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AN UNDERSTANDING OF *RASA-RAKTA SAMVAHANA PRAKRIYA* AS A CIRCULATION

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Abstract:

Ayurveda is branch of science which deals with Sapta Dhatus (Tissues) that establish the body's core, offering nourishment, development, and physical stability. These Sapta Dhatus signifies seven foundational elements that deliver support and resilience. They consist of Rasa (Plasma), Rakta (Blood), Mamsa (Muscle), Meda (Fat tissue), Asthi (Bones), Majja (Bone marrow), and Shukra (Reproductive tissue). Rasa-Rakta-Samvahana pertains to the vital functions of circulation that involve bodily fluids (Rasa) and blood (Rakta), which are essential for preserving health and warding off illnesses. This review study aims to enhance the understanding of the concept of human circulation, comparing both modern and Ayurvedic perspectives.

Keywords:

Blood, Circulation, *Hridaya, Rasa, Rakta, Samvahana.*

Introduction:

Rasa (nutrient food or plasma) and *Rakta* (blood tissue) serve to provide *Preenana* (nourishment) and *Jivana* (life through oxygenation), and they are perpetually circulated throughout the body. Each *Dhatu* is associated with a corresponding *Updhatus* (sub-component) that enhances and supports the body. While *Updhatus* play a role in bolstering the body's strength, they do not nourish the tissues in the same manner as the *Dhatus.* In the order of origin, nourishment, and development of the *Dhatus,* the essence of *Ahara rasa* (food) leads to the creation of *rasa dhatu* (plasma). From the nourishing aspect of *rasa dhatu*, the essence of *rasa* is produced, which aids in the nourishment of *Rakta dhatu* (blood). The *Sharira* is fundamentally made up of *Dosha*, *Dhatu*, and *Mala*. Beyond these components, there exist numerous structures that hold great importance both anatomically and physiologically for the sustenance of life. *Rasa-Rakta Samvahana* denotes the well-regulated circulation of *Rasa* and *Rakta.*

Concept of *Rasa- Rakta Samvahana Prakirya*:

Rasa and *Rakta* are circulated together and *Jeevana* means life. Life is dependent on *Rakta Dhatu*. How *Rakta Dhatu* is supplied to each and every cell is understood by the process of *Rasa-Rakta Samvahana.*[2]

Important factors for *Rasa-Rakta Samvahana*:

***Hridaya*: (Heart)**

In *Sushruta Samhita*, *Sharira Sthana*, has mentioned that *hridaya* is located in between breasts and the door of *amashaya*.[3] The term ***Hridaya*** is derived from ***'Hri'*** (to draw back - the impure blood) **+** ***'da'*** (to provide – the pure blood) **+** ***'ya'*** (to regulate – the process of giving and taking). Thus, the term *hridaya* itself symbolizes the circulation process.[4] The *Hridaya* is a site of *Chetana*. This is obvious, because tissue or cells can survive only after proper blood circulation. Oxygen also supplies to cells through blood only.

Effect on Cardiac pathology: Slight abnormality in the heart function can cause fainting attack but major problem can fatal. [5]

Relation of *Hridaya* & *Dosha-Dhatu-Mala:*

- ✓ ***Hridaya* & *Udana Vayu*-** Expiration, to expel gaseous waste is a function of *Udana Vayu*.
- ✓ ***Hridaya* & *Vyana Vayu*-** Site of *Vyana Vayu* is *Hridaya*. Electric activity is under *Vyana*. Cardiac Cycle is maintained by *Vyana Vayu*.

- ✓ ***Hridaya & Avalambaka Kapha-*** The heart functions continuously from birth to death. It's responsible for protection & nutrition of cardiac muscles.
- ✓ ***Hridaya & Ojas –*** *Ojas* is essence from all the body tissue which stays in heart.

Rasa Dhatu:

Rasa dhatu is the first *dhatu* in the body that gets its nourishment from the *Ahara Rasa. Ahara rasa* is the nutrients of food after digestion. *Rasa dhatu* (Plasma) is generated in the body within 24 hours. *Jala* (Water) *Mahabhuta* is present in *Rasa Dhatu*.

तस्य हृदयं स्थानम् । स हृदयात् चतुर्विंशति धमनीः अनुप्रविश्य उर्ध्वगाः दश,

दश च अधोगामिन्यः चतस्त्र तिर्यग्गाः कृत्स्नं शरीरं अहः अहः तर्पयति' । [6]

The heart is the main site of *Rasa Dhatu*. 24 *Dhamani's* (Vessels) Originating from the heart are considered the Primary location of the *Rasavaha Srotas*. The *Rasavaha Srotas*, which facilitate the transportation and circulation of *Rasa dhatu* (nutritive fluids or plasma), originate from the heart and the *dhamani's* that extend from it. Therefore, the heart and its branching vessels act as the primary location for the *rasa dhatu* and its distribution.

Rakta Dhatu:

Rakta Dhatu is the second *dhatu* formed from *Ahara rasa*. It indicates Red colour of the tissues. As per Acharya Sushruta, the duration required for the formation of *Rakta dhatu* is five days.

शोणितवहानां स्रोतसां यकृत् मूलं प्लीहा च । [7]

तेजो रसानां सर्वेषां मनुजानां यदुच्यते । पित्तोष्मणः स रागेण रसो रक्तत्वमृच्छति ।। [8]

According to Charaka, *Rasa dhatu* is initially devoid of color and encompasses the nutrients of the seven *dhatus*. When this liquid, which appears white, flows into the *Raktavaha srotas* (the channels responsible for blood circulation) located in the liver (*Yakruta*) and spleen (*Pleeha*), it takes on a red hue due to the influence of *Ranjaka pitta*. The volume of *Rakta* is defined as eight *Anjali*. One *anjali* represents the quantity of substance that can be contained in the cupped palms of a person when they are brought together. This measurement is subject to variation based on the individual. (1 *anjali* = 16 *tola* = 5120 ml).

Rasa-Rakta Vikshepana Kriya: [9]

- ➢ *Rasa Dhatu* formed from *Ahara Rasa* in small intestine is carried to the heart due to stimulation of *Samana Vayu.*

- From the *Hridaya, rasa* and *rakta* are transported to the lungs for the purpose of purification. Subsequently, the purified *Rakta* is returned to the *Hridaya.*
- Thereafter, *Rasa*, which possesses *Preenana* activity, along with *Rakta,* which contains *Prana,* is distributed throughout the entire body.
- This all takes place due to *Vyana Vayu*. This all-procedure purification and circulation are going on continuously.

In *Bhela Samhita*, explains the circulatory and continuous activity of cardiac cycle.

***Rasa-Rakta Samvahana* Process:[10]**

- By the *Vyana Vayu* stimulation, *Rasa* & *Rakta* is continuously circulating. Circulation takes place in 3 directions- Upward, Downward & Transverse.
- *Aacharya Sushruta* has compared the direction of circulation with the direction of fire flame in upward direction, Water flow in downward direction & Sound waves in transverse direction.
- *Rasa-Rakta Samvahana* in *Hridaya* from *Dasha Dhamani*, then through its branching network *rasa dhatu* is circulated throughout the body.
- After contraction of heart muscles nourishment & oxygen is provide to body tissues. Metabolic wastes again mix with blood and returned back to heart through vessels.
- During rest the heart functions slows down. This is the only time, that heart can relax a bit, but complete rest is not possible in the life.
- *Rasa Rakta Samvahana* is continuous function from birth to death. It this function, even stops momentarily the person can die.

Human Circulation (modern View):[10, 11]

Blood is not a stable liquid and it circulated continuously throughout the body all the time, during life was explained by William Harvey. Circulatory system is an organic transport system. Its function is to supply food, oxygen, & other nutrients to the body cells and to remove waste products from cell & carry them to the organs like lungs, kidney and liver for elimination.

In Humans, Blood circulation flows in double circulation way – 1. Pulmonary Circulation - from heart to lungs and back to heart. 2. Systemic Circulation- from heart to rest of organs and back to heart.

Blood Vascular System Consist: Heart, Blood vessels and Blood, the medium of circulation.

Heart:

Heart is hollow, muscular organ, with size of one closed fist. Heart is situated ventrally in thorax the between the lungs. It's covered with rib cage and covered with double membrane, called pericardium.

External structure of Heart:

Heart is conical with its apex directed posteriorly, pointing towards the left. Heart is made of 4 chambers- 2 atrium & 2 ventricles. Left ventricle is slightly bigger than right one.

Atria are receiving chambers. Rt, atrium receives the superior and inferior vena cava, while left atrium receives pulmonary veins.

Ventricles are propelling chambers. Right ventricles give out the pulmonary artery, while the left ventricle gives out aorta or aortic arch.

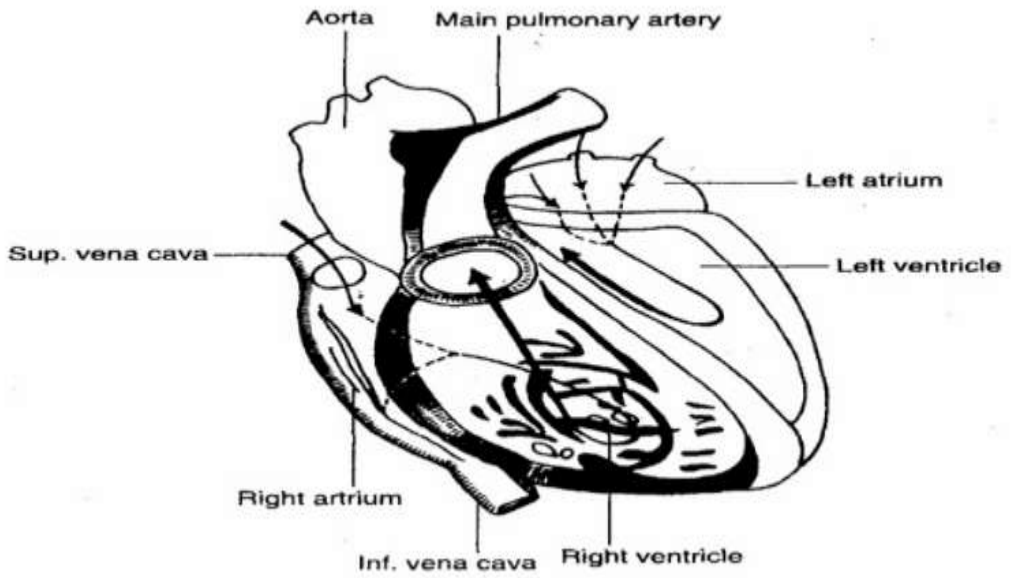
The heart also has the right and left coronary arteries arising from aorta as it is origin and supplying blood to the wall of heart itself. The coronary arteries divide into capillaries ramifying in the Wall of heart. These capillaries ultimately joined to form coronary sinus which open directly into the right Atrium

Internal structure of heart:

Internally the heart is divided into right and left halves by a ventricle partition so that the right-side deals with deoxygenated of blood and the left side deals with oxygenated blood partition between the Atria is called as inner atrial septum and between the ventricle is called as inner ventricular septum.

Atria: As they are receiving Chambers, they are thin wall. the right Atrium collect deoxygenated blood from the body through superior and inferior Vena cava. left Atrium receives oxygenated blood from lungs through pulmonary veins.

Ventricles: Ventricles are thick wall because there are forcing chamber. The left ventricle is larger and more muscular than right ventricles because it has to pump the blood to the entire body the right ventricle gives out Pulmonary artery which carries deoxygenated blood to the lungs while the left ventricle gives out Aortic arch carrying oxygenated blood to the body.



Blood circulation through Heart

The atrium and ventricles are connected with each other through atrio-ventricular openings guarded by cuspid valves. Right atria & right ventricles = Tricuspid Valve, left atria & Left ventricles = Bicuspid Valve (Mitral Valve) this prevents the extension of valves back into the auricle during the contraction of ventricle.

Semilunar Or Atrial Valves- at opening trunk arising from right ventricle and at the base of aortic arch, arising from left ventricle, are seen three semilunar valves, which also prevents back flow. Heart is a double pump- pumping blood to the lungs and pumping to the rest of the body.

Working of Heart:

Heart is made of cardiac muscles, which are capable of rhythmic contraction and relaxation. The sequence of contraction (Systole) and relaxation (Diastole) of heart, is called heart beat or cardiac cycle. The heart of man is myogenic, as its contraction is initiated and conducted by the modified muscle plexuses called nodes, independent of nerve supply.

Conduction system of heart:

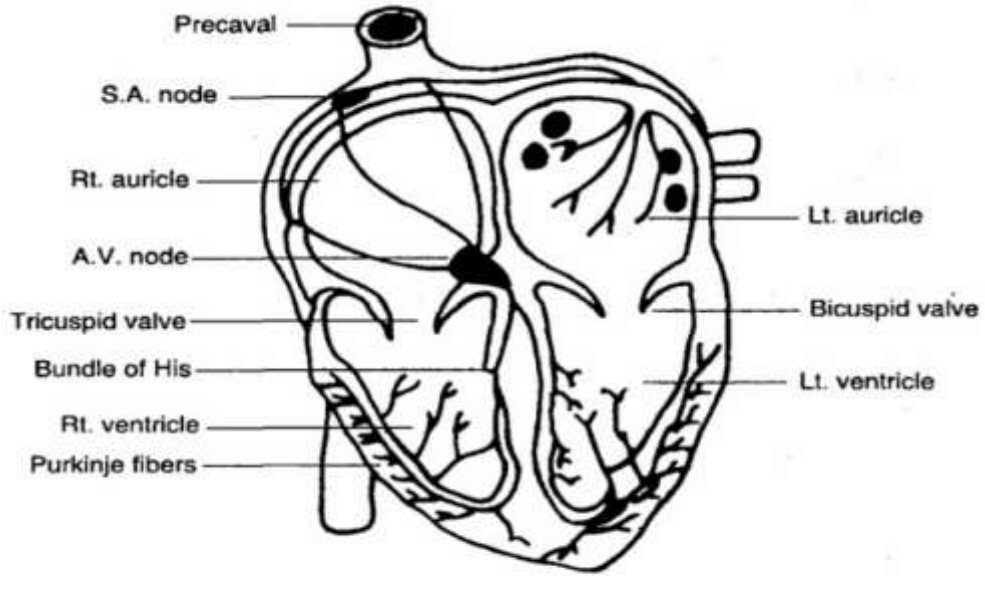
For proper functioning of heart beats, in regular manner, the heart has special conduction system as follows: **Sino-atrial Node (SA Node)-** Situated at opening of the Superior vena cava. As it maintains the rhythm. Also called as pace maker. **Atrio-ventricular Node (AV Node)-** Situated in the middle partition conducting impulses from atria to ventricles. **Bundle of His-** consisting of specialized muscle fibers called Purkinje fibers dividing and ramifying in the wall of ventricle.

Cardiac Cycle:

In Cardiac cycle, atria and ventricles contract and relax which cause pressure changes. Blood flows the area of higher pressure to lower pressure. Phase of contraction is called as a Systole and phase of relaxation is called as a diastole.

Phases of Cardiac cycle:

1. At the end of heart beat, ventricle start to relax. This is the beginning of relaxation.
2. At this position ventricular blood volume does not change, because both semilunar and AV valves are closed. This is isovolumic relaxation.
3. When ventricular pressure drops below atrial pressure, the AV valves open and Rapid filling phase occurs. Nearly 2/3rd blood passes from atria to ventricle.
4. This is followed by middle 1/3rd reduced filling phase or diastole.
5. Subsequently, the activation of the SA node leads to atrial depolarization. Atrial systole occurs in last 1/3rd of ventricular filling.
6. At the end of atrial systole, the impulse from SA node has passed through AV node and into the ventricles (Depolarization of ventricles). Ventricles get filled with blood. AV and semilunar valves, both are closed. So, this is isovolumic contraction.
7. As ventricular contraction continues, the pressure inside the chamber rises, SLVS open and Rapid ejection phase occurs.
8. Above phase is followed by reduced ejection phase which is the 3rd and last phase of ventricular contraction.



Conduction system of Heart

Conclusion:

The review of the study regarding the concept of human circulation in contemporary Ayurveda emphasizes the correlation between classical Ayurvedic descriptions of the circulatory system and modern anatomy and physiology. The objective is to connect traditional knowledge with current scientific understanding, frequently asserting that ancient texts possessed advanced insights into blood circulation.

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