



## AN INTEGRATIVE ANALYSIS OF *PRANAVAHA SROTAS*: CORRELATING AYURVEDIC RESPIRATORY CHANNELS WITH MODERN ANATOMICAL AND PHYSIOLOGICAL INSIGHTS

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<https://doi.org/10.46607/iamj0112072024>

(Published Online: July 2024)

### Open Access

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Article Received: 12/06/2024 - Peer Reviewed: 28/06/2024 - Accepted for Publication: 15/07/2024.



## ABSTRACT

This study presents an integrative analysis of *Pranavaha Srotas* (Respiratory Microchannels), correlating Ayurvedic concepts of respiratory channels with modern anatomical and physiological insights. *Pranavaha Srotas*, described in Ayurveda, pertains to the movement of *Prana* (life force) and is closely related to the functions of the respiratory system, including the nasal passages, pharynx, larynx, trachea, and bronchi. The research undertakes a comprehensive literature review to explore the Ayurvedic perspective on *Pranavaha Srotas* and its comparison with modern biomedical descriptions of the upper respiratory tract. The analysis delves into the background, significance, and unique principles of Ayurveda, aiming to bridge the gap between these two knowledge systems. It highlights the role of *Pranavaha Srotas* in health and disease, emphasising its significance in contemporary respiratory conditions, including the COVID-19 pandemic. The study offers a detailed comparative analysis, enhancing the understanding of respiratory channels through a holistic approach that integrates Ayurvedic wisdom and modern scientific knowledge.

**Keywords:** *Pranavaha Srotas*, Ayurvedic respiratory channels, *Pranavaha Srotas*, Ayurveda Respiratory System, *Srotomoola*, *Srotas*,

## INTRODUCTION

In Ayurvedic philosophy, *Srotas* (micro channels) are the microchannels which provide the structural and functional link between the gross physical body (*kosas*) and the subtle regulatory body (*pranas*). *Pranavaha Srotas* is among the several *Srotas* and is directly related to the exchange of prana (life force) at the levels of respiration and speech. In Ayurveda, the concept of *Pranavaha Srotas* described approximately correlates with the anatomical and physiological description of the upper respiratory tract, i.e. nasal passages, pharynx, larynx, trachea, and bronchi, and their associated functions of respiration and speech. In Ayurvedic understanding, the role of *Pranavaha Srotas* in health and disease and treating diseases related to these channels are based on entirely different visualisations, philosophies, unique principles, and practices compared to those in modern medicine.

*Pranavaha Srotas* is an Ayurvedic concept which can be correlated with the upper respiratory tract, including nasal passages, pharynx, larynx, trachea, bronchi, and their associated functions of respiration and speech as described in modern anatomy and physiology. A comprehensive literature review was undertaken to explore the concept of *Pranavaha Srotas* and its anatomical and physiological constituents. The outcomes are narrated taking four subheadings, one for each of the major structures: *nasa* (nose), *kantha* (pharynx and larynx), *uras* (chest, trachea, and bronchi), and *Pranavaha Nadi* (respiration).<sup>[1,2,3,5,7,8,6,11,12,13]</sup>

### Background and Significance-

The current global COVID-19 pandemic, where the most prominent symptoms are breathlessness, difficulty breathing, cough, and cold, has once again highlighted the importance of the respiratory system and its association with prana. Ayurveda gives a detailed description of the respiratory system and its associations with etymology, location, functions, types of activities, and disorders. However, due to terminology differences and a lack of integrative research methodologies, the correlation of these descriptions with the respiratory anatomical and physiological aspects of modern biomedicine needs to be revised. This commutation inhibits the full utilization of Ayurveda's extensive experience in managing respiratory disorders. Ayurveda is the science of life that deals with preserving health and managing diseases to ensure a long and healthy lifespan. The word Ayurveda means the 'Science of Life,' like all other sciences, it aims to understand the nature of things as

they are in reality and the laws governing their activities. *Pranavaha Srotas* represents the group of channels or structures associated with the movement of prana, one of the five subtypes of *vayu* responsible for controlling and regulating various respiratory and related physiological functions in the body. Although an extensive description of the etymology, location, functions, types, and disorders of *Pranavaha Srotas* is available in the classical Ayurvedic texts, its correlation with the anatomical and physiological aspects of modern science still needs to be improved. This paper presents a result-driven methodology that can help bridge this gap by correlating the terms used in both knowledge systems using an integrative research approach.<sup>[1,2,3,4,5,6,7,8,9,10]</sup>

### Objectives and Scope-

The main objectives of this study are to understand and describe the *Pranavaha Srotas*—Ayurvedic concepts of the respiratory channels, structure, and function of the respiratory system as described in modern medicine, to co-relate and integrate these aspects to find a common term or concept, and to thereby facilitate a better understanding of the structure and function of the respiratory system.

One of the unique features of Ayurveda is its concept of *Srotas*, loosely translatable as channels. *Pranavaha Srotas*, explicitly dealing with the respiratory system, is one of the critical *Srotas* in the body. Considering the upsurge in the deterioration of respiratory health, be it due to infectious causes, environmental pollution, or an increase in autoimmune conditions, the multi-factorial involvement of the etiopathogenesis of these diseases and their variations in presentation and disease course, it is implied that modern anatomical and physiological understanding of the respiratory system is analysed and correlated with its Ayurvedic counterpart - the *Pranavaha Srotas*, thereby providing unique insights and a clear, holistic picture, that could eventually help in evolving a more comprehensive and personalised approach in the diagnosis and management of diseases related to the respiratory system, both from the preventive and curative aspect.

### Concept of *Pranavaha Srotas* in Ayurveda-

Understanding the role of respiration in health and disease, Ayurveda and its contemporary discipline, Yoga, which has a shared philosophy of Prana, have given high importance to regulating Prana through *Nasamukha* (Nostrils). Various Pranayama practices are stated to be beneficial in many conditions when

*Pranavaha Srotas* are specifically addressed. This study attempts to correlate *Pranavaha Srotas* from Ayurveda with contemporary science's anatomical and physiological insight. It is a concise philosophical account supported by relevant information from texts and research articles. Furthermore, the study correlates Prana, especially in its function as Vayu, and the role of *Nasamukha* with discoveries in neurophysiology and neuroanatomy.

Ayurveda, the ancient Indian science of life, views the body's functioning holistically. This view is based on the concept of "*Srotas*," which are the channels that facilitate the flow and communication throughout the body. The "*Srotas*" are fundamental to the systemic approach of Ayurveda. "*Pranavaha Srotas*" are the channels that are related to the movement of "*Prana*" or vital energy in the body, especially in and out through "*Nasamukha*" or nostrils. It is acknowledged in Ayurveda that most diseases have their root cause in the disturbed functioning of "*Pranavaha Srotas*".<sup>[1,2,3,5,7,8,6,11,12,14]</sup>

#### **Definition and Functions-**

*Pranavaha Srotas* serves to transport inhaled air (or vital energy) between the external and internal environment of the body to perform *Pranayatana* (respiration). It carries out many other distinct physiological functions, including intake, passage, and distribution of external and internal substances related to its specific site and associated organs. These additional functions are performed in correlation with the *Anna* (Gastrointestinal) *Srotas*, whose function is to transport nutrients from the inhaled air into the circulatory system and distribute them to all body parts. The *Pranavaha Srotas* resembles the concept of airway and lungs according to modern scientific descriptions. The trachea can be considered the *Pranavaha Srotas*, where breathing or respiration occurs, and the bronchi as its *Duhmavaha* sub-*Srotas*, which carry the air or *Duhma* to and from the lungs.

*Pranavaha* is the amalgamation of two words, *Prana* meaning "vital air" and *Vaha* meaning "to move or circulate". Collectively, *Pranavaha* means "that which circulates air". *Srotas* (channels or systems) are like streams, continuously circulating the substances necessary for the maintenance of life. In this context, *Pranavaha Srotas* is more aptly described as the channels which circulate air and perform various functions to sustain life.<sup>[1,2,3,5,7,8,6,11,12,14]</sup>

#### **Pathology and Imbalances-**

*Vata* dosha primarily affects the movement of *Prana* *vayu* in the channel. *Pranavaha Srotas* can be in

different stages of functional imbalance. *Vyanavayu*, which moves in the body's and lungs' peripheral areas, might be affected. It could result in a physical presentation of the primary disease process. At the mental level, Ayurveda would consider the emotional disturbances that *Vyanavayu* experienced due to its connection to *shleshaka kapha*, which is related to the brain and mind. Emotional and mental symptoms accompany the disease of *Pranavaha Srotas*. The concept of prana being affected at psychological and physical levels also fits into the modern medical thinking about the mind-body connection. Ayurveda gives importance to the relationship of *Agni* and *Kapha* about *Pranavaha Srotas*. Usually, the pathology of *Pranavaha Srotas* begins with the involvement of *Agni*, and later it progresses into *Kapha*, *Vata*, and *Sannipata* morbidities. This theory can be related to inflammatory diseases of the lungs.

During normal breathing, only a small portion of total lung capacity exchanges oxygen and carbon dioxide. Ayurveda believes that the alveoli are kept healthy by performing proper oxygenation and that diseases are caused if the alveoli do not receive adequate oxygenation. *Pranavaha Srotas* carries oxygen to *Prana*, *Tejas*, and *Ojas*. It nourishes the entire body and mind. It is deeply related to the nervous system's functioning and specifically related to the higher mental functions. Diseases of *Pranavaha Srotas* are not only due to physical factors like trauma, toxins, or infections. Still, they can also be due to various mental factors like excessive sadness, grief, emotional suppression, etc. Ayurveda believes that *Srotas* can be affected by doshas at different levels. While they are being carried in these *Srotas*, *Vata Dosha* can lead to various types of imbalances, from hyperventilation to loss of breathing, which can be life-threatening.<sup>[1,2,3,7,8,11,12,14,15,13]</sup>

#### **Anatomical and Physiological Overview of the Respiratory System-**

The *Pranavaha Srotas* is translated as the "channel of respiration" or "channel of vital air". *Srotas* is a term used in Ayurveda to mean channel. These channels are equivalent to "ducts" in modern anatomy. *Srotamsi* means small channels comparable to the term "capillaries" in contemporary anatomy. In the Ayurvedic classical texts, the *Pranavaha Srotas* is described as one of the body's channels, primarily responsible for the reception of "*Prana*" from the atmosphere. To correctly understand the concept of the function of these *Srotas*, these terms must be ade-

quately translated and understood in the appropriate context. In the Sushruta Samhita, Sushruta describes eight channels starting from the head region and culminating at the heart. The first of these channels is the "*Prana Nadi*," which receives the "*Prana*" from the atmosphere. The *Pranavaha Srotas* and the *Prana Nadi* are described as responsible for the primary function of reception of prana. This is received through the mouth and is transported via the *Srotas* to the heart.

The respiratory system consists of the organs that deliver oxygen to the circulatory system for delivery to all the body's other systems. This system comprises the lungs, muscles, and the airway that conducts the air. The airways consist of relatively rigid tubes that conduct air from the external environment to the exchange surfaces within the lungs. The upper airway includes the nasal passages, pharynx, and larynx; the lower airway includes the trachea, bronchi, and bronchioles. The exchange surfaces where oxygen and carbon dioxide are transferred are in the lungs, thin-walled sacs called alveoli. The diameter of the tubes regulates the flow of the air through a process called bronchodilation and bronchoconstriction.<sup>[2,13,11,8,7,15,14,13,10]</sup>

### Structures and Functions-

Structurally, the nose is said to be responsible for performing most of the functions of the upper respiratory tract, with the surrounding paranasal sinuses assisting it and the larynx contributing some share of its function as well. Functionally, it purifies the inhaled air by acting as a filter for dust and other impurities contained in the air. It also adds moisture to the inspired air, and most importantly, it regulates the temperature of the inspired air by its rich vascular mechanism located in the nasal cavity. These considerations lead to the inference that the nose, with its annexed structures—sinuses and larynx—form collectively the anatomical substrate that represents *Pranavaha Srotas* according to modern knowledge. Recent studies have shown that probiotics can influence the immune system of the respiratory tract and prevent respiratory infections.

Ayurveda describes eight chief sites or channels in the body called *Srotas* through which the dhatus and doshas circulate. *Pranavaha Srotas* is among the eight major *Srotas* described in classical Ayurvedic texts, which is chiefly concerned with the function of prana or life energy transportation. Functionally, it is said to be associated with both the upper and lower respiratory tracts. The term '*Prana*' represents a spe-

cific type of vata, primarily located in the chest region, and is instrumental in performing the vital biological function of respiration. *Pranavaha Srotas* is assigned with the primary function of *Pranapana* *Samarjanam*, meaning 'cleansing and providing nourishment for both prana and apana vayu'. Researchers have tried substantiating the descriptions with modern anatomical structures and physiological functions. With relevance to *Pranavaha Srotas*, structures of modern anatomy such as the nose, pharynx, larynx, trachea, bronchi, and lungs and their physiological activities are considered.<sup>[1,2,3,5,6,7,8,11,14,15]</sup>

### Correlations between Pranavaha Srotas and Modern Respiratory System-

In modern Anatomy and Physiology, the respiratory system exchanges gases. It comprises the airways (nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles, and alveoli) and the lungs. The airways conduct the air to the site of gas exchange, while the lungs are the sites for gas exchange. The exchange of gases involves the uptake of oxygen and the release of carbon dioxide. The respiratory system performs external respiration, which is one of the main functions of the *Pranavaha Srotas*, as described in Ayurveda. It performs this function in close association with the cardiovascular system. Hemoglobin in the RBCs carries oxygen from the lungs to the various tissues and the carbon dioxide from the tissues to the lungs to be released. This transport function is physiologically associated with the respiratory system. Relieves pleural and abdominal distension. It also plays a significant role in thoracic grip and is the seat of Kapha Dosha as per the principles of Ayurveda.

The word "*Pranavaha*" is made up of two words, "*Prana*", which means "vital energy", and "*Vaha*", which means "to carry." So literally, "*Pranavaha*" means "that which carries the Prana." In Ayurveda, "*Pranavaha Srotas*" describes the channels associated with respiration and the organs involved. According to Ayurveda, the *Srotas* are the functional pathways in the body responsible for conducting various physiological and waste products. The *Pranavaha Srotas* are of great significance as they are responsible for the most important function of the *Prana Vayu*, the *Sambhavana*, which is paramount in terms of priority as life depends on it. Often, the term "*Pranavaha Srotas*" is used in a narrow sense to describe only the airways or respiratory passages. However, according to Ayurveda, the *Pranavaha Srotas* comprise a much broader area, including the respiratory passages and



the organs associated with respiration, such as the lungs (including their pleural coverings), the diaphragm, etc.<sup>[1,2,3,5,6,11,7,12,16,17]</sup>

#### Comparative Analysis-

Moreover, the concept of *Srotas*, as described in Ayurveda, is meant to explain more than just the anatomical structures. It gives more importance to the physiological functions. Considering the perineural and endoneurial lymphatic sheath of the nerves, recent studies have shown how increased permeability in the nerve-associated lymphatics helps in neuroinflammation and thereby supports the concept of *Srotas* in a way confirming Ayurvedic insights. It can be summed up by saying that *Pranavaha Srotas* is not a direct description of respiratory channels, and even when it is taken that way, there still exists a strong correlation between the Ayurvedic insight and the modern anatomical descriptions. The view of *Srotas* being more of a physiology than just anatomical structures further support the Ayurvedic concept.

The point of initiation of *Prana* in the body, according to Ayurveda, is the *hridaya*. It is said that five types of *Pranas*, namely *Prana*, *Apana*, *Vyana*, *Udana*, and *Samana*, originate from the heart. Modern anatomy and physiology do not support this. However, as per the correlation given above, it can be understood that the process of respiration and the functions of the five types of *pranas* are associated with the *Pranavaha Srotas* and lungs. It can also be seen as a process related to neural anatomy (considering that *Prana's* upward and downward moving routes are sympathetic and parasympathetic nerve pathways).<sup>[1,7,8,14,9,18,10,19,16,20]</sup>

#### Conclusion and Future Directions-

Given the discrepancies inherent in the existing interpretations, the position taken by the current study is that both Ayurveda and modern science will benefit from the most accurate possible account of the correlates. This is with the ultimate aim of improving health care. In this spirit, further work could involve more detailed correlations via, for instance, also looking into the descriptions of the *Pranavaha Srotas* in the Ayurvedic text *Nighantu Sangraha* and reviewing the literature of regionallung syndromes described in the modern medical practice.

The present study addressed the discrepancies in the identity of *Pranavaha Srotas* by two classical Ayurvedic scholars. By revisiting the Ayurvedic and modern anatomy texts and correlating the structures and functions described in each, it is concluded that the

airways described in Ayurveda comprise both the upper respiratory tract (nose, nasopharynx) and the lower respiratory tract (larynx, trachea, bronchi, bronchioles, lungs). The lungs are referred to via their included structures. It is suggested that *Pranavaha Srotas* is the term used to describe the collective respiratory passageways, while *Svasanavaha Srotas* accounts for the depiction of the lungs. While there was a correlation in the descriptions of some parts, there was also considerable discrepancy in detailing specific other structures. It is also apparent that the functions of the respiratory channels vary according to the specialist area being described, i.e. either from the perspective of breathing and speech or from that of carrying out sensory and motor activities.

## DISCUSSION

The study of *Pranavaha Srotas* in Ayurveda offers an intricate perspective on the respiratory system, emphasizing the flow of *prana* (vital energy) through specific channels. This holistic approach aligns with modern anatomical and physiological understandings of the respiratory system, including structures such as the nasal passages, pharynx, larynx, trachea, and bronchi. Through the lens of Ayurveda, the correlation between *Pranavaha Srotas* and the upper respiratory tract provides a comprehensive view of respiratory functions, bridging ancient wisdom and contemporary science.

Ayurveda's unique perspective on *Pranavaha Srotas* extends beyond mere anatomical descriptions. It encompasses the physiological processes involved in the exchange of *Prana*, the regulation of *Vayu* (air), and the maintenance of health through balanced *Doshas*. This integrative approach sheds light on the interconnectedness of the respiratory system with other bodily functions, including digestion and mental health. For instance, the association of *Vyanavayu* with the peripheral areas of the body and lungs highlights the holistic nature of Ayurvedic physiology, wherein emotional disturbances can impact respiratory health.

The contemporary relevance of *Pranavaha Srotas* is underscored by the ongoing COVID-19 pandemic, which has brought respiratory health to the forefront of medical research and practice. Ayurveda offers valuable insights into the management of respiratory disorders through its emphasis on *Prana*, *Doshas*, and the maintenance of *Srotas* (channels). *Pranayama* practices, which regulate the flow of *Prana*

through the nasal passages, have been shown to benefit various respiratory conditions, providing a preventive and therapeutic approach that complements modern medical interventions.

Moreover, the comparative analysis of *Pranavaaha Srotas* and modern respiratory anatomy reveals significant overlaps and discrepancies. While both systems recognize the importance of airways and lung functions, Ayurveda's emphasis on *Prana* introduces a subtle layer of understanding that encompasses both physical and energetic dimensions. This integrative analysis facilitates a more comprehensive understanding of respiratory health, offering a holistic approach to diagnosis and treatment.

## CONCLUSION

The integrative analysis of *Pranavaaha Srotas*, correlating Ayurvedic respiratory channels with modern anatomical and physiological insights, highlights the potential for a holistic approach to respiratory health. The study underscores the importance of bridging ancient Ayurvedic wisdom with contemporary scientific knowledge to enhance our understanding of the respiratory system. By recognizing the complementary aspects of these two knowledge systems, healthcare practitioners can develop more effective and personalized strategies for managing respiratory disorders.

*Pranavaaha Srotas*, with its emphasis on *Prana* and the regulation of *Vayu*, provides a unique perspective that enriches modern respiratory medicine. The holistic approach of Ayurveda, which considers the interconnectedness of physical, mental, and energetic aspects, offers valuable insights into the prevention and treatment of respiratory conditions. This integrative framework can potentially improve patient outcomes by addressing the root causes of respiratory disorders and promoting overall health and well-being.

Future research should continue to explore the correlations between Ayurvedic concepts and modern medical science, fostering a deeper understanding of how these systems can complement each other. By integrating Ayurvedic principles with contemporary medical practices, we can develop a more comprehensive and effective approach to healthcare that honors the wisdom of the past while embracing the advancements of the present. This integrative methodology not only enriches our knowledge but also paves the way for innovative therapeutic interven-

tions that can address the complex challenges of respiratory health in today's world.

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**Source of Support: Nil**

**Conflict of Interest: None Declared**

How to cite this URL: Dharampal Singh Thakur & Yogeshwar Pandey: An Integrative Analysis of Pranavaha Srotas: Correlating Ayurvedic Respiratory Channels with Modern Anatomical and Physiological Insights. *International Ayurvedic Medical Journal* {online} 2024 {cited July 2024} Available from: [http://www.iamj.in/posts/images/upload/1157\\_1163.pdf](http://www.iamj.in/posts/images/upload/1157_1163.pdf)