

Structural Analysis of Hippocampal Subdivisions and Their Relationship with the Hypothalamus in Trauma Survivors

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The structural connections between the hypothalamus and hippocampus in humans remain largely unexplored. This study investigated these relationships following acute trauma and recovery, and during chronic stress from COVID-19 pandemic. Acute trauma survivors (n=189) were recruited after life-threatening experiences and underwent initial structural MRI scans within 2 weeks. Ninety-nine survivors returned for follow-up scans a year later. Forty-two survivors took additional scans during the pandemic. Partial correlation analyses were used to test the relationships between bilateral hypothalamic and hippocampal head/body volumes, as well as correlations between 5 hypothalamic nuclei and 7/8 subfields in hippocampal head/body (FreeSurfer v7.2), controlling for age, sex and intracranial volume. Chi-square analyses were used to test the changes of nuclei-subfield correlations under different physical conditions. Results revealed bilateral hypothalamic volumes were significantly positively correlated with hippocampal head/body volumes under acute and chronic stresses (ps: <0.001-0.029), and with hippocampal body in recovery (ps: <0.001-0.011). The number of significant nuclei-subfield correlations (threshold p<0.01) was greater in hippocampal body than in head (ps=0.009 and 0.005 for left/right hypothalamus). All nuclei-subfield correlations in the hippocampal body did not show differences in all conditions. However, nuclei-subfield correlations in the hippocampal head were observed only during chronic stress for the left hypothalamus. Conversely, they significantly increased during acute stress and diminished during recovery for the right hypothalamus (ps=0.004). This study indicates initial evidence of positive associations between hypothalamic nuclei and hippocampal subfields in humans, suggesting predominant structural connections within the hippocampal body and exhibiting reversibility in hippocampal head in response to stress.

Keywords: PTSD, Trauma, Hypothalamus, Hippocampus, Stress