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Review Article

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REVIEW ARTICLE ON ANALYTICAL STUDY OF HEART IN AYURVEDA

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ABSTRACT

The heart is an important organ of the human body, it is situated in middle mediastinum in thoracic cavity, enclosed within the pericardium. The circulation of blood throughout the body is maintained by the heart so it plays an important role in appropriate nutrition, excretion, gaseous exchange, thermoregulation etc., heart is a vital organ for life in the body. This fairly explains the importance of this organ in our body and its vulnerability to any kind of disturbances in the body. It is important to understand this organ thoroughly for better understanding and management of the cardiovascular diseases. In Ayurveda *hridaya* is considered under *trimarma* and *dasa prana ayatana* which indicates the importance of this organ in causation. However, the term *Hridaya* mentioned in Ayurveda is denoting an organ which controls the passage of *prana* by collecting, distributing in a rhythm. This definition indicates that in Ayurveda the term *hridaya* is uses for heart and brain as both. *Hridaya*, is considered as the *kosthanga* by Acharya Charak and *kostha* by Acharya Susruta. This article covers the concept of heart in Ayurveda i.e., *hridaya* in Ayurveda; including its *nirukty* (etymology), *sharira rachana* (anatomy), *sharir kriya* (physiology) with modern visions.

KEYWORDS: Ayurveda, heart, hridaya, trimarma.

INTRODUCTION

The human heart is responsible for providing vital nutrients to tissues, and helping excretion of the waste products. Subsequentl. cardiac dysfunction causes disturbing physiologic consequences. Disruption of any element of the heart - myocardium, valves, conduction system, and coronary vasculature, can adversely affect pumping efficiency thus leading to morbidity and mortality.[1] Cardiovascular diseases are number one cause of worldwide mortality, with about 79% of the burden occurring in developing countries.[2] In Ayurvedic classics heart is the "*Urastha Hridaya*".[3] It is considered one among the three organs (trimarma) which needs constant vigilance and a keen eye on lifestyle and gastronomy, in order to avoid diseases with poor prognosis.[4]

Nirukti

The word "hridaya" in Ayurveda is a synonymous for the word heart. "Hridaya" is derived from three verbs (as per satpathbrahman and brihadaranyak). "Hrun" which means to abduct, "dad" which means to donate and "in gatou" self-generated rhythmicity for contraction and relaxation.

[5]The *hridaya* thus means an organ which draws fluid including blood from all over the body and then supplies it to all the parts of the body.[6] The hridaya is a vital organ and if affected, may cause instantaneous death.[7]

Definition of Hridaya

The marma located in the thorax (uras) in between the two breast (stanyor- madhye) and near to that of esophageal orifice (amashaya-dwar), where resides the tamas, rajas and sattva guna, is known as hridaya.[3]

Synonyms

According to Amarkosha: cheta, swantam, hrit and manas.[8]
According to Charak : mahaphala, mahat and artha.[9]

Hridaya and dasha dhamani Anatomy (Rachana)

Bruhadaranyaka Upanishad describes the hridaya as a fleshy muscular organ (mamsa-pesichayo)[10] resembling a red lotus bud and hangs with its apex downwards;[11] from which vessels and capillaries spread all over the

body.[6] Ten major blood vessels originate from it.[12]

Location: Uras (thorax).[13]

Hridaya is located on left side of kloma and above yakri and pleeha and to the right of phupphusa.[14]

Hridaya is located in the thorax (uras) in between the two breasts (stanyor- madhye) and near to that of esophageal orifice (amashaya-dwar).[3]

Kala

Kala is the fine structure that separates the dhatus from their asayas.[15] Thus the mamsa dhara kala is stated to separate and support the mamsa dhatu, in which latter are to found siras, dhananis, snayus, and srotamsi.[16]

Marma

Hridaya is a type of sira marma.[17] sadyo-prana hara marma,[7] one among trimarma and dasa vishesa ayatana,[18] an asaya,[19] and a Kostha,[20] as per Susruta and a Kosthanga,[21] as per Charaka and Vagbhata.

Sandhi

There are three sandhis in hridayam.[22] And the type of sandhi present in hridaya is "mandala sandhi".[23]

Peshi

Hridaya consists of two peshis.[24]

Embryology

Embryologically, the hridaya originates from the essence of shonita and kapha tissues and develops into a muscular organ.[14] Genetically, in the development of the hridaya maternal influence dominate.

[25]Hence in an individual with hridroga, it is particularly important to inquire regarding hridroga on the maternal side. Hridaya become more obvious by the 4th month of garbha utpatti krama.[26] According to Charak, it starts functioning in the third foetal month.[27]

Physiology (kriya)

The hridaya is a very sensitive organ having its own inherent rhythm. It keeps on contracting and relaxing on its own.[28] The vata system also controls its rhythmicity which continues lifelong in a cyclic manner.

[29]The hridaya is more active during the day.

Hridaya provides rasa, rakta and oja to entire srotas of the body through siras like that of the mountain ranges which provide water and there by nutrition and life to the entire world through rivers.[30]

Circulation of the body fluids i.e. rasa in the body

The body fluids i.e. the first dhatu (rasa) are derived from the diet.[31] After digestion and absorption, the food is converted into "rasa" which carries the nutrients for all the tissues of the body. It passes from intestines into blood vessels and then to the *hridaya* by the action of saman vayu. From the *hridaya*, it is pumped through its main blood vessels by the action of vyan vayu into millions of capillaries.[28] The circulation is controlled by autonomic nervous system i.e. by vyana vayu[32] mainly and also by samana vayu. From capillaries, rasa penetrates all the tissues and cells of the body. The fluid from the tissues is brought back to the hridaya by capillaries and veins.[33]

Rakta is derived from rasa [34] and it circulates together with rasa.[35] Ayurvedic literature emphasizes on the circulation of rasa whose prime function is to supply nutrients to tissues. [36] Rakta floats in rasa in the blood vessels and transports oxygen to tissues. [37] The hridaya pumps rakta along with rasa all over the body. [28]

Circulation of oja

Hridaya is the seat of the vital fluid oja. Rasa is derived from diet.[31] All the nutrients in rasa cannot be directly utilized by tissues as such. These nutrients are modified by the Agni and converted into vital fluids which can be utilized by all the tissues. Oja is the essence of the vital fluids of all the tissues of the body which supplies energy to different tissues.[38] Oja is circulated into all tissues by the hridaya through blood vessels. Life as well as health and happiness depend on oja.[39]

In regards the mode of transport and circulation of this Oja, to which all dhatus are stated to make a contribution, Cakrapanidatta notes that, "Param teja which is the sara of all dhatus (comparable to the ghee of the milk and the honey of the flowers and fruits), being located in the hridayam, mixes with rasa, and circulates through the dhamanis and performs (actions spoken of as) tarpana of the entire body. It represents the Bala of all the dhatus and is present in the organism, from the time of the fertilization of the shonita by shukra, due to its swakarma (properties).[40]

Describing the vital role heart and circulation play in the distribution of sleishmika oja to all of the body, Charaka says: "The dasa mahamukla dhamanis are the channels of transport of ojas to entire body. They are spoken of as dhamanyah because, they pulsate; as srotamsi, because, they permit the exudation (filteration, diffusion, permeation) and sira because, they maintain a steady (and continuous) flow of rasa-rakta.[39]

The heart thus pumps „rasa" i.e. fluids and nutrients, rakta and oja i.e. vital fluids to all the tissues and organs of the body.[28] Hence life, vitality, consciousness, functioning of sense organs, mind and intellect and indirectly happiness and sorrow depend on the proper functioning or otherwise of the heart.

Hridaya And Primary Dhatus In It

The hridaya, itself being a muscular organ,[24] derives its nutrition from rasa, its nutition from Rakta,[41] and its vital energy from Oja.[42] Its movements are controlled by vyana vayu (Autonomic nervous system).[43]

Sadhaka pitta resides at Hridaya.[44] Its functions are: shourya (courage, bravery), bhaya (fear), krodhra (anger, rage), harsha (excitation, cheerfulness), moha (delusion, fainting).[45] Also Atharva Veda has mentioned that hridaya and Shiras are sutured together, because of this relationship,[46] vayu is located in the upper portion of mastishka and it controls everything.[46] Again, the terms manas, chitta, buddhi and hridaya represent different functional aspects of the mind and are not distinctly different organs located in various parts of the body.[47] So every disturbance or involvement of hridaya affects sadhakpitta.

Avalambaka kapha bear a striking resemblance to the mode or supply of nutrition to the hridaya from rasa; support lubrication provided to hridaya by the peri-cardial fluid and synovial fluid to the thoracic joints (trik pradesha), and the replenishment of fluid to the fluid systems of the body.[48]

Any of the eight basic elements viz. rasa, rakta, muscular tissue, Oja, prana vayu, vyana-vayu, sadhaka pitta and avalambaka kapha when affected, can disturb the function of the hridaya and cause hridroga.[49] On the other hand these elements in hridaya are affected and form Hridroga owing to other causes or diseases of other organs in the body.

PRANA
It is situated in shira. However, mula sthana of prana vaha srota is hridaya and mahasrotas.[50]

It is appeared that the terms manas, chitta, buddhi and hridayam represent different functional aspects of the mind and are not distinctly different organs located in various parts of the body, such for instance, as the head and the chest and connected by shrotasas.[8,46]

RASA
Dhatu which is being continuosly circulated in the body is called rasa dhatu.[51] Rasa dhatu is the first dhatu in the body being nourished from ahara ras.[52]

Functions of Rasa"
Liquidity, unctuousness, dullness are the qualities of rasa dhatu, which help it to gratify (preenanam) the body, provides nutrition (tusti), preseve (dharana), and nourish rakta dhatu.[52,41]

RAKTA
When Rasa dhatu receive its property of color from ranjakapitta it is termed as rakta.[53]

Function of Rakta
Carries element of life i.e. oxygen, to the body, thereby provides immunity, complexion, satisfaction and longevity. Therefore to preserve life proper protection of rakta dhatu is essential.[54,55]

A distinction between the circulating rasa and rakta cannot be made as the fluid that circulates in the dhamanis and siras is a composite whole and a complex flowing tissue.[35]

Rasa becomes coloured red while passing through yakrit and pliha under the influence of the tapas of tejas.[54]

Chakrapani Datta has recognised hridaya, as the seat of rakta.[56] In addition yakrit (liver) and pleeha (spleen), raktavaha srotamsis (arteries, veins) are considered to be mula sthan or seat of rakta vaha srota by Charaka.[57]

MAMSA OJA
Essence of all seven dhatus is called as oja, on which strength (bala) depends. It protects life against various diseases.[38] After hridaya being formed in the garbha, the oja which is nourishing the garbha enters hridaya and then activities of hridaya begins.[26]

Functions
Dhatus, oja and bala are interdependent constituents of the body. Dhatus support, nourish and sustain the body. Ojas while supporting the body, donot nourish it. It protects the body from decay, degeneration and diseases. It stimulates functions of the panca indriya and mind, maintains integrity of body-mind-senses and soul.[45]

Doshas and heart
Pran Vayu
It is vital for the functioning of heart, mind and intellect.[58]

Vyanavayu
Vyanavayu controls contraction, relaxation and rhythmicity of hridaya. It also maintains the tone of blood vessels, which is responsible for maintaining blood pressure. It represents the entire nervous control of circulation. e.g. simultaneous increase in heart rate along with increased body activity occurs due to action of vyanavayu.[43,32]

Sadhaka Pitta
Proper action of hridaya and indirectly, circulation and functions of nervous system like intelligence etc. are dependent on sadhaka pitta. Disorders of sadhaka pitta lead to weak action of hridayam resulting into various disorders due to defects in conduction system of the heart (hridibadha) and ultimately heart failure (hridroga).[59]

Avalambaka Kapha
Avalambaka kapha provides the necessary lubrication and strength to the hridayam and uru pradesha for its continuous work. It helps also to prevent friction between two cells as well as between hridaya and other organ in the kostha (mediastinum).[48] Pericardial effusion, pleural effusion and pulmonary oedema also result from disorders of avalambaka kapha.

Anatomy & Physiology
The heart is a muscular pump that ejects blood into the

vascular tree with sufficient pressure to maintain optimal circulation. Heart is divided into four chambers; a right and a left atrium both lying superiorly, and a right and left ventricle both lying inferiorly and are larger. The atria are separated by a thin inter atrial partition called interatrial septum, while the ventricles are separated by thick muscular partition called interventricular septum.[60] The blood in the heart chambers moves in a carefully prescribed pathway: *venous blood from systemic circulation □ right atrium □ right ventricle □ pulmonary arteries □ lungs □ pulmonary veins □ left atrium □ left ventricle □ aorta □ systemic arterial supply*.[60]

The transport of the blood is regulated by cardiac valves: two loose flap-like atrio- ventricular valves, tricuspid on the right and mitral (bicuspid) on the left, and two semilunar valves: with three leaflets each, the pulmonary and aortic valves, guarding the outflow tract.[60]

Wall of the heart consists of mainly the myocardium which is covered externally by a thin membrane, the epicardium or visceral pericardium, and lined internally by another thin layer, the endocardium.[60]

Conduction system

The conduction system of the heart located in the myometrium and is responsible for regulating rate and rhythm of the heart. It is composed of specialized purkinje fibres which contain some contractile myofilaments and conduct a action potential rapidly. The conduction system consists of four major components; sino-atrial nodes" also called cardiac pacemaker, atrioventricular bundle, atrio- ventricular node and bundle of HIS.[60]

Blood supply

Blood is transported to myocardial cells by the coronary arteries which originate immediately above the aortic semilunar valve. Most of the blood flow to the myocardium occurs during diastole. There are three major coronary trunks, each supplying blood to specific segments of the heart[61]

- Anterior descending branch of the left coronary artery.
- Circumflex branch of the left coronary artery.
- Right coronary artery

Venous drainage

There are three venous drainage systems in heart:[62]

1. Coronary sinus
2. Anterior cardiac vein
3. Thebesian veins

About 60% of the venous blood of the heart drains into the right atrium via the coronary sinus and remaining 40% drains into the different chambers of the heart via anterior cardiac veins and thebesian veins.

Lymphatic drainage

The lymphatic drainage of the heart flows from subendothelial vessels to an extensive capillary plexus lying throughout the sub-epicardium. These capillaries converge in collecting lymphatic channels which run alongside the coronary vessels which forms the right lymphatic ducts. There are two major lymphatic channels:

1. Right coronary channel
2. Left coronary channel

Nerve supply

The nerve supply of the heart is derived from

1. The cardiac plexus formed by the sympathetic and parasympathetic (vagal) fibres.

Cardiac plexus	Branches to
a. Superficial cardiac plexus (below arch of aorta)	• Right coronary artery (through coronary plexus) • Left anterior pulmonary plexus • Deepcardiac plexus
b. Deep cardiac plexus (behind the aortic arch)	• Both atria • Both coronary arteries • Right and left anterior pulmonary plexus

Nerve supply	Features
i. Sympathetic innervations	ii. More at the base than at the apex of the heart.
iii. Vagal activity	iv. Greater in posterior ventricular myocardium
v. Right sympathetic and vagus nerve	vi. Affect SA node > AV node
vii. Left sympathetic and vagus nerve	viii.Affect AV node > SA node

2. And baroreceptors and chemoreceptors.

Receptors	Location
A. Baroreceptors 1. Arterial baroreceptors 2. (pressure receptors) 3. Cardiac baroreceptors a. Volume receptors b. Pressure receptors	➢ Carotid sinus ➢ Aortic arch ➢ Root of subclavian artery ➢ Pulmonary trunk ➢ Atriocaval receptors (right atrium) ➢ Pulmonary venoatrial receptors (left atrium) ➢ Atrial: right and left atrium, inter-atrial septum ➢ Ventricular: left ventricle, interventricular septum
B. Chemoreceptors 1. Carotid bodies 2. Aortic bodies	 ➢ Common carotid artery bifurcation ➢ Around aortic arch

CONCLUSION

Hridaya and heart

Atharva Veda mentioned the term "Hridaya" first time. And it was considered as an organ system comprising sirastha hridaya i.e. brain and urustha hridaya i.e. heart. This hridaya in Samhitas was considered to be hollow organ (kostha), made up of two pesi, and three mandala sandhis, and in a shape of lotus and connected with ten maha dhamanies i.e. pulsating vessels and supply blood, nutrition, oxygen and thus immunity to the entire body thus anatomically, physiologically and functionally urastha hridaya is similar to that of heart.

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