

Understanding Prana Vayu as A Neuro-Respiratory Regulatory Mechanism: An Integrative Approach

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Abstract—In Ayurveda, Prana Vayu is considered the foremost subtype of Vata Dosha, responsible for regulating vital functions such as respiration, sensory perception, mental activity, and consciousness. Classical texts including the Charaka Samhita and Sushruta Samhita describe Prana Vayu as residing primarily in the head and chest, governing the intake of air, swallowing, and the coordination of higher neurological processes. From a modern physiological perspective, these functions show strong parallels with the neuro-respiratory regulatory mechanisms controlled by the central nervous system, particularly the brainstem respiratory centers and autonomic pathways. This integrative review explores the conceptual correlation between Prana Vayu and the neuro-respiratory control system. It analyzes classical Ayurvedic descriptions alongside contemporary knowledge from neurophysiology and respiratory medicine. The regulation of breathing rhythm, airway reflexes, sensory processing, and maintenance of consciousness can be interpreted through the coordinated action of medullary respiratory centers, vagal regulation, and cortical inputs, which collectively resemble the functional attributes of Prana Vayu. Furthermore, disturbances in Prana Vayu described in Ayurveda—manifesting as dyspnea, anxiety, impaired cognition, and altered consciousness—can be compared with dysfunctions in neural respiratory regulation and autonomic imbalance. Understanding Prana Vayu through a neuro-respiratory framework provides a scientific basis for integrating Ayurvedic concepts with modern physiology. Such an approach may enhance interdisciplinary research and support evidence-based interpretation of traditional knowledge, contributing to a broader understanding of human physiological regulation and holistic healthcare.

Index Terms—Prana Vayu, Vata Dosha, Neuro-respiratory regulation, Ayurveda physiology, Brainstem respiratory centers, Integrative physiology, Autonomic nervous system.

I. INTRODUCTION

Ayurveda, the traditional system of medicine originating in ancient India, explains the structure and function of the human body through a number of fundamental physiological concepts. One of the most important among these concepts is Srotas, which represent the channels responsible for the transportation and circulation of various substances within the body. These channels play a crucial role in both physiological and pathological processes. According to classical Ayurvedic literature, the proper functioning of Srotas ensures nourishment of tissues, while obstruction or dysfunction of these channels may lead to the manifestation of disease. ¹

Acharya Charaka described Srotas as pathways through which substances such as nutrients and metabolic products circulate in the body. These channels facilitate the transport of tissue elements undergoing transformation and ensure proper nourishment of various Dhatus. Each tissue in the body possesses its own specific channel responsible for supplying nourishment, indicating a highly organized system of physiological transport within the body. ²

Among the various channels described in Ayurveda, Pranavaha Srotas is considered one of the most vital systems because it is responsible for the transportation of Prana, the essential life force necessary for sustaining life. The functioning of these channels is closely associated with respiration and the maintenance of vitality. Classical texts describe that disturbances in these channels can lead to respiratory disorders and other systemic disturbances. ³

Ayurveda explains that Prana is maintained and regulated by Prana Vayu, one of the five subdivisions

of Vata Dosha. Prana Vayu is responsible for controlling vital activities such as respiration, swallowing, sensory perception, and mental functions. It is considered the governing force that maintains coordination between the body, senses, and mind. ⁴ The anatomical sites of Prana Vayu described in Ayurvedic literature include the head, chest, throat, nose, and tongue. These locations correspond closely to structures involved in respiratory and neurological regulation. The heart and Rasavahi Dhamani are described as the principal sites of origin of Pranavaha Srotas, indicating the relationship between respiration and circulation in maintaining life. ⁵⁻⁶

Modern physiology explains respiration as a complex process involving the respiratory system, nervous system, and circulatory system. The neuro-respiratory regulatory mechanism includes respiratory centers located in the brainstem, neural pathways controlling respiratory muscles, and chemoreceptors that regulate breathing according to metabolic demands. These mechanisms ensure continuous oxygen supply to tissues and removal of carbon dioxide from the body. ⁷

When examined from an integrative perspective, the functions attributed to Prana Vayu show remarkable similarities with the neuro-respiratory regulatory system described in modern physiology. The processes of inhalation, exhalation, coordination of airway reflexes, and maintenance of consciousness reflect the combined functioning of respiratory and neural control mechanisms. ⁸

Therefore, correlating the Ayurvedic concept of Prana Vayu with modern neuro-respiratory physiology may provide a deeper understanding of respiratory regulation and highlight the scientific relevance of classical Ayurvedic principles in contemporary biomedical research.

II. CONCEPT OF PRANA VAYU IN AYURVEDA

In Ayurvedic physiology, Vata Dosha is considered the primary regulatory force responsible for all forms of movement and communication within the body. Vata is subdivided into five functional types, namely Prana Vayu, Udana Vayu, Samana Vayu, Vyana Vayu, and Apana Vayu. Among these subdivisions, Prana Vayu is regarded as the most vital because it governs fundamental life-sustaining activities such as

respiration, swallowing, perception, and cognitive functions. ⁶

Prana Vayu is considered the central regulator of other forms of Vata and plays a key role in maintaining physiological coordination between the body, mind, and sensory organs. According to classical Ayurvedic texts, it regulates the process of inhalation and exhalation and ensures the proper functioning of sensory perception and consciousness. The normal functioning of Prana Vayu is therefore essential for maintaining life and vitality. ⁷

Disturbances in Prana Vayu may lead to dysfunction of respiratory activity, impairment of sensory perception, and disturbances in mental functions. Hence, Prana Vayu is regarded as the fundamental life-sustaining force responsible for maintaining respiratory rhythm and neurological coordination.

Functions of Prana Vayu

Prana Vayu performs several important physiological functions related to respiration and airway protection. These activities ensure proper intake of air and coordination of reflex mechanisms associated with breathing and swallowing.

Major physiological actions attributed to Prana Vayu include:

- Regulation of respiration
- Control of swallowing of food
- Sneezing and coughing reflexes
- Spitting and expulsion mechanisms
- Belching and airway protective reflexes⁷

These functions demonstrate that Prana Vayu plays a critical role in maintaining respiratory activities as well as protective reflexes of the upper respiratory tract.

Table 1: Functions of Prana Vayu and Their Physiological Significance

Function described in Ayurveda	Physiological interpretation
Shwasa (respiration)	Breathing process
Kshavathu (sneezing)	Airway protective reflex
Sthivana (spitting)	Oral secretion clearance
Udgara (belching)	Gastro-respiratory reflex
Ahara Swallowing	Deglutition mechanism

Anatomical Location of Prana Vayu

Ayurvedic texts describe several anatomical regions where Prana Vayu primarily operates. These locations correspond closely with organs involved in respiratory and neurological control.⁷

The major locations of Prana Vayu include:

- Head
- Chest
- Throat
- Nose
- Tongue
- Mouth

These structures are associated with both respiratory passages and neural control mechanisms.

Table 2: Classical Sites of Prana Vayu and Modern Correlation

Ayurvedic site	Possible modern anatomical correlation
Head	Brain and respiratory centers
Chest	Lungs and thoracic cavity
Throat	Larynx and trachea
Nose	Nasal airway
Tongue and mouth	Cranial nerve-controlled swallowing

Pranavaha Srotas and Its Mula

The respiratory channels described in Ayurveda are known as Pranavaha Srotas. These channels are responsible for the transportation and circulation of Prana within the body.

According to classical Ayurvedic literature, the Mula (root) of Pranavaha Srotas includes the heart and Rasavahi Dhamani. These structures function as the principal sites responsible for the regulation and circulation of Prana throughout the body.⁸⁻⁹

The heart is regarded as the central organ responsible for maintaining circulation, while Rasavahi Dhamani represents the network of channels responsible for transporting nutritive fluids and vital elements.

Table 3: Mula of Pranavaha Srotas

Ayurvedic description	Modern interpretation
Hridaya (heart)	Cardiac pump and circulatory regulation
Rasavahi Dhamani	Arterial circulation

III. RESPIRATION IN MODERN PHYSIOLOGY

Respiration is a complex physiological process that involves the intake of oxygen and removal of carbon dioxide from the body. This process ensures adequate oxygen supply to tissues for metabolic activities and removal of metabolic waste products.¹⁰

Respiration can be broadly divided into two main processes:

- External respiration – exchange of gases between lungs and atmosphere
- Internal respiration – exchange of gases between blood and tissues

The respiratory system works in close coordination with the cardiovascular system to transport oxygen throughout the body. Oxygen inhaled through the lungs diffuses into the bloodstream where it binds with hemoglobin in red blood cells. Approximately 98–99% of oxygen is transported bound to hemoglobin, while a small proportion remains dissolved in plasma.¹⁰

Carbon dioxide produced during cellular metabolism is transported back to the lungs through venous blood and is eliminated during expiration.

Neuro-Respiratory Regulation

The regulation of respiration is controlled by complex neural mechanisms involving the central nervous system. Specialized respiratory centers located in the brainstem coordinate the rhythm and depth of breathing.

The primary respiratory centers are located in:

- Medulla oblongata
- Pons

These centers regulate the contraction and relaxation of respiratory muscles, thereby maintaining rhythmic breathing patterns. Chemoreceptors present in the carotid and aortic bodies detect changes in oxygen, carbon dioxide, and blood pH levels and send signals to the respiratory centers to adjust breathing rate accordingly.

This neural control system ensures that respiration continuously adapts to the metabolic needs of the body.

Table 4: Components of Neuro-Respiratory Regulation

Component	Function
Medulla oblongata	Generates breathing rhythm
Pons	Modulates respiratory pattern
Chemoreceptors	Detect blood gas changes
Respiratory muscles	Perform ventilation
Nervous system pathways	Coordinate breathing reflexes

Correlation Between Prana Vayu and Neuro-Respiratory Regulation

The functions attributed to Prana Vayu in Ayurveda show significant similarities with the neuro-respiratory regulatory mechanisms described in modern physiology.

Regulation of Breathing

Prana Vayu governs the process of inhalation and exhalation, which corresponds to the rhythmic breathing controlled by respiratory centers located in the brainstem.

Airway Protective Reflexes

Functions such as sneezing, coughing, and spitting described under the actions of Prana Vayu correspond to airway protective reflexes mediated by neural circuits within the brainstem and cranial nerves.

Coordination of Swallowing

Prana Vayu regulates swallowing of food, which is controlled in modern physiology through coordinated activity of cranial nerves and brainstem swallowing centers.

Maintenance of Vitality

Ayurveda considers Prana Vayu essential for sustaining life. Similarly, continuous respiration is required to maintain oxygen supply necessary for cellular metabolism and survival.

Table 5: Integrative Correlation

Ayurvedic concept	Modern physiological equivalent
Prana Vayu	Neuro-respiratory control mechanism
Shwasa-Prashwasa	Ventilation
Indriya coordination	Neural integration
Chetana	Consciousness
Prana circulation	Oxygen transport

Pathological Conditions of Pranavaha Srotas

Disturbances of Pranavaha Srotas may occur due to several etiological factors including excessive exertion, starvation, dehydration, suppression of natural urges, and violation of healthy lifestyle practices.¹¹

When these channels become vitiated, several symptoms may manifest such as:

- Difficulty in breathing
- Prolonged respiration
- Shallow breathing
- Painful breathing

These symptoms indicate disturbance in respiratory function.¹²

In severe conditions, injury to these channels may lead to symptoms such as dizziness, loss of consciousness, tremors, and severe respiratory distress.¹³

Management of Pranavaha Srotas Disorders

The management of disorders related to Pranavaha Srotas involves therapeutic approaches aimed at restoring normal respiratory function. Treatment principles generally follow the line of management described for respiratory diseases.¹⁴

Important therapeutic approaches include:

- Regulation of breathing
- Proper diet and lifestyle
- Avoidance of etiological factors
- Therapies that restore normal Vata function

These interventions help maintain normal respiratory rhythm and support overall physiological balance.

IV. DISCUSSION

The concept of Prana Vayu reflects the sophisticated physiological understanding present in classical Ayurvedic literature. Ancient scholars described respiration, airway reflexes, and coordination between the body and mind under the functional domain of Prana Vayu. These descriptions suggest that Ayurveda recognized the central role of respiratory activity in maintaining life. Modern physiology explains respiration through a complex neuro-respiratory regulatory system involving brainstem respiratory centers, neural pathways, and respiratory muscles. These mechanisms ensure continuous oxygen supply to tissues and removal of carbon dioxide. The similarities between these two perspectives suggest

that Prana Vayu may represent a functional description of respiratory regulation that integrates both neural and physiological mechanisms. By correlating Ayurvedic concepts with modern biomedical knowledge, it becomes possible to interpret classical physiological principles in a scientific framework.

V. CONCLUSION

Prana Vayu represents a vital regulatory principle in Ayurvedic physiology responsible for controlling respiration, airway reflexes, and coordination of vital activities. The anatomical locations and physiological functions attributed to Prana Vayu show strong similarities with the neuro-respiratory regulatory mechanisms described in modern physiology. Understanding this correlation helps bridge the conceptual gap between classical Ayurvedic knowledge and modern biomedical science. Such integrative interpretations can contribute to a deeper understanding of respiratory physiology and may support the development of holistic approaches for maintaining respiratory health.

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