Alexithymia Associated With Bilateral Globus Pallidus Lesions After Carbon Monoxide Poisoning

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Alexithymia refers to a person's inability to identify and describe feelings. We present a patient who developed alexithymia after carbon monoxide poisoning following a suicide attempt by burning charcoal in an enclosed space. Brain computed tomography revealed bilateral globus pallidus hypoxic lesions. Because of the time frame and the presence of brain structural lesions, the alexithymia in this patient was thought to be caused by bilateral globus pallidus hypoxic lesions resulting from carbon monoxide poisoning. The alexithymia in this patient did not respond to a variety of psychotropic drugs, including sertraline, venalfaxine, bupropion or methylphenidate. We suggest that alexithymia, which was associated with brain hypoxic lesions in this case, is resistant to treatment.

Key Words: alexithymia, carbon monoxide poisoning, globus pallidus
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Alexithymia refers to a person's inability to identify and describe feelings because of a lack of emotional awareness. Severe cases of alexithymia are associated with poor quality of life [1] and poor outcomes for a variety of diseases [2–4]. Abnormalities in the brain regions involving emotion processing, such as the left side of the anterior cingulate gyrus, the middle temporal gyrus, and the inferior frontal gyrus, may contribute to alexithymia [5]. Because the subcortical regions may be involved in emotional processing [6] and have numerous connections with the neocortex, it is possible that subcortical lesions can cause alexithymia, although there is no evidence for this in the literature.

Attempting suicide by burning charcoal in an enclosed space is a novel method, and has contributed to an increase in suicide rates of over 20% in some Asian countries [7]. Since charcoal is readily available and media coverage of such incidents has been notable, the number of suicides using burning charcoal is projected to increase further in the near future. Inhalation of the charcoal fumes results in carbon monoxide (CO) poisoning and commonly brain hypoxia. Because the subcortical area is quite vulnerable to hypoxia, survivors of CO poisoning often present with several brain complications, including movement disorders [8]. However, alexithymia after CO poisoning has yet to be reported. We present a case whose alexithymia developed after CO poisoning following a suicide attempt by burning charcoal in an enclosed room.

Case Presentation

The present case, a 33-year-old woman, had experienced difficulty in describing her feelings after

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surviving from a suicide attempt by burning charcoal. She had become passive, socially withdrawn, taciturn, showing flat affect and low self-confidence since the event. She reported suffering emotionally because of this change and that she felt as if she had become another person.

She reported having been an outgoing, active, expressive and self-assured person in the past. Marital discord brought on a depressive episode, which led to a visit to the psychiatric service about 6 months before her suicide attempt, where she was diagnosed with a major depressive disorder. She attempted suicide by burning charcoal, waking 8 hours later. She did not notice any immediate discomfort and did not seek medical assistance. Over time, she suspected that something was different about her. She found it hard to be aware of what she felt, which was the opposite of her usual self. Her friends also noticed changes in her character.

On examination, she did not have obvious neurological sequelae. However, she did present with significant alexithymia syndrome, as indicated by a high score of 70 on the Toronto Alexithymia Scale (TAS), where scores above 60 suggest alexithymia [9]. All scores on the subscales of the TAS, including subscales of difficulty in describing feelings, difficulty in identifying feelings, and externally oriented thinking, were high. She did not present with clinically significant depression or apathy. Her cognitive function was assessed using Wechsler Adult Intelligence Scale, and no significant cognitive impairments were found (full intelligence quotient, 95). A brain computed tomography (CT) scan performed about 10 months after the CO poisoning event revealed hypodense lesions in the medial part of the bilateral globus pallidus that were of 0.37 cm^2 and 0.12 cm^2 in size on the left and right sides, respectively.

She had good drug adherence and her depressive symptoms improved over 8 weeks. However, despite separate and full-course/full-dose trials of sertraline, venalfaxine, bupropion, and methylphenidate therapy, there were no improvements in the TAS total score.

Discussion

This patient presented with treatment-resistant alexithymia because of CO poisoning caused by an attempted suicide by burning charcoal. Interpretation of the brain CT imaging suggested that hypoxic lesions in the bilateral globus pallidus might be responsible for the alexithymia.

Mood and behavior complications are common after CO inhalation [10,11]. Carbon monoxide binds to hemoglobin in the blood to form carboxyhemoglobin, which cannot bind to oxygen (O_2), thus impairing O_2 transport and delivery to the body. Ultimately, the cells become hypoxic and die. Neurons in the basal ganglia and globus pallidus seem to be the most vulnerable to hypoxic damage caused by CO poisoning [12,13].

Since the brain lesions resulting from CO exposure can cause mental disorders, physicians are advised to watch closely for changes in the personality of their patients, mood and cognitive functions. This heightened awareness should be maintained for months, even years. In our patient, alexithymia seems to be a complication of CO poisoning, because of the time frame of onset. Her brain CT findings suggest that the bilateral globus pallidus hypoxic lesions were responsible for her alexithymia.

We believe this paper is the first to connect alexithymia with the globus pallidus. The globus pallidus is one of the structures involved in all three frontal-subcortical circuits, namely the dorsolateral, orbitofrontal and anterior cingulate [14]. Damage to any part of each of these circuits produces a distinct syndrome. The anterior cingulate circuit is involved in motivated behavior, so damage can result in apathy, lack of motivation, alexithymia [15] and anhedonia [16]. The anterior cingulate circuit travels through the striatum, the rostromedial and ventral globus pallidus, and the thalamus. In this patient, hypoxic damage to the globus pallidus, possibly the rostromedial and ventral sections, may have caused a syndrome similar to the one produced by lesions at the anterior cingulate gyrus. However, because the topographic resolution of brain CT is not high enough to detect all of the lesions caused by CO poisoning, further brain studies, such as functional imaging, could provide more information about the underlying brain lesions caused by CO poisoning.

Thus far, no standardized treatment for alexithymia has been suggested. Our patient had been treated with antidepressants for approximately 6 months before her suicide attempt and has continued antidepressant treatment since her attempt. The depressive syndrome improved during the early stage

of treatment, but the patient's alexithymia did not respond to a variety of psychotropic medicines, including a selective serotonin reuptake inhibitor, a serotonin-norepinephrine reuptake inhibitor, a norepinephrine-dopamine reuptake inhibitor or a psychostimulant.

Although it is premature to conclude that all psychotropic drugs are ineffective in alexithymia, a non-pharmacotherapeutic strategy may be another option. Deep brain stimulation of the globus pallidus has been used for patients with Parkinson's disease. In addition to improving the movement symptoms, deep brain stimulation increased the patients' quality of life and sense of emotional well being [17]. Further clinical trials should examine the effect of deep brain stimulation on alexithymia caused by bilateral globus pallidus lesions.

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與一氧化碳中毒後兩側蒼白球病變相關的情感表達不能：個案報告

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情感表達不能，指的是無法辨認及描述情感。在此我們報告一位燒碳自殺一氧化碳中毒後產生情感表達不能的個案，電腦斷層顯示其雙側蒼白球缺血性病兆。由時序上與腦部結構性病變推測，此個案的情感表達不能為燒碳的後遺症。經過多種藥物，包括 **sertraline**、**venalfaxine**、**bupropion** 和 **methylphenidate** 的治療仍無法改善。由此案例，我們推估與腦部缺氧性病變相關的情感表達不能對藥物治療反應不佳。

關鍵詞：情感表達不能、一氧化碳中毒、蒼白球

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