

Conceptual Analysis of Kha Vaigunya within the Shatkriyakala Framework in Adult-Onset Neurodegenerative Diseases: A Narrative Review

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ABSTRACT

Adult-onset neurodegenerative diseases (AONDs) comprise a heterogeneous group of disorders marked by progressive, age-dependent neuronal dysfunction, with synaptic and axonal impairments preceding overt neuronal loss. Despite diverse genetic and environmental triggers, these diseases share common pathological trajectories that remain inadequately explained by late-stage molecular or cellular events alone. Ayurveda provides an alternative, stage-based understanding of disease evolution through the framework of *Shatkriyakala*, within which *Kha Vaigunya*—defined as a latent defect or vulnerability in channels of transport and transformation (*srotas*)—is recognized as a prerequisite for disease manifestation.

This narrative review critically examines classical Ayurvedic descriptions of Kha Vaigunya and Shatkriyakala alongside contemporary neuroscientific evidence on AONDs. The analysis demonstrates that early, silent disturbances described in the initial stages of Shatkriyakala correspond closely with preclinical synaptic and axonal dysfunction documented in AONDs. Kha Vaigunya is identified as a disease-producing cause (*utpada hetu*), facilitating localization of pathology (*sthana samshraya*) and explaining selective neuronal vulnerability, prolonged latency, and progressive disease course observed in AONDs.

The synthesis highlights a conceptual convergence between Ayurvedic and modern biomedical models, wherein impaired transport and communication systems represent a common substrate underlying neurodegenerative progression. This integrative perspective provides a structured understanding of early disease evolution in AONDs and establishes a foundation for further discussion on preventive and therapeutic considerations.

Keywords: Kha Vaigunya; Shatkriyakala; Adult-onset neurodegenerative diseases; Axonal transport; Srotas

INTRODUCTION

Adult-onset neurodegenerative diseases (AONDs) constitute a heterogeneous group of disorders characterised by progressive, age-dependent decline in neuronal function, ultimately leading to selective neuronal loss.^[1] Despite differences in aetiology and clinical presentation, AONDs share several unifying pathological features: gradual progression over decades, early synaptic and axonal dysfunction preceding overt neuronal death, and convergence of familial and sporadic forms into largely indistinguishable phenotypes.^[2] Contemporary biomedical research increasingly recognises impairments in axonal transport, synaptic connectivity, and intracellular trafficking as early and critical events in AOND pathogenesis, suggesting that disruption of neuronal “transport systems” may represent a common pathogenic denominator across these disorders.^[3]

Ayurveda, the classical Indian system of medicine, offers a conceptual framework that may provide complementary insights into these early, preclinical disturbances through the concept of *Kha Vaigunya*. Literally meaning “defect or vulnerability in channels,” Kha Vaigunya refers to subtle abnormalities in the body’s systems of transportation, transformation, and communication (*srotas*).^[4] According to Ayurvedic pathophysiology, Kha Vaigunya represents a predisposed or weakened state of tissues and microstructures that does not immediately manifest as disease but creates a fertile ground for future pathology.^[5] These defects may arise at multiple levels, including genetic predisposition, microcellular dysfunction, chronic low-grade inflammation, residual damage from prior disease or treatment, or accumulation of incompletely eliminated toxins. Importantly, Kha Vaigunya is recognised as a critical milestone in *Shatkriyakala*, the six-stage model of disease progression, wherein vitiated *doshas* localise to structurally or functionally compromised tissues, initiating disease development.^[6]

The Ayurvedic distinction between disease occurrence and recurrence further underscores the relevance of *Kha Vaigunya* to chronic, progressive disorders such as AONDs. Occurrence denotes the initial manifestation of disease following the first significant disequilibrium of tissues, whereas recurrence reflects repeated or progressive disease expression due to persistence of underlying vulnerabilities, incomplete resolution, or ongoing pathogenic influences.^[7] In both scenarios, the concept of a “defective body system” remains central. When viewed through this lens, AONDs may be interpreted as conditions in which long-standing, subclinical vulnerabilities within neuronal transport and communication systems gradually culminate in clinically apparent degeneration.^[8]

Modern neuroscience observations parallel this perspective. Neurons, owing to their large size and complex subcellular architecture, are uniquely dependent on efficient axonal transport for maintenance of synaptic integrity and cellular homeostasis.^[9] Deficits in axonal transport have been documented across most AONDs, irrespective of their initiating genetic or environmental factors, leading to the proposal that many of these disorders may be categorised as “dysferopathies,” in which impaired intracellular transport is central to pathogenesis.^[10] Notably, pathogenic mutations associated with familial AONDs often fail to explain selective neuronal vulnerability or the long latent period preceding symptom onset, suggesting that cumulative, system-level dysfunctions rather than single molecular defects drive disease evolution.^[11]

Integrating the Ayurvedic concept of *Kha Vaigunya* with contemporary understanding of AONDs provides a unifying, systems-oriented framework for interpreting these paradoxes. *Kha Vaigunya* may be viewed as an early, permissive state corresponding to subtle impairments in neuronal transport, synaptic function, and tissue resilience changes that precede irreversible neurodegeneration by decades. From an applied perspective, this integrative approach emphasises early identification of vulnerability, prevention of progression, and restoration of transport and communication pathways, thereby aligning with current efforts to develop disease-modifying strategies aimed at halting or slowing neurodegenerative processes before extensive neuronal loss occurs.

MATERIALS AND METHODS

This narrative review was conducted through a critical analysis of classical Ayurvedic texts describing *Shatkriyakala* and *Kha Vaigunya*, alongside peer-reviewed scientific literature on adult-onset neurodegenerative diseases. Conceptual synthesis was performed by mapping Ayurvedic pathophysiological stages to documented molecular and cellular events reported in experimental and clinical studies of AONDs.

RESULT AND DISCUSSION

Shatkriyakala and Temporal Pattern of Disease Evolution

Analysis of classical Ayurvedic literature demonstrates that disease evolution is described as a sequential, six-stage process known as *Shatkriyakala*. These stages *chaya* (accumulation), *prakopa* (aggravation), *prasara* (spread), *sthana samshraya* (localisation), *vyakti* (manifestation), and *bheda* (complication) outline a gradual transition from subtle physiological imbalance to overt disease.^[6] Early stages are characterised by vague, non-specific disturbances that lack clear clinical or structural markers.

Review of contemporary neurodegenerative disease literature reveals a comparable temporal pattern in adult-onset neurodegenerative diseases (AONDs). Across multiple AONDs, functional abnormalities in neurons, particularly at synaptic and axonal levels, are consistently observed before detectable neuronal loss. Behavioural, electrophysiological, and imaging abnormalities are reported in presymptomatic or early symptomatic stages, indicating that disease progression begins long before classical pathological hallmarks become evident.^[12]

Kha Vaigunya as an Early Pathological Condition

Within the *Shatkriyakala* framework, *Kha Vaigunya* is identified as a critical antecedent condition. *Kha Vaigunya* is defined as a defect or vulnerability in the body’s channels of transport and transformation (*srotas*). It does not constitute a disease by itself but represents a permissive state that allows deranged *doshas* to localise and initiate pathology. Classical descriptions emphasise that *Kha Vaigunya* is subtle, chronic, and often undetectable through direct observation or investigation.^[13]

The reviewed data indicate that *Kha Vaigunya* is categorised as a disease-producing cause (*utpadaka hetu*), distinct from disease-manifesting causes (*vyanjaka hetu*).^[4] Disease-producing causes are described as latent, nonspecific, and common to multiple disease states. Their presence precedes clinical manifestation and remains silent until interacting with additional precipitating factors.

Srotas Dysfunction and Transport Failure

Physiological descriptions of *srotas* emphasise their role in the reception, transformation, circulation, and elimination of biological substances. Proper functioning of srotas depends on patency, structural integrity, and the presence of *akasha* (space), which allows unobstructed flow (*apratighata*).^[14] Disruption of these features leads to impaired transport, metabolic stagnation, and accumulation of non-transformable byproducts.

Neurobiological findings in AONDs consistently report early impairment of axonal transport and synaptic connectivity. Neurons are structurally dependent on efficient intracellular transport due to their size and polarity. Experimental and pathological evidence shows that alterations in axonal transport occur early in disease progression and precede neuronal death. These defects are observed across diverse AONDs, irrespective of their initiating genetic or environmental factors.

Localisation of Pathology

Ayurvedic sources state that disease manifests when vitiated *doshas* localise at sites of Kha Vaigunya (*sthana samshraya*).^[15] This localisation determines the tissue specificity and clinical expression of the disease. Similarly, in AONDs, selective vulnerability of specific neuronal populations is observed despite widespread expression of disease-associated proteins. Pathological changes preferentially affect axons and synapses, particularly in long projection neurons, indicating site-specific susceptibility rather than uniform cellular failure.

Occurrence and Recurrence

The occurrence of disease is described as the first manifestation following localisation of pathology at a vulnerable site, while recurrence reflects repeated or progressive disease expression due to persistence of underlying defects. In both cases, Kha Vaigunya is described as a common underlying condition. Review of AOND literature shows that neurodegeneration follows a progressive course with continued functional decline, consistent with the presence of an unresolved preclinical vulnerability rather than a single acute event.

Early, silent defects in transport and transformation systems emerge as a unifying substrate for disease vulnerability, progression, and recurrence. Recognition and management of these defects at preclinical stages appear critical for effective prevention and for altering the otherwise progressive course of adult-onset neurodegenerative diseases.

CONCLUSION

The reviewed evidence indicates that adult-onset neurodegenerative diseases follow a prolonged, staged course of evolution that closely parallels the Ayurvedic model of *Shatkriyakala*. Within this framework, *Kha Vaigunya* emerges as a fundamental preclinical condition characterised by latent defects in transport and transformation systems, corresponding to early axonal and synaptic dysfunction observed in AONDs.

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