

**NEURODEGENERATION IN AYURVEDA A CONCEPTUAL REVIEW WITH
CONTEMPORARY CORRELATION****Dr. Meenakshi*¹, Dr. Sidram Guled², Dr. Ananta S. Desai³**

*¹Final Year PG Scholar, Dept. of PG & Ph.D Studies in Kayachikitsa, Government Ayurveda Medical College and Hospital, Mysore. Karnataka, India.

²Assistant Professor, Dept. of PG & Ph.D Studies in Kayachikitsa, Government Ayurveda Medical College and Hospital, Mysore. Karnataka, India.

³Professor & HOD Dept. of PG & Ph.D Studies in Kayachikitsa, Government Ayurveda Medical College and Hospital, Mysore, Karnataka, India.

***Corresponding Author: Dr. Meenakshi**

Final Year PG Scholar, Dept. of PG & Ph.D Studies in Kayachikitsa, Government Ayurveda Medical College and Hospital, Mysore. Karnataka, India.

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ABSTRACT

Neurodegenerative diseases such as Alzheimer's and Parkinson's disease constitute a growing global health burden. Modern neuroscience attributes neurodegeneration to protein aggregation, oxidative stress, mitochondrial dysfunction, and neuroinflammation, whereas Ayurveda explains degeneration through derangements of *Dosha* and depletion of *Dhatu*s. This conceptual review aims to elucidate neurodegeneration through Ayurvedic principles and correlate them with contemporary biomedical mechanisms. Classical Ayurvedic texts and relevant PubMed-indexed literature were reviewed to establish integrative correlations. Neurodegeneration is primarily understood as *Mastulunga Majja dhatu kshaya* (brain and nervous tissue depletion) with predominant *Vata dosha* involvement, particularly *Prana*, *Udana*, and *Vyana Vata*, leading to cognitive, speech, and motor impairments. Disturbances of *Samana* and *Apana Vata* explain gut–brain axis dysfunction and autonomic manifestations. Secondary involvement of *Pitta* and *Kapha* contributes to *Dhatupaka* (pathological metabolism), neuroinflammation, protein aggregation, and impaired metabolic clearance. The *Samprapti* of neurodegeneration is best explained through *Dhatukshaya* and *Avarana* models. This integrative framework aligns Ayurvedic pathophysiology with modern neurobiology and supports Ayurveda's relevance in understanding neurodegenerative disorders.

KEYWORDS: Alzheimer's disease, Cognitive impairment, *Dhatupaka*, *Majja dhatu kshaya*, *Mastulunga majja*, Motor neuron disease, Neurodegeneration, Parkinson's disease.

INTRODUCTION

Neurological disorders have become a major contributor to global morbidity and disability. Reports from the World Health Organization indicate that their overall burden has increased by approximately 18% since 1990.^[1] Further evidence from the Global Burden of Disease (GBD) 2021 analysis highlights a continuous rise in the prevalence of neurodegenerative conditions, particularly Alzheimer's disease and related dementias, largely driven by population aging and increased life expectancy.^[2]

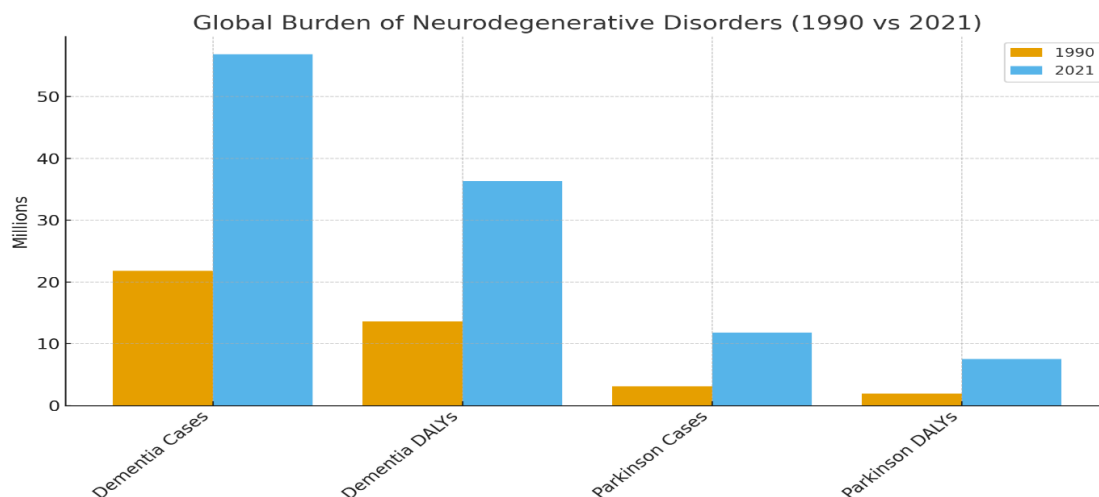


Figure 1: Global Burden of Major Neurodegenerative Diseases.^[4]

Neurodegeneration refers to the progressive loss of neuronal structure and function, resulting from multifactorial causes such as genetic susceptibility, metabolic disturbances, and environmental exposures. Clinically, these disorders manifest as a spectrum ranging from cognitive impairment to motor dysfunctions including rigidity and tremors.^[3] Consequently, neurodegenerative diseases, including Alzheimer's disease and Parkinson's disease, represent a significant and growing public health challenge, exerting considerable clinical, social, and economic burden on individuals, families, and healthcare systems worldwide.^[4]

According to Ayurveda, *Dosha*, *Dhatu*, and *Mala* together form the fundamental basis of the human body.^[5] In the early stages of life, the dhatus develop optimally and sustain normal physiological functions. However, with advancing age, gradual depletion (*kṣhaya*) of dhatus occurs. *Jara* (Aging) is described as a *Svabhavika vyadhi*^[6] a natural and inevitable process. When the functions of *Dhatus* are hampered, degeneration becomes evident, particularly in *Mastulunga majja*^[7] (brain and nervous tissue). Ayurveda recognizes that neurodegenerative changes begin around the fourth decade of life^[8], a concept that aligns with contemporary biomedical understanding of brain aging and neuronal decline.

Neurodegeneration in modern science

Alzheimer's disease, Parkinson's disease and amyotrophic lateral sclerosis have neurodegeneration as a primary feature. However, in other CNS diseases such as multiple sclerosis, stroke, traumatic brain injury, and spinal cord injury, neurodegeneration follows another insult, such as demyelination or ischaemia. Although there are different primary causes to these diseases, they all share a hallmark of neuroinflammation. Neuroinflammation can occur through the activation of resident immune cells such as microglia, cells of the innate and adaptive peripheral immune system,

meningeal inflammation and autoantibodies directed toward components of the CNS.^[9]

Understanding the earliest clinical symptom is important for identifying the underlying neurodegenerative disease. A retrospective study of autopsy proven cases of 301 patients, memory disturbance most often appeared first in Alzheimer's disease, frontotemporal lobar degeneration and Lewy body disease, while gait problems were more common as initial symptoms in progressive supranuclear palsy and multiple system atrophy. These first symptoms showed strong predictive value for specific neuropathological diagnoses. Early symptom patterns were also linked to survival, where cognitive onset indicated longer survival and motor onset indicated shorter survival.^[10]

Ayurvedic Understanding of Nervous system and Neurodegeneration

Ayurveda offers a holistic framework for understanding nervous system function through the combined roles of *Mastulunga Majja Dhatu* and *Vata Dosha*. While modern science identifies neurons as the primary units responsible for electrical transmission and communication, Ayurveda correlates these functions with *Mastulunga Majja*, the structural substrate of the brain, spinal cord, and peripheral nerves. Classical descriptions of *Mastulunga majja*^[11] and *Shira marma*^[12] (vital head points) emphasize the sensitivity of neural structures, with injuries producing paralysis, speech impairment, sensory loss, and motor dysfunction findings comparable to stroke and neurodegenerative presentations.

Functionally, *Dosha* governs movement, communication, sensory processing, and cognitive responses. Its subtypes map closely onto neurological domains: *Prana* regulates autonomic activity; *Udana* supports speech and motor control; *Vyana* governs peripheral neural conduction; *Samana* modulates gut-brain integration; and *Apana* influences pelvic neural mechanisms.^[13] Balanced *Vata* supports cognitive clarity, stable neural activity, and

vitality, whereas aggravated *Vata* produces tremors, disturbed sleep, loss of strength, abdominal discomfort, and sensory disturbances features resembling early neurodegenerative decline.^[14] Classical texts describe *Vata* as *Yogavahi*^[15], highlighting its regulatory dominance over *Pitta* and *Kapha*; thus, *Vata* imbalance initiates cascading dysfunctions.

Neurodegeneration aligns with *Majja dhatu kṣaya*, where structural depletion impairs *Vata*'s functional stability. This interdependence of structure and function offers a coherent Ayurvedic model for understanding degenerative nervous system disorders.

AIMS and OBJECTIVES

Aim

To conceptualize neurodegeneration through ayurvedic principles and correlate them with contemporary biomedical mechanisms.

Objectives

To analyze classical ayurvedic descriptions relevant to neurodegeneration.

To develop an integrative conceptual framework for understanding neurodegenerative disorders.

METHODOLOGY

Classical Ayurvedic texts including Charaka Samhita, Sushruta Samhita, Astanga Hridaya, and Sharngadhara Samhita were reviewed to understand the Ayurvedic conceptualization of neurodegeneration. Contemporary scientific literature was searched using PubMed and related databases to identify studies describing modern mechanisms of neurodegenerative disorders. Relevant articles were analyzed and correlated with Ayurvedic principles to develop an integrative conceptual framework.

DISCUSSION

Among the three doshas, *Vata* is the prime regulator of movement, communication, and neural functions. It is described as *Tantra-yantra-dharaḥ* the force that maintains and operates all physiological mechanisms.^[16]

Derangement of *Vata* (*Vataprakopa* or *Vataavarāṇa*) compromises its normal regulatory capacity, leading to disturbance in normal functioning of vital systems. In the nervous system, this is primarily expressed through *Prana Vata*, which governs higher functions including respiration, circulation, sensory perception, mental clarity, and cognition. The Dysfunction of *Prana Vata* manifests as impaired memory, speech disturbances, tremors, rigidity, and reduced responsiveness clinical features that resemble hypofunction of neuronal circuits in modern neurodegeneration, such as in Parkinson's disease or Alzheimer's disease.

Thus, the hampering of *Vata doṣha*, especially *Prana Vata*, can be conceptually correlated with the decline of neuronal excitability, synaptic transmission, and higher

regulatory functions of the brain, highlighting its central role in the pathology of neurodegeneration.

In a disease presents with impairment of cognition and speech, it signifies the involvement of *Prana Vata*, since this subtype resides in the *Buddhi* (intellect), *Hridaya* (heart), *Indriya* (senses), and *Chitta* (mind); thus, any disturbance in these domains in neurodegenerative disorders can be attributed to *Prana Vata* dysfunction.

Motor system impairment clinically reflects dysfunction of *Vyana Vata*, which is responsible for the circulation of impulses throughout the body, regulation of peripheral activity, and coordination between sensory and motor pathways. *Vyana Vata* ensures the smooth execution of voluntary and involuntary movements by distributing neural signals from the central nervous system to the periphery. Disturbance of this subtype results in weakness, lack of coordination, tremors, and gait abnormalities. In neurodegenerative disorders such as Parkinson's disease, amyotrophic lateral sclerosis, and multiple system atrophy, the impairment of motor activity and locomotion can be consider as dysfunction of *Vyana Vata*.

Udana vata, which governs *Vak pravṛtti* (Speech), *Prayatna* (Effort), *Bala* (Strength), *Varṇa* (Language), and *smṛiti* (Memory), when vitiated, manifest as disturbance in speech, muscle power and cognitive functions. This subtype of *Vata* is situated in the chest region and governs upward movements, articulation, vitality, and the expression of thoughts through speech. In Ayurveda, *Udana Vata* is described as essential for communication, enthusiasm, and coordinated voluntary activity. Disturbance of this subtype leads to disorders of voice, speech production, initiative, and mental clarity. In the context of neurodegenerative diseases, features such as dysarthria, aphasia, loss of motivation, fatigue, and cognitive decline can be conceptually correlated with *Udana Vata* dysfunction. Conditions like motor neuron disease, Parkinson's disease, and frontotemporal dementia often exhibit these symptoms, thereby supporting the interpretation that *Udana Vata* involvement contributes significantly to the clinical spectrum of neurodegeneration.

Samana Vata seated near the *Pacaka agni* (Digestive fire), regulates digestion, absorption, and assimilation and does functions like Coordinates *Jatharagni* (gut fire), balances nutrient absorption, and maintains harmony between *Prana* and *Apana*. Modern science shows strong links between the gut-brain axis and neurological disorders. Altered microbiota, impaired nutrient absorption, and metabolic dysfunctions contribute to diseases like Parkinson's and Alzheimer's.^[17] In Ayurveda, when *Samana Vata* is disturbed, it leads to *Agnimandya* (weak metabolism) and *Amotpatti* (toxic accumulation), resulting in impaired nourishment of *Dhatus* (including *Majja*). This explains why metabolic syndrome, malnutrition, or chronic gut

inflammation often coexist with or accelerate neurodegeneration.

Apana Vata seated in *Pelvic* region; governs elimination (defecation, urination), reproduction, and downward movement and it does Functions like Controls excretion, menstruation, ejaculation, childbirth, and downward neural reflexes. In advanced stages of neurodegenerative disorders, pelvic floor dysfunction, urinary incontinence, constipation, and sexual dysfunction are common features. In Ayurveda, this reflects *Apana Vata dushti*. For example: Constipation is a hallmark non-motor symptom in Parkinson's disease (correlating with *Apana Vata* impairment). Urinary incontinence and bowel irregularities are also seen in dementia and motor neuron diseases. Thus, *Apana Vata* involvement highlights the systemic progression of neurodegeneration, extending beyond cognition and motor control to autonomic and pelvic functions.

The *Prana*, *Udana*, and *Vyana Vata* directly explains cognitive, speech, and motor dysfunction in neurodegenerative disorders, disturbances of *Samana Vata* (via gut-brain axis, impaired metabolism, and *Amotpatti*) and *Apana Vata* (via autonomic and pelvic dysfunctions such as constipation, urinary incontinence, and reproductive decline) also play a contributory role. This underscores the holistic Ayurvedic view that neurodegeneration is not confined to the brain but represents systemic *Vata* derangement.

Secondary risk factors for neurodegeneration (*Pitta & Kapha Dushti*)

Vata remains the primary *Doṣha* in the pathogenesis of neurodegeneration, *Pitta* plays an important secondary role by accelerating tissue damage through its metabolic and inflammatory actions. In particular, *Sadhaka Pitta*, situated in the *Hridaya* and functionally linked with *Manas*, *Buddhi*, and *Smriti*, sustains memory, intellect, and emotional stability. When disturbed, it produces irritability, emotional instability, impaired cognition, and loss of clarity of thought. These disturbances conceptually parallel the neuroinflammation, oxidative stress, and limbic dysfunction described in modern neuropathology. Clinical features such as memory decline in Alzheimer's disease, personality changes in frontotemporal dementia, and affective disturbances in Parkinson's disease reflect *Sadhaka Pitta dushti*. Thus, while *Vata* initiates functional decline and structural depletion, *Pitta* aggravation accelerates degeneration by contributing inflammatory, oxidative, and cognitive-emotional disturbances, worsening the overall pathology.

Prakrita Kapha provides *Shlakshnatva* (lubrication), *Sthiratva* (stability), *Mridutva* (softness), and *Bala* (strength) to body and mind. In the nervous system, *Kapha* ensures structural integrity, synaptic stability, and metabolic support to neurons and glial cells. Its subtle essence is linked with *Ojas*, which sustains immunity and vitality.

Kapha vridddhi associated with *Ama* causes *Srotorodha* in *Mastulunga majjavaha srotas*, leading to obstructive pathology. This can be correlated with protein aggregation such as amyloid plaques, tau tangles, and α -synuclein deposits.

Kapha kṣhaya results in loss of *Snigdhatva* and *Sthiratva*, causing synaptic instability and myelin damage. It also impairs glymphatic clearance, especially during *Prajagara* (sleep deprivation), allowing accumulation of neurotoxic metabolites. Impaired clearance of metabolites (defective glymphatic system function). The glymphatic system is a brain-wide waste clearance pathway. It is most active during natural sleep, especially slow-wave sleep. Sleep deprivation impairs clearance of neurotoxic metabolites such as β -amyloid, tau proteins, which accumulate in conditions like Alzheimer's, Parkinson's, and other neurodegenerative disorders.^[18]

Together, *Kapha duṣṭi* facilitates *Vata* aggravation, accelerating functional and structural neurodegeneration.

Correlation between *Dhatupaka* and Neuroinflammation

Dhatupaka denotes the morbid transformation or "pathological metabolism" of tissues due to the vitiation of *Doṣha*, particularly *Pitta* and *Vata*.^[19] The term *Paka* signifies oxidative alteration, implying an abnormal catabolic process within the *dhatu* i.e., *Dhatu parinama*. When this occurs in *Mastulunga Majja dhatu* the tissue corresponding to the central nervous system it leads to *Majja Dhatupaka*, representing inflammatory and degenerative alterations in neural tissue. This process can be viewed as a progressive continuum beginning with *Pitta prakopa* (metabolic overactivity and inflammation), followed by *Vataanubandha* (functional depletion and neuronal loss).

Dhatupaka can be conceptually correlated with modern mechanisms of neuroinflammation and oxidative stress. Aggravated *Pitta* produces excessive *Uṣhṇa* (heat) and *Tikṣhṇa* (sharpness) qualities, leading to destructive cellular metabolism and tissue irritation, comparable to microglial activation and cytokine-induced neuronal injury in neurodegenerative diseases. Simultaneously, *Ama* the metabolic toxin generated from impaired *Agni* accumulates in the *Srotas* and blocks neural microchannels (*Srotorodha*), analogous to protein aggregation (e.g., amyloid- β , α -synuclein) and mitochondrial dysfunction observed in Alzheimer's and Parkinson's pathology. This toxic milieu promotes oxidative stress and free radical damage, mirroring the *Dhatupaka* (oxidative burn) described in Ayurvedic terms.

As the process advances, the *Dhatu*s undergo *Kṣhaya* (depletion), leading to *Ojas hani* (loss of vitality and immunity) and *Vataprakopa* (functional deterioration). These sequential changes explain the chronic, progressive nature of neurodegenerative disorders where

neuronal inflammation and oxidative imbalance coexist with loss of structure and function. Hence, *Dhatupaka* provides an integrative Ayurvedic framework that parallels the biochemical and cellular cascade of modern

neurodegeneration bridging classical pathophysiology with contemporary understanding of neuroinflammatory and oxidative processes.

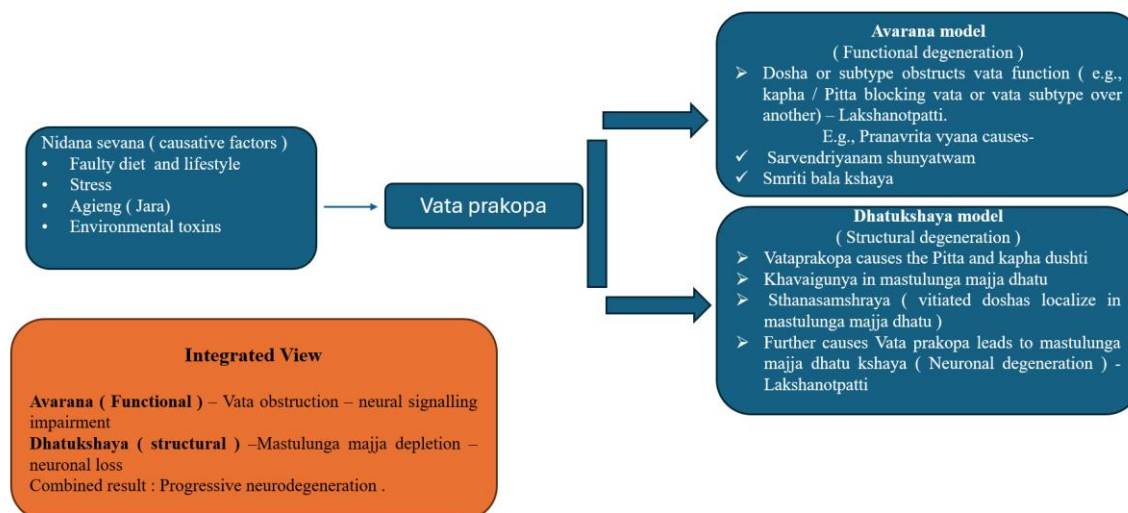


Fig.02: Conceptual understanding of Samprapti (Pathophysiology) of Neurodegeneration in Ayurveda.

CONCLUSION

Neurodegeneration, though described in modern science through mechanisms such as protein aggregation, oxidative stress, mitochondrial dysfunction, and neuroinflammation, can be conceptually understood in Ayurveda through the frameworks of *Dhatukshaya* (tissue depletion) and *Avarana* (functional obstruction) [Fig.02]. *Vata* remains the primary dosha responsible for initiating functional decline and structural deterioration of *Mastulunga Majja dhatu*, while *Pitta* and *Kapha* contribute secondarily through inflammatory acceleration, oxidative damage, and obstructive protein accumulation. This integrated view not only aligns with current biomedical understanding but also enriches it by providing a holistic, systemic model that links structural, functional, and subtle energetic principles. Such conceptualization underscores the importance of Ayurveda in offering a broader perspective on neurodegeneration, serving as a foundation for future research and integrative therapeutic approaches.

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