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Roga Nidana in the Era of Precision Medicine: A Review of Classical Concepts and Modern Diagnostic Paradigms

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Abstract

Background: The discipline of *Roga Nidana*—encompassing the causation and interpretation of diseases—constitutes a cornerstone of *Ayurvedic* diagnostics. It elucidates disease evolution through the classical doctrines of *Nidana panchaka* and *Samprapti*, focusing on etiology, early warning signs, the course of pathology, complications, and outcome prediction. Simultaneously, modern precision medicine is revolutionizing diagnostics through genomics, proteomics, metabolomics, and artificial intelligence. The shared emphasis on individualized assessment and early intervention creates fertile ground for conceptual integration[1,2].

Objective: This review aims to correlate the classical diagnostic structure of *Roga Nidan* with modern precision medicine approaches, identifying intersections that may inform predictive, preventive, and personalized models of care.

Methods: A narrative synthesis of *Ayurvedic* canonical texts (*Caraka Samhita*, *Sushruta Samhita*, *Madhava Nidana*) was performed alongside an extensive search of biomedical databases (PubMed, Scopus, Google Scholar; 2020–2025). Search keywords included *Roga Nidana*, 'Ayurgenomics', 'AI diagnostics', 'multi-omics', and 'digital phenotyping'[3,5].

Results: Comparative analysis revealed strong alignments between traditional and modern diagnostics: *Nidana* corresponds with risk assessment and exposomic profiling; *Purvarupa* parallels prodromal markers and digital phenotyping; *Rupa* mirrors clinical phenotyping; *Upadrava* equates with secondary complications; *Sadhya-asadhyata* corresponds with prognostic modeling; and *Samprapti* resonates with systems biology[6,8]. Opportunities lie in merging *prakriti*-based assessment with genomic data and AI-assisted prediction systems.

Conclusion: The *Roga Nidana* framework provides a timeless model of individualized and anticipatory diagnosis that aligns closely with the ethos of precision medicine. By integrating *Ayurvedic* diagnostic wisdom with emerging digital and molecular innovations, healthcare can evolve toward a more comprehensive and ethically responsible paradigm of precision diagnostics.

Keywords – *Roga Nidana,* Ayurgenomics ,*Samprapti*

Introduction :

Diagnosis forms the bedrock of effective clinical practice across all medical traditions. In *Ayurveda*, *Roga Nidana* offers an intricate understanding of the origin, development, and prognosis of diseases. Through the fivefold diagnostic schema known as *Nidana panchaka*, practitioners systematically identify causative factors (*Nidana*), premonitory symptoms (*Purvarupa*), evident manifestations (*Rupa*), complications (*Upadrava*), and curability status (*Sadhya-asadhyata*)[1,2]. This structure embodies a preventive and predictive philosophy, emphasizing disease interception prior to full manifestation.

Acharya Charak highlighted the primacy of causal knowledge by asserting that treatment devoid of etiological understanding is futile[1]. *Sushruta* and *Madhava* further refined the description of disease progression via *Samprapti*, a dynamic account of *dosha-dusya* interactions that parallels the systemic models of modern pathophysiology[2,3]. In contemporary biomedicine, precision medicine represents an analogous shift from population-based to individualized care, integrating genetic, molecular, and environmental data to tailor diagnostics and therapy[4]. The *Ayurvedic* notion of *prakriti*, describing constitutional variability among individuals, mirrors the precision medicine concept of biological uniqueness[5].

Materials and Methods :

This study was conducted as a two-phase narrative review. The first phase included an analytical examination of classical *Ayurvedic* literature—*Charak Samhita*, *Sushruta Samhita*, and *Madhava Nidana*—with special attention to *Nidana panchak*, *Samprapti*, and diagnostic reasoning[1,3]. Commentaries by *Chakrapani* and *Dalhana* were critically evaluated for interpretive insights. The second phase entailed a structured review of biomedical literature from 2020 to 2025 using PubMed, Scopus, and Google Scholar, incorporating keywords such as *Roga Nidana*, 'Ayurgenomics', 'AI diagnostics', and 'multi-omics'[4,6]. The collected data were synthesized thematically to identify conceptual overlaps, structural correspondences, and opportunities for translational convergence.

Results and Discussion :

The conceptual foundation of *Roganidan* lies in *Nidana panchak*, encapsulating the journey of disease from causation to prognosis. *Nidana* outlines etiological agents including diet, behavior, and environment; *Purvarupa* represents prodromal symptoms; *Rupa* indicates definitive signs; *Upadrava* describes complications; and *Sadhya-Asadhyata* defines curability[1,2]. *Samprapti* explicates the mechanism of disease through *dosha*, *dushya*, and *srotas* interplay, paralleling systemic disease modeling in modern biology[6,7].

Modern diagnostics are transforming rapidly through molecular profiling, imaging, and artificial intelligence. AI-driven algorithms interpret radiological and genomic data with remarkable precision[8,9]. Predictive modeling and multi-omics approaches, encompassing genomics, proteomics, and metabolomics, now enable stratification of individuals by molecular phenotype[10]. These advancements echo *Ayurveda's* personalized diagnostic philosophy, emphasizing early detection and individualized care[11].

Conceptual mapping shows that *Nidana* aligns with risk factor identification, *Purvarupa* with digital and biochemical biomarkers, *Rupa* with clinical phenotyping, *Upadrava* with comorbid conditions, and *Sadhya-Asadhyata* with prognosis prediction models[6,10]. *Samprapti's* focus on interconnected systemic dynamics resonates with systems biology and network medicine[12]. Integrative approaches such as Ayurgenomics link *prakriti* profiling with genetic and molecular markers, supporting precision diagnostics[13,14].

However, challenges remain in methodological standardization, reproducibility, and ethical governance[15]. Developing integrative frameworks requires robust cross-disciplinary collaboration and validation through clinical trials[16]. Despite these challenges, *Roganidana's* emphasis on causation, prevention, and personalization can significantly enhance modern predictive health models.

Conclusion :

Roga Nidana, as envisioned in classical *Ayurvedic* literature, presents a sophisticated diagnostic framework centered on causation, prediction, and personalization. Its congruence with modern precision medicine demonstrates the potential for an integrative, patient-centered diagnostic paradigm. Merging *Prakriti*-based assessment, *dosha* dynamics, and *Samprapti* analysis with multi-omics and AI-based analytics could redefine diagnostic science. A collaborative, ethical, and evidence-based approach is essential to realize this synthesis for the future of precision healthcare.

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Conflict of Interest : None