuroinflammation, cell signaling and cytokine functions [21], has provided useful biomarkers for HAND through predicting HIV-associated cognitive impairments [22]. The Veterans Aging Cohort Study Index, developed as a risk index for HIV, in relation to global cognition, was found to vary as a function of ethnic/racial grouping [23]. In a study of HIV patients in Nigeria, it was shown that the risk of developing neurocognitive impairment differed between genders possibly due to the effects of higher plasma levels of HIV coercing the activation of circulating monocytes [24]. Male transgenic mice, inducibly expressing HIV-1 Tat, the HIV-1 transactivator of transcription, or non-expressing control mice, displayed spatial memory impairments and other cognitive deficits, together with increased vulnerability of parvalbumin-expressing and somatostatin-expressing interneurons in the hippocampus [25] and other markers of neuronal damage [26].

Physical exercise has been described as a combination of planned and organized physical activities that fulfill the intent for development and advancment several domains that include health, physical fitness, quality-of-life and functional sufficiency [27]. Exercise/activity encompasses any and all physical activity that provokes force muscular force dissembling existing enertia [28]. Muscular exertion through physical activity bestows marked benefits for cerebral integrity and neurocognition [29-31], in addition to the development and proliferation of brain structure and function, improved quality-of-life and physical endurance and strength [32]. Simonik et al. [33] have shown that the propensity and compliance to engage in exercise among individuals enduring HIV presents a dynamic and fluctuating construct that may be influenced by the episodic nature of HIV and multi-morbidity with the recommendation that enhancement of physical activity/exercise ought to maximize health outcomes. Combinations of endurance (aerobic) and resistance exercise three times weekly well-tolerated by HIV-patients and brought about improvements in cardiorespiratory fitness, strength, body composition and quality-of-life [34]. Higher levels of education, socioeconomic status, cognitively-challenging occupations and intelligence indices predict superior cognitive function and daily functional activity in HIV afflicted individual. Certainly, exercise interventions for Nigerian HIV-patients (18 years and above) improved markedly both pulmonary functions and alleviated respiratory and depressive symptoms [35]. Physical activity engagement and employment are linked to greater performance in neurocognitive tasks [36-38]. Cross-sectional studies have indicated that activity and active engagement in daily activities bolsters neurocognitive functioning [39]. As implied by Mattson [40]

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and others [41-46], HAND patients ought to benefit from the plethora of health advantages bestowed by regular physical exercise: accelerated brain-derived factor and other trophic factor production, enhanced synaptic (even axonal) plasticity, neurogenesis and neuron arborization, increased production of anti-inflammatory cytokines and other aspects of improved neuroimmune functioning, and marked dividends for cognitive performance and affective balance. Furthermore, exercise intervention was applied to fifteen HIV-infected individuals between 35 and 51 years-of-age, and improvements in hand strength, scapular force, and several quality-of-life domains, including environment, perception of quality-of-life and global health [47,48]. Thirty HIV patients, undergoing highly active antiretroviral therapy, were either assigned to a nonlinear resistance exercise group or to a group with the exercise intervention interval covering 12 weeks [49]. After the 12-week intervention, the exercise group had augmented levels of lean body mass, with a reduction in body fat mass and body fat percentage whereas the levels of total cholesterol, low density lipoprotein cholesterol, triglyceride, and c-reactive protein were reduced, with the high density lipoprotein cholesterol level increased. Thus, the exercise intervention brought about alleviative changes in the body composition, lipid profile, and inflammation markers of HIV patients. Finally, in a study of the aerobic (endurance) plus resistance exercise training combination upon self-reported mood disturbances, e.g. reported depression and profiles of mood states, perceived stress, frequency of self-reported symptoms, and symptom-distress in Exercised or Non-exercised HIV-infected individuals, obtained significant decreases in reported depression scores and total profile of mood state. Taken together, the consensus of current findings and notions concerning intervention implies that physical exercise holds manifest benefits, certainly as an adjunctive therapy, for HIV-infected individuals presenting HANDS.

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