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The Implementation of Memantine for Recovering Stroke Patients

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Introduction

Stroke is the fourth leading cause of death worldwide. It is caused by a blood clot or a ruptured artery in the brain. Following stroke onset, 70%–88% of patients have motor dysfunction. Rehabilitation programs aim to combat this motor deficit through repetitive tasks designed to guide the brain to adapt to new movements and gain muscle memory in those movements. Rehabilitation is strongly dependent on the brain’s plasticity, which is enacted through molecular signaling pathways that act directly on the central nervous system, specifically, in the hippocampus, cerebellum, cerebral cortex, and spinal cord. The critical period following stroke onset to better understand the relationship between time and brain plasticity is an average period of time known as the critical period in which the adult brain’s plasticity is at its highest. Certain studies state that the stroke recovery is at its highest in the first six to eight weeks after stroke onset. Others argue that programs started within the first one hundred days produce the same results no matter when the patient began rehabilitation within the 100-day period.

Objectives

The two main objectives of this study are:
1. To understand the relationship between factors such as time, exercise, and plasticity to refine existing rehabilitation programs for stroke patients.
2. To introduce Memantine, a drug commonly used for Alzheimer’s disease, as a new addition to stroke rehabilitation programs.

Methods

A compilation of expert opinions on stroke recovery, rehabilitation programs, brain plasticity, and neuronal growth was examined, in addition to analyses of case studies relating factors such as time, and physical activity to neuronal regrowth and adaptation. The literature analyzed includes studies from the Journal of Neuroscience, Journal of American Medical Association, and the Journal of the American Physical Therapy Association.

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Professor Mary C. Boyes and the Honors College at Virginia Commonwealth University

Results

Rehabilitation Programs

Previous studies have proven that rehabilitation procedures increase cellular proliferation and dendritic growth. With the cellular proliferation comes the creation of new neurons and neuronal pathways. The new neurons allow the brain to be plastic and adapt to new environments and thus allow recovering patients to regain their lost motor functions and fix their motor impairment.

• The key to neurorehabilitation of the brain after a stroke is repetitive tasks that are similar to the patient’s everyday movements. The tasks are designed in this method so that patients can concentrate and gain practice in the movements that are most important in their day-to-day life. The application of their rehabilitation training with practical tasks creates stronger muscle memory than if the training was done by itself.

Physical Activity

• BDNF belongs to a family of protein groups that is responsible for neuroprotection, neurogenesis, and neuroplasticity. It has been noted as a key mediator for motor learning and rehabilitation after a stroke occurrence, and is essential for long term memory, learning, and memory formation.

1. Time

• The length of time in which the brain is plastic differs slightly for every patient. However, there is an average period of time known as the critical period in which the adult brain’s plasticity is at its highest.

2. Memantine

• Memantine, an Alzheimer’s drug tested in rats regarding motor function, is a viable drug to increase plasticity. In several rat models, Memantine was proven to increase cognitive function and BDNF levels in the brain, which is vital for the recovery of stroke patients. However, the drug is still only used to treat Alzheimer’s patients. So, by understanding the relationship between time, exercise, plasticity, and recovery, Memantine can be introduced and implemented in recovery programs for stroke patients.

References

1. Memantine can be administered as an official treatment, further studies must be conducted regarding:
   1. The critical period following stroke onset to better understand the relationship between time and brain plasticity.
   2. Physical activity and Memantine to establish a baseline combination therapy for the average stroke patient.

Conclusions

• The checklist for the best chance of higher BDNF levels is a relatively simple list to complete. The tasks are simply aerobic exercises at a 70% heart rate for four days a week. By following this list, patients have higher BDNF levels. However, patients are not always capable of meeting these requirements due to emotional, mental, or physical capacity or ability.

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