

## INTRODUCTION TO SROTAS AND FUNDAMENTAL ASPECTS OF PRANAHAHA SROTAS

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## ABSTRACT

*Ayurveda* gives various ideas of *Rachana Shareera*, and there are many topics like *Kala*, *Sira*, *Dhamani*, and *Srotas*. So here we have taken *Srotas* as one of the basic concepts of *Rachana Shareera*. It holds *Srotas* in high regard as a crucial component of the Human Body's structure and functions. *Srotas* fulfill a significant role in the transportation and circulation of various materials within the body. *Pranavaha Srotas* maintains the maintenance of life throughout. *Pranavaha srotas* means channel, which carries the external air into the Body to sustain life. *Pranavayu* is represented as the functional unit of the respiratory Centre, sensory and motor organs, mind, intellect, and consciousness. It maintains the life and life process by supplying oxygen. Thus, the *Pranavaha Srotas* is most important for preserving life and longevity. *Hridaya* and *Maha Srotas* are the *Mula Sthana of Pranavaha Srotas*. Life starts with Breath and ends with Breathlessness. Breathlessness may be due to physiological or pathological problems, pathological is one of the leading causes of morbidity.

**Keywords:** *Srotas*, *Pranavaha Srotas*, Breathlessness.

## INTRODUCTION

The etymology of the term *Vata* is derived from the verb "Vaa" which signifies movement. Ordinarily,

*Vata* is synonym of air. Universally, *Vata* governs all movements<sup>1</sup>. *Vata* is subtle, lightweight, rough, clear

etc... that is, Sukshma, Laghu, Khara, Ruksha, and Vishad. It is always on the move, in every direction. Vata is essential for supporting all functions of the body as well as the maintenance of mind and intellect. Inspiration, deglutition, sneezing and expectoration are monitored by Pranavayu<sup>2</sup>. स्रवनात् स्रोतांसि || (c.su-30/12)

The Sanskrit term *Srotas* is an anatomical and Physiological Parlors means of structural or functional channel or pathway. Biochemical pathways are metamorphologically called so to denote sequential changes of metabolites and nutrients. Thus, we have glucose pathway, lipid pathway etc.... which are not tubular structures. In contemporary science it is termed as the tracts such as GIT, Circulatory, Respiratory are tubular structures. They are/have anatomical pathways termed as *Srotas*. The term *Srotas* also means orifice or opening.

*Caraka Samhita* has dedicated fifth chapter of Vimana Stana for detailing channels of the body, chapter named *Sroto-Vimaanam*. In *Sushruta Samhita* major external orifice of the body termed as *Baahya Srotaamsi* are mentioned in *Sarira Sthana*, *Sarirasankhya-Vyakranam Sariram* and *Dhamani Vyakaranam Sariram*. In *Astangahrudaya* description about the channels of the body, both internal and external, has been mentioned in *Angavibhaga sariram*.

#### **SROTO-BHEDA(TYPES)**

*Srotas* are of different types according to the site, size, content etc.

Without *Srotas* all the transported substances neither originate nor get depleted. This means that for the origination, increase and decrease of physical constituent's channels are necessary.

In male there are nine external *Srotas* commonly known as *Nava-Dwara* (nine openings), seven of them are situated above neck region and two of them situated below the nabhi or trunk<sup>4</sup>. In an addition tenth opening is mentioned by *Sharangadara* on the vertex<sup>5</sup>. That is Fontana but this remains as an open foramen only in fetal life. The nine openings are as follows.

1. Two Orbits - 2
2. Two Nostrils - 2

3. Two Ears - 2
4. Mouth - 1
5. Urinary opening - 1
6. Anus - 1

In female there are three more openings. One is the vaginal orifice for reproduction and two openings of the Brest to secrete milk. In men the urethra serves as excretory as well as reproductive outlet. Through there are two nostrils, they are separated only externally, inside the body they continue as one respiratory channel.

*Acharya Susruta* has mentioned 22 internal channels, and also named them as *Yoga Vaahee* Channels. These are countable channels. Though enumerated as 22, they are 11 pairs.

*Acharya Caraka* enumerates 13 internal channels. The reproductive channel in women is considered by *Caraka* in context of embryology including there are 14 channels.

*Dalhana* explains that *sushruta-Samhita* is detailing the *srotasmsi* (channels) in context of injury of their *Moolaani* (roots) for Surgical Purpose. *Moolaani* of *Asthi* (bone), are *majja* (bone marrow) and *sveda* (sweat) are spread all over the body.

The *Srotas* could be classified as into *Sukshma* (minute) and *Sthula* (gross). There are external channels that could be classified as gross channels, but there are many gross channels among internal channels too. In fact, which is an alimentary tract termed as *Maha Srotas*. The Respiratory Tract is also sufficiently gross. *Sukshma* such as *Rakta vaha srotas* (capillaries).

According to the contents, the channels are named and hence the channel for *Rasa*, *Rakta*, etc... are separate divisions. Yet we can group the contents into five and accordingly the channels could be classified as follows:

1. Channels conducting nutrients to tissues (*Dhatu vaha Srotaamsi*).
2. Channels conducting waste (*Mala vaha Srotaamsi*).
3. Channels conducting three humors (*Dosha vaha Srotaamsi*).

4. Channels for food, drink, and air (*Praanaanod-aka vaha Srotamsi*).
5. Channels for imperceptible entities such as mind (*Ateendriya vaha Srotaamsi*).

### EMBRYOLOGICAL APPRAISAL OF PRANAVAHA SROTAS

Embryologically the term “*Mula*” refers to a generative or developmental site.

According to *acharya Charaka* and *Sushruta* the “*Moolasthan*” of *Pranavaha Srotas* is “*Hridaya*” (heart) as well as “*MahaSrotas*”<sup>6</sup> and *acharya Sushruta*<sup>7</sup> identifies “*Rasavahinidhamani*” as the location of *Moolasthan* of *Pranavaha Srotas*.

### INTRODUCTION TO PRANAVAHA SROTAS

The *Pranavaha Srotas* is one of the most crucial anatomical structures in the human body. *Prana*, also referred to as *Pavana* or *Anila*, is vital for vitality and sustenance of life. The *Ambara Peeyusha* comprised of oxygen and water in the body is essential for life. The etymology of the term *Prana* stems from the Sanskrit root “*An*” which means to breathe or live, with the prefix “*Pra*”.

*Pra* conveys the sense of fulfillment, whereas “*Na*” denotes the nasal passage consequently, *Prana* signifies fulfillment through the nasal cavity, arguably essential in the quest for the longevity of life.

*Acharya Chakrapani* expounded that *Pranavaha Srotas* are the conduits through which *Pranavayu* streams. *Charaka* put forward that *Hridaya* and *Mahasrotas* serve as the origin of *Pranavaha Srotas*, whereas *Acharya Sushruta* opine that the *Hridaya* and *Rasavaha Dhamani* are the founts of *Pranavaha Srotas*.

The *Sharangadhara Samhita* notes that *Phupphusa* serves as the *adhara* for *Udanavayu*, which facilitates the act of *Ucchvasa kriya*<sup>8</sup>. This highlights *Phupphusa* as a *Mahasrotas*. The *Rasavaha Dhamani* is the term used to describe the arteries responsible for carrying pure and nutrient dense blood from *Phupphusa* to the *Hridaya* and subsequently all other bodily tissues<sup>9</sup>.

In the context of human anatomy, the nasal passage, also known as the *Nasa*, is believed to serve as the portal to the head region. Therefore, it can be inferred

that the *Pranavaha Srotas* encompasses a system of organs that begins from the tip of nasal passage and extends up to the *Mahasrotas*. It appears that *Sushruta* has suggested this notion by asserting that the thoracic heart, referred to as *Hridaya* in this discourse and the *Rasavahini Dhamanies* constitute the foundations of the *Pranavaha Srotas*.

All physiological and pathological processes occurring in the body are contingent upon the *Srotas*. Among these the *Pranavaha Srotas* remain preeminent, as they serve as the medium for the passage of *Pranaswaroopa Vayu*, or oxygen, throughout the body. By conveying oxygen to every part of the body, the *Pranavaha Srotas* sustain our lives. In contemporary scientific understanding, the cardiopulmonary system is responsible for the transportation of oxygen, in a manner that parallels the *Pranavaha Srotas*. The *Pranavaha Srotas* has two *Moolasthan*, from which it is regulated. Within the cardiopulmonary system there are two interdependent subsystems: Respiratory and Cardiovascular. The respiratory system is responsible for the transfer of oxygen to the bloodstream, thus oxygenating it, while the cardiovascular system carries the oxygen throughout the body. Since the heart and lungs and their attendant components form the principal organs of the cardiopulmonary system, there are many striking similarities between the functions, signs, and symptoms of the *Pranavaha Srotas* and cardiopulmonary system.

As per *Acharya Sushruta*, it is believed that the *moolasthan* of *Pranavaha Srotas* is situated in *Hridaya* and *Rasavaha Dhamani*. Meanwhile according to *Acharya Sharangadaras* opinion that *Ahararasa* reaches *Hridaya*, it is then transported throughout the body via *Vyana vayu*, with the purpose of nourishing each and every cell. This remarkable process takes place through the *Rasavaha Dhamani*<sup>9</sup>.

Therefore, *Hridaya* and *Rasavaha Dhamanis* are regarded as the *moolasthan* of *Pranavaha srotas* by *Acharya Sushruta*.

All anatomical structures in the human body will either cease to function or undergo reduction if the respective circulation pathways are absent. These pathways transport the transforming tissue elements

and their constituents, known as dhatus, to their designated location.

As per *acharya Sharangadharas* exposition on the complete mechanism of respiration, it can be inferred that *Hridaya* serves as the fundamental site of *Pranavaha Srotas*. *Sharangadhara* expounds that “*Prana Pavana*” located at Nabhi or the heart, upon traversing through *Hritkamala* or lungs, emerges mixed with *Vishnupadamruta* through *Kantha*. Post inhalation of *Ambara Peeyusha* or oxygen, it expeditiously returns back into the system, catering to nourishment of the entire body and kindling the digestive fire in the stomach<sup>10</sup>.

The cardiovascular system plays a crucial role in the respiratory process, which is regulated by both the cardiac conduction system and the Medulla Oblongata (Medullary Rhythmicity Area). Hence, *Hridaya* serves as the fundamental center for the flow of *Pranavaha Srotas*.

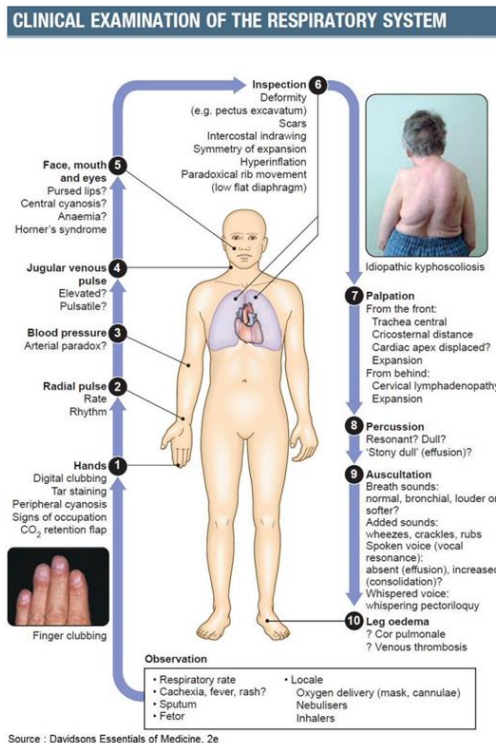
*Hridaya* is the adobe of *Ojas*<sup>11</sup>, *Prana* and the root of the *Rasavaha Srotas*. Therefore, it is evident that

these *siras* or *dhamanis* transport the vital essence of the *Ojus* or *Prana* from the Heart to the minutest units of the body as they progressively bifurcate into several branches. Subsequently, *Prana* disseminates to every nook and cranny of the body through the *Rasavaha Dhamani* and then executes its respective functions. Hence the *Rasavaha Dhamani* is Reckoned as *Moolasthan*- the primary mode of transportation.

### PRANAVAHA SROTODUSTI HETU

The impairment of the *Pranavaha Srotas*, or respiratory system is caused by various factors that can vitiate the *Srotas*. These factors may include loss of tissue or dhatu *Kshaya*, suppression of urges or forcefully retention of natural urges, intake of dry and rough substances, excessive physical exercise or excretion and hunger or malnutrition<sup>12</sup>.

The *Pranavaha Srotas* originates from the Heart and the *MahaSrotas*, and any dysfunction in these organs can cause various respiratory problems such as frequent respiration, shortness of breath and pain.



CLINICAL EXAMINATION OF PRANAVAHA SROTAS FIG-1 <sup>13</sup>

Etiological factors, Vata becomes aggravated in the *Pranavaha Srotas*(the channels responsible for car-

rying *prana*) and disrupts the *Kapha* located in the thoracic region, resulting in a critical obstruction of

*Pranavayu* and the emergence of five types of ominous *Hikka* and *Shwasa*.

Signs and symptoms of vitiation of *Pranavaha Srotas*.<sup>14</sup>

1. *Atisrushtam* (Respiratory act is too long)
2. *Atibaddham* (Restricted Respiration)
3. *Kupitam* (Agitated Respiration)
4. *Alpalpam* (Shallow or Short breath)
5. *Abhikshnam* (Frequent or repeated breaths)
6. *Sasabdham* (Stertorous)
7. *Sashoola* (Painful)

These signs and symptoms indicate the changes in the respiration.

According to *Sushruta* “*Viddha Laxanas of Pranavaha Srotas*”:

An *abhighata* or injury to the *Pranavaha Srotas* produces the following signs and symptoms.

1. *Akrosana* (Loud grooming)
2. *Vinamana* (Deformation of the thoracic region)
3. *Mohana* (Loss of consciousness)
4. *Bhramana* (Illusion)
5. *Vepana* (Tremors)
6. *Maranam* (Death)

#### **SROTO DUSTI**<sup>15</sup>

When the *Srotas* becomes afflicted, the symptoms of their derangements are expressed through both functional and structural aberrations. Change in the flow of the conveyed substance (characterized by motion) *ATIPRAVRUTTI* refers to the excessive or abnormal flow or function of a specific substance. It indicates deviance from the physiological or natural rhythm of bodily functions which leads to an imbalance or disturbance in the physical, mental, or emotional aspects of an individual. Eg- high *Pitta* accumulation in the stomach leading to an acidic stomach, increased bowel movements or diarrhea, an increased blood sugar level, or any other increase or overactivity in body functions beyond their normal range. It can occur due to internal or external factors, including stress, dietary habits, environment factors. It aggravates symptoms associated with *Vata*, *Pitta*, and *Kapha*, specific disorders and can lead to complications if left untreated.

*SANGA* refers to obstruction or any hindrance that causes a deviation from the natural or intended path of body functions. It means blocking or hampering the natural circulation of fluids and other physiological components such as Blood, Lymph and waste products. *Sanga* can lead to a reduction in the metabolism of targeted organs with symptoms related to blockage including abdominal discomfort and constipation, inadequate hepatic metabolism.

*VIMARGA GAMANA* is the term used to describe the abnormal flow or movement of a particular substance or physiological function, pathway. *Raktapitta* (Bleeding disorders) exemplifies *Vimarga gamana*, as there is abnormal flow or outward migration of blood from the target organs, making it difficult for the body to streamline the production of blood and preventing aggravation of negative symptoms from the bleed.

*SIRA GRANTHI* describes an abnormal growth or accumulation of blood or tissue within circulatory system, obstructing necessary and natural bodily functions. It is characterized by dilation, enlargement, or constriction, an abnormal because of increased pressure. *Sira granthi* poses a potentially vulnerable breakdown of many sub-sentient functions, with varicose vein condition presenting an analogy to dilation with hardening of the vessels.

When there is an alteration in the anatomical structures of these channels, the channels lose their natural function and lead to imbalance. This physiological dysfunction refers to “*Srotodushti*,” which may be caused by factors like lifestyle habitat, diet choices, etc... it may manifest as abnormalities with changes in the size, shape, or hardness of the *Srotas* and their adjoining channels. The structural changes manifest in the circulatory system and can include symptoms like an aneurysm or varicose vein epoxidation.

#### **RESPIRATORY DISORDERS**<sup>16</sup>

Respiratory insufficiency is a clinical condition wherein the respiratory system is compromised in its ability to execute the essential gas exchange functions of inhalation and exhalation, either associated



with insufficient oxygen (hypoxemic) or excessive carbon dioxide (hypercapnic) buildup.

Type 1 respiratory failure, or hypoxemic respiratory failure, is distinguished by having an arterial oxygen tension (PaO<sub>2</sub>) that falls below 60mmHg and a normal or decreased arterial carbon dioxide tension (PaCO<sub>2</sub>). This is the most prevalent manifestation of respiratory failure and may be linked to almost all acute lung problems, usually involving the filling of fluid in alveolar units or their collapse. Cardiogenic or noncardiogenic pulmonary edema, pneumonia, as well as other ailments, are examples of type 1 respiratory failure.

Type 2 respiratory failure, or hypercapnic respiratory failure, is distinguished by a PaCO<sub>2</sub> level exceeding 50mmHg. Hypoxemia is prevalent among patients with hypercapnic respiratory failure who inhale ambient air. The pH value is determined by the bicarbonate level, which is influenced by the duration of hypercapnia. Drug overdose, chest wall irregularities, and severe airway disorders such as asthma and chronic obstructive pulmonary disease (COPD) are routine causes.

The condition of respiratory failure can be categorized as acute or chronic. While acute respiratory failure is identified by potentially fatal disruptions in arterial blood gases and acid-base equilibrium, the indication of chronic respiratory failure is less severe and may not be immediately observable. Restrictive pulmonary diseases are persistent illnesses that restrain the lung's capacity to inflate while inhaling, ultimately diminishing the quantity of air that an individual can take in. Consequently, to fulfill the oxygen requirements of the body, the individual's respiration pace commonly elevates.

There have been no reports of respiratory agitation manifesting as dyspnea, but more accurately described as the inability to breathe comfortably.

Shallow breathing, Thoracic breathing, Chest breathing is the drawing of minimal breath into the lungs, usually by drawing air into the chest area using the intercostal muscles rather than throughout the lungs via the diaphragm. Shallow breathing can result in or

be symptomatic of rapid breathing and hypoventilation.

Shallow breathing is the inadequate drawing of breath into the lungs, wherein the air is predominantly filling the chest area; this is often carried out through the accessory respiratory muscles located between the pairs of ribs, rather than sending air thoroughly across the lungs by rhythmic inhalation and exhalation via the diaphragm. Shallow breathing engenders appearance for both rapid breathing and hypoventilation, where expulsion of carbon dioxide does not match the rate of production, leading to reduced oxygen inflow, amongst other complications.

One form of sonorous respiration is stertor. This nomenclature indicates a sound engendered either in the nasal cavity or at the posterior aspect of the throat. Its pitch is usually low and its timbre most resembles the nasal congestion often produced by a cold or the noise elicited by snoring.

Stertor is a type of sonorous respiration, denoting the occlusion experienced either in the nasal cavity or posterior part of the oropharynx. Its tone is generally low-pitched, and its quality is most comparable to that of nasal congestion caused by the common cold, or the snoring indicated during sleep.

Failed chest is a traumatic condition of the thorax. It may occur when three or more ribs are broken in at least 2 places. It is considered a clinical diagnosis with this fracture pattern does not develop a Fail Chest. Failed chest arises when these injuries cause a segment of the chest wall to move independently of the rest of the chest wall. It can create a significant disturbance to respiratory physiology. A Fail Chest is usually associated with significant blunt chest wall trauma.

Failed chest is a traumatic injury arising in the thorax. The condition most often evokes the following fractures of at least three or more ribs, each in two separate sites, though several other fractures may also contribute. While the fractures scattered across the ribcage do not cause a 'Fail Chest', the said injury comes to prevail is when the physiognomy of the interrupted bones makes them overlap or move dis-

parately from the customary positioning, causing an imperfection along the movement of chest during breaths. Alarming breach of the respiratory physiology, it is a clinical emergency. The momentum of this kind of trunk injury overwhelmingly cascades from significant blunt clashes exerted on the defenseless structure of the chest wall. Failure of the chest hence underscores profound disruption of respiratory annexation.

## DIAGNOSTIC TOOLS USED IN RESPIRATORY SYSTEM<sup>17</sup>

1. A Chest Radiograph, called a chest X-ray (CXR), is a projection radiograph of the chest used to diagnose conditions affecting the chest, its contents and nearby structures.

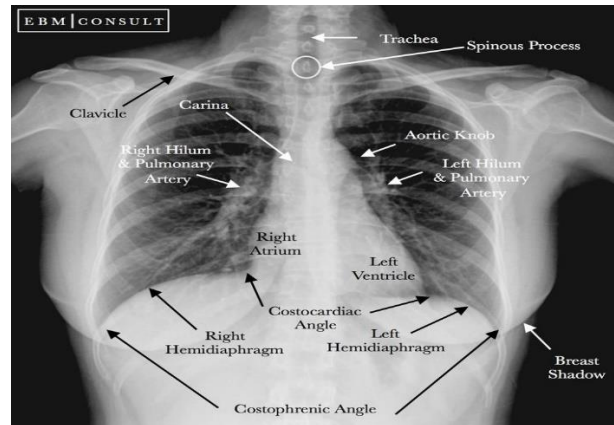


Fig-2. CHEST X-RAY<sup>18</sup>.

2. Computed Tomography or CT scan, which uses a series of computerized views taken from different angles to create detailed internal pictures of your body. A computer collects the pictures and puts them in sequence.

Compared with traditional X-rays, CT scans create two-dimensional, cross-sectional images that provide more information. Although the CT scan cannot give a definitive diagnosis, it is helpful in the evaluation of lung diseases and conditions such as pneumonia, cancer, blood clots or damage etc...

3. An Echocardiogram to look at your Heart's structure and determine how well your heart is functioning. This common procedure uses high frequency sound waves to produce images of the heart and helps to determine the problems. This procedure can also be called Diagnostic Cardiac Ultrasound.
4. A pulmonary function test encompasses various evaluations to assess lung functionality. Spirometry represents the elementary test, whereby lung

capacity is evaluated by measuring the volume of air the lungs are capable of holding.

5. Magnetic resonance imaging (MRI) of the thoracic cavity is conducted through the fascinating interaction between a forceful magnetic field, radio waves, and advanced computing technology which brings well-defined images of the anatomical features inside the chest into existence. It is predominantly utilized to investigate peculiarities detected on various previous screening tests, such as computed tomography (CT) scan of the chest.
6. Bronchoscopy constitutes a methodology implemented to examine the air ducts effectively by means of a petite camera located at the extremity of a flexible tube. This conduit also encompasses a narrow passageway that facilitates the extraction of lung tissue samples from the patient. Such samples subsequently undergo comprehensive analysis with the objective of detecting underlying respiratory pathologies.

## DISCUSSION

“Srotas” is a term in ayurveda used to define the channels or pathways that distribute bodily fluids, molecules of various types, food elements, etc., within individual’s bodies.

Yes, the natural oozing process of water is referred to as “Sroto ambu sarana”, which means water flows through channels. It signifies the flow of water through various channels, such as rivers, streams, and underground sources, which supply nourishment and sustenance to all living beings on earth.

According to ayurvedic principles, the health and well-being through which vital substances like blood, fluids circulate. The same principle can be applied to the natural channels of water in the environment, which are believed to be equally important for the survival and nourishment of all living beings. It can be stated that *MahaSrotas* as the trachea, its branches and their subsequent divisions into bronchioles and alveoli, all of which contribute to respiration- a process governed by the *Pranavaha Srotas*. *Rasavaha Dhamanis* refers to internal or tissues respiration, encompassing gaseous exchange between cells and their surrounding medium. In contrast, modern science characterizes the respiratory system as the operation of both external and internal respiration, both of which are governed by the *Pranavaha Srotas* in *ayurveda*.

A highly significant verse simplifying the complexity associated with *Prana* clearly states that *Prana* is the air used in respiration i.e., *Prana Vayu*. The channels which carry the *Prana Vayu* to be used for respiration are the *Pranavaha Srotas*. The *Pranavaha Srotas* is considered to be the respiratory system. The symptoms associated with the *Pranavaha Sroto Dusthi* also indicate involvement of respiratory system. So, it is clear that *Pranavaha Srotas* are the channels of oxygen transportation from nasal cavity to thoracic cavity.

Owing to immoderate indulgence in causative factors, *vataprakopa* occurs and combines with *udana-gata dusta pranavayu*; this results in the aggravation of *pranavata* and *udanavata*. Consequently, *vata* moves upwards and affects the channels of circula-

tion in the upper portion of the body. This leads to the manifestation of respiratory disorders.

Organized living beings have evolved specific secretory and transport channels known as “Srotas” in *ayurveda* and Systems in contemporary science that speedily and efficiently create, transport, and deliver (O<sub>2</sub>) elements essential for maintaining various aspects of physiology as well as to expels (CO<sub>2</sub>) waste products collected through these processes.

We must exercise great caution, specifically in cases where there is a disturbance in the flow of *Pranavaha Srotas* leading to signs of dysfunction.

It plays a key role in regulating and balancing the various physiological processes required for the ongoing survival of living organisms. The principal objective behind selecting this topic concerns the *Pranavaha Sroto Dusti Laxnas*, as suggested in an ancient period. However, in this modern era, diagnostic tools have been updated in the realm of scientific research. Hence when a symptom such as *atisrushtam* is referred to, it is imperative that we analyze it through diagnostic tools such as X-ray, to render theoretically suggested *srotodusti* into an evidence based medical science. This will subsequently aid medical scholars in their day-to-day clinical practice.

## CONCLUSION

- It can be inferred that all the bodily organs tissues and cells possess micro channels commonly designated as *Srotas*.
- *Srotas* facilitate smooth and coordinated interactions between *Doshas*, *Dhatu*s, and *Malas*.
- *Pranavaha Srotas* means the *Srotas* which transport special type of *vata* i.e *Pranavata*.
- The activity of *Pranavata*, situated in the brain, a nectar-like substance is consumed through the act of respiration. This substance in turn nourishes the whole body, *Jiva* (Blood) and *Jatharagni*.
- It is one of the most common infectious systems of the body.



- From a physiological perspective, *pranavaha Srotas* transport vital nutrients including *Rasa* and *Rakta* to remote areas of the body to aid in nourishment of tissues.

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