ABSTRACT

The term ‘Hrudaya’ itself has been controversial since ages and continues to be so even today. The scholars subscribe to an astonishing range of opinions. The term has been assigned to at least a dozen organs in the body, each claim being backed by reasoning and commonsense. Ayurveda considers hrudaya as one of the vital organ of the body. As it is one among the trimarams, any injury to the hrudaya leads to severe complications & even death. Hrudaya is an organ which draws blood from all over the body and then supplies it to all parts of the body. The hrudaya being a muscular organ derives its nutrition from rasa, its oxygen from rakta and its vital energy from ojas. Its movements are controlled by vyanavata. Different references available in Ayurveda samhitas regarding situation, shape, size, colour, structure, functions etc. of hrudaya suggest that heart is the similar structure of hrudaya in modern science.

KEYWORDS: Hrudaya, Rasa, Rakta, Heart, Artery.

INTRODUCTION

A considerable knowledge regarding the hrudaya can be made available in Ayurveda, but very confusing array of glossary used by Ayurvedic acharyas in various places to describe the anatomical term hrudaya. Ayurveda considers hrudaya as one of the vital organ of the body. Hrudaya is an organ which draws blood from all over the body and then supplies it to all parts of the body. The hrudaya being a muscular organ derives its nutrition from rasa, its oxygen from rakta and its vital energy from ojas. Its movements are controlled by vyanavata. Thus, when we, go through different references about hrudaya in Sushruta samhita, it denotes urohrudaya (heart) only whenever Sushruta uses the word ‘hrudaya’. But references from texts like Charaka, Bhela, Sarangadhara, Madhava nidana etc. the word hrudaya
indicates sirohrudaya (brain) and several other organs in different contexts. In this present article scholar try to correlate the hrudaya with urohrudaya only and whenever the term hrudaya appears it should be taken for granted that it is synonymous with Heart.

Review of literature
In Ayurveda hrudaya is well known structure and it is elaborately available anatomical, functional and clinical aspects of hrudaya.

A. Derivation
The term hrudaya was explained many years ago in Satapada brahmana for the first time and that gives the functional analysis of hrudaya. The term hrudaya is composed of the three words viz Hra Harane, (to take, or to acquire.), Da Dane (to give) and Ya Gatau (one in which transport takes place). The hrudaya performs all the three activities in a sequence. The cycle is completed by receiving, giving and transport in itself.

B. Situation
Hrudaya has also been recognized as one of the Koshtanga. Hrudaya is situated between the two breasts in the chest (thorax) at the opening of amasaya. The pliha and puppusa are situated below and beneath the hrudaya on the left side and the yakrut and kloma below and beneath the hrudaya on the right side.

Ashtanga Hrudayakara opines the same that the satvadidhama hrudaya is situated in the madhya bhaga of stana, ura and koshta. According to Sarangadhara hrudaya is jivaraktasaya, the seat for lively blood, is situates in the chest.

C. Development
Embryologically hrudaya is produced from the essence of rakta and kapha. The dhamanis carrying prana to the body part are attached to hrudaya. Charaka believes that complete development of hrudaya takes place either at the end of third month, whereas Sushruta believes that it develops in the beginning of fourth month. According to him hrudaya is derivative of matruja bhava (maternal factor).

D. Shape and position
The shape of hrudaya resembles like pundarika (lotus bud) facing downward.
E. Measurement
In Ayurveda hrudaya is measured as two angulies. While Sushruta has mentioned the size of hrudaya marma is panitala (four anguli).\[11\]

F. Structure
In Ayurveda described structure of the hrudaya following way
1. The hrudaya is an assemblage of fleshy muscular structure. While describing the peshi, Sushruta has clearly mentioned that there are two peshies within the hrudaya.\[12\] In Ashtanga Hrudaya it is mentioned that the hrudaya is constituted predominantly by the peshi.\[13\]
2. The hrudaya resembles like a pundarika (red lotus), with its apex turned downwards (adhomukha). Dalhana has also described hrudaya like a lotus bud facing downwards.\[14\]
3. It has mandala sandhi.\[15\]
4. The nadis spread all over body are related to the hrudaya.\[16\]
5. In Ashtanga Sangraha Vagbhata said that hrudaya has ‘sushira’ (hallow organ).\[17\] Sarangadhara also considered the same; according to him hrudaya is jivaraktasaya present in uraha.\[6\]
6. Acharya Vagbhata has referred a word samvrtta (closed orifice) and asamvrtta Dwara (Open orifice).\[5\]

G. Functions
In Ayurveda explained the functions of hrudaya in following way
1. The hrudaya has been especially described as the seat of chetana in all human beings. It is considered as a seat of chetana based on its un-interrupted work throughout the entire period of life and stop working at the end of life leading to death, which then makes body achetana (non-conscious, lifeless). Hrudaya is only place where is stored the life activity (chetana).\[18\]

2. Hrudaya and its attached vessels provide life by supplying the jiva tatva (blood) to whole of the body.\[19\]

3. Sankocha or nimilana or contraction and vikasa or vikasita or relaxations are the properties of hrudaya, described by Sushruta.\[10\] Sankocha or contraction or systole and vikasa or relaxation or diastole both are generated repeatedly and automatically.

4. The functioning of heart during day and night time has been narrated by Bhela like a lotus which opens in day time and closes in night time.\[20\] Charaka said hrudaya becomes mlana
and samvrrta in the night.\textsuperscript{[21]} Sushruta and Vagbhata also considered the same. Hrudaya opens when a person is awake (jagrata) and closes when he is asleep (svapata).

5. Acharya Sarangadhara explained circulatory system in Sarangadhara samhita. The contraction and relaxation are the two stages of the heart he quoted it as sankochara and vikasha. During contraction, the hrudaya expels out blood from hrudaya to dhamanis. During relaxation period, the blood fills back by the sras in the heart again.\textsuperscript{[22]}

6. It is a seat of the vital force (ojas) in the body; this vital force is the soul of all vital activities ever thought of. Charaka said; “The dasah mahamula dhamanis are the channels of transport of ojas to the entire body”.\textsuperscript{[23]}

7. The rasa which is purified is collected in the hrudaya and thrown away by the action of vyana vayu, passes everywhere in the body.\textsuperscript{[24]}

8. Hrudaya and dhamani are common mula of pranavaha Srotas and rasavaha srotas for achieving both the common objectives i.e. supply of oxygen and nutrition up to cellular level of body.\textsuperscript{[25]}

\textbf{DISCUSSION}

Thus, when we, go through different references about hrudaya in Sushruta samhita, it denotes ‘heart’ only whenever Sushruta uses the word ‘hrudaya’. But references from texts like Charaka, Bhela, Sarangadhara, Madhava nidana etc. the word hrudaya indicates several other organs in different contexts. The structures which are referred to as hrudaya are—umbilicus, chest, lungs, pericardium, brain, lower end of oesophagus, epigastric region, mind and soul. But the following different references about hrudaya available in Ayurveda samhitas regarding derivation, situation, shape, size, colour, structure, functions etc. is very similar to structural and functional description about heart in modern science but not any other organs.

- Seeing the derivation of hrudaya Hri comes from Harati which means ‘to receive’, Da is the short form of Dadati which means ‘to give’ and ya stands for Ayati which means ‘to go’, ‘to move’ or ‘to circulate’. It is interesting to note that the heart performs exactly these three functions of giving blood, receiving blood and circulating blood by acting as a pump.
Regarding situation of the *hrudaya* Ghanekar said that *Sushruta* has mentioned *amasaya dwara* is because of its near position to the *hrudaya*, not because it as the cardiac orifice.[26] Pandit Gananatha Sen also agrees with Ghanekar, has given an elaborate description regarding *hrudaya* in Pratyaksha sharira. He explains *hrudaya* along with its covering sheath pericardium is situated in the middle mediastinum just behind the sternum. He elaborated the relations too, i.e. lungs are present in both sides of *hrudaya* along with the principle bronchus. *Annanalika* (esophagus) comes in its posterior aspect.[27]

Situation of the *hrudaya* is very similar to the heart in modern anatomy. According to modern anatomy heart is a conical muscular organ placed in the middle mediastinum of the thorasic cavity. It enclosed within the pericardium. The heart is placed obliquely behind the body of the sternum and adjoining part of the costal cartilages. So that 1/3 of it lies to the right and 2/3 to the left of median plane. It rests on the central tendon of diaphragm.[28]

*Sushruta* described that the *hrudaya* is developed from *kapha* and *rakta prasada*. The word *kapha- prasada* & *rakta- prasada*, means that the *hrudaya* is made up from the gracious elements of *kapha* and *rakta* and a group of muscular fibers. It clearly indicates that *kapha- prasada* & *rakta- prasada* means a specialized musculature tissue which is known as specialized heart muscle tissue or the conductive system of heart, has some white bands in it.

Pandit Gananatha Sen in Pratyaksha sharira explains that *hrudaya* is in the shape of inverted lotus bud which is obliquely placed in the mediastinum. Modern anatomy also considered the same that the heart is cone shaped and narrow apex faces downwards.[29]

In Ayurveda *hrudaya* is measured as two angulies. Here two angulies might have referred for the apex of heart. While *Sushruta* has mentioned the size of *hrudaya marma* is *panitala* (four anguli). The heart is roughly the same size as a closed fist (*panitala*). The heart measures about 12x9 cm and weight about 300 grams in males and 250 grams in females.[30]

While describing the *peshi*, *Sushruta* has clearly mentioned that there are two *peshies* within the *hrudaya*. It should interpret with the pericardium and myocardium of heart.

*Acharya Vagbhata* has referred a word *samvrtta* (closed orifice) and *asamvrtta dwara* (Open orifice) present in *hrudaya*. It is may be considered as valve of the heart.
Here the word *chetana* can be considered as the source of energy. *Hrudaya* is the source of energy for all the other functions happen in the body. Modern studies reveal that even after the Brain death; the only organ which functions for a while is heart. The conduction system of the heart is functions itself without nerve impulses.[31]

When the man is at rest the rate of heart beat comes slow and when at work, the heart rate goes up. That is why *Sushruta* writes that the *hrudaya* blooms when the man is awaking and it closes when he is sleep. *Sri Kanthmurthy*, in his commentary on *Sushruta samhita* considers that the terms *jagrata* and *svapata* should as period of life and death respectively not in general popular meaning of wake fullness and sleep, since the nature of working of the heart does not change significantly during these two states.[32]

According to *Charaka*, the *mula sthana* of *pranavaha srotas* is *hrudaya* and *maha srotas*. *Sushruta* explains *hrudaya* and *rasavahini dhamanis* as the *pranavaha sroto mulas*. *Sarangdhara* envisage the importance of *prana vayu* (oxygen) is widely distributed through the body from *hrudaya* and it is constantly nourish the *dhatu* in the presence of air.

In scholars view according to modern medical science, oxygen transportation is the function of blood. Oxygen is the *prana vayu*. As blood is the transporting agent of *prana vayu*, as it is circulated from the Heart, *hrudaya* is the *mula of pranavaha srotas*. And thus by supplying *prana* to the whole body, *hrudaya* does the *jivana karma*.

Heart is the only organ by which the Oxygen is able to supply to each and every tissue by its pumping mechanism. Heart accomplishes the function of supplying the Oxygen to tissues of the body and also which functions independently without much dependent on other organs, where no other organ can bring out this function.[33]

Heart sounds in the term of *Ayurveda* together called as *dhamana* results due to *spandan* activity of the *hrudaya*. These sounds indicate the life activity (*chetana*) in living beings.

In *svabhava vipratipatti* chapter, *Acharya Sushruta* has been recognizing a serious medical problem. The development of pain at the base of the breasts, heart and chest are indicative sign of death.[34] Now with the devolvement of the science it is clear that incomplete obstruction (usually due to spasm of coronary artery) causes angina pectoris which are associated with the agonizing pain in the pericardial region and down to the medial side of
the left arm. It affects annually seven million people and causes nearly half a million death in united state.

- *Hrudaya* has been described as one of the *marma* of the thorax. It is *sira marma* and *sadya pranahara marma*. as the central supports the wood and bamboo form work of the roof, so the heart represents the substratum of all the entities and qualities of individual. And even a small injury to the *hrudaya* results in the fainting and any serious injury to it lead to death. According to *charaka hrudaya* is the one of the main *marma* among *tri marmas* because *marmas* of limbs are depend on *hrudaya* for nutrition. injury to this leads to immediate death.\[^{35}\]

- According to *Ayurveda nadis* are encircles the *hrudaya* like a spokes of wheel. This statement indicates *nadis* means tubular structures, it surrounds the *hrudaya*. *Hrudaya* is the *mula* (root) of *dasa* (ten) *maha dhamanis* as they spring from the heart. Modern science also conforms this statement of *Ayurveda*; arteries encircle the heart in the manner of a crown, hence the name coronary arteries\[^{36}\] (Latin word corona - crown). The statement of *Charaka regarding dasa* (ten) *maha dhmanis* is true because the vessels emerging out of the heart are the nutrition agents of the body. As far as the number of ten vessels attached to the heart is concerned, vessels bringing blood to the heart and taking blood out of the heart can be enumerate as aorta, superior vena cava, inferior vena cava, pulmonary vessels and coronary arteries.

### Table I: Correlation in between *hrudaya* and heart.

<table>
<thead>
<tr>
<th>Feature</th>
<th><em>Hrudaya</em></th>
<th>Heart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derivation</td>
<td><em>Hri</em> means, <em>Haran</em> (to receive) and <em>Dadati</em> means to pump out.</td>
<td>Blood vessels form a close circuit of tubes that carries blood away from the heart to tissues of the body and then return back to the heart.</td>
</tr>
<tr>
<td>Situation</td>
<td><em>koshtanga, uraha pradesha</em>, in between two breasts.</td>
<td>In thoracic cavity, Inferior middle mediastinum; the place in between two lungs.</td>
</tr>
<tr>
<td>Shape</td>
<td>Like lotus bud (<em>pundarika</em>) facing downwards (<em>adhomukha</em>).</td>
<td>Cone shape with narrow apex faces downwards</td>
</tr>
<tr>
<td>Size</td>
<td><em>panitala</em></td>
<td>Size of closed fist</td>
</tr>
<tr>
<td>Colour</td>
<td>Red</td>
<td>Red</td>
</tr>
</tbody>
</table>
| Structure     | (i) fleshy muscular structure  
(ii) Has *sushira* or *asaya*  
(iii) *Samvrtta*(closed orifice) and *asamvrtta dwara* (Open orifice) | (i)Cardiac muscle(mycardium)  
(ii) Hallow organ, chambers of heart  
(iii) Opening and closing of valves |
| Relations     | Inferiorly: Opening of *amasaya*.  
Left side: *pliha* and *puppusa*  
Right side: *yakrut* and *kloma* | Right side and left side: lungs  
Inferiorly: cardiac orifice of stomach, liver and spleen |
<table>
<thead>
<tr>
<th>Structures taking Origin</th>
<th>Ten <em>maha dhamani</em> and origin of <em>siras</em>.</th>
<th>Venae cavae, aorta, pulmonary veins, pulmonary trunk and coronary arteries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functions</td>
<td>(i) <em>Pranavahana</em> and <em>rasavahana</em></td>
<td>(i) Carrying of <em>rasa</em> (lymph) and <em>rakta</em> (blood)</td>
</tr>
<tr>
<td></td>
<td>(ii) <em>Jagrata</em> and <em>svapata</em></td>
<td>(ii) Contraction and dilatation</td>
</tr>
<tr>
<td></td>
<td>(iii) <em>Dhatu poshana</em></td>
<td>(iii) Nutrition of tissues</td>
</tr>
</tbody>
</table>

**CONCLUSION**

It has so many controversies about *hrudaya* regarding modern correlation. So many scholars interpreted the different structures for *hrudaya* in modern science. These types of controversies arise due to different opinions of *samhitakaras* and different commentators of *samhitas*. In scholars view the different references about *hrudaya* available in *Ayurveda samhitas* regarding derivation, situation, shape, size, colour, structure, functions etc. is very similar to structural and functional description about heart in modern science but not any other organs.

**REFERENCES**


