Can prolonged exposure to cortisol excess have an irreversible effect on emotion-related brain areas?

Cortisol is a hormone produced in humans by adrenal glands and it is necessary to live. In healthy people, cortisol level naturally increases in response to stressful situations, but when cortisol level in the body is too high during a long period of time it can have negative effects. Cushing's syndrome is a rare endocrine disorder caused by prolonged exposure to high levels of cortisol (hypercortisolism) due to a benign tumor. Therefore, patients with Cushing's syndrome represent a human model for studying the effects of prolonged exposure to hypercortisolism on the brain.

Previous studies have shown that cortisol can affect structures and functions of the brain. In fact, patients with Cushing's syndrome usually raise complaints about poor memory and difficulty on concentrating. These cognitive problems had been related with changes of brain structures in patients with Cushing's syndrome after cortisol excess. However, until now, it was not known if there was a relationship between the cortisol effects on the brain and the affective alterations (or psychiatric symptomatology) observed in Cushing's syndrome. For this reason, this study investigated if patients with Cushing's syndrome, after exposure to high levels of cortisol, showed changes on a brain area related with emotional regulation, called ventromedial prefrontal cortex (vmPFC).

Proton magnetic resonance spectroscopy, an imaging technique, was used to evaluate the brain tissue of vmPFC. This imaging technique lead measured in vivo some markers (indicators) of brain activity. The most common markers of brain activity are glutamate and N-Acetyl-Aspartate (NAA). Low concentrations of glutamate and NAA point out dysfunction of brain cells. This study assessed concentrations of these brain markers on vmPFC in patients with Cushing's syndrome and healthy people.

Results showed that patients with Cushing's syndrome have lower concentrations of glutamate and NAA compared with healthy people, indicating reduced brain activity in the vmPFC. Moreover, the data indicated that patients with Cushing's syndrome, who were exposed to cortisol excess during a long period of time, show the lowest brain activity and the highest anxiety levels. Therefore, the longer exposure of high cortisol levels the greater would be the damage on vmPFC and anxiety symptoms.

In conclusion, prolonged exposure to cortisol excess has important effects on emotion-related brain areas like vmPFC, and these effects could cause emotional alterations such as anxiety and depressive symptoms in patients with Cushing's syndrome.

Therefore, an early diagnosis of Cushing's syndrome and an effective treatment of cortisol excess are crucial to avoid irreversible brain damage.

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