**Stroke Case Study and Review**

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April 24, 2022

A stroke is a type of cerebrovascular disease that affects the brain and its blood vessels. It occurs when blood flow to the brain is interrupted or reduced due to a blockage or leakage within the blood vessels. As a result, the brain is deprived of oxygen and nutrients, causing brain cells to begin dying. In 2020, one in every six deaths related to cardiovascular disease was attributed to stroke. In the United States, a stroke occurs every 40 seconds, and one person dies from a stroke approximately every 3.5 minutes. Nearly one million people in the U.S. experience a stroke each year, with first-time and recurrent strokes accounting for slightly over 500,000 cases. Ischemic strokes, which result from an obstruction in blood flow to the brain, make up approximately 87 percent of all stroke cases. Between 2017 and 2018, the estimated economic burden of stroke in the United States was around $53 billion. This figure includes healthcare costs, treatment expenses, and lost productivity due to reduced work hours. Stroke remains one of the leading causes of long-term disability.

A stroke occurs when blood circulation to the brain is disrupted or diminished due to a blockage or leakage in the blood vessels. The brain is deprived of oxygen and nutrients, causing neurons to begin dying. Stroke is a serious medical condition that affects the blood vessels responsible for delivering oxygenated blood to the brain, known as cerebrovascular vessels. If the brain does not receive enough oxygen, it can become permanently damaged. This is a potentially life-threatening event. While some strokes can be managed with medical intervention, others may lead to long-term disability or death. Individuals with certain risk factors are more likely to experience a stroke. Some of these risk factors are modifiable or controllable, while others are not.

Among the medically treatable or controllable risk factors, high blood pressure is one of the most significant. Elevated blood pressure can damage the arteries that supply the brain, increasing stroke risk. Heatstroke is also a major cause of mortality among stroke survivors and one of the most common complications after stroke. Many risk factors for stroke overlap with those for coronary heart disease. People with diabetes face a higher risk of stroke compared to those without the condition. Smoking nearly doubles the risk of having an ischemic stroke. The use of oral contraceptives can also increase stroke risk, particularly in individuals with other contributing factors. A history of transient ischemic attacks (TIAs), often called mini-strokes, is another critical indicator. TIAs produce temporary stroke-like symptoms, but they do not cause lasting damage. However, having one or more TIAs significantly increases the likelihood of a full stroke, with some studies suggesting nearly a tenfold increased risk compared to individuals of the same age and gender with no TIA history.

Other modifiable risk factors include abnormal blood characteristics, such as elevated red blood cell count, which can thicken the blood and promote clot formation. High levels of LDL cholesterol and triglycerides also increase stroke risk by contributing to atherosclerosis, the buildup of plaque—composed of fatty material, cholesterol, and calcium—on the inner walls of arteries. This can narrow the arteries and restrict blood flow to the brain. Obesity and physical inactivity further elevate the risk. Excessive alcohol consumption can increase blood pressure and the likelihood of stroke, especially in cases of binge drinking. Drinking more than two glasses of alcohol per day can raise blood volume and strain the circulatory system.

Intravenous drug use also raises stroke risk, particularly with substances like cocaine, which has been linked to cardiovascular complications including irregular heart rhythms and arterial damage. Certain types of cardiovascular disease, especially atrial fibrillation, are major contributors to stroke risk. Atrial fibrillation causes an irregular heartbeat and is one of the most common and treatable structural heart issues associated with stroke. Chronic heart conditions, such as coronary valve disease, can also increase the likelihood of stroke over time.

There are also non-modifiable risk factors that cannot be controlled. Age is a major factor; after age 55, the risk of stroke doubles with each passing decade. Race plays a role as well—African-Americans face a significantly higher risk of stroke-related death and disability than whites, largely due to the higher prevalence of hypertension in this population. Although strokes are more common in men, they are more likely to be fatal in women. A personal history of stroke is another strong risk factor; individuals who have had a stroke are more likely to experience a second one. Genetics also play a role, as having a close relative who has had a stroke increases your own risk. Additionally, stroke is more prevalent in people living in the southeastern United States, a region often referred to as the “Stroke Belt,” due to its higher rates of stroke and related conditions compared to other areas.

**Symptoms**

A stroke occurs when blood circulation to the brain is disrupted or diminished due to a blockage or leakage in the blood vessels. The brain is deprived of oxygen and nutrients, causing neurons to die. Stroke is a serious medical condition that affects the cerebrovascular system, which includes the blood vessels supplying oxygen-rich blood to the brain. Without proper oxygen, brain tissue becomes damaged, leading to potentially fatal outcomes. While some strokes can be managed, others may result in long-term disability or death. It is essential to recognize the symptoms early, as several treatment options are most effective when administered shortly after onset.

Common symptoms of a stroke include sudden confusion, difficulty speaking or understanding speech, numbness or weakness in the face, arm, or leg—typically on one side of the body—difficulty raising both arms evenly, facial drooping, sudden vision problems such as blurriness or double vision, and loss of balance or coordination. Severe headache accompanied by vomiting or loss of consciousness may also indicate a stroke. Early recognition and immediate medical attention are critical for better outcomes.

A proprietary approach in support of stroke recovery includes nutritional formulations. Proprietary Blend 1 contains silica, vitamin C, and trace minerals. Proprietary Blend 2 includes N-acetyl L-tyrosine, anhydrous caffeine, L-theanine, velvet bean seed, pine bark, and curcumin. Proprietary Blend 3 combines black seed oil, resveratrol, turmeric, raspberry ketone, apple cider vinegar, aloe vera, D-ribose, and vitamin D.

Research has highlighted the role of vitamin D in stroke recovery. Vitamin D deficiency has been linked to poorer outcomes following ischemic stroke, which accounts for 87% of all strokes in the United States. This deficiency is also associated with major stroke risk factors such as hypertension, obesity, and type 2 diabetes. Fortunately, studies show that after three months of vitamin D supplementation, patients demonstrate significant improvements in stroke outcomes. Adequate vitamin D intake may offer neuroprotective, neuromuscular, and osteoprotective benefits, supporting recovery and reducing the risk of cognitive impairment. Maintaining appropriate vitamin D levels may also help reduce the likelihood of a second stroke.

While vitamin C supplementation has shown no consistent impact on stroke prevention in clinical trials, its long-term low-dose effects remain uncertain, and the relationship between circulating vitamin C levels and stroke risk is not well established. A meta-analysis of prospective trials was conducted to explore these uncertainties further.

A case study involved a 62-year-old male with a history of hypertension (18 years) and type 2 diabetes (3 years), as well as a 20-cigarette-per-day smoking habit. He was taking 10 mg amlodipine and 1000 mg metformin. At the initial consultation, he had recently experienced an ischemic stroke. He had limited mobility in his left hand and leg, required a walking frame, had difficulty speaking, and experienced fatigue.

Ischemic stroke and intracerebral hemorrhage are both strongly associated with hypertension, particularly elevated systolic blood pressure. Isolated systolic hypertension is a common form in older adults and those with type 2 diabetes. Controlling high blood pressure—especially systolic pressure—has long been known to reduce stroke risk. For hypertensive diabetic patients at higher risk of primary stroke, a target blood pressure of 130/80 mm Hg is currently recommended. Although there is no consensus on a preferred drug class for stroke prevention in this population, clinical guidelines emphasize strict blood pressure control. Common therapeutic regimens include thiazide diuretics, beta-blockers, calcium channel blockers, and angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers.

Hyperglycemia, common in diabetes, contributes to increased lactate production in the brain, making hypoperfused tissues more vulnerable to infarction. Glucose levels above 140 mg/dL can worsen stroke outcomes by reducing the benefits of early blood flow restoration. These findings underscore the need for controlled trials on intensive glycemic management in acute stroke patients. While aggressive glycemic control is recommended to prevent microvascular complications in both type 1 and type 2 diabetes, its role in reducing stroke incidence remains unproven. Insulin resistance, particularly in those with lacunar infarctions, may also be an independent risk factor for stroke in individuals with type 2 diabetes.

In summary, low vitamin D levels are a significant modifiable risk factor for poor stroke outcomes. Supplementation has been associated with improved recovery, neuroprotection, and reduced risk of subsequent strokes. A consistent daily intake of vitamin D supports the brain’s ability to heal and plays an important role in long-term stroke prevention and rehabilitation.

**How to Get Vitamin D Naturally**

Your body can naturally produce vitamin D, often referred to as the “sunshine vitamin,” through exposure to sunlight. However, it is important to be mindful of sun exposure during peak hours, typically between 10 a.m. and 4 p.m., when UV radiation is strongest. If exposure to sunlight is limited due to medical reasons such as an increased risk of skin cancer, it is essential to consume vitamin D-rich foods like oily fish, cheese, and egg yolks. In addition, vitamin B12, found in animal products such as fish, meat, poultry, eggs, and milk, is critical for neurological health. For individuals with stroke risk factors like high cholesterol or atherosclerosis, consuming lean proteins such as fish or poultry is advisable.

Rehabilitation following a stroke typically involves physical therapy, which helps patients relearn basic motor skills, including walking, standing, transitioning between movements, and maintaining balance. Motion therapy is also used to restore daily functional activities and strengthen muscles. It helps individuals relearn everyday tasks such as dressing, bathing, cooking, writing, and using the bathroom. Occupational therapists assist patients in achieving independence or near-independence, while speech therapy is beneficial for those who have difficulty understanding or producing speech but do not have cognitive impairments. With consistent effort and support, many stroke survivors can regain much, if not most, of their communication and speech abilities.

Nutritional strategies are essential for stroke rehabilitation. Providing adequate nutrition, especially for intubated patients, helps prevent deficiencies that can lead to poor functional outcomes and extended hospital stays. Research shows that proper nutritional interventions, particularly protein supplementation, can improve neurocognitive recovery in patients with ischemic stroke. Experimental studies indicate that ischemia blocks protein synthesis in the brain’s penumbra region. This inhibition, if not reversed, results in neuronal death. However, restoring protein synthesis allows brain cells to repair damage and regain function. In fact, the extent of protein synthesis inhibition is a more accurate predictor of infarct size than measures like energy depletion or DNA fragmentation.

Studies have also found that oxidative stress, caused by free radical production and lipid peroxidation, contributes to cellular damage in ischemic stroke. B-vitamin supplementation has been shown to reduce oxidative damage and protect neurons. Zinc deficiency is common among stroke patients, and clinical data suggest that zinc supplementation improves neurological recovery compared to placebo.

Nutritional deficits, especially related to protein, can negatively impact brain function even in otherwise healthy individuals. Epidemiological studies have reported neurological impairments in people with chronically low protein intake. Rehabilitation research has shown that stroke patients who receive protein supplements demonstrate better recovery outcomes. In one study, patients who took 20 grams of protein daily for 21 days experienced significantly greater neurological improvement, as measured by the National Institutes of Health Stroke Scale (NIHSS), compared to those given a placebo.

Muscle hypercatabolism makes stroke patients more vulnerable to impairment. Amino acid supplementation has shown promise in post-stroke recovery by reducing muscle protein breakdown and supporting functional and cognitive performance. This supplementation counters the cycle of protein loss and amino acid deficiency that commonly occurs after stroke. Amino acids have anti-proteolytic properties that aid in maintaining muscle mass, improving strength, and supporting recovery.

In conclusion, stroke rehabilitation requires a comprehensive approach that includes physical, occupational, and speech therapy, along with targeted nutritional support. Nutrients such as vitamin D, protein, B vitamins, zinc, and amino acids can play a key role in improving neurocognitive function, enhancing physical strength, and reducing the risk of long-term disability following a stroke.

**Neuroprotective Effects of Sono-Chemical- Synthesized Silica Nanoparticles In-Vivo Models of Ischemic/Reperfusion Injury in Stroke.**

In *in vivo* models of ischemia/reperfusion injury in stroke, sonochemically produced silica nanoparticles (SiO₂ NPs) have demonstrated neuroprotective properties. In a rat model, SiO₂ NPs significantly reduced cerebral ischemia/reperfusion damage. Their neuroprotective effects appear to be associated with increased cell viability and reduced neurodegeneration in the CA1 region of the hippocampus. This effect is linked to the inhibition of NF-κB activity, resulting in a decrease in inflammatory responses. SiO₂ nanoparticles show promise for a wide range of biomedical applications, though further research is needed to fully understand their characteristics and therapeutic potential.