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Commentary OMICS International

Commentary on Association between Motor and Cognitive Performance in Patients with Traumatic Brain Injury

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Traumatic brain injuries (TBI) have diverse consequences which influence functions from the affected physiological functioning of cells through neurological and psychological impairments to medical problems and disabilities. Typically physically well-recovered patients with TBI often complain of impaired motor performance. This impairment may not be revealed in conventional neurological examination because they do not have difficulties to be able to walk and run. However, they may have significant problems when performing premorbid motor activities. Furthermore, the assessment of the relationship between cognitive and motor functions in patients with TBI has been very scarce.

It has been considered important to recognize rapid alternating movements, gait and balance, static or dynamic posture and vestibular system integrity with respect to physical problems after mild or moderate TBI. Many patients with TBI also have difficulties in tasks requiring simultaneous rhythmic movements of the upper and lower limbs compared with healthy controls.

In our studies [1,2] the physically well-recovered men with TBI attending a national rehabilitation centre (Käpylä Rehabilitation Centre, Helsinki, Finland) reported experiencing motor problems such as difficulties in running, impairments in balance, clumsiness in arm movements and fatigue. Defects in balance are typically manifested in deep parenchymal brain damage or focal cerebral lesions. Even though motor performance is maintained in a highly functional person with TBI residual consequences on walking often remain [3].

Motor performance was assessed using tests measuring balance, agility (figure-of-eight run) and rhythm coordination. Consequently, the men with TBI had defects in static and dynamic balance and performed the agility test significantly more slowly compared with the group of healthy men. In addition, they had difficulties to coordinate movements in the given rhythm, e.g. starting and proceed with simultaneous rhythmical movements of hands and feet.

It has been hypothesised that measures of attention, information processing, and executive functions or self-regulation skills may be associated with motor performance. After having noticed obvious impairments in motor functions of physically well-recovered patients with TBI we were interested to examine the association between cognitive functions (information processing, attention, cognitive control and monitoring behaviours, and praxis of the upper limbs) and motor functions (agility, postural balance, and rhythm-coordination) [4]. To evaluate patients' cognitive functioning a cognitive screening battery CERAD and several other neuropsychological tests were used. Subtests of Luria's Neuropsychological Investigation [5] were used to assess the motor regulation and praxis of the upper limbs.

As a result, the highest rank correlations were observed between the time for Trail Making tests and the time for running a figure-of-eight test. Furthermore, the latter correlated inversely with the scores on the Digit Symbol test.

Associations between the speed of complex attention and information processing (the Trail Making and Digit Symbol tests), and performance time in agility (running a figure-of-eight) was showed after analyzing the relationships between the neuropsychological and motor-performance tests.

Furthermore, in the measures of executive functioning (reproduction of rhythmic structures and verbal fluency) patients with normal performance also had a faster mean performance time in tests of agility and/or dynamic balance (running a figure-of-eight and Tandem walking forwards/backwards) than those with abnormal executive functioning. Therefore, the speed of walking and running was related to the fluency of executive functioning and information processing and conversely. Also simple and complex forms of hand praxis correlated with all motor-performance tests except static balance.

In conclusion, the findings indicate that measures of attention, information processing, and executive functioning may be associated with motor functions. Thus, the results support the relationship between cognition and motor performance as reported in the literature. It would be essential for further research in order to determine how cognitive and motor pathways are neurally connected to use technologies such as functional magnetic resonance imaging and diffusion tensor imaging. The interplay between cognition and motor functions may also have potential clinical relevance with regard to developing effective methods for comprehensive neurorehabilitation.

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