



INTEGRATIVE PATHOPHYSIOLOGICAL UNDERSTANDING OF THE LUMBOSACRAL SPINE AND GRIDHRASI: A CONCEPTUAL REVIEW

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ABSTRACT Lumbosacral radiculopathy (sciatica) and Gridhrasi represent parallel constructs across modern and Ayurvedic medicine for radiating lower limb pain; however, their pathophysiological convergence remains underexplored. This study aimed to integrate Ayurvedic nosology/samprapti of Gridhrasi with contemporary lumbosacral spine anatomy and radiculopathy mechanisms, proposing a unified conceptual model. A Narrative review synthesizing classical Ayurvedic texts with conventional literature on spinal anatomy, disc disease, stenosis, and neural sensitization was conducted. Vāta derangement provides a mechanistic rationale linking Ayurvedic etiology to modern nerve compression, supporting hybrid diagnostics (laksana + SLR + imaging) and tiered care (Snehana-Basti + PT → surgery). Pragmatic trials validating dosha-phenotype correlations with imaging and prognosis are urgently needed to advance integrative spine care.

KEYWORDS : Lumbosacral Radiculopathy, Gridhrasi, Ayurveda

INTRODUCTION

Lumbosacral radiculopathy and sciatica are significant contributors to pain, disability, and healthcare utilization worldwide, affecting working-age and elderly populations. [1] Concurrently the condition known as Gridhrasi occupies a prominent position within the Vātavāyādhī spectrum in Ayurveda, frequently exhibiting similar patterns of radiating pain, stiffness, and functional impairment in the lower extremities.[2] In conventional medicine, lumbosacral radiculopathy is predominantly attributed to structural and neuroinflammatory changes involving the intervertebral discs, vertebral joints, spinal canal, and nerve roots, resulting in compression and irritation of fibres that ultimately converge into the sciatic nerve.[3] Clinical entities such as lumbar disc herniation, spinal stenosis, and degenerative spondylolisthesis are now well-characterized both radiologically and clinically; however, they often fail to encompass the full individual variability in symptoms, chronicity, and treatment response.[4]

In contrast, Ayurveda conceptualizes Gridhrasi as a manifestation of aggravated Vāta, often with Kapha association, acting on Dhātu (Tissues) and Srotas (Subsystems) in the Kati-Sphik-Uru-Jānu-Janghā-Pāda axis (Hip to foot), emphasizing qualitative changes such as dryness, obstruction, and deranged movement within tissues and channels.[5] Despite the evident phenomenological overlap between Gridhrasi and sciatica, the two frameworks have historically evolved in isolation, resulting in gaps in the translation between Ayurvedic nosology and conventional spinal pathophysiology, thereby limiting systematic and integrative care. An explicit comparative and conceptual review juxtaposing the lumbosacral spine model with the Ayurvedic understanding of Gridhrasi can explain shared anatomical and functional correlates, reconcile explanatory mechanisms, and generate more refined and integrative diagnostic and therapeutic strategies for this condition.

This article thus aims to (i) outline the classical Ayurvedic nosology and etiopathogenesis of Gridhrasi, (ii) summarize key anatomical and pathophysiological concepts of intravertebral pathologies, lumbosacral radiculopathy, and sciatica, and (iii) propose an integrative pathophysiological model that links Vāta imbalance with structural and neurodynamic changes in the lumbosacral spine and sciatic pathway.

Conventional Concept of Lumbosacral Radiculopathy

The lumbosacral spine serves as the biomechanical foundation for both weight-bearing and mobility, comprising lumbar vertebrae L1–L5, the sacrum, intervertebral discs, facet joints, paraspinal musculature, and the lumbosacral plexus, which gives rise to the sciatic nerve. Lumbosacral radiculopathy occurs when these nerve roots (primarily L4–S1) are compressed or irritated, resulting in pain,

sensory changes, and motor deficits that radiate along dermatomal distributions into the lower limb, commonly referred to as sciatica when involving the sciatic nerve pathway.[6]

Anatomy of the Lumbosacral Spine and Neural Elements

The lumbar spine transitions from thoracic lordosis to sacral kyphosis at the L5–S1 level, creating a region of high stress that is susceptible to degeneration. Intervertebral discs function as shock absorbers, supported by a hydrated nucleus pulposus enclosed within the annulus fibrosus, while facet joints and ligaments contribute to stabilization.[7] The ventral rami from L4–S3 constitute the lumbosacral plexus; the sciatic nerve exits through the greater sciatic foramen and bifurcates into the tibial and common peroneal components, which innervate the posterior thigh, calf, and foot muscles, in addition to providing sensory innervation to the posterior leg and sole.[8]

Pathophysiological Mechanisms

Radiculopathy arises from both mechanical compression and chemical irritation. As intervertebral discs age, they undergo dehydration and stiffening, leading to the development of fissures in the annulus fibrosus. This degeneration permits the disc material to protrude outward. The posterior aspect of the spine is structurally the strongest at the center, rendering the lateral regions more susceptible to damage. [9]

Herniated nucleus pulposus releases proinflammatory mediators, such as TNF- α and phospholipase A2, which sensitize nociceptors and disrupt axonal transport, even in the absence of explicit compression. [10]

Clinical Presentation and Diagnosis

Lumbosacral radiculopathy is defined as symptoms arising from the compression of the lumbosacral nerve roots. Affected individuals may present with pain, numbness, tingling, weakness, or difficulty ambulating. The severity and pattern of these symptoms vary according to the specific nerve root involved in the injury. [11]

The initial examination necessitates a comprehensive history, physical examination, muscle testing, sensory testing, reflex assessment, and evaluation of Lasegue's sign. Physical examination findings direct the neurosurgeon to the pertinent spinal region for further MRI and electrodiagnostic testing.[12]

Ayurveda Nosology and Samprapti of Gridhrasi:

Gridhrasi occupies a distinct position within Ayurvedic nosology as a Vātavāyādhī, characterized by radiating pain and stiffness extending from the gluteal region to the foot. This condition reflects an interruption in Vāta function within key neuromusculoskeletal structures. [13]

Classification [14]

- Gridhrasi is classified under Vātavyādhi in classical samhitās, specifically as one of the 20 major Vāta disorders and 80 Nanātmaja Vāta Vyādhis. It is characterized by Kevala Vātaja and Vāta-Kaphaja.
- This dual typology corresponds with its Śhūla-pradhāna (pain characteristics) nature, emphasizing that "no pain arises without Vāta," highlighting Vāta as the primary dosha with Kapha as an associate. Classical texts identify mechanical, degenerative, and lifestyle factors that provoke Apāna and Vyāna Vāta, Consumption of dry, cold, or light foods; excessive standing, walking, or riding; awkward postures; trauma; heavy lifting; overexertion; senility; suppression of natural urges; and exposure to cold or wind.

Classical Symptoms [15]

The hallmark presentation follows a proximal-to-distal radiation pattern, mirroring the sciatic pathway.

- Core symptoms: Rujā (pain), Toda (shooting/pricking), Stambha (stiffness), Spandana (twitching/tingling), Suptatā (numbness).
- Associated: Gaurava (heaviness), Tandra (drowsiness), Aroha (anorexia) in Vāta-Kaphaja type.
- Pathognomonic signs include Sakthutkshepa Nigrāha (inability to lift the thigh) and antalgic "vulture-like" gait (Gridhra-gati).

Pain trajectory: Spḥik (gluteal) → Kati (low back) → Prstha (posterior thigh) → Uru → Jānu → Janghā → Pāda.

The anatomical descriptions in Ayurveda and contemporary neuroanatomy converge in delineating the Kati–Spḥik–Pāda pathway of Gridhrasi with the lumbosacral plexus and the sciatic nerve trajectory. Ayurvedic terms like Kandara, Snayu, Sira, and Gridhrasi-nādi correspond to nerve roots, fascial planes, and vascular channels surrounding the sciatic pathway, while symptom radiation patterns (Spḥik → Pāda) reflect the dermatomal distributions of L4–S3.[16]

Symptom Mapping

Classical laksanas of Gridhrasi demonstrate precise phenomenological overlap with radiculopathy signs, enabling direct clinical translation.

Pain trajectory alignment: Spḥik (buttock) → Kati (low back) → Prstha-Uru (post thigh) → Jānu-Janghā (knee-calf) → Pāda (foot) traces the sciatic nerve precisely, with Spḥik onset distinguishing true radiculopathy from hip pathology. [17]

Clinical Pattern Recognition [18]

- Vātaja Gridhrasi: Acute, mechanical onset → Disc herniation pattern (unilateral, flexion-aggravated).
- Vāta-Kaphaja: Chronic, heavy → Stenosis/spondylosis (extension-aggravated, bilateral tendency).
- Root-level specificity: While Ayurveda lacks dermatomal precision, predominant pada involvement suggests S1, Jangha suggests L5, and Uru suggests L4 patterns.

This mapping substantiates Gridhrasi as a clinical construct that encompasses the entire spectrum of radiculopathy while incorporating qualitative dimensions, such as dosha subtypes and gait analysis, which are absent in contemporary classification systems. Consequently, an integrative assessment can merge Ayurvedic pathway evaluation with root-specific neurological testing to achieve a refined phenotyping.

Vāta-prakopa and Degenerative "Drying"

Nidāna sevana provokes Vyāna/Apāna Vāta from Pakvāsāya, inducing Rūksatā (dryness) and Kharatā (roughness) in Asthi–Sandhi structures. Contemporary correlations include the following:

- Disc desiccation: Loss of Ślesaka Kapha lubrication parallels nucleus pulposus dehydration and reduced proteoglycan content at L4–L5/L5–S1.
- Facet arthrosis: Vāta-induced śithilatā (laxity) leads to microinstability, annular tears, and progressive height loss, mirroring spondylosis. [19]

Kapha-ksaya and Structural Instability [20]

Chronic Vāta erodes Ślesaka Kapha, compromising joint lubrication and stability, which manifests as Stambha and vulnerability to bhramśa (displacement). This aligns with:

- Intervertebral disc protrusion due to failed annulus containment.
- Foraminal narrowing due to uncinat hypertrophy and degeneration of the superior articular process.

Vāta-Kapha Srotorodha: Space-occupying Pathology[21]

Dosa-dūśya sammūrchana in Māmsavaha/Medovaha/Asthivaha Srotas produces obstruction, equated to soft-tissue proliferation:

- Ligamentum flavum thickening/edema: Kapha-mediated Srotorodha compresses the lateral recess roots.
- Osteophytes/myofascial spasm: Reactive bone and muscle changes narrow foramina, akin to Vata-Kaphaja Gaurava.

Neural irritation: Vāta in Kandara-Snāyu-Sira [22]

Localized Sthāna-samśraya affects neural correlates, generating Toda/Suptatā via vaigunya

- Chemical radiculitis: Herniated nucleus releases proinflammatory mediators (TNF- α , IL-1), interpreted as vāta overstimulation of sira.

Ectopic firing/ischemia: Compression plus microvascular compromise produces Spandana along Gridhrasi-nādi, matching sciatic nerve sensitization.

This model unifies acute discogenic (Vātaja: sudden bhramśa) and chronic degenerative (Vāta-Kaphaja: progressive Srotorodha) patterns of LBP Chronicity arises from persistent Vāta in the Majjāvaha Srotas, fostering central sensitization beyond structural relief.

Integrated Clinical Phenotyping

Ayurvedic subtyping complements modern etiology classification

- Vātaja Gridhrasi: Acute onset, mechanical triggers → Disc herniation pattern (flexion-aggravated, SLR+).
- Vāta-Kaphaja: Insidious, Gaurava-dominant → Degenerative stenosis/spondylolisthesis (extension-aggravated, claudication).
- Mixed/Āma presentations: Systemic features (Tandra, Arochaka) → Inflammatory or plexopathy differentials

Ayurvedic Management Principles [23]

- Vātaja Gridhrasi (acute/discogenic): Snehana (lubrication), Svedana (decongestion), Basti (Vāta normalization), Agnikarma/Sirāvyadha (neuromodulation).
- Vāta-Kaphaja (chronic/stenotic): Mridu Śodhana (Srotorodha clearance), Asthi-Majjā Rasāyana (degeneration reversal), Guggulu compounds (anti-inflammatory).
- Core goals: Restore Ślesaka Kapha, pacify Vyāna/Apāna Vāta, and relieve Kandara-Snāyu

Integrative Pathways

- Acute (0–6 weeks): Snehana + NSAIDs + graded activity (90% resolution).
- Subacute (6–12 weeks): Basti + PT + injections if SLR persists.
- Chronic (>12 weeks): Śhodhana + surgery + rehabilitation.

This synthesis positions Ayurveda as complementary to conservative care (pain relief, addressing chronicity) and rehabilitation

Research Gaps and Future Directions

Gap	Description	Evidence
Diagnostic standardization	No validated criteria linking laksanas/dosha profiling to radiculopathy grades (e.g., SLR angle, ODI).	Single studies used VAS/SLR but ignored MRI progression.
Phenotyping	Vātaja and Vāta-Kaphaja did not correlate with disc and stenosis patterns.	Case reports assume equivalence without subgroup analyses.
Trial design	Predominance of n-of-1 cases; rare RCTs (e.g., Agnikarma vs. Katibasti) lack blinding and controls.	Heterogeneity in interventions and outcomes precluded the meta-analysis.
Objective measures	Minimal use of MRI/EMG pre-post; no biomarkers (e.g., proinflammatory cytokines).	X-rays in 2/10 studies; MRI absent despite discogenic etiology.
Long-term data	Focus on short-term pain relief; recurrence/chronicity is untracked.	The 6-month follow-up was rare, and no disability-adjusted life years were reported

CONCLUSION

This review examines Gridhrasi and lumbosacral radiculopathy as convergent models for similar syndromes. The concept of Vāta-prakopa is associated with disc degeneration, Srotorodha with

foraminal narrowing, and Kandara-Snāyu vaigunya is manifested as Toda and Suptatā along the sciatic pathway. By mapping the Kati trajectory to the L4–S3 dermatomes, Slesaka ksaya to disc desiccation, and Vāta-Kapha obstruction to stenosis, Ayurveda captures qualitative dimensions, such as dosha subtypes and gait patterns, that are absent in imaging.

This integration facilitates refined phenotyping, stratified care, and research linking classical laksanas to ODI/SLR/MRI endpoints. Future spine care should unify models in which Vāta normalization complements microdiscectomy, Agnikarma augments steroids, and dosha profiling guides personalized rehabilitation. This approach transforms Gridhrasi/sciatica into translational neuromusculoskeletal medicine by merging ancient precision with modern validation.

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