



## Review Article

### PATHOPHYSIOLOGY OF SHWASROGA W.S.R. DYSPNOEA

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#### ABSTRACT

Respiratory system is divided in two parts, as upper and the lower respiratory tract. The upper respiratory tract is consists the part like the nose, nasal cavity, nasopharynx, oral cavity, while the lower respiratory tract contains larynx, pharynx, trachea, lungs, and alveoli. Major functions of respiratory system are like conduction of the air, gaseous exchange, pulmonary circulation, excretion of the metabolic waste in the form of carbon dioxide. It directly correlates with *Pranavaha srotas* in Ayurveda. *Pranavaha Srotas* plays a vital role in maintaining the vitality of the body, not only due to movement of vital *Prana* in this *Srotas* but also as it is the major route through which the pathogens enters inside the body. Dyspnoea is the one of most important common clinical feature in respiratory disorders. It is a subjective awareness of the sensation of uncomfortable breathing. It may be of physiological, pathological or environmental origin. The pathophysiology of dyspnoea is strenuous and involves the activation of various pathways that lead to increased work of breathing, stimulus of the receptors of the upper or lower airway, lung parenchyma, or chest wall and excessive stimulation of the respiratory centre. In Ayurveda dyspnoea is directly correlates with *Shwaskruchchhta*. The pathophysiology, etiology and clinical presentation of dyspnoea are reviewed in this article. This definitely will help to have a comprehensive Ayurvedic view in modern medicine context and to get success in diagnosis and treatment of *Shwasaroga*.

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### INTRODUCTION

Respiration is vital sign of life. It is the process by which oxygen is taken in and carbon dioxide is given out.<sup>[1]</sup> Respiratory system is broadly divided in to two, as upper and the lower respiratory tract. The upper respiratory tract consists of the parts like the nose, nasal cavity, nasopharynx, oral cavity, while the lower respiratory tract contains larynx, laryngeal pharynx, trachea, lungs, and alveoli. Major functions of respiratory system are likes conduction of the air, gaseous exchange, pulmonary circulation, excretion of the metabolic waste in the form of carbon dioxide. It also helps to maintain intra thoracic and pleural pressure, pulmonary blood pressure, expansion and compliance of the lung, surfactant action. Airways possess total cross-sectional airway diameter much greater than that of the trachea.

Further the whole control of the respiration is through the respiratory centres present in occipital lobe of the cerebrum through, inspiratory, expiratory pneumotaxic, apneustic centers. The Respiratory system can be compared to *Pranavahasrotas* in Ayurveda. Dyspnoea is most important symptom of respiratory distress. Dyspnoea is defined as uncomfortable sensation of breathing. The respiratory stress, chemoreceptor and involuntary impulse originate in lungs, chest wall receptors and neuroventilatory dissociation may all contribute to the sensation of dyspnea. Its shortness of breath can be compared to *Shwasroga* or *Shwaskruchchhata* explained in Ayurveda. *Shwasvyadhi* are described as *Maha Shwas*, *Urdhava Shwas*, *Chinna Shwas*, *Kshudra Shwas* and *Tamakshwas* in Ayurveda.<sup>[2]</sup>

**AIM AND OBJECTIVE**

To understand pathophysiology of dyspnoea with Ayurvedic review.

**MATERIAL METHODS**

Review of literature regarding *Shwasroga* and dyspnoea is collected from *Brihatrayi*, *Laghutrayi*, literature of modern medicine and available commentaries on it and research articles are also searched from various websites.

**Definition of Dyspnoea**

Dyspnoea is the term generally applied to sensations experienced by individuals who complain of unpleasant or uncomfortable or disturb respiratory sensations. Many others definitions of dyspnoea have been offered in different texts, including: "difficult, laboured, uncomfortable breathing, awareness of respiratory distress, the sensation of feeling breathless or experiencing air hunger, and an uncomfortable sensation of breathing"<sup>[3]</sup>. These definitions have sometimes mixed the true symptom (what patient's say they are feeling) with physical signs (what the physician observes about the patient, e.g., "exhibits labored breathing"). In Ayurveda dyspnoea can be correlated with *Shwaskruchchhta* (Breathlessness).

"*Shwasitianenanaiti shwas swasitam vayu iti shwas*" According to *Vachaspatyam* the word *Shwas* is derived from the root '*Shwas*'*Dhatu*+*Ghanjpratyaya* and it implies for both *Vayuvyapara*. It represents both physiological as well as pathological respiration.

"*Shwasastubhaastrikaadhmanasamvatodhrvagamita*".<sup>[4]</sup> It is the prolonged expiration which is similar to the blowing of air from the *Bhastrika*.

When *Vayu* preceded by *Kapha* obstructs the passage and itself being obstructed moves here and there, it produces *Shwas*. The word *Shwas* is used for both physiological and pathological states. *Shwas roga* may be defined simply as a disease in which the respiration and exchange of gas is disturbed<sup>[5]</sup>.

**Shwaskriya**

"*Nabhisthprana*

*pawana*.....*samyogadamurchchte*"<sup>[6]</sup>

*Acharya Sharangdhara* has described in *Purvakhanda* the physiological process of normal breathing. The total process of normal breathing is transportation of oxygen to the tissues and the cells. *Acharya* narrated that this respiration starts from *Nabhi*, which may be considered as umbilical region and abdominal muscles helps for respiration. Diaphragm is also having an important role of respiratory process where the exact position takes

place. The upward and downward movement of diaphragm produces expiratory and inspiratory process of respiration where it touches to *Hritkamalantaram*. Inhaled air travels through trachea reaches to the lungs where gaseous exchange takes place. A certain amount of blood is continuously being pumped by the *Hridaya* into the *Phupphusa*. This blood absorbs the *Ambarapiyusha* (oxygen) from the air present inside and leaves off its *Kitta* CO<sub>2</sub>) which is exhaled out. The main process of *Shwasanakriya* involves the above mechanism.

**Pathophysiology of Dyspnoea**

According to modern point of view there are two phases of respiration. One is inspiration and second is expiration. In inspiration the air enter in the lungs from atmosphere and the expiration which the air leaves from the lungs. The classical reference for the two phase of respiration is given by *Arundatta* as below;

".....*Chla*

*Utsahochchhravasanihwasachestavegapravartan*"<sup>[7]</sup>

"*Uchchhawasudhrvashwansanmshwasamukti*

*/Nishwasshwasayasharirantpraveshanam*"<sup>[8]</sup>

Hence, *Uchchhawasa* is inspiration and *Nishwasa* is expiration. This whole process of function depends mainly by *Pranavayu* for *Nishwasha* and *Udanavayu* for *Uchchhawasa*. *Shwashankriya* (respiration) is the process which takes place from the time of birth up till death last second. Dyspnoea is a complex symptom that occurs from physiological impairment and signals one to the possibility of threatened homeostasis. The discomfort primarily occurs as a result of either cardiovascular or respiratory system compromise, but may also be attributed to metabolic derangements, neuromuscular disorders or psychogenic conditions. The condition is perceived as increased respiratory effort, chest tightness, or air hunger, which are caused by pulmonary ventilation not matching the drive to breath<sup>[9]</sup>. The dissociation between pulmonary ventilation and respiratory drive arises from a mismatch between afferent receptors in the airways, lungs and chest wall structures, and central respiratory motor activity. Physiological pathways lead to difficult shortness of breath via specific acid- sensing ion channels, mechanoreceptors and lung receptors located in different zones of the respiratory apparatus. Chemoreceptors in the carotid bodies and medulla supply information with regard to the blood gas levels of O<sub>2</sub>, CO<sub>2</sub> and H<sup>+</sup>. In the lungs, juxta capillary receptors are sensitive to pulmonary interstitial edema, while stretch receptors signal

broncho constriction. Weakness or mechanical inefficiency of respiratory muscles results in a mismatch between central respiratory motor output and achieved ventilation. This mismatch may clarify the dyspnoea by patients with neuromuscular disease affecting the respiratory musculature and patients with respiratory muscle fatigue. As the pressure generating capacity of the respiratory muscle fall and as the ratio of the pressures produced by the respiratory muscle to the maximum pressure that can be achieved increases, dyspnoea progressively worsens, the most important being the diaphragm<sup>[10]</sup>. Three main elements contribute to dyspnoea afferent signals, efferent signals, and central information processing. The central actions in the brain balance the afferent and efferent signals and dyspnoea results when a mismatch occurs between the two, such as when the need for ventilation (afferent signal) is not being met by physical breathing (efferent signal). The afferent receptors allow the brain to assess whether the efferent or motor commands to the ventilatory muscles are effective, meeting the required demands of airway pressure, air flow and lung movement. When these react inappropriately to the exact, the potency of the dyspnoea increases. The sensory cortex is simultaneously started when motor signals are sent to the chest wall, resulting in the sensitive sensation of muscular effort and breathlessness. There is also a strong psychological component to dyspnoea, as some people may become aware of their breathing in such circumstances but not experience the distress typical of the condition.

### Applied Aspect of These Two Phases

For the auscultation of lungs in clinical aspect of modern science, it divides respiration in two phase inspiration and expiration; there is small pause between them. Both phases are further divided into alveolar phase and bronchial phase. The alveolar phase is one when air is in alveoli of lungs and bronchial phase is one when air enters into the bronchus of the lungs. The pathological adventitious sound (crepitation, wheezing sound, pleural rub etc.) are also vary according to quality of sound during these two phases which is described as *Ghurghurakumdwani* under the description of *Tamakshwasha*. In the context with the diagnostic aspect for clinician the normal physiology of two phases are important to keep in mind for diagnosis of this.

*"Tatrapranavahanasrotasam.....PradusthanitiVighata"*<sup>[11]</sup>

*"Atisrushtamuchchhavasantam"*. It means give up easily, if depth of respiration is increased, it may be termed as hyperpnoea or hyperventilation.

*"Atibadhdamkupitamalpamuchchhvasantam"* Means gross reduction in vital capacity of lungs; it means depth of respiration is decrease. If the depth of respiration is decreased, it is termed as "Shortness of breath" or "Swallow breathing" or "Breath stays halfway in the throat" or "Breath cannot perform naturally, all expression of breathing correlate with *Atibaddhucchavasati*. If the respiratory rate is also less in number than normal it is termed as *Alpaalpam*.

*"Alpalpamabhikshanamuchchhavasantam"* means if the respiratory rate is increased and decreased, it may be termed as tachypnea, *Abhiksyamuchchavasantam*.

*"Sashabdashoolamuchchhavasantam"*. If the respiration is along with some adventitious sound of lungs like rhonchi, crepitation, pleural rub, some clearly heard wheeze with unaided ears and laryngeal strider it means *Shashabdamuchchavasati* and if the respiration is painful in case of pleurisy, it means *Shasulamuchchavasati*.

*"Atisrushtamatibadhdamkupitamalpambhikshamuchchhavasantam"* means Chynes-Stoke respiration, gradually increase and decrease, in the rate and amplitude of respiration, it is commonly seen in LVF (left ventricular failure), CVA (cerebrovascular attack) and uremia.

Kussmaul's respiration, deep and rapid breathing or air hunger due to acidosis, this is generally seen in diabetic ketoacidosis, renal failure due to acidosis, alcoholism and starvation. Biot's respiration irregularly irregular pattern of breathing, this is commonly seen in *Majjagatjwara* (meningitis). Paradoxical breathing, multiple fracture of the ribs or sternum can result in flail chest with paradoxical breathing, the unsupported chest wall being drawn in due to the negative intra thoracic pressure. Abnormally abdominal minimal thoracic type of breathing is seen in pleurisy and collapse of the lungs. Abnormally purely thoracic type of breathing is seen in peritonitis, ascites (severe) and diaphragmatic paralysis. Spirometry is the technique which measures inspiratory and expiratory volume of ventilated air in lungs. It is one type of lung function test, which is done during normal breathing at rest and during exercise to diagnose different lungs disease. It measures FVC (Vital Capacity- The maximum flow rate during expiration, normal), FEV1 (Forced Expiratory Volume, 75-80% of VC is normal).

**DISCUSSION**

As we seen the abnormal breathing patterns of respiration has various pathological causes and it is seen in various emergency conditions. Dyspnoea is a complex symptom and sensation of difficult or laboured breathing or breathlessness that accompanies cardio-respiratory disease and may have different pathophysiologic base. The predominant mechanisms comprise corollary discharge of respiratory motor activity and evaluation from chemoreceptor and mechano-receptor in the lung and chest wall. Types of *Shwasvyadhi* can be correlated with abnormal breathing patterns. These are useful for treatment and diagnostic purpose also and can be treated as per conditions.

**CONCLUSION**

The assessment of dyspnoea is an interpretative part of patient evaluation and management when cardiopulmonary disease is present. Hence understanding the physiological and pathological state of the same under the purview of contemporary medical sciences helps for the better clinical diagnosis.

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