

A COMPARITIVE STUDY ON CONCEPTS OF CIRCULATION OF BLOOD

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ABSTRACT: This study traces the progressively evolving concepts of blood circulation. Evidences from medical and non-medical Sanskrit literature have been presented to high the fact that the Ayurvedic concepts of physiology are time tested.

1. INTRODUCTION

It is noteworthy to observe that in the Vedic and Ayurvedic lore, the phenomenon of circulation of blood has been described. The working of heart as a pump has been recorded and also the importance of such a function of heart through blood vessels has been recognized.

Although, Harvey (1578-1657) won the credit as discoverer of circulation of blood there has been always a point of controversy among the medical historians regarding the true discoverer of circulation.

By the time the western scientists tried to understand the implication of circulation of blood through experiments the Vedic and ayurvedic works had already indicated the importance of heart as the pump to the thrust the nutrient fluid in to circulation and also the necessity of such functioning of heart for substance of the body

2. THE VEDIC AND AYURVEDIC CONCEPT

A critical study of the Vedic and Ayurvedic works reveals that both of them contain the knowledge of the implications of circulation of blood.

The functioning of heart as pump to push the nutrient fluid into circulation, as well as the importance of this function have already been mentioned in the Vedas and the Ayurveda.

3. IMPORTANT FACTORS

The following factors govern the regular circulation of blood

- i) Muscular structure of the heart for its functioning i.e. the movement of the heart through its regular contractions and relaxation.
- ii) The heart's action as a pump i.e. through its functioning. The heart continually takes in the blood during contraction.
- iii) The circulation of blood i.e. the circular movement the nutrient fluid in the body

3. (A) MUSCULAR STRUCTURE OF THE HEART AND ITS ACTION

Susruta (2500 B.C-100 B.C) mentioned that Hydra(heart) contains two muscles (Mamsa-pesi).He has also described the shape of heart which resembles a Lotus-bud with its apex downward Susruta's above statement is in keeping with the Vedic lore (Agama).In the Agama "Hridaya" is mentioned to be made of muscles, resembling the shape of red-lotus with its apex downward.

According to the Ayurvedic system of medicine, all kinds of movements are medicated through the muscles. The muscles, when ever they are located in the body, are caused to move through the function of the incorporeal and unstable vata, the powerful and important of the three dosa.

Susrta gives the derivation of term vata from the root "va gatigandhanayoh" i.e. to move. Thus the function of gait (or to move) is expressed through the movement of the heart muscles i.e. by the contraction and relaxation.

3(B) (i) THE HEART FUNCTIONG AS A PUMP

i) The Ojas enters in to the Cardiac Cycle First

With in the human chest lines the most efficient pump ever created termed "Heart". The above mentioned Agama describes at the sample place that the heart is seat of the Ojas and reservoir of the consciousness. Furthermore, it states purified from enters the heart and is circulated in the whole body by the vata called Vyana

The same opinion, however, is held Caraka. He defines heart giving its synonyms as "mahat" i.e. great and "Artha" i.e. serving all purposes. He says that ojas is the initial embryo which enters into the cardiac cycle first. It is the cream of the nutrient fluid which if destroyed leads to destruction. Because ojas is located in the heart, the word hrdayam bears synonyms like mahat and artha.

3 (B)(ii) FROM THE HEART ENSUES TEN GREAT VESSELS

"From the heart as root ten great vessels carrying ojas pulsate all over the body and as the carry the ojas i.e. the cream of the nutrient fluid, they (vessels) are called ojavaha and even mhaphala. " these vessels are called arteries i.e. dhamani due to pulsation, channels i.e. (srotas) due to flowing and veins (sira) due to moving swiftly.

3 (b) (iii) THE OJAS:ITS COLOUR

"The ojas is of pure red color with slightly yellowish appearance" says Caraka.

It is collected from all the seven dhatu. Hence its definition as the cream of the nutrient fluid. For, it is collected from the seven substances just as honey is collected by the bee from the flowers and fruits".

Therefore instead of calling as the cream of nutrient fluid sometimes it is also called the nutrient nutrient fluid i.e. rasa. In Cakrapani's contention, the other liquid dhatus, like rakta (blood) also should be taken along with the rasadhathu.

3.b (iv) HEART FUNCTION STARTS IN THE EMBRYO

Ayurvedic works emphasize that hrdayam (heart) is the seat of rasadhātu and explain that in its pure form i.e. rakta (blood) it enters into the heart to saturate the primary or excellent ojas i.e. prahana ojas.

It is the excellent ojas that enters into the cardiac cycle first as an initial essence of embryo which is saturated with the maternal nutrient fluid. So the hrdayam starts functioning as a pump months before the child's birth.

3.b (v). THE PUMP

The heart begins to circulate blood all over the body months before the birth and it functions without rest until death.

To keep the nutrient fluid moving, the heart must have rhythmic contractions with valves to prevent back flow and regular relaxations with valves to receive the inflow.

3. (b) (vi) CHAMBERS WITH COMPARTMENTS

In one of the Vedic lore the heart in its lotus shape is said to have chambers (vesma).

The heart is said to be divided into two parts in the same fashion as the sky and the earth are divided by the Horizon. In the same lore, it has been contented that these chambers of the hrdayam have four compartments. As the wind blows sky, the pranavayu that enters the nostrils forces to flow the other four vata to the four directions, thus making four compartments (sushi) of the heart (i.e. the thoracic heart).

3. (b) (vii) THE VEDIC LORE EXPLAINS THE FUNCTIONAL ASPECTS OF THE HEART

In the satapatha brahmana, the derivation of the term hrdayam has been given with a view to explain the above stated actions of the heart

It has been said that the term hridayam consist of three roots i.e. "Hri" "Da" and "yam". The respective meanings of these three words are: "Haranam", "Danam" and "Ayanam" i.e. receipt, giving away & to sustain or maintain the two earlier functions. Thus the first and second terms explain the relaxation and contraction movements while the third term clearly explains the device of valves in the heart

Eight basic Factors of Heart

In Ayurveda, eight basic factors are associated with cardiac activity.

1.rasa: The food after digestion is converted into rasa

2.rakta: It means blood. The rasa in its purified form acquires red color and enters into heart as nutrient fluid, which is circulated all over the body through the vyanavata.

3. Ojas: The heart is the seat of ojas.it represents the vital energy, which is required for the functioning of body and mind.

4. Masapesi: (Muscle tissues): As already mentioned, the heart pulsates rhythmically due to the action of the muscles.

5. Pranavayu: (Oxygen): the air inhaled and exhaled is called the pranavayu. It is required for the vital existence of all living beings.

6. Vyanavayu: The nutrient fluid is put into circulatory movement through the action of

the Vyanavayu. Thus, it controls the rhythmically of the heart and tone of blood vessels. Its function resembles that of the autonomic nervous system.

7. Sadhakupitta: Enzymes in the heart namely SGOT, aldolase etc. are represented by Sadhakupitta.

8. Avalambaka Kapha: The intracellular and intestinal fluids in the heart are represented by the Avalambakakapha. Besides, it provides lubrication and strength to heart for its continuous working.

Hence these elements bear marked resemblance, to modern concepts regarding plasma, enzymes, chromo biology etc.

3. (b) (viii) THE HEART AND THE BELLOWS

The illustration of the natural functional aspects of the heart is made in one of the ancient works called Yogavasistha. This work is ascribed to sage Valmiki the author of Valmiki Ramayanam.

This subject comes as apart of discussion between the Vasista And Rama. Vasista says, "Like the bellows (bhasra) of blacksmith, the movement of which takes place by the air that enters into or comes out of its space, the heart is also put to motion by the air (pranavayu) that enters or comes out with the inhaled or exhaled air respectively through the nostrils".

Thus, the whole natural aspect of function as pump has been explained in the above-mentioned Vedic and Ayurvedic works.

3. (C) The Circulation of Blood :or the Circulatory movement

"The nutrient fluid, circulates all over the body like the motion of wheel "- Says Caraka.

The rasadhātu, or the essence of the food acquires redness in its purified form, from the color of the fire (pitta) and turns into raktadhātu. As already explained, this purified rasadhātu enters the heart and is forced to move all over the body.

Thus, it has been said that depends up on the ejecting force of the heart (the stimulants of Vyanavata) the rasadhātu (blood) is put in to circulation. This circulatory movement of the blood is an eternal phenomenon, which goes on ceaselessly until death.

4. Vascular System in Ayurveda

Description of the arteries (dhamani) channels (srotas) and veins (sira) has been already made, while it has been show that from the heart root, ten great vessels pulsate all over the body. In the present context, the derivations of the names dhamani (arteries) and sira (veins) are relevant to the Ayurvedic concept of circulation of blood.

"Dhamanis are called so, because they pulsate. Srotamsi are spoken so because they permit oozing and sira are said so because they maintain a continuous flow of blood "- Says Caraka.

The critical study of their characteristic features makes it clear that dhamanis (arteries) end in the srotamsi (capillaries), which in turn are united to form sira (veins).

Thus as different parts of the vascular system these constitute a single circulatory unit.

5. A comparative study of the modern Views responsible for the discovery of circulation of blood

A brief comparison may be made to show that unfortunately the medical men could not study the Vedic and Ayurvedic concepts of circulation of blood and the result was that the knowledge of this subject was acquired by them on the basis of ingenious dissections of observations on wounded and healthy persons or probably on sacrificial animals etc.

Thus, it will be noticed that by the time the western scientists were busy with such observations on trail and error methods, the Ayurvedic works had already indicated this knowledge.

Hence, the medical historians have bypassed the scrutiny of Ayurveda, the oldest medical knowledge of the world while giving their decision about the discovery of circulation of blood.

5. (A) Sequence of Events

On the basis of various medical encyclopedias and historical evidences the sequence of events that occurred with the western scientists in this field may be summarized below:

5. (a)(i) Events of pre-Christian Era

The knowledge that was held by the Egyptians and the early Greeks about the heart and blood vessels even by such great scientists as Hippocrates (4th cent. B.C.) And Aristotle (3rd Cent. B.C.) Was but rudimentary.

However, an approximate idea of the anatomical conditions of the vessels

connecting heart and lungs was formed by the Alexandrian School (3rd Cent. B.C.).

5. (a)(ii) Events of Post-Christian Era GALAN:

This knowledge was widened by Galan (129-201 A.D) by his interesting physiological experiments. According to his observations, the movement of blood was of shuttle –wise ebb and flow between the closed arterial and venous procedure. In spite of his interesting observations Galan never spoke about the circulation of blood, as it is understood now. It was only his lack of knowledge. Though he did not seem to have formed a clear idea of the full process, his theory was accepted by Byzantine, Syriac and Islamic physicians for period of fourteen centuries.

5. (a)(iii) Avicenna’s Contributions

Basing on the experiences of Galan, Avicenna (908-1037) enriched the knowledge by observing patients and dissecting animals. He described the size, shape and location of the heart and made an attempt to show the division of the heart into various chambers. He also mentioned the difference between the oxygenated blood and its compartmentalization in the heart.

The theory that the blood was continually created or renewed by the liver and carried to the peripheral organs where it perished, was formulated in an organized system by Avicenna.

What is more thrilling is that he described the membranous covering of the writes. He also mentioned about the fluid between the body of heart and the covering membrane. The membrane is known as the pericardium (canon volume I & III).

As all his views and observations were made one thousand years back they may not keeping with the modern knowledge. Nevertheless, his analytical and scientific approach is remarkable, indeed.

5. (b) Harvey's Discovery of Circulation of Blood

Later on Avicenna's view was transmitted to the medical science of Western Europe and was accepted and not contested even by Vasalinas (1514-64 A.D.).

Study of the anatomical works of the Galen and Avicenna was made by Ibn An-Nafis during early Sixteenth century who criticized the views of Galen, Haly Abbas and Avicenna regarding the purification of blood and blood circulation, thus bringing to light the theory of the lesser or pulmonary circulation. This theory however was explained independently by Michael Servetus (1511-1553) and Realdo Colombo (1511-59).

Andreas Vesalpinus (1524-1603) explained the features of the general circulation, but without any support of convincing experiments.

The entire methodological and experimental exposition of circulation of blood was demonstrated by William Harvey (1578-1657) who thus won the credit of medical history.

6. Conclusion

Thus it is concluded that the Vedic and Ayurvedic works already contained the implications of the circulation of blood. But unfortunately, western intellectuals and medical historians ignored the scrutiny of these works, and the result was that the trail and error methods. Although the credit of discovery of circulation of blood was won by William Harvey the fact remains that this knowledge was recorded in ancient works of Ayurveda that, "everything is well explained and nothing is written imaginary or unexamined".

Hence it should be always born in mind that whatever is written on this subject in the Ayurveda is as well examined and nothing is imaginary.