A review on role of *Rakt dhatu* functions with special reference to Tissue Level Respiration.

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Abstract:

Internal respiration is gas exchange occurs between the blood and the tissue of the body. With the help of cardiovascular system the inhaled O2 rich blood is transported to the tissues of body. So blood is important & common mediator to nourishment of all dhatus through respiratory & cardiovascular System. The exchange of gases at tissue level is called as peripheral gas Exchange. It is also Known as internal respiration, as it involves the respiratory Procedure. The adjustments to increased metabolic rate or to hypoxia are achieved by increasing conductances[1]. So these adjustments consists both increased and decreased local blood flow and in improvement of diffusion conditions i.e. enlargements and recruitment of capillaries. So blood is transport medium of gases exchange at tissue level.

The exact phenomenon of this exchange model stated in Ayurveda in the form of *Raktdhatu* and its functions as '*Prano Shonitam Anuvartate*' i.e. *Prana Vayu* follws *Raktadhatu* to nourish tissues of whole body[2]. Here attempt has been made to review *rakt dhatu* functions with special reference to tissue level Respiration.

Introduction:

The respiratory system does not work alone in transporting oxygen through the body. The respiratory system works directly with the circulatory system to provide oxygen to the body. Oxygen taken in from the respiratory system moves into blood vessels that then circulate oxygen-rich blood to tissues and cells.[3]

Raktadhatu is most vital organ out of ten vital points hence utmost care should be taken of *Raktadhatu*[4]. Body cannot survive without *Prana* & *Raktadhatu* is a medium for the conduction of *Prana* hence life depends on *Raktadhatu*. All the Ayurvedic treatises realize the importance of *Raktadhatu*.

Susruta considered the *Raktadhatu* as fourth body humors[5]. Sushruta tried to emphasize control of *Raktadhatu* on the other body entities. Susruta also mentioned that *Raktadhatu* is responsible for nourishment of all remaining Dhatu[6] (tissue) & their status of waning or increment also depend on it. As body humours, Tridosha are responsible for creation of living body & maintain the homeostasis of the body in same fashion *Raktadhatu* (Blood) also takes part in origin, sustaining & maintaining homeostasis of the body therefore *Rakta* is extremely important for the sustenance of life. It is therefore needed to protect this Dhatu (tissue) by every possible measure

Aim:

A review on role of *Raktadhatu* functions with special reference to tissue level respiration.

Objectives:

1. Review on physiological properties of *rakta dhatu*.
2. Review on tissue level respiration with physiological aspects of *Rakt dhat*u.

Methodology:

Physiological properties of *Raktdhatu*:

Raktadhatu in pure or wholesome status looks like heated gold which turns red after putting in fire; insect *Indragopa* red lotus or like Abrus Precatorius i.e.*Gunja*[7]. These various shades depend upon individuals Sushruta also described characteristics of pure *Raktadhatu* are of proper density & do not bear any other color than meant of pure blood *Raktadhatu* is neither very cool nor very warm. It is sweet; unctuous, red in color, heavy, smells typically[8]. Other properties of *raktadhatu* are it reacts to items which affect the *pitta*, Cheerful complexion is symptom of *Visuddha Raktadhatu* in individual. It maintains the normal color of the skin.

***Pran Vayu*:**

The *Vata* from nature and the *Vata* from body are not visible or *Pratyakshagamya*. They are identified by their works. The *Prana Vayu* plays a vital role in the process of respiration. Sites of Prana Vayu Head & chest are two main sites[9]. Head, throat, mouth, tongue, nose, heart, mind & intelligence are also included in sites of *Pranavayu*. *Pranas* of the living beings stay in umbilicus & umbilicus is dependent on *Pranas*. Umbilicus is surrounded by *Siras* in the same way as the nave of the wheel is surrounded by spoks[10]. It indicates that *Siras* are the basic seat of *Pranas* i.e. *Pranas*

depends on *siras*, because through this *Siras* from heart the *Prana* is circulated to whole parts of the body and here the work *Prana* is done.

Functions of *Prana Vayu*[11]:

Movement, carrying sensation upwards, filling with food (ingestion), segregation and upholding characterized by these and divided into five accordingly *Vayu* sustains the body. Equilibrium, decrease and increase of *doshas, dhatus, malas* etc. should be known by their natural characters and functions, hence in the content of equilibrium both these character should be taken into consideration.

Praspandanam: movements of the body, this is the function of *Vyana*.

Udvahanam: carrying sensation upwards, this is the function of *Udana*.

Puranam: filling of stomach with food, this is the function of *Prana*;

Vivekah: Segregation of essence (*Rasa*) and excrement (urine and feces) this is the function of *Samanavayu*;

Dharanam: upholding semen, urine etc. and during urge pushing them out, this is the function of *Apanavayu*;

Thus *Vayu* is divided into five types : *Prana, Udana, Samana Vyana, Apana*.

Agni is flamed and preserved in all ways by three types of *Vayu - Prana, Apana, Samana*, staying in their respective positions. To perceive the sensation and to decide which functions of sensory and motor organs are, Inspiration and deglutition are most important functions of *Prana*. Pure air and food (external *Prana*) are taken in the direction and *Prana* activity is from nature to body (external to internal). If these inwards movements get obstructed problems like asthma begins. Spitting, sneezing and belching are comparatively less important functions.

***Pranavaha Strotas*:**

The *Pranavayu* is circulated through *Pranavaha Srotas* and along with the important needed *Pranashakti* is also provided by *Pranavaha Srotas*. Among the internal opening *Srotas* the first description is of *Pranavaha Srotas*. The physiological importance of *Pranavaha Srotas* is much higher than other *Srotas* so it is described first. *Prana* is very important for living body and this *Prana* is carried by *Pranavaha Srotas*.

***Mulasthana* [12]:**

There has been diverse of opinion, even among the authentic texts of *Charak* & *Susruta Samhita*. Based on the description of the texts, the commentators express their own views in their own line of

thinking. According to *Charak*, the *Hrdaya* & the *Mahasrotas* are at the *Mula* (Root) of "*Pranavaha Srotas*".

Respiration:

Mechanism of Respiration The clear physiology of respiration is available in different Ayurvedic and Sanskrit literature. In *Yajurveda*, it is mentioned that air (vata) in the form of *Prana* and *Apana* enters in the *nasika*. ("*Vatam pranena apanenasike*": YAJ 15/12). It shows that *Prana* & *Apana* are the words used to indicate inspiration & expiration. *Shwasa Kriya* or Respiration is the process which involves two phases as *Nishwasa* (Inspiration) & *Uchawasa* (Expiration) going on alternatively. The *Prana Vayu* which enters through the nasal passages, along the course of *Swasanalika* (Trachea, Bronchi) & fills up the *kostha* (alveoli) Thereby it is allowed for a short period & is forced out through the same *Srotas*. This whole process depends mainly on *Prana Vay*u for *Nishwasa* & *Udana Vayu* for *Uchawasa* From *nasa* to the *Vayu koshas* there is interior *sleshmika kala* (mucous memberane) is lined & which secretes a small amount of *Kapha* always. This *Kapha* Known as *Awalambaka Kapha* helps the part by keeping *Aardra* (moist) & also conferring *Bala* (strength). It helps to hold any foreign matter coming along with the air.

Hemoglobin[13]:

Hemoglobin is iron matter of RBC. The function of hemoglobin is to carry respiratory gases, oxygen and carbon dioxide. The main function of hemoglobin is transport of respiratory gases:

i. Oxygen from the lungs to tissues
ii. Carbon dioxide from tissues to lungs.

It is a conjugated protein. It consists of a protein combined with an iron containing pigment. Iron is an essential mineral and an important component of protein involved in oxygen transport. Human body needs iron for oxygen transport.

Tissue respiration-Ayurved concept:

Acharya Sharangdhar[14] has described in *Purvakhanda* the physiological process of normal breathing as the total process of normal breathing to far transportation of organ to the tissue & the cells. He stands with the view that it is the *Prana Vayu* situated at *Nabhi Pradesha* (center of the body) comes out of the neck, touching the lotus like heart & after getting saturated with *Vishnu Padamrata* (O2) from atmospheric air again enters back forcefully[15] This respiration starts from nabhi, which may be considered as umbilical region i.e abdominal muscles helps for respiration. Diaphragm is also having an important role of respiratory process. The upward & downward movement of diaphragm produces expiratory & inspiratory process of respiration where it touches to *Hrut kamalantaram*. Inhaled air travels through trachea reaches to

the lungs where gaseous exchange takes place. A certain amount of blood is continuously being pumped out by *hrdaya* (heart) & *Phupphusa* (Lungs). This blood absorbs the *ambarpiyush* (O2) from the air present inside & leaves off its waste CO2 which is exhaled out. Supporting *Acharya Sharangdhar* view the term "*Pranvahadve*" Prof. Ghanekar says that both the lungs situated on either side in the thorax, should be regarded. In this view the term "*Mulam Hrdayam*" signifies the pulmonary arteries originating from the heart & transverse towards the lungs. He also accounts the bronchioles branching out from both the bronchi. Thus the deoxygenated blood, brought by pulmonary arteries gets spread over the surface of the lungs & after getting oxygenated with the "*Pranavayu*" carried in by bronchioles the blood goes back into the heart through the pulmonary veins. This description concludes that the take up & carry of the "*Pranavayu*" are mainly conducted by lungs & its accessory channels.

PEFR [16]:

Peak expiratory flow rate is the maximum rate at which air can be expired after deep inspiration. It is useful for assessing the respiratory diseases especially to differentiate the obstructive & restrictive diseases**.**

Discussion:

Pranavaha Srotas is obviously the transport system of *Prana* which has been narrated as vital air inhaled & also be the vital energy of the body responsible for each & every activity of living being. Therefore the concept of *Pranavaha Srotas* also is understood in the light of these facts. Among the five types of *Vayu*, there is one named "*Prana*" which is commonly used & appear to be appropriate. This *Prana Vayu* signifies the atmospheric air which is essential for respiration & vitality of life & *udan vayu* for expiration process. The organs described in *Pranavaha Srotas* according to Gangadhar Tikka are *Hridaya* & *Vaksha*. (*Phusphusa* i.e. lungs). Chakrapani says the passage through which "*Vayu*" in terms of "*Pra- navaha*" passes through the body is known as *Pranavaha Srotas*. *Pransadnyakvat* means inspiration of *Prana Vayu* & Expiration of *Udan Vayu* which are the functions of *Pranavaha Srotas*. *Pranavayu* is circulated through the body by *Hridaya* with the help of *Vyan Vayu*. *Sadhak Pitta* which is in the heart (*hridaya*) with the help of *Vyan Vayu Avalambaka Kapha* is secreted by micro respiratory tubules & alveoli (Vayu Kostha) in Phuphusa. Avalambaka Kapha is present between *Hridayavaran* (Pericardium) & *Phuphusavaran* (pleural cavity). *Avalambaka kapha* helps in the functions of *Hridaya* & *Phuphusa*. *Sleshaka Kapha* present in *Pranavaha Srota*s helps in the *sandhan* of all the *peshis.* According to Susruta, there are two Pranavaha Srotasas originating from *Hrdaya* (heart) & *Rasavahinis dhamanis* (Arteries carrying nutritional fluid). In connection with *Rasavahinis dhamanis*, there is difference of text, where we find *Pranavahi Dhamanis* in its place[17].

Regulation of Respiration The basic control of breathing is governed by the activities of neurons of medulla & pons. The respiratory centers in the Medulla & Pons are sensitive to both excitatory & inhibitory stimuli. According to Charaka Samhita the increased & decreases number of *Swasana* (respiration) is found in the internal covering (avarana) of *Vayu Dosa*. Thus the *Prana Vayu* seated at murdha (brain) controls the *swasana karma* in life. In fact the *swasana* is a well-known carrier of *Prana Vayu* (*Nabhistha prana pawanah*) which is the key point of life & without the proper supply of air the O2 cannot be absorbed by the blood. So concluding above discussion points, *rakt dhatu* along with *strotas* itself i.e. *Raktvaha Strot*as and *Pranavaha strotas* plays important role in tissue respiration process.

Conclusion:

The exact phenomenon of this exchange model stated in Ayurveda in the form of *Raktdhatu* and its functions as '*Prano Shonitam Anuvartate*' i.e. *Prana Vayu follws Raktadhatu* to nourish tissues of whole body. So functioning of respiratory system that maintains and effects external & internal environment of body through *Rakt dhatu* through Tissue Respiration Process.

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