Study finds chronic fatigue syndrome patients had reduced activity in brain's 'reward center'

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Chronic fatigue syndrome, a medical disorder characterized by extreme and ongoing fatigue with no other diagnosed cause, remains poorly understood despite decades of scientific study. Although researchers estimate that more than 1 million Americans are affected by this condition, the cause for chronic fatigue syndrome, a definitive way to diagnose it, and even its very existence remain in question. In a new study, researchers have found differing brain responses in people with this condition compared to healthy controls, suggesting an association between a biologic functional response and chronic fatigue syndrome.

The findings show that patients with chronic fatigue syndrome have decreased activation of an area of the brain known as the basal ganglia in response to reward. Additionally, the extent of this lowered activation was associated with each patient's measured level of fatigue. The basal ganglia are at the base of the brain and are associated with a variety of functions, including motor activity and motivation. Diseases affecting basal ganglia are often associated with fatigue. These results shed more light on this mysterious condition, information that researchers hope may eventually lead to better treatments for chronic fatigue syndrome.

The study was conducted by Elizabeth R. Unger, James F. Jones, and Hao Tian of the Centers for Disease Control and Prevention (CDC), Andrew H. Miller and Daniel F. Drake of Emory University School of Medicine, and Giuseppe Pagnoni of the University of Modena and Reggio Emilia. An abstract of their study entitled, "Decreased Basal Ganglia Activation in Chronic Fatigue Syndrome Subjects is Associated with Increased Fatigue," will be discussed at the meeting Experimental Biology 2012, being held April 21-25 at the San Diego Convention Center.

More Fatigue, Less Activation

Dr. Unger says that she and her colleagues became curious about the role of the basal ganglia after previous studies by collaborators at Emory University showed that patients treated with interferon alpha, a common treatment for chronic hepatitis C and several other conditions, often experienced extreme fatigue. Further investigation into this phenomenon showed that basal ganglia activity decreased in patients who received this immune therapy. Since the fatigue induced by interferon alpha shares many characteristics with chronic fatigue syndrome, Unger and her colleagues decided to investigate whether the basal ganglia were also affected in this disorder.

The researchers recruited 18 patients with chronic fatigue syndrome, as well as 41 healthy volunteers with no symptoms of CFS. Each study participant underwent functional magnetic resonance imaging, a brain scan technique that measures activity in various parts of the brain by blood flow, while they played a simple card game meant to stimulate feelings of reward. The participants were each told that they'd win a small amount of money if they correctly guessed whether a preselected card was red or black. After making their choice, they were presented with the card while researchers measured blood flow to the basal ganglia during winning and losing hands.

The researchers showed that patients with chronic fatigue syndrome experienced significantly less change in basal ganglia blood flow between winning and losing than the healthy volunteers. When the researchers looked at scores for the Multidimensional Fatigue Inventory, a survey often used to document fatigue for chronic fatigue syndrome and various other conditions, they also found that the extent of a patient's fatigue was

tightly tied with the change in brain activity between winning and losing. Those with the most fatigue had the smallest change.

Results Suggest Role of Inflammation

Unger notes that the findings add to our understanding of biological factors that may play a role in chronic fatigue syndrome. "Many patients with chronic fatigue syndrome encounter a lot of skepticism about their illness," she says. "They have difficulty getting their friends, colleagues, coworkers, and even some physicians to understand their illness. These results provide another clue into the biology of chronic fatigue syndrome."

The study also suggests some areas of further research that could help scientists develop treatments for this condition in the future, she adds. Since the basal ganglia use the chemical dopamine as their major neurotransmitter, dopamine metabolism may play an important role in understanding and changing the course of this illness. Similarly, the difference in basal ganglia activation between the patients and healthy volunteers may be caused by inflammation, a factor now recognized as pivotal in a variety of conditions, ranging from heart disease to cancer.

Estimates from the CDC suggest that annual medical costs associated with chronic fatigue syndrome total about $14 billion in the United States. Annual losses to productivity because of lost work time range between $9 and $37 billion, with costs to individual households ranging between $8,000 and $20,000 per year.

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