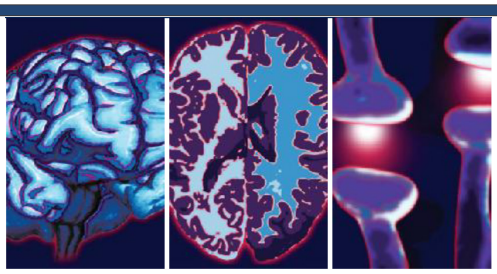
Opinion Article



Exploring Neurodegenerative Diseases Classification and Prevention

Ruth Fernaldin†

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Description

Neurodegenerative diseases are a group of disorders characterized by the progressive loss of structure or function of neurons, including their death. They affect millions of people worldwide and pose significant challenges to healthcare systems due to their chronic and weakening nature. These conditions typically develop over time and lead to the gradual deterioration of motor, cognitive and behavioral functions. The most well-known neurodegenerative diseases include Alzheimer's disease, Parkinson's disease, Amyotrophic Lateral Sclerosis (ALS), Huntington's disease and Multiple Sclerosis (MS). Neurodegenerative diseases can be classified based on the type of neurons affected, the brain regions involved, or the specific proteins that accumulate and cause neuronal damage. Alzheimer's Disease (AD) is the most common cause of dementia, accounting for approximately 60%-70% of cases. It primarily affects older adults and is characterized by memory loss, confusion and cognitive decline. The unique characteristic of alzheimer's disease is the accumulation of amyloid-beta plaques and tau tangles in the brain, which disrupt neuronal communication and lead to cell death.

The progressive nature of the disease results in a gradual decline in thinking, reasoning and the ability to perform everyday tasks. Parkinson's Disease (PD) is a neurodegenerative disorder that affects the motor system, leading to symptoms such as tremors, rigidity, bradykinesia (slowness of movement) and postural instability. It is caused by the loss of dopamine-producing neurons in the substantia nigra, a region of the brain responsible for regulating movement. The exact cause of neuron loss in parkinson's is not fully understood, but genetic factors and environmental factors are believed to play a key role. In addition to motor symptoms, parkinson's patients may experience cognitive and emotional changes, including depression and dementia in later stages. Amyotrophic Lateral Sclerosis (ALS) also known as Lou Gehrig's disease, ALS is a neurodegenerative disorder that affects motor neurons, the nerve cells responsible for controlling voluntary muscles.

As these neurons degenerate, individuals lose the ability to initiate and control muscle movement, leading to paralysis and eventually, death. The exact cause of ALS remains unknown, but both genetic and environmental factors are believed to contribute to its development. In most cases, ALS progresses rapidly and there is currently no cure. Huntington's Disease (HD) Huntington's disease is a hereditary neurodegenerative disorder caused by a genetic mutation in the *HTT* gene. This mutation leads to the accumulation of a toxic protein called huntingtin, which causes the gradual

Department of Neurology, Aachen University, Aachen, Germany

†**Author for Correspondence:** Ruth Fernaldin, Department of Neurology, Aachen University, Aachen, Germany, Italy

email: ruth_fernaldin@au22.de

breakdown of neurons in specific regions of the brain, particularly those involved in movement and cognitive function. Symptoms of huntington's disease typically appear in mid-adulthood and include involuntary jerking movements (chorea), cognitive decline and psychiatric disturbances such as depression and irritability. As the disease progresses, patients lose their ability to speak, walk and perform daily tasks independently. Multiple Sclerosis (MS) is an autoimmune disease in which the immune system attacks the myelin sheath, the protective covering of nerve fibers in the central nervous system.

This results in inflammation and damage to the nerves, leading to a wide range of symptoms, including numbness, weakness, loss of coordination and visual disturbances. The course of the disease varies, with some individuals experiencing periods of remission, while others face a steady decline in neurological function. Although MS is not classified as a neurodegenerative disease in the traditional sense, it shares some characteristics with other disorders in this group, such as chronic neuronal damage and progressive disability. Neurodegenerative diseases share several common mechanisms that lead to the progressive loss of neurons. Abnormal proteins, such as amyloid-beta in alzheimer's or alpha-synuclein in parkinson's, misfold and accumulate, forming toxic aggregates that interfere with normal cellular function. The overproduction of Reactive Oxygen Species (ROS) can damage cellular components, including DNA, proteins and lipids leading to neuronal death.

▪ Prevention strategies

A balanced diet rich in antioxidants, omega-3 fatty acids and anti-inflammatory compounds can protect against neurodegenerative diseases. Foods such as leafy greens, berries, nuts and fatty fish have been shown to promote brain health. The Mediterranean diet, which emphasizes plant-based foods, whole grains and healthy fats is associated with a reduced risk of Alzheimer's and Parkinson's diseases. Exercise is one of the most effective ways to reduce the risk of neurodegenerative diseases. Regular physical activity increases blood flow to the brain, promotes the growth of new neurons and enhances cognitive function. Studies have shown that aerobic exercise, in particular can delay the onset of Alzheimer's disease and improve motor symptoms in Parkinson's patients.

Conclusion

Neurodegenerative diseases present a significant public health issue due to their chronic and progressive nature. While there is no cure for these conditions, understanding their classification and the underlying mechanisms that contribute to neuronal loss can guide the development of prevention strategies. By adopting healthy lifestyle habits, including a balanced diet, regular physical activity, cognitive stimulation and stress management, individuals can reduce their risk of developing neurodegenerative diseases and potentially slow their progression. Ongoing studies into the causes and prevention of these disorders provides hope for more effective treatments and interventions in the future.