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Structural and cerebral blood flow changes in the brain of patients with obstructive sleep apnea: Before and after a long-term CPAP therapy

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Obstructive sleep apnea (OSA) is a common sleep disorder of repetitive cessations of breathing during sleep, which induces frequent arousals, hypoxemia, and disturbed sleep. Furthermore, OSA is associated with remarkable changes in blood pressure, heart rate, cerebral perfusion, intracranial pressure, and sympathetic nervous activity during night sleep. These changes may cause not only excessive daytime sleepiness and cognitive dysfunction, but also functional and structural changes in the human brain. Many studies have been done for investigating functional and structural brain abnormalities of OSA patients. Previous studies on structural brain changes of OSA patients were controversial. But one study showed a significant decrease in gray matter concentration in the hippocampus and Parahippocampal gyri of OSA patients. We also reported a significant decrease of cortical thickness in multiple brain regions of 38 patients with severe OSA compared to 36 normal controls. We performed brain SPECT (single photon emission computed tomography) in 27 severe OSA patients and normal controls to investigate rCBF (regional cerebral blood flow) abnormalities in patients with OSA, and found that rCBF was significantly decreased in bilateral Parahippocampal gyri and left lingual gyrus during awake state. Recently we measured and compared rCBF in severe OSA patients before and after 6 months or more of nasal CPAP therapy. Untreated patients showed a rCBF decrease in multiple brain regions. After a long-term CPAP treatment, partial rCBF recovery was observed in limbic and prefrontal brain regions and complete recovery of rCBF in medial orbitofrontal, angular and cerebellar regions. We also measured brain volume and cortical thickness before and after a long-term treatment of nasal CPAP in severe OSA patients (a mean AHI = 64). The large overlap between the initial brain damage and the extent of recovery after treatment suggests partial recovery of non-permanent structural brain damage. This study indicates structural brain changes due to OSA can be reversible with nasal CPAP treatment. In summary, OSA patients showed a significant decrease in brain gray matter concentration, brain volume, and rCBF, and long-term nasal CPAP therapy could improve these deficits.

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