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Alteration in the Functional Organization of the Default Mode Network Following Closed Non-severe Traumatic Brain Injury

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Abstract
The debilitating effect of traumatic brain injury (TBI) extends years after the initial injury and hampers the recovery process and quality of life. In this study, we explore the functional reorganization of the default mode network (DMN) of those affected with non-severe TBI. Traumatic brain injury (TBI) is a wide-spectrum disease that has heterogeneous effects on its victims and impacts everyday functioning. The functional disruption of the default mode network (DMN) after TBI has been established, but its link to causal effective connectivity remains to be explored. This study investigated the differences in the DMN between healthy participants and mild and moderate TBI, in terms of functional and effective connectivity using resting-state functional magnetic resonance imaging (fMRI). Nineteen non-severe TBI (mean age 30.84 ± 14.56) and twenty-two healthy (HC; mean age 27.23 ± 6.32) participants were recruited for this study. Resting-state fMRI data were obtained at the subacute phase (mean days 40.63 ± 10.14) and analyzed for functional activation and connectivity, independent component analysis, and effective connectivity within and between the DMN. Neuropsychological tests were also performed to assess the cognitive and memory domains. Compared to the HC, the TBI group exhibited lower activation in the thalamus, as well as significant functional hypoconnectivity between DMN and LN. Within the DMN nodes, decreased activations were detected in the left inferior parietal lobule, precuneus, and right superior frontal gyrus. Altered effective connectivities were also observed in the TBI group and were linked to the diminished activation in the left parietal region and precuneus. With regard to intra-DMN connectivity within the TBI group, positive correlations were found in verbal and visual

memory with the language network, while a negative correlation was found in the cognitive domain with the visual network. Our results suggested that aberrant activities and functional connectivities within the DMN and with other RSNs were accompanied by the altered effective connectivities in the TBI group. These alterations were associated with impaired cognitive and memory domains in the TBI group, in particular within the language domain. These findings may provide insight for future TBI observational and interventional research. Copyright © 2022 Abdul Rahman, Abd Hamid, Noh, Omar, Chai, Idris, Ahmad, Fitzrol, Ab. Ghani, Wan Mohamad, Mohamed Mustafar, Hanafi, Reza, Umar, Mohd Zulkifly, Ang, Zakaria, Musa, Othman, Embong, Sapiai, Kandasamy, Ibrahim, Abdullah, Amaruchkul, Valdes-Sosa, Luisa-Bringas, Biswal, Songsiri, Yaacob, Sumari, Jamir Singh, Azman and Abdullah.

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default mode network; effective connectivity; functional connectivity; neuropsychology; traumatic brain injury

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