

Alzheimer's disease in stroke patients: A novel detection and treatment method

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1 Introduction

Strokes are one of the leading causes of disability in the United States ¹. As this phenomenon becomes more common within all age groups due to the rise in obesity which increases the likelihood of a stroke ², it is important to analyze the lasting neurological side effects of a stroke. A stroke occurs when there is a disruption of cerebral blood flow. This interruption prevents important nutrients, such as oxygen, from reaching brain tissue. These nutrients are necessary for neurons to produce energy which they require to process information and to communicate with other neurons ³. Due to the lack of oxygen to the brain, there are many effects that strokes have on the body, such as paralysis, speech loss, vision loss, depression, and anxiety ⁴. Strokes can also cause severe brain damage which increases the risk of Alzheimer's disease, the most common form of dementia ⁵. It is projected that within five years of having a stroke, one third of survivors could develop a form of dementia ⁶. Alzheimer's disease causes the brain to shrink at a greater rate than normal and results in the death of neurons ⁷. In particular, Alzheimer's disease results in shrinkage of the hippocampal section of the brain which is responsible for learning and memory ⁸. As a result, Alzheimer's disease is associated with severe memory loss and increased difficulty

completing everyday tasks⁹. Currently, there is no cure for Alzheimer's disease.

Strokes can incur massive amounts of oxidative stress, or the imbalance of pro-oxidants and antioxidants and excessive production of reactive oxygen species, in the brain. High levels of oxidative stress can cause neuronal apoptosis, or the death of neurons which can lead to neurodegenerative diseases. As the brain uses almost a fifth of the oxygen uptake of the human body, the lack of oxygen can have extreme consequences. If there is oxidative stress, the amyloid precursor protein on chromosome 21 mutates to produce toxic AB-42 aggregates, causing cell death.

The current detection method for Alzheimer's is ineffective for stroke patients. Currently, there are 4 neuropsychological tests employed: learning and comprehension, visual association, perceptual identification, and listening comprehension. These tests are useful in determining what general level of cognitive impairment the patient has, but it is not deductive enough to determine whether or not the damage is Alzheimer's or a different issue. This problem is especially important for stroke patients, as many will suffer memory loss or cognitive difficulties within the healing process of their stroke. The method employed in this study brings in the usage of technology to determine the severity/overall presence of Alzheimer's in the patient by comparing it against pre-diagnosed images, which speeds up the process and makes the diagnosis more detailed than neuropsychological exams.

2 Method and Results

After someone is beginning to recover from a stroke, they may begin to show signs of severe memory impairment. Such impairment could be due to the development of Alzheimer's. Since Alzheimer's is best treated when caught early, it is best to employ the novel treatment and detection method I have come up with.

Doctors should first use a PET (positron emission tomography) scan which is often used to detect the presence of amyloid plaques, deposits on the amyloid protein and often associated with neurodegenerative disorders and aging, in the brain of a moderate to late stage Alzheimer's patient. Radioactive tracers are used to highlight amyloid plaques in patients, which can indicate Alzheimer's disease; however, some people have amyloid plaques but do not have Alzheimer's disease. Therefore, PET scans are far more effective to rule out Alzheimer's diseases than to actually confirm its presence.

If amyloid plaques are found by PET scans, it could be a sign of Alzheimer's, but not all people with amyloid plaques have Alzheimer's, so further investigation is needed. It is recommended a MRI (magnetic resonance imaging) scan is used to determine if a patient has Alzheimer's disease and what stage it is. To determine the accuracy of using an MRI for stroke patients with amyloid plaques, 52 sample images and Google's Teachable machine were used. Google's Teachable Machine was used to determine the algorithm that categorizes the images into one of the following categories: non-demented, very mildly demented, mildly demented, and moderately demented.. Overall, a 72% accuracy rate was achieved using the method, and the system is very effective at

determining non-demented brains

3 Ethics and Safety

There are a few things to consider when looking at this detection method. The PET scan uses a radioactive material and glucose mixture injection into the patient. Diabetic patients will have to undergo a blood sugar evaluation before continuing on, which may hinder the process. PET scanning is also a long process, and those with musculoskeletal and/or mobility problems may be uncomfortable during the experience. Exposure to excessive radiation can result in the development of cancer in some patients. Because of the sensitivity of PET scans, greater chances for false results. Lastly, the procedure may not be as cost-effective due to the novelty of the technology.

4 Conclusions

Overall, the novel detection method of employing a PET scan and then a MRI will enable for earlier detection of Alzheimer's disease, and, therefore, enable it to be treated earlier. Additionally, the novel method will provide better insight to whether a stroke patient suffering from memory impairment is facing Alzheimer's disease or some other issue. By having a more concrete and accurate method for diagnosing Alzheimer's disease, treatments can be employed earlier. Treatments could then be implemented such as a hippocampal prosthesis which is designed to be implemented in the hippocampal region of the brain and help maintain the brain's ability to form long term memories. This treatment method has been found to show a 37% improvement in memory and works best when implemented early. Ultimately, the earlier and more effective diagnosis of Alzheimer's

disease will allow for it to be more effectively treated. However, there are still issues ahead in implementing this novel early detection method, but with further development, it can revolutionize how we confront Alzheimer's disease.

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