



## PHYSIOLOGICAL ASPECTS OF RESPIRATORY SYSTEM IN ANCIENT INDIAN MEDICINE (AYURVEDA): A REVIEW

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### ABSTRACT

Respiration is vital function of body. Clear explanation about physiology of respiration available recently in the beginning of accurate knowledge concerning the physiology of breathing dates back to the 16<sup>th</sup> century but the physiology available in sharanghadhara samhita written by acharya sharanghadhara & Acharya Adamalla commentator of sharanghadhara samhita. "Brahmaarandramarohatyavarohati" This means sensory & motor nerve impulse movement from respiration centre to lungs for process of inspiration and expiration "shabdaocharananiswasochwaskaasadikaranam" these two stages cause pronunciation of words and cough, hiccup etc diseases. It may be compared to Ventilation stage which involves two sub stages a) inspiration & b) expiration. "Nabhistaha pranapavanaha spustwaa hritkamalanaram" it says that deoxygenated blood collected in inferior venacava at nabhi region enters in to heart through pulmonary vein it circulated to lungs where gaseous exchange takes place this oxygenated blood then circulates to whole body. According to Ayurvedic scholars agni is necessary for life and pranavata is not only necessary to maintain the agni it provides shakti, arogya, swasthya, bala, utsaha, upachaya, prabha etc Once agni vanished means death thus it means presence of pranavata is life & its absence is death. This may correlated with Cellular respiration stage of respiration.

**Key words:** Ventilation, Gaseous exchange, cellular respiration, Hritkamala, Brahmaarandra, Nabhi

### INTRODUCTION

दोषधातुमलमूलं हि शरीरम् Human body constituted by the three doshas saptadhatu and trimalas<sup>1</sup> सर्वा हि चेष्टा वतेन स प्रणः प्रणिनां स्मृतः तेनैव रोगा जयन्ते तेन चैवोपरुद्यत Among these vata is responsible for all kind of biological activities are carried out in the human body.<sup>2</sup>

वत्पित्तश्लेष्मणं पुनः सर्वशरीरचरणं सर्वस्रोतास्ययनभुतानीति tridoshas will move through all channels (srotas) of the body.<sup>3</sup> According to sharanghadhara पित्तं पंगु कफः पंगु पंगवो मलधातवः वायुना यत्र नीयन्ते तत्र गच्छन्ति मेघवत् Vata among the three is only dosha having quality of gati i.e. capacity to move from one place to another. The movement of other two doshas is also with the help of vata dosha.<sup>4</sup> According to charaka उत्साहोच्छ्वासनिःश्वासचेष्टा धातुगतिः समा समो मोक्षो गतिमतां वायोः कर्मविकारजम् the respiratory movements like inhalation, exhalation are due to vata.<sup>5</sup> Same explanation found in Vagbhata too उत्साहोच्छ्वासनिःश्वास चेष्टावेगप्रवर्तनैः सम्यग्गत्या च धातुनामरक्षाणां पटवेन च अनुग्रहिण्यविकृतः<sup>6</sup> while explaining functions of vata.

स्थानं प्रणस्य शिर्षोरः (मूर्धोरः) कर्णजिह्वास्यनसिकाः शीवनं क्ष्वथूद्वारादि कर्म च<sup>7</sup> & वयुर्हि वक्त्रसंचारि स प्रणो नाम देहधृक् सोत्रं प्रवेशयत्यन्तः प्रणश्चाप्यवलम्बत<sup>8</sup> Uchwsa & Niswsa i.e. inhalation & exhalation are the functions of respiration carried out by pranavata (pranavayu). pranavata is one among the five sub

divisions of vata which does different physiological functions of the body.

Cells need a continuous supply of oxygen to carry out the activities that are vital to their survival. Many of these activities release quantities of carbon dioxide since an excessive amount of carbon dioxide produces acid conditions that are poisonous to cell, the gas must be eliminated quickly & efficiently the two systems that supply oxygen and eliminate carbon dioxide are the cardiovascular system & respiratory system.

Oxygen in the air moves from the lungs through blood vessels to the heart, which pumps the oxygen-rich blood to all parts of the body. Oxygen then moves from the bloodstream into cells & exchange of gas between blood & cells takes place is also known as internal respiration. In the cells, the process by which organisms convert food into chemical energy, requires oxygen Scientifically one can define it as the oxidative process occurring within living cells by which the chemical energy of organic molecules is released in a series of metabolic steps involving the consumption of oxygen and the liberation of carbon dioxide and water ( $6C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 36ATP$ ) oxygen is used in a separate energy-producing process called cellular respiration, which produces carbon dioxide as a by product The bloodstream carries carbon dioxide to the heart, which pumps the carbon dioxide-laden blood to the lungs. In the lungs, breathing out, or exhalation, removes carbon dioxide from the body, thus completing the respiration cycle.

## Review of literature

स्थानं प्रणस्य शिर्षोरः (मूर्धोरः) कर्णजिह्वास्यनसिकाः शीवनं क्षवथूद्वारादि कर्म च <sup>7</sup> Acharya Charaka has described that inhalation & exhalation are the function of vata dosha. While explaining pranavaha srotas clear hridaya & mahasrotas are considered as sroto moola but clear explanation of respiration physiology is not available. Same kind of description also said by vagbhata in astanga hridaya. प्राणोत्र मूर्धगः उरः कंटचरो बुद्धिहृदयेन्द्रियचित्तधुक् शीवनं क्षवथूद्वारादिः श्वासान्नप्रवेशकृत <sup>9</sup> he has classified vata in to five sub types among five Prana vata is mainly responsible for the respiration process.

Its Acharya Sharangdhara who has given clear description about physiology of respiration. His commentator adamalla & others elaborated it much more clearly. नभिस्तः प्रणपवनः स्पष्ट्वा हृत्कमलन्तरम् कण्ठाद्वहिर्विनिर्यति पातुं विष्णुपदमृतम् पीत्वा चम्बरपीयुषं पुनरयति वेगतः प्रीणयन्देहमखिलं जीवं च जठरानलम् <sup>10</sup> Vayu from nabhi region comes to hridaya through kantha marga it expelled out from the body to take Vishnupadamrita (oxygen). i.e. deoxygenated blood collected in inferior venacava at nabhi region enters in to heart through pulmonary vein it circulated to lungs where gaseous exchange takes place carbon dioxide gas is expelled out and oxygen is inhaled in to lungs through kantha i.e. respiratory track. Meanwhile Ambara peeyusha i.e. oxygen inhaled in to body with fast inspiratory movement enters in to the body & nourishes the whole body.

The study of human physiology dates back to at least 420 B.C. and the time of Hippocrates, the father of medicine.<sup>11</sup> Physiology was first recognized in the early 1960s. The critical thinking of Aristotle and his emphasis on the relationship between structure and function marked the beginning of physiology in Ancient Greece, while Claudius Galenus (c. 126-199 A.D.), known as Galen, was the first to use experiments to probe the function of the body. Galen was the founder of experimental physiology.<sup>12</sup> The medical world moved on from Galenism only with the appearance of Andreas Vesalius and William Harvey.<sup>13</sup>

During the Middle Ages, the ancient Greek and Indian medical traditions were further developed by Muslim physicians. Notable work in this period was done by Avicenna (980-1037), author of the Canon of Medicine and Ibn al-Nafis (1213-1288) among others.

16<sup>th</sup> century onwards clear idea of the mechanics of respiration was give by Borelli. He has considered respiration much more essential to life. He has recognized that air was taken into the circulation but being a physicist, insisted that the interaction was not chemical but a physical entrance of particles of air into the blood stream. In 1660 Robert Boyle showed that air is essential to life. Later on Robert Hooke showed that after the thorax of a dog had been widely opened, life could be prolonged indefinitely by artificial respiration. This proved that the respiration takes place in the lungs, the movements of the chest are of only value in so far as they mechanically, by alternately collapsing and expanding the lungs, bring air to them. Experiments of Hooke's with the artificial respiration, Richard Lower upset the old ideas that the change in color of the blood took place in the heart rather than in the lungs. He has noticed that the blood as it entered the lungs was dark in color, where as when it leaves lungs it became bright red, so long as artificial respiration was kept up. When this was stopped, the blood pulmonary veins and left heart became dark and venous. Up to

this time, no one apparently, thought of anything except the whole air as concerned in breathing.

Swedish pharmacist Carl Wilhelm Scheele was first discovered Oxygen. He had produced oxygen gas by heating mercuric oxide and various nitrates by the year about 1672. He discovered that heating this compound produced a gas which makes a candle to burn more brightly and a mouse to live four times as long compared to the normal atmosphere. Thus invented gas was oxygen. It was Lagrange presented the idea that oxidation takes place in all parts of the body to which blood circulates, excepting that he thought it occurred in the blood itself, and not in the tissues, as we know today, and which Apallanzalli demonstrated. In spite of that, however, Lavoisier's ideas held away <sup>14-16</sup>

Thus we see that the development of the physiology of respiration from Borelli to Wagnus was almost exclusively the work of three mathematicians, two physicists, and five chemists.

## DISCUSSION

ब्रह्मरन्ध्रमरोहयवरोहति <sup>17</sup> upward and downward movements from brahmarandra through tantuja cause respiration process. This commentary part of Adamalla we can co related with sensory & motor nerve impulse movement from respiration centre of medulla oblongata to lungs for process of inspiration and expiration through nerve plexus.

जीवः प्रणसमारुहो रन्जकः स्पटिको यठ इति <sup>17</sup> jeeva is within the prana and it is similar to ranjaka & spatikabha. Here adamalla meaning of jeeva. During respiration process dark red coloured blood concerted in to bright red coloured thus we can say that oxygen which is responsible for bright red colour of blood, essential for life, needed for cellular oxidation, metabolic activities & on which life depends considered to be jeeva

तस्य कारणत्वं तन्त्रन्तरेपि कथितम् यथा तेषामुष्णतमः प्रणो नभिकन्दादधःस्थितः <sup>17</sup> Reason for gaseous exchange is deoxygenated bold drained in inferior venacava at umbilical region which is hot compared to oxygenated blood 1. Increased % of CO<sub>2</sub> & 2. Ph of blood is acidic.

शब्दोच्चारणनिश्वासोच्छवासकसदि करणम् <sup>17</sup> Respiration process also responsible for pronunciation of words inhalation exhalation etc.

Respiration also provides humans for expressing emotions such as laughing, yawning singing more over respiratory air can be used to expel foreign matters from the upper passage through the action such as sneezing coughing <sup>18</sup>

पुनरिति तेनैव पथा वेगतस्तत्क्षणादेव आयति स्वस्थान इति <sup>17</sup> drinking Aambara peeyusha it will enters in to the body with much faster rate in which it is expelled out. It means the duration of exhalation is longer compare to inhalation. Same kind of explanation seen in modern science.

The function of medullary rhythm city area to control the basic rhythm of respiration in normal resting state expiration usually last about 3 sec & inspiration for about 2 sec. <sup>19</sup>

अखिलमिति शिखादिचरणपर्यन्तं न केवलं देहं पुष्णति अपि तु जीवं जठरानलं च <sup>17</sup> means inhaled air nourishes whole body from head to foot i.e. the circulation of oxygenated blood to each & every

part of the body supplies oxygen which is necessary for metabolic activity to produce energy survival of life.

जठरानलः पाचकग्निः तस्य पाचकदिशक्तिं करोतीत्यभिप्रायः & आयुर्वेदो बलं स्वस्तमुत्साहो उपचयप्रभः ओजस्तेजो अग्नयः प्रनश्चोक्ता देहे अग्निहेतुकाः शक्ते अग्नौ म्रियते युक्ते चिरंजीवत्यनामयः<sup>17</sup> according to ayurvedic scholars agni is necessary for life and pranaila is not only necessary to maintain the agni it provides shakti to it and arogya, swastya bala, utsaha, upachaya, prabha etc depend on agni once agni vanished means death thus it means presence of pranaila is life & its absence is death. So this may correlated with Cellular respiration stage of respiration. Metabolic activity in cell is sign of it's livens but this metabolic activity is because of oxygen by which energy is produced and that energy is utilised for different functions. Absence of metabolic functions in body is indirect mean of death

नभिस्त इति कारणत् नभौ स्थितः सकल शरीरव्यपकत्वत् एतेन नाभ्याव्रतशिरस्वपि स्थित इति भवः<sup>17</sup> According to Shushruta nabhi is considered as sira moola and they spread in all directions from nabhi. Maximum quantity of deoxygenated blood from the whole body drained to the inferior venacava through "nabhyvrat shira" drained in to heart. As the physical shape of heart is similar to bud of lotus flower called as hridayakamala. By the pulmonary circulation blood is circulated to lungs where the gaseous exchange takes place i.e. haemoglobin leaves carbon dioxide & oxygen is taken to form oxyhaemoglobin.

Like this Acharya sharanghadhara explained respiration physiology in short for better understand but commentator adhamalla has wrote detail commentary on this by explaining whole process of respiration.

## CONCLUSION

Respiration is much more than just breathing in fact, respiration is one of the cardinal sign in living being. Over all exchange of gas between atmospheres, the blood and the cells is respiration. In Ayurvedic classical literature too the similar physiology of respiration process is available. Charaka, vagbhata, shushruta acharyas have mentioned the inhalation & exhalation process are the functions of vata.

Inhalation and exhalation stages of Ventilation, Gaseous exchange between inspired air and the blood in the pulmonary circulation & cellular respiration all these three stages of respiration. While explaining Prana vata which is sub type of vata, it's clearly mentioned that respiration is function of it & physiology which has been explained is similar to that of modern science hence it can be said that the physiology of respiration was well known to ancient Ayurvedic acharyas. This concept might be considered for better understanding & research.

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